



PEDESTRIAN / BICYCLE SAFETY REVIEW

Palm Bay Road from Babcock Street to Lipscomb Street



Prepared for:
**Space Coast Transportation
Planning Organization**
2725 Judge Fran Jamieson Way
Bldg. B / Room 105 / MS #82
Melbourne, FL 32940

Prepared by:
Kittelson & Associates, Inc.
225 E. Robinson Street, Suite 450
Orlando, FL 32801
407.540.0555
kittelson.com

February 2016

Pedestrian/Bicycle Safety Action Plan

Pedestrian/Bicycle Safety Review Report for Palm Bay Road from Babcock Street to Lipscomb Street

Brevard County

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Project Title: Palm Bay Road Pedestrian/Bicycle Safety Review

Field Review Dates: August 19th and 20th, 2015 (daytime/nighttime reviews and follow up meeting)

Participants:

John R. Freeman Jr. – Kittelson and Associates, Inc. – Team Leader
Laura Carter – Space Coast Transportation Planning Organization
Georganna Gillette – Space Coast Transportation Planning Organization
Kim Smith – Space Coast Transportation Planning Organization
Conroy Jacobs – Brevard County
Devin Swanson – Brevard County
Kwabena Ofosu – City of Palm Bay
Joe Chagnon – Space Coast Area Transit
Lt. Greg Moore – Palm Bay Police Department
Michael Eagle – Kittelson and Associates, Inc.

Project Characteristics:

Field Review Type: Pedestrian, Bicycle, Existing Road
Adjacent Land Use: Urban; Commercial, Industrial, Residential
Posted Speed Limit: 45 miles per hour (mph) along the length of the study corridor
Opposite Flow Separation: Raised Grass Median
Service Function: Urban Principal Arterial
Terrain: Flat
Climatic Conditions: Sunny, Hot

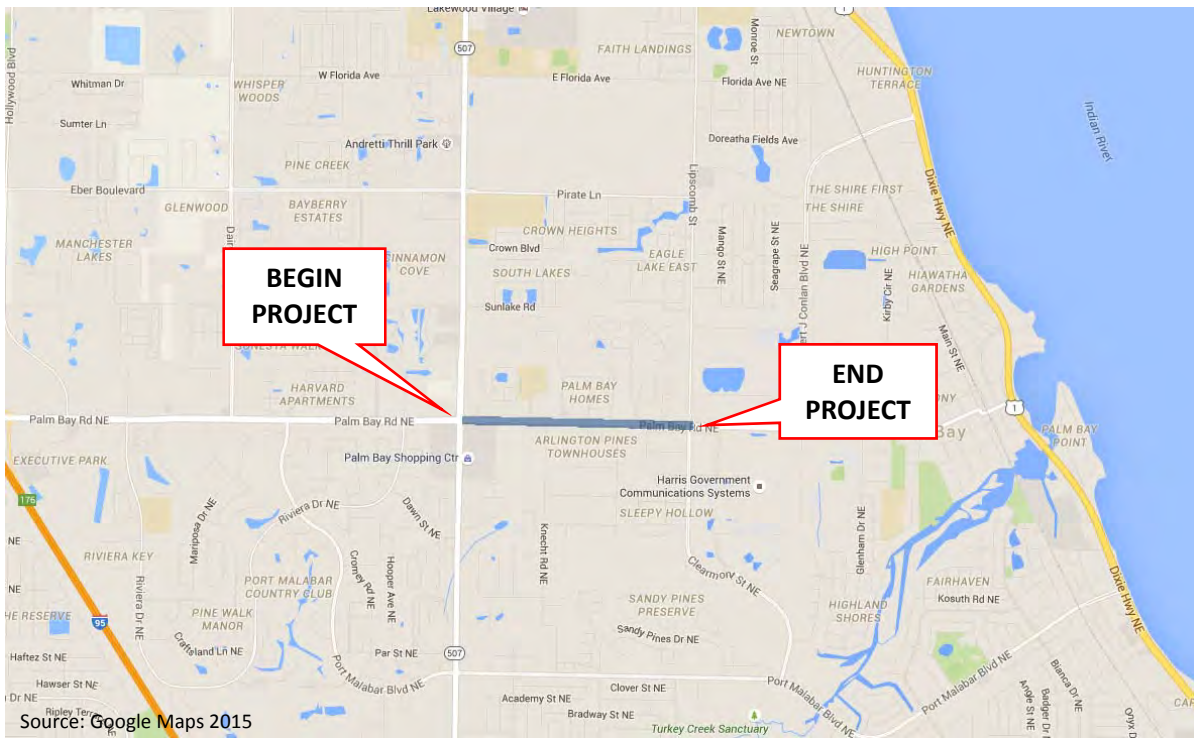


Figure 1 – Palm Bay Road Corridor

Background

In late 2014, the Florida Department of Transportation (FDOT) released its Pedestrian and Bicycle Focused Initiative for 2015 and identified Brevard County as a Top 15 High Priority County. The goal of the Pedestrian/Bicycle Safety Action Plan is to generate a list of suggested improvements at high crash locations to address the growing need for improved pedestrian/bicycle safety in Brevard County. Palm Bay Road from Babcock Street to Lipscomb Street (**Figure 1**), a 1.00 mile corridor in southern Brevard County was identified as one of these high crash locations. In order to suggest improvements along this high crash corridor, the crash history was evaluated and a field review was conducted.

This pedestrian/bicycle safety review was commissioned by the Space Coast Transportation Planning Organization (SCTPO) to develop maintenance-type, near-term, and long-term suggestions to improve pedestrian and bicyclist safety within the study limits.

The pedestrian/bicycle safety review process involves multi-disciplinary representatives from various stakeholders, potentially including representatives from transportation planning, traffic operations, roadway design, safety, and law enforcement. Pedestrian/bicycle safety reviews are conducted to identify potential safety issues and provide improvement suggestions in a team collaborative environment. This safety review is limited in scope and should not be construed as a comprehensive safety study; nor is it a formal Road Safety Audit. It is intended to identify potential operational and safety improvements related to pedestrians and bicyclists to be considered by SCTPO staff and partner agencies (i.e. FDOT District Five (D5), Brevard County, City of Palm Bay, SCAT, local law enforcement). Some improvements presented in this report may be implemented as maintenance-type activities while other suggested safety improvements may be considered for future study. Each suggestion identified in this study is classified into one of three categories:

- Maintenance – issues identified for maintenance may be addressed by public agency staff on a short timeframe and at a relatively low cost.
- Near-Term Improvement (within 3 to 5 years) – activities that may be incorporated into an upcoming construction project in the area, including 3R milling and resurfacing projects.
- Long-Term Improvement (5+ years) – activities that may be incorporated into upcoming construction projects and may need to be programmed for funding as separate projects.

The issues and suggested improvements reflect the consensus of the pedestrian/bicycle safety review team and not necessarily that of the SCTPO.

The field review was conducted on Wednesday, August 19th, 2015. The team met in the morning at the Palm Bay Community Center to discuss the study corridor and crash history. After lunch, the study team drove the entire corridor, west to east and east to west, to gain an understanding of the facility characteristics from a driver's perspective. The road safety audit teams split into two teams. One team walked on the sidewalk along the north side of the roadway, while the other team walked on the sidewalk along the south side of the roadway. The team reassembled in the evening, after sunset, to make observations in nighttime conditions. Similar to the daytime field review, the team drove and walked the corridor to gain both the driver's and pedestrian/bicyclist's perspectives in the nighttime conditions. A follow-up debrief meeting was held at the Palm Bay Community Center the following morning (August 20th) to discuss the corridor's issues and potential improvements identified by the team. Study corridor characteristics are reviewed below:

- Babcock Street to Lipscomb Street – 1.00 mile,
 - Six lane, divided facility with landscaped medians;
 - Posted speed long the study corridor limits at 45 mph;
 - There are three (3) signalized intersections within the study limits:
 - Babcock Street
 - Dual exclusive left-turn lanes along all four approaches with protected left-turn phasing
 - Exclusive right-turn lanes along all four approaches
 - Old version of special emphasis crosswalk markings on each approach
 - Pinewood Drive
 - Exclusive left-turn lanes along eastbound and westbound approaches with protected left-turn phasing
 - Exclusive right-turn lane on westbound approach
 - Old version of special emphasis crosswalk markings on the north and west legs of the intersection
 - Lipscomb Street
 - Exclusive left-turn lanes along eastbound and westbound approaches with protected left-turn phasing
 - Exclusive left-turn lanes along northbound and southbound approaches with protected/permitted left-turn phasing
 - Exclusive right-turn lane on all four approaches
 - Old version of special emphasis crosswalk markings on each leg of the intersection with the exception of the south leg. This south leg includes current special emphasis crosswalk markings.
 - Sidewalks are located along both sides of the facility for the length of the study corridor;

- Five-foot paved shoulders are located along both sides of the facility and are usable as a bike lane. Right-turn lane keyholes are provided.
- Overhead street lighting is located at the Babcock Street and Lipscomb Street intersections, but is not present along the remainder of the corridor.

Crash History (2009 – 2014)

Six (6) years of available pedestrian and bicycle related crash data, 2009 to 2014, were utilized for the Palm Bay Road crash analysis. Crash data was obtained from the Signal Four Analytics database maintained by University of Florida from 2009 to 2014. CARS data was not obtained for this roadway segment as the roadway is not a state facility. Kittelson and Associates, Inc. (KAI) created collision diagrams along the corridor to summarize the pedestrian/bicycle-related crash history. The collision diagrams are included in **Appendix A**.

Eighteen (18) pedestrian or bicycle-related crashes were reported over the six-year study period, 44 percent of which involved pedestrians (8 crashes) and 56 percent of which involved bicycles (10 crashes). Of the eighteen (18) pedestrian and bicycle crashes, there were three (3) fatal crashes (17 percent), twelve (12) injury crashes (67 percent), and three (3) property-damage-only (PDO) crashes (17 percent) during the study period. The three fatal pedestrian crashes (all three of which occurred during dark lighting conditions and one of which involved alcohol) are summarized below (summarized from west to east):

- Crash Number 842026640
 - On November 15, 2013 at 7:58 PM, a crash involving a pedestrian occurred in the inside westbound lane along Palm Bay Road approximately 250 feet west of Windwood Drive under dark un-lighted conditions. The pedestrian was attempting to cross Palm Bay Road north to south. The first vehicle was traveling west on Palm Bay Road in the outside lane when it collided with the pedestrian at approximately 45 miles per hour. A second vehicle, traveling behind the first vehicle, then collided with the rear bumper of the first vehicle. The pedestrian was pronounced deceased on the scene.
- Crash Number 802360790
 - On November 24, 2010 at 6:27 PM, a crash involving a pedestrian occurred along the inside eastbound lane of Palm Bay Road under dark un-lighted conditions. The pedestrian was crossing southbound at a midblock location between Windwood Drive and Skippers Way. The pedestrian stepped into the path of the vehicle, traveling east and caused a collision. The pedestrian suffered fatal injuries and was pronounced deceased on the scene.
- Crash Number 842030440
 - On January 13, 2014 at 7:36 PM, a crash involving a pedestrian occurred along Palm Bay Road near Knecht Road under dark un-lighted conditions. The pedestrian attempted to cross Palm Bay Road southbound at a mid-block location between Skippers Way and Knecht Road. The vehicle was traveling west on Palm Bay Road in the inside lane when it collided with the pedestrian at approximately 45 miles per hour. The pedestrian was treated on scene by paramedics and then transported to Holmes Regional Medical Center with life threatening injuries. The pedestrian was pronounced deceased by hospital staff. The pedestrian was under the influence of alcohol at the time of the crash.

Thirty-three (33) percent of the crashes occurred in dark lighting conditions and 67 percent occurred under daylight lighting conditions. Of the total crashes, eighty-three (83) percent occurred under dry roadway conditions and 17 percent occurred under wet roadway surface conditions.

The reported crashes are displayed by different measures of time (such as year, month, day, and hour) in **Figure 2** to **Figure 5**.

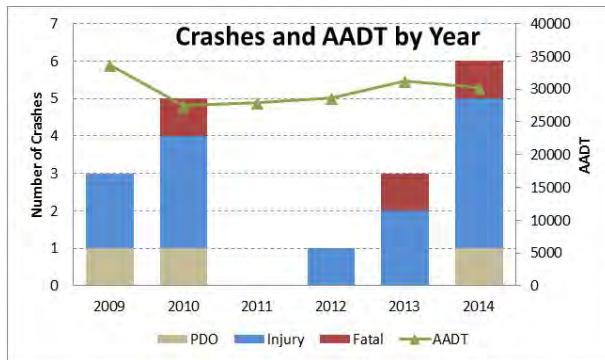


Figure 2

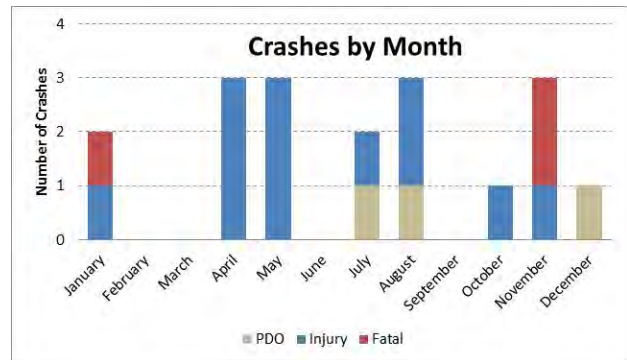


Figure 3

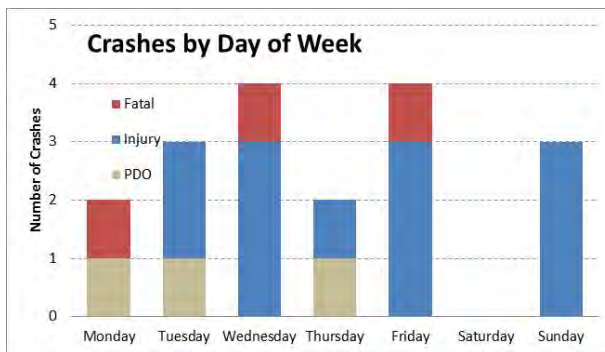


Figure 4

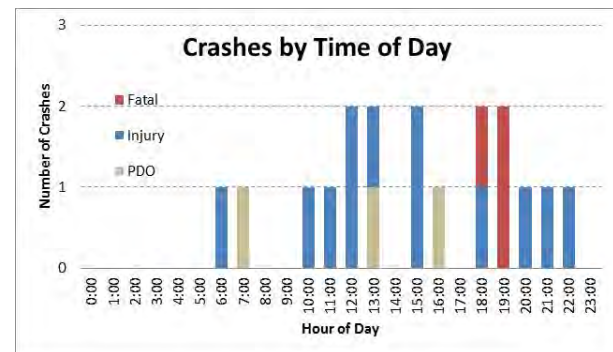


Figure 5

Overall, the number of pedestrian and bicycle crashes have varied in regards to yearly crash frequency. Over this same time period, the Annual Average Daily Traffic (AADT) along the segment has remained constant between 2010 (27,500) and 2014 (30,300). In 2011, there were no reported pedestrian/bicycle crashes. The corridor experienced a spike in pedestrian and bicycle crashes in 2014 with 6 reported crashes, 1 of which resulted in a fatality.

The crashes are relatively consistent between the days of the week with the exception of Saturdays, where no crashes were reported. Three (3) of the 18 crashes occurred in November with two (2) of the three (3) fatal crashes occurring within that month. Four (4) crashes occurred between the hours of 6:00 PM and 8:00 PM with all three (3) fatal crashes occurring within this timeframe.

The reported crashes are displayed by lighting condition and by alcohol or drug involvement in **Figure 6** and **Figure 7**. Three (3) fatal crashes occurred under dark un-lighted conditions. Two (2) of the 18 crashes involved alcohol, and was involved in one of the fatal crashes.

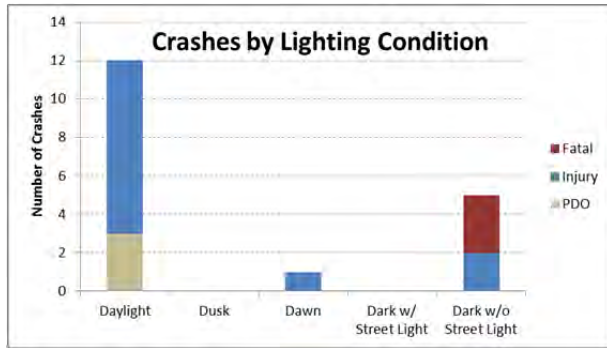


Figure 6

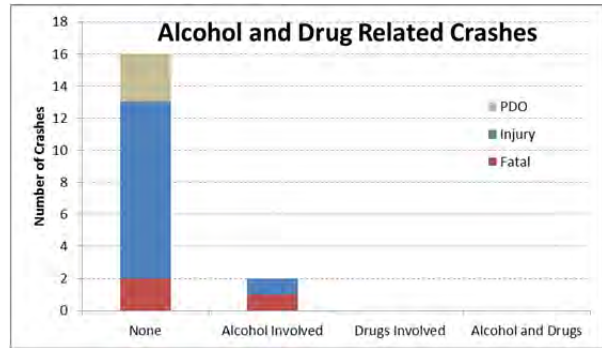


Figure 7

A few other crash statistics worthy to note:

- Seven (7) of the 10 bicycle crashes (70 percent) involved a bicyclist traveling against the flow of traffic;
 - Six (6) of these seven (7) crashes occurred along the sidewalk and involved a vehicle making a right-turn movement.
 - One (1) of these seven (7) crashes occurred within the bike lane at a signalized intersection.
- All of the three (3) fatal crashes occurred in the inside lane of travel, with the pedestrian attempting to cross Palm Bay Road at a mid-block location in the segment between Windwood Drive and Knecht Drive;
 - The pedestrian had almost reached the center median before getting hit in two (2) of the three (3) fatal crashes.
 - The pedestrian got struck immediately after leaving the center median in the third fatal pedestrian crash along this segment.
- The vehicle had the right-of-way in all three (3) fatal pedestrian crashes;
- The bicyclist had the right-of-way in six (6) of the ten (10) bicycle crashes;
- The bicyclist or pedestrian had the right-of-way in three (3) of the four (4) crashes that occurred at a signalized intersection; and
- In five (5) of the 8 pedestrian crashes (28 percent of total crashes), the pedestrian was attempting to cross Palm Bay Road at an uncontrolled location between signalized intersections.

The locations of reported crashes are shown in the collision diagram (see **Appendix A**) and are summarized as follows:

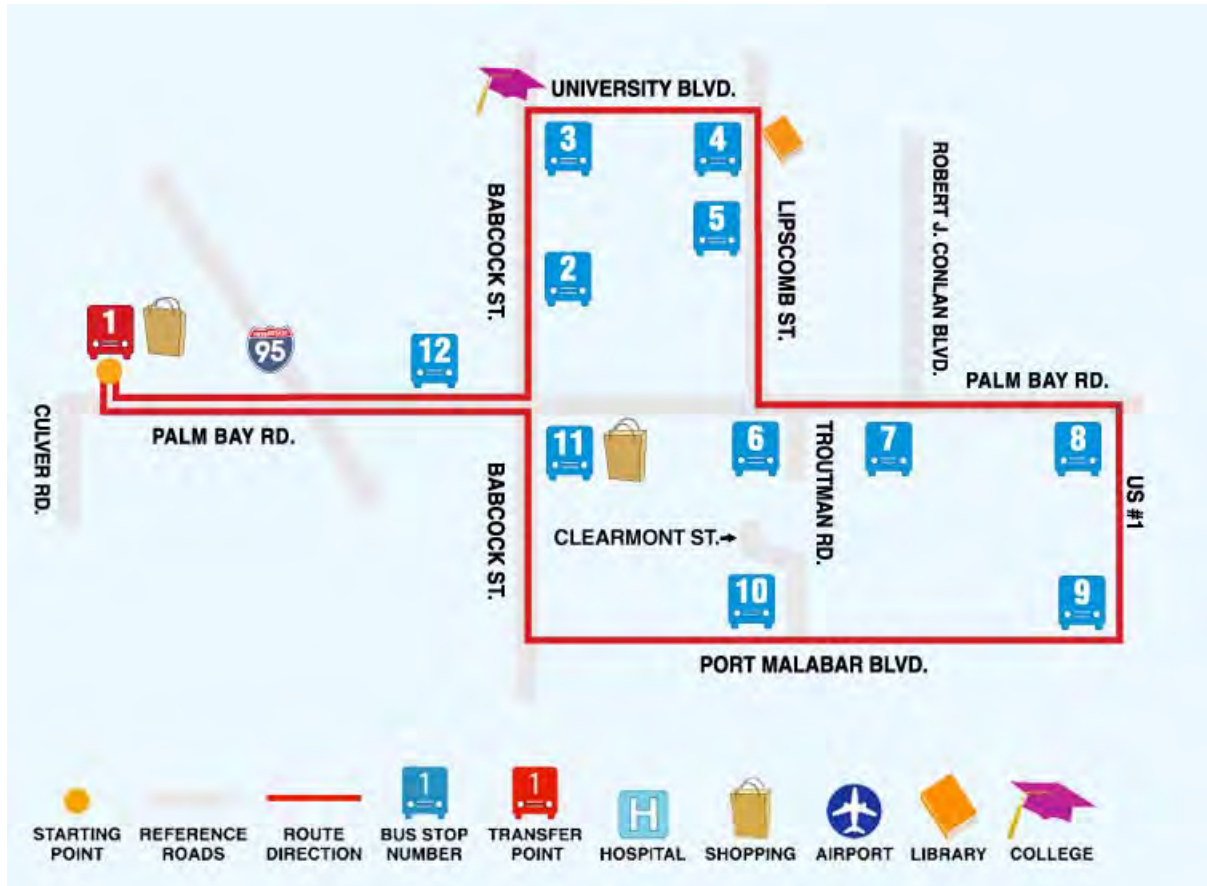
- Signalized Intersections – Four (4) crashes (22 percent) occurred at or near one of the three signalized intersections along the corridor. The signalized intersections with these crashes are identified below:
 - Pinewood Drive – Three (3) crashes
 - 1 crash where the pedestrian was crossing Pinewood Drive eastbound within the north leg’s crosswalk and was struck by a southbound vehicle attempting to turn right onto Palm Bay Road.
 - 1 crash where the bicyclist was crossing Pinewood Drive eastbound within the marked bike lane and was struck by a southbound vehicle attempting to make a right-turn onto Palm Bay Road.

- 1 crash where the pedestrian was northbound crossing the east leg of the intersection. A marked crosswalk is not provided along the east leg of the intersection.
 - Both pedestrians were injured in the two pedestrian crashes.
 - Lipscomb Street – One (1) crash
 - 1 crash where the pedestrian was walking westbound along Palm Bay Road in the right-turn lane near the intersection when they were struck from behind by a vehicle. This crash resulted in one (1) injury.
 - No pedestrian or bicycle crashes occurred at the Palm Bay Road/Babcock Street intersection during the analysis period.
- Segments – The remaining 14 pedestrian or bicycle-related crashes (78 percent) occurred at driveways or mid-block along the Palm Bay Road segment. The driveway and mid-block locations with more than one (1) crash are identified below:
 - Mid-block between Windwood Drive and Knecht Road
 - Three (3) pedestrian crashes in which the pedestrian was crossing Palm Bay Road mid-block heading north.
 - All three (3) of these crashes resulted in fatalities.
 - All three (3) crashes occurred under dark un-lighted conditions.
 - One (1) of these fatal crashes involved a pedestrian under the influence of alcohol.
 - One (1) bicycle crash in which the bicycle was crossing Palm Bay Road mid-block heading north and struck a vehicle attempting to make a U-turn. This crash resulted in one (1) injury.
 - Knecht Road
 - Two (2) crashes in which the bicyclist was crossing Knecht Road, traveling westbound, and was struck by vehicles attempting to turn right onto Palm Bay Road. The bicyclist's direction of travel is unknown in one (1) of the crashes. One (1) of the bicycle crashes resulted in one (1) injury.
 - One (1) pedestrian crash in which the pedestrian was crossing Knecht Road, traveling westbound, and was struck by a vehicle attempting to turn right onto Palm Bay Road. This crash resulted in one (1) injury.
 - Lakewood Drive
 - One (1) bicycle crash in which the bicyclist was traveling eastbound along the sidewalk on the north side of Palm Bay Road and was struck by a vehicle attempting to turn right onto Palm Bay Road.
 - One (1) bicycle crash in which the bicyclist was attempting to cross Palm Bay Road at a mid-block location just west of Lakewood Drive, and was struck by a vehicle in the inside lane along Palm Bay Road. The bicyclist's direction of travel is unknown.
 - Both bicycle crashes resulted in one (1) injury each.

PEDESTRIAN/BICYCLE FIELD REVIEW FINDINGS

Transit

The Space Coast Area Transit (SCAT) recently completed the Bus Stop Americans with Disabilities Act (ADA) Assessment Report for every transit stop within their network. SCAT does not serve Palm Bay Road within the limits of this study. Route 27 serves Palm Bay Road near the study limits; however, the route travels around the study limits between Babcock Street and Lipscomb Street as illustrated in **Figure 8**. There were no transit related improvements as part of this study.



Source: Space Coast Area Transit

Figure 8 – SCAT Route 27

Location: Corridor-Wide

Issue #1: Lighting

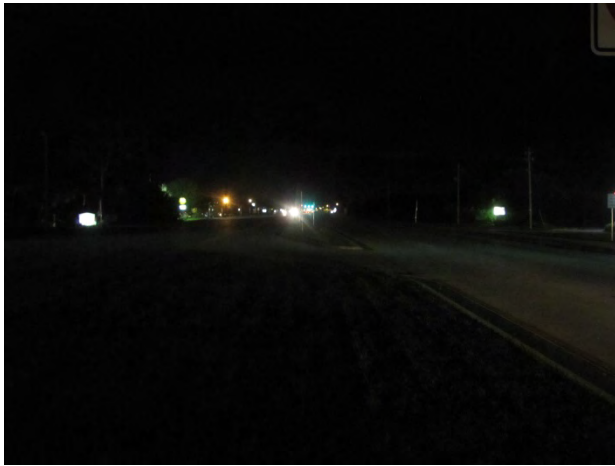


Figure 9



Figure 10

Description of Issue:

The crash statistics showed 33 percent of the pedestrian/bicycle crashes, including all three fatal pedestrian crashes, occurred during non-daylight conditions. Intersection lighting is present at the Babcock Street intersection with one light each on the southeast and southwest corners of the intersection. No intersection lighting is provided at Pinewood Drive, and one light is provided on the northwest corner of the Lipscomb Street intersection. Segment lighting is almost non-existent along the length of the corridor and during the nighttime field review, the study team experienced difficulty in seeing pedestrians or bicyclists along the corridor at night, especially those wearing dark clothing. The lighting conditions observed at nighttime are illustrated in **Figure 9** and **Figure 10**.

Suggestions for Improvement:

Consider upgrading the lighting at the intersection of Palm Bay Road and Babcock Street to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT PPM. This may require the existing lighting to be replaced.

Incremental implementation of lighting should be considered as funding may dictate potential implementation. Priority should be given to implementing intersection lighting at the remainder of the signalized intersections to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT PPM.

Priority then should be given to lighting the segment between Babcock Street and Knecht Road as this segment includes many of the corridor's nighttime crashes. As funding becomes available, consider implementing roadway lighting along the entire corridor.

Location: Corridor-Wide

Issue #2: Crosswalk Markings



Figure 11



Figure 12



Figure 13



Figure 14

Description of Issue:

Marked crosswalks are not included along any of the minor street approaches at the unsignalized intersections throughout the corridor (see **Figure 11** and **Figure 12**). This was observed along the east and west sides of the study corridor. Inclusion of standard crosswalks at the unsignalized intersections and major driveways may give better indication to drivers that pedestrians may be present.

Crosswalk markings at some signalized intersections are beginning to wear (illustrated in **Figure 13**). The crosswalks at all three of the signalized intersections along the corridor are marked with the old standard emphasis markings (shown in **Figure 14**) with the exception of the south leg of the Lipscomb Street intersection. This intersection approach was recently modified in 2014/2015.

Suggestions for Improvement:

Consider marking all minor street approaches at unsignalized intersections along the corridor. Standard crosswalk markings as shown on sheet 9 of the FDOT Design Standard Index 17346 should be used for the unsignalized crossings. Special emphasis markings as shown on sheet 9 of Design Index 17346 should be used for the signalized crossings at the three signalized intersections within the study limits.

Location: Corridor-Wide

Issue #3: Bicycle Lanes



Figure 15



Figure 16



Figure 17



Figure 18

Description of Issue:

Over half of the bicycle crashes involved bicyclist riding along the sidewalk and against the flow of traffic. Some bicyclists were observed riding within the paved shoulder, but most bicyclists were observed riding along the sidewalks. Examples of observed bicycle activity are illustrated in **Figure 15** and **Figure 16**. No marked bicycle lanes are provided along the length of the corridor, but a five-foot paved shoulder is provided as shown in **Figure 17** and **Figure 18**.

Suggestions for Improvement:

The existing cross section includes three 11-foot eastbound and westbound travel lanes, five-foot paved shoulders, and a raised landscaped center median. In many locations, an exclusive left-turn is also provided resulting in approximately 77 feet of pavement. Based upon the existing pavement, there is not adequate width to accommodate buffered bike lanes in addition to the six 11-foot travel lanes, turn lanes, and raised center median without adjusting the existing curb line.

Appropriate bicycle lane signage and pavement markings should be installed using the existing five-foot paved shoulder according to the standards in the FDOT Standard Index 17347.

Location: Corridor-Wide

Issue #4: Median Nose Visibility



Figure 19



Figure 20

Description of Issue:

Twenty-eight percent of the pedestrian/bicycle crashes reported on the corridor in the analysis period involved pedestrians crossing at unmarked location between signalized intersections. The pedestrians are using the center median as refuge to complete two-stage crossings. The center median can be difficult to see at nighttime as illustrated in **Figure 19**. It is also difficult to differentiate between the paved median opening and raised grass median due to the darkness along this section of roadway. The paint on the center median nose is starting to wear and no longer appears to be yellow (**Figure 20**).

Suggestions for Improvement:

Consider restriping the median noses with a yellow retroreflective paint to increase visibility in the daytime and nighttime conditions. Installation of raised retroreflective pavement markers could also be considered as a center median nose treatment.

Location: Corridor-Wide

Issue #5: Sidewalks



Figure 21



Figure 22

Description of Issue:

As the study team walked both sides of the corridor, very few sidewalks were observed along the minor street approaches. Eight-foot sidewalks are provided along both sides of Palm Bay Road for the entire limits of the study corridor, but there is limited sidewalk connectivity to the neighborhoods on the north and south sides of the roadway. The limited sidewalk connectivity creates situations where pedestrians and wheelchair-bound pedestrians must use the roadway for a hard surface to get to Palm Bay Road. Examples of some minor street approaches that lack sidewalks are presented in **Figure 21** and **Figure 22**.

Suggestions for Improvement:

Consider installing sidewalks along minor streets with pedestrian generators/attractors to enhance the pedestrian connectivity along the corridor. The following minor streets could be considered with a higher priority as they do not have sidewalks on either side of the roadway:

- Windwood Drive
- Monterey Drive
- Knecht Road
- Lakewood Drive
- Bottlebrush Drive
- Franklin Drive
- Woodlake Drive

As mentioned previously, there are some minor streets that have sidewalks present on one side of the roadway. Consideration could be given to filling in the sidewalk gaps to tie into the sidewalk network along Palm Bay Road. The side streets having existing sidewalk are summarized below:

- Skippers Way
 - Continuous sidewalk on the west side of the roadway north of Palm Bay Road.
- Pinewood Drive
 - Continuous sidewalk on the east side of the roadway north of Palm Bay Road.

- Tropicana Road
 - 450' of sidewalk on the west side of the roadway south of Palm Bay Road.
- Lipscomb Street
 - Continuous sidewalk on the east side of the roadway north of Palm Bay Road.
 - Continuous sidewalk on both sides of the roadway south of Palm Bay Road.

It should be noted that the minor streets above should be given less priority for sidewalks than streets currently having no sidewalks.

Location: Babcock Intersection

Issue #6: Pedestrian Push Button Signage



Figure 23



Figure 24



Figure 25



Figure 26

Description of Issue:

The push button signage is inconsistent on the four corners of the intersection. An old version of the R10-3 pedestrian plaques is present on the poles to cross the Palm Bay Road approaches as illustrated in **Figure 23** and **Figure 24**. This old version does not indicate to the pedestrian which road they are crossing. However, R10-3i pedestrian plaques are present to cross the Babcock Street approaches as shown in **Figure 25** and **Figure 26**.

Suggestions for Improvement:

Install R10-3i pedestrian plaques for the Palm Bay Road crossing movement on the applicable poles at the intersection to provide consistent pedestrian signage at the intersection.

Location: Babcock Street Intersection

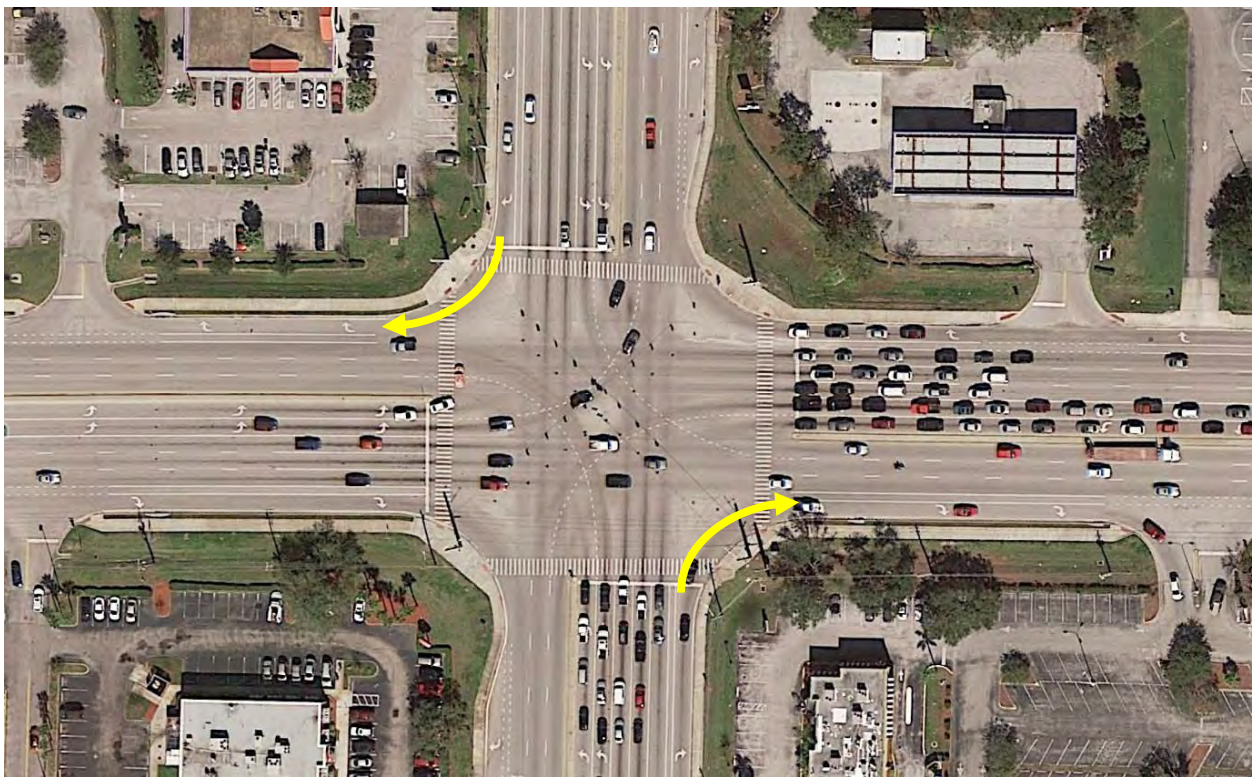
Issue #7: Pedestrian Crossing Distances



Figure 27



Figure 28



Source: Google Earth

Figure 29

Description of Issue:

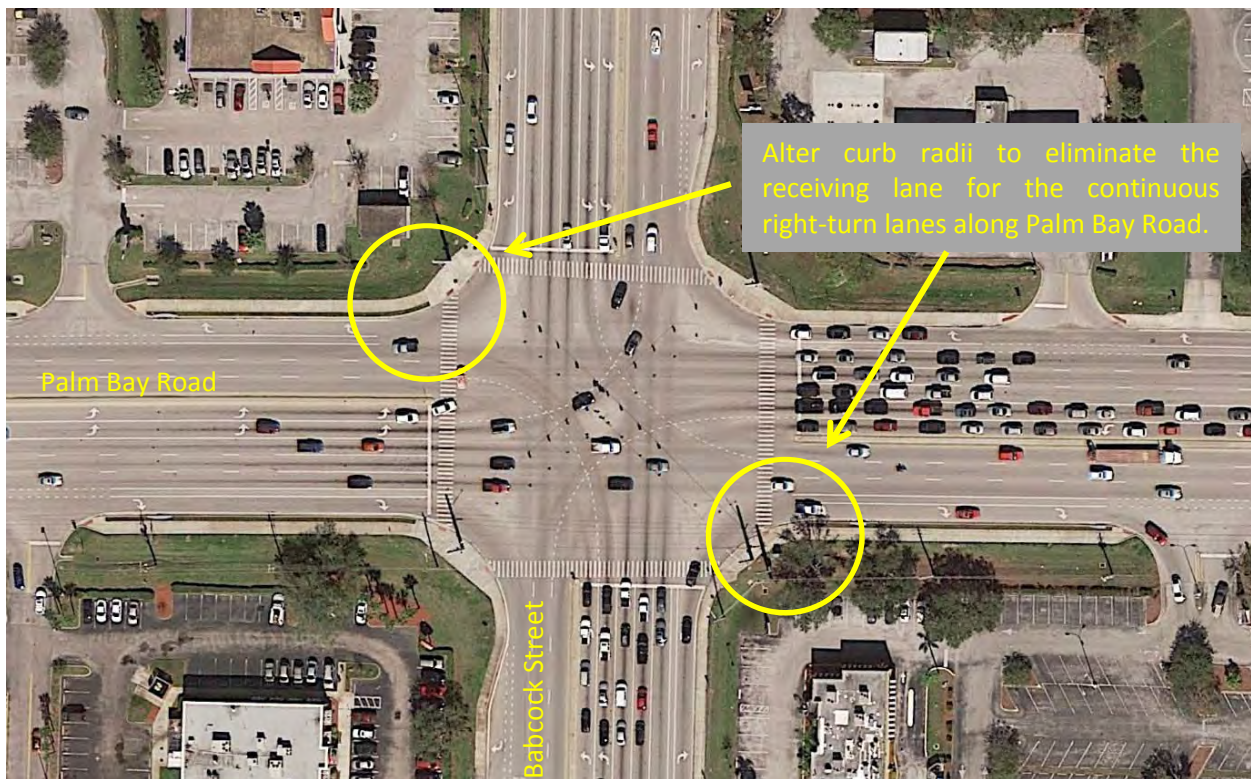
Due to the number of lanes along Babcock Street and Palm Bay Road on each intersection approach, the crossing distance is relatively long. The crossing distance for the west leg of the intersection is approximately 150 feet (illustrated in **Figure 27**) and the crossing distance for the east leg of the intersection is approximately 140 feet as shown in **Figure 28**.

When making a northbound or southbound right-turn movement, the curb line guides drivers into either a continuous eastbound (for the northbound movement) or westbound (for the southbound movement) right-turn lane, as depicted in **Figure 29**. This forces drivers to have to merge with thru traffic. The larger curve radius encourages higher speeds for the northbound and southbound right-turn movements, posing potential higher speed interactions with pedestrians and bicyclists. The larger curve radius also extends the distance a pedestrian must cross northbound and southbound.

Suggestions for Improvement:

Consider altering the curb radii on the northwest and southeast corners of the intersection to create a bulb out (locations illustrated in **Figure 30**). The existing eastbound and westbound right-turn lanes could be developed approximately 35-40 feet downstream of the intersection. This would look something similar to the north and south legs as those right-turn lanes are developed downstream of the intersection. This would eliminate the receiving lane for the continuous right-turn lanes along Palm Bay Road and would decrease the crossing distance for pedestrians crossing Palm Bay Road. If this were implemented, the pedestrian clearance intervals could also be reduced.

If the bulb outs are constructed, the continuous eastbound and westbound right-turn lanes downstream of the intersection would be shortened. Consideration should be given as to whether or not adequate deceleration and queue storage lengths will be provided for these lanes. There are multiple access points for the developments on the northwest and southeast corners of the intersection so if adequate right-turn lane lengths cannot be accommodated, consider eliminating the continuous eastbound and westbound right-turn lanes downstream of the intersection.



Source: Google Earth

Figure 30

Location: Babcock Street Intersection

Issue #8: Right-Turn On Red Yield Compliance



Figure 31



Figure 32

Description of Issue:

The study team observed relatively low right-turn on red (RTOR) vehicular yield compliance. There were multiple occasions where vehicles did not observe pedestrians and failed to yield the right-of-way to pedestrians within the crosswalk or on the corner of the intersection. Each approach includes a Turning Traffic Must Yield to Pedestrians sign as shown in **Figure 31**. The westbound approach has a dynamic message sign on the span wire (shown in **Figure 32**) that restricts the westbound RTOR movement when the pedestrian phase is activated to cross Babcock Street.

Suggestions for Improvement:

Consider installing dynamic message signs like what is present for westbound right-turning vehicles on the other three approaches. Consider installing supplemental Turning Vehicles Yield to Pedestrians (R10-15) signage on the span wire adjacent to the dynamic message sign. Should this signage be installed, consider enhanced enforcement.

Location: Windwood Drive to Knecht Drive

Issue #9: Mid-Block Crosswalk



Figure 33



Figure 34

Description of Issue:

There were four pedestrian and bicycle-related crashes (3 pedestrian and 1 bicycle) at unmarked locations between Windwood Drive and Knecht Drive during the analysis period. All three fatal pedestrian crashes occurred along this segment. During the safety review, the study team observed pedestrian crossing within this segment (**Figure 33**) and this location was identified as a high pedestrian traffic area by the police officers in the area.

There is a center landscaped median and back-to-back eastbound/westbound turn lanes serving the Palm Bay Shopping Center (southeast corner of the Babcock Street intersection) and a small commercial plaza (northwest corner of the Skipper's Way intersection). **Figure 34** illustrates the westbound turn lane into the Palm Bay Shopping Center. The westbound left-turn lane length is approximately 325 feet and the eastbound left-turn lane is approximately 275 feet.

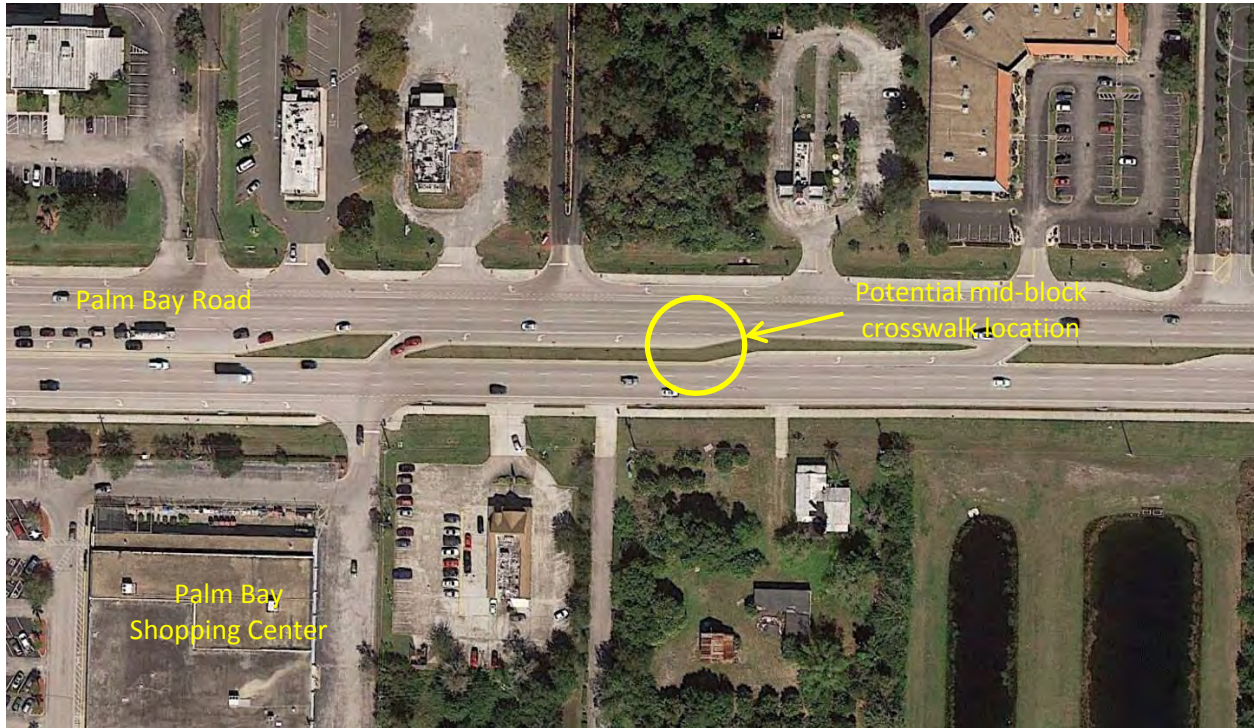
Suggestions for Improvement:

The team discussed consideration for a mid-block crossing to serve the existing crossing demand along this segment (location displayed in **Figure 35**). The westbound left-turn lane length into the Palm Bay Shopping Center could be reduced to allow for a mid-block crossing. According to the FDOT Standard Index 301, a left-turn lane needs a deceleration length of 185 feet. Assuming a distance of 100 feet (~4 vehicles) for queue storage, the combination of the deceleration length and queue storage length is 285 feet, leaving 40 feet for a mid-block crossing. In this case, the length of the existing eastbound left-turn lane at this location would not be impacted. The following safety enhancements should be considered as part of this consideration:

- Provide an active warning device, such as Rapid Rectangular Flashing Beacons (RRFB), at the crosswalk. RRFBs may also be used on the advance crosswalk signs per FHWA's interim approval memorandum.
- Provide a staggered z-crossing median refuge island for pedestrians in the existing landscaped center median. This would force the pedestrian to perform a two-stage crossing. The pedestrian would be required to separately activate the RRFB for crossing each direction of travel along

Palm Bay Road.

- Install lighting on the crosswalk's north and south sides.
- Stripe the crosswalk with Special Emphasis Crosswalk markings consistent with sheet 10 of the FDOT Design Index 17346.



Source: Google Earth

Figure 35

Location: Pinewood Drive Intersection

Issue #10: Pedestrian Push Button Signage



Figure 36



Figure 37

Description of Issue:

The pedestrian push button signage on northwest corner of the intersection does not indicate which street to cross as shown in **Figure 36**. The field review team observed pedestrians pushing both buttons on the pole to cross Palm Bay Road because the signage was unclear. The push button signage on the southwest corner's pole was missing. The lack of signage is illustrated in **Figure 37**.

Suggestions for Improvement:

Install R10-3i pedestrian plaques on all poles at the intersection indicating which street the pedestrian push button corresponds with.

Location: Pinewood Drive Intersection

Issue #11: Pedestrian Signal Heads



Figure 38

Description of Issue:

The pedestrian signal heads on the northwest corner of the intersection associated with northbound pedestrians crossing Palm Bay Road and westbound pedestrians crossing Pinewood Drive are not functioning properly. The walk indication is properly illuminated; however, the countdown numbers did not illuminate when crossing the two legs.

Suggestions for Improvement:

Dispatch a signal technician to review if all pedestrian countdown signals are working properly or replace the pedestrian signal heads as necessary.

Location: Pinewood Drive to Lipscomb Street

Issue #12: Drainage



Figure 39



Figure 40

Description of Issue:

Water pools up onto the curb ramp and detectable warning surface on the east side of the driveway to the 7-11 gas station (northeast corner of the Pinewood Drive intersection). This issue is displayed in **Figure 39** and **Figure 40**. This poses an issue to pedestrians, bicyclists, and vehicles as they cross the approach or make a westbound right-turn maneuver. There is a curb inlet approximately 90 feet west of the issue and approximately 65 feet east of the drainage issue.

Suggestions for Improvement:

Consider evaluating the slope, drainage inlet size, drainage inlet locations, etc. near the issue to determine if modifications to the roadway or drainage inlets are necessary to properly remove storm water from the roadway.

Location: Pinewood Drive to Lipscomb Street

Issue #13: School Entrance Signage



Figure 41



Figure 42

Description of Issue:

A School Entrance sign is located on the south side of Palm Bay Road just west of Bellaire Lane as illustrated in **Figure 41** and **Figure 42**. Bellaire Drive used to be the main entrance to the Palm Bay Academy Charter School, but the main entrance has been moved off of Tropicana Drive. Tropicana Drive is approximately 375 feet east of Bellaire Lane.

Suggestions for Improvement:

Consider relocating the School Entrance Sign east between Bellaire Lane and Tropicana Drive.

Location: Pinewood Drive to Lipscomb Street

Issue #14: Emergency Signal



Figure 43

Description of Issue:

The mast arms at the intersection of Bottlebrush Drive and Palm Bay Road previously served as an emergency signal for a fire station on the northeast corner of the intersection (eastbound mast arm shown in **Figure 43**). The fire station was relocated and the signal heads were removed from the mast arms. However, the Stop Here on Red (R10-6) signage and stop bar pavement markings are still present on the eastbound and westbound approaches. The presence of the inactive emergency signal mast arms, signage, and pavement markings may deliver an inconsistent expectation to pedestrians/bicyclists and motorists in the area. Pedestrians/bicyclists may see the mast arms and assume that that location is a safe place to cross.

Suggestions for Improvement:

Consider coordinating with Palm Bay to remove the mast arms, signage, and pavement markings associated with the previous emergency signal. The signage and pavement markings could be removed as a maintenance-type improvement and removal of the mast arms could be a near-term improvement.

Summary of Suggestions

This pedestrian/bicycle safety review considers operational and safety related issues for pedestrians and bicyclists on Palm Bay Road from Babcock Street to Lipscomb Street. This study was commissioned by the SCTPO to develop suggestions to improve the safety of pedestrians and bicyclists within the study limits. Each suggestion identified in this study is classified into one of three categories:

- Maintenance – issues identified for maintenance may be addressed by public agency staff on a short timeframe and at a relatively low cost.
- Near-Term Improvement (within 3 to 5 years) – activities that may be incorporated into an upcoming construction project in the area, including 3R milling and resurfacing projects.
- Long-Term Improvement (5+ years) – activities that may be incorporated into upcoming construction projects and may need to be programmed for funding as separate projects.

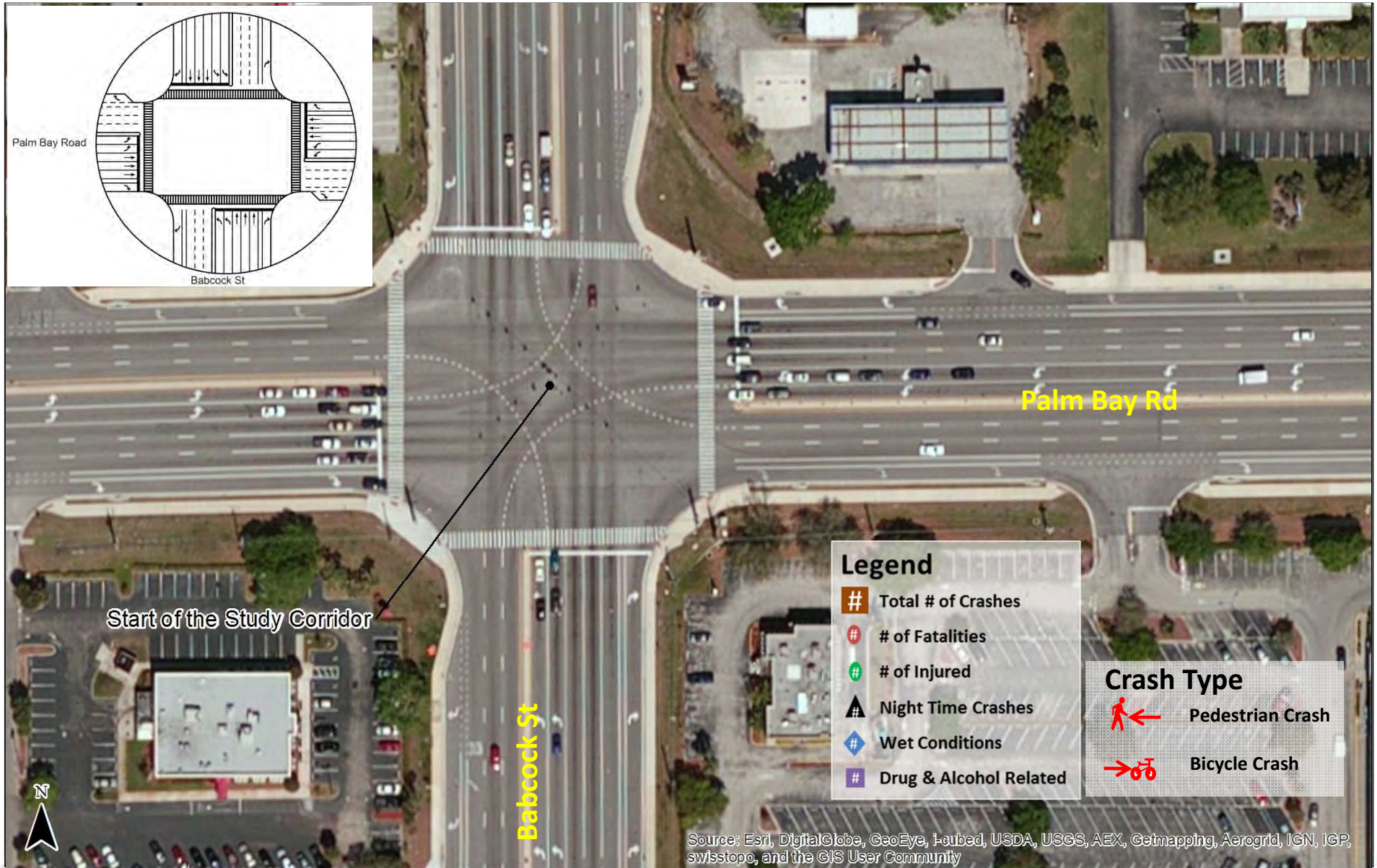
The following tables summarize the suggestions of this study by priority (maintenance, near-term, or long-term).

Location	Issue Number	Issue	Suggestion
MAINTENANCE			
Corridor Wide	2	Crosswalk Markings	Consider marking all minor street approaches at all of the unsignalized intersections along the corridor study limits. Standard crosswalk markings as shown on sheet 9 of the FDOT Design Standard Index 17346 should be used for the unsignalized crossings. Special emphasis markings as shown on sheet 9 of Design Index 17346 should be used for the three signalized intersections within the study limits.
Corridor Wide	3	Bicycle Lanes	Appropriate bicycle lane signage and pavement markings should be installed using the existing five-foot paved shoulder according to the standards in the FDOT Standard Index 17347.
Corridor Wide	4	Median Nose Visibility	Consider restriping the median noses with a yellow retroreflective paint to increase visibility in the daytime and nighttime conditions. Installation of raised retroreflective pavement markers could also be considered as a center median nose treatment.
Babcock Street Intersection	6	Pedestrian Push Button Signage	Install R10-3i pedestrian plaques for the Palm Bay Road crossing movement on the applicable poles at the intersection to provide consistent pedestrian signage at the intersection.
Babcock Street Intersection	8	Right-Turn on Red Yield Compliance	Consider installing dynamic message signs like what is present for westbound right-turning vehicles on the other three approaches. Consider installing supplemental Turning Vehicles Yield to Pedestrians (R10-15) signage on the span wire adjacent to the dynamic message sign. Should this signage be installed, consider enhanced enforcement.
Pinewood Drive Intersection	10	Pedestrian Push Button Signage	Install R10-3i pedestrian plaques on all poles at the intersection indicating which street the pedestrian push button corresponds with.
Pinewood Drive Intersection	11	Pedestrian Signal Heads	Dispatch a signal technician to review if all pedestrian countdown signals are working properly or replace the pedestrian signal heads as necessary.
Pinewood Drive to Lipscomb Street	12	Drainage	Consider evaluating the slope, drainage inlet size, drainage inlet locations, etc. near the issue to determine if modifications to the roadway or drainage inlets are necessary to properly remove storm water from the roadway.
Pinewood Drive to Lipscomb Street	13	School Entrance Signage	Consider relocating the School Entrance Sign east between Bellaire Lane and Tropicana Drive.
Pinewood Drive to Lipscomb Street	14	Emergency Signal	Consider removing the signage and pavement markings associated with the previous emergency signal.

Location	Issue Number	Issue	Suggestion
NEAR-TERM PRIORITY			
Corridor Wide	1	Lighting	Consider upgrading the lighting at the intersection of Palm Bay Road and Babcock Street to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT PPM. This may require the existing lighting to be replaced.
Corridor Wide	1	Lighting	Incremental implementation of lighting should be considered as funding may dictate potential implementation. Priority should be given to implementing intersection lighting at the remainder of the signalized intersections to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT PPM.
Corridor Wide	5	Sidewalks	Consider installing sidewalks along minor streets with pedestrian generators/attractors to enhance the pedestrian connectivity along the corridor. The following minor streets could be considered with a higher priority as they do not have sidewalks on either side of the roadway: <ul style="list-style-type: none"> • Windwood Drive • Monterey Drive • Knecht Road • Lakewood Drive • Bottlebrush Drive • Franklin Drive • Woodlake Drive
Babcock Street Intersection	7	Pedestrian Crossing Distances	Consider altering the curb radii on the northwest and southeast corners of the intersection to create a bulb out (locations illustrated in Figure 29). The existing right-turn lanes could be developed approximately 35-40 feet downstream of the intersection. This would look something similar to the north and south legs as those right-turn lanes are developed downstream of the intersection.
Windwood Drive to Knecht Drive	9	Mid-Block Crosswalk	The team discussed consideration for a mid-block crossing to serve the existing crossing demand along this segment. The following safety enhancements should be considered as part of this consideration: <ul style="list-style-type: none"> • Provide an active warning device, such as Rapid Rectangular Flashing Beacons (RRFB), at the crosswalk. RRFBs may also be used on the advance crosswalk signs per FHWA's interim approval memorandum. • Provide a staggered z-crossing median refuge island for pedestrians in the existing landscaped center median. This would force the pedestrian to perform a two-stage crossing. The pedestrian would be required to separately activate the RRFB for crossing each direction of travel along Palm Bay Road. • Install lighting on the crosswalk's north and south sides. • Stripe the crosswalk with Special Emphasis Crosswalk markings consistent with sheet 10 of the FDOT Design Index 17346.
Pinewood Drive to Lipscomb Street	14	Emergency Signal	Coordinate with Brevard County to remove the mast arms associated with the previous emergency signal.

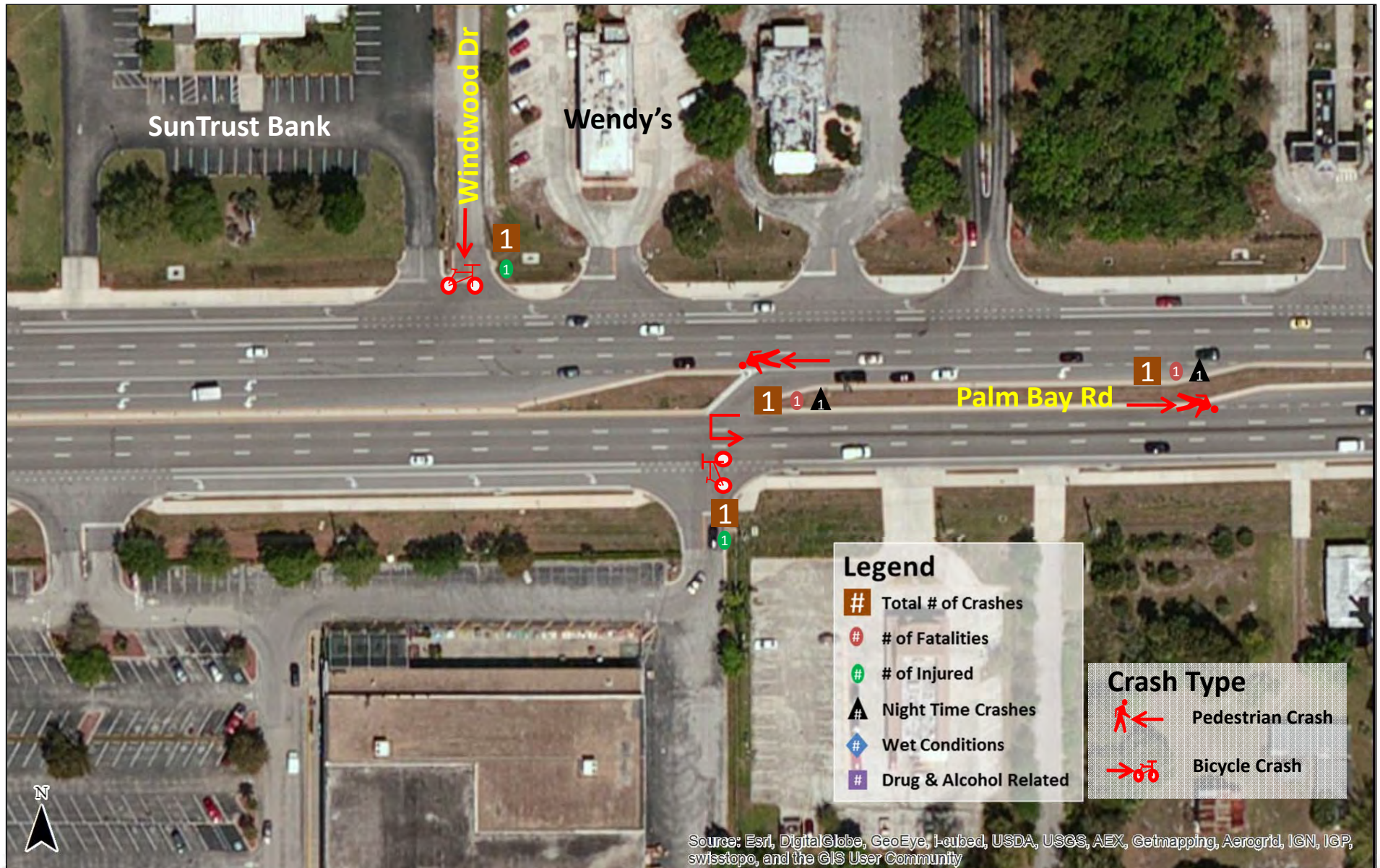
Location	Issue Number	Issue	Suggestion
LONG-TERM PRIORITY			
Corridor Wide	1	Lighting	Consider lighting the segment between Babcock Street and Knecht Road as this segment includes many of the corridor's nighttime crashes. As funding becomes available, consider implementing roadway lighting along the entire corridor.
Corridor Wide	5	Sidewalks	<p>There are some sidewalks present along one side of a few side streets. Consideration could be given to filling in the sidewalks on both sides of the street to tie into the sidewalk network along Palm Bay Road. These locations are briefly summarized below with the location of existing sidewalk and could be considered with less priority than streets listed previously:</p> <ul style="list-style-type: none"> • Skippers Way <ul style="list-style-type: none"> o Continuous sidewalk on the west side of the roadway to the north of Palm Bay Road. • Pinewood Drive <ul style="list-style-type: none"> o Continuous sidewalk on the east side of the roadway to the north of Palm Bay Road. • Tropicana Road <ul style="list-style-type: none"> o 450' of sidewalk on the west side of the roadway to the south of Palm Bay Road. • Lipscomb Street <ul style="list-style-type: none"> o Continuous sidewalk on the east side of the roadway to the north of Palm Bay Road. o Continuous sidewalk on both sides of the roadway to the south of Palm Bay Road.

Appendix A – Collision Diagrams



**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Babcock Street and Palm Bay Road Intersection**

Figure
1



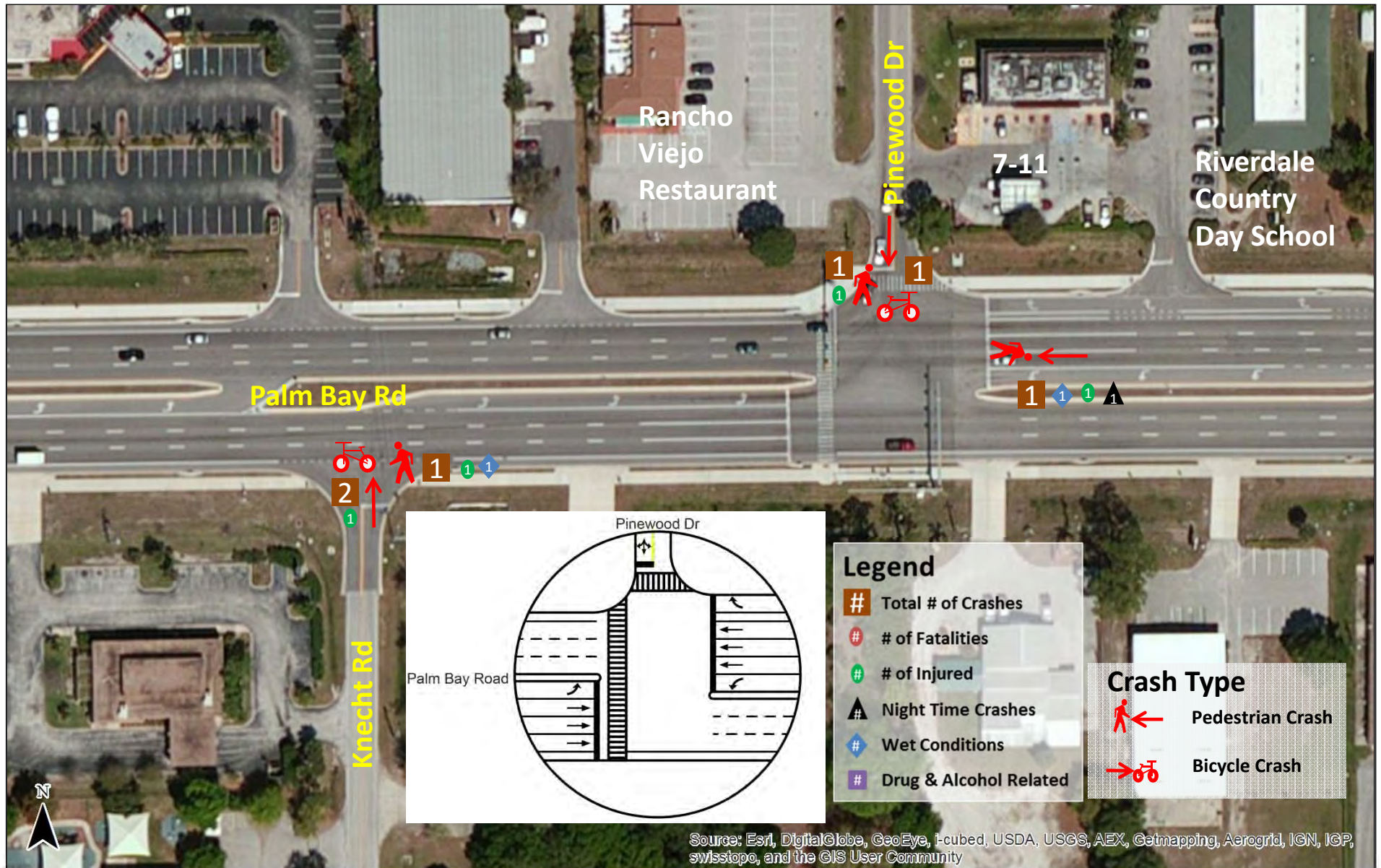
**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Windwood Drive and Palm Bay Road Intersection**

Figure
2



**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Skippers Way and Palm Bay Road Intersection**

Figure
3



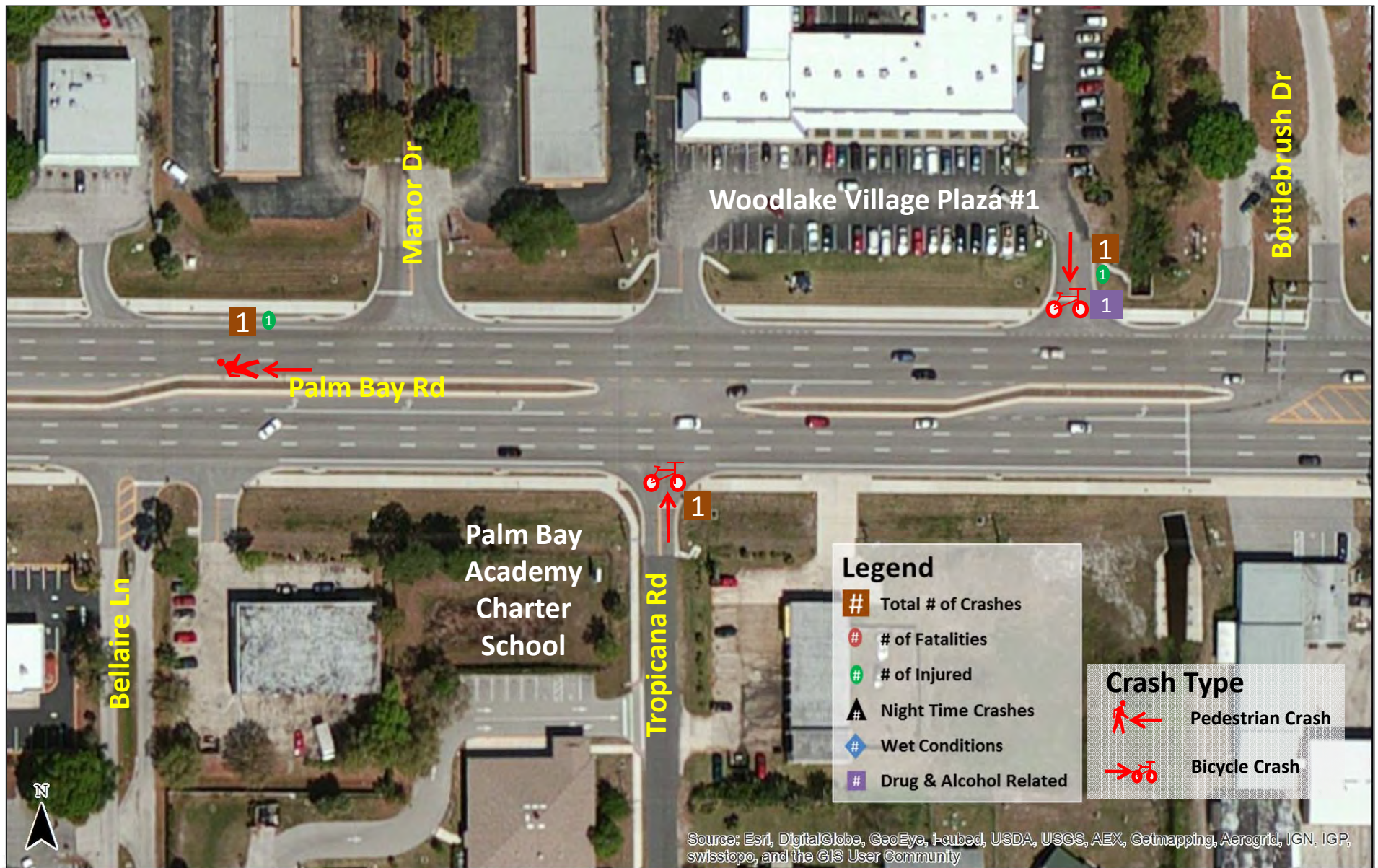
**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Knecht Road to Pinewood Drive**

Figure
4



**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Lakewood Drive to Bellaire Lane**

Figure
5



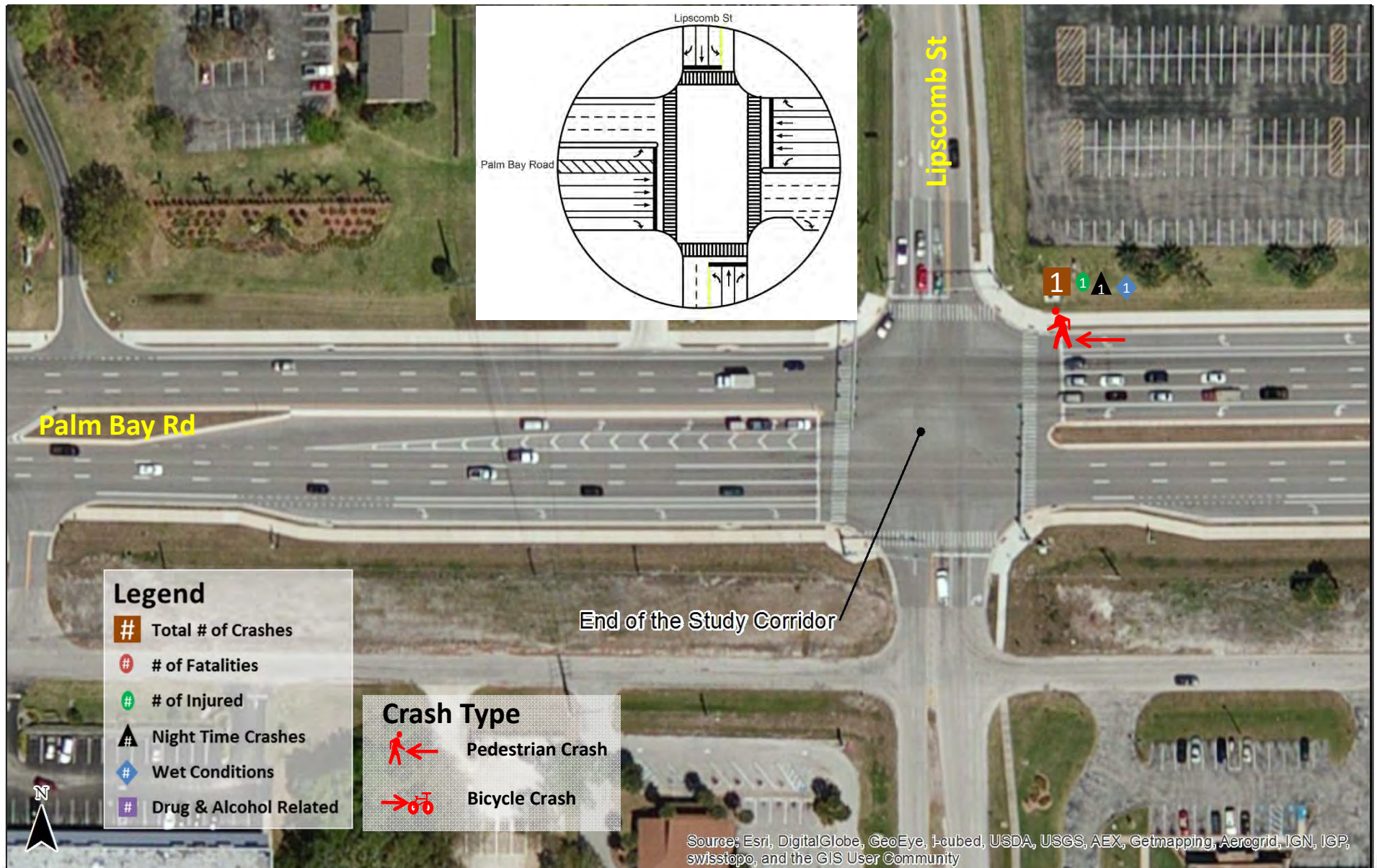
**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Bellaire Lane to Bottlebrush Drive**

Figure
6



**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Bottlebrush Drive to Woodlake Drive**

Figure
7



**Palm Bay Road Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Lipscomb Street and Palm Bay Road Intersection**

Figure
8