

PEDESTRIAN / BICYCLE SAFETY REVIEW

US 1 / University Boulevard to New Haven Avenue



Prepared for:
**Space Coast Transportation
Planning Organization**
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February 2016

Pedestrian/Bicycle Safety Action Plan

Pedestrian/Bicycle Safety Review Report for US 1 (Melbourne) from University Boulevard to New Haven Avenue

Section Number: 70010000

Mile Post: 16.073 – 17.198

Brevard County

Prepared for:



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Project Title: US 1 (Melbourne) Pedestrian/Bicycle Safety Review

Field Review Dates: August 25th and 26th, 2015 (daytime/nighttime reviews and follow up meeting)

Participants:

Ryan Cunningham – Kittelson & Associates, Inc. – Team Leader
Laura Carter – Space Coast Transportation Planning Organization
Zach Zalneraitis (August 25th only) – Florida Department of Transportation, District 5
Tami Gillen (August 25th only) – City of Melbourne
Tom Baker (August 26th only) – City of Melbourne
Todd Corwin (August 25th only) – City of Melbourne
Anne Denn (August 25th only) – City of Melbourne
Conroy Jacobs – Brevard County
Joe Chagnon – Space Coast Area Transit
Lt. Cheryl Trainer (August 25th only) – Melbourne Police Department
Travis Hills – Kittelson & Associates, Inc.

Project Characteristics:

Field Review Type: Pedestrian, Bicycle, Existing Road
Adjacent Land Use: Urban; Commercial, Industrial, Residential
Posted Speed Limit: 40 miles per hour (MPH)
Opposite Flow Separation: Two Way Left Turn Lane (TWLTL)
Service Function: Urban Principal Arterial
Terrain: Flat
Climatic Conditions: Sunny, Hot

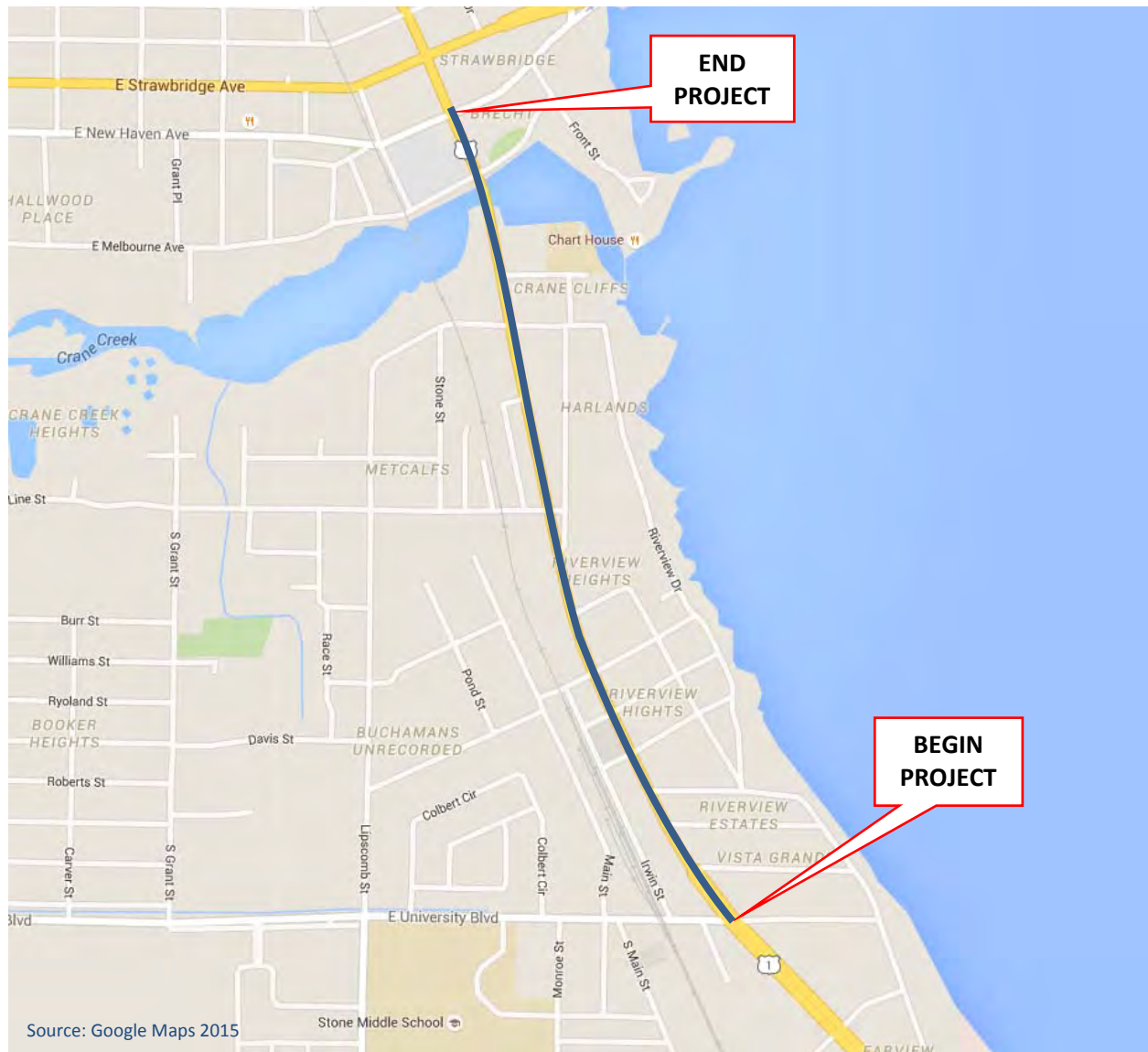


Figure 1 – US 1 Study Corridor

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 select locations having a pedestrian and/or bicycle crash history to address pedestrian/bicycle safety in Brevard County. US 1 from University Boulevard to New Haven Avenue (**Figure 1**), a 1.15 mile corridor in the City of Melbourne, was identified as one of these locations. In order to suggest improvements along this 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 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 Melbourne, SCAT, local law enforcement). Some improvements presented in this report may be implemented as maintenance-type projects 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 Tuesday August 25th, 2015. The team met in the morning at the City of Melbourne Engineering Department to discuss the study corridor and crash history. After lunch, the study team drove the entire corridor, south to north then north to south, to gain an understanding of the facility characteristics from a driver's perspective. The team then divided up to walk the length of sidewalk along both sides of the roadway. The team reassembled in the evening, after sunset, to make observations in nighttime conditions. A follow-up debrief meeting was held at the City of Melbourne Engineering Department the following morning (August 26th) to discuss the corridor's issues and potential improvements identified by the team. Study corridor characteristics are reviewed below:

- University Boulevard to New Haven Avenue – 1.13 miles
- The posted speed along the study corridor is 40 MPH.
- Seven lane section, three northbound and three southbound travel lanes with a center two-way left-turn lane.
- No bicycle lanes are present along the length of the corridor.
- Overhead street lighting is present along the east and west sides throughout the entire length of the corridor.
- Type F curb and gutter is present along the east and west sides of US 1.
- Four (4) signalized intersections at University Boulevard, Line Street, Prospect Avenue, and New Haven Avenue:
 - University Boulevard:
 - Dual northbound left-turn lanes operating under protected phasing;
 - One southbound left-turn lane operating under protected phasing;
 - One eastbound left-turn lane and one shared left/through lane operating under split phasing;
 - Dual eastbound right-turn lanes;

- One westbound shared left/thru/right turn lane operating under split phasing;
- Old version of special emphasis without standard markings on the west, north, and east legs;
- All crosswalks include pedestrian actuated signals with push buttons and countdown timers;
- Continuous sidewalks in all directions, except along the south side of University Boulevard east of US 1; and
- Five (5) foot paved area between outside travel lane and curb and gutter/sidewalk present from south of the intersection to Avenida del Rio.
- Line Street:
 - One northbound left-turn lane operating under protected/permitted phasing with flashing yellow signal;
 - One southbound left-turn lane operating under protected/permitted phasing with flashing yellow signal;
 - One westbound shared left/thru/right turn lane operating under permitted phasing;
 - One eastbound shared left/thru/right turn lane operating under permitted phasing;
 - Special emphasis crosswalk markings on all four legs;
 - All crosswalks include pedestrian actuated signals with push buttons and countdown timers; and
 - Continuous sidewalks on the east and west sides of US 1, and partial sidewalks on the north and south sides of Line Street.
- Prospect Avenue:
 - One northbound left-turn lane operating under permitted phasing (no LT signal);
 - One southbound left-turn lane operating under permitted phasing (no LT signal);
 - One westbound shared left/thru/right turn lane operating under permitted phasing;
 - One eastbound shared left/thru/right turn lane operating under permitted phasing;
 - Special emphasis crosswalk markings on all four legs of the intersection;
 - All crosswalks include pedestrian actuated signals with push buttons and countdown timers; and
 - Continuous sidewalks in all directions.
- New Haven Avenue:
 - One northbound left-turn lane operating under protected-permitted phasing;
 - One southbound left-turn lane operating under protected-permitted phasing;
 - One westbound left-turn lane operating under split phasing;
 - One eastbound left-turn lane operating under split phasing;
 - Special emphasis crosswalk markings on all four intersection legs;
 - All crosswalks include pedestrian actuated signals with push buttons and countdown timers; and
 - Continuous sidewalks in all directions.

Crash History (2009 – 2014)

Six (6) years of available pedestrian and bicycle related crash data, 2009 to 2014, were utilized for the US 1 crash analysis. Crash data was obtained from two sources: 1. The FDOT Crash Analysis Reporting System (CARS) database from 2009 to 2013 and 2. The Signal Four Analytics database maintained by University of Florida from 2009 to 2014. The 2014 CARS data was not yet FDOT certified at the time this study was initiated, thus the reason for six years of crash data instead of the traditional five. The 2014 FDOT CARS data was approved in Summer 2015. The additional crashes from the Signal Four Analytics database supplemented the CARS data along US 1. Crash diagrams were created along the corridor to summarize the pedestrian/bicycle-related crash history. The crash diagrams are included in the **Appendix A**.

Twelve (12) pedestrian or bicycle-related crashes were reported over the six-year study period, 42 percent of which involved pedestrians (5 crashes). Of the twelve (12) pedestrian and bicycle crashes reported during the study period, there were three (3) fatal pedestrian crashes (25 percent) and nine (9) injury crashes (75 percent). The three (3) fatal pedestrian crashes (all during dark conditions) are summarized below (summarized from south to north):

- Crash Number 901336550
 - On December 12, 2009 at 11:22 PM a crash involving a pedestrian and a vehicle occurred at the intersection of US 1 and Prospect Avenue under dark lighting and wet road conditions. The pedestrian was attempting to cross US 1 from west to east along the marked crossing on the south leg of the intersection. The vehicle was traveling south on US 1 in the inside lane at approximately 40 miles per hour and collided with the pedestrian. The pedestrian expired due to impact from the crash. Tests indicated that the vehicle driver had blood alcohol content (BAC) of 0.116. Charges for DUI and DUI manslaughter were filed with the State Attorney’s office against the vehicle driver.
- Crash Number 842893490
 - On December 26, 2013 at 9:10 PM a crash involving a pedestrian and a vehicle occurred 300 feet north of the intersection of US 1 and East River Drive under dark lighting conditions. The pedestrian was attempting to cross US 1 from west to east at an unmarked mid-block crossing. The vehicle was traveling south on US 1 in the middle lane at approximately 45 miles per hour and collided with the pedestrian. The pedestrian was transported to the hospital and pronounced dead due to blunt force trauma to the head. The deceased victim’s (pedestrian) toxicology reports indicated a BAC of 0.182 and the presence of cocaine metabolite in his system. Investigative reports conclude that the pedestrian failed to yield to the right of way of the vehicle.
- Crash Number 901311630
 - On November 2, 2010 at 7:32 PM a crash involving a pedestrian and a vehicle occurred at the south leg of the intersection of US 1 and New Haven Avenue under dark lighting conditions. The pedestrian was attempting to cross US 1 from west to east at a marked pedestrian crossing. The vehicle was traveling south on US 1 in the outside lane at approximately 40 miles per hour and collided with the pedestrian. The pedestrian expired due to impact from the crash. The pedestrian was found at fault for the crash since the pedestrian crossed the roadway when the pedestrian signal was not activated.

The reported crashes are displayed by different measures of time (such as year, month, day, and hour) in **Figure 2** through **Figure 5** below. Overall, the number of pedestrian and bicycle crashes declined from

a high of four (4) crashes in 2009 to two (2) crashes per year in 2010, 2012, 2013, and 2014. There were no reported crashes in 2011. Over this same five-year time period, there has been a slight decline in the Annual Average Daily Traffic (AADT) along the corridor. Eight (8) crashes occurred during the months of September through December. All three (3) fatal crashes occurred in the evening between 7:00 PM - 12:00 AM.

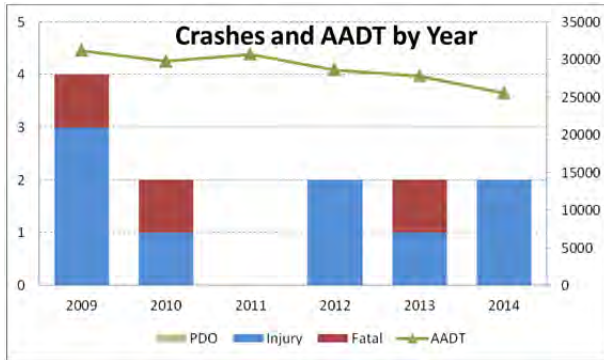


Figure 2

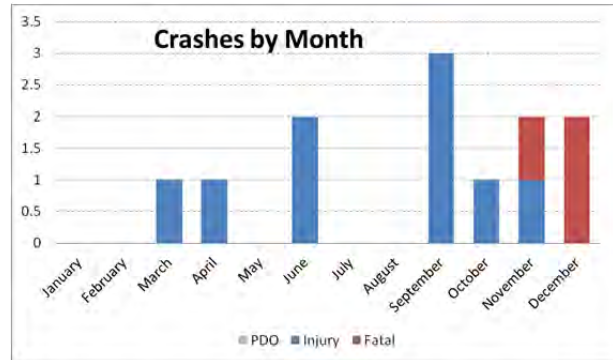


Figure 3

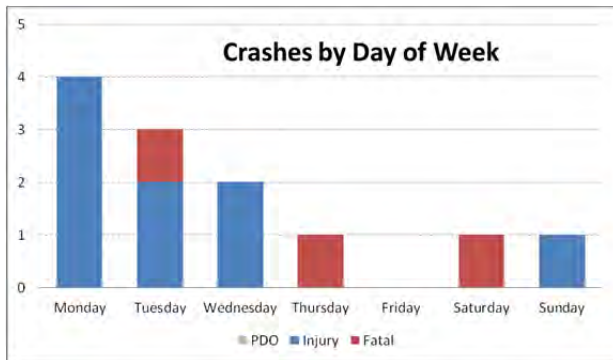


Figure 4

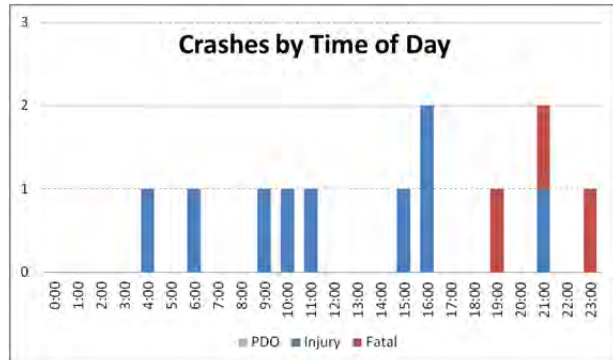


Figure 5

As displayed in **Figure 6**, six (6) crashes occurred under normal daylight conditions and six crashes occurred under dark lighting conditions. All three fatal crashes occurred under dark lighting conditions. **Figure 7** displays the eight (8) crashes occurring under dry conditions, three (3) under wet conditions, and one (1) crash report did not contain road condition information.

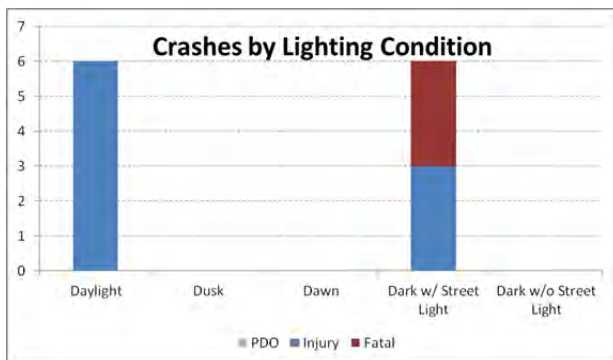


Figure 6

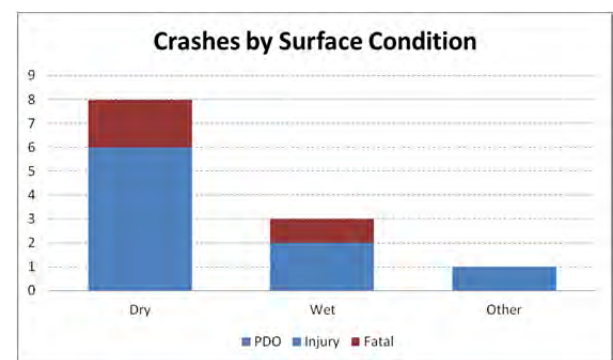


Figure 7

As displayed in **Figure 8**, one (1) crash involved alcohol and one (1) crash involved alcohol and drugs. Both crashes that involved alcohol/drugs resulted in a pedestrian fatality.

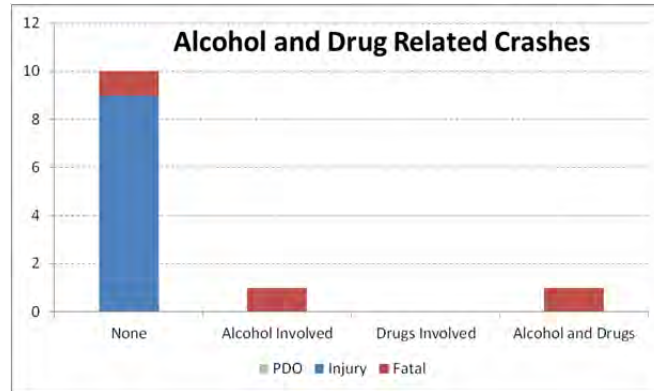


Figure 8

A few other crash statistics worthy to note:

- In four (4) of the seven (7) bicycle crashes, the bicycle had the right-of-way;
- The vehicle had the right-of-way in all five (5) pedestrian crashes;
- Six (6) of twelve (12) crashes occurred at signalized intersections, with five (5) of those occurring within a marked crosswalk; and
- Six (6) crashes occurred at mid-block locations.

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

- Signalized Intersections – Six (6) crashes occurred at signalized intersections.
 - Prospect Avenue
 - One (1) pedestrian crashes
 - Pedestrian was walking in crosswalk and struck by vehicle. Incident resulted in a fatality.
 - Two (2) bicycle crashes
 - Bicyclist was traveling north in outside lane when a northbound vehicle turned right from Prospect Avenue into the outside lane and struck the bicyclist. Incident resulted in injury.
 - Vehicle was traveling west into the intersection and struck a southbound bicyclist utilizing the crosswalk on the east leg. The bicyclist entered the crosswalk against the pedestrian signal (signal displayed the “DO NOT WALK” hand). Incident resulted in injury.
 - New Haven Avenue
 - One (1) pedestrian crash
 - Pedestrian was walking east in the south leg crosswalk against the pedestrian signal. Incident resulted in a fatality.
 - Two (2) bicyclist crashes

- Bicyclist was traveling east in the south leg crosswalk and was struck by a westbound to southbound left turning vehicle. Incident result in injury.
- Bicyclist was traveling east in the south leg crosswalk and was struck by a northbound traveling vehicle who failed to yield to traffic signal. Incident result in injury.
- Segments – The remaining six (6) crashes occurred at mid-block locations. Mid-block locations with more than one (1) crash are further detailed below.
 - Mid-block just north of E River Drive
 - One (1) bicycle crash
 - Bicyclist traveling east made a mid-block crossing and collided with a vehicle attempting to make an eastbound to northbound left turn onto US 1 from the Crane Creek Medical Clinic. Incident resulted in injury.
 - One (1) pedestrian crash
 - Pedestrian attempted a mid-block crossing and was struck by southbound vehicle. Incident resulted in a fatality (previously described).

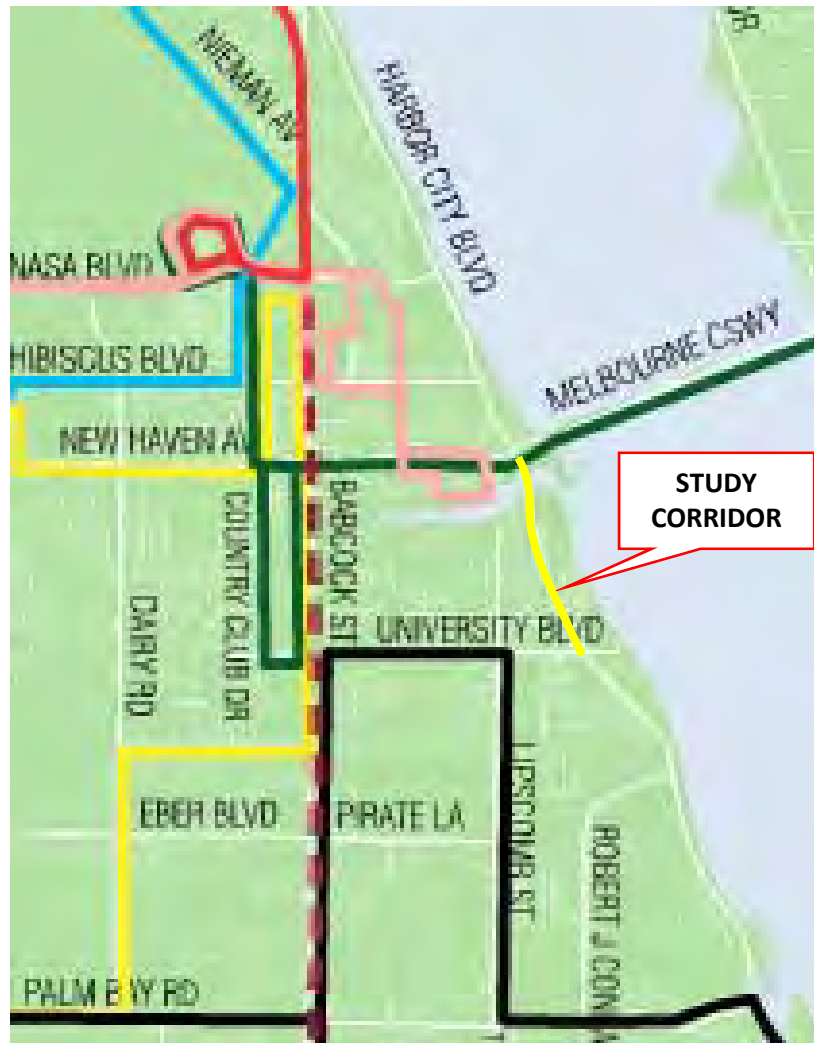
The study team also reviewed the crash history at the intersection of US 1 and US 192/Strawbridge Avenue based upon a request by the City of Melbourne. Even though this intersection was not included in the original study and was not reviewed in the field, the close proximity to the northern study intersection of US 1 and New Haven Avenue lends itself to potential systemic safety improvements identified as part of this study. Below are the crash statistics from the US 1/US 192/Strawbridge Avenue intersection:

- Three total crashes, two bicycle and one pedestrian
- The two bicycle crashes occurred within the crosswalk, with the vehicle having the right-of-way
- The pedestrian crash occurred just south of the intersection with a homeless man crossing mid-block
 - The pedestrian had suspected alcohol use
- All three crashes resulted in either the bicyclist or pedestrian being injured
- All three crashes occurred at night

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 US 1 within the limits of this study. Route 26 serves US 192 and route 27 serves University Boulevard near the study limits; however, there are no routes along US 1 within the study limits, as illustrated in **Figure 9**. There were no transit related improvements as part of this study.



Source: Space Coast Area Transit

Figure 9

Location: Corridor-Wide

Issue #1: Seven Lane Cross Section

Figure 10



Figure 11

Description of Issue:

US 1 within the study limits consists of a seven lane cross section, with three 11' travel lanes northbound and three 11' travel lanes southbound separated by an 11' center two-way left-turn lane (TWLTL) as displayed in **Figure 10**. These types of facilities present numerous conflict points due to the TWLTL and the seven lane cross section requires mid-block crossing pedestrians/bicyclists to cross 77' of pavement at once or cross one set of travel lanes and wait in the TWLTL for a gap to cross the other set of travel lanes. If the pedestrian/bicyclist is waiting in the TWLTL, there are potential conflicts with vehicles, as observed in **Figure 11**. Four of the 12 crashes along the corridor involved a pedestrian/bicycle crossing mid-block between signalized intersections.

Suggestions for Improvement:

Consider a study to review potential locations for spot medians. These spot medians are typically 40' in length and should be located in places where they do not restrict turning movements at minor streets or at major driveways. Consider reviewing how driveways are utilized along the corridor, especially at abandoned property locations or locations where properties have multiple driveways, as this may increase the number of potential locations for spot medians.

Location: Corridor-Wide

Issue #2: Sight Distance at Driveways/Intersections



Figure 12



Figure 13

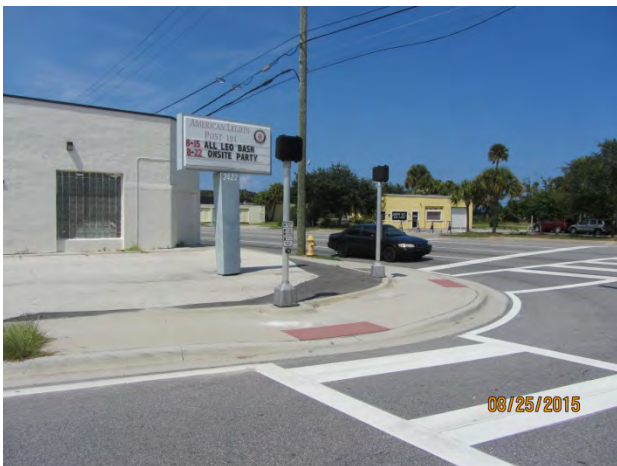


Figure 14



Figure 15

Description of Issue:

Along the US 1 corridor, development patterns allowed for buildings to be constructed up to the corner of intersections (both signalized and unsignalized) and driveways, as displayed in **Figure 12** through **Figure 15**. Two of the 12 crashes occurred where there was limited sight distance at a driveway/intersection due to a building on the corner.

Suggestions for Improvement:

The City of Melbourne has long term plans to redevelop along this section of US 1. As properties redevelop, enforce the City of Melbourne building setback standards so as to increase the sight distance at these driveways and intersections.

Location: Corridor-Wide

Issue #3: Sidewalk Walkability



Figure 16



Figure 17

Description of Issue:

Along the corridor, multiple sidewalk locations were observed as having walkability issues due to sand partially (yellow area in **Figure 16**) or fully (**Figure 17**) covering the sidewalk. At these locations, the landscape buffer strip was raised approximately $\frac{1}{2}$ " to 1" higher than the sidewalk which does not allow for water to properly drain into the grass, thus creating the ponding/sand on the sidewalk.

Suggestions for Improvement:

Consider regular sidewalk maintenance (sweeping debris/sand) along the corridor. The maintenance may be scheduled (once every one or two weeks, etc.) or may be performed after a heavy rain event.

Consider reducing the height of landscape strip to be level or just below the sidewalk and replace with new sod. Also consider raising the sidewalk to be level with the landscape strip. The lowered height of the buffer strip or the raised sidewalk option would allow for water to drain off the sidewalk into the landscape strip.

In lieu of regular sidewalk maintenance by a local jurisdiction, local businesses along the corridor could apply for the FDOT Adopt-A-Highway program. According to the website (found at <http://www.dot.state.fl.us/statemaintenanceoffice/aah.shtm>), volunteers would "enter into a two-year agreement with DOT, during which they agree to conduct litter removal at regularly scheduled intervals. Many miles of highway are adopted statewide by various organizations, allowing civic-minded people to make a difference in their communities. This eases the load of DOT work crews, enabling them to devote more time to other road maintenance and special highway projects."

Location: Corridor-Wide

Issue #4: Driveways



Figure 18



Figure 19



Figure 20

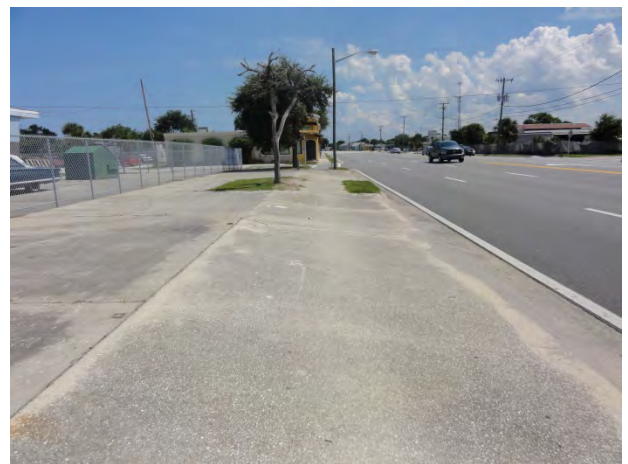


Figure 21

Description of Issue:

At some driveways throughout the corridor, the sidewalk merges into the existing driveway as displayed in **Figure 18** through **Figure 21**. With the sidewalk not being stand alone, it is subject to the cross slope of the driveway, which in most cases was between seven and 12 percent (based on field review measurements by the study team). The driveways measured exceeded the maximum two (2) percent cross slope per section R302.6 in the ADA PROWAG guidance.

Along the study corridor, properties were observed as having multiple driveways onto US 1. Some of these properties were undeveloped parcels (**Figure 20**) while other properties currently do not have access to their driveways (**Figure 19** and **Figure 21**). A number of driveways were also noted to be longer than the 36' maximum driveway width as specified per FDOT Standard Index 515. While there was not a high amount of pedestrian/bicycle crashes at driveways (2 out of the 12 crashes), driveways are conflict points between pedestrians/bicyclists utilizing the sidewalk and vehicles exiting the property or turning from US 1. The higher the number of driveways along a corridor, the higher the potential for crashes between a pedestrian/bicycle utilizing the sidewalk and a vehicle exiting/entering a property.

Suggestions for Improvement:

Consider driveway reconstruction during the roadway's next 3R project to provide a level path for the sidewalk and meet ADA guidance. As part of this construction, consider reducing the driveway widths down to the 36' maximum per FDOT Standard Index 515. Also as part of this future 3R project, consider eliminating unused driveways, like those shown in **Figure 19** and **Figure 21**. US 1 was recently resurfaced from Roosevelt Avenue to north of New Haven Avenue, thus this may not happen for another 5 to 10 years. As properties redevelop along the corridor, consider rebuilding the driveways. It appears these improvements can be done without negatively impacting parking or site circulation on the subject parcels.

To address the issue of multiple driveways for the same property, consider driveway consolidation during potential redevelopments where feasible. For currently undeveloped properties, consolidating these driveways during development will reduce the amount of conflict areas between pedestrians/bicyclists and vehicles. Some local government agencies around Central Florida have incorporated land use policies encouraging pedestrian cross access between adjacent commercial and office properties. Cross-access between adjacent parcels within a block should be a focus on the US 1 corridor as properties redevelop which would help eliminate unused or underutilized driveways.

Location: Corridor-Wide

Issue #5: Unsignalized Minor Street Pedestrian Facilities



Figure 22



Figure 23

Description of Issue:

As part of the resurfacing project along US 1 from Roosevelt Avenue to north of New Haven Avenue, standard marked crosswalks and detectable warning surfaces were installed at all unsignalized minor street approaches (see **Figure 22** at Powell Avenue). Outside the limits of the resurfacing project (University Boulevard to Roosevelt Avenue), the unsignalized minor street approaches did not include marked crosswalks or detectable warning surfaces (see **Figure 23** at Hoag Avenue).

Suggestions for Improvement:

As a maintenance-type suggestion, consider emphasizing the pedestrian realm across unsignalized minor street approaches by adding standard crosswalk markings and detectable warning surfaces. This would provide corridor consistency while also giving the pedestrians a dedicated walking area when crossing these minor street approaches. Emphasizing the crosswalk would indicate to drivers that pedestrians have the right of way when crossing the minor street approach.

Location: Corridor-Wide**Issue #6: Off Peak Signal Cycle Lengths****Description of Issue:**

During the off peak periods, it was noted that green time along US 1 was given a higher priority than a pedestrian call. If a pedestrian pushed the button wanting to cross US 1, the light would remain green until the northbound/southbound movement reached its maximum timing. This would mean the pedestrian was waiting upwards of 2 minutes or more until they were allowed to cross the roadway. Due to this condition, pedestrians could get impatient and cross when there is a gap in traffic instead of waiting for the pedestrian signal. Field observations noted there were vehicular gaps when pedestrians could cross during the northbound/southbound green time.

Suggestions for Improvement:

Consider signal timing adjustments along the corridor to better serve pedestrians attempting to cross US 1. One way to accomplish this is to treat the pedestrian call as a side street call and force the intersection to gap out when the major movement has a gap in traffic. When a pedestrian is present and requests to cross the roadway, the northbound/southbound movement would be cut short during off-peak periods, allowing better response time for pedestrians attempting to cross US 1. For this adjustment to work, the combined Walk/Flashing Don't Walk for the north/south crosswalks must time out before the minimum green for the north/south movement.

If the major movement volumes are high, the pedestrians would have to wait until the maximum green for the major movement was reached and the minor movement was allowed to proceed. The signal timing would remain the same as existing during peak periods.

Location: Corridor-Wide

Issue #7: Lighting

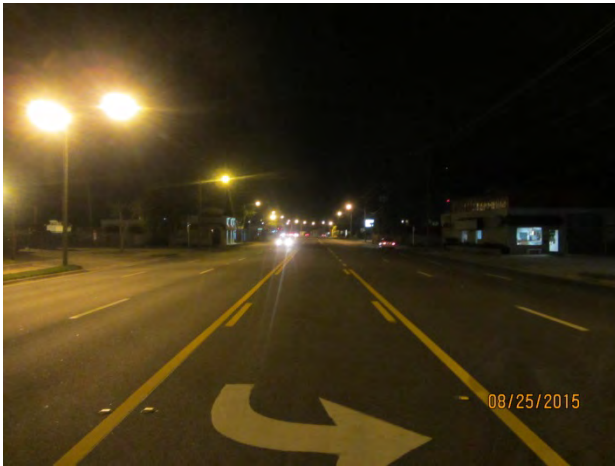


Figure 24



Figure 25

Description of Issue:

The field review team noted multiple lights were burnt out along the corridor contributing to the inconsistent lighting issue.

Even though overhead lighting is present along the corridor, the spacing of the lighting is inconsistent. With the inconsistent spacing, there are areas along the corridor where dark spots are present making it more difficult for motorists to see pedestrians/bicyclists. In total, six (6) of the 12 crashes occurred under dark lighting conditions with all three fatal crashes happening at night. Two of those six crashes involved pedestrians/bicyclists crossing the roadway between signalized intersections, with one of those being a fatal crash.

Suggestions for Improvement:

Consider contacting the operator/maintainer of the lighting system to replace the burnt out light bulbs along the corridor.

Consider a lighting uniformity study to review lighting consistency along the corridor. Providing consistent spacing of the lights along the corridor will make the pedestrians/bicyclists more visible during dark lighting conditions.

During implementation of the results of the study, consider changing from the current high pressure sodium lights to LED lighting to help improve lighting levels along the corridor.

Location: University Boulevard Intersection

Issue #8: Pedestrian Facilities



Figure 26



Figure 27



Figure 28



Figure 29



Figure 30



Source: Google Earth Streetview

Figure 31

Description of Issue:

A bush is located upstream of the intersection on the northwest corner, restricting sight distance for southbound right turning vehicles to see pedestrians crossing the west leg of the intersection, as displayed in **Figure 26**.

The crosswalks were faded on the east, north (**Figure 27**), and west (**Figure 28**) legs of the intersection along with the stop bars for all four approaches. The stop bar for the east leg (westbound approach) is approximately 25' away from the crosswalk. No detectable warning surfaces were present for the curb ramps at the intersection.

No crosswalk is striped on the south leg of the intersection, as displayed in **Figure 29**.

Due to the skew of the intersection, the north leg crosswalk does not lead to the curb ramp on the northwest corner (**Figure 30**). The curb ramp for the north leg crosswalk on the northeast corner of the intersection (**Figure 31**) points towards the middle of the intersection and doesn't lead to the crosswalk.

Suggestions for Improvement:

Consider removing the shrubbery on the northwest corner so vehicles can better see pedestrians/bicyclists crossing the west leg crosswalk.

Consider re-striping the faded east, north, and west legs with Special Emphasis Crosswalk markings consistent with sheet 9 of the FDOT Design Standard Index 17346. Consider installing detectable warning surfaces on all curb ramps. Consider re-striping the stop bars at the intersection to emphasize where the vehicle needs to stop. Consider moving the east leg stop bar closer to the intersection. Per sheet 4 of the FDOT Design Standard Index 17346, the minimum distance between the stop bar and the marked crosswalk should be 4'.

Consider striping the south leg crosswalk with Special Emphasis markings. When the south leg crosswalk is striped, corresponding pedestrian features (pedestrian countdown signal and push buttons) should also be installed. Due to the skew of the intersection, long crossing distance, setback of the stop bar on the west leg, and the dual eastbound right turn lanes, consider installing TURNING VEHICLES YIELD TO PEDESTRIANS (R10-15) on the mast arm and on a single post for the west leg approach. Because the east/west movements are split phased, another solution to the potential conflict between eastbound right turning vehicles and south leg pedestrians would be to have the pedestrian call on the south leg only activate with the westbound movement.



R10-15

- * A fluorescent yellow-green background color may be used instead of yellow for this sign.

Consider constructing a separate curb ramp on the northwest corner for the north leg crosswalk and re-aligning the crosswalk slightly to match the new curb ramp. Consider relocating the curb ramp on the northeast corner approximately 5' north (just south of the drainage inlet) so the ramp aligns with the crosswalk. Consideration by the study team was given to making the north leg crosswalk more perpendicular to US 1. Due to the skew of the intersection and the sight obstructions on the northeast corner, potential issues were foreseen between westbound right turning vehicles and pedestrians crossing the north leg.

Location: Mid-Block between University Boulevard and Line Street

Issue #9: Don Bell Property Fence



Figure 32



Figure 33



Figure 34



Figure 35

Description of Issue:

The Don Bell property fence line just south of Powell Avenue on the west side of the roadway has rusty wire ties poking through fence into the sidewalk as displayed in **Figure 32** and **Figure 33**. A metal pole was also observed sticking out of fence into the sidewalk as displayed in **Figure 34** and **Figure 35**. Protruding objects on the fence pose a hazard to pedestrians on the sidewalk.

Suggestions for Improvement:

Consider contacting City of Melbourne code enforcement to request the Don Bell property owner to remove the rusty wires and metal pole protruding into the sidewalk.

Location: Line Street Intersection

Issue #10: Intersection Lighting

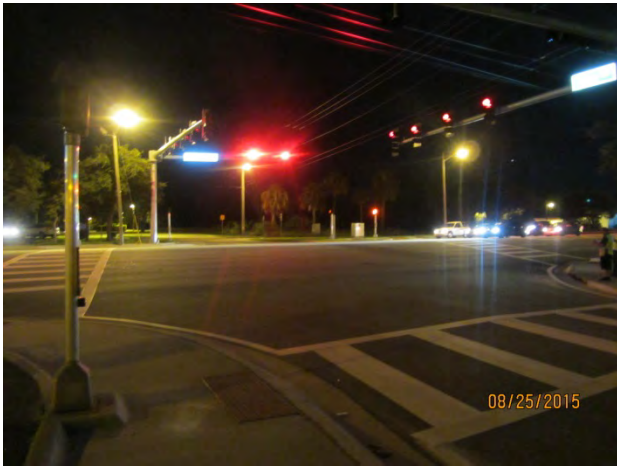


Figure 36



Figure 37

Description of Issue:

Intersection lighting is provided on the southeast and northeast corners of the intersection as displayed in **Figure 36**. No intersection lighting is provided on the southwest (**Figure 37**) or northwest corners of the intersection.

Suggestions for Improvement:

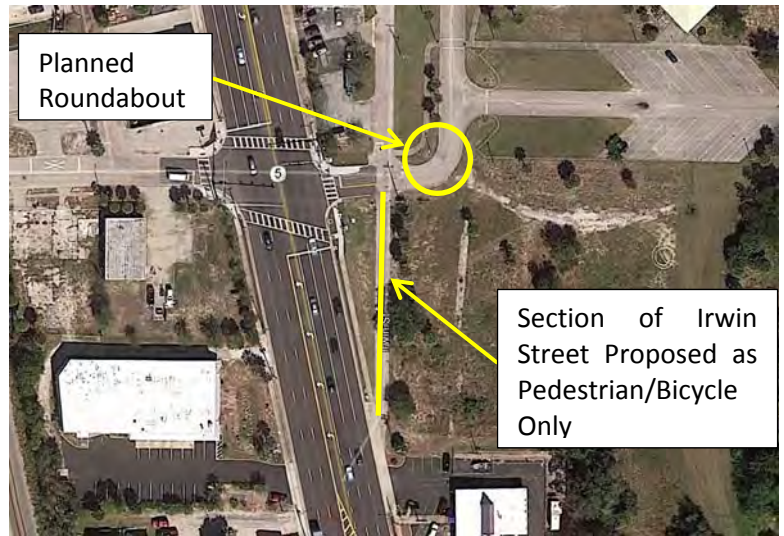
Consider upgrading the lighting at the intersection to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT Plans Preparation Manual (PPM). This may require the existing lighting to be replaced.

Location: Line Street Intersection

Issue #11: Irwin Street South of Line Street



Figure 38



Source: Google Earth

Figure 39

Description of Issue:

During the field review, multiple pedestrians were observed walking along Irwin Street south of Line Street. This roadway begins at a driveway from US 1 approximately 250' south of the Line Street intersection (**Figure 38**) and extends into Melbourne Riverview Park. City staff noted this section of Irwin Street is rarely utilized for vehicular traffic.

Suggestions for Improvement:

The City of Melbourne has plans to redevelop Riverview Park (see **Appendix B** for plan). With this redevelopment, having easily accessible pedestrian/bicycle routes to the new park is key to generating activity within the park. The study team considered removing the driveway from US 1 to Irwin Street and making the section up to Line Street a pedestrian/bicycle only facility. A roundabout is proposed near the intersection of Line Street and Irwin Street so the pedestrian/bicycle only facility could tie into the future design of that intersection.

Location: Line Street Intersection

Issue #12: Slope from Sidewalk to Curb



Figure 40



Figure 41

Description of Issue:

Immediately south (**Figure 40**) and north (**Figure 41**) of the Line Street intersection on the west side of the road, steep grades were observed from sidewalk to the back of the curb. If a pedestrian/bicyclist is utilizing the sidewalk in these locations, they may accidentally step/ride off the sidewalk onto the sloped grass or concrete areas and fall into the roadway.

Suggestions for Improvement:

Due to the steep slope between the sidewalk and curb consider reviewing these locations based on FDOT Plans Preparation Manual (PPM) Figure 8.8.1. If railing is needed, install the railing just off the east edge of the sidewalk to prevent pedestrians/bicyclists from falling off the sidewalk into the roadway.

Location: Prospect Avenue Intersection

Issue #13: Southwest Corner Curb Ramp

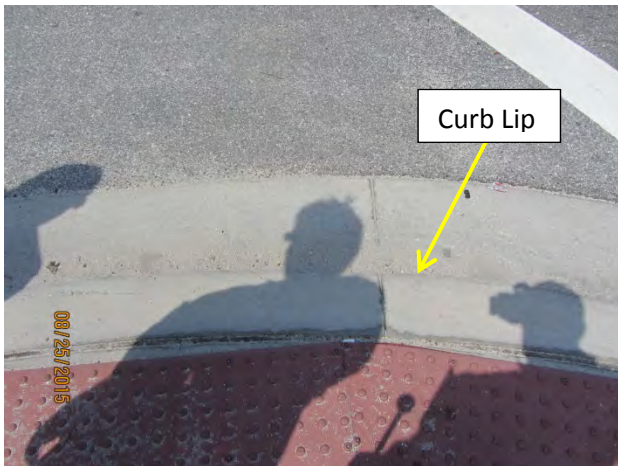


Figure 42

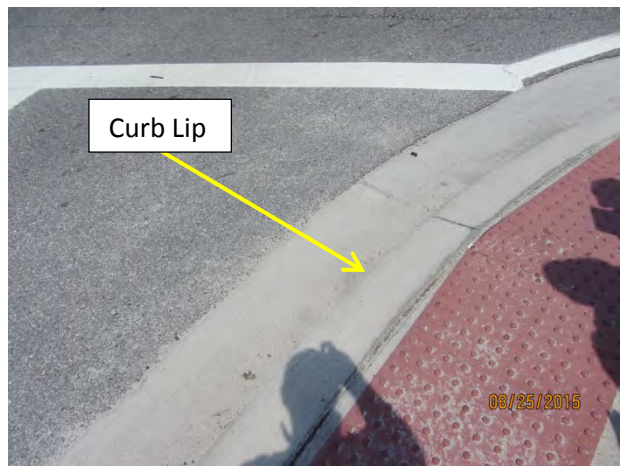


Figure 43

Description of Issue:

When the curb return on the southwest corner of the intersection was constructed, the valley gutter was built with a lip as displayed in **Figure 42** and **Figure 43**. The lip constructed may make it difficult for a wheelchair pedestrian to exit the crosswalk utilizing the curb ramp to access the sidewalk.

Suggestions for Improvement:

Consider beveling the lip or rebuilding the curb return so there is no lip on the valley gutter between the curb ramp and the roadway.

Location: Prospect Avenue Intersection**Issue #14: No Left Turn Phasing****Description of Issue:**

There are no protected left turn phases for the northbound or southbound left turns at the intersection. With no protected left turn phasing, left turning vehicles will queue and have to wait for a gap along the US 1 mainline to make their left turn movement. Having to focus on crossing three travel lanes may make it difficult to focus on pedestrians utilizing the east and west leg crosswalks.

Suggestions for Improvement:

Mast arms are currently in design for the intersection. As part of this design, consider making the northbound and southbound left turns protected/permissive signal phasing. By giving those turning movements their own phase, it will reduce the amount of vehicles left turning during the permissive phase of the cycle (when the adjacent crosswalk would have a WALK phase), thus reducing the amount of potential conflict between crossing pedestrians and vehicles. Consider the flashing yellow arrow signal head configuration, which has a green arrow for the protected left turn phase but goes to a flashing yellow arrow for the permissive phase.

Location: Prospect Avenue Intersection

Issue #15: Pedestrian Signage



Figure 44



Figure 45



Figure 46

Description of Issue:

The push button signage on the northwest corner's pole was missing, as illustrated in **Figure 44**.

On the northeast corner, the stop bar is placed approximately 35' away from the outside northbound travel lane due to the east leg crosswalk placement. Where the stop bar is currently located, a westbound right turning vehicle will typically pull forward past the stop bar and wait in the crosswalk because a traffic controller cabinet on the southeast corner is obstructing the sight distance looking southbound (**Figure 45**). The study team observed most vehicles not stopping at the stop bar at all but just pulling up to the edge of the travel lane. The building on the northeast corner also limits the sight distance for westbound vehicles and pedestrians/bicyclists utilizing the sidewalk traveling in the southbound direction (**Figure 46**). There was one crash involving a bicycle traveling in the southbound direction and a westbound traveling vehicle.

Suggestions for Improvement:

Install **R10-3i** pedestrian plaques on the northwest corner indicating the respective pedestrian push button's corresponding street.



R10-3i

Due to the crosswalk placement and sight distance issues, consider installing Stop Here for Pedestrians signage (**R1-5b** or **R1-5c**) at the marked crosswalk on the WB approach.



R1-5b



R1-5c

As discussed in **Issue #14: No Left Turn Phasing**, most arms are currently in design for the intersection. As part of this design, consider relocating the traffic controller cabinet so as to remove the sight distance obstruction on the southeast corner. Doing so may increase stop bar compliance for westbound right turning vehicles.

Location: Prospect Avenue Intersection

Issue #16: Intersection Lighting

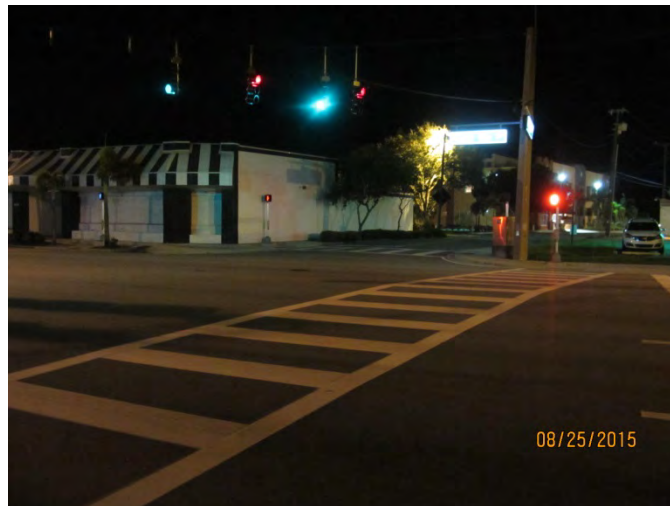


Figure 47

Description of Issue:

Intersection lighting is provided on the southeast and northwest corners of the intersection. No intersection lighting is provided on the northeast (**Figure 47**) or southwest corners of the intersection. One fatal nighttime crash occurred on the south leg crosswalk in the southwest corner of the intersection while another nighttime crash occurred near the northeast corner of the intersection.

Suggestions for Improvement:

Consider upgrading the lighting at the intersection 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.

Location: Mid-Block between Prospect Avenue and New Haven Avenue

Issue #17: Lighting



Source: Google Earth Streetview

Figure 48

Description of Issue:

Pedestrian level lighting is located along the west side of US 1 in front of the Crane Creek Medical Center (Figure 48). During the nighttime field review, a number of consecutive lights just south of bridge over the Indian River Lagoon were not lit. Nighttime construction was taking place on the west side of the bridge after the nighttime field review, which may be the reason for the lights being turned off.

Suggestions for Improvement:

After the nighttime construction on the bridge is completed, go back into the field and check to see if the lights have been turned back on. If not, consider checking with the operator/maintainer of the lights to see if the lights need to be turned back on or if the light bulbs are burnt out.

Location: New Haven Avenue Intersection

Issue #18: Intersection Lighting



Figure 49



Figure 50

Description of Issue:

The street light bulb in the northwest corner was burnt out.

Intersection lighting is provided on the northwest, northeast, and southeast corners of the intersection. No intersection lighting is provided on the southwest corner of the intersection (**Figure 49**). Two nighttime crashes occurred on the south leg crosswalk in the southwest corner of the intersection, one of those being fatal.

No street lighting was present immediately south of the intersection on the west side of the roadway as displayed in **Figure 50**.

Suggestions for Improvement:

Contact the operator/maintainer of the lighting system to replace the burnt out light bulb on the northwest corner.

Consider upgrading the lighting at the intersection 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.

As part of the corridor wide lighting uniformity study discussed in **Issue #7: Lighting**, review the area on the west side of US 1 just south of the New Haven intersection to the north side of the bridge over the Indian River Lagoon.

Summary of Suggestions

This pedestrian/bicycle safety review considers operational and safety related issues for pedestrians and bicyclists on US 1 from University Boulevard to New Haven Avenue. 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.

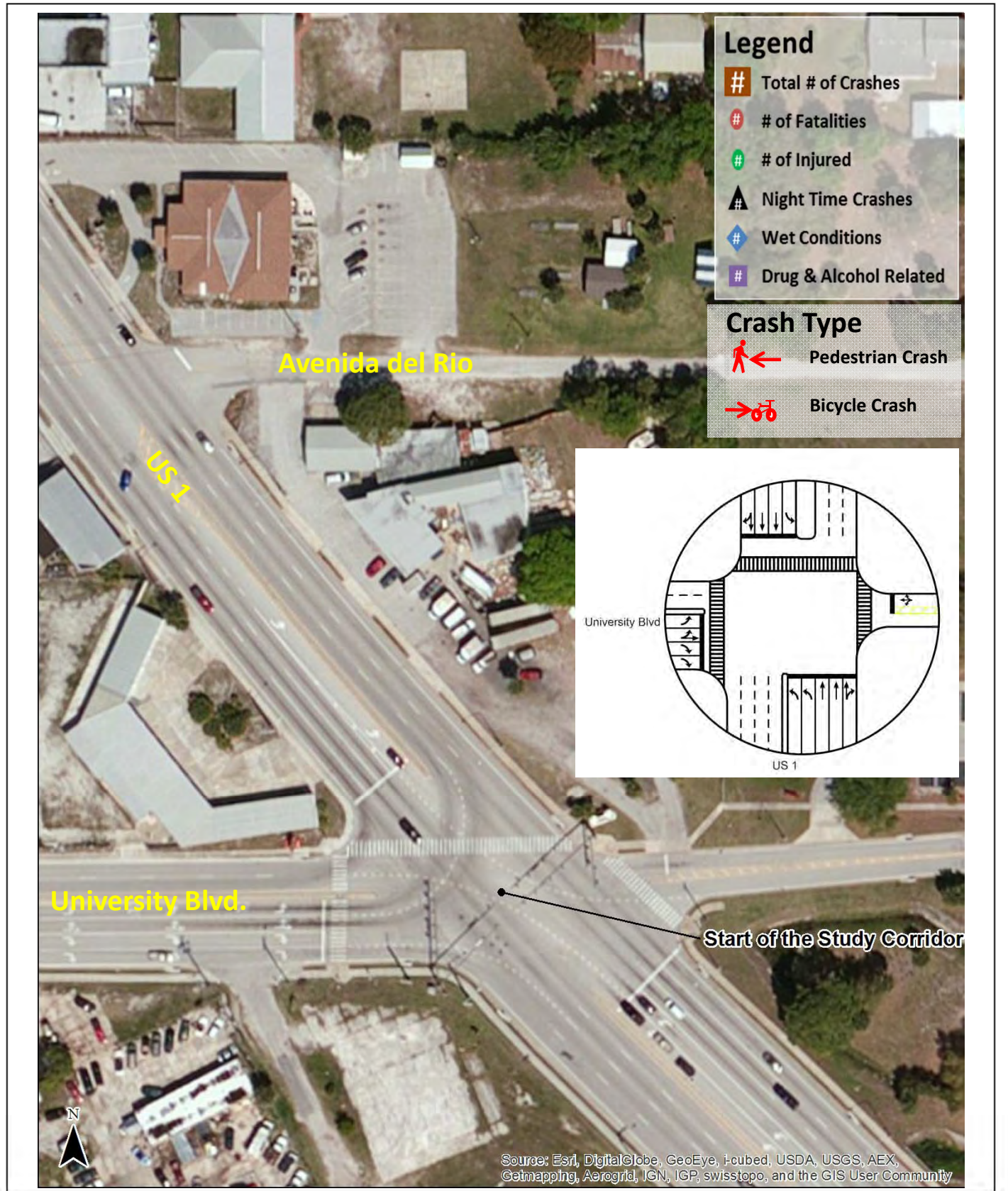
The following tables summarize the suggestions of this study by priority (maintenance, near-term, or long-term).

Location	Issue Number	Issue	Suggestion
MAINTENANCE			
Corridor Wide	3	Sidewalk Walkability	Consider regular sidewalk maintenance (sweeping debris/sand) along the corridor. The maintenance may be scheduled (once every one or two weeks, etc.) or may be performed after a heavy rain event. Consider reducing the height of landscape strip to be level or just below the sidewalk and replace with new sod. Also consider raising the sidewalk to be level with the landscape strip.
Corridor Wide	5	Unsignalized Minor Street Pedestrian Facilities	Consider emphasizing the pedestrian realm across unsignalized minor street approaches by adding standard crosswalk markings and detectable warning surfaces.
Corridor Wide	7	Lighting	Consider contacting the operator/maintainer of the lighting system to replace the burnt out light bulbs along the corridor.
University Boulevard Intersection	8	Pedestrian Facilities	Consider removing the shrubbery on the northwest corner so vehicles can better see pedestrians/bicyclists crossing the west leg crosswalk. Consider re-striping the faded east, north, and west legs with Special Emphasis Crosswalk markings consistent with sheet 10 of the FDOT Design Standard Index 17346. Consider installing detectable warning surfaces on all curb ramps. Consider re-striping the stop bars at the intersection to emphasize where the vehicle needs to stop. Consider moving the east leg stop bar closer to the intersection.
Mid-Block between University Boulevard and Line Street	9	Don Bell Property Fence	Consider contacting City of Melbourne code enforcement to request the Don Bell property owner to remove the rusty wires and metal pole protruding into the sidewalk.
Prospect Avenue Intersection	13	Southwest Corner Curb Ramp	Consider beveling the lip or rebuilding the curb return so there is no lip on the valley gutter between the curb ramp and the roadway.
Prospect Avenue Intersection	15	Pedestrian Signage	Install R10-3i pedestrian plaques on the northwest corner indicating which street the pedestrian push button corresponds with. Consider installing Stop Here for Pedestrians signage (R1-5b or R1-5c) at the marked crosswalk on the WB approach.
Mid-Block between Prospect Avenue and New Haven Avenue	17	Lighting	After the nighttime construction on the bridge is completed, go back into the field and check to see if the lights have been turned back on. If not, consider checking with the operator/maintainer of the lights to see if the lights need to be turned back on or if the light bulbs are burnt out.
New Haven Avenue Intersection	18	Intersection Lighting	Contact the operator/maintainer of the lighting system to replace the burnt out light bulb on the northwest corner.

Location	Issue Number	Issue	Suggestion
NEAR-TERM PRIORITY			
Corridor Wide	1	Seven Lane Cross Section	Consider a study to review potential locations for spot medians. Consider reviewing how driveways are utilized along the corridor, especially at abandoned property locations or locations where properties have multiple driveways, as this may increase the number of potential locations for spot medians.
Corridor Wide	3	Sidewalk Walkability	In lieu of regular sidewalk maintenance by a local jurisdiction, local businesses along the corridor could apply for the FDOT Adopt-A-Highway program (found at http://www.dot.state.fl.us/statemaintenanceoffice/aah.shtm).
Corridor Wide	6	Off Peak Signal Cycle Lengths	Consider signal timing adjustments to better serve pedestrians attempting to cross SR A1A by treating the pedestrian call as a side street call and force the intersection to gap out when the major movement has a gap. The signal timing would remain the same as existing during peak periods.
Corridor Wide	7	Lighting	Consider a lighting uniformity study to review lighting consistency along the corridor.
University Boulevard Intersection	8	Pedestrian Facilities	Consider striping the south leg crosswalk with Special Emphasis markings. When the south leg crosswalk is striped, corresponding pedestrian features (pedestrian countdown signal and push buttons) should also be installed. Consider installing TURNING VEHICLES YIELD TO PEDESTRIANS (R10-15) on the mast arm and on a single post for the west leg approach. Consider having the pedestrian call on the south leg only activate with the westbound movement.
University Boulevard Intersection	8	Pedestrian Facilities	Consider constructing a separate curb ramp on the northwest corner for the north leg crosswalk and re-aligning the crosswalk slightly to match the new curb ramp. Consider relocating the curb ramp on the northeast corner approximately 5' north so the ramp aligns with the crosswalk.
Line Street Intersection	10	Intersection Lighting	Consider upgrading the lighting at the intersection to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT Plans Preparation Manual (PPM). This may require the existing lighting to be replaced.
Line Street Intersection	12	Slope from Sidewalk to Curb	Consider reviewing locations based on FDOT Plans Preparation Manual (PPM) Figure 8.8.1. If railing is needed, install the railing just off the east edge of the sidewalk to prevent pedestrians/bicyclists from falling off the sidewalk into the roadway.
Prospect Avenue Intersection	14	No Left Turn Phasing	Mast arms are currently in design for the intersection. As part of this design, consider making the northbound and southbound left turns protected/permissive signal phasing. Consider the flashing yellow arrow signal head configuration, which has a green arrow for the protected left turn phase but goes to a flashing yellow arrow for the permissive phase.
Prospect Avenue Intersection	15	Pedestrian Signage	As discussed in Issue #14: No Left Turn Phasing , mast arms are currently in design for the intersection. As part of this design, consider relocating the traffic controller cabinet so as to remove the sight distance obstruction on the southeast corner.
Prospect Avenue Intersection	16	Intersection Lighting	Consider upgrading the lighting at the intersection to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT Plans Preparation Manual (PPM). This may require the existing lighting to be replaced.
New Haven Avenue Intersection	18	Intersection Lighting	Consider upgrading the lighting at the intersection to meet the requirements of section 7.3.2.2 in Volume 1 of the FDOT Plans Preparation Manual (PPM). This may require the existing lighting to be replaced. As part of the corridor wide lighting uniformity study discussed in Issue #7: Lighting , review the area on the west side of US 1 just south of the New Haven intersection to the north side of the bridge over the Indian River Lagoon.

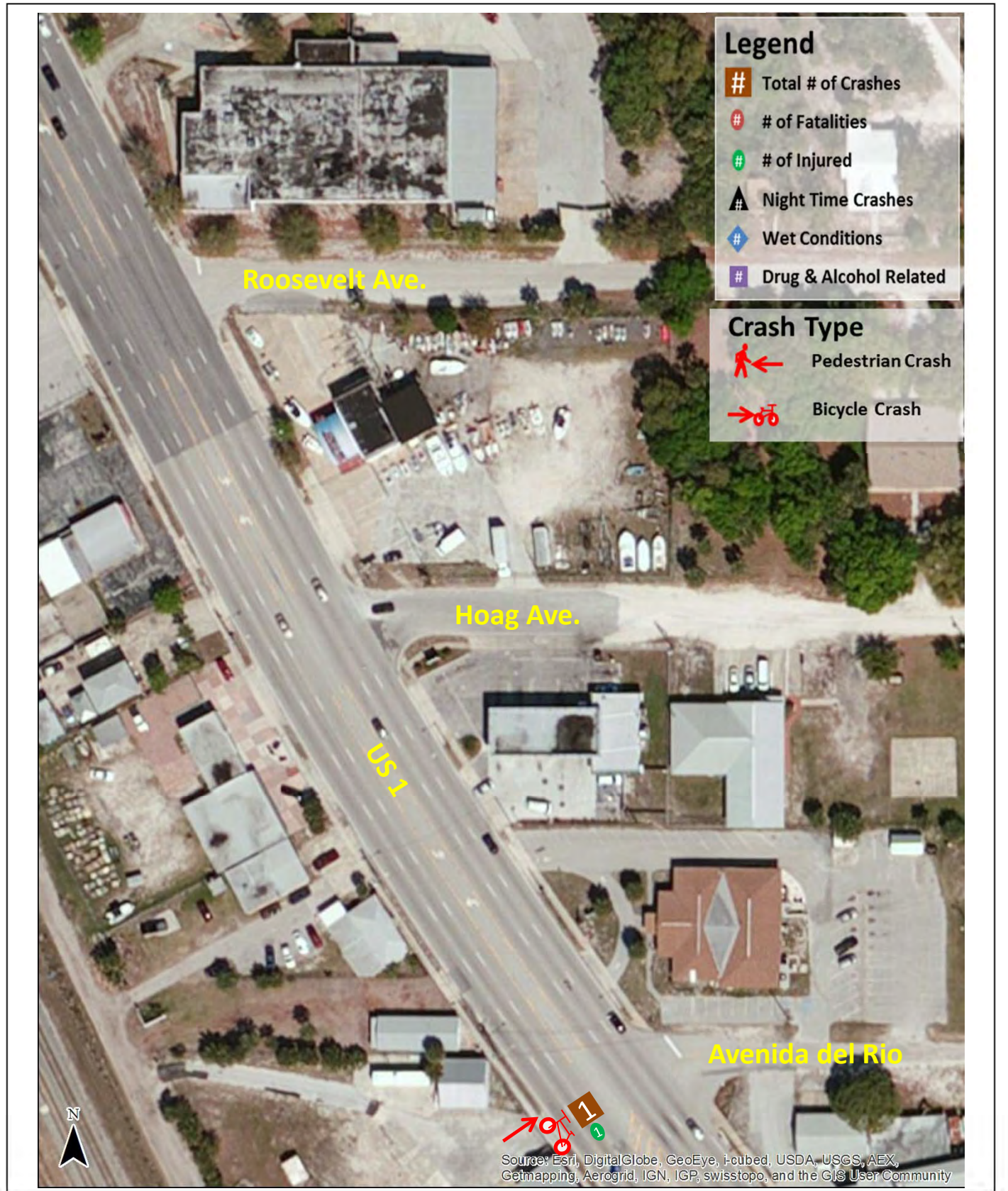
Location	Issue Number	Issue	Suggestion
LONG-TERM PRIORITY			
Corridor Wide	2	Sight Distance at Driveways/ Intersections	As properties redevelop, enforce the City of Melbourne building setback standards so as to increase the sight distance at these driveways and intersections.
Corridor Wide	4	Driveways	Consider driveway reconstruction during the roadway's next 3R project to provide a level path for the sidewalk and meet ADA guidance. Consider reducing the driveway widths down to the 36' maximum per FDOT Standard Index 515. As properties redevelop along the corridor, consider rebuilding/consolidating the driveways.
Corridor Wide	7	Lighting	Implement results of lighting uniformity study and consider changing from the current high pressure sodium lights to LED lighting to help improve lighting levels along the corridor.
Line Street Intersection	11	Irwin Street South of Line Street	Consider removing the driveway from US 1 to Irwin Street and making the section up to Line Street a pedestrian/bicycle only facility. A roundabout is proposed near the intersection of Line Street and Irwin Street so the pedestrian/bicycle only facility could tie into the future design of that intersection.

Appendix A – Collision Diagrams



**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
University Boulevard to Avenida del Rio**

Figure
1



**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Avenida del Rio to Roosevelt Avenue**

**Figure
2**



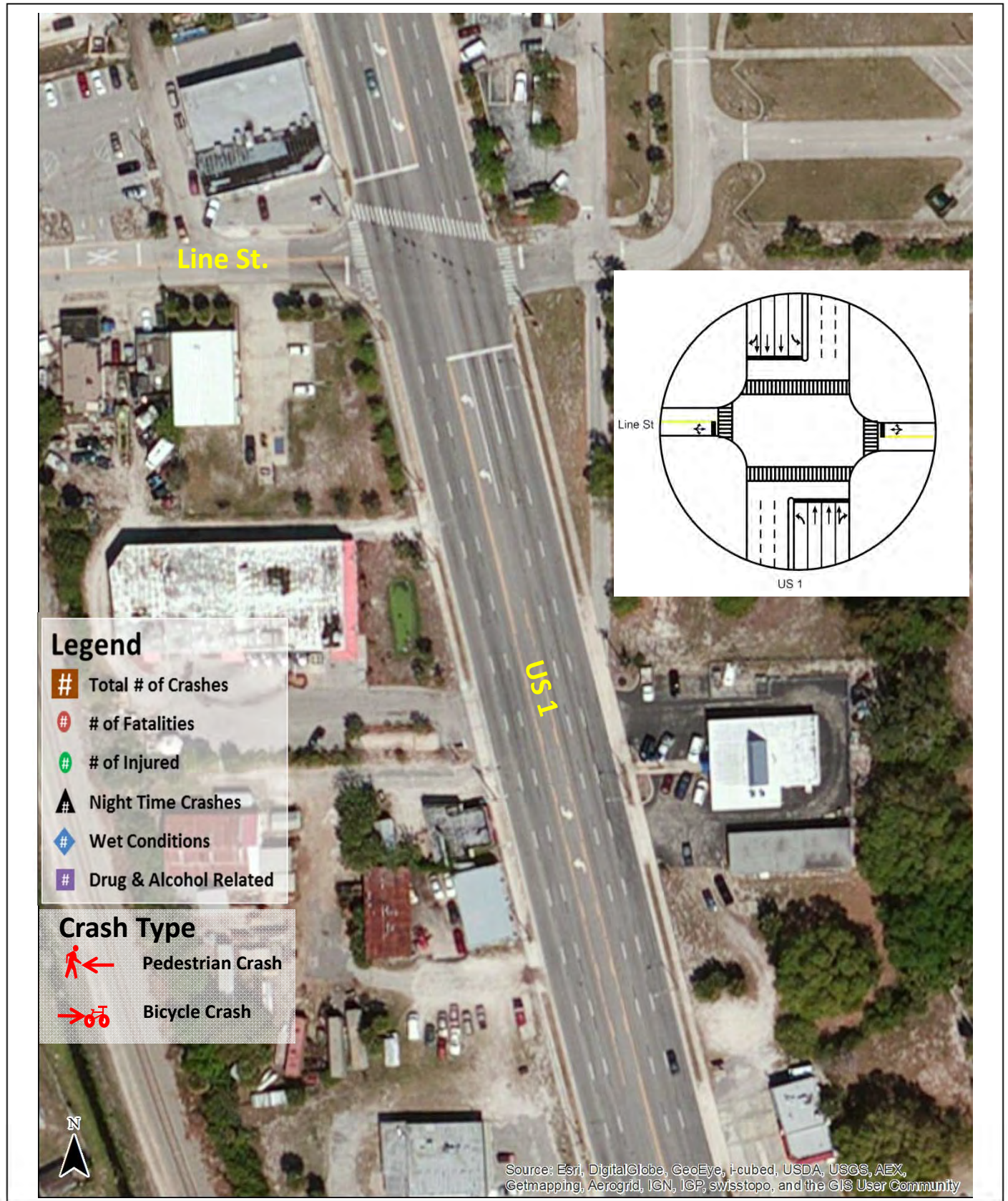
**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Roosevelt Avenue to Lookout Terrace**

**Figure
3**



**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Jernigan Avenue to Shenandoah Drive**

Figure
4



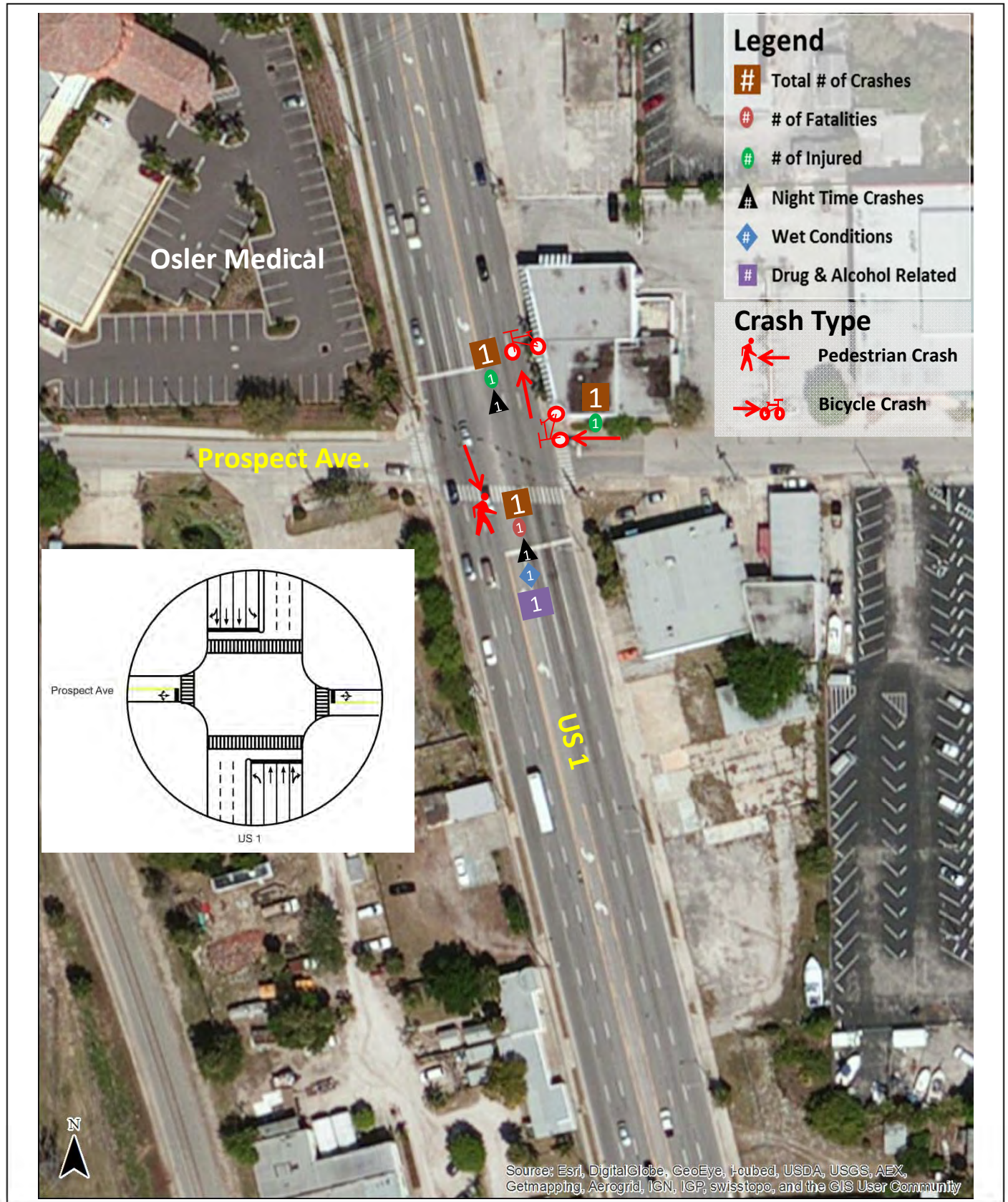
**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Shenandoah Drive to Line Street**

**Figure
5**



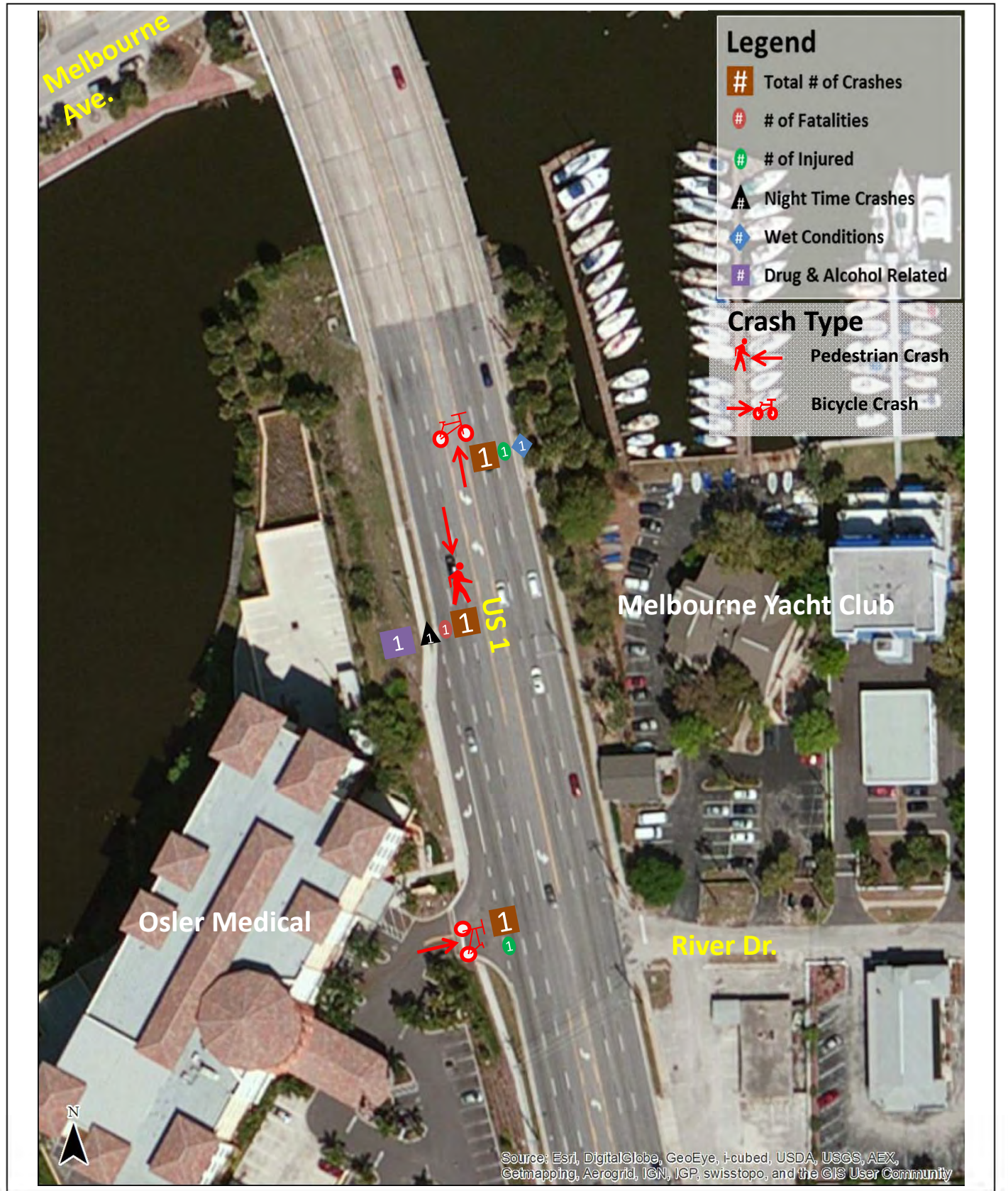
**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Line Street to Johnny Ellison Drive**

**Figure
6**



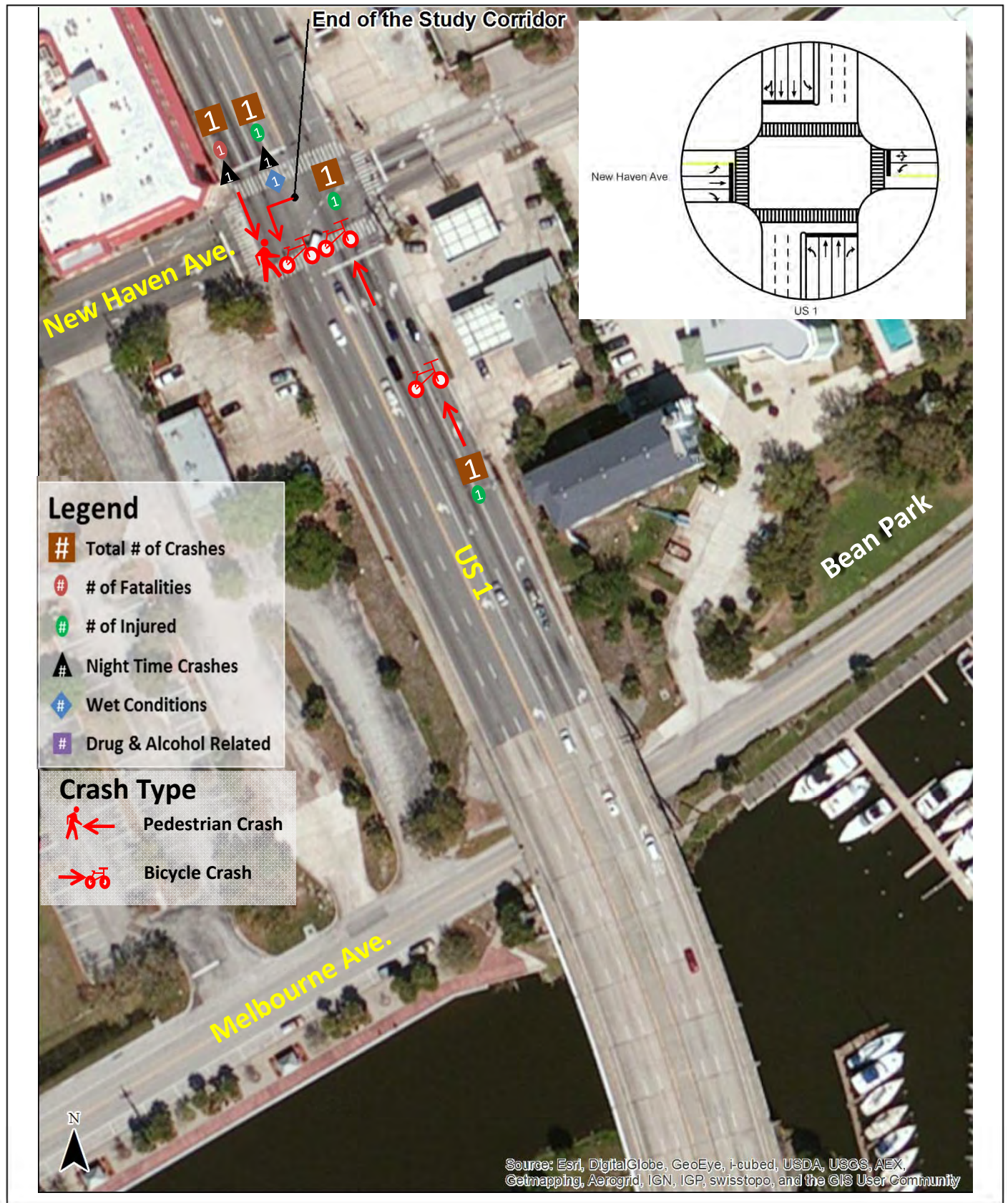
**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Johnny Ellison Drive to Prospect Avenue**

Figure
7



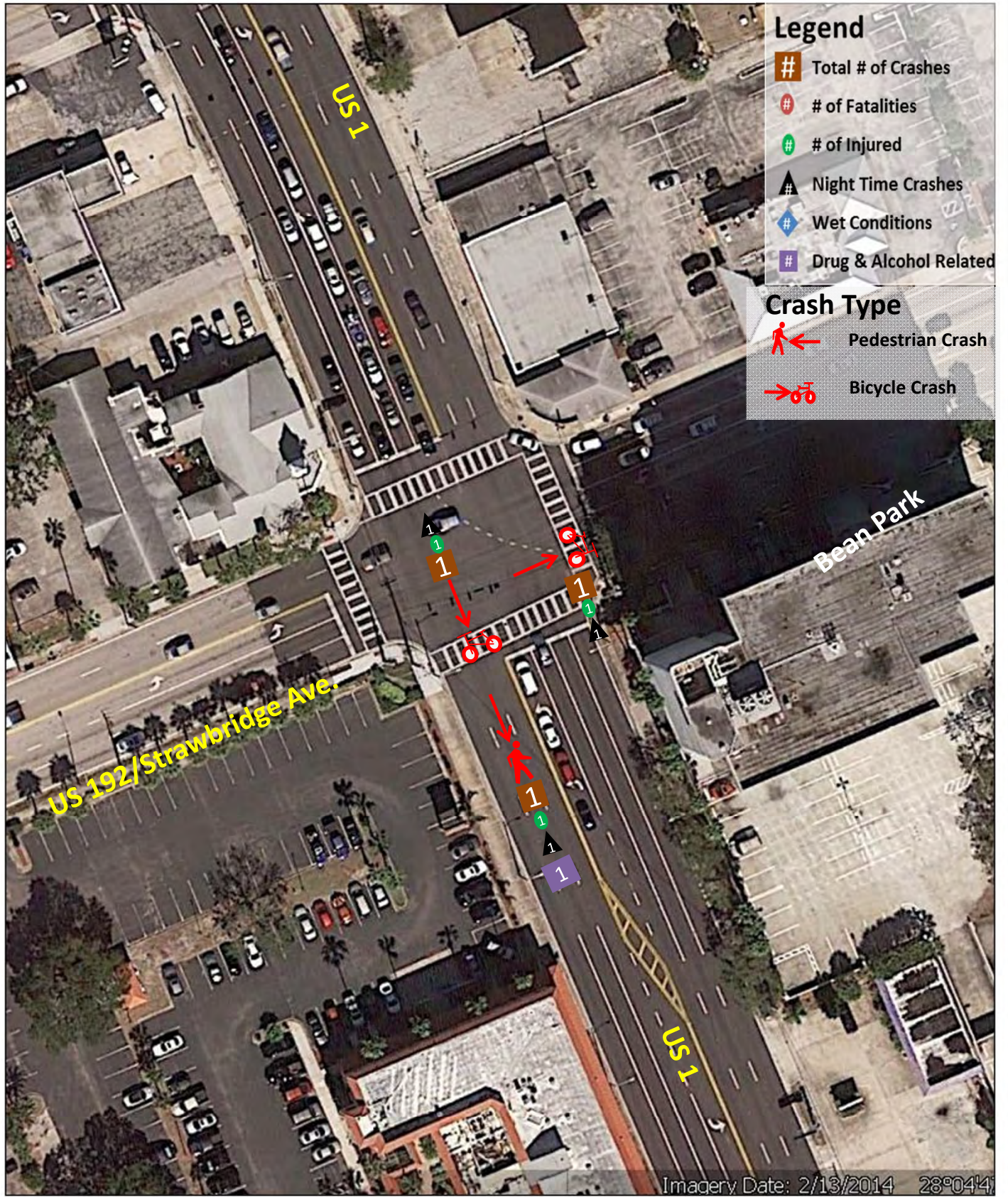
**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
River Drive to Melbourne Avenue**

**Figure
8**



**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
Melbourne Avenue to New Haven Avenue**

**Figure
9**



**US 1 Ped/Bike Field Review
Collision Diagram (2009 – 2014)
New Haven Avenue to US 192/Strawbridge Avenue**

**Figure
10**

Appendix B – Riverview Park Redevelopment Plan

PLAN LEGEND

- A ENTRY SIGNAGE
- B LOADING ZONE
- C VENDOR VILLAGE/WATERSIDE VENDING
- D SPLASH PAD
- E PICNIC PAVILION
- F EXISTING PAVILION
- G RIVERVIEW DRIVE IMPROVEMENTS W/ UNDERGROUND POWER
- H OPEN SPACE
- I IMPROVED NON-MOTORIZED BOAT LAUNCH (W/ FRESH WATER AVAILABLE)
- J SHADE SAIL OVER BENCHES
- K IRWIN STREET AND PROSPECT AVENUE IMPROVEMENTS
- L REMOVE INTERIOR DRIVE
- M INCREASE LANDSCAPING
- N SAND VOLLEYBALL COURTS
- O EXISTING STORMWATER AREAS
- P EXISTING LOOP FOR SPECIAL EVENTS
- Q REMOVABLE BOLLARDS AND TURNAROUND AREA
- R EVENT LAWN
- S DECORATIVE HARDSCAPE
- T SWINGS UNDER TRELLISES
- U SEA WALL
- V SHORT FISHING PIER
- W PARK OFFICE WITH RESTROOMS AND STORAGE
- X PLAYGROUND
- Y OBSERVATION TOWER
- Z ELEVATED BOARDWALK WITH EDUCATIONAL SIGNAGE
- AA PASSIVE OPEN SPACE W/ DISC GOLF & ULTIMATE FRISBEE FIELD
- BB CORNER ENTRY MONUMENT



VIEW OF SITE ENTRY SIGN



VIEW OF VENDOR VILLAGE



MELBOURNE RIVERVIEW PARK
 ILLUSTRATIVE SITE PLAN | 4/23/2014



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