



Impact of Transit Stop Location on Pedestrian Safety

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Final Report

PREPARED FOR
Florida Department of Transportation



Disclaimer

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

Metric Conversion

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft³	cubic feet	0.028	cubic meters	m ³
yd³	cubic yards	0.765	cubic meters	m ³
Note: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or metric ton)	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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Executive Summary

Florida has an unfortunate reputation for being pedestrian unfriendly. For example, of the 20 most dangerous metropolitan areas listed by Smart Growth America in its 2016 Dangerous by Design report, nine are in Florida. In fact, the first seven in the list are all in Florida. In 2015, there were 9,085 pedestrian crashes in Florida statewide according to the Department of Highway Safety and Motor Vehicles. Broward County ranked second in the state, and Palm Beach County ranked fourth.

With these statistics in mind, this report explored ways of improving pedestrian safety around bus stops within District 4 of the Florida Department of Transportation (FDOT). Bus stops are potentially high-risk areas for pedestrians because oftentimes the bus stop are not integrated with land use development and are juxtaposed in a vehicular dominated environment. This report had three main objectives.

1. Identify the issues and concerns regarding unsafe walking behavior by identifying transit stops with locations that encourage uncontrolled pedestrian crossing/jaywalking.
2. Identify the common traits and characteristics of these bus stop locations.
3. Develop viable improvement and implementation strategies for designing, locating, and relocating stops to include enhancement to local traffic and engineering controls that will reduce potential for problematic crossing.

The study approach that was used involved four basic steps.

1. Use a geographic information system (GIS) to map the pedestrian crashes that occurred within close proximity of a Broward County Transit or Palm Tran bus stop.
2. Rank the bus stops according to three weighted variables:
 - a. Number of crashes near the bus stop
 - b. Annual average daily traffic of the street
 - c. Transit rider on/offers at the bus stop
3. Review the police reports of all the crashes.
4. Conduct Road Safety Audits (RSAs) of the worst bus stops

In addition to the above four steps, a literature review was conducted of the latest research related to pedestrian safety near bus stops. Also, the results of the data analysis and bus stop ranking were shared with local stakeholders via a survey. The comments received from the stakeholders were used to finalize a list of ten intersections (five in each county) that were field-inspected by the RSA team.

In the paragraphs that follow below, the key findings are presented from the crash data analysis, the stakeholder survey, and the field visits. As important as the recommended safety

improvements are, what is more important is that FDOT District 4 now has a systematic process for reviewing bus stops in regards to pedestrian safety. Prior to this study, no such process existed. Furthermore, the RSAs conducted for this study can serve as a guide for future collaborative RSAs by FDOT, the transit agencies, and the local governments.

Key Findings from Crash Data Analysis

There were 357 pedestrian crashes that occurred within 100 feet of a Broward County Transit bus stop between 2011 and 2014, and there were 221 pedestrian crashes within 100 feet of a Palm Tran bus stop. Most of these crashes did not involve bus patrons according to the police narratives in the crash reports. In Broward County, only 18 of the 357 pedestrian crashes (5.0%) involved a BCT patron. In Palm Beach County, only 8 out of 221 pedestrian crashes (3.6%) involved a Palm Tran patron. When reading the police narratives of the crash reports for these 26 pedestrian crashes, the most recurring theme was that the bus patron was crossing at mid-block or some other location outside of the designated crosswalk. This was in spite of the fact that in almost every single case there was a crosswalk in the immediate vicinity.

The majority of the pedestrian crashes within both counties occurred under clear weather conditions and during daylight hours. That being said, the percentage that occurred during the hours of darkness was not insignificant. In Broward County, it was 40.5 percent. In Palm Beach County, it was 38.0 percent. This could indicate a need for better lighting around the intersections where these bus stops are located.

In both counties, the largest percentage of crashes, both total and fatal, occurred on roads where the posted speed limit was between 35 and 40 miles per hour (mph). In Broward County, 40.6 percent of all the pedestrian crashes and 54.2 percent of the fatal crashes occurred on these roads. In Palm Beach County, it was 48.9 percent of all pedestrian crashes and 47.1 percent of the fatal crashes. In Palm Beach County, a disproportionate percentage of the fatal crashes occurred on roads with posted speed limits between 45 and 50 mph. These roads accounted for 25.3 percent of total crashes but 41.2 percent of the fatal crashes.

A characteristic difference that was noted between the pedestrian crashes in the two counties was that Palm Beach had a higher percentage of alcohol-related crashes (i.e. the pedestrian was intoxicated). In Palm Beach County, 14.0 percent of the pedestrian crashes were alcohol related compared to just 8.4 percent in Broward County.

With the Broward County data, it was possible to cross tabulate the number of pedestrian crashes to bus stop configuration (i.e. far-side, near-side, mid-block). According to transportation research literature, far-side stops are considered safer for pedestrians than near-side stops because the pedestrian crosses the intersection behind the bus and can be seen by passing vehicles. At near-side stops, the pedestrian is obscured from passing vehicles because he/she crosses the intersection in front of the stopped bus. The study results did not show near-side bus stops to be disproportionately unsafe compared to other bus stop configurations. For example, near-side stops account for 40 percent of BCT's bus stop inventory but only 38.9 percent of the pedestrian crashes involving a patron.

All of the bus stops in Broward County and Palm Beach County were ranked in terms of pedestrian safety according to three weighted variables: the number of pedestrian crashes within 100 feet of that bus stop, the annual average daily traffic of the street at the bus stop location, and the number of bus passenger on/offers at that bus stop. From that, a list was compiled of the worst five bus stops in each county. The list for Palm Beach County was later expanded to six bus stops because two of the stops were at the same intersection.

The “Worst 5” bus stops in Broward County were:

- Bus Stop 1808, W. Sunrise Blvd. and NW 15th Ave., Eastbound Direction
- Bus Stop 2136, Oakland Park Blvd. and NW 9th Ave., Westbound Direction
- Bus Stop 257, N. University Dr. and NW 44th St., Southbound Direction
- Bus Stop 1791, W. Sunrise Blvd. and Sunset Strip, Eastbound Direction
- Bus Stop 775, U.S. 1 and NE 48th St., Northbound Direction

The “Worst 6” bus stops in Palm Beach County were:

- Bus Stop 82, Broadway and 40th St., Southbound Direction
- Bus Stop 429, Broadway and 40th St., Northbound Direction
- Bus Stop 3061, 45th St. and Poinciana Plaza, Westbound Direction
- Bus Stop 513, Dixie Highway and 2nd Ave., Southbound Direction
- Bus Stop 1055, S. Military Trail and Cresthaven Blvd., Southbound Direction
- Bus Stop 136, Dixie Highway and Forest Hill Blvd., Southbound Direction

Key Findings from Stakeholder Survey

The results of the data analysis were shared with local agency staff (e.g. County Public Works, BCT, Palm Tran, and the MPOs). The survey sample size was small (9 people), and it was not intended that the survey yield statistically significant results. Instead, it was intended as a type of reality check to the data analysis. Five of the nine respondents agreed with the problematic bus stop locations that were identified in the report. Four of the nine respondents disagreed. Most of the disagreement came from Palm Beach County staff. They listed several other locations that they considered to be problematic from a pedestrian safety perspective. In the survey responses, there were no suggestions of alternative crash locations for Broward County. However, several alternative crash locations were suggested in an email from a staff person from the Traffic Engineering Division of Broward County Public Works. Based on the feedback that was received in the stakeholder survey, the list of bus stops to be included in a field visit was revised.

All but one of the nine respondents agreed with the study finding that the most common reported theme was pedestrians crossing at mid-block or at some other location outside the crosswalk. Other unsafe behavior that they said they have observed include drivers not looking

for pedestrians or bicyclists when turning right at intersections and pedestrians not using the pedestrian button or not waiting for the pedestrian signal phase before crossing.

The survey asked the agencies what process they use to determine whether a bus stop will be relocated. Based on the responses, there does not appear to be a formal process in place. This situation is not unique to South Florida. In order to fill this void, the District 4 Office of Modal Development has developed a flowchart diagram that outlines their proposed process for relocating bus stops. It calls for mapping bus stops and crash locations in GIS, and it also calls for field reviews of problematic bus stop locations with other departments and agencies. This flow chart can be found in Chapter 3, Figure 3-1.

The original list of “worst” bus stops that were to be field-visited by the road safety audit (RSA) team was modified based on local input. This input came not just from the stakeholder survey but also from emails from agency staff and planning documents such as the Palm Beach MPO’s Pedestrian and Bicycle Safety Study. The bus stops/intersections that were field-reviewed by the RSA team were as follows:

Broward County

- Bus Stop 2136, Oakland Park Blvd. and NW 9th Ave.
- Bus 1808, W. Sunrise Blvd. and NW 15th Ave.
- Bus Stop 1791, W. Sunrise Blvd. and Sunset Strip
- Bus Stops 893, 749, 715, and 626, Broward Blvd. and State Road 7
- Bus Stops 906, 2620, 733, and 4225, Broward Blvd. and University Dr.

Palm Beach County

- Bus Stop 6806, Lantana Rd. and Brentwood Blvd.
- Bus Stop 830, S. Congress Ave., and Lake Worth Rd.
- Bus Stop 1277, S. Military Trail and Forest Hill Blvd.
- Bus Stop 82, Broadway and 40th St.
- Bus Stop 429, Broadway and 40th St.
- Bus Stop 3061, 45th St. and Poinciana Plaza

Key Findings from Field Visits

The road safety audit team (RSA) was a multi-disciplinary team consisting of members from CUTR, FDOT, Palm Tran, Broward County Transit, the Palm Beach Metropolitan Planning Organization, and Broward County Traffic Engineering. The field visits confirmed what was seen in the crash data analysis, namely pedestrians crossing the street outside of the crosswalk, often at mid-block, even when there was a crosswalk nearby. Numerous photos of this pedestrian behavior were taken and are provided in Appendix C and Appendix D.

The site-specific safety improvement recommendations can be found in Chapter 4. In addition to these, two general recommendations were made. The first general recommendation is that FDOT District 4 should consider expanded use of the pedestrian barriers that are being tested on Oakland Park Blvd. between NW 55th Avenue and NW 56th Avenue in order to deter mid-block crossings. A photo of this pedestrian barrier can be found in Chapter 4, Photo 4-1. The second recommendation is that BCT and Palm Tran should consider adding sidewalk stencils near all bus stops that direct alighting passengers to the nearest crosswalk. An example of the proposed stencil can be found in Chapter 4, Photo 4-2.

Chapter 1 Literature Review

Although there has been extensive research on pedestrian safety in general, not as much has been written specifically on the topic of pedestrian safety as it relates to bus stop location and design. That being said, the literature review did discover several government agency-produced guidebooks on the topic of bus stop safety as well as a few research papers. The guidebooks are discussed first followed by the research.

TCRP Report 19 - Guidelines for the Location and Design of Bus Stops

This report was published in 1996 by the Transit Cooperative Research Program, which is a sub-component of the Transportation Research Board. As stated in the foreword of the paper, the purpose of TCRP 19 was to develop guidelines for locating and designing bus stops in various operational settings. Information for the report was gathered a number of ways. Individuals and groups with an interest in bus stop placement and design were identified and surveyed by mail and by phone. There was also a review of 28 transit agency manuals on bus stop design and location, field observations at more than 270 bus stops in Arizona, Michigan, and California, traffic field studies at 14 bus stops and pedestrian field studies at 10 bus stops.

TCRP 19 includes many pieces of information related to pedestrian safety around bus stops. For example, it states that many safety elements need to be taken into consideration when placing bus stops. These include:

- Passenger protection from passing traffic
- Access for people with disabilities
- All-weather surface to step from/to the bus
- Proximity to passenger crosswalks and curb ramps
- Proximity to major trip generators
- Convenient passenger transfers to routes with nearby stops
- Proximity of stop for the same route in the opposite direction
- Street lighting

TCRP 19 documents the various pros and cons of far-side, near-side, and mid-block bus stops. The main advantage of a far-side stop, as it relates to pedestrian safety, is that encourages alighting bus passengers to cross the intersection behind the bus where they can be seen more easily by approaching motorists. A potential disadvantage of a far-side stop is that it could result in increased rear-ended collisions from vehicles that are not expecting to stop again so soon after passing through the intersection. The main advantage of a near-side stop is that allows passengers to board and alight in the closest proximity to the crosswalk. A potential disadvantage is that the passengers would be crossing in front of the bus where they are less visible to vehicles in the adjacent lanes. The main advantage of a mid-block stop is that it provides better access to points of interest that are not located near an intersection. A potential disadvantage of a mid-block stop is that it could encourage jaywalking unless it is accompanied by a crosswalk.

TCRP 19 discusses several mitigation measures that have the potential to improve pedestrian safety in and around bus stops. For example, it encourages the development of nubs (aka curb extensions or bus bulbs) that extend the sidewalk from the curb of a parking lane to the edge of the through lane. This allows the bus to stop for passengers without having to weave out of the traffic lane. Nubs benefit pedestrians waiting at bus stops by calming traffic, minimizing the crossing distance to the bus, and providing extra waiting space in locations where the sidewalks are crowded. TCRP 19 cautions against placing bus stops near commercial driveways because of the potential conflict between pedestrians and vehicles. For situations where it is unavoidable, the report provides some guidelines to help minimize the conflict. These include: keeping at least one driveway entrance open for vehicles while the bus is loading/unloading passengers; placing the bus stop on the far side of the driveway to provide good visibility to cars leaving the driveway; locating the bus stop so that passengers are not forced to wait for the bus in the middle of the driveway; and locating the bus stop so that the passengers load/unload from the curb and not the driveway.

Several other miscellaneous guidelines related to pedestrian safety near bus stops include the following:

- A minimum clearance of 5 feet between the crosswalk and the front or rear of the bus at the bus stop
- Access to the bus stop from the intersection should be as direct as possible
- Sidewalks should be a minimum of 3 feet wide (preferably 4 to 5 feet wide)
- Installation of a discontinuous sidewalk from the intersection to the bus stop is better than no sidewalk access because it is the first step toward providing complete access to the bus stop
- Bus stops should have night time lighting that provides between 2 to 5 footcandles. A cost-effective approach to providing indirect lighting at a site is to locate bus stops near existing street lights.

TCRP Report 153 – Guidelines for Providing Access to Public Transportation Stations

This report provides guidelines for the planning and design of high capacity transit stations. Although the focus of this TCRP report is on rapid transit stations (i.e. rail), some of the guidelines are just as applicable to regular bus stops. For example, one of the topics covered in the TCRP report, which is of particular relevance to this study, is pedestrian access to, from, and within the station. The report identifies multiple strategies for improving pedestrian and bicycle access at the immediate approach to the station as well as the surrounding station area. They include:

- providing paved sidewalks at least 5 feet wide
- removing sidewalk clutter near station entrances
- building pedestrian overpasses and/or underpasses
- providing weather-protected connections to adjacent land uses
- improving night visibility
- installing intersection safety improvements (e.g. crosswalks)

The report lists several issues to consider when designing pedestrian access to transit stations. The pedestrian route to the transit station should be as direct as possible. It should be secure and visible to other road users. Adequate street lighting, proper building setbacks and orientations, and sidewalks are help to convey a message to the pedestrian that he/she is welcome. The addition of wayfinding information (i.e. signage) on how to get to the station helps to orient travelers who are new to the area or who only use transit occasionally.

Pedestrian Safety Guide for Transit Agencies

This guidebook, produced in February 2008 by the Federal Highway Administration, describes some of the common pedestrian safety issues that are encountered near transit stops and the solutions that have been implemented by transit agencies. These solutions fall under the categories of engineering, education and enforcement.

In regards to engineering solutions, the guidebook states that sidewalks should be wide enough to accommodate the expected levels of pedestrian traffic so that pedestrians do not walk in the roadway. At a minimum, the sidewalk should be 5 feet wide. Whenever possible, a buffer area between the sidewalk and the roadway should be provided for extra safety. Maximizing the sight distance between pedestrians and drivers is critical. Therefore, avoid placing bus stops near hills, curves, and heavy landscaping. Far-side bus stops facilitate better sight distances because the pedestrian is not obscured by the front of the bus when crossing the intersection. The guidebook notes that while marked crosswalks are helpful, they are not enough to ensure pedestrian safety by themselves. Crosswalks work best in combination with other improvements.

Median islands are beneficial to safety because they provide a refuge area for pedestrians and allow them to cross the street one direction of traffic at a time. The guidebook noted that studies have shown up to a 40 percent reduction in pedestrian crashes where median islands have been installed. Median islands with an angled cut-through encourage pedestrians to face in the direction of the oncoming traffic. Another engineering solution is a curb extension or bulb-out. These can be used on roads where there is on-street parking in order to shorten the distance that a pedestrian has to cross to board the bus. They also have a traffic calming effect.

Reducing curb radii at the corners of intersections helps to reduce the speed of turning vehicles. It also improves the sight distance between the vehicles and the pedestrians and shortens the crossing distance for the pedestrians. Care must be taken however not to reduce the curb radius too much. If the radius is too small, trucks and buses are more likely to drive over the curb, which can endanger pedestrians.

High visibility pedestrian warning signs help to increase driver awareness of pedestrians in the area. Although not specifically mentioned in the guidebook, pedestrian-activated warning signs that use a flashing amber strobe light are being implemented in an increasing number of Florida municipalities.

The guidebook favors far-side bus stops over near-side and mid-block stops because far-side stops encourage the alighting passengers to cross the intersection behind the bus where they

can be better seen by oncoming traffic. The guidebook has several other recommendations in regards to siting bus stops. The ideal bus stop location should:

- maximize the sight line distance between approaching buses and the loading area
- reduce the walking distance to key destinations
- be located on the same side of intersection where frequent transfers are made
- be located close to crosswalks so as to reduce jaywalking
- take advantage of existing sidewalk infrastructure and avoid dropping passengers off where they must walk in the roadway, on embankments, or in dirt, grass, or mud
- avoid being located next to driveways

The guide notes that while some actions to improve pedestrian safety near bus stops require the collaboration of multiple agencies, there are some actions that a transit agency can take on its own initiative. These include:

- making organizational improvements such as establishing a pedestrian and/or bus stop coordinator position that works with local and state transportation departments
- providing periodic training on pedestrian safety to transit agency staff and bus operators
- maintaining an updated inventory of bus stops and their features so that pedestrian safety and access improvements can be prioritized
- conducting safety audits of bus stops on a regular basis
- modifying services and facilities such as changing bus routes and stop locations to reduce walking distances

Pedestrian Safety and Transit Corridors

A 2004 research paper by Hess, Moudon, and Matlick published in the Journal of Public Transportation looked at the relationship between the locations of pedestrian accidents on state-owned roadways and the presence of transit riders boarding and alighting at bus stops. The study area was King County in Washington State. The primary data was Pedestrian Accident Locations (PALs), which the Washington State Department of Transportation (WSDOT) defines as a 0.10 mile stretch of road that has four or more collisions over a six-year period. Other data included bus stop level on/off data taken from METRO's automated passenger counter (APC) system, parcel level land use data taken from the King County Assessor's Office, and roadway condition data (e.g. traffic volumes, speeds, roadway widths, and number of lanes) taken from WSDOT and the Puget Sound Regional Council.

The research found that 47 percent of the state's PALs were located in King County, and that 57 percent of the PALs in King County were located on one roadway, State Road 99. Much of the development along the SR 99 corridor is commercial strip development. The facility has four to six lanes of traffic and high average daily traffic (ADT) volumes that range from 20,000 to 40,000 vehicles. Many segments of SR 99 have no curbs or sidewalks yet it is an important transit corridor.

The analysis compared sample point data from SR 99 to sample point data from all other state-owned roadways. The sample point data for each data set included PAL locations and randomly selected non-PAL locations. The regression modeling that was done showed that there was a positive relationship between bus stop usage and whether a site was a pedestrian accident location. On SR 99, bus usage was the only variable that was a statistically significant predictor of whether a sample point was a pedestrian accident location.

A Review of Pedestrian Safety Research in the United States and Abroad

This publication was produced for FHWA in January 2004. As the title implies, the purpose of the report was to provide an overview of the research that had been done to date on pedestrian safety. The report included details of pedestrian crash characteristics as well as specific roadway improvements and their effects on pedestrian safety. The authors' review of the research found that far-side bus stops and bus stops with good sight distance and alignment (e.g. not on a steep grade or curve) play an important role in improving safety. In regards to the preference for far-side stops, it is based on a 1975 study by Berger (see references) in which a before and after study was conducted of the relocation of two bus stops (one in Miami and one in San Diego) from near-side to far-side. That report indicated that the relocation of the bus stops eliminated the undesired behavior of crossing in front of the bus. This 1975 report also indicated that two percent of all pedestrian collisions in urban areas can be classified as pedestrian collisions at bus stops. Most of these collisions do not involve a pedestrian being struck by a bus. Rather, the bus creates a visual screen between the approaching driver and the pedestrians crossing in front of the bus.

Several of the other research findings, while not directly tied to bus stops, nevertheless have implications for this study and the possible recommendations. For example, the report states that existing research shows that simply adding a WALK/DON'T WALK signal with a standard timing scheme to a signalized intersection has been shown to have no significant impact on reducing pedestrian crashes. Standard timing means that vehicle traffic is allowed to move parallel to the pedestrian traffic and may turn right or left on a green light across the pedestrian's path. In contrast, providing an exclusive pedestrian interval where vehicles are momentarily stopped in all directions has been shown to reduce pedestrian collisions by 50 percent. Similarly, report states that existing research shows that allowing right-turn-on-red (RTOR) maneuvers appears to result in a small but clear safety problem for pedestrians. The countermeasures that have been shown to be effective in reducing pedestrian risks related to RTOR include illuminated NTOR signs and offset stop bars at intersections where RTOR is allowed.

Hazardous Bus Stops Identification: An Illustration Using GIS

This study by Pulugurtha and Vanapalli involved developing a Geographic Information System (GIS) based methodology to identify and rank bus stops in high auto-pedestrian collision areas in the Las Vegas metropolitan region. The methodology used various pieces of data including auto-pedestrian crash data, traffic volumes, bus stop coverage, transit ridership data, and street centerline coverage. A challenge that the authors faced was that the auto-pedestrian crash data provided by the Nevada DOT did not readily identify collisions that involved transit

system users. Therefore, all auto-pedestrian crashes were used in the study. The methodology involved several steps. They included:

1. geocoding the auto-pedestrian collision data
2. creating an auto-pedestrian collision concentration map
3. overlaying the bus-stop coverage on the auto-pedestrian collision concentration map
4. extracting the number of collisions for each bus stop in the high auto-pedestrian collision concentration areas
5. identifying the traffic volumes and obtaining the transit alighting and boarding data
6. computing the collision frequency and collision rates
7. ranking the high-collision bus stops.

The fourth step involved generating a GIS buffer around each bus stop. The purpose of the buffer was to capture the number of auto-pedestrian crashes that were within the area of influence of each stop. The challenge was identifying the appropriate buffer size. Buffers of both 100 feet and 200 feet were tested. In the end, the authors decided went with the 100 foot buffer. This decision was based on a number of factors. For one, the rank-ordered list of high collision bus stops differed between the two buffer sizes. On the one hand, the 200 foot buffer captured a larger number of auto-pedestrian collisions than the 100 foot buffer. However, the 200 foot buffer also increased the likelihood of capturing collisions unrelated to transit activity. Furthermore, the 200 foot buffer resulted in a greater frequency of duplication whereby collisions fell within the influence area of more than one bus stop (e.g. bus stops at the same intersection on opposite sides of the street).

The authors ranked the bus stops using three different methods. In the first method, the ranking was based solely on the number of collisions. In the second method, the ranking was based on a collision rate that was calculated by dividing the number of auto-pedestrian collisions for a bus stop by the corresponding annual average daily traffic (AADT). The third method involved a three-step process. First, the percent of total auto-pedestrian collisions for a bus stop was calculated by dividing the number of collisions for that stop by the total number of collisions at all selected bus stops. Next, the percent of total boardings and alightings (on/off) at that bus stop was calculated by dividing the boardings and alightings for that bus stop by the total number of boardings and alightings at all stops. The percent of collisions and the percent of boardings and alightings was then used to calculate what the authors called the “Collision rate – TP” (where TP stands for transit passenger). This was achieved by dividing the percent of collisions by the percent of boardings and alightings. These three methods resulted in three different rank-ordered lists of bus stops.

This study is particularly beneficial for the current study being conducted by CUTR for FDOT District Four. CUTR used a similar methodology albeit with some minor changes. The CUTR methodology is described in more detail in the next section of this document that deals with the analysis of the crash data.

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Chapter 2 Analysis of Pedestrian Crash Data

Methodology

The objective of the crash data analysis component of this study was to see if there are any common characteristics of pedestrian crashes in the vicinity of BCT and Palm Tran bus stops. In order to do that, it was necessary to map all of the pedestrian crashes in Broward and Palm Beach counties in a geographic information system (GIS) and match them to the nearest bus stop. This was accomplished using following datasets:

- Florida pedestrian crash data from the Signal Four Analytics website
- Bus stop location and passenger on/off data from BCT and Palm Tran
- Annual Average Daily Traffic (AADT) data from FDOT Roadway Characteristics Inventory

The pedestrian crash data was downloaded from the Signal Four (S4) Analytics website (<http://s4.geoplan.ufl.edu/>), which is sponsored by the FDOT Safety Office. S4 Analytics geocodes the Florida Traffic Crash Reports that are maintained by the Florida Department of Highway Safety and Motor Vehicles (FDHSMV). The S4 dataset includes numerous descriptive fields with details about the crash (e.g. whether drugs and alcohol were involved, the time of the crash, the daylight and weather conditions, etc.). The CUTR project team used the S4 Analytics web-based interface to retrieve all of the pedestrian crash data for Broward and Palm Beach Counties from 2011 to 2014.

Bus Stop location and passenger on/off data were provided by BCT and Palm Tran. The data contained unique bus stop identifiers and ridership data acquired from the agency's automatic passenger counter (APC) systems. Palm Tran's data were provided in a spreadsheet with latitude/longitude coordinates. The coordinates were used to map the stop locations and determine the proximity to crash locations. BCT's data was provided in a GIS format (shapefile) and included various bus stop characteristics.

The AADT data was taken from the FDOT statistics office website (<http://www.fdot.gov/planning/statistics/GIS/trafficdata.shtm>). The FDOT maintains the traffic data in a GIS format. The AADT data is available for most roads but not all roads in the state. Nonetheless, most of the Palm Tran and BCT bus stops were aligned with a roadway with AADT data. Using a GIS method commonly known as a spatial join, the AADT of the roadway were assigned to the nearest the bus stop.

The pedestrian crashes were mapped in GIS and then matched to the closest BCT or Palm Tran bus stop. Initially, a buffer distance of 300 feet was used. However, this resulted in a large amount of duplication whereby some crashes were associated with more than one bus stop. In order to minimize the duplication, the buffer distance was shrunk to 100 feet. Out of a total inventory of 4,585 BCT bus stops, 296 had one or more pedestrian crashes that occurred within 100 feet of its location between 2011 and 2014. That translated into 357 pedestrian crashes. Out of a total inventory of 3,129 Palm Tran bus stops, 196 had one or more pedestrian crashes

that occurred within 100 feet of its location between 2011 and 2014. That translated into 221 pedestrian crashes. After mapping the crash data in GIS, it was analyzed three separate ways.

First, the study looked at all 357 pedestrian crashes that were within 100 feet of a BCT bus stop and all 221 pedestrian crashes that were within 100 feet of a Palm Tran bus stop and tested for several variables. These variables included things such as:

- weather and light conditions
- day of the week
- age of the pedestrian struck
- suspected use of drugs or alcohol
- posted speed limit

Second, the police narratives in the crash reports for 357 crashes in Broward County and all 221 crashes in Palm Beach County were read to see how many mentioned the pedestrian being a bus patron. The purpose here was to quantify the number of pedestrian crashes that involved bus patrons and to identify any common characteristics of these crashes. This part of the analysis also included a cross-tabulation of the pedestrian crashes by bus stop configuration (i.e. near-side, far-side, mid-block). This was done only with the Broward County data because the research team had the configuration information for BCT's bus stops but not Palm Tran's.

Third, the analysis ranked the "Worst 5" bus stops in Broward County and the "Worst 6" bus stop in Palm Beach County in terms of pedestrian safety. The list for Palm Beach County was expanded to six bus stops because two of the stops were at the same intersection. These "worst" bus stops were ranked using three weighted variables: the number of pedestrian crashes within 100 feet of that bus stop, the annual average daily traffic of the street at the bus stop location, and the number of bus passenger on/offers at that bus stop. The weighting was as follows:

- total pedestrian crashes within 100 feet of the bus stop (60%)
- AADT of the street where the bus stop is located (20%)
- average weekday bus passenger on/offers for the bus stop (20%)

The bus stops were given a composite score on a scale of 0 to 100 where 0 was the worst and 100 was the best. Higher numbers of pedestrian crashes, AADT, and bus passenger on/offers resulted in lower scores. The logic behind giving a lower score to a crash location with a high AADT and a high number of on/offers was that these locations were more likely have conflicts between vehicles and pedestrians. The rankings for the 296 BCT bus stops that had one or more pedestrian crashes within 100 feet of their location can be found in Appendix A. The rankings for the 196 Palm Tran bus stops can be found in Appendix B.

Broward County

Out of a total inventory of 4,585 BCT bus stops, 296 had one or more pedestrian crashes that occurred within 100 feet of its location between 2011 and 2014. That translated into 357 pedestrian crashes. There is some duplication in that number since a crash could occur within 100 feet of more than one bus stop (e.g. bus stops on opposite sides of a street). Figure 2-1 is a bubble map that graphically illustrates the number of pedestrian crashes that occurred within 100 feet of these 296 bus stops.

Key Data Findings

- Only 18 of the 357 pedestrian crashes that occurred within 100 feet of a BCT bus stop between 2011 and 2014 involved a BCT patron. That translates into 5 percent of the crashes.
- The single most recurring theme in pedestrian crashes involving a BCT patron was crossing at mid-block or somewhere else outside of the designated crosswalk (11 of the 18 crashes). In another four of the crashes, the pedestrian was in the crosswalk but was crossing against the light.
- Nine of the 18 crashes occurred when the person was walking to the bus stop. In three of these nine crashes, the person was trying to catch a waiting bus. Eight of the 18 crashes occurred after the person got off the bus.
- In general, the distribution of pedestrian crashes involving BCT patrons according to bus stop configuration (far-side, near-side, mid-block) was proportional to the distribution of bus stop configurations. For example, 40 percent of BCT's bus stops in Broward County are near-side stops, and 38.9 percent of the pedestrian crashes occurred at near-side stops.
- Two corridors may warrant closer attention for improving pedestrian safety.
 - W. Sunrise Blvd. was the location of three crashes involving BCT patrons. These occurred at NW 16th Street, Sunset Strip, and NE 24th Avenue.
 - W. Oakland Park Blvd. was the location of two crashes involving BCT patrons. These occurred at NW 9th Avenue and at U.S. 441.
- The "Worst 5" BCT bus stops were at the following intersections:
 - Bus Stop 1808 – W. Sunrise Blvd. @ NW 15th Ave.
 - Bus Stop 2136 – Oakland Park Blvd. @ NW 9th Ave.
 - Bus Stop 257 - N. University Dr. @ NW 44th St.
 - Bus Stop 1791 – W. Sunrise Blvd. @ Sunset Strip
 - Bus Stop 775 – U.S. 1 @ NE 48th St.
- There were 16 pedestrian crashes associated with the "Worst 5" bus stops. However, only two of them involved a BCT patron.

- The single most recurring theme in the crash reports from these “Worst 5” BCT bus stops was the same as it was for the 18 county-wide crashes involving a BCT patron. The pedestrian was not using the crosswalk or was crossing against the traffic light. This is in spite of the fact that every one of the intersections at these bus stops has marked crosswalks.
- A preliminary recommendation calls for increased public education on pedestrian safety (e.g. PSAs on the buses reminding passengers to use designated crosswalks after alighting; PSAs with the message that it’s better to miss the bus instead than to lose one’s life; and possibly added signage at bus stops that directs alighting passengers to the crosswalks).

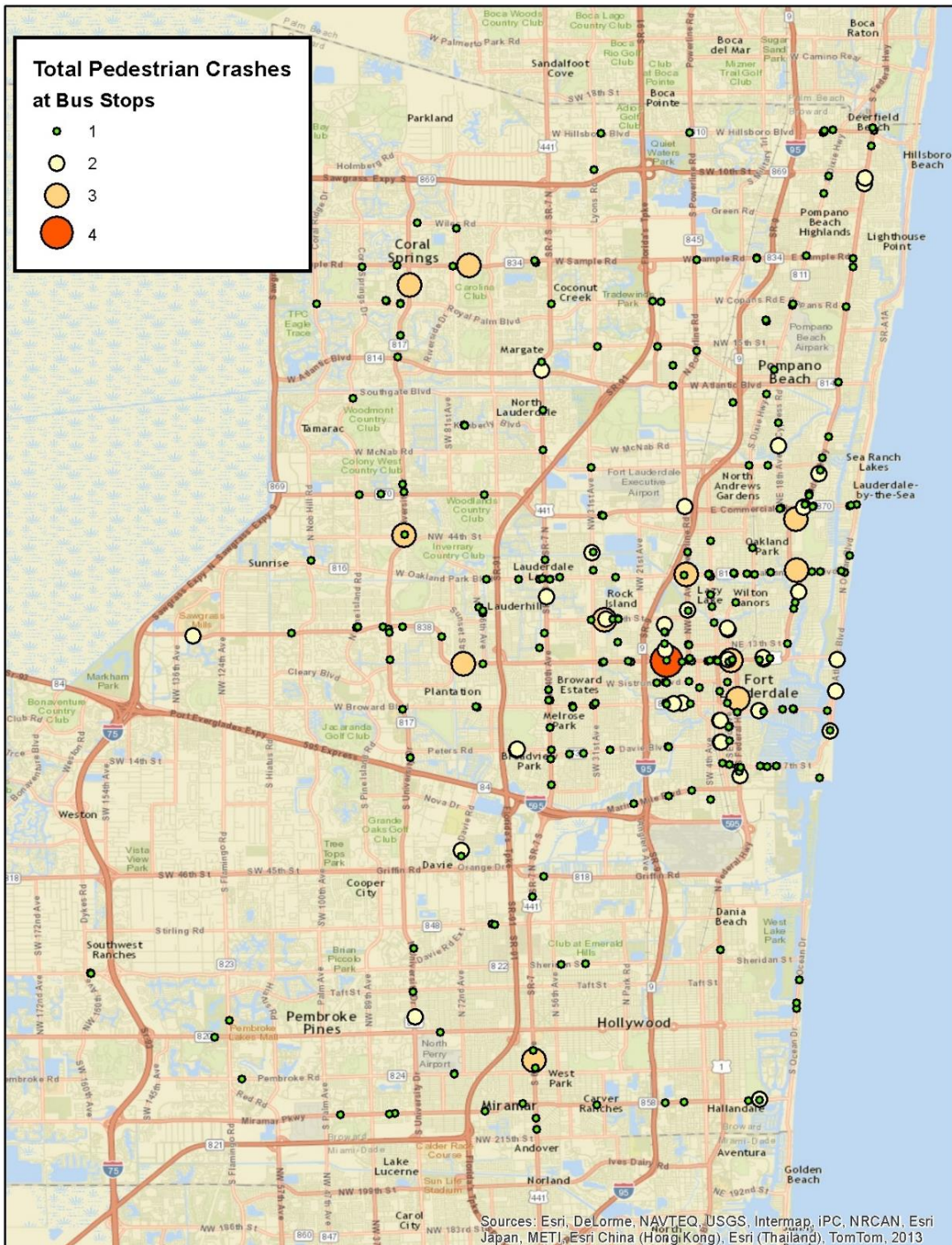


Figure 2-1 Total Pedestrian Crashes at BCT Bus Stops

The majority of the crashes occurred under clear weather conditions (79.8%). The majority also occurred during the hours of daylight though it was a lesser percentage (58.5%). A considerable percentage of the crashes (40.5%) occurred during the hours of darkness.

Table 2-1 Weather and Light Conditions – Broward County

Weather Conditions	Crashes	Percent		Light Conditions	Crashes	Percent
Clear	285	79.8%		Daylight	209	58.5%
Cloudy	41	11.5%		Dark – Lighted	109	30.5%
Rain	31	8.7%		Dark – Not Lighted	21	5.9%
				Dusk	14	3.9%
				Dawn	3	1.0%
				Dark – Unk. Lighting	1	0.2%
Total	357	100.0%		Total	357	100.0%

The crashes that occurred on weekdays (Mon-Fri) were fairly evenly distributed though there was a small peak on Fridays. The percentage of weekend crashes was smaller.

Table 2-2 Days of the Week – Broward County

Day of Week	Crashes	Percent
Mon	50	14.0%
Tue	56	15.7%
Wed	60	16.8%
Thu	51	14.3%
Fri	71	19.9%
Sat	44	12.3%
Sun	25	7.0%
Total	357	100.0%

Only 30 of the 357 crashes (8.4%) were alcohol related. Only 1 crash (0.3%) was drug related.

In Florida, a person is considered a minor until the age of 18. Unfortunately, the S-4 Analytics website does not break down the age categories in a way that cleanly divides between minors and non-minors. Instead, it brackets the age groups in 5-year increments (under 5, 5-9, 10-14, 15-19, etc.). Therefore the 15-19 age group includes some non-minors. Nevertheless, the analysis for this paper looked at the distribution of pedestrian crashes by age. 72 of the 357 crashes (20.2%) involved a pedestrian that was 19 or younger. 41 of the 357 crashes (11.5%) involved a pedestrian that was 65 or older.

Table 2-3 Age Ranges of Pedestrians Struck– Broward County

Age Range	Crashes	Percent
19 and under	72	20.2%
20-64	244	68.3%
65 and over	41	11.5%
Total	357	100.0%

Twenty-four (24) of the 357 crashes (6.7%) were fatalities. Most of the pedestrian crashes and most of the fatalities occurred on roads where the posted speed limit was between 31 and 40 miles per hour (mph).

Table 2-4 Posted Speed Limits at Crash Locations – Broward County

Speed Limit	All Ped Crashes	Percent	Fatal Ped Crashes	Percent
41-54 MPH	104	29.1%	6	25.0%
31-40 MPH	145	40.6%	13	54.2%
21-30 MPH	108	30.3%	5	20.8%
Total	357	100.0%	24	100.0%

Pedestrian Crashes Involving BCT Patrons

There were 18 pedestrian crashes that occurred within 100 feet of a BCT bus stop between 2010 and 2014 that involved a BCT patron. Summaries from the crash reports for these 18 crashes are provided below. The single most recurring theme was patrons crossing at mid-block or somewhere else outside of the designated crosswalk (11 of the 18 crashes). In another four of the crashes, the pedestrian was in the crosswalk but was crossing against the light. Another piece of information worth pointing out from the crash reports is that three of the crash reports specifically mentioned that the pedestrian was struck while trying to catch a bus that was waiting on the opposite side of the street.

BCT’s bus stop inventory includes information on whether a bus stop is near-side, far-side, in front of a point of interest, or opposite a point of interest. Using this information, an analysis was done to determine if one type of bus stop configuration had a prevalence of crashes. In theory, far-side bus stops are considered safer than near-side bus stops because they encourage the passengers to cross the intersection behind the bus where they are more visible to oncoming cars. At near-side stops, passengers cross the intersection in front of the bus and are more obscured by the bus. Table 2-5 below compares the distribution of bus stop configurations in BCT’s inventory to the distribution of pedestrian crashes involving BCT patrons. The data results do not show near-side bus stops to be disproportionately unsafe compared to other types of bus stops. Near-side stops account for 40 percent of BCT’s bus stop inventory but only 38.9 percent of the pedestrian crashes involving a patron. Caution must be taken with interpreting the data because there were so few crashes that involved a BCT patron.

Table 2-5 Bus Stop Configuration at Crash Locations – Broward County

Bus Stop Type	No. of Stops	%	Crashes w/in 100ft of Bus Stop	%
Far-side	2,442	53.3%	9	50.0%
Near-side	1,883	40.0%	7	38.9%
Other	310	6.7%	2	11.1%
Total	4,585	100.0%	18	100.0%

1. **Crash No. 80521882:** This crash occurred on 5/5/12 at 9:40 p.m. in the eastbound lanes of Pembroke Road on the west side of the intersection with Desoto Drive. The pedestrian was a 65-year old female. She was heading southbound across Pembroke Road after getting off the bus at Bus Stop 131. This bus stop is a mid-block stop with no crosswalk. The nearest crosswalks are 0.2 miles to the west and east at the intersections with Island Drive and SW 72nd Avenue, respectively. She had made it across the westbound lanes and was struck by a vehicle in the eastbound lanes.
2. **Crash No. 82157209:** This crash occurred on 3/28/11 at 7:03 a.m. in the northbound lanes of West Sunrise Boulevard on the north side of the intersection with NW 16th Street. The pedestrian was an 18-year old female high school student. She had gotten off the bus at Bus Stop 2946 on the northeast side of the intersection. This is a far-side stop. She was attempting to cross the northbound lanes of Sunrise Boulevard in order to get to Plantation High School, which is located across the street. She was crossing against the light and was not in the crosswalk. Witnesses stated that the driver of the vehicle was driving at an excessive speed in spite of the yellow flashing school light that is located approximately 360 feet south of the intersection.
3. **Crash No. 82207496:** This crash occurred on 8/25/14 at 3:13 p.m. in the northbound lanes of North Federal Highway south of intersection with East Sample Road. The crash was between a BCT bus and a pedestrian who was trying to board the bus as it pulled away from Bus Stop 842. The pedestrian was a 61-year old male. Bus Stop 843 is located 0.1 miles south of the intersection with East Sample Road and serves the northbound direction. The pedestrian ran across the road from west to east and in front of the bus while it was at the stop. The bus driver said she saw the pedestrian cross in front of the bus but was unaware he was at the right side of the bus when she prepared to rejoin the flow of traffic. The pedestrian was knocking on the bus demanding entry as it pulled away and was knocked down.
4. **Crash No. 82417824:** This crash occurred on 6/30/11 at 4:35 p.m. in eastbound lanes of Kimberly Boulevard east of the intersection with SW 78th Avenue. This location is a

residential area with single family homes. The pedestrian was a 50-year old female. She had gotten off the bus at Bus Stop 2865, which is just east of SW 78th Avenue, and then crossed Kimberly Boulevard diagonally in a south-east direction. She made it to the grassy median and was struck by a vehicle in the eastbound lanes. It should be noted that there is no crosswalk at this intersection.

5. **Crash No. 82740666:** This crash occurred on 9/16/11 at 6:00 a.m. in the eastbound lanes of West Commercial Boulevard on the east side of the intersection with Woodlands Boulevard. The pedestrian was a male just shy of 16 years. He was running in a southerly direction across the eastbound lanes of Commercial Boulevard from the center median to get to Bus Stop 5095 and was struck by an eastbound vehicle. Although the pedestrian was in the crosswalk, he was crossing against the light.
6. **Crash No. 82747337:** This crash was a fatality. The crash occurred on 3/29/12 at 11:46 a.m. in the southbound lanes of South Cypress Road south of the intersection with SW 15th Street. The pedestrian was a 32-year old male. He was standing near the bus stop on the west side of Cypress Road (Bus Stop 1478). This bus stop is approximately 180 feet south of the intersection of SW 15th St., where there is a crosswalk. When he attempted to cross the street at midblock, he was struck and killed by a southbound vehicle.
7. **Crash No. 82751004:** This crash occurred on 11/16/11 at 6:55 a.m. in the southbound lanes of Sea Grape Drive at the intersection of Commercial Boulevard. The pedestrian was a 25-year old male. He was walking eastbound on north side of Commercial Boulevard and was attempting to cross Sea Grape Drive in order to get to the bus stop on the northeast side of the intersection (Bus Stop 5357). He was in the crosswalk and was crossing with the light. There was a southbound vehicle stopped at the intersection that was attempting to turn right on red. As the pedestrian crossed in front of the vehicle, the driver moved forward not noticing the pedestrian and struck him.
8. **Crash No. 83064307:** This crash occurred on 2/25/12 at 5:50 p.m. in the southbound lanes of U.S. 441 South (SR 7) north of the intersection with NW 12th Street. The pedestrian was a 17-year old male. He had gotten off the bus at Bus Stop 1285 and attempted to U.S. 441. The bus driver honked the horn several times to warn the pedestrian about oncoming traffic, but it was too late.
9. **Crash No. 83106724:** This crash occurred on 10/26/12 at 11:32 a.m. in the westbound lanes of West Oakland Park Boulevard just east of the intersection with U.S. 441. The pedestrian was a 20-year old female. She was crossing Oakland Park Boulevard from

north to south to get to the Bus Stop 3085 on the south side of street. She was not in the crosswalk and was struck by a westbound car in the left turn lane.

10. **Crash No. 83609523:** This crash occurred on 10/5/12 at 2:21 p.m. in the southbound lanes of North Dixie Highway just north of the intersection with East Sample Road. The pedestrian was a 15-year old male. He was in a rush to catch the bus that was waiting at Bus Stop 3114 on the east side of North Dixie Highway. He ran from the west side of the road to the east side approximately 100 feet north of the crosswalk Sample Road. As he was crossing the southbound left turn lane, he was struck by a vehicle. This crash was a hit and run.
11. **Crash No. 83627997:** This crash occurred on 11/19/12 at 10:45 a.m. in the southbound lanes of SW 3rd Avenue on the south side of the intersection at West Hillsboro Boulevard. The pedestrian involved in the crash was actually a BCT bus driver. The bus driver was assisting a passenger remove his bike from the bike rack on the front of the bus when he was struck on the left elbow by a passing vehicle. This accident occurred at Bus Stop 3118.
12. **Crash No. 83629860:** This crash occurred on 1/16/13 at 3:14 p.m. in the westbound lanes of NE 62nd Street on the west side of the intersection at North Dixie Highway. The pedestrian was a 16-year old female. She had gotten off the bus at Bus Stop 4779, which is on the south side of NE 62nd Street near the intersection with NE 9th Avenue. She was crossing NE 62nd Street in order to get to Bus Stop 5436, which is on the north side of NE 62nd Street near Dixie Highway. Because there is no crosswalk at the intersection with NE 9th Avenue where she got off the bus, and the crosswalk at Dixie Highway is 0.1 miles from Bus Stop 4779, she crossed at mid-block. She made it to the median and then walked in front of a van that was stopped in the westbound median left-turn lane. This van blocked her from the view of oncoming westbound traffic. When she stepped out from the front of the van, she was struck by a westbound vehicle.
13. **Crash No. 83988057:** This crash occurred on 3/29/13 at 7:39 p.m. in the eastbound lanes of East Sunrise Boulevard on the east side of the intersection at NE 24th Avenue. The pedestrian was a 36-year old female. She had gotten off an eastbound bus at Bus Stop 1806 on the southeast side of the intersection. She ran across Sunrise Boulevard from south to north and was struck by an eastbound vehicle. She was not in the crosswalk.
14. **Crash No. 84446590:** This crashed occurred on 1/24/2014 at 07:36 a.m. on NW 12th Street near the T-intersection with NW 42nd Way. The pedestrian was a 17-year old male. He was walking northbound on NW 42nd Way, presumably from his place of

residence, to get to the Lauderhill Mall bus terminal (Bus Stop 1284) on the north side of NW 12th Street. He told the police officer that he takes a BCT bus to school. There is no crosswalk at this T-intersection. The pedestrian did not see the westbound vehicle on NW 12th Street. The vehicle stopped, but the pedestrian's hand touched the vehicle's left front mirror.

15. **Crash No. 85019617:** This crashed occurred on 12/7/14 at 6:40 p.m. in the northbound lanes of North Federal Highway on the south side of the intersection at NE 21st Street. The pedestrian was an 82-year old female. She was walking westbound across Federal Highway and was not in the crosswalk when she was struck by a northbound vehicle. She told the police that she was trying to get to the bus stop on opposite side of Federal Highway (Bus Stop 875) to catch the southbound bus.
16. **Crash No. 88230548:** This accident occurred on 3/17/11 at 8:22 p.m. in the eastbound lanes of West Oakland Park Boulevard on the west side of the intersection with NW 9th Avenue. The pedestrian was a 56-year old male. He had gotten off the bus at Bus Stop 2135 located on the south side of Oakland Park Boulevard. This bus stop is approximately 300 feet west of the crosswalk at NW 9th Ave. The bus driver observed the pedestrian run eastbound on the sidewalk and then out into eastbound the lanes of Oakland Park Boulevard. He ran in between vehicles that were stopped at the red light and was struck by a vehicle in the left turn lane that was proceeding on a green arrow. The pedestrian was not in the crosswalk.
17. **Crash No. 90736101:** This crash occurred on 4/5/2011 at 4:42 p.m. in the eastbound lanes of West Sunrise Boulevard on the west side of the intersection with Sunset Strip. The vehicle was travelling eastbound on Sunrise Boulevard and was proceeding on a solid green light. The pedestrians were a mother and her three children who were running southbound across Sunrise Boulevard to catch that bus that was stopped at Bus Stop 1791. Although the pedestrians were in the crosswalk, they were crossing against the light, presumably because they were afraid they would miss the bus. The children had run ahead of their mother. Two of them made it across the road. The third child, a 10-year old female, had stopped at the median after crossing the westbound lanes and then began to continue across the eastbound lanes. She was struck by the eastbound vehicle when entering the crosswalk and landed approximately 50 feet east of the impact location. Amazingly, the crash report did not indicate a fatality.
18. **Crash No.91383898:** This crash occurred on 4/9/11 at 10:38 a.m. in the westbound lanes of NW 19th Street on the east side of the intersection at NW 27th Avenue. A westbound bus was pulling up to Bus Stop 3136. After the bus came to a stop, a

pedestrian who was waiting at the bus stop became dizzy, fainted, and fell in front of the bus.

“Worst 5” BCT Bus Stops

Table 2-6 shows the “Worst 5” bus stops and their scores. The full list for all 296 bus stops can be found at the end of this report in Appendix A

Table 2-6 “Worst 5” BCT Bus Stops

Stop ID	Main Street	Cross Street	Direction	Crashes	Crash Score	Mean AADT	AADT Score	Transit Rider On/Offs	On/Off Score	Combined Score
1808	W SUNRISE BLVD	NW 15 AVE	EB	4	0.0	51,500	6.6	208	19.4	26.0
2136	OAKLAND PARK BLVD	NW 9 AVE	WB	3	20.0	57,000	5.1	434	18.8	43.9
257	N UNIVERSITY DR	NW 44 ST	SB	3	20.0	55,500	5.5	128	19.6	45.1
1791	W SUNRISE BLVD	SUNSET SRIP	EB	3	20.0	48,500	7.5	158	19.6	47.0
775	U.S. 1	NE 48 ST	NB	3	20.0	45,000	8.4	25	19.9	48.4

There were 16 pedestrian crashes total associated with these five bus stops. One of them was a fatality but did not involve a BCT patron. Two of the 16 pedestrian crashes did involve BCT patrons. Summaries of the crash reports for these five bus stops can be found on the following pages. The single most recurring theme was pedestrians not using the crosswalks or crossing against the traffic light. In fact, 11 of the 16 crashes involved this scenario. It should be noted that every one of the intersections involved has marked crosswalks.

Bus Stop 1808 – W SUNRISE BLVD/NW 15 AVE

Bus Stop 1808 is a far-side stop located on W. Sunrise Blvd. on the south-east side of the T-intersection with NW 15th Ave. It is serviced by two routes, the Route 31 and the Route 36. An aerial photo of the intersection is shown in Photo 2-1. There are six (6) thru lanes of traffic going across W. Sunrise Blvd. plus a left-turn lane, and there is a grass median in the middle. The crosswalk for W. Sunrise Blvd. is located on the west side of the intersection approximately 130 feet behind the bus stop. The posted speed limit in this location is 40 miles per hour (mph). Street level photos of the Bus Stop 1808 are shown in Photo 2-2 and Photo 2-3.



Photo 2-1 W. Sunrise Blvd. & NW 15th Ave.

Source: Google Maps



Photo 2-2 Bus Stop 1808 (looking east on W. Sunrise Blvd.)

Source: Google Maps



Photo 2-3 Bus Stop 1808 (looking west on W. Sunrise Blvd.)

There were four (4) pedestrian crashes that occurred within 100 feet of Bus Stop 1808. In three of the four crashes, the pedestrian was not using the crosswalk or was crossing against the traffic signal. One of the four crashes was a fatality. The fatal crash occurred at 11:16 p.m., which was after the operating hours of the Routes 31 but still during the operating hours of the Route 36. There was no mention in any of the police reports for the four crashes that the pedestrians involved were BCT passengers.

Crash No. 84609042: This crash was a fatality. It occurred at 11:16 p.m. The pedestrian/victim was a 71-year old female who was attempting to cross Sunrise Blvd. mid-block (i.e. not in the crosswalk) from south to north. She was struck by an east-bound vehicle that fled the scene.

Crash No. 84609496: This crash occurred at 4:33 p.m. The pedestrian was a 24-year old female. She was using the crosswalk to go south across W. Sunrise Blvd. when she was struck by a vehicle turning right from southbound NW 15th Ave. to westbound W. Sunrise Blvd. The vehicle fled the scene. The pedestrian reported to police that the vehicle had a red light and that she had the right of way.

Crash No. 91381920: This crashed occurred at 12:22 p.m. The driver of the vehicle was traveling southbound on NW 15th Ave. and was turning left to go eastbound on W. Sunrise Blvd. The driver had a green light. The pedestrian, a 25-year old male, was crossing W. Sunrise Blvd. from south to north not at the crosswalk and against the signal. The pedestrian unlawfully walked into the path of the vehicle and was struck.

Crash No. 91416471: This crash occurred at 3:11 p.m. The driver of the vehicle was headed south on NW 15th Ave. and was stopped at the traffic light. When the light turned green, the driver proceeded into the intersection to turn left onto eastbound W. Sunrise Blvd. Approximately 10 feet east of the intersection, the pedestrian, an 11 year-old male, ran into the roadway from the sidewalk on the south side of W. Sunrise Blvd. to cross north. The pedestrian was not in the crosswalk. The driver of the vehicle braked suddenly but was unable to avoid a collision.

Weather and Light Conditions

All four of the pedestrian crashes at this location occurred under clear weather conditions. Three of the four occurred during daylight hours. The single crash that occurred during the hours of darkness (time of crash 11:16 p.m.) was a fatality. The time of that crash was after the operating hours of the Routes 31 but still within the operating hours of the Route 36.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	4	Daylight	3
Cloudy	0	Dark – Lighted	1
Rain	0	Dawn	0
Total	4	Total	4

Days of the Week of Crashes

All of the crashes occurred on a weekday.

Day of Week	Crashes
Weekday	4
Weekend	0
Total	4

Involvement of Drugs and/or Alcohol

None of the crashes involved suspected use of drugs and/or alcohol.

Involvement of Elderly and Pedestrians 19 and under

One of four crashes involved a minor (11 years old), and another one involved an elderly person (71 years old). The latter was a fatality.

Fatalities

One crash at this location involved a fatality.

Bus Stop 2136 – W OAKLAND PARK BLVD/NW 9 AVE

Bus Stop 2136 is a far-side stop located on W. Oakland Park Blvd. on the northwest corner of the intersection with NW 9th Ave/Powerline Rd. It is located just before a driveway entrance to a Mobil gas station. An aerial photo of the intersection is shown in Photo 2-4. Bus Stop 2136 is serviced by the Route 72. Street level photos are shown in Photo 2-5 and Photo 2-6. At this location, W. Oakland Park Blvd. has six (6) thru lanes of traffic, a left turn lane, and a median. The posted speed limit is 35 miles per hour.



Photo 2-4 W. Oakland Park Blvd. & NW 9th Ave.

Source: Google Maps



Photo 2-5 Bus Stop 2136 (looking west on W. Oakland Park Blvd.)

Source: Google Maps



Photo 2-6 Bus Stop 2136 (looking east on W. Oakland Park Blvd.)

There were three (3) pedestrian crashes that occurred within 100 feet of Bus Stop 2136. All three crashes involved pedestrians who were not using the crosswalk or were crossing against the traffic signal. One of the crashes involved a BCT bus passenger. After disembarking from a bus on the south side of W. Oakland Park Blvd., this person dashed north across W. Oakland

Park Blvd. in between vehicles that were stopped at the traffic light and was struck by a vehicle in the left turn lane that was proceeding on a green arrow.

Crash No. 82230532: This accident occurred at 9:33 a.m. in the eastbound lanes of W. Oakland Park Blvd. on the west side of the intersection with NW 9th Ave. The pedestrian a 77-year old male. He was crossing the east bound lanes of W. Oakland Park Blvd. in between vehicles that were stopped at the red light. The pedestrian was not using the crosswalk. He crossed from the sidewalk on the south side of the road approximately 100 feet west of the intersection with NW 9th Ave. When the pedestrian entered the left turn lane, he was struck by a vehicle that was proceeding on a green arrow.

Crash No. 82230532: This accident occurred at 12:44 a.m. in the eastbound lanes of W. Oakland Park Blvd. on the west side of the intersection with NW 9th Ave. The pedestrian hit was a 26-year old male. He darted out from the sidewalk on the south side of W. Oakland Park Blvd. at the Chevron gas station and was struck by a vehicle that was proceeding eastbound. The pedestrian was not in the crosswalk.

Crash No. 88230548: This accident occurred at 8:22 p.m. in the eastbound lanes of W. Oakland Park Blvd. on the west side of the intersection with NW 9th Ave. The pedestrian was a 56-year old male. He had disembarked from a Broward County Transit bus at the bus stop located on the south side of W. Oakland Park Blvd. (Bus Stop 2135). This bus stop is approximately 300 feet west of the crosswalk at the intersection with NW 9th Ave. The BCT bus driver observed the pedestrian run eastbound on the sidewalk and then run out into eastbound the lanes of W. Oakland Park Blvd. The pedestrian ran in between vehicles that were stopped at the red light and was struck by a vehicle in the left turn lane. The pedestrian was not in the crosswalk.

Weather and Light Conditions

Two of the three pedestrian crashes at this location occurred under clear weather conditions, and one occurred under cloudy conditions. Two of the three occurred during the hours of darkness. All three crashes occurred inside the operating hours of the Route 72.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	1
Cloudy	1	Dark – Lighted	2
Rain	0	Dawn	0
Total	3	Total	3

Days of the Week of Crashes

All of the crashes occurred on a weekday.

Day of Week	Crashes
Weekday	3
Weekend	0
Total	3

Involvement of Drugs and/or Alcohol

None of the crashes involved suspected use of drugs and/or alcohol.

Involvement of Elderly and Pedestrians 19 and under

One of crashes involved an elderly person (77 years old).

Fatalities

None of the crashes involved a fatality.

Bus Stop 257 – N UNIVERSITY DR/NW 44 ST

Bus Stop 257 is a near-side stop located on N. University Drive on the northwest side of the intersection with NW 44th Street. An aerial photo of the intersection is shown in Photo 2-7. Bus Stop 257 is serviced by the Route 2. The bus stop is located approximately 100 feet from the crosswalk with N. University Drive. Street level photos of the Bus Stop 257 are shown in Photo 2-8 and Photo 2-9. In this location, N. University Drive has six (6) lanes of thru traffic, two left turn lanes, and a median. The posted speed limit is 45 miles per hour.

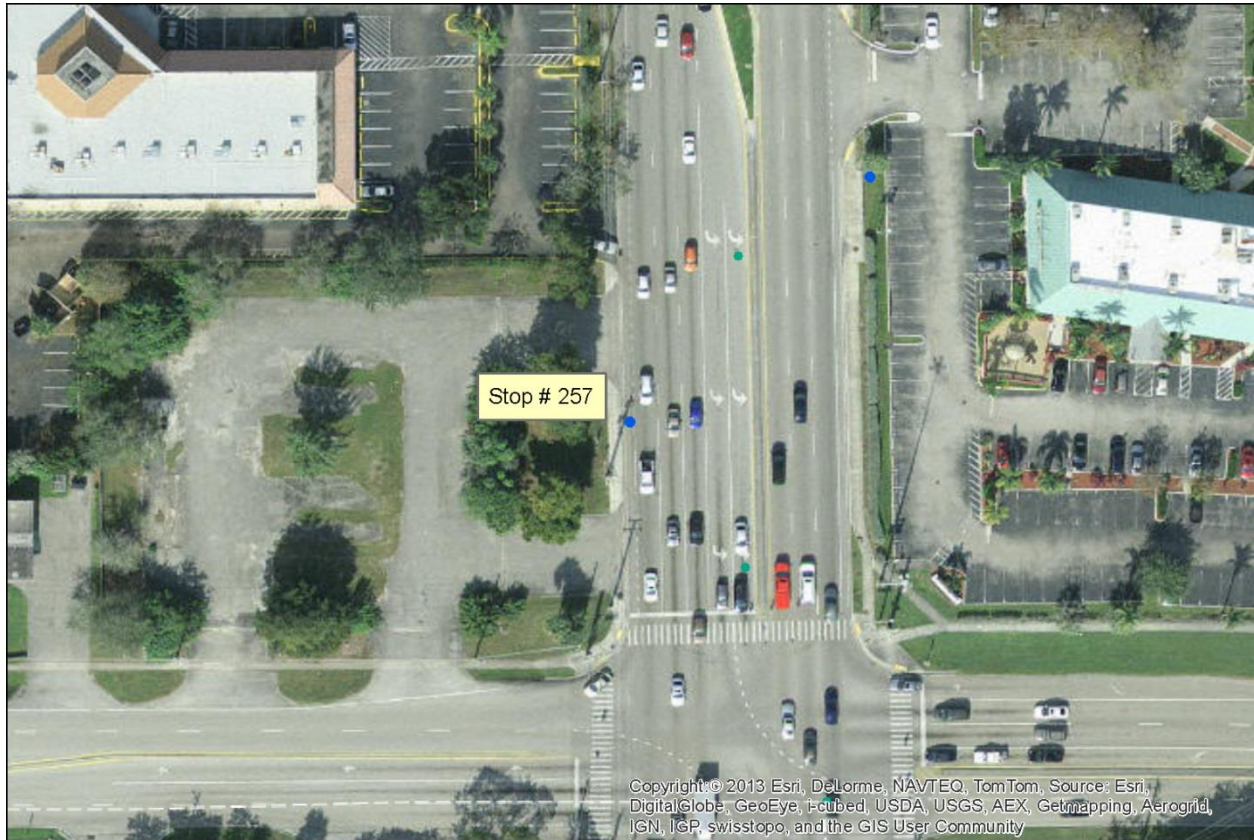


Photo 2-7 N. University Dr. & NW 44th St.

Source: Google Maps



Photo 2-8 Bus Stop 257 (looking south on N. University Dr.)

Source: Google Maps



Photo 2-9 Bus Stop 257 (looking north on N. University Dr.)

There were three (3) pedestrian crashes that occurred within 100 feet of Bus Stop 257. Two of the crashes involved pedestrians that were not in the crosswalk.

Crash No. 82648066: This accident occurred at 1:08 p.m. Two pedestrians were struck by a car that was making a right turn from southbound N. University Drive to westbound NW 44th Street. One of the two pedestrians had already been transported to the hospital when police arrived. The other pedestrian that was hit was a 54-year old male. According to the driver of the vehicle, the pedestrian that had been transported to the hospital was not in the crosswalk. According to an eyewitness, the second pedestrian was in the crosswalk.

Crash No. 90737685: This accident occurred at 7:49 p.m. The vehicle was stopped for a red light in the northbound left turn lane of N. University Drive. The pedestrian, a 63-year old male, was crossing N. University Drive in the crosswalk from west to east on the south side of the intersection. The pedestrian was just past the middle of N. University Dr. when the left turn light changed to green. The vehicle proceeded to make U-turn and collided with the pedestrian.

Crash No. 82648572: This accident occurred at 8:45 p.m. The vehicle was traveling northbound on N. University Drive on a green light. The pedestrian, a 15-year old male, was crossing N. University Drive from east to west on the north side of the intersection. The pedestrian was crossing the street 300 feet from the intersection and was not in the crosswalk.

Weather and Light Conditions

Two of the three pedestrian crashes at this location occurred under clear weather conditions, and one occurred under cloudy conditions. Two of the three occurred during the hours of darkness. All three crashes occurred during the operating hours of the Route 2.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	1
Cloudy	1	Dark – Lighted	2
Rain	0	Dawn	0
Total	3	Total	3

Days of the Week of Crashes

Two of the crashes occurred on a weekday, and one occurred on a weekend.

Day of Week	Crashes
Weekday	2
Weekend	1
Total	3

Involvement of Drugs and/or Alcohol

None of the crashes involved suspected use of drugs and/or alcohol.

Involvement of Elderly and Pedestrians 19 and under

One of crashes involved a minor (15 years old).

Fatalities

None of the crashes involved a fatality.

Bus Stop 1791 – W SUNRISE BLVD/SUNSET STRIP

Bus Stop 1791 is a near-side stop located on W. Sunrise Blvd. just west of the T-intersection with Sunset Strip on the south side of the road. This bus stop is serviced by the Route 36. An aerial photo of the T-intersection is shown in Photo 2-10. The bus stop is located just before the crosswalk for W. Sunrise Blvd. There is a tapered sidewalk of approximately 175 feet where the bus stop is located. There is no sidewalk beyond the bus stop on the south side of W. Sunrise Blvd. At this location, W. Sunrise Blvd. has six (6) thru lanes of traffic, a left turn lane, and a median. The posted speed limit is 45 miles per hour. Street level photos of Bus Stop 1791 are shown in Photo 2-11 and Photo 2-12.



Photo 2-10 W. Sunrise Blvd. & Sunset Strip

Source: Google Maps



Photo 2-11 Bus Stop 1791 (looking east on W. Sunrise Blvd.)

Source: Google Maps



Photo 2-12 Bus Stop 1791 (looking west on W. Sunrise Blvd.)

There were three (3) pedestrian crashes that occurred within 100 feet of Bus Stop 1791. Two of them occurred on Sunset Strip, and one occurred on W. Sunrise Blvd. In one of the Sunset Strip crashes, the pedestrian was not using the crosswalk. In the other crash, the pedestrian was using the crosswalk and was crossing on a green pedestrian light. The crash that occurred on W.

Sunrise Blvd. involved a family that was attempting to catch the BCT bus that was waiting at Bus Stop 1791. They were in the crosswalk but were crossing against the light.

Crash No. 83091410: This accident occurred at 5:13 p.m. The vehicle was travelling south on Sunset Strip in the left thru lane when the pedestrian, a 71-year old female darted out into the roadway from behind some bushes. The pedestrian was attempting to cross from east to west across Sunset Strip and was not using the crosswalk.

Crash No. 83091351: This accident occurred at 12:29 p.m. The vehicle southbound on Sunset Strip and was in the right turn lane. The pedestrian, a 60-year old female, was crossing Sunset Strip in the eastbound direction and was in the crosswalk. The driver of the vehicle was looking left (i.e. to the east) to make sure it was clear to turn right and did not see the pedestrian to his right. When he moved forward, he struck the pedestrian in the crosswalk.

Crash No. 90736101: This accident occurred at 4:42 p.m. The vehicle was travelling eastbound on W. Sunrise Blvd. and was proceeding on a solid green light. The pedestrians were a mother and her three children who were running southbound across W. Sunrise Blvd. to catch a bus that was stopped at Bus Stop 1791. Although the pedestrians were in the crosswalk, they were crossing against the light, presumably because they were afraid they would miss the bus. The children had run ahead of their mother. Two of them made it across the road. The third child, a 10-year old female, had stopped at the median after crossing the westbound lanes and then began to continue across the eastbound lanes. She was struck by the eastbound vehicle when entering the crosswalk and landed approximately 50 feet east of the impact location.

Weather and Light Conditions

Two of the three pedestrian crashes at this location occurred under clear weather conditions. The third occurred under cloudy conditions. Two of the three crashes occurred during the hours of daylight. The third crash occurred during the hours of dusk. All three crashes occurred during the operating hours of the Route 36.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	2
Cloudy	1	Dusk	1
Total	3	Total	3

Days of the Week of Crashes

All three crashes occurred on a weekday.

Day of Week	Crashes
Weekday	3
Weekend	0
Total	3

Involvement of Drugs and/or Alcohol

None of the crashes involved suspected use of drugs and/or alcohol.

Involvement of Elderly and Persons 19 and under

Two of the crashes involved elderly persons (ages 71 and 60), and one crash involved a minor (age 10).

Fatalities

None of the crashes involved a fatality.

Bus Stop 775 – U.S. 1/NE 48 ST

Bus Stop 775 is a near-side stop located on U.S. 1 just before the entrance to Holy Cross Hospital. Holy Cross is on the west side of U.S. 1, and Bus Stop 775 is on the east side. This bus stop is serviced by the Route 10. An aerial photo of the intersection is shown in Photo 2-13. The crosswalk for U.S. 1 is right next to the bus stop. Street level photos of the Bus Stop 775 are shown in Photo 2-14 and Photo 2-15. At this location, U.S. 1 has six (6) lanes of thru traffic, a left turn lane, and a median. The posted speed limit is 45 miles per hour.



Photo 2-13 U.S. 1 & NE 48th St.

Source: Google Maps



Photo 2-14 Bus Stop 775 (looking northeast on U.S. 1)

Source: Google Maps



Photo 2-15 Bus Stop 775 (looking southwest on U.S. 1)

There were three (3) pedestrian crashes that occurred within 100 feet of Bus Stop 775. However, two of them occurred on the grounds of Holy Cross Hospital. The third crash occurred on U.S. 1 and involved a pedestrian that was not using the crosswalk.

Crash No. 84138363: This accident occurred at 11:50 a.m. in the parking lot of Holy Cross Hospital. The parking lot is immediately adjacent to both U.S. 1 and the crosswalk. The driver reported that he was backing up into a parking space when he struck the pedestrian.

Crash No. 84410117: This accident occurred at 3:40 p.m. in the ambulance entrance to Holy Cross Hospital (i.e. not on U.S. 1). The victim was an emergency medical technician (EMT) who was standing behind his work vehicle when he was struck by the vehicle behind his left knee.

Crash No. 84411487: This accident occurred at 1:19 a.m. The vehicle was proceeding northbound on U.S. 1 in the middle thru lane. The pedestrian, a 45-year old female, was crossing U.S. 1 from west to east and was not in the crosswalk.

Weather and Light Conditions

All three pedestrian crashes at this location occurred under clear weather conditions. Two of the three occurred during the hours of daylight. The one crash that occurred during the hours of darkness occurred outside the operating hours of the Route 10.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	3	Daylight	2
		Dark – Lighted	1
Total	3	Total	3

Days of the Week of Crashes

All three crashes occurred on a weekday.

Day of Week	Crashes
Weekday	3
Weekend	0
Total	3

Involvement of Drugs and/or Alcohol

None of the crashes involved suspected use of drugs and/or alcohol.

Involvement of Elderly and Persons 19 and Under

None of the crashes involved an elderly person or a minor.

Fatalities

None of the crashes involved a fatality.

Palm Beach County Crash Data

Out of a total inventory of 3,129 Palm Tran bus stops, 196 had one or more pedestrian crashes that occurred within 100 feet of its location between 2011 and 2014. That translated into 221 pedestrian crashes. There is some duplication in that number since a crash could occur within 100 feet of more than one bus stop (e.g. bus stops on opposite sides of a street). Figure 2-2 is a bubble map that graphically illustrates the number of pedestrian crashes that occurred within 100 feet of these 196 bus stops.

Key Data Findings

- Only eight of the 221 pedestrian crashes that occurred within 100 feet of a Palm Tran bus stop between 2011 and 2014 involved a Palm Tran patron. That translates into 3.6 percent of the crashes.
- The single most recurring theme in the pedestrian crashes involving Palm Tran patrons was crossing at mid-block or somewhere else outside of the designated crosswalk (5 of the 8 crashes). In two of the five crashes, there were either no designated crosswalks or the crosswalk was more than 500 feet away. In the other three crashes, there was a nearby crosswalk, but the pedestrian did not use it.
- Four of the eight crashes occurred after the person got off the bus, two occurred when the person was walking to the bus stop, and two occurred while the person was at the bus stop.
- Forest Hill Boulevard may warrant closer attention for improving pedestrian safety. It was the site of three of the eight bus patron crashes. One occurred at the intersection of S. Military Trail, and another two were at the intersection of S. Dixie Highway.
- The “Worst 6” Palm Tran bus stops were at the following intersections. The list was expanded from five to six because the top two bus stops were at the same intersection.
 - Bus Stop 82 – Broadway @ 40th St.
 - Bus Stop 429 – Broadway @ 40th St.
 - Bus Stop 3061 – 45th St. @Poinciana Plaza
 - Bus Stop 513 – Dixie Hwy. @ 2nd Ave. N.
 - Bus Stop 1055 – S. Military Trail @ Cresthaven Blvd.
 - Bus Stop 136 – Dixie Hwy. @ Forest Hill Blvd.
- There were 11 pedestrian crashes associated with the “Worst 6” bus stops, but only one involved a Palm Tran patron.
- The most recurring theme in the crash reports at these six bus stop locations was the same as it was for the eight county-wide pedestrian crashes involving Palm Tran patrons. The pedestrian was crossing at mid-block instead of at the nearby crosswalks.

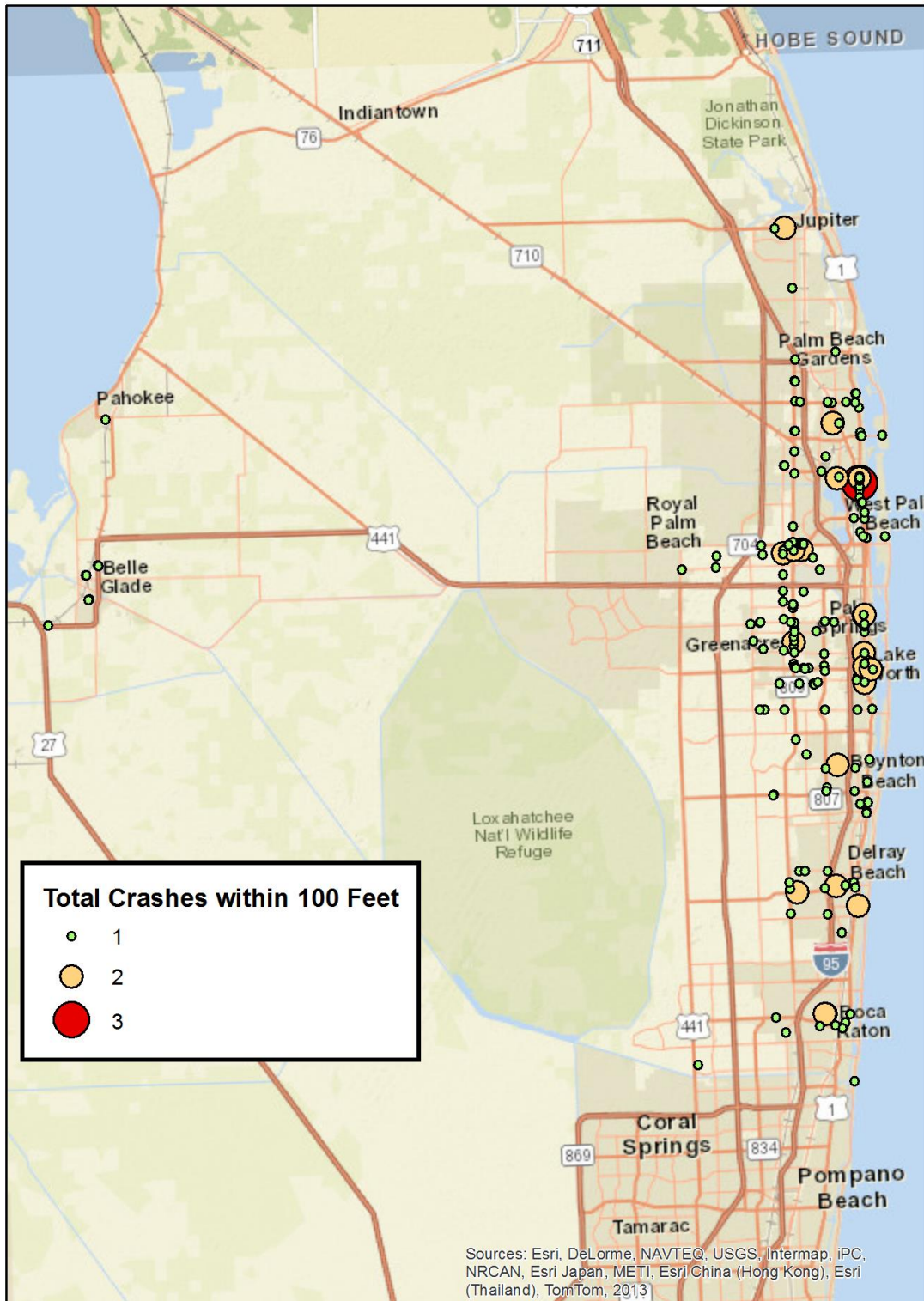


Figure 2-2 Total Pedestrian Crashes at Palm Tran Bus Stops

The majority of the 221 crashes occurred under clear weather conditions (71.0%). The majority also occurred during the hours of daylight though it was a lesser percentage (59.7%). A considerable percentage of the crashes (38.0%) occurred during the hours of darkness.

Table 2-7 Weather and Light Conditions – Palm Beach County

Weather Conditions	Crashes	Percent	Light Conditions	Crashes	Percent
Clear	157	71.0%	Daylight	132	59.7%
Cloudy	43	19.5%	Dark – Lighted	71	32.1%
Rain	21	9.5%	Dusk	6	2.7%
			Dark – Not Lighted	5	2.3%
			Dawn	5	2.3%
			Dark – Unk. Lighting	2	0.9%
Total	221	100.0%		221	100.0%

The crashes that occurred on weekdays (Mon-Fri) were fairly evenly distributed except for on Thursdays where the percentage dropped. There were actually more pedestrians crashes on Saturdays than on Thursdays.

Table 2-8 Days of the Week – Palm Beach County

Day of Week	Crashes	Percent
Mon	35	15.8%
Tue	37	16.7%
Wed	38	17.2%
Thu	24	10.9%
Fri	38	17.2%
Sat	30	13.6%
Sun	19	8.6%
Total	221	100.0%

Only 3.2 percent of the crashes involved suspected use of drugs. However, 14.0 percent of the crashes involved the suspected use of alcohol.

In Florida, a person is considered a minor until the age of 18. Unfortunately, the S-4 Analytics website does not break down the age categories in a way that cleanly divides between minors and non-minors. It brackets the age groups in 5-year increments (under 5, 5-9, 10-14, 15-19, etc.). Therefore the 15-19 age bracket includes some non-minors. Nevertheless, the analysis for this paper looked at the distribution of pedestrian crashes by age. 41 of the 221 crashes (18.6%) involved a pedestrian that was 19 or younger. 35 of the 221 crashes (15.8%) involved a pedestrian that was 65 or older.

Table 2-9 Age Ranges of Pedestrians Struck – Palm Beach County

Age Range	Crashes	Percent
19 and under	41	18.6%
20-64	145	65.6%
65 and over	35	15.8%
Total	221	100.0%

17 of the 221 pedestrian crashes (7.7%) were fatalities. The largest percentage of pedestrian crashes and the largest percentage of fatal pedestrian crashes occurred on roads with posted speed limits between 31 and 40 miles per hour. However, it is worth pointing out that a disproportionate percentage of the fatal crashes occurred on roads with speed limits between 41 and 45 mph. They accounted for 25.3 percent of all crashes but 41.2 percent of the fatal crashes.

Table 2-10 Posted Speed Limits at Crash Locations – Palm Beach County

Road Speed Limit	All Ped Crashes	Percent	Fatal Ped Crashes	Percent
41-54 MPH	56	25.3%	7	41.2%
31-40 MPH	108	48.9%	8	47.1%
21-30 MPH	48	21.7%	2	11.8%
6-20 MPH	9	4.1%	0	0.0%
Total	221	100.0%	17	100.0%

Pedestrian Crashes Involving Palm Tran Patrons

There were eight pedestrian crashes that occurred within 100 feet of a Palm Tran bus stop between 2010 and 2014 that involved a Palm Tran patron. Summaries from the crash reports for these eight crashes are provided below. The single most recurring theme was patrons crossing at mid-block or somewhere else outside of the designated crosswalk (5 of the 8 crashes).

1. **Crash No. 81338563:** This crash occurred on 3/6/12 at 2:15 p.m. in the westbound lanes of Lantana Rd. on the west side of the intersection at Brentwood Blvd. A Palm Tran bus had stopped at Bus Stop 6806 to drop off a passenger. The passenger got off the bus and began to walk eastbound on the sidewalk. A vehicle that was traveling westbound on Lantana Rd. in the outside lane attempted to pass the stopped bus on the right by going over the curb onto the sidewalk and struck the pedestrian.
2. **Crash No. 81363887:** This crash occurred on 4/29/13 at 6:42 a.m. on Haverhill Rd. on the east side of the intersection with Dryden Rd. The pedestrian was a 14-year old male.

He was walking southbound on Haverhill Rd. to catch the bus that was waiting at Bus Stop 1516 on the southeast side of the intersection. This intersection does not have crosswalks. As the pedestrian was crossing Dryden Rd., he was hit by a westbound vehicle that did not come to a complete stop at the stop sign.

3. **Crash No. 81376734:** This crash occurred on 10/29/13 at 3:11 p.m. at Bus Stop 830, which is located on S. Congress Ave. in front of Palm Beach State College. The pedestrian was a 53-year old female who had just gotten off the bus. The vehicle involved was stopped in the right turn lane that is immediately north of the bus stop. The vehicle was backing up in the lane and struck the pedestrian as she was attempting to cross S. Congress Ave mid-block. The closest crosswalks are 0.1 miles to the north and south at the intersection of Lake Worth Rd. and the entrance to Palm Beach State College, respectively.
4. **Crash No. 81388359:** This crash occurred on 4/8/14 at 1:30 p.m. in the northbound lanes of S. Military Trail south of the intersection with Forest Hill Blvd. The pedestrian was a 36-year old female. She had gotten off the bus at Bus Stop 1277, which is located on the northbound side of S. Military Trail approximately 180 feet south of the intersection with Forest Hill Blvd. She was attempting to cross S. Military Trail in the vicinity of the bus stop and was not in the crosswalk. She walked between vehicles that were stopped at the traffic light and was struck by a northbound vehicle in the left turn lane that was proceeding on a green arrow.
5. **Crash No. 83967631:** This crash occurred on 10/14/13 at 4:21 p.m. in the southbound lanes of Lindell Blvd. just north of Carl Bolter Dr. This area is a residential neighborhood, and Lindell Blvd. is a 2-lane residential street. The pedestrian was a 70-year old male. He was standing at Bus Stop 7367 and was attempting to wave down an approaching Palm Tran bus, and when he put his arm out into the roadway, it was struck by the bus. The bus driver thought the pedestrian was part of a work crew that was clearing tree debris and did not stop right away.
6. **Crash No. 84267587:** This crash occurred on 11/14/13 at 7:19 a.m. in the westbound lanes of Forest Hill Blvd. west of the intersection with S. Dixie Highway. The pedestrian was a 14-year old male. He was attempting to cross northbound over Forest Hill Blvd. to catch the bus that was waiting at Bus Stop 5380. He was not in the crosswalk and was struck by a westbound vehicle.
7. **Crash No. 84820465:** This crash occurred on 7/15/14 at 12:45 p.m. in the northbound lanes of S. Dixie Highway on the south side of the intersection with Forest Hill Blvd. The passenger, a 78-year old female, had just got off the bus at Bus Stop 373. This is a near-

side stop located at the corner of the intersection and is right next to the crosswalk. According to the bus driver, the passenger walked to the rear of the bus after getting off (i.e. away from the crosswalk) and attempted to cross Dixie Highway at mid-block. As she attempted to cross Dixie Highway, she was struck by a northbound vehicle.

8. **Crash No. 84820745:** This crash occurred on 7/31/14 at 8:31 p.m. in the southbound lanes of Broadway Ave. at the intersection of 45th Street. A southbound Palm Tran bus was stopped at the traffic light by Bus Stop 79. As the bus began to move forward, the pedestrian, a 56-year old male, approached the bus from the rear passenger side and began to hit the bus with his hand in order to get the bus to stop. He either stumbled or tripped on the curb, and as he fell was run over by the rear tire of the bus. Alcohol use on the part of the pedestrian was suspected.

Worst 6 Palm Tran Bus Stops

The “Worst 6” Palm Tran bus stops, in terms of pedestrian safety, are shown below in Table 2-11. The complete ranked list for all 196 bus stops can be found at the end of this report in Appendix B. The list for Palm Beach County was expanded from five to six bus stops because the top two bus stops (Bus Stop 82 and Bus Stop 429) are at the same intersection and had the same three crashes associated with them.

Table 2-11 Worst 6 Palm Tran Bus Stops

Stop ID	Main Street	Cross Street	Direction	Crashes	Crash Score	Mean AADT	AADT Score	Transit Rider On/Offs	On/Off Score	Combined Score
82	BROADWAY	40TH ST	SB	3	0.0	20,500	14.4	987	16.6	31.1
429	BROADWAY	40TH ST	NB	3	0.0	20,500	14.4	884	17.0	31.4
3061	45TH ST	POINCIANA PLAZA	WB	2	30.0	42,000	8.0	3,061	9.5	47.6
513	DIXIE HWY	2ND AVE N	SB	2	30.0	20,000	14.6	3,549	7.9	52.5
1055	S MILITARY TRAIL	CRESTHAVEN BLVD	SB	2	30.0	40,000	8.6	1,505	14.9	53.5
136	DIXIE HWY	FOREST HILL BLVD	SB	2	30.0	23,000	13.7	2,475	11.5	55.2

The six bus stops that were examined had 14 pedestrian crashes associated with them. However, three of them are duplicates that are associated with both Bus Stop 82 and Bus Stop 429. There were 11 individual crashes. None involved a fatality. Two characteristics stand out about the 11 crashes. Six involved pedestrians who were crossing mid-block even though every one of these intersections is equipped with crosswalks. One of these crashes involved a Palm Tran bus passenger. The other noteworthy characteristic is that 5 of the crashes involved suspected alcohol or drug use on the part of the pedestrian.

Bus Stop 82 – BROADWAY/40TH ST

Bus Stop 82 is a near-side stop located on Broadway (A1A) on the northwest corner of the intersection with 40th Street. It is serviced by the Route 1. There are crosswalks on all sides of the intersection. In fact, this bus stop is only about 30 feet from the crosswalk. This section of Broadway is a four-lane undivided roadway with a left turn lane. The posted speed limit is 35 miles per hour. An aerial photo of the intersection is shown in Photo 2-16. Street level photos of Bus Stop 82 are shown in Photo 2-17 and Photo 2-18.

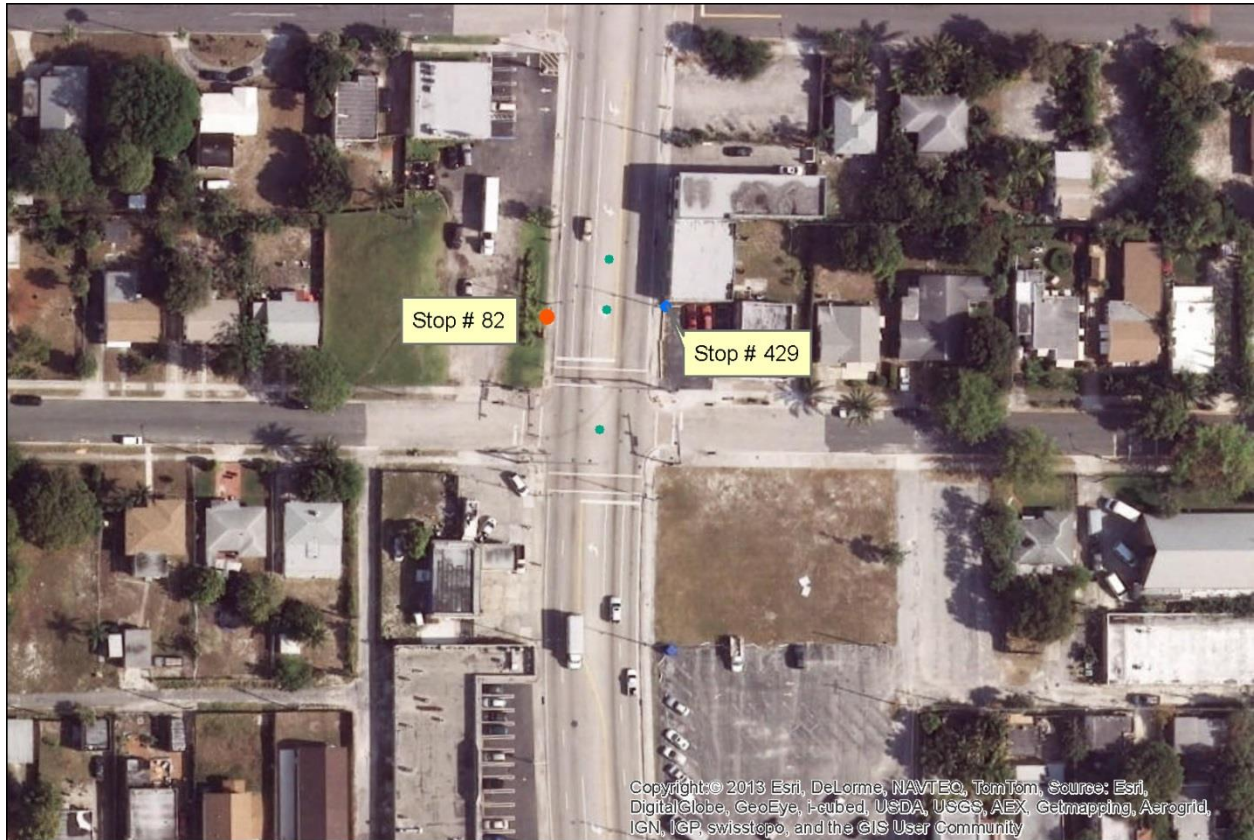


Photo 2-16 Broadway and 40th Street

Source: Google Maps



Photo 2-17 Bus Stop 82 (looking south on Broadway)

Source: Google Maps



Photo 2-18 Bus Stop 82 (looking south on Broadway)

There were three (3) pedestrian crashes that occurred within 100 feet of Bus Stop 82. Short summaries of those crashes are provided below. The details are taken from the Florida Department of Highway Safety and Motor Vehicles (DHSMV) crash reports. Two of the three crashes involved intoxicated pedestrians who were crossing Broadway at mid-block between 40th and 41st Streets.

Crash No. 82520032: This crash occurred at 11:36 a.m. Although this crash occurred within 100 feet of the bus stop, it was away from the intersection. The vehicle was travelling eastbound on 40th Street. The pedestrian was a 4-year old male who was standing with his family in front of a parked minivan on 40th Street. For unknown reasons, the boy jumped out in front of the car. According to the police report, the boy was likely running home as the location of the collision was directly in front of his residence.

Crash No. 82520442: This crash occurred at 6:33 p.m. The pedestrian, a 48-year old female, was crossing Broadway midblock between 40th and 41st Streets from east to west. The vehicle was traveling south on Broadway in the outside lane when the pedestrian made contact with the driver’s side mirror and collapsed. Alcohol use on the part of the pedestrian was suspected as the police officer reported a strong odor of alcohol on the woman’s breath.

Crash No. 82519655: This crash occurred at 9:11 p.m. The pedestrian, a 30-year old male, was crossing Broadway midblock between 40th and 41st Street from west to east. The vehicle was traveling north on Broadway in the inside lane. The driver saw the pedestrian in the middle of the road and barely hit the pedestrian with the right view mirror. The pedestrian fell to the ground but was not injured. According to the police report, the pedestrian was extremely drunk.

Weather and Light Conditions

Two of the three pedestrian crashes at this location occurred under clear weather conditions. Two of the three occurred during the hours of darkness. All of the crashes occurred during the operating hours of the Route 1.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	1
Cloudy	1	Dark – Lighted	2
Total	3	Total	3

Days of the Week

One of the crashes occurred on a weekday, and the other two occurred during the weekend.

Day of Week	Crashes
Weekday	1
Weekend	2
Total	3

Involvement of Drugs and/or Alcohol

Two of the three crashes involved suspected use of alcohol.

Involvement of Elderly and Persons 19 and under

None of the crashes involved an elderly person or a person under 19.

Fatalities

None of the crashes involved a fatality.

Bus Stop 429 – BROADWAY/40TH ST

Bus Stop 429 is a far-side stop located on Broadway (A1A) on the northeast corner of the intersection with 40th Street. It is located across the street from Bus Stop 82, which was just profiled. It too is serviced by the Route 1. There are crosswalks on all sides of the intersection. In fact, this bus stop is only about 30 feet from the crosswalk. This section of Broadway is a 4-lane undivided roadway with a left turn lane. The posted speed limit is 35 miles per hour (mph). An aerial photo of the intersection is shown in Photo 2-19. Street level photos of Bus Stop 429 are shown in Photo 2-20 and Photo 2-21.

The three crashes that occurred near this bus stop are the same three crashes that occurred near Bus Stop 82. Therefore, the analysis will not be repeated.



Photo 2-19 Broadway and 40th Street

Source: Google Maps



Photo 2-20 Bus Stop 429 (looking north on Broadway)

Source: Google Maps

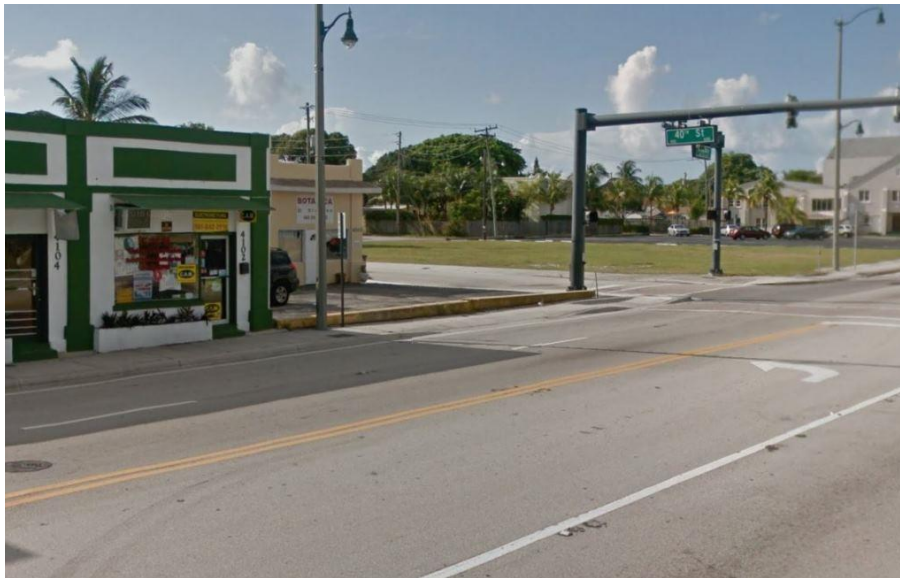


Photo 2-21 Bus Stop 429 (looking south on Broadway)

Bus Stop 3061 - 45TH ST/POINCIANA PLAZA

This bus stop is not located near an intersection but rather in front of a place of interest, Poinciana Plaza. It is located on the north side of 45th Street. It is 220 feet upstream from one of the plaza's driveways and 90 feet downstream from another. It is about 0.1 miles west of the intersection with N. Australian Avenue. Bus Stop 3061 is serviced by the Routes 20, 31, and 33. This section of 45th Avenue is a six-lane divided roadway with a median. It has one left turn lane in the westbound direction and two left turn lanes in the eastbound direction. The posted speed limit is 40 mph. An aerial photo of this location is shown in Photo 2-22. Street level views are shown in Photo 2-23 and Photo 2-24.

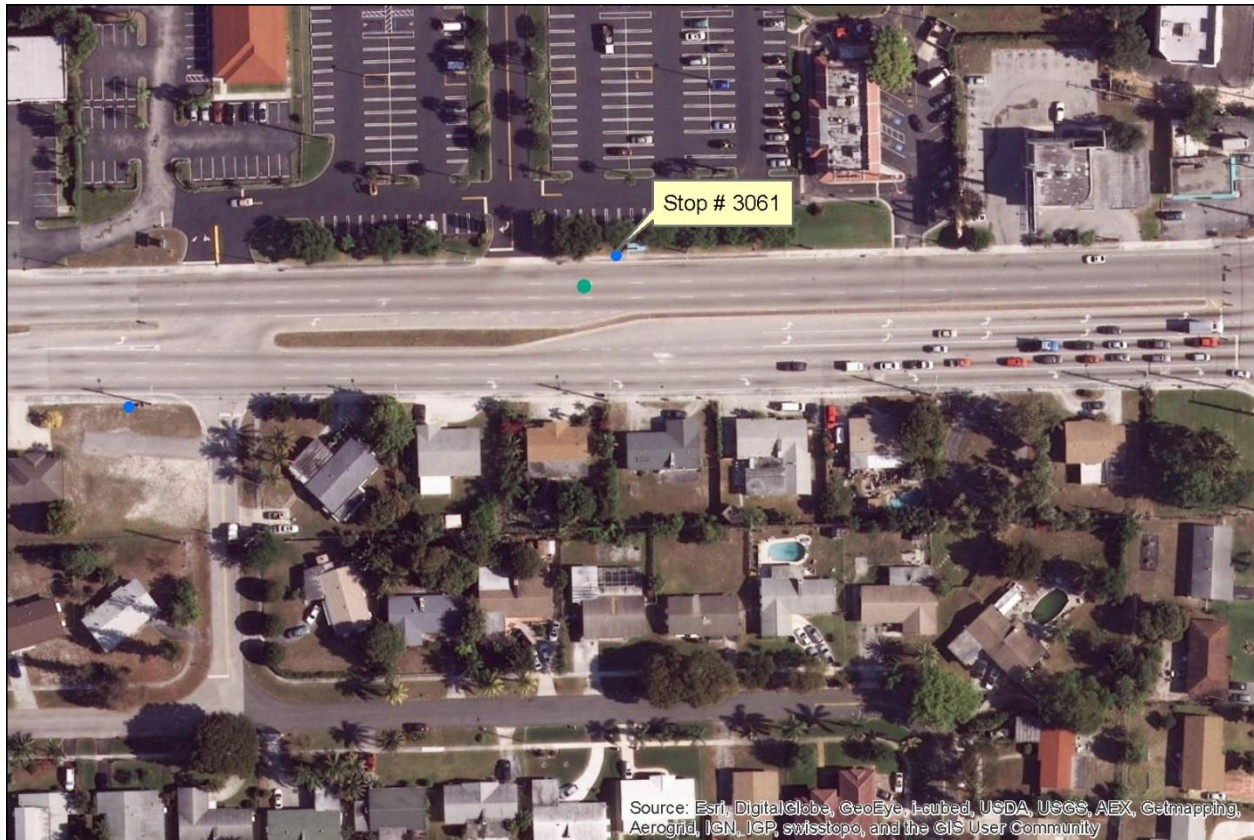


Photo 2-22 45th Street at Poinciana Plaza

Source: Google Maps



Photo 2-23 Bus Stop 3061 (looking east on 45th Street)

Source: Google Maps



Photo 2-24 Bus Stop 3061 (looking west on 45th Street)

There were two (2) pedestrian crashes that occurred near this intersection. One of them occurred in the parking lot of Poinciana Plaza and had nothing to do with either Bus Stop 3061 or traffic on 45th Street. The second crash involved a pedestrian walking on the sidewalk and being struck by a car coming out of Poinciana Plaza. This crash illustrates the dangers faced by pedestrians around commercial strip developments.

Crash No. 81364699: This crash occurred at 4:46 p.m. in the parking lot of Poinciana Plaza. It was not related in any way to Bus Stop 3061 or to traffic on 45th Street.

Crash No. 81384764: This crash occurred at 12:36 p.m. The pedestrian, a 50-year old male, was walking east on the sidewalk in front of the main entrance/exit to Poinciana Plaza when he was struck by a vehicle that was exiting the plaza.

Weather and Light Conditions

One crash (the one that occurred in the parking lot) occurred under rainy weather, and the other crash occurred under cloudy weather. Both crashes occurred during daylight hours.

Weather Conditions	Crashes		Light Conditions	Crashes
Rain	1		Daylight	2
Cloudy	1			
Total	2		Total	2

Days of the Week of Crashes

Both crashes occurred on a weekday.

Day of Week	Crashes
Weekday	2
Weekend	0
Total	2

Involvement of Drugs and/or Alcohol

Neither of the two crashes involved suspected use of alcohol or drugs.

Involvement of Elderly and Persons 19 and under

Neither of the two crashes involved an elderly person or a person under 19.

Fatalities

Neither of the two crashes involved a fatality.

Bus Stop 513 - DIXIE HWY/2ND AVE N

Bus Stop 513 is a near-side stop located on Dixie Highway (U.S. 1) on the northwest corner of the intersection with 2nd Avenue N. It is serviced by the Routes 1 and 61. There are crosswalks on all sides of the intersection. In fact, this bus stop is located immediately next to the crosswalk that crosses Dixie Highway. This section of Dixie Highway is a 4-lane undivided roadway with a left turn lane. The posted speed limit is 35 miles per hour (mph). An aerial photo of the intersection is shown in Photo 2-25. A street level photo of Bus Stop 513 is shown in Photo 2-26.



Photo 2-25 Dixie Hwy and 2nd Ave N

Source: Google Maps



Photo 2-26 Bus Stop 513

There were two (2) pedestrian crashes that occurred within 100 feet of Bus Stop 513. One of them occurred in a parking lot and had nothing to do with Bus Stop 513 or traffic on Dixie Highway. The second crash was a hit-and-run that involved a pedestrian in a crosswalk.

Crash No. 81359228: This crash occurred in the Publix parking lot on the northeast side of the intersection. It was caused by a vehicle backing into a Publix customer who was loading groceries into his trunk. It had nothing to do with Bus Stop 513 or traffic on Dixie Highway.

Crash No. 81381261: This crash was a hit and run that occurred on a Saturday night at 10:00 p.m. The pedestrian was a 38-year old male who was walking northbound on the east side sidewalk of Dixie Highway. He was attempting to cross 2nd Avenue and was within the crosswalk when he was struck by a westbound vehicle on 2nd Avenue that was turning right onto Dixie Highway. The vehicle fled the scene. The pedestrian was suspected of using alcohol.

Weather and Light Conditions

Both crashes occurred under clear weather conditions. The accident that occurred in the Publix parking lot occurred during daylight hours. The hit-and-run crash occurred during the hours of darkness. The hit and run accident also occurred after the Saturday operating hours of both the Route 1 and Route 61.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	1
		Dark – Lighted	1
Total	2	Total	2

Days of the Week

One crash occurred on a weekday, and the other occurred on a weekend day.

Day of Week	Crashes
Weekday	1
Weekend	1
Total	2

Involvement of Drugs and/or Alcohol

One of the crashes involved suspected use of alcohol.

Involvement of Elderly and Persons 19 and under

Neither of the two crashes involved an elderly person or a person under 19.

Fatalities

Neither of the two crashes involved a fatality.

Bus Stop 1055 - S MILITARY TRAIL/CRESTHAVEN BLVD

Bus Stop 1055 is a far-side bus stop located on S. Military Trail on the southwest side of a T-intersection with Cresthaven Blvd. This intersection has two crosswalks: an east-west crosswalk going across S. Military Trail on the south side of the intersection, and a north-south crosswalk going across Cresthaven Blvd. on the west side of the intersection. Bus Stop 1055 is located immediately after the driveway to a Cumberland Farms gas station and is approximately 85 feet from the crosswalk that crosses S. Military Trail. This bus stop is serviced by the Route 3 and Route 61. This section of S. Military Trail is six-lane divided roadway with a median and a left turn lane. The posted speed limit is 40 mph. An aerial photo of the intersection is shown in Photo 2-27. Street level photos are shown in Photo 2-28 and Photo 2-29.

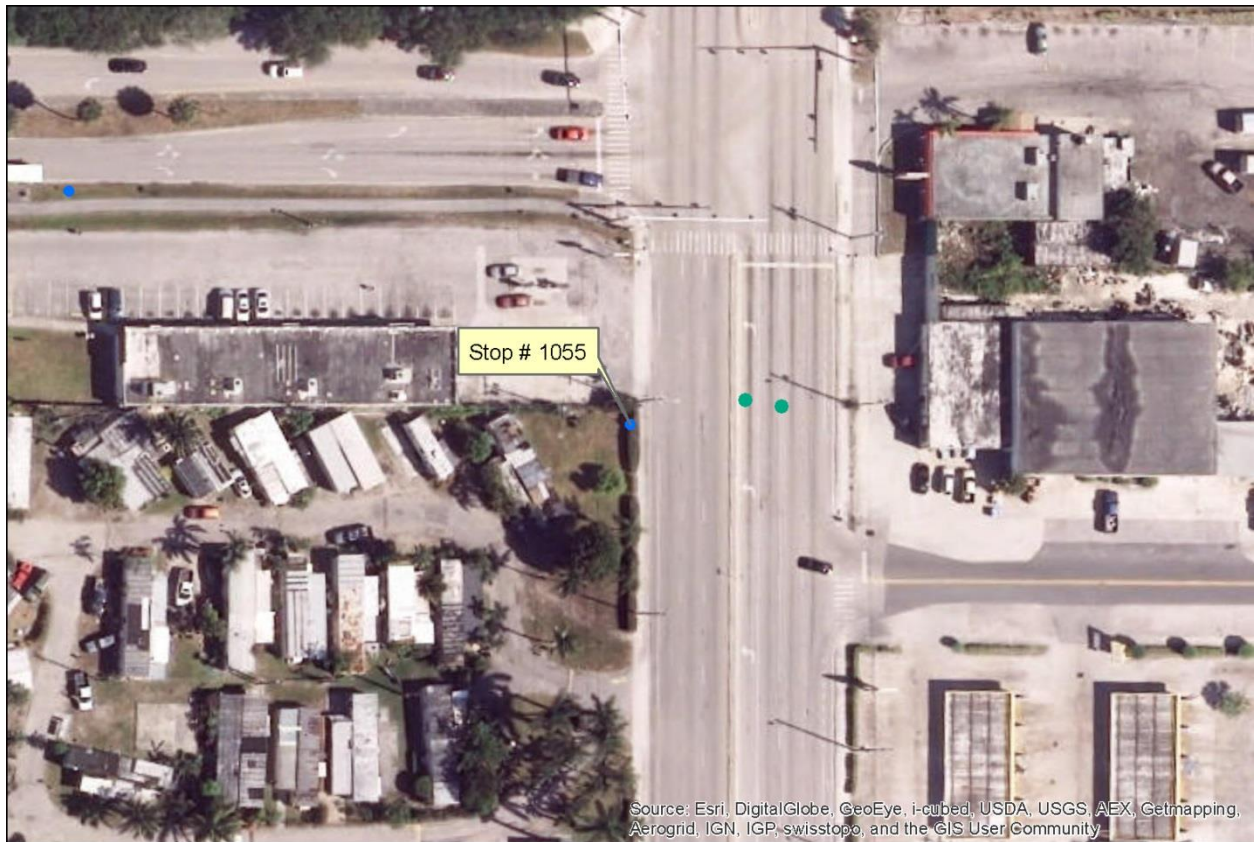


Photo 2-27 S Military Trail and Cresthaven Blvd.

Source: Google Maps



Photo 2-28 Bus Stop 1055 (looking north on S. Military Trail)

Source: Google Maps



Photo 2-29 Bus Stop 1055 (looking south on S. Military Trail)

There were two (2) pedestrian crashes at this location that were within 100 feet of Bus Stop 1055. Circumstance around one of the two crashes is disputed. However, in neither instance was the pedestrian in the crosswalk.

Crash No. 81404689: This crash occurred at 7:54 a.m. The police report indicated conflicting accounts of the crash. The pedestrian was a 26-year old female. She was crossing S. Military Trail eastbound on the north side of the intersection and was not in the crosswalk. According to her account, it was a hit-and-run. An eyewitness gave a different account. The witness stated that vehicle stopped without hitting the pedestrian. The pedestrian then threw herself on the ground in front of the car and yelled, “You hit me!” The driver of the vehicle said, “You’re crazy, lady. I didn’t hit you” and drove away.

Crash No. 81338838: This crash occurred at 9:15 p.m. The vehicle was traveling northbound on S. Military Trail just north of Cresthaven Blvd. The pedestrian, a 28-year old female, was crossing S. Military Trail from west to east and was not in the crosswalk. The pedestrian walked into the side of the vehicle as it traveled by at 40 mph. The officer reported that the pedestrian appeared to be highly intoxicated.

Weather and Light Conditions

Both crashes occurred under clear weather conditions. One crash occurred during daylight hours, and the other crash occurred during the hours of darkness. In the crash that occurred at night, the pedestrian was suspected of alcohol and drug use. Both crashes occurred during the operating hours of the Route 3, but the night time crash occurred after the operating hours of the Route 61.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	2	Daylight	1
		Dark – Lighted	1
Total	2	Total	2

Days of the Week

Both crashes occurred on a weekday.

Day of Week	Crashes
Weekday	2
Weekend	0
Total	2

Involvement of Drugs and/or Alcohol

One of the crashes involved suspected use of drugs and alcohol.

Involvement of Elderly and Persons 19 and under

Neither of the two crashes involved an elderly person or a person under 19.

Fatalities

Neither of the two crashes involved a fatality.

Bus Stop 136 - DIXIE HWY/FOREST HILL BLVD

Bus Stop 136 is a far-side stop located on Dixie Highway (U.S. 1) on the southwest side of the intersection with Forest Hill Blvd. All sides of the intersection have crosswalks. The bus stop is approximately 100 feet south of the intersection. It is served by the Route 1 and Route 46. This section of Dixie Highway is a 4-lane undivided roadway with a left turn lane and no median. The posted speed limit is 35 mph. An aerial photo of the intersection is shown in Photo 2-30. Street level photos of Bus Stop 136 are shown in Photo 2-31 and Photo 2-32.

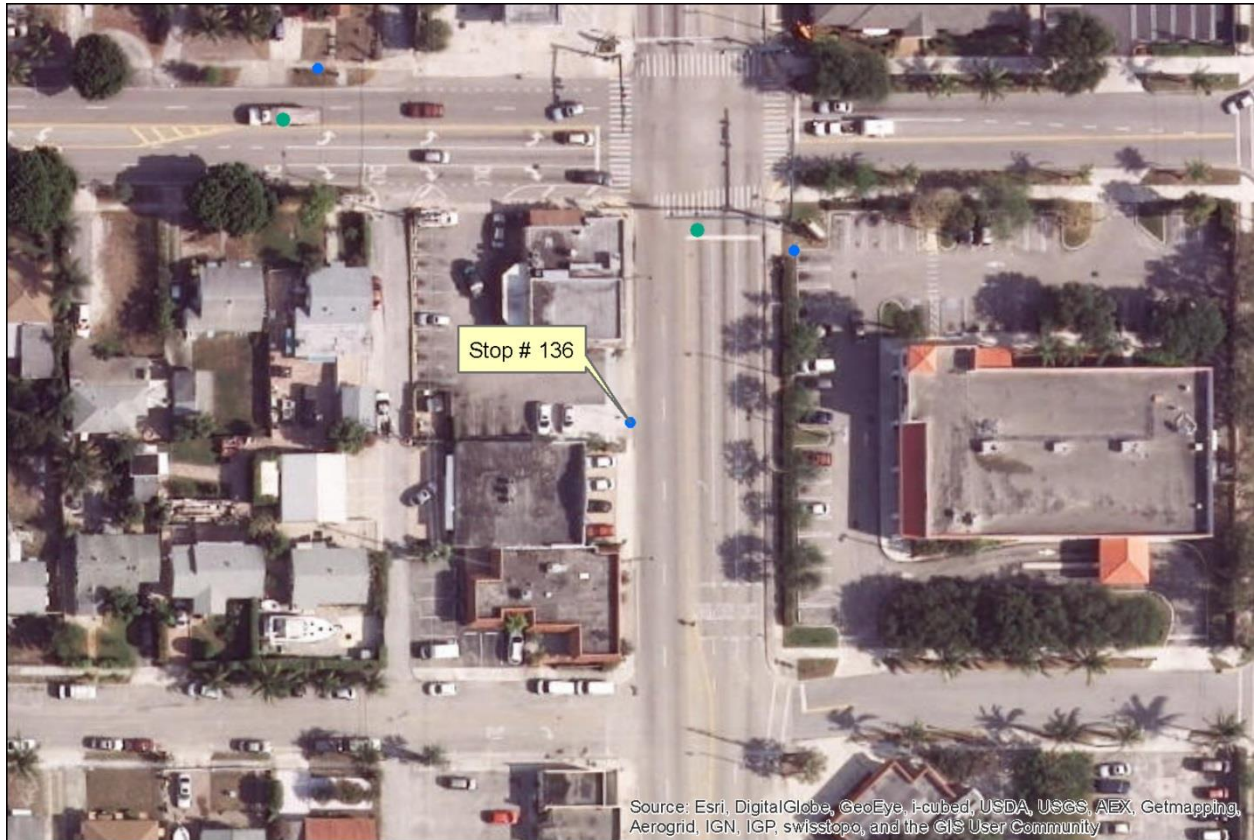


Photo 2-30 Dixie Hwy and Forest Hill Blvd.

Source: Google Maps



Photo 2-31 Bus Stop 136 (looking south on Dixie Hwy.)

Source: Google Maps



Photo 2-32 Bus Stop 136 (looking north on Dixie Hwy.)

There were two (2) pedestrian crashes that occurred within 100 feet of Bus Stop 136. In neither crash was the pedestrian in the crosswalk. One of the crashes directly involved a Palm Tran bus passenger. The other crash involved a pedestrian who was highly intoxicated.

Crash No. 84820465: This crash occurred at 12:45 p.m. The vehicle was heading north on Dixie Highway in the left lane and was approaching the intersection with Forest Hill Blvd. The pedestrian, a 78-year old female, was a Palm Tran bus passenger. She had just got off the bus at Bus Stop 373, which is across the street from Bus Stop 136. Bus Stop 373 is a near-side stop located at the corner of the intersection and is right next to the crosswalk. According to the bus driver, she walked to the rear of the bus after getting off (i.e. away from the crosswalk) and attempted to cross Dixie Highway at mid-block. As she attempted to cross Dixie Highway, she was struck by the northbound vehicle.

Crash No. 84648359: This crash occurred at 9:21 a.m. The vehicle was heading north on Dixie Highway in the left lane and was approaching the intersection with Forest Hill Blvd. The pedestrian, a 45-year old female, was seen by witnesses running across Dixie Highway at an angle in an easterly direction. She was not in the crosswalk. She was struck unconscious by the vehicle and was transported to St. Mary’s Hospital. The trauma staff at the hospital reported to the police officer that the pedestrian was extremely intoxicated.

Weather and Light Conditions

Both crashes occurred during daylight hours. One crash occurred under clear weather, the other under rainy weather.

Weather Conditions	Crashes	Light Conditions	Crashes
Clear	1	Daylight	2
Rain	1		
Total	2	Total	2

Days of the Week of Crashes

Both crashes occurred on a weekday.

Day of Week	Crashes
Weekday	2
Weekend	0
Total	2

Involvement of Drugs and/or Alcohol

One of the crashes involved suspected use of alcohol.

Involvement of Elderly and Persons 19 and under

One of the crashes involved an elderly person (age 78).

Fatalities

Neither of the two crashes involved a fatality.

Chapter 3 Stakeholder Surveys

The purpose of the stakeholder survey was to share the results of the pedestrian crash data analysis with Broward County Transit, Palm Tran, and the metropolitan planning organizations for Broward and Palm Beach Counties and to ask them whether the study conclusions matched what their data shows. Because of the small sample size (nine people), the survey was not intended to produce statistically significant results. Instead, the online survey was used as an informal reality check to the study report's findings.

Five of the nine respondents agreed with the problematic bus stop locations that were identified in the report. Four of the nine respondents disagreed. Based on the open-ended comments that were made in a follow-up survey question, it appears that most of the disagreement came from Palm Beach County staff. They listed several other locations that they considered to be problematic from a pedestrian safety perspective. These included: Okeechobee Boulevard, Military Trail, Glades Road, Boynton Beach Blvd, Congress Avenue and Lake Worth Road. Subsequent to the survey, FDOT District 4 provided CUTR a copy of the Palm Beach MPO Pedestrian and Bicycle Safety Study, which had its own lists of "hot spot" intersection locations and problem corridors. The alternative locations mentioned by the survey respondents are very similar to the locations mentioned in the MPO study. However, it needs to be pointed out that the Palm Beach MPO study identified the worst bicycle and pedestrian crash locations county-wide regardless of their proximity to a bus stop. In other words, the MPO study had a different purpose than this study. Nevertheless, there was some overlap in crash locations. Specifically:

- The MPO report cited Military Trail at Forest Hill Blvd. as one of the Top 10 Hot Spots. In our report, it was noted that Forest Hill Blvd. was the site of three crashes involving bus patrons. Two of them occurred at the intersection with S. Dixie Highway, and one occurred at the intersection with Military Trail. The MPO report recommended that a pedestrian crossing island be installed near Military Trail and Forest Hill Blvd.
- The MPO report cited Lake Worth Road at Congress Avenue as another one of the Top Ten Hot Spots. In our report, it was noted that one of the crashes involving a bus patron occurred on Congress Avenue just south of the intersection with Lake Worth Road. The MPO report recommended that the bus stop be relocated closer to the intersection.
- The MPO report cited Lantana Road from Jog Road to Military Trail as one of the Top 10 High Crash Corridors for Potential Countermeasures. In our report, we noted that one of the crashes involving a bus patron occurred on Lantana Rd. at the intersection with Brentwood Blvd., which is between Jog Road and Military Trail.

There were no suggestions of alternative crash locations for Broward County in the survey responses. However, several alternative crash locations were suggested in an email from a staff person from the Traffic Engineering Division of Broward County Public Works. These included Broward Blvd. at State Road 7 and Broward Blvd. at University Drive.

All but one of the nine respondents agreed with our finding from the crash reports that the most common reported theme was pedestrians crossing at mid-block or at some other location outside the crosswalk. Other unsafe behavior that they said they have observed include drivers not looking for pedestrians or bicyclists when turning right at intersections and pedestrians not using the pedestrian button or not waiting for the pedestrian signal phase before crossing.

The survey asked the agencies what types of strategies they have already tried in order to improve pedestrian safety. The most frequently mentioned strategies included adding crosswalks, adding sidewalks, installing mid-block crossings, installing pedestrian activated warning signs, and increasing police enforcement of traffic regulations against jaywalking.

The survey asked the agencies what process they use to determine whether a bus stop will be relocated. There does not appear to be a formal process in place. This is not surprising. This same question was put to all the transit agencies in Florida via an email query to the Florida Transit Safety Network. The only response that was received came from Lee Tran. They responded that they try as much as possible to place their bus stops on the far side of the intersection so that the pedestrians cross behind the bus. Lee Tran will investigate a bus stop if they receive notice that it is unsafe, but they do not have any defined thresholds for relocating stops. BCT and Palm Tran stated in an email that they rely on TCRP 19 (Guidelines for the Location and Design of Bus Stops) and FDOT's Accessing Transit: Design Handbook for Florida Bus Passenger Facilities. However, these two guidebooks do not include a defined process for relocating bus stops. In the meantime, the District 4 Office of Modal Development has developed a flowchart diagram that outlines their proposed process for relocating bus stops. It calls for mapping bus stops and crash locations in GIS, similar to what this study did, and it also calls for field reviews of problematic bus stop locations with other departments and agencies. A copy of the flowchart diagram is shown in Figure 3-1.

Systematic Approach to Relocate Bus Stops - OMD

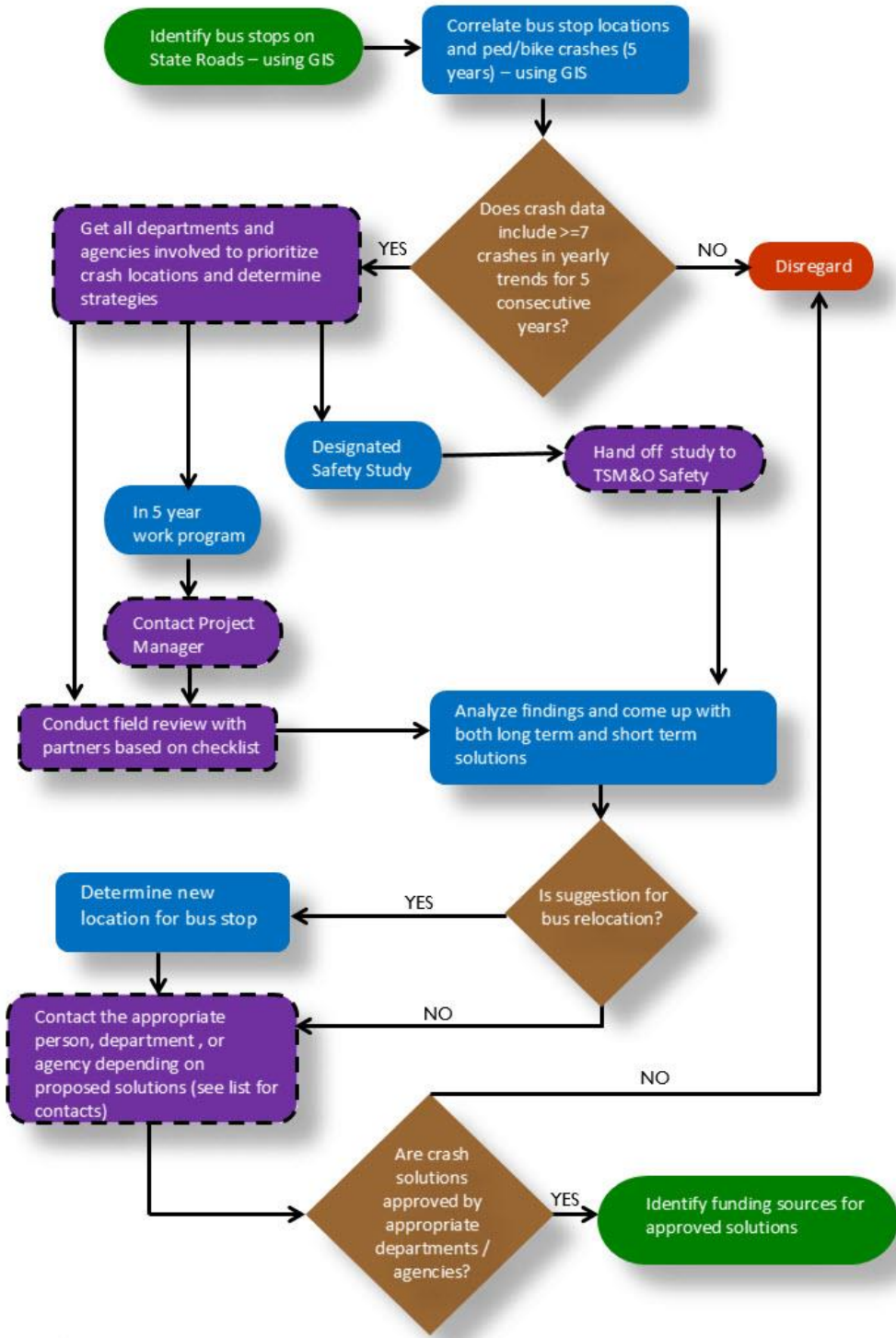


Figure 3-1 FDOT District 4 Bus Stop Relocation Process

On March 3, CUTR met with FDOT District 4 staff to discuss the results of the crash data analysis and the stakeholder survey. FDOT staff members expressed a desire to include bus transfer activity in the methodology that is used to identify problematic bus stop locations. The methodology that was used in Task 1 involved ranking each of the bus stops according to three weighted variables. The variables and the weighting were as follows:

- Total pedestrian crashes within 100 feet of the bus stop (60%)
- AADT of the street where the bus stop is located (20%)
- Average weekday bus passenger on/offers for the bus stop (20%)

Using data provided by FDOT District 4 on high transfer locations, CUTR re-ran the analysis according to the four weighted variables below:

- Total pedestrian crashes within 100 feet of the bus stop (60%)
- AADT of the street where the bus stop is located (20%)
- Average weekday bus passenger on/offers for the bus stop (10%)
- High transfer location (Y/N) (10%)

Using the extra fourth variable did not change the ranking of the worst bus stop locations in either Broward County or Palm Beach County.

Survey Responses

The survey responses are given in the text below. The bulleted comments reflect the actual, unedited words of the respondents.

Question 1: Based on your local knowledge, how much do agree that the bus stop locations identified in the report are the ones that are the most problematic from a pedestrian safety perspective?

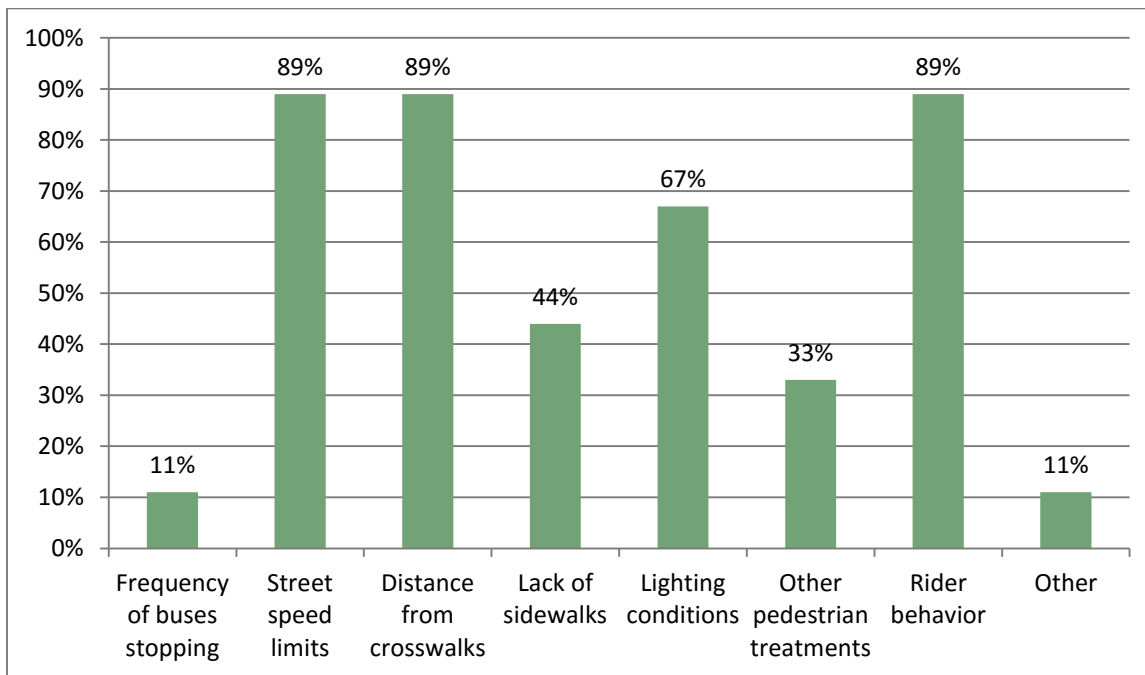
Answer	No. Responses	Percent
Completely Agree	1	11%
Mostly Agree	1	11%
Agree	3	33%
Mostly Disagree	4	44%
Completely Disagree	0	0%
Total	9	100%

Question 2: Are there other stop locations with a high intensity of accidents and incidents not listed above? If yes, could you please tell us the bus stop location(s)?

- For Palm Tran customers bus stops that are on busy ridership corridors are the most problematic in terms of safety. The intersections where two higher speed, multiple lane arterials are of concern. In particular Okeechobee Boulevard, Military Trail, Glades Road, Boynton Beach Blvd, Congress Avenue and Lake Worth Road have typically four bus stops in a quadrant that all need intersection improvements.
- Generally the Military Trail corridor between Community Drive and Lake Worth Rd, Okeechobee Blvd between Military Trail and Haverhill Rd, and Lake Worth Rd between Congress Ave and Haverhill Rd have been known for high pedestrian crashes and it is believed that many of these crashes have to do with bus stop locations.
- According to the Palm Beach MPO planning effort the following are high crash corridors near bus stops:
 - Route 10 (on Indiantown Rd)
 - Route 1 (on Northlake Blvd)
 - Route 3 (on Military Rd -between Okeechobee and Lake Worth Rd)
 - Routes 2, 31, 40, 41, 42, 43, 44, 45, 49 (on Tamarind Ave -near intermodal center)
 - Route 62 (on Lake Worth Road -between Jog Rd and Dixie Hwy)
 - Routes 1, 70, 81 (on U.S. 1 -near Delray Tri-rail Plaza)

Question 3: From your experience, in general, what characteristics do you think contribute to unsafe bus stop locations? CHECK ALL THAT APPLY.

Answer	No. Responses	Percent
Frequency of buses stopping	1	11%
Street speed limits	8	89%
Distance from crosswalks	8	89%
Lack of sidewalks	4	44%
Lighting conditions	6	67%
Other pedestrian treatments	3	33%
Rider behavior	8	89%
Other	1	11%



Question 4: If you selected "Other" in the last question, could you please describe it?

- Lack of mid block cross walks
- I think social culture plays a part, as does education of pedestrian safety. Lack of building density and the super block phenomenon add to the occurrence of mid block crossings.

Question 5: Based on your local knowledge, how much do you agree with our finding from the police narratives in the crash report that the most common reported theme was pedestrians crossing at mid-block or at some other location outside the crosswalk?

Answer	No. Responses	Percent
Completely Agree	5	56%
Mostly Agree	2	22%
Agree	1	11%
Mostly Disagree	1	11%
Completely Disagree	0	0%
Total	9	100%

Question 6: If you choose "Mostly Disagree" or "Completely Disagree" in the previous question, please explain why.

- I do not see a clear nexus between people that get hit in the middle of the street and bus stops being placed mid-block. The report itself lists less than 5% of crashes in PBC had anything to do with bus patrons. The real issue is rider behavior and a County that values vehicle throughput at the expense of non-motorized users. Okeechobee Boulevard is designed speedway that beckons users to go well in advance of the posted 45 MPH. Combine that with a lack of pedestrian striping at intersections and pedestrian-timed signals, etc.
- Intersections in general have numerous conflict areas, so it is very possible that there are other issues involving these accidents.
- Patrons tend to chose the shortest distance between two points. Oftentimes the closest intersection is not as close (or convenient) as crossing midblock.

Question 7: In regards to pedestrian behavior at the time of crash, does your data show any other themes that our data did not reveal?

Answer	No. Responses	Percent
Yes	0	0%
No	8	100%
Total	8	100%

Question 8: If you clicked "Yes" in the previous question, please tell us what those other pedestrian behaviors are that your data shows.

No responses

Question 9: In regards to pedestrian behavior in general, do you or your staff observe other types of unsafe behavior that our data did not reveal (e.g. behavior that leads to near misses)?

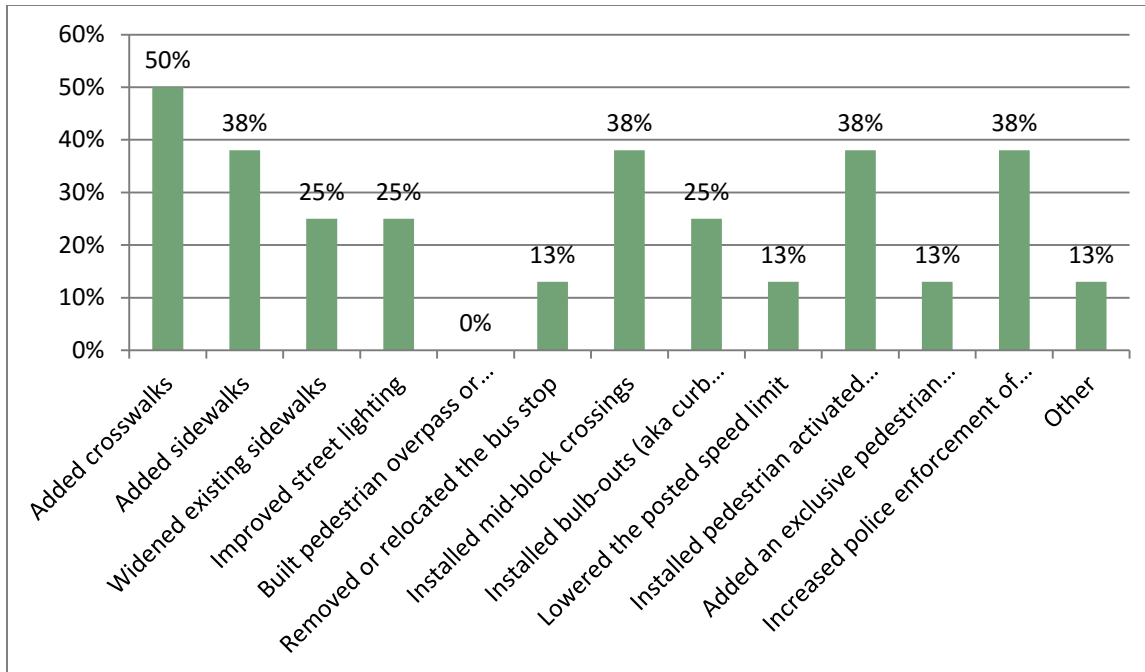
Answer	No. Responses	Percent
Yes	2	25%
No	6	75%
Total	8	100%

Question 10: If you clicked "Yes" in the previous question, please tell us what those other pedestrian behaviors are that you or your staff have observed.

- Auto users do not navigate right turns with any concern for pedestrians or bicyclists.
- Pedestrians sometimes either don't push the pedestrian button at signals or they don't wait for the pedestrian signal phase before crossing.
- We have not studied behavior in depth. We have a 5 year history of crashes mapped with some data about the incidents, but not enough to explore causation.

Question 11: What types of strategies has your agency tried already to improve pedestrian safety both in general and at bus stop locations? CHECK ALL THAT APPLY.

Answer	No. Responses	Percent
Added crosswalks	4	50%
Added sidewalks	3	38%
Widened existing sidewalks	2	25%
Improved street lighting	2	25%
Built pedestrian overpass or underpass	0	0%
Removed or relocated the bus stop	1	13%
Installed mid-block crossings	3	38%
Installed bulb-outs (aka curb extensions)	2	25%
Lowered the posted speed limit	1	13%
Installed pedestrian activated warning signs	3	38%
Added an exclusive pedestrian interval to the intersection signal timing	1	13%
Increased police enforcement of traffic regulations against jaywalking	3	38%
Other	1	13%



Question 12: If you selected "Other" in the previous question, could you please describe it?

- Our agency cannot implement projects rather we have encouraged municipalities to identify their sidewalk and ADA needs and apply for funding to complete projects. We are also working with Palm Tran to access their current network of stops that they plan to consolidate and improve.
- Installed count down pedestrian signals. installed European crosswalk pavement markings

Question 13: What is the process your agency uses to determine if/how a bus stop will be relocated?

- Available right-of-way. Relocate closer to the intersection.
- We cannot relocate stops however, we have asked Palm Tran during their "RPM" redesign effort to remove redundant stops, stops with very low ridership, and move stops closer to intersections (either near side or far side of the intersections, where appropriate.)
- Many factors: Safety, Ridership, Level of amenity/investment (bench,shelter) , ADA compliance, Existence of a turn lane

- It is done based on ridership and accident considerations at the individual stops in our transit corridor studies. If the ridership (on/off) is low and there are immediate stops nearby, then we approach the transit agency to see if it is possible for the relocation and/or removal.
- Unfortunately, this task is done exclusively by Palm Tran with almost no involvement of the county's engineering department.
- Analysis of bus stop spacing, distance from a crosswalk and other bus stop placement guidelines as per TCRP 19
- We do not currently have a process for this.

Question 14: Please provide any suggestions you have that would add value to this study.

- Add ability to communicate success stories that are best practices from agencies who have seen a reduction in crashes.
- Thank you for this survey. We need to move the needle in this state.
- Provide an action plan with follow-up dates for FDOT and the transit agencies to commit to solutions that will make some improvements in these top safety locations.
- One inherent flaw of the crash reports is human error in estimating the distance from a landmark of the location of the crash by the police officer. The only way to sort this out is by reading the narratives on the reports. Many crashes can potentially be overlooked as a result. To overcome this shortcoming, examine crashes that are coded at locations that are far from the designated bus stop locations.

Chapter 4 Field Visits

Summary of Field Visits

On May 5 and May 12, 2017, a Road Safety Audit (RSA) team conducted field visits of several intersections in Broward and Palm Beach Counties. These field visits were part of a study being conducted by the Center for Urban Transportation Research (CUTR) for District 4 of the Florida Department of Transportation entitled “Impact of Transit Stop Location on Pedestrian Safety”. The study has three purposes: to identify issues and concerns regarding unsafe pedestrian behavior around bus stops; to identify any common traits or characteristics of bus stops that are high pedestrian crash locations; and to recommend strategies for improving pedestrian safety at these locations.

Five intersections were visited in Broward County, and another five were visited in Palm Beach County. The intersections were selected based on the results of the crash data analysis performed by CUTR as well as the input of local agencies. The RSA team was composed of members from CUTR, FDOT, Palm Tran, Broward County Transit, the Palm Beach Metropolitan Planning Organization, and Broward County Traffic Engineering.

The crash data analysis revealed a recurring theme in the pedestrian crashes that occurred within 100 feet of a bus stop: pedestrians crossing the street outside of the crosswalk, often at mid-block, even when there was a crosswalk nearby. This data finding was confirmed during the field visits. In both counties, numerous instances of pedestrians crossing mid-block were observed by the RSA team. The photos taken of these occurrences are included in Appendix C Photos of Observed Mid-block Crossing in Broward County and in Appendix D Photos of Observed Mid-block Crossing in Palm Beach County.

This report details the observations that were made by the RSA team at each intersection and recommends location-specific improvements. In addition, two general recommendations are also suggested. To deter mid-block crossings, FDOT District 4 should consider expanded use of the pedestrian barriers that are being tested on Oakland Park Blvd. between NW 55th Avenue and NW 56th Avenue (see Photo 4-1). It should also consider adding sidewalk stencils near all bus stops that direct alighting passengers to the crosswalk (see Photo 4-2).



Source: FDOT, District 4

Photo 4-1 Experimental Pedestrian Barrier on Oakland Park Blvd.

Source: WYPR, Maryland



Photo 4-2 "Use Crosswalk" sidewalk stencil

Broward County Field Visit

The Broward County field visit was conducted the morning of Friday, May 5, 2017. The weather was overcast and included heavy showers around 11 a.m. Table 4-1 shows the bus stops and intersections that were visited in the order in which they were visited. The team that conducted the road safety audit (RSA) included the individuals shown in Table 4-2.

Table 4-1 Broward County Bus Stops Visited

Stop ID	Main Street	Cross Street
2136	Oakland Park Blvd.	NW 9 th Ave.
1808	W. Sunrise Blvd.	NW 15 th Ave.
1791	W. Sunrise Blvd.	Sunset Strip
893, 749, 715, 626	Broward Blvd.	State Road 7
906, 2620, 733, 4225	Broward Blvd.	University Dr.

Table 4-2 Broward County RSA Team

Name	Agency
Brian Pessaro	CUTR
Zhenyu Wang	CUTR
Mitch Spicer	CUTR
Stephan Ramoutar	Broward County Traffic Engineering
Rebecca Martinez	Broward County Traffic Engineering
Ralph Viola	Broward County Transit
Maria Anaya de Yeats	FDOT, District 4
Janelle Wilcox	FDOT, District 4

W. Oakland Park Boulevard at NW 9th Avenue

The RSA team focused on the two bus stops that are on the western side of the intersection. Bus Stop 2136 is a far-side stop and serves westbound buses on W. Oakland Park Boulevard. Bus Stop 2122 is a near-side stop and serves the eastbound buses. There were three pedestrian crashes at this location. All three crashes involved pedestrians who were not using the crosswalk or were crossing against the traffic signal. One of the crashes involved a BCT bus passenger. The passenger got off at Bus Stop 2122, dashed north across W. Oakland Park Boulevard in between vehicles that were stopped at the traffic light, and was struck in the left turn lane by a vehicle that was proceeding on a green arrow.

Observations:

During the field visit, the RSA field team observed BCT patrons crossing W. Oakland Park Boulevard at mid-block in order to go from Bus Stop 2122 to Bus Stop 2136 (see Appendix C, Photo C-2). This was in spite of the fact that this location has signage in the median telling people not to cross at mid-block and to use the crosswalk (see Photo 4-3). This intersection already has a high emphasis crosswalk. Nevertheless, it was observed that a considerable number of vehicles passed the stop bar when the traffic light was red and occupied the eastbound and westbound crosswalks.

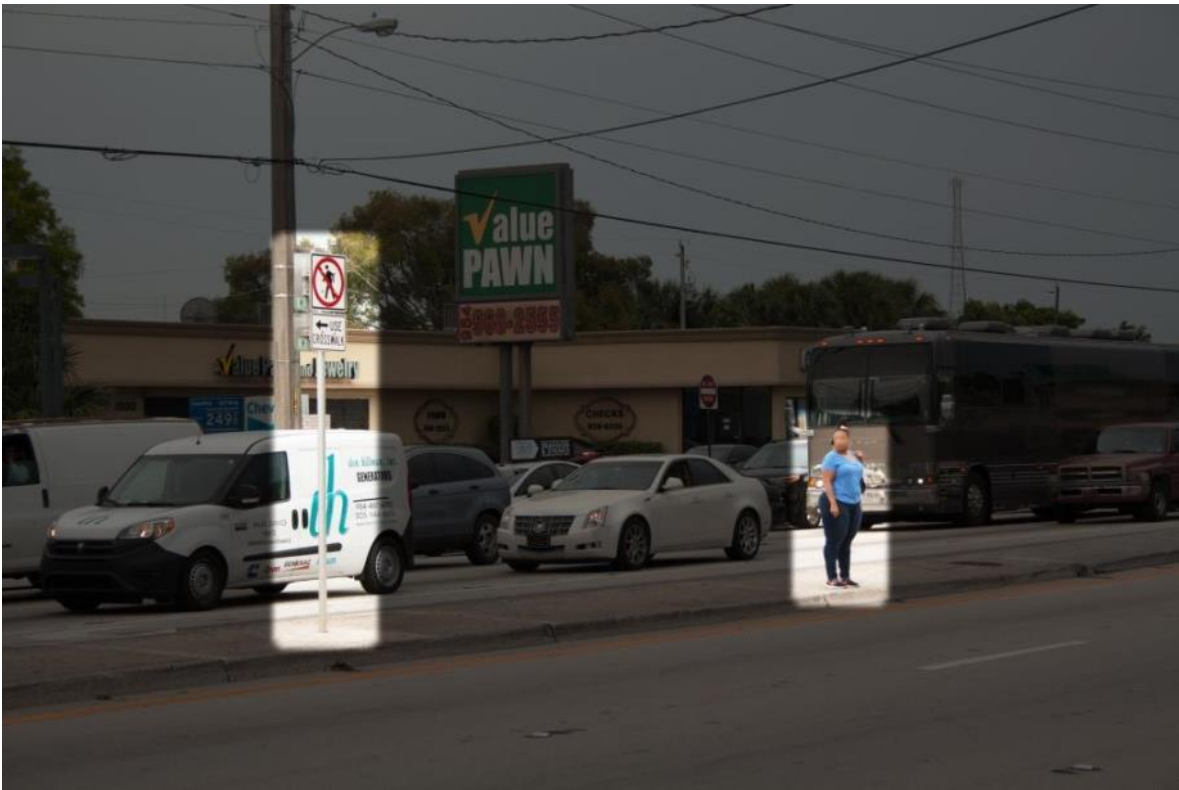


Photo 4-3 Pedestrian crossing mid-block on W. Oakland Park Blvd. despite warning signs

Bus Stop 2122 is about 360 feet from the intersection. The RSA team discussed the possibility of relocating this stop closer to the intersection. However, BCT later responded in an email that it would not be possible to relocate the stop closer to the intersection due to increased conflict with vehicles entering and exiting the gasoline station and proximity to the intersection itself.

CUTR conducted an analysis of the night time lighting conditions, signal timing, and turning movements. These analyses were done because two of the three crashes occurred at night in the eastbound left turn lane of W. Oakland Park Boulevard. The functional classification of this road is Urban, Principal Arterial, Other (major arterial). According to the FDOT Plans and Preparation Manual, the lighting requirement for this road is 1.5 Horizontal Foot Candles (see Table 4-3).

Table 4-3 Lighting Requirements for Conventional Lighting – Roadways and Signalized Intersections

Roadway Characteristics	Average Horizontal Foot Candle (HFC)	Illumination Uniformity Ratios		Veiling Luminance Ratio Lv(max)/Lavg
		AVG/MIN	MAX/MIN	
Freeway & Major Arterials	1.5	≤ 4:1	≤ 10:1	≤ 0.3:1
All other roadways	1.0	≤ 4:1	≤ 10:1	≤ 0.3:1
Sidewalks and shared used paths	2.0	≤ 4:1	≤ 10:1	---

Source: FDOT Plans Preparation Manual, Volume 1, Table 7.3.1

The lighting measurements were conducted along the median next to the eastbound left-turn lane at 9 p.m. as shown in Photo 4-4. While on location, it was observed that there are two side street lights installed. The average horizontal foot candle was 0.57, which is much lower than the required 1.5 HFC.



Photo 4-4 Locations of light measurement readings on W. Oakland Blvd.

In regards to the signal timing, CUTR does not recommend any changes. The signal type is semi-actuated (coordinated), and the traffic demands on eastbound/westbound W. Oakland Park Boulevard are high.

Recommendations:

- To prevent pedestrians crossing mid-block, evaluate the feasibility of installing a landscape median fence on the west leg of the intersection. Please note this effort is contingent on the results of the Oakland Park Boulevard pedestrian barrier pilot project (see Photo 4-1).
- Improve the street lighting level on the west side of the intersection. There is a FDOT lighting retrofit project from Atrium West to State Road A1A (FM No. 440088-1; letting date 4/24/19), and this intersection is included in that project.
- Add “STOP HERE ON RED” (MUTCD Sign No. R10-6 or R10-6a) to remind drivers not to block the crosswalk. According to MUTCD, this sign is suggested to be used where highway vehicles frequently violate the stop line or where it is not obvious to road users where to stop.



R10-6



R10-6a

W. Sunrise Boulevard at NW 15th Avenue

Bus Stop 1808 is a far-side stop located on W. Sunrise Blvd. on the south-east side of the T-intersection with NW 15th Avenue. There were four pedestrian crashes that occurred within 100 feet of Bus Stop 1808. In three of the four crashes, the pedestrian was not using the crosswalk or was crossing against the traffic signal. One of the four crashes was a fatality. This crash occurred at 11:16 p.m. There was no mention in any of the police reports that the pedestrians involved were BCT passengers.

Observations:

This location is a T-intersection, and the bus stop is located on east side of the intersection. However, the crosswalk is on the west side of the intersection. This configuration encourages bus passengers to jaywalk across W. Sunrise Boulevard in order to get from one bus stop to the other. In fact, the RSA team observed numerous instances of jaywalking by pedestrians including BCT patrons (see Appendix C, Photo C-3, and Photo C-4). The RSA team member from BCT mentioned that Bus Stop 1808 cannot be relocated west of the intersection because this stop serves the Route 31, which travels south on NW 15th Avenue and turns left onto W. Sunrise Boulevard. He added that many of the jaywalkers are kids coming from Carter Park, which located behind the bus stop, and they are often trying to get to the Burger King on the north side of the street.

CUTR conducted an analysis of the lighting conditions because the fatal crash occurred at night. The functional classification of W. Sunrise Boulevard is Urban - Principal Arterial – Other (major arterial). According to the FDOT Plans and Preparation Manual, the lighting requirement for this road is 1.5 HFC (see Table 4-3). The lighting measurements were conducted at 9:30 p.m. in the eastbound lanes of W. Sunrise Boulevard in front of Bus Stop 1808 (see Photo 4-5). The average horizontal foot candle was 0.7, which is much lower than the required 1.5 HFC. There are two side street lights at this location. The trees on the roadside and in the median may be blocking some of the lighting.



Photo 4-5 Locations of light measurement readings on W. Sunrise Blvd.

The RSA team also checked traffic signal signs related pedestrian safety. There is one Turning Vehicle Yield to Pedestrian sign (R10-15) on the traffic light post for southbound right turning vehicles (see red circle in Photo 4-6). However, this sign is difficult to see because of its small size and location.



Photo 4-6 Turning Vehicle Yield to Pedestrian sign on SB NW 15th Ave. is difficult to see



R10-15

Recommendations:

- Replace the faded pedestrian push button sign on the northwest side of the intersection (no picture available).
- Investigate the feasibility of relocating the existing mid-block crossing on W. Sunrise Boulevard that is near NW 13th Avenue further to the west near where the Burger King is located. This new location would better serve bus riders waiting at the stops on both sides of W. Sunrise Boulevard. It would also serve pedestrians that are going to or coming from Carter Park, and it would still serve pedestrians going to or coming from Sunland Park Academy.
- Improve the street lighting near Bus Stop 1808 and/or trim the trees that may be blocking the lighting. FDOT is currently conducting a safety study along W. Sunrise Boulevard from I-95 to NW 11th Avenue, and this intersection is included in the study.
- Add a roadside Turning Vehicle Yield to Pedestrian (R10-15) sign on NW 15th Avenue for southbound vehicles that are turning right (westbound) onto W. Sunrise Boulevard.
- Add an illuminated “No Right Turn on Red” across Sunrise Blvd. for the southbound traffic on NW 15th Avenue that illuminates when the crosswalk button has been pushed.

W. Sunrise Boulevard at Sunset Strip

Bus Stop 1791 is a near-side stop located on the south side of W. Sunrise Boulevard just west of the T-intersection with Sunset Strip. There were three pedestrian crashes that occurred within 100 feet of Bus Stop 1791. Two occurred on Sunset Strip, and one occurred on W. Sunrise Boulevard. In one of the Sunset Strip crashes, the pedestrian was not using the crosswalk. In the other crash, the pedestrian was using the crosswalk and was crossing on a green pedestrian light. The crash that occurred on W. Sunrise Boulevard involved a family that was attempting to catch the BCT bus that was waiting at Bus Stop 1791. They were in the crosswalk but were crossing against the light.

Observations:

The main observations at this site were that there needs to be better “Yield to Pedestrian” signage on southbound Sunset Strip, and the crosswalk needs to be emphasized more. As shown in Photo 4-7, this crosswalk is not a high emphasis crosswalk. The RSA team discussed the possibility of eliminating Bus Stop 1791. However, BCT responded in a later email that this stop services a large number of transit riders that live, work and shop on Sunset Strip, and it serves as a transfer stop for the Route 81 and Route 36.



Photo 4-7 Crosswalks at W. Sunrise Blvd. and Sunset Strip should be upgraded from regular to high emphasis

Recommendations:

- Upgrade the existing regular crossing markings to high emphasis crosswalk markings at the intersection.
- Conduct a study to consider installation of audible pedestrian signals at the intersection.
- Evaluate the feasibility of adding a leading pedestrian interval (LPI) on all approaches that would allow the pedestrians to cross ahead of the vehicles.
- Replace the faded pedestrian push button sign on the northwest corner of the intersection (no picture available).
- Replace the westbound left-turn pavement markings with U-turn markings.

Broward Boulevard at State Road 7

This intersection was recommended for field review by Broward County Traffic Engineering (Yves d'Anjou, P.E.). There was one crash at this intersection (Crash No. 82703243). It involved a BCT patron who was standing with his bicycle at Bus Stop 626, which is on State Road 7 on the southwest side of the intersection. According to the police report, as the driver was turning right onto State Road 7, his shoe came off, causing him to lose control of the vehicle, go up onto the sidewalk, and strike the pedestrian.

Observations:

The RSA team made several observations at this location. The chief observation is that three of the four bus stops on Broward Boulevard are considerable distances from the intersection. As a result, it is difficult for BCT patrons to cross north-south across Broward Boulevard in a way that is both convenient and safe. Even at Bus Stop 893, which is located on the north-west corner of the intersection and is reasonably close to the intersection, the RSA team observed mid-block crossings by BCT patrons (see Appendix C, Photo C-1). The crosswalk button on the northeast corner of the intersection is broken. The crosswalks are not high emphasis. When crossing Broward Boulevard, the pedestrian signal only gives 33 seconds to cross nine lanes of traffic (see Photo 4-8). When crossing from east to west across State Road 7, the pedestrian signal on the southwest corner did not show a countdown.



Photo 4-8 Pedestrian countdown signal to cross Broward Blvd. is too short

Recommendations:

- Upgrade the existing regular crosswalk markings to high emphasis crosswalk markings.
- Increase the pedestrian signal timing across Broward Boulevard to be in compliance with the 2009 MUTCD guidance, using the recommended walking speed of 3.5 feet per second.
- Fix the countdown timer for the pedestrian signal on the southwest corner of the intersection.

Broward Boulevard at University Drive

This intersection was recommended for field review by Broward County Traffic Engineering (Yves d'Anjou, P.E.). There were four pedestrian crashes at this intersection. A pedestrian was struck in the crosswalk on the south side of the intersection by right turning vehicle (Crash No. 82156584). A pedestrian was struck on the north side of the intersection by a right turning vehicle (Crash No. 84445441). In the police report, there was a dispute as to whether the pedestrian was in the crosswalk. A third pedestrian was struck on the westbound lanes in the vicinity of Bus Stop 906 on the west side of the intersection after darting into traffic (Crash No. 82705487). In the fourth crash, the pedestrian was struck on the south side of the intersection while crossing outside of the crosswalk and drinking a beer (Crash No. 82705590).

Observations:

The pedestrian crosswalk on the east side of the intersection is not where one would expect it. It is located further east, away from the intersection. Additionally, the curb for the northbound to eastbound right turn lane has a large radius (see Photo 4-9). As a result, right turning vehicles pick up speed as they go into their turn. The drivers are not looking for pedestrians in the crosswalk because they are looking left instead. During the field visit, three right turning vehicles sped by members of the RSA team one after another without yielding even though they were all wearing yellow fluorescent safety vests, were in the crosswalk, and were crossing on a green pedestrian light. There are three signs on northbound University Drive alerting drivers to the presence of pedestrians up ahead (see Photo 4-10). However, none of them are close to the intersection, and one of them is blocked by a hospital sign (see Photo 4-11).



Photo 4-9 Northbound right turn lane has large radius that encourages high speed turns



Photo 4-10 Sequence of Yield to Pedestrian Signs on NB University Drive



Photo 4-11 Yield to Pedestrian Sign on NB University Drive is obscured

Recommendations:

- Relocate the TURNING VEHICLES YIELD TO PEDESTRIANS sign facing northbound motorists closer to the intersection and replace it with R10-15 MUTCD sign.
- Add a triangular pedestrian island on the southeast side of the intersection (i.e. where the triangle is currently painted in Photo 4-9) to slow down northbound right turning vehicles and provide a refuge area for pedestrians. Realign the north-south crosswalk on the east side of the intersection to align with the pedestrian island.

Palm Beach County Field Visit

The Palm Beach County field visit was conducted the morning of Friday, May 12, 2017. The weather was sunny. Table 4-4 shows the bus stops and intersections that were visited in the order in which they were visited. The team that conducted the road safety audit (RSA) included the individuals shown in Table 4-5.

Table 4-4 Palm Beach County Bus Stops Visited

Stop ID	Main Street	Cross Street
6806	Lantana Rd.	Brentwood Blvd.
830	S. Congress Ave.	Lake Worth Rd.
1277	S. Military Trail	Forest Hill Blvd.
82	Broadway	40 th Street
429	Broadway	40 th Street
3061	45 th Street	Poinciana Plaza

Table 4-5 Palm Beach County RSA Team

Name	Agency
Brian Pessaro	CUTR
Zhenyu Wang	CUTR
Mitch Spicer	CUTR
Mary Pierce	Palm Tran
Anie Delgado	Palm Beach MPO
Lisa Maack	FDOT, District 4
Alex Barr	FDOT District 4
Suresh Allu	FDOT, District 4
Janelle Wilcox	FDOT, District 4

Lantana Road at Brentwood Boulevard

This intersection was recommended for field review in the MPO's Bike Ped Safety Study. The study cited Lantana Road from Jog Road to Military Trail as one of the Top 10 High Crash Corridors for Potential Countermeasures. The CUTR report noted that one of the crashes involving a bus patron occurred on Lantana Rd. at the intersection with Brentwood Blvd., which is between Jog Road and Military Trail.

Observations:

The main observation at this location is that there is no easy way to cross Lantana Road (see Photo 4-12). Jog Road is 0.3 miles to the west, and Edgecliff Avenue is 0.2 miles to the east. The RSA team observed PalmTran riders getting off the bus and jaywalking across Lantana Road (see Appendix D, Photo D-3). Furthermore, there is no east-west crosswalk across Brentwood Boulevard or Strawberry Lakes Circle (see Photo 4-13), and there is no sidewalk on the northwest side of Brentwood Blvd. (see Photo 4-14).



Photo 4-12 There is no easy way to cross Lantana Road at Brentwood Blvd.



Photo 4-13 There is no crosswalk across Brentwood Blvd.



Photo 4-14 There is no sidewalk on the northwest side of Brentwood Blvd.

Recommendations:

- Conduct an engineering study to see whether the criteria are met to add a signalized mid-block crossing across Lantana Road near the bus stop.
- Add a sidewalk to the northwest side of Brentwood Boulevard.
- Add an east-west crosswalk across Brentwood Boulevard and Strawberry Lakes Circle.

S. Congress Avenue at Lake Worth Road

This intersection was recommended for field review in the MPO's Bike Ped Safety Study. The study cited Lake Worth Road at Congress Avenue as one of the Top Ten Hot Spots. The CUTR report found that one of the crashes involving a bus patron occurred on Congress Avenue just south of the intersection with Lake Worth Road. The MPO report recommended that the bus stop be relocated closer to the intersection. For the field review, the RSA team actually looked at two bus stops on S. Congress Avenue. It looked at Bus Stop 830, which is located about 500 feet south of the intersection and serves northbound buses. It also looked at Bus Stop 829, which is located 500 feet further south and is near the entrance to Palm Beach State College.

Observations:

At Bus Stop 829 located near the entrance to Palm Beach State College, the RSA team noted that the crosswalk markings and the sign for the pedestrian push buttons are both faded (see Photo 4-15 and Photo 4-16). Furthermore, there are no "Yield to Pedestrian" signs at this location, and there is no ADA accessible ramp on the west side of S. Congress Avenue (see Photo 4-17).

Bus Stop 830 (see Photo 4-18) is where the reported crash with the Palm Tran patron occurred. The RSA team noted that not only is this bus stop far from the intersection with Lake Worth Road, but also that there is no access to Palm Beach State College at this location because of a fence (see Photo 4-19). Bus Stop 830 does not appear to provide access to anything.

Recommendations:

Bus Stop 829 (near the entrance to Palm Beach State College):

- Make the crosswalk a special treatment crosswalk because of its proximity to the college entrance
- Fix the faded signage on the pedestrian push button
- Add an ADA ramp to the west side of S. Congress Avenue
- Add MUTCD R10-15 Yield to Pedestrian signage
- Conduct a study to consider installation of audible pedestrian signals at the intersection

Bus Stop 830 (the stop that is closer to Lake Worth Road)

- Conduct a feasibility study to relocate Bus Stop 830 to be closer to the intersection and crosswalk (i.e. in the right turn lane) and add transit signal priority. Several software and hardware changes may be needed for the control cabinet at the intersection. Additional signal heads and signs may also be needed.



Photo 4-15 Crosswalk markings on S. Congress Ave. at the entrance to Palm Beach State College are faded



Photo 4-16 Pedestrian signal push button signs near the entrance to Palm Beach State College are faded



Photo 4-17 There is no ADA ramp on west side of S. Congress Ave. near the entrance to Palm Beach State College



Photo 4-18 Bus Stop 830 is located approximately 530 feet south of Lake Worth Road



Photo 4-19 Bus Stop 830 has no access to Palm Beach State College because of a fence

S. Military Trail at Forest Hill Boulevard

This intersection was recommended for field review in the MPO's Bike Ped Safety Study. The study cited Military Trail at Forest Hill Boulevard as one of the Top 10 Hot Spots. The MPO study recommended that a pedestrian crossing island be installed near Military Trail and Forest Hill Boulevard. There was one pedestrian crash at this intersection, and it involved a bus patron. This person was attempting to cross S. Military Trail outside of the crosswalk from east to west in the vicinity Bus Stop 1277 on the southeast side of the intersection. She was walking in between vehicles that were stopped at the traffic light and was struck in the left turn lane by a northbound vehicle that was proceeding on a green arrow.

Observations:

The RSA team observed jaywalking in the intersection by pedestrians, including bus patrons (see Appendix D, Photo D-4). This was in spite of the fact that there is signage in the median telling pedestrians to use the crosswalks (see Photo 4-20). While at this location, the CUTR members of the RSA team noticed green tape on the sidewalk directing people towards the crosswalk (see Photo 4-21). Anie Delgado, the RSA team member from the Palm Beach MPO, said she had placed the tape there. Seeing this tape gave the rest of the RSA team members the idea to suggest adding a painted stencil near all of the bus stops that direct passengers toward the crosswalk (see Photo 4-2).

Recommendations:

- Include pedestrian crossing islands on all four approaches as part of the intersection improvement scheduled in the TIP (Project No. 437878-1); pedestrian crossing islands were recommended in the Palm Beach MPO's Bike Ped Safety Study for this location.
- Evaluate feasibility of adding leading pedestrian interval (LPI) on all four approaches; LPIs were recommended in the Palm Beach MPO's Bike Ped Safety Study for this location.
- To prevent pedestrians crossing mid-block, evaluate the feasibility of installing a landscape median fence on the south leg of S. Military Trail from Forest Hill Blvd. to Line Drive. Please note this effort is contingent on the results of the Oakland Park Blvd. pedestrian barrier pilot project (see Photo 4-1).
- Add stenciled "Use Crosswalk" signs to the sidewalk near the bus stop



Photo 4-20 Use Crosswalk sign at S. Military Trail and Forest Hill Blvd.



Photo 4-21 Tape on sidewalk directing pedestrians toward crosswalk

Broadway and 40th Street

The intersection has two bus stops. Bus Stop 82 is a near-side stop located on Broadway (A1A) that serves the southbound buses. Bus Stop 429 is a far-side stop located on Broadway (A1A) that serves the northbound buses. There were three reported crashes at this location. Two of them occurred in the evening hours and involved pedestrians who were intoxicated.

Observations:

Several instances of jaywalking were observed by the RSA team while at this location (see Appendix D, Photo D-2). Although two of the three pedestrian crashes occurred in the evening hours, there is adequate street lighting on both sides (see Photo 4-22). The street lights are doubled (i.e. one at mid-level and another higher up). Therefore, no nighttime light measurements were taken at this location. This intersection has brick pavers, but they are faded (see Photo 4-23). The RSA team noted that the pedestrian crossing signals do not include a count-down display. The pedestrian crossing signs and push buttons on the southeast, southwest, and northwest sides of the intersection are out of date and need to be updated (see Photo 4-24). The ADA tactile warning tiles on the southeast and southwest sides of the intersection are also out of date (see Photo 4-25).



Photo 4-22 Broadway and 40th Street has double street lighting



Photo 4-23 Brick pavers at Broadway and 40th Street have faded



Photo 4-24 Pedestrian push button at Broadway and 40th Street is out of date



Photo 4-25 ADA tactile paver at Broadway and 40th Street is out of date

Recommendations:

- Update the pedestrian crossing signals to include a countdown display, updated signage and push buttons.
- Update the ADA tactile warning tiles on the southwest and southeast sides of the intersection.
- Re-dye the brick pavers to make their appearance prominent.
- Consider replacing school crossing signs on the southeast and northwest corners of the intersection to comply with MUTCD.

45th Street at Poinciana Plaza

Bus Stop 3061 is located on the north side of 45th Street not near an intersection but rather in front of a place of interest, Poinciana Plaza. It is 220 feet upstream from one of the plaza's driveways and 90 feet downstream from another. There were two pedestrian crashes that occurred near this stop. One of them occurred in the parking lot of Poinciana Plaza. The other one involved a pedestrian walking on the sidewalk and being struck by a car coming out of Poinciana Plaza.

Observations:

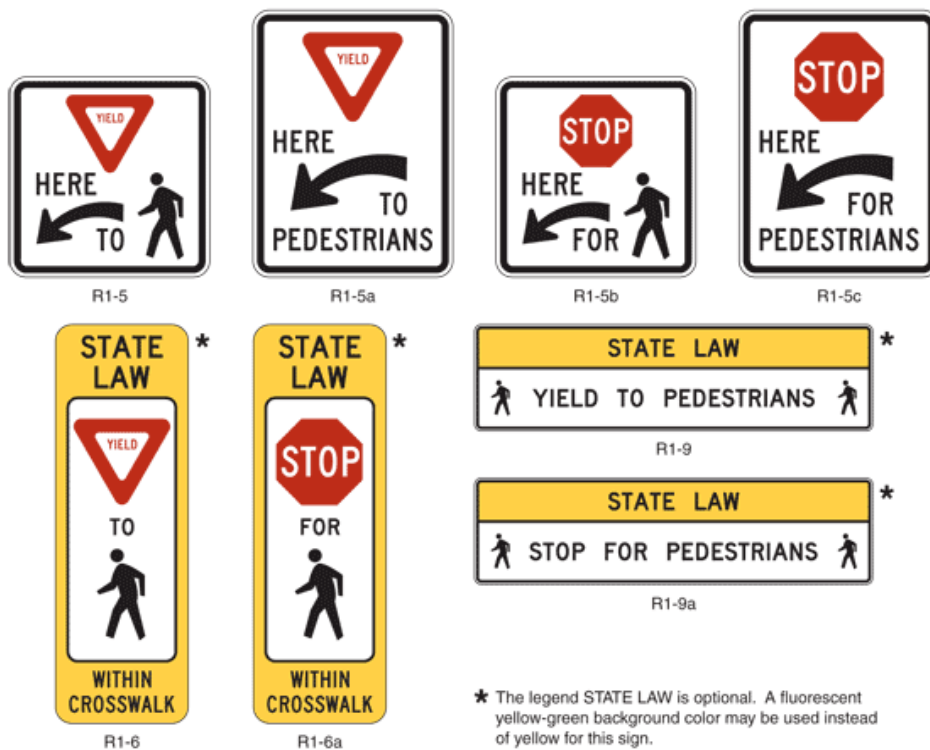
The RSA team observed several instances of jaywalking across 45th Street including jaywalking by people who were going to Bus Stops 3061 and Bus Stop 3013, which is located on the south side of 45th Street (see Appendix D, Photo D-1). In regards to the pedestrian crash that occurred near the entrance to Poinciana Plaza, the RSA team noted that there is no signage alerting drivers to watch for pedestrians (see Photo 4-26).



Photo 4-26 No pedestrian warning signs at entrance to Poinciana Plaza

Recommendations:

- Paint a crosswalk across the entrance to Poinciana Plaza and add an MUTCD approved R-1 series sign for an unsignalized pedestrian crosswalk (see below) to make drivers aware of pedestrian traffic.
- To prevent pedestrians crossing mid-block, evaluate the feasibility of installing a landscape median fence on 45th Street between N. Australia Avenue and Wajeka Road. Please note this effort is contingent on the results of the Oakland Park Blvd. pedestrian barrier pilot project (see Photo 4-1).
- Relocate the “STOP” sign at the entrance to make it more visible for exiting drivers. It is blocked by the billboard.



Appendix A

Ranking of BCT Bus Stops with Pedestrian Crashes within 100 feet

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
1	1808	4	0.0	51,500	6.6	208	19.4	26.0
2	2136	3	20.0	57,000	5.1	434	18.8	43.9
3	257	3	20.0	55,500	5.5	128	19.6	45.1
4	1791	3	20.0	48,500	7.5	158	19.6	47.0
5	775	3	20.0	45,000	8.4	25	19.9	48.4
6	1816	3	20.0	42,500	9.1	172	19.5	48.7
7	5394	3	20.0	41,000	9.6	35	19.9	49.5
8	3630	3	20.0	39,000	10.1	239	19.3	49.5
9	3188	3	20.0	40,000	9.8	40	19.9	49.7
10	2278	3	20.0	39,000	10.1	29	19.9	50.0
11	2279	3	20.0	25,000	14.1	25	19.9	54.0
12	4867	3	20.0	8,400	18.7	127	19.6	58.4
13	612	2	40.0	75,000	0.0	157	19.6	59.6
14	728	2	40.0	75,000	0.0	91	19.7	59.7
15	3553	2	40.0	55,500	5.5	68	19.8	65.3
16	4759	2	40.0	50,877	6.8	382	18.9	65.7
17	882	2	40.0	52,000	6.5	210	19.4	65.9
18	135	2	40.0	53,500	6.0	39	19.9	65.9
19	768	2	40.0	53,000	6.2	61	19.8	66.0
20	1396	2	40.0	52,000	6.5	156	19.6	66.0
21	1284	1	60.0	48,500	7.5	7,254	0.0	67.5
22	776	2	40.0	45,000	8.4	56	19.8	68.3
23	1824	2	40.0	42,500	9.1	123	19.7	68.8
24	77	2	40.0	41,500	9.4	121	19.7	69.1
25	5319	2	40.0	40,500	9.7	22	19.9	69.6
26	779	2	40.0	39,000	10.1	23	19.9	70.1
27	4048	2	40.0	37,000	10.7	56	19.8	70.5
28	3180	2	40.0	36,500	10.8	24	19.9	70.8
29	833	2	40.0	36,500	10.8	19	19.9	70.8
30	3510	2	40.0	34,500	11.4	21	19.9	71.3
31	4360	2	40.0	30,500	12.5	108	19.7	72.2
32	2220	2	40.0	31,000	12.4	45	19.9	72.3
33	3979	2	40.0	30,500	12.5	51	19.9	72.4
34	6049	2	40.0	29,000	12.9	0	20.0	72.9
35	2406	2	40.0	25,000	14.1	35	19.9	74.0
36	1194	2	40.0	23,500	14.5	52	19.9	74.3
37	1478	2	40.0	22,000	14.9	47	19.9	74.8

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
38	1780	2	40.0	21,000	15.2	38	19.9	75.1
39	1751	2	40.0	21,000	15.2	28	19.9	75.1
40	1776	2	40.0	16,400	16.5	159	19.6	76.0
41	3868	2	40.0	17,500	16.2	30	19.9	76.1
42	3336	2	40.0	17,500	16.2	24	19.9	76.1
43	1755	2	40.0	16,400	16.5	128	19.6	76.1
44	1910	2	40.0	16,400	16.5	118	19.7	76.2
45	992	2	40.0	16,000	16.6	6	20.0	76.6
46	1969	2	40.0	14,000	17.2	110	19.7	76.9
47	1513	2	40.0	13,000	17.4	49	19.9	77.3
48	1735	2	40.0	8,900	18.6	28	19.9	78.5
49	4031	2	40.0	8,900	18.6	7	20.0	78.6
50	727	1	60.0	75,000	0.0	127	19.6	79.6
51	614	1	60.0	75,000	0.0	111	19.7	79.7
52	731	1	60.0	75,000	0.0	106	19.7	79.7
53	165	1	60.0	74,000	0.3	39	19.9	80.2
54	3493	1	60.0	69,500	1.5	304	19.2	80.7
55	3085	1	60.0	58,000	4.8	739	18.0	82.7
56	3916	1	60.0	53,000	6.2	1,137	16.9	83.1
57	3911	1	60.0	53,000	6.2	900	17.5	83.7
58	4225	1	60.0	57,500	4.9	390	18.9	83.8
59	2122	1	60.0	57,000	5.1	415	18.9	83.9
60	5030	1	60.0	60,500	4.1	37	19.9	84.0
61	1850	1	60.0	57,500	4.9	285	19.2	84.1
62	2311	1	60.0	58,500	4.6	169	19.5	84.2
63	2292	1	60.0	58,500	4.6	141	19.6	84.3
64	2144	1	60.0	58,000	4.8	144	19.6	84.4
65	4267	1	60.0	53,500	6.0	518	18.6	84.6
66	2739	1	60.0	57,500	4.9	60	19.8	84.8
67	1782	1	60.0	57,500	4.9	19	19.9	84.9
68	2134	1	60.0	53,500	6.0	401	18.9	84.9
69	3934	1	60.0	55,500	5.5	108	19.7	85.2
70	4983	1	60.0	56,000	5.3	29	19.9	85.3
71	4986	1	60.0	56,000	5.3	14	20.0	85.3
72	116	1	60.0	55,500	5.5	36	19.9	85.4
73	3222	1	60.0	52,500	6.3	229	19.4	85.7
74	4241	1	60.0	51,500	6.6	242	19.3	85.9
75	843	1	60.0	45,500	8.3	854	17.6	85.9
76	297	1	60.0	53,500	6.0	33	19.9	86.0

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
77	4468	1	60.0	46,000	8.2	796	17.8	86.0
78	2110	1	60.0	53,000	6.2	66	19.8	86.0
79	767	1	60.0	53,000	6.2	25	19.9	86.1
80	1709	1	60.0	53,000	6.2	21	19.9	86.1
81	2385	1	60.0	53,000	6.2	10	20.0	86.2
82	1810	1	60.0	51,500	6.6	159	19.6	86.2
83	1091	1	60.0	51,500	6.6	150	19.6	86.2
84	5575	1	60.0	52,095	6.4	84	19.8	86.2
85	1562	1	60.0	51,084	6.7	187	19.5	86.2
86	881	1	60.0	52,000	6.5	87	19.8	86.2
87	3232	1	60.0	52,500	6.3	35	19.9	86.2
88	5231	1	60.0	52,500	6.3	18	20.0	86.3
89	5308	1	60.0	52,500	6.3	5	20.0	86.3
90	2542	1	60.0	51,000	6.8	147	19.6	86.3
91	4864	1	60.0	47,500	7.7	443	18.8	86.5
92	5104	1	60.0	50,877	6.8	81	19.8	86.6
93	1200	1	60.0	50,000	7.0	151	19.6	86.6
94	4131	1	60.0	51,000	6.8	33	19.9	86.7
95	1564	1	60.0	51,084	6.7	20	19.9	86.7
96	4137	1	60.0	51,000	6.8	22	19.9	86.7
97	1678	1	60.0	51,000	6.8	8	20.0	86.7
98	1694	1	60.0	51,000	6.8	7	20.0	86.7
99	1283	1	60.0	48,500	7.5	258	19.3	86.7
100	1276	1	60.0	50,000	7.0	104	19.7	86.7
101	2814	1	60.0	50,500	6.9	49	19.9	86.8
102	1885	1	60.0	50,500	6.9	46	19.9	86.8
103	1813	1	60.0	50,000	7.0	85	19.8	86.8
104	1826	1	60.0	50,000	7.0	60	19.8	86.9
105	3823	1	60.0	47,000	7.9	365	19.0	86.9
106	1825	1	60.0	50,000	7.0	21	19.9	87.0
107	1792	1	60.0	48,500	7.5	168	19.5	87.0
108	4289	1	60.0	49,500	7.2	63	19.8	87.0
109	1292	1	60.0	47,000	7.9	312	19.1	87.0
110	1387	1	60.0	43,000	9.0	673	18.1	87.1
111	203	1	60.0	47,500	7.7	181	19.5	87.2
112	1022	1	60.0	47,500	7.7	130	19.6	87.4
113	5095	1	60.0	48,000	7.6	33	19.9	87.5
114	1410	1	60.0	47,500	7.7	83	19.8	87.5
115	3076	1	60.0	48,000	7.6	7	20.0	87.6

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
116	1830	1	60.0	46,500	8.0	153	19.6	87.6
117	1806	1	60.0	46,500	8.0	140	19.6	87.6
118	1833	1	60.0	46,500	8.0	25	19.9	87.9
119	1029	1	60.0	45,693	8.2	105	19.7	88.0
120	1803	1	60.0	46,500	8.0	21	19.9	88.0
121	758	1	60.0	45,000	8.4	166	19.5	88.0
122	2126	1	60.0	45,500	8.3	72	19.8	88.1
123	4274	1	60.0	45,500	8.3	57	19.8	88.1
124	5055	1	60.0	45,500	8.3	46	19.9	88.2
125	205	1	60.0	45,500	8.3	20	19.9	88.2
126	3490	1	60.0	45,000	8.4	14	20.0	88.4
127	898	1	60.0	45,000	8.4	12	20.0	88.4
128	789	1	60.0	43,000	9.0	178	19.5	88.5
129	4644	1	60.0	44,000	8.7	49	19.9	88.6
130	1077	1	60.0	43,500	8.9	76	19.8	88.7
131	5350	1	60.0	44,000	8.7	7	20.0	88.7
132	1080	1	60.0	43,500	8.9	33	19.9	88.8
133	2429	1	60.0	43,000	9.0	82	19.8	88.8
134	857	1	60.0	43,000	9.0	59	19.8	88.8
135	5335	1	60.0	43,000	9.0	44	19.9	88.9
136	3526	1	60.0	41,500	9.4	188	19.5	88.9
137	783	1	60.0	43,000	9.0	19	19.9	88.9
138	4717	1	60.0	43,000	9.0	14	20.0	89.0
139	4716	1	60.0	43,000	9.0	10	20.0	89.0
140	5533	1	60.0	42,500	9.1	58	19.8	89.0
141	2431	1	60.0	42,500	9.1	26	19.9	89.1
142	1312	1	60.0	42,500	9.1	19	19.9	89.1
143	50	1	60.0	41,500	9.4	102	19.7	89.1
144	5357	1	60.0	42,000	9.3	37	19.9	89.2
145	221	1	60.0	41,000	9.6	128	19.6	89.2
146	4251	1	60.0	41,000	9.6	119	19.7	89.2
147	3295	1	60.0	42,000	9.3	12	20.0	89.2
148	5355	1	60.0	42,000	9.3	12	20.0	89.2
149	1759	1	60.0	40,500	9.7	162	19.6	89.3
150	1662	1	60.0	42,000	9.3	7	20.0	89.3
151	1713	1	60.0	42,000	9.3	6	20.0	89.3
152	3007	1	60.0	41,000	9.6	46	19.9	89.4
153	3871	1	60.0	40,500	9.7	66	19.8	89.5
154	5071	1	60.0	41,000	9.6	12	20.0	89.5

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
155	3301	1	60.0	41,000	9.6	11	20.0	89.5
156	314	1	60.0	41,000	9.6	0	20.0	89.6
157	306	1	60.0	40,500	9.7	32	19.9	89.6
158	628	1	60.0	40,500	9.7	22	19.9	89.6
159	3094	1	60.0	40,500	9.7	19	19.9	89.7
160	5336	1	60.0	40,500	9.7	19	19.9	89.7
161	131	1	60.0	40,500	9.7	16	20.0	89.7
162	1268	1	60.0	39,500	10.0	103	19.7	89.7
163	176	1	60.0	39,500	10.0	89	19.8	89.7
164	4977	1	60.0	39,000	10.1	125	19.7	89.8
165	1900	1	60.0	39,000	10.1	120	19.7	89.8
166	214	1	60.0	39,500	10.0	25	19.9	89.9
167	1889	1	60.0	39,000	10.1	42	19.9	90.0
168	623	1	60.0	38,500	10.3	72	19.8	90.1
169	780	1	60.0	39,000	10.1	16	20.0	90.1
170	620	1	60.0	38,500	10.3	65	19.8	90.1
171	861	1	60.0	39,000	10.1	13	20.0	90.1
172	3556	1	60.0	39,000	10.1	10	20.0	90.1
173	2128	1	60.0	38,500	10.3	59	19.8	90.1
174	3842	1	60.0	38,500	10.3	18	20.0	90.2
175	3	1	60.0	38,500	10.3	1	20.0	90.3
176	2589	1	60.0	37,500	10.5	47	19.9	90.4
177	878	1	60.0	37,500	10.5	10	20.0	90.5
178	3439	1	60.0	37,500	10.5	0	20.0	90.5
179	5171	1	60.0	37,000	10.7	31	19.9	90.6
180	4800	1	60.0	37,000	10.7	21	19.9	90.6
181	5155	1	60.0	37,000	10.7	19	19.9	90.6
182	5652	1	60.0	37,000	10.7	9	20.0	90.7
183	743	1	60.0	37,000	10.7	8	20.0	90.7
184	4639	1	60.0	36,500	10.8	20	19.9	90.8
185	525	1	60.0	36,500	10.8	2	20.0	90.8
186	4807	1	60.0	35,500	11.1	7	20.0	91.1
187	5436	1	60.0	35,000	11.3	51	19.9	91.1
188	1898	1	60.0	34,500	11.4	64	19.8	91.2
189	1665	1	60.0	34,500	11.4	22	19.9	91.3
190	1893	1	60.0	34,500	11.4	14	20.0	91.4
191	1895	1	60.0	34,500	11.4	0	20.0	91.4
192	2921	1	60.0	33,500	11.7	85	19.8	91.4
193	1102	1	60.0	34,000	11.5	27	19.9	91.5

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
194	517	1	60.0	33,000	11.8	83	19.8	91.6
195	2946	1	60.0	32,000	12.1	159	19.6	91.7
196	513	1	60.0	33,000	11.8	55	19.8	91.7
197	4629	1	60.0	32,500	12.0	33	19.9	91.9
198	4050	1	60.0	32,000	12.1	27	19.9	92.0
199	4480	1	60.0	31,500	12.2	74	19.8	92.0
200	5014	1	60.0	31,500	12.2	49	19.9	92.1
201	2646	1	60.0	31,000	12.4	68	19.8	92.2
202	5429	1	60.0	31,000	12.4	9	20.0	92.4
203	4384	1	60.0	30,500	12.5	8	20.0	92.5
204	3266	1	60.0	30,500	12.5	4	20.0	92.5
205	104	1	60.0	30,000	12.7	41	19.9	92.5
206	3096	1	60.0	29,000	12.9	81	19.8	92.7
207	284	1	60.0	29,000	12.9	36	19.9	92.8
208	3658	1	60.0	29,000	12.9	15	20.0	92.9
209	1934	1	60.0	27,500	13.4	18	20.0	93.3
210	1460	1	60.0	26,500	13.6	91	19.7	93.4
211	2815	1	60.0	27,000	13.5	7	20.0	93.5
212	1720	1	60.0	26,500	13.6	49	19.9	93.5
213	4562	1	60.0	26,500	13.6	45	19.9	93.5
214	1652	1	60.0	26,500	13.6	22	19.9	93.6
215	3246	1	60.0	26,000	13.8	27	19.9	93.7
216	2132	1	60.0	24,500	14.2	147	19.6	93.8
217	2022	1	60.0	24,000	14.3	165	19.5	93.9
218	2481	1	60.0	25,500	13.9	6	20.0	93.9
219	2851	1	60.0	25,500	13.9	2	20.0	93.9
220	3136	1	60.0	25,000	14.1	30	19.9	94.0
221	3141	1	60.0	25,000	14.1	19	19.9	94.0
222	1916	1	60.0	25,000	14.1	18	20.0	94.0
223	3140	1	60.0	25,000	14.1	9	20.0	94.0
224	2240	1	60.0	24,500	14.2	31	19.9	94.1
225	5540	1	60.0	24,500	14.2	22	19.9	94.1
226	240	1	60.0	24,000	14.3	72	19.8	94.1
227	565	1	60.0	24,000	14.3	58	19.8	94.2
228	2510	1	60.0	24,000	14.3	48	19.9	94.2
229	4513	1	60.0	24,000	14.3	42	19.9	94.2
230	597	1	60.0	24,000	14.3	26	19.9	94.3
231	2556	1	60.0	24,000	14.3	23	19.9	94.3
232	4398	1	60.0	23,500	14.5	38	19.9	94.4

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
233	3991	1	60.0	23,500	14.5	37	19.9	94.4
234	4057	1	60.0	23,500	14.5	33	19.9	94.4
235	2460	1	60.0	23,000	14.6	82	19.8	94.4
236	5579	1	60.0	23,500	14.5	21	19.9	94.4
237	1953	1	60.0	23,500	14.5	20	19.9	94.4
238	4409	1	60.0	22,500	14.8	118	19.7	94.4
239	4441	1	60.0	23,500	14.5	10	20.0	94.5
240	3004	1	60.0	23,000	14.6	32	19.9	94.5
241	2478	1	60.0	23,000	14.6	30	19.9	94.5
242	2027	1	60.0	22,000	14.9	33	19.9	94.8
243	1992	1	60.0	22,000	14.9	26	19.9	94.8
244	1997	1	60.0	21,000	15.2	122	19.7	94.9
245	4056	1	60.0	20,400	15.4	141	19.6	95.0
246	2502	1	60.0	21,000	15.2	58	19.8	95.0
247	3002	1	60.0	21,000	15.2	2	20.0	95.2
248	3106	1	60.0	20,400	15.4	47	19.9	95.2
249	4218	1	60.0	20,400	15.4	47	19.9	95.2
250	3984	1	60.0	18,600	15.9	185	19.5	95.4
251	2788	1	60.0	19,900	15.5	43	19.9	95.4
252	2775	1	60.0	19,900	15.5	34	19.9	95.4
253	4171	1	60.0	19,900	15.5	16	20.0	95.5
254	2789	1	60.0	19,900	15.5	13	20.0	95.5
255	979	1	60.0	19,000	15.8	99	19.7	95.5
256	3844	1	60.0	19,800	15.5	4	20.0	95.5
257	1004	1	60.0	18,700	15.8	105	19.7	95.5
258	1884	1	60.0	19,000	15.8	67	19.8	95.6
259	4796	1	60.0	15,000	16.9	353	19.0	95.9
260	2034	1	60.0	18,400	15.9	3	20.0	95.9
261	2009	1	60.0	17,500	16.2	50	19.9	96.0
262	3125	1	60.0	16,700	16.4	97	19.7	96.1
263	941	1	60.0	17,100	16.3	46	19.9	96.2
264	3124	1	60.0	16,700	16.4	14	20.0	96.4
265	1462	1	60.0	15,900	16.6	74	19.8	96.4
266	913	1	60.0	16,000	16.6	15	20.0	96.6
267	4460	1	60.0	15,500	16.7	9	20.0	96.7
268	986	1	60.0	14,300	17.1	68	19.8	96.9
269	4951	1	60.0	14,500	17.0	35	19.9	96.9
270	918	1	60.0	14,300	17.1	9	20.0	97.0
271	988	1	60.0	14,300	17.1	8	20.0	97.1

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	BCT ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
272	989	1	60.0	14,300	17.1	6	20.0	97.1
273	4197	1	60.0	13,500	17.3	82	19.8	97.1
274	1967	1	60.0	14,000	17.2	30	19.9	97.1
275	2865	1	60.0	13,500	17.3	66	19.8	97.1
276	11	1	60.0	12,000	17.7	180	19.5	97.2
277	3320	1	60.0	12,000	17.7	180	19.5	97.2
278	3432	1	60.0	12,200	17.7	99	19.7	97.4
279	3256	1	60.0	12,000	17.7	100	19.7	97.4
280	5498	1	60.0	12,900	17.5	0	20.0	97.5
281	3981	1	60.0	12,000	17.7	29	19.9	97.6
282	1045	1	60.0	12,200	17.7	5	20.0	97.7
283	1908	1	60.0	11,200	17.9	107	19.7	97.7
284	1007	1	60.0	12,200	17.7	2	20.0	97.7
285	1047	1	60.0	12,200	17.7	2	20.0	97.7
286	6	1	60.0	12,000	17.7	9	20.0	97.7
287	1014	1	60.0	11,300	17.9	39	19.9	97.8
288	3987	1	60.0	10,500	18.1	112	19.7	97.8
289	3195	1	60.0	9,700	18.4	11	20.0	98.3
290	3118	1	60.0	6,500	19.3	320	19.1	98.4
291	1094	1	60.0	8,900	18.6	19	19.9	98.5
292	1197	1	60.0	8,900	18.6	17	20.0	98.5
293	3236	1	60.0	8,900	18.6	14	20.0	98.6
294	4383	1	60.0	6,100	19.4	3	20.0	99.4
295	207	1	60.0	6,100	19.4	2	20.0	99.4
296	4269	1	60.0	3,900	20.0	26	19.9	99.9

Appendix B
Ranking of Palm Tran Bus Stops with Pedestrian Crashes within 100 feet

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
1	82	3	0.0	20,500	14.4	987	16.6	31.1
2	429	3	0.0	20,500	14.4	884	17.0	31.4
3	3061	2	30.0	42,000	8.0	3,061	9.5	47.6
4	513	2	30.0	20,000	14.6	3,549	7.9	52.5
5	1055	2	30.0	40,000	8.6	1,505	14.9	53.5
6	136	2	30.0	23,000	13.7	2,475	11.5	55.2
7	79	2	30.0	20,500	14.4	2,564	11.2	55.7
8	159	2	30.0	19,200	14.8	2,362	11.9	56.8
9	373	2	30.0	23,000	13.7	1,986	13.2	56.9
10	151	2	30.0	20,400	14.5	2,187	12.5	57.0
11	3827	2	30.0	28,050	12.2	1,520	14.8	57.0
12	7301	2	30.0	44,500	7.3	61	19.8	57.1
13	160	2	30.0	16,900	15.5	1,889	13.5	59.1
14	7708	2	30.0	37,500	9.4	52	19.8	59.2
15	681	2	30.0	36,000	9.8	103	19.7	59.5
16	215	2	30.0	13,000	16.7	1,348	15.4	62.1
17	1531	2	30.0	20,400	14.5	39	19.9	64.3
18	1410	2	30.0	13,100	16.6	212	19.3	65.9
19	1714	2	30.0	13,000	16.7	159	19.5	66.1
20	2597	2	30.0	13,100	16.6	83	19.7	66.4
21	8306	2	30.0	10,400	17.4	80	19.7	67.2
22	8307	2	30.0	10,400	17.4	16	19.9	67.4
23	5959	2	30.0	7,600	18.3	12	20.0	68.2
24	1201	1	60.0	33,500	10.6	5,855	0.0	70.6
25	1231	1	60.0	43,000	7.7	4,181	5.7	73.5
26	1036	1	60.0	34,000	10.4	3,792	7.0	77.5
27	356	1	60.0	20,000	14.6	5,008	2.9	77.5
28	3797	1	60.0	18,800	14.9	5,008	2.9	77.8
29	3282	1	60.0	56,500	3.7	1,538	14.7	78.5
30	3210	1	60.0	69,000	0.0	347	18.8	78.8
31	1277	1	60.0	47,000	6.5	2,237	12.4	78.9
32	3288	1	60.0	65,000	1.2	524	18.2	79.4
33	3209	1	60.0	69,000	0.0	42	19.9	79.9
34	448	1	60.0	21,500	14.1	4,081	6.1	80.2
35	5911	1	60.0	52,500	4.9	1,116	16.2	81.1
36	1283	1	60.0	35,500	10.0	2,513	11.4	81.4
37	1211	1	60.0	42,500	7.9	1,849	13.7	81.6

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
38	647	1	60.0	41,000	8.3	1,906	13.5	81.8
39	8373	1	60.0	61,000	2.4	95	19.7	82.1
40	8355	1	60.0	52,000	5.1	874	17.0	82.1
41	5965	1	60.0	52,500	4.9	809	17.2	82.2
42	882	1	60.0	43,500	7.6	1,503	14.9	82.5
43	830	1	60.0	32,000	11.0	2,501	11.5	82.5
44	1218	1	60.0	41,500	8.2	1,593	14.6	82.7
45	865	1	60.0	36,500	9.7	1,808	13.8	83.5
46	1285	1	60.0	41,500	8.2	1,288	15.6	83.8
47	4543	1	60.0	41,000	8.3	1,283	15.6	84.0
48	1031	1	60.0	34,000	10.4	1,775	13.9	84.4
49	1209	1	60.0	40,000	8.6	1,176	16.0	84.6
50	4669	1	60.0	37,000	9.5	1,435	15.1	84.6
51	2312	1	60.0	50,000	5.7	286	19.0	84.7
52	649	1	60.0	35,500	10.0	1,484	14.9	84.9
53	257	1	60.0	32,000	11.0	1,787	13.9	84.9
54	4668	1	60.0	37,000	9.5	1,157	16.1	85.6
55	340	1	60.0	22,500	13.8	2,400	11.8	85.6
56	5947	1	60.0	37,000	9.5	1,053	16.4	85.9
57	6775	1	60.0	46,000	6.8	255	19.1	86.0
58	2236	1	60.0	43,000	7.7	498	18.3	86.0
59	351	1	60.0	16,900	15.5	2,694	10.8	86.3
60	790	1	60.0	33,000	10.7	1,278	15.6	86.4
61	923	1	60.0	28,000	12.2	1,710	14.2	86.4
62	432	1	60.0	20,500	14.4	2,329	12.0	86.5
63	4679	1	60.0	36,500	9.7	919	16.9	86.5
64	1287	1	60.0	40,000	8.6	561	18.1	86.7
65	1048	1	60.0	41,500	8.2	419	18.6	86.8
66	6776	1	60.0	46,000	6.8	6	20.0	86.8
67	2307	1	60.0	43,000	7.7	213	19.3	87.0
68	1499	1	60.0	42,500	7.9	256	19.1	87.0
69	926	1	60.0	38,000	9.2	629	17.9	87.1
70	1004	1	60.0	40,000	8.6	436	18.5	87.1
71	5405	1	60.0	42,500	7.9	213	19.3	87.2
72	1156	1	60.0	33,000	10.7	1,016	16.5	87.2
73	1212	1	60.0	42,500	7.9	163	19.4	87.3
74	6515	1	60.0	30,500	11.5	1,206	15.9	87.3

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
75	41	1	60.0	39,000	8.9	451	18.5	87.4
76	1263	1	60.0	37,500	9.4	575	18.0	87.4
77	1267	1	60.0	40,000	8.6	343	18.8	87.5
78	2237	1	60.0	43,000	7.7	81	19.7	87.5
79	1250	1	60.0	32,500	10.9	936	16.8	87.7
80	1745	1	60.0	42,000	8.0	85	19.7	87.7
81	7625	1	60.0	40,500	8.5	214	19.3	87.8
82	840	1	60.0	24,500	13.2	1,600	14.5	87.8
83	193	1	60.0	26,000	12.8	1,465	15.0	87.8
84	5910	1	60.0	37,000	9.5	463	18.4	87.9
85	1700	1	60.0	36,000	9.8	514	18.2	88.1
86	366	1	60.0	21,500	14.1	1,748	14.0	88.2
87	6516	1	60.0	30,500	11.5	950	16.8	88.2
88	810	1	60.0	36,500	9.7	411	18.6	88.3
89	1056	1	60.0	40,000	8.6	87	19.7	88.3
90	6703	1	60.0	34,000	10.4	550	18.1	88.5
91	6118	1	60.0	39,500	8.8	51	19.8	88.6
92	6164	1	60.0	39,500	8.8	50	19.8	88.6
93	1063	1	60.0	33,500	10.6	543	18.1	88.7
94	2610	1	60.0	35,000	10.1	391	18.7	88.8
95	359	1	60.0	20,400	14.5	1,649	14.4	88.8
96	449	1	60.0	21,500	14.1	1,542	14.7	88.9
97	8546	1	60.0	39,000	8.9	6	20.0	88.9
98	246	1	60.0	26,000	12.8	1,035	16.5	89.3
99	6806	1	60.0	34,000	10.4	334	18.9	89.3
100	369	1	60.0	23,000	13.7	1,287	15.6	89.3
101	1115	1	60.0	36,000	9.8	119	19.6	89.4
102	5747	1	60.0	25,000	13.1	1,049	16.4	89.5
103	6702	1	60.0	34,000	10.4	259	19.1	89.5
104	310	1	60.0	26,000	12.8	935	16.8	89.6
105	1158	1	60.0	33,000	10.7	314	18.9	89.6
106	1079	1	60.0	32,500	10.9	261	19.1	90.0
107	6706	1	60.0	34,000	10.4	21	19.9	90.3
108	6766	1	60.0	31,000	11.3	230	19.2	90.5
109	421	1	60.0	18,300	15.1	1,265	15.7	90.8
110	141	1	60.0	23,000	13.7	848	17.1	90.8
111	91	1	60.0	18,300	15.1	1,197	15.9	91.0

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
112	5725	1	60.0	25,000	13.1	607	17.9	91.0
113	415	1	60.0	18,300	15.1	1,121	16.2	91.3
114	2518	1	60.0	29,500	11.8	139	19.5	91.3
115	459	1	60.0	24,500	13.2	572	18.0	91.3
116	4008	1	60.0	22,500	13.8	621	17.9	91.7
117	83	1	60.0	20,500	14.4	767	17.4	91.8
118	5660	1	60.0	24,500	13.2	414	18.6	91.8
119	84	1	60.0	18,300	15.1	954	16.7	91.8
120	1013	1	60.0	27,500	12.4	136	19.5	91.9
121	154	1	60.0	20,000	14.6	788	17.3	91.9
122	428	1	60.0	20,500	14.4	705	17.6	92.0
123	5693	1	60.0	24,500	13.2	352	18.8	92.0
124	3043	1	60.0	21,000	14.3	649	17.8	92.1
125	3031	1	60.0	21,000	14.3	603	17.9	92.2
126	7621	1	60.0	26,000	12.8	152	19.5	92.3
127	1255	1	60.0	27,500	12.4	1	20.0	92.4
128	430	1	60.0	20,500	14.4	587	18.0	92.4
129	431	1	60.0	20,500	14.4	587	18.0	92.4
130	253	1	60.0	26,000	12.8	98	19.7	92.5
131	322	1	60.0	18,600	15.0	739	17.5	92.5
132	7310	1	60.0	27,000	12.5	3	20.0	92.5
133	1402	1	60.0	13,000	16.7	1,210	15.9	92.5
134	314	1	60.0	23,500	13.5	235	19.2	92.7
135	51	1	60.0	26,000	12.8	16	19.9	92.7
136	1513	1	60.0	25,000	13.1	99	19.7	92.8
137	462	1	60.0	26,000	12.8	9	20.0	92.8
138	8203	1	60.0	25,500	12.9	36	19.9	92.8
139	1573	1	60.0	13,000	16.7	1,106	16.2	92.9
140	4014	1	60.0	22,500	13.8	270	19.1	92.9
141	5664	1	60.0	24,500	13.2	79	19.7	93.0
142	5689	1	60.0	24,500	13.2	63	19.8	93.0
143	190	1	60.0	23,500	13.5	143	19.5	93.1
144	368	1	60.0	23,000	13.7	165	19.4	93.1
145	2556	1	60.0	11,400	17.1	1,163	16.0	93.2
146	1409	1	60.0	23,000	13.7	110	19.6	93.3
147	1434	1	60.0	23,000	13.7	78	19.7	93.4
148	85	1	60.0	18,300	15.1	465	18.4	93.5

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
149	1516	1	60.0	23,000	13.7	55	19.8	93.5
150	4066	1	60.0	22,500	13.8	48	19.8	93.7
151	6359	1	60.0	15,700	15.9	613	17.9	93.8
152	1579	1	60.0	22,000	14.0	35	19.9	93.9
153	78	1	60.0	20,500	14.4	153	19.5	93.9
154	2812	1	60.0	16,900	15.5	466	18.4	93.9
155	5702	1	60.0	20,500	14.4	142	19.5	94.0
156	88	1	60.0	18,300	15.1	291	19.0	94.1
157	1442	1	60.0	20,400	14.5	96	19.7	94.1
158	1443	1	60.0	20,400	14.5	28	19.9	94.4
159	2599	1	60.0	13,100	16.6	578	18.0	94.7
160	2270	1	60.0	16,100	15.7	300	19.0	94.7
161	5380	1	60.0	17,600	15.3	8	20.0	95.3
162	2581	1	60.0	17,100	15.4	42	19.9	95.3
163	1466	1	60.0	13,400	16.5	334	18.9	95.4
164	5050	1	60.0	16,100	15.7	43	19.9	95.6
165	3735	1	60.0	6,300	18.7	866	17.0	95.7
166	634	1	60.0	10,600	17.4	466	18.4	95.8
167	177	1	60.0	15,300	16.0	43	19.9	95.8
168	6786	1	60.0	14,700	16.2	44	19.9	96.0
169	3730	1	60.0	6,300	18.7	751	17.4	96.1
170	4920	1	60.0	14,400	16.3	34	19.9	96.1
171	614	1	60.0	10,900	17.3	337	18.9	96.1
172	4919	1	60.0	14,400	16.3	32	19.9	96.1
173	5669	1	60.0	14,600	16.2	1	20.0	96.2
174	6334	1	60.0	12,400	16.8	151	19.5	96.3
175	413	1	60.0	1,900	20.0	1,060	16.4	96.4
176	613	1	60.0	5,200	19.0	764	17.4	96.4
177	6439	1	60.0	10,900	17.3	216	19.3	96.6
178	7308	1	60.0	10,100	17.5	219	19.3	96.8
179	3494	1	60.0	12,400	16.8	4	20.0	96.8
180	3236	1	60.0	9,600	17.7	235	19.2	96.9
181	8316	1	60.0	9,100	17.8	273	19.1	96.9
182	8659	1	60.0	11,300	17.2	56	19.8	97.0
183	5040	1	60.0	5,700	18.8	485	18.3	97.2
184	7367	1	60.0	8,100	18.1	239	19.2	97.3
185	5069	1	60.0	5,700	18.8	311	18.9	97.8

RANK	STOP ID	PED CRASHES	WEIGHTED PED CRASH SCORE	MEAN AADT	WEIGHTED AADT SCORE	PALM TRAN ON/OFFS	WEIGHTED ON/OFF SCORE	COMBINED WEIGHT SCORE
186	4559	1	60.0	8,000	18.2	39	19.9	98.0
187	5960	1	60.0	7,600	18.3	5	20.0	98.3
188	4813	1	60.0	6,000	18.8	115	19.6	98.4
189	5387	1	60.0	6,100	18.7	91	19.7	98.4
190	7618	1	60.0	3,700	19.4	271	19.1	98.5
191	5134	1	60.0	5,800	18.8	22	19.9	98.7
192	5121	1	60.0	5,800	18.8	16	19.9	98.8
193	5396	1	60.0	5,000	19.0	6	20.0	99.0
194	1706	1	60.0	1,800	20.0	267	19.1	99.1
195	7679	1	60.0	2,300	19.9	75	19.7	99.6
196	402	1	60.0	2,700	19.7	1	20.0	99.7

Appendix C
Photos of Observed Mid-block Crossing in Broward County



Photo C-1 Observed mid-block crossing near BCT Stop 893 (Broward Blvd at State Road 7)



Photo C-2 Observed mid-block crossing near BCT Stops 2122 and 2136 (Oakland Blvd at 9th Avenue)



Photo C-3 Observed mid-block crossing near BCT Stop 1808 (W Sunrise Blvd at NW 15th Avenue)



Photo C-4 Observed mid-block crossing near BCT Stop 1808 (W. Sunrise Blvd and NW 15th Avenue)

Appendix D
Photos of Observed Mid-block Crossing in Palm Beach County



Photo D-1 Observed mid-block crossing near Palm Tran Stop 3061 (45th Street at Poinciana Plaza)



Photo D-2 Observed mid-block crossing near Palm Tran Stops 82 and 429 (Broadway at 40th Street)



Photo D-3 Observed mid-block crossing near Palm Tran Stop 6806 (Lantana Road at Brentwood Blvd)



Photo D-4 Observed mid-block crossing near Palm Tran Stop 1277 (Military Trail at Forest Hill Blvd)