# SCHOOL ROUTES ANALYSIS

# HARBOR CITY ELEMENTARY SCHOOL


## ASSESSMENT & IMPLEMENTATION REPORT

JULY 2020

SPACE COAST TPO

KITTELSON & ASSOCIATES

# School Routes Analysis

# Harbor City Elementary School

# Melbourne, FL

## Assessment & Implementation Report

## July 2020


**Prepared for:**

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# Table of Contents

# List of Figures

# List of Tables

# Executive Summary

Space Coast Transportation Planning Organization (SCTPO) with assistance from Kittelson & Associates, Inc. (KAI) documented existing conditions and developed Safe Routes to School (SRTS) recommendations for nine schools as part of the School Routes Analysis (SRA) project. The nine study schools were selected by the cities of Melbourne and Palm Bay prior to this project. The analysis reviewed the 'study areas' that were identified based on walk zones and attendance boundaries around the nine study schools. This SRA project is intended to serve as a pilot to establish a study methodology that can be replicated at other schools within Brevard County. This report documents the assessment of the existing conditions and lists recommendations for Harbor City Elementary School located at 1377 Sarno Road, Melbourne, FL 32935.

## Purpose

The purpose of this project is to create a safe environment for students to walk or bike to school. The goal for the assessment phase of the SRA is to provide the SCTPO with a comprehensive study that will document the observed pedestrian and bicycle circulation routes adjacent to the school site, identify issues associated with student pedestrians and bicyclists within the study area, and make recommendations for improvement. The goal for the implementation phase of this study is to develop recommendations from the assessment phase to create a safer environment for children who live within the walk zone and choose to walk or bicycle to and from the school.

Many local, state, and federal laws require transportation agencies to focus on pedestrian and bicyclist infrastructure as part of the overall transportation network. The Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) of 2005 established the Safe Routes to School program that explicitly focused on funding projects to enhance pedestrian and bicyclist infrastructure near schools. Fixing America's Surface Transportation Act (FAST) of 2015 reinforces the Safe Routes to School program. The analysis in the report is to identify projects that could be funded by the State of Florida's Safe Routes to School program or other transportation funding.

## Study Process

A study area was identified for the school based on the respective school's walk zone and attendance boundary to determine where students walk and bike. As part of stakeholder engagement, a Technical Committee (TC) was established. The TC was comprised of representatives from the City of Melbourne, the City of Palm Bay, Brevard County Planning, Public Works, and Public Schools, and the Florida Department of Transportation (FDOT). The TC functioned as a sounding board for the Project Team and acted as liaisons for their respective agencies throughout the planning process.

As part of the Assessment Phase of the project, existing conditions, crash data, and survey data were analyzed and mapped prior to the school coordination meeting. The school coordination meeting, comprising of relevant TC members and school administration, was conducted a day prior to the field review at the school campus. A field review of the school's study area was conducted to observe current pedestrian and bicyclist behaviors.

As part of the Implementation Phase of the project, a list of draft issues and recommendations were developed. Recommendations were based on the input received at the school coordination meeting and field review observations. The draft list of recommendations was revised and finalized based on feedback received from TC members. Planning-level cost estimates were calculated for the final recommendations. **Figure 1** graphically shows the study process. Recommendations for Harbor City Elementary School are summarized in **Table 1**.

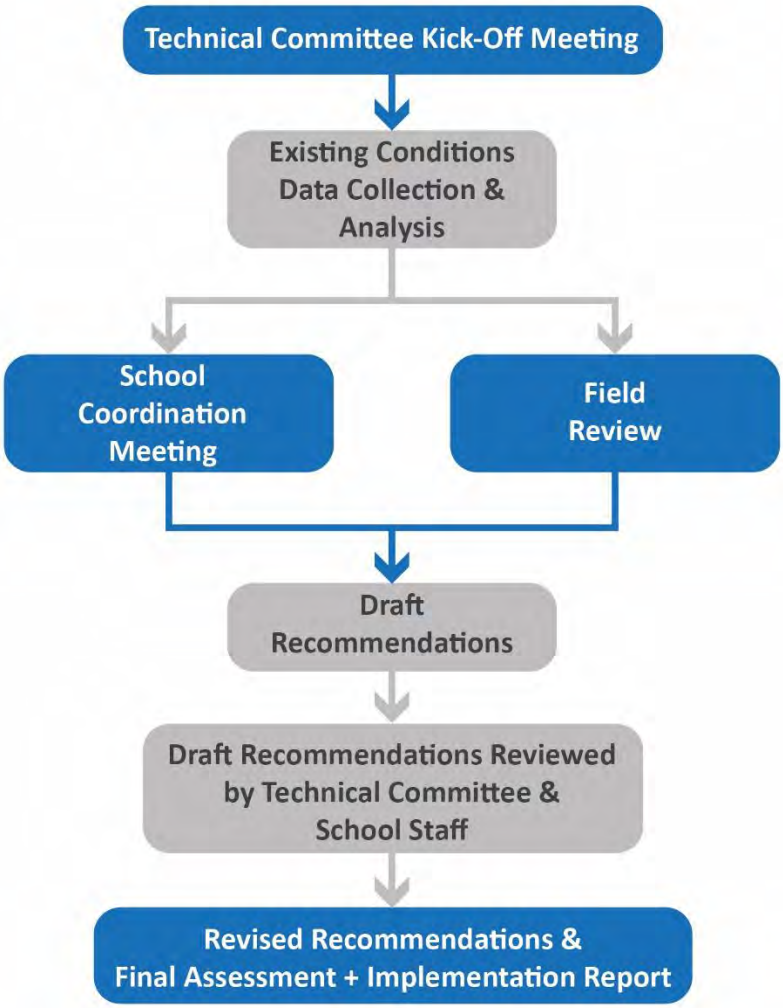



*Figure 1: Study Process*

## *Table 1: Recommendations Summary*

| School Campus Recommendations | | | | | |
|---|---|---|---|---|---|
| **No.** | **Location** | **Recommendation** | **Type** | **Time-Frame** | **Cost Estimate** |
| 1 | School Main Entrance | Build an 8 foot wide sidewalk connection from Sarno Road to the main school entrance door. | Sidewalk | Near-Term | <$10,000 |
| 2 | School Campus East Parking Lot | Extend the fenced walkway and mark a high visibility crosswalk across the parking lot. | Sidewalk | Near-Term | <$10,000 |
| 3 | School Campus Drop-Off/Pick-Up Loops | Re-stripe crosswalks as high-visibility crosswalks and add ADA compliant pedestrian ramps. | Crossing | Maintenance /Near-Term | <$10,000 |
| 4 | School Campus Drop-Off/Pick-Up Loops | Rework school internal circulation to push drop-off/pick-up point further south and extend the drop-off/pick-up loop to add more stacking space for cars. | School Circulation | Long-Term | Further study is required |
| 5 | School Driveways along Sarno Road | Construct right-in/right-out channelized islands at school driveways alongside recommendation No. 4. | Sidewalks (Driveways) | Near-Term | $15,000 to $20,000 |

| Study Area Recommendations | | | | | |
|---|---|---|---|---|---|
| **No.** | **Location** | **Recommendation** | **Type** | **Time-Frame** | **Cost Estimate** |
| 6 | Midblock Crossing across Apollo Boulevard near Hidden Harbor Drive | Install RRFB at the midblock crosswalk. | Crossing | Near-Term | $45,000 to $55,000 |
| 7 | Sarno Road from Croton Road to US 1 | Upgrade existing sidewalks to be ADA compliant along Sarno Road. | Sidewalk | Near-Term | Further study is required |
| 8 | Sarno Road from Croton Road to US 1, Croton Road from Sarno Road to End of Roadway, Garfield Street, Ixora Drive, and Within the Brevard County Driver License and Tax Collector Complex | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs of the signalized intersections | Crossing | Near-Term | $65,000 to $75,000 |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 9 | Sarno Road | Implement Sarno Road Corridor Study Recommendations - five lane cross-section with TWLTL, spot medians, access management, and 8 foot wide sidewalks on both sides. | Previous Study (Corridor) | Long-Term | $20,885,000. Further study is required to estimate the cost for access management |
| 10 | Sycamore Road/Cadillac Circle N and Ixora Drive Intersection | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs. | Crossing | Near-Term | $10,000 to $15,000 |
| 11 | Ironwood Drive, Tupelo Drive, Ixora Drive, Cadillac Circle, and Sycamore Road (See **Figure 31** for extents) | Install neighborhood traffic calming treatments such as speed cushions, speed humps, curb extensions, street trees, etc. | Traffic Calming | Near-Term | Further study is required |
| 12 | Bell Street from Sarno Road to Tynan Drive | Build a 5 to 6 foot wide sidewalk on the east side of Bell Street. | Sidewalk | Near-Term | $60,000 to $70,000 |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 13 | Neiman Avenue from Lorraine Avenue to Babcock Street | Build a 5 to 6 foot wide sidewalk along both sides of Neiman Avenue | Sidewalk | Near-Term | $500,000 to $600,000 |
| 14 | Bus Stop at Sarno Road and Apollo Boulevard | Make an ADA compliant bus stop. Add bench and shelter. | Sidewalk (Transit) | Near-Term | $32,000 |
| 15 | South and East of the School Campus | Conduct a feasibility study to build a 12 foot wide trail connection south of the school between the school campus and Sycamore Drive and Teak Drive intersection. | Feasibility Study (Trail) | Near-Term | Further study is required |
| 16 | South and East of the School Campus | Conduct a feasibility study to build a new roadway connection south of the school campus to connect to Apollo Boulevard and/or St. Michaels Place. | Feasibility Study (Roadway) | Near-Term | Further study is required |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 17 | Apollo Boulevard and Sarno Road Intersection | Install blank out signage for the south-bound right, east-bound right, and north-bound right turn lanes. These signs would show no right-turn-on-red when the conflicting crosswalk pedestrian push button is activated, but otherwise will stay blank. | Sign/Signal | Near-Term | $25,000 to $30,000 |
| 18 | Sarno Road | Install school zone speed limit flashing beacons on mast arms to replace existing signs on poles. | Sign/Signal | Near-Term | $155,000 to $185,000 |

# Assessment

This section of the report documents the existing conditions within the Harbor City Elementary School study area and summarizes the student and parent survey data, crash analysis, school coordination meeting, and observations from the field review.

A study area was developed for each school. The study area is the walk zone defined as the two mile walking radius within the school's attendance boundary around the school where no school bus service is provided. The study area excludes pedestrian hazardous areas within the two mile walking radius. Pedestrian hazardous areas are generally identified as areas that are separated from the school by major physical barriers such as highways or rivers.

## Existing Conditions Mapping & Analysis

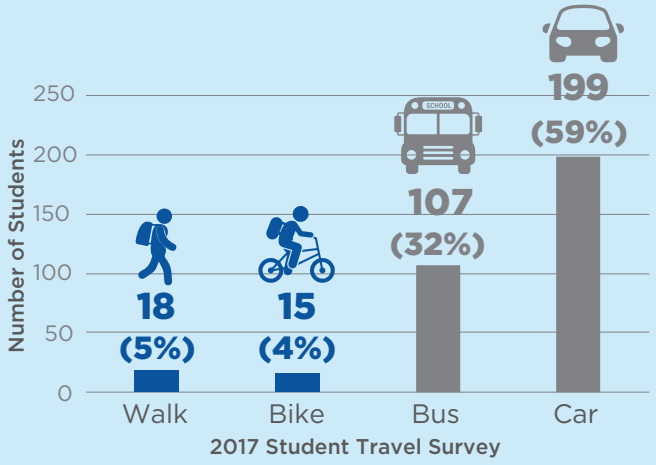
A series of maps were prepared to show the existing conditions within the Harbor City Elementary School study area including existing and proposed pedestrian and bicycle infrastructure, traffic data, crash data, and school circulation patterns. These maps were developed through GIS data collection, review of previous studies and plans, aerial satellite imagery, input from the TC, and observations from the field visit.

### Previous and Ongoing Studies

Sarno Road Corridor Study is a recently completed study that spans the study area. The Sarno Road Corridor Study was completed in 2018 by The City of Melbourne, Brevard County, FDOT and SCTPO and spans from Eau Gallie Boulevard to US 1. This study recommended short-term, medium-term, and long-term recommendations to improve pedestrian and bicycle facilities as well as to address safety issues, traffic operations, and transit movements along the corridor. Major recommendations that are relevant to the study area are summarized in **Figure 2.**

**Figure 2** is an info-graphic summarizing the main background information collected as part of the existing conditions analysis.

## Student Travel Modes (2017)




## Total Bicycle & Pedestrian Crashes within Study Area

**21** Pedestrian

**23** Bicycle

## School Aged Bicycle & Pedestrian Crashes within Study Area

**4** Pedestrian

- **4** Injury

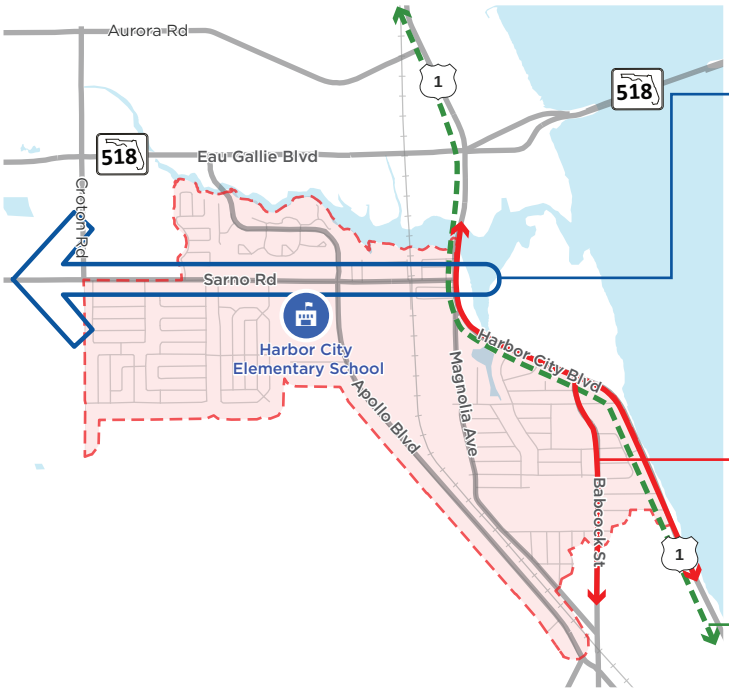
**3** Bicycle

- **2** Property Damage Only
- **1** Injury

2014 to 2018 Crashes from University of Florida's Signal Four Analytics Database

## Signals and Crossings within Study Area

- **11** Signalized Intersections
- **2** Unsignalized Marked Crosswalks Across Major Streets
- **2** Crossing Guards at Apollo Blvd. & Sarno Rd. Intersection




## Previous & Ongoing Plans

### Sarno Road Corridor Study (2018)

- Enhance the FEC railroad crossing to include pedestrian facilities on both the north and south side of Sarno Road.
- Reconstruct sidewalks from Wickham Road to US 1 to 8' where possible (both sides of roadway).
- Construct a five-lane urban roadway section from Croton Road to Apollo Boulevard.
- Develop a comprehensive landscaping plan.

### Bicycle & Pedestrian Master Plan (Ongoing)

- Bicycle Facilities and Sidewalks prioritized along US 1.
- Bicycle Facilities prioritized on Babcock Street.

### Showcase Trails Network

- Trail planned along US 1.

# Figure 2: Background Information

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School Routes Analysis

**Harbor City Elementary School**

## Existing and Planned Bicycle and Pedestrian Facilities

Existing and planned pedestrian and bicycle facilities including sidewalks, bike lanes, trails, crosswalks, signals, and crossing guard locations were mapped and analyzed. The datasets were mapped using GIS data provided by the City of Melbourne and SCTPO as well as utilizing aerial satellite imagery and field review observations.

Sarno Road has sidewalks on both sides from Croton Road to Apollo Boulevard and on the south side from Apollo Boulevard to US 1. The Sarno Road Corridor Study recommended to enhance the FEC railroad crossing to include pedestrian facilities on both the north and south side of Sarno Road. The study also proposed to reconstruct sidewalks from Wickham Road to US 1 to 8' on both sides of roadway as a long-term recommendation.

The neighborhoods directly to the west of Harbor City Elementary School have sidewalks on both sides of the roadways. Most of the other neighborhoods within the study area have large sidewalk gaps. There is a sidewalk along the west side of Apollo Road within the study area. The sidewalk is only present along the east side of Apollo Road from Sarno Road to Eau Gallie Boulevard.

The only bicycle facilities within the study area are located along Apollo Boulevard from Sarno Road to Eau Gallie Boulevard. Currently proposed bicycle facilities were mapped using recommendations from the SCTPO Bicycle and Pedestrian Master Plan. Bicycle facilities are proposed along US 1 from Sarno Road to the southern boundary of the study area and along Babcock Street within the study area.

Signalized intersections and marked crosswalks across major streets were mapped using data from aerial satellite imagery. Crossing guard information was provided by the City of Melbourne. The signalized intersections along Sarno Road have crosswalks for students to cross northbound and southbound across Sarno Road. Crossing guards are present at the intersection of Sarno Road and Apollo Boulevard. There is a midblock crossing located along Apollo Road 2,000 feet north of the intersection with Sarno Road.

There is a trail located between Apollo Boulevard and Sarno Road near Tortoise Cove. The Showcase Trails Network plans to create a trail along US 1.

**Figure 3** shows the existing and planned bicycle and pedestrian facilities within and around the study area. **Figure 4** shows the existing planned bicycle and pedestrian facilities within the immediate context surrounding the school campus.


** Note: Existing Bicycle Facilities include marked bike lanes, buffered bike lanes, 2-way cycle tracks, and ≥5' wide shoulders. Draft Bicycle and Pedestrian Master Plan does not identify specific bicycle facility types for Prioritized Bicycle Facilities.*

**Figure 3: Existing and Planned Bicycle and Pedestrian Facilities**

School Routes Analysis

# Harbor City Elementary School

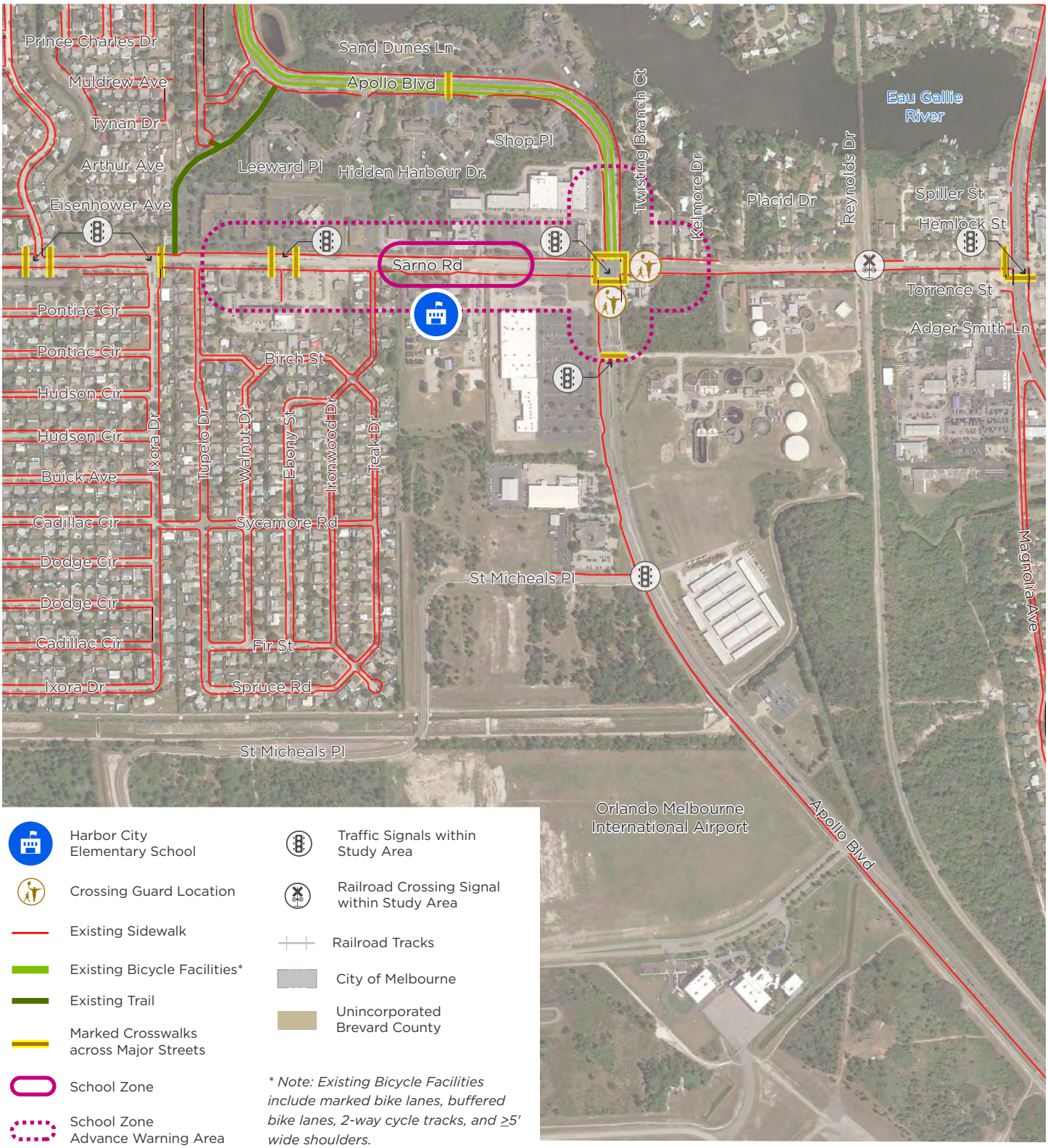


**Figure 4: Existing Conditions: School Context Aerial Map**

School Routes Analysis

# Harbor City Elementary School

## Existing Conditions Traffic Data

Posted speeds, annual average daily traffic (AADT), and school zones were mapped as part of existing conditions traffic data analysis. Speed limit information was mapped using data from FDOT and Open Streets Map. The speed limit along Sarno Road directly in front of the school entrance is 40 MPH. AADT information was mapped using data from SCTPO's 2018 State of the System (SOS) and FDOT. Traffic volume along Sarno Road in front of the school ranges from 20,000 to 40,000 vehicles per day.

School zone and school zone advance warning areas were mapped using data from aerial satellite imagery and field review observations. The only school zone within the study area is located along Sarno Road at the entrance to the school. The intersection of Sarno Road and Apollo Boulevard contains a school zone advance warning area but does not require vehicles to slow down with a regulatory school zone.

**Figure 5** shows the existing conditions of traffic data.

## School Campus Circulation

Circulation patterns were gathered during the school coordination meeting and field review. There are four entrances to the school campus located along Sarno Road. The eastern most entrance is used by bicyclists and has a bike rack near the entrance to the school. The second eastern most entrance to the school is primarily used for the drop-off/pick-up of Grade 4 to Grade 6 students. This entrance is also used for the school bus entry and exit. Students walking to school prior to 7:30 AM also enter the school campus along this loop, since the walker's gate is not open before 7:30 AM.

The second western most entrance to the school is primarily used for the drop-off/pick-up of kindergarten to Grade 3 students. A visitor and staff parking lot is also located at the south end of this loop. The western most entrance serves a parent and staff parking lot. The exit to this loop is used by pedestrians and bicyclists to enter and exit the school and has a bike rack along the sidewalk. Students walk along a fenced walkway then through the parking lot to a marked crosswalk to enter the school.

**Figure 6** shows various circulation patterns within the school campus.

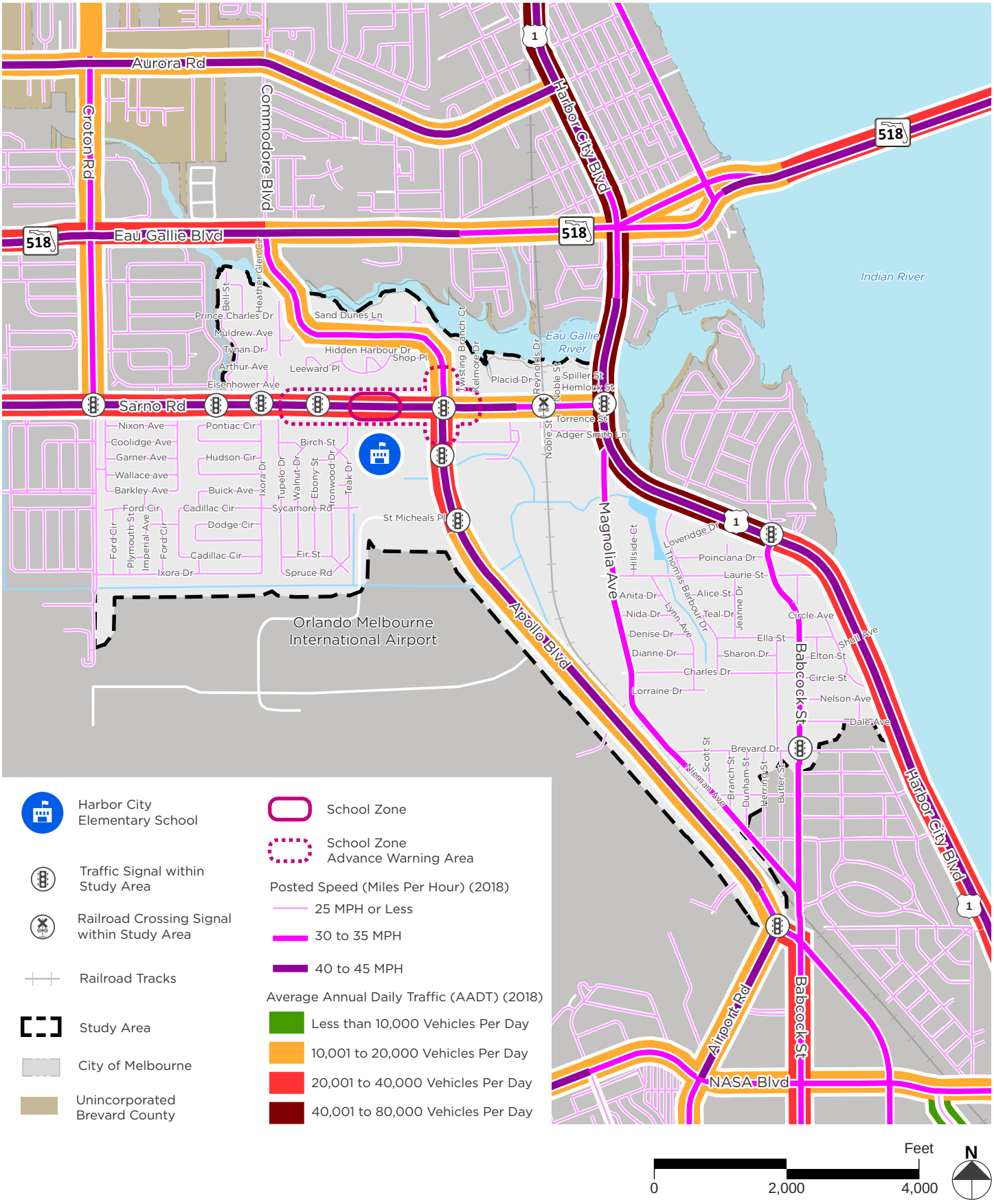


**Figure 5: Existing Conditions Traffic Data**

School Routes Analysis

# Harbor City Elementary School

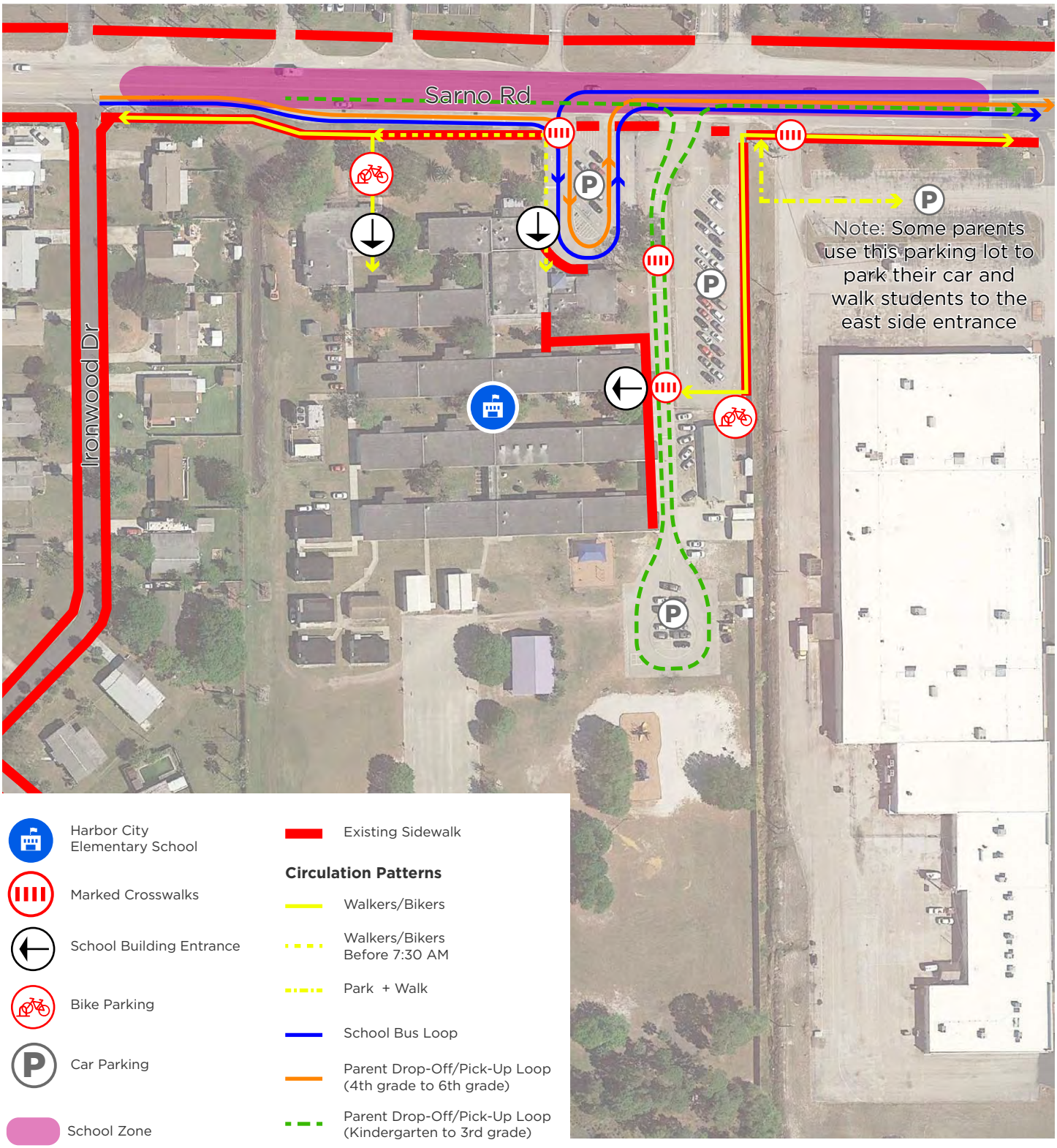


**Figure 6: Existing School Circulation Map**

School Routes Analysis

# Harbor City Elementary School

## School Student & Parent Survey Summary

The SCTPO conducts student and parent surveys alternating every other year, with the latest Student Travel Mode Survey conducted in 2017 and Parent Survey conducted in 2018, to assess how students get to school and what factors affect parent's decisions to allow or not allow their child to walk or bike to school. This section summarizes the results of these surveys for Harbor City Elementary School. These surveys are conducted once every two years and provide a snapshot of conditions when the respondents fill out the survey. The survey results may not truly represent the daily average. Variables such as weather, day of week, time of year when the survey is taken, all play into the results of these surveys.

### Student Travel Mode Survey

Students at Harbor City Elementary School were surveyed asking how they traveled to and from school.

**Figure 7** shows the percentage of students walking or biking to school from 2000 to 2017. **Figure 8** shows the total number of students walking or biking to school from 2000 to 2017. **Figure 9** shows the percentage of students walking or biking to school in 2017 in the AM and PM. **Figure 10** shows the total number of students walking or biking to school in 2017 in the AM and PM.

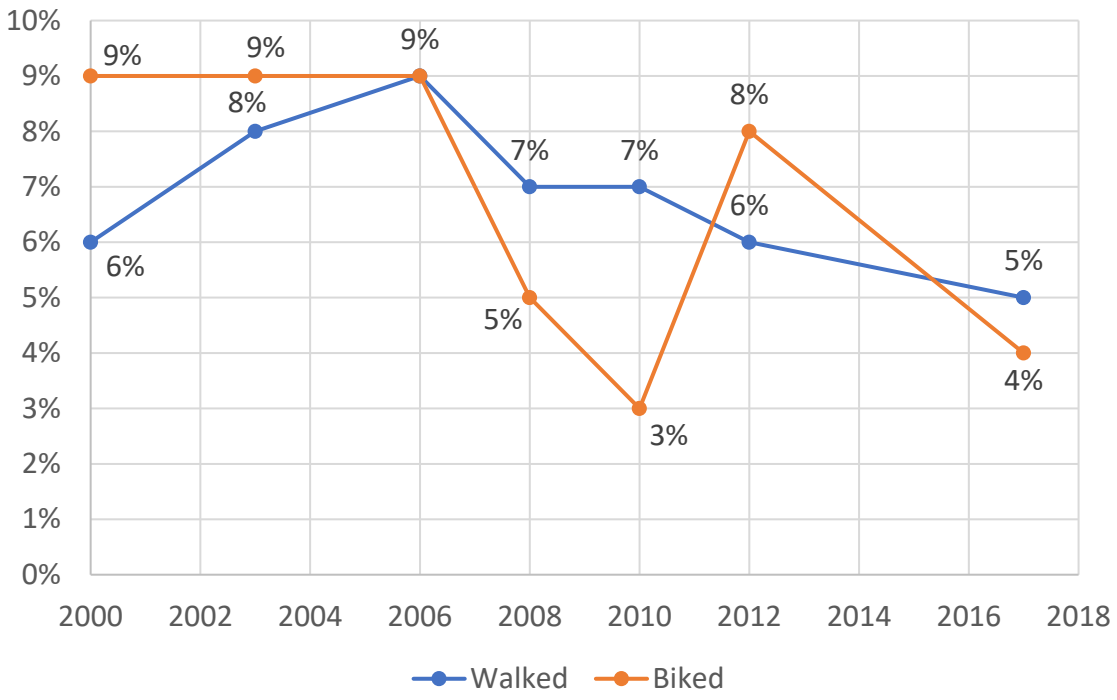


*Figure 7: Percentage of Students Walking or Biking to School from 2000 to 2017*

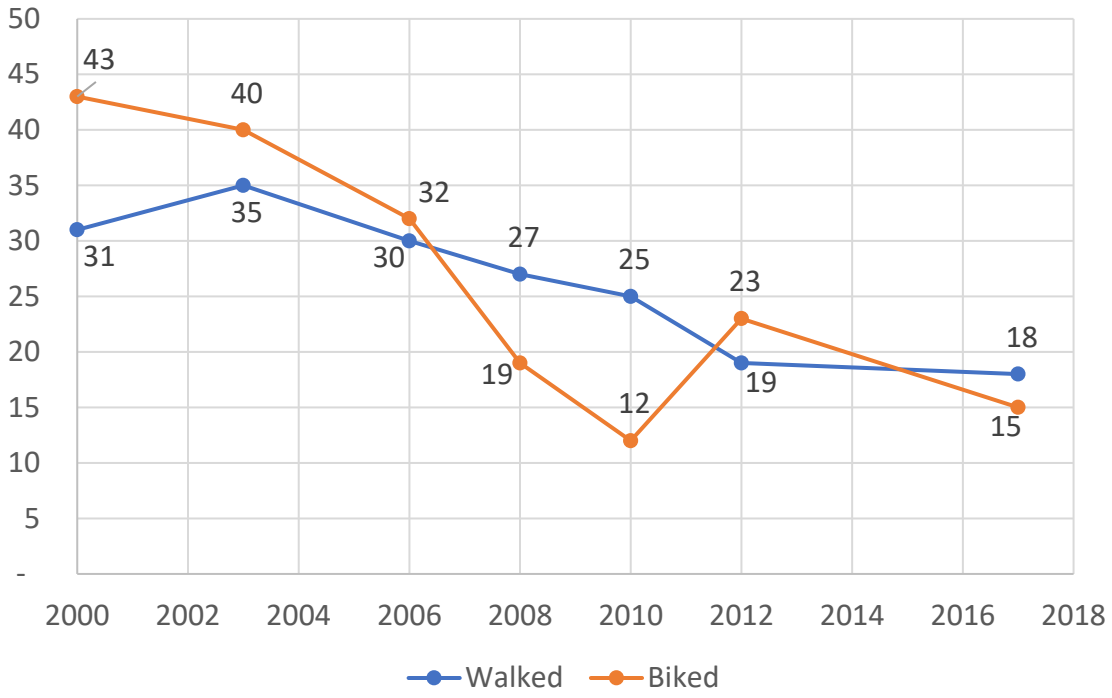


***Figure 8: Total Number of Students Walking or Biking to School from 2000 to 2017***

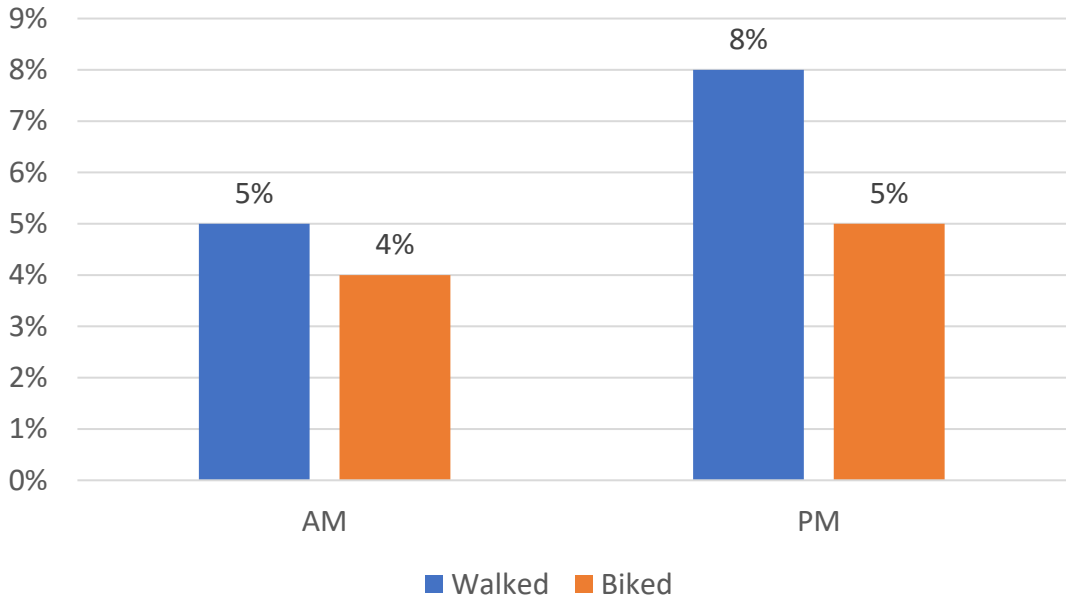


***Figure 9: Percentage of Students Walking or Biking to School in 2017 in AM and PM***

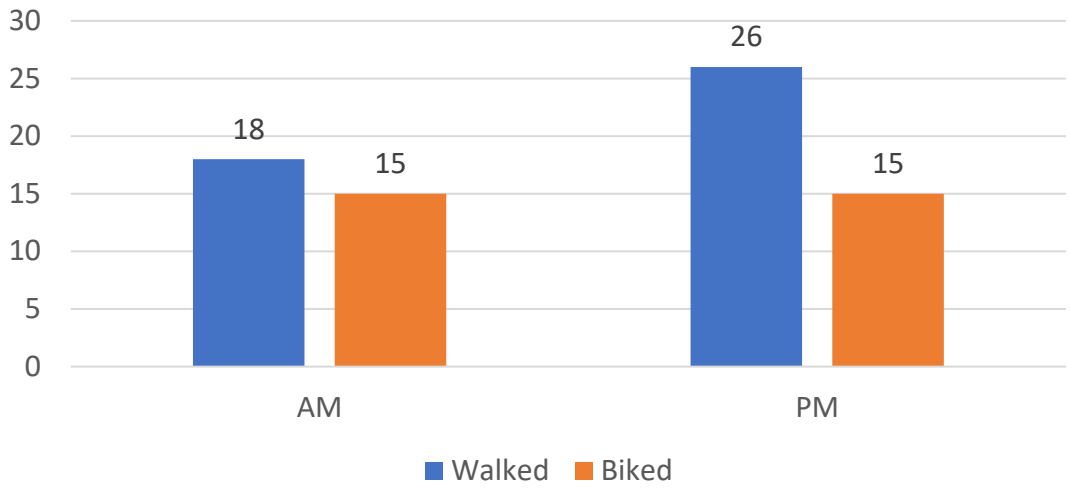


***Figure 10: Total Number of Students Walking or Biking to School in 2017 in AM and PM***

Main takeaways from the Student Travel Mode Survey:

- Based on the survey data from year 2000 to 2017, on average about 14 percent of total students travel by walking (seven percent) or biking (seven percent).
- The total number of students seen walking or biking to school has decreased from 2000 to 2017 which is likely due to the total number of students that answered the survey also decreased from 2000 to 2017.
- On average, more students walk or bike to school in the afternoon than in the morning. Most students either travel by car (59 percent) or bus (32 percent) to school as shown in **Figure 2**.

## Parent Survey

The following data shows the results from surveys taken from parents with students attending 86 different schools in the area. Data was used from all the schools in the survey because there was not enough data from each individual school to draw reasonable conclusions.

**Figure 11** shows issues reported to affect the decision to allow a child to walk or bike to/from school by parents.

**Figure 12** shows the parent's opinions about how healthy walking and biking to/from school is for their child.

**Figure 13** parent's opinions about how much their child's school encourages or discourages walking and biking to/from school.

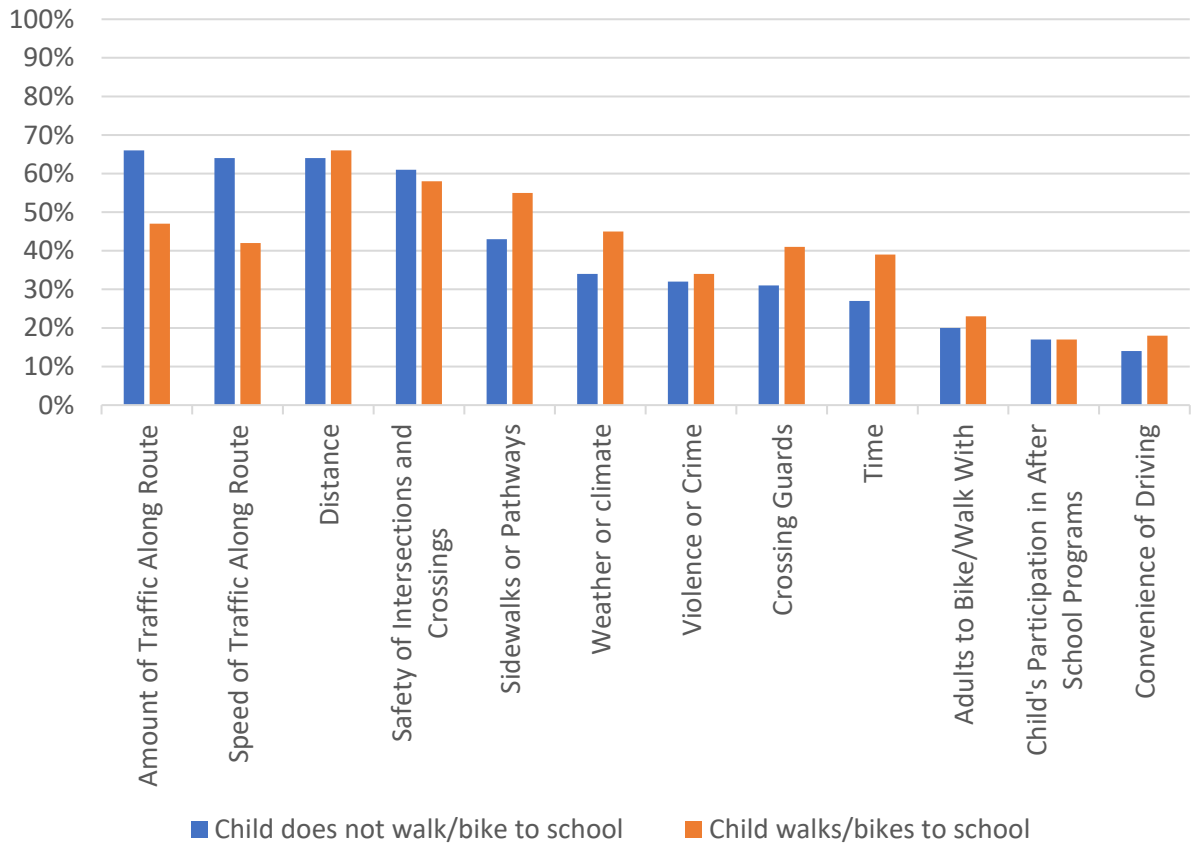


***Figure 11: Issues Reported to Affect the Decision to Allow a Child to Walk or Bike to/from School by Parents (Based on 2018 Survey)***

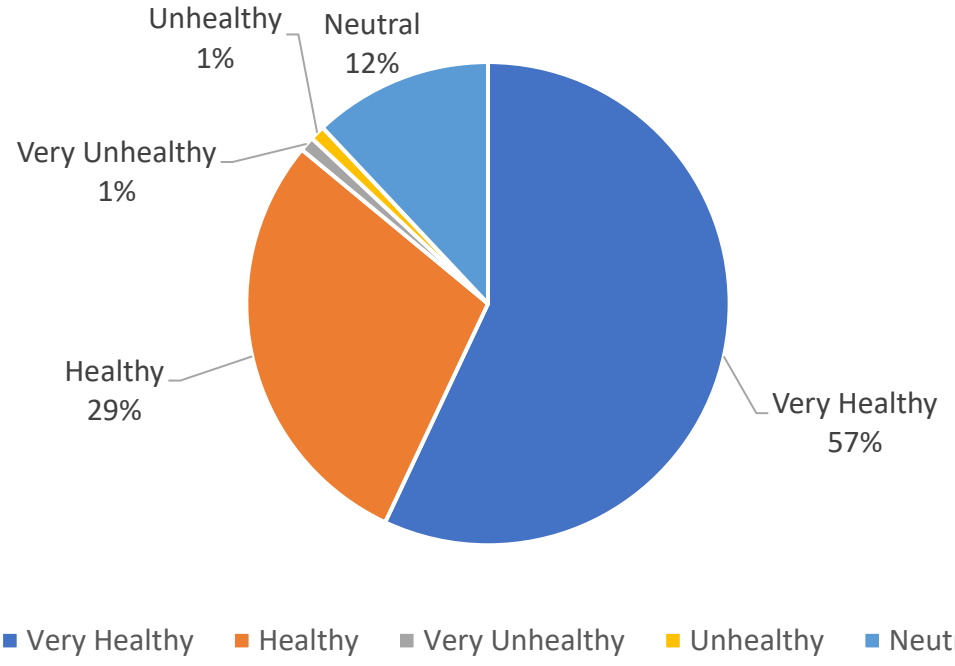


***Figure 12: Parent's Opinions about How Healthy Walking and Biking to/from School is for Their Child (Based on 2018 Survey)***

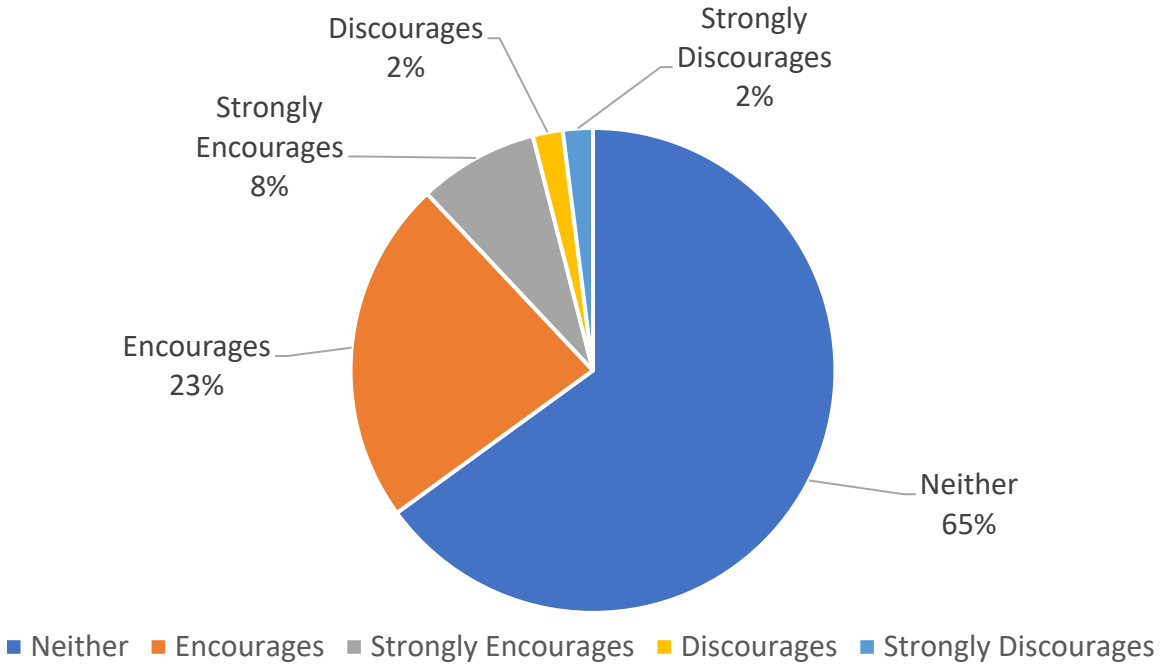


***Figure 13: Parent's Opinions about How Much their Child's School Encourages or Discourages Walking and Biking to/from School (Based on 2018 Survey)***

Main takeaways from the Parent Survey:

- The most common issues that affect both parents of children who already bike or walk to school and parents' of children that do not currently walk or bike to school decision to allow their child to walk or bike to school are:
    - The amount of traffic along the route
    - The speed of traffic along the route
    - Distance
    - The safety of intersections and crossings
    - Sidewalks or pathways
- Most parents think that walking or biking to school is very healthy for their child but think their child's school neither encourages nor discourages children to walk or bike to school.

For full or updated student or parent surveys please contact SCTPO.

## Crash Data Analysis

Crash records were obtained for the Harbor City Elementary School study area for the most recent five-year period on record (2014 through 2018) from the University of Florida's Signal Four Analytics Database. This section summarizes both the school aged and non-school aged pedestrian/bicycle crashes in the Harbor City Elementary School study area.

### Pedestrian/Bicycle Crash Statistics

There were 44 total pedestrian and bicycle crashes within the study area (21 pedestrian and 23 bicycle). Nine of the crashes were property damage only, 33 of the crashes resulted in injury, and two crashes resulted in a fatality. Sixty six percent of crashes occurred during the day and 96 percent of crashes occurred under dry conditions. Alcohol and/or drug involved crashes accounted for nine percent of reported crashes. The reported crashes are displayed by different measures of time (year, month, day, and hour) in **Figure 14**, **Figure 15**, **Figure 16**, and **Figure 17**.

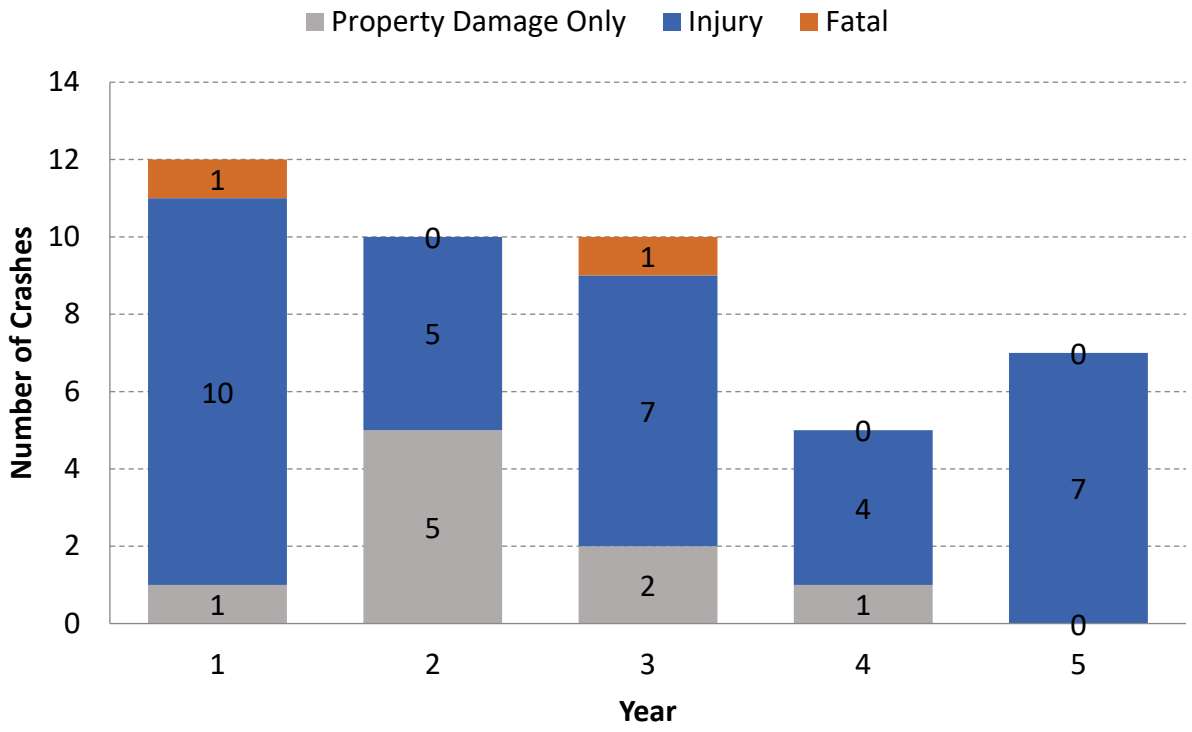


*Figure 14: Crashes by Year and Severity*

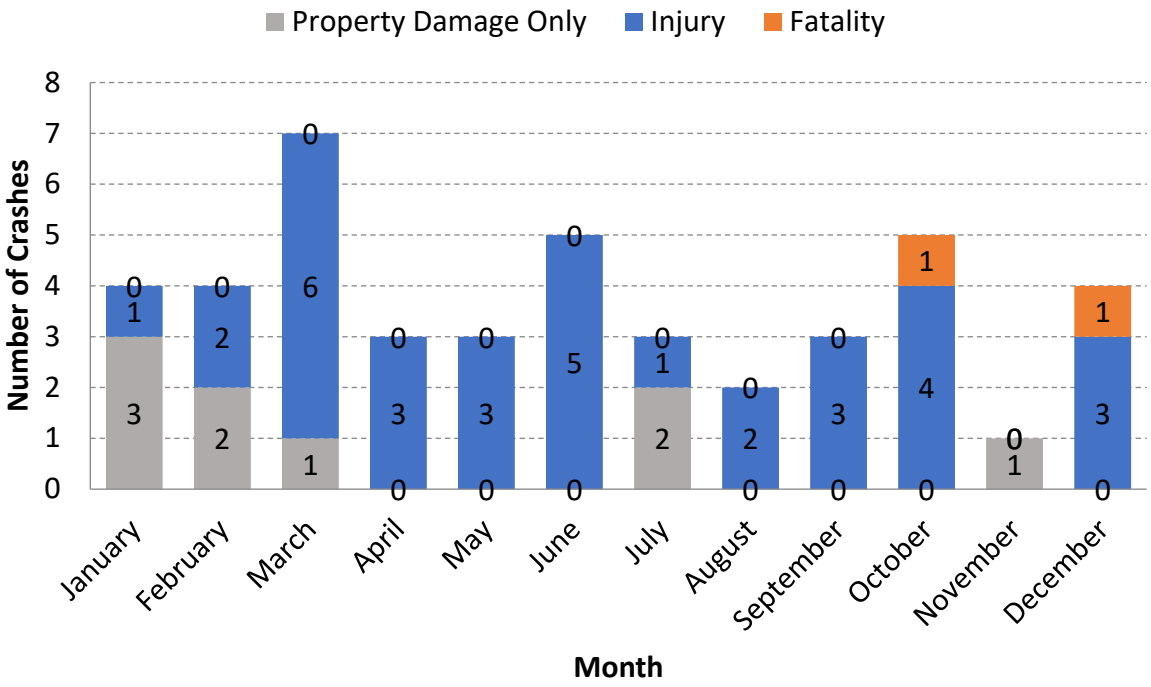


*Figure 15: Crashes by Month and Severity*

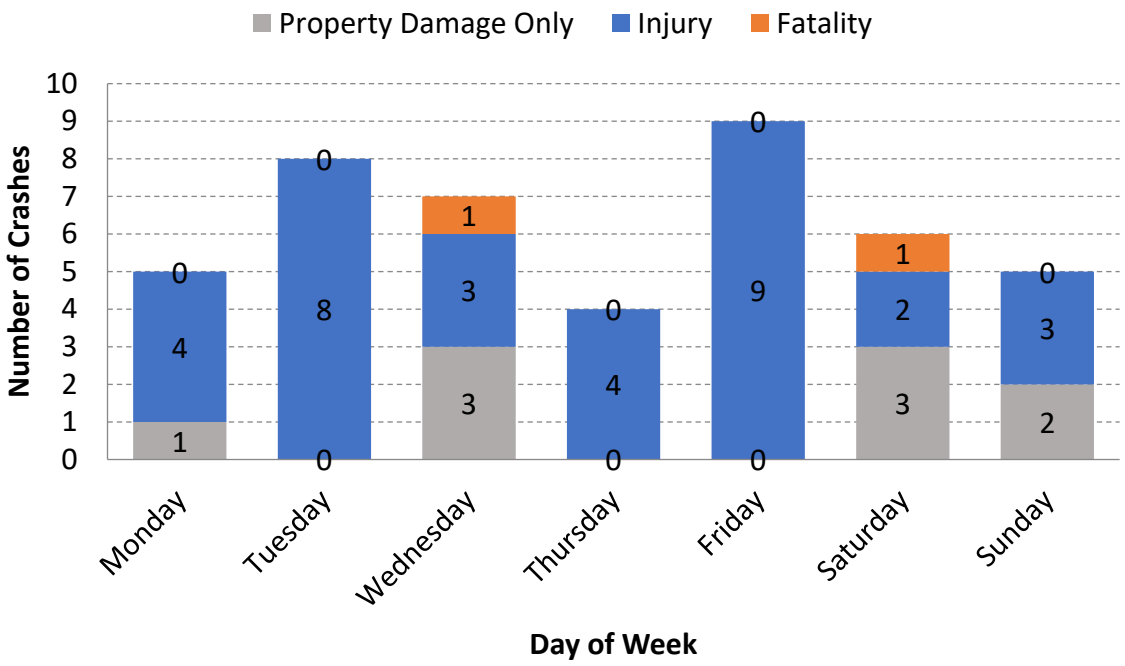


*Figure 16: Crashes by Day of Week and Severity*

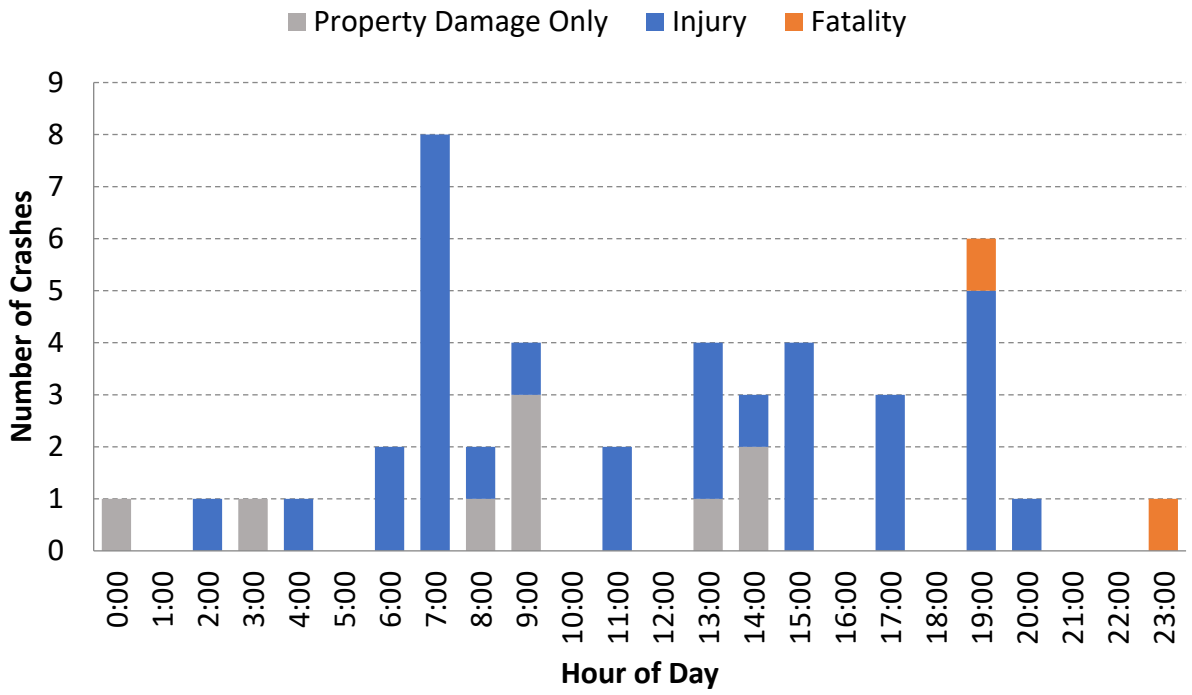


*Figure 17: Crashes by Hour of Day and Severity*

There was an average of nine crashes per year from 2014 to 2018. The most crashes occurred in the month of March (seven) and Friday was the most common day when crashes occurred (nine). By time of day, the highest crash hour was from 7 AM to 8 AM (eight).

## School Aged Pedestrian/Bicycle Crash Statistics

There were seven total school aged pedestrian and bicycle crashes within the study area (four pedestrian and three bicycle). Two of the crashes were property damage only and five crashes resulted in injury. All the reported crashes occurred under dry conditions during the day. **Figure 18** maps the locations of the school-aged pedestrian and bicycle crashes. The reported crashes are displayed by different measures of time (year, month, day, and hour) in **Figure 19**, **Figure 20**, **Figure 21,** and **Figure 22**.

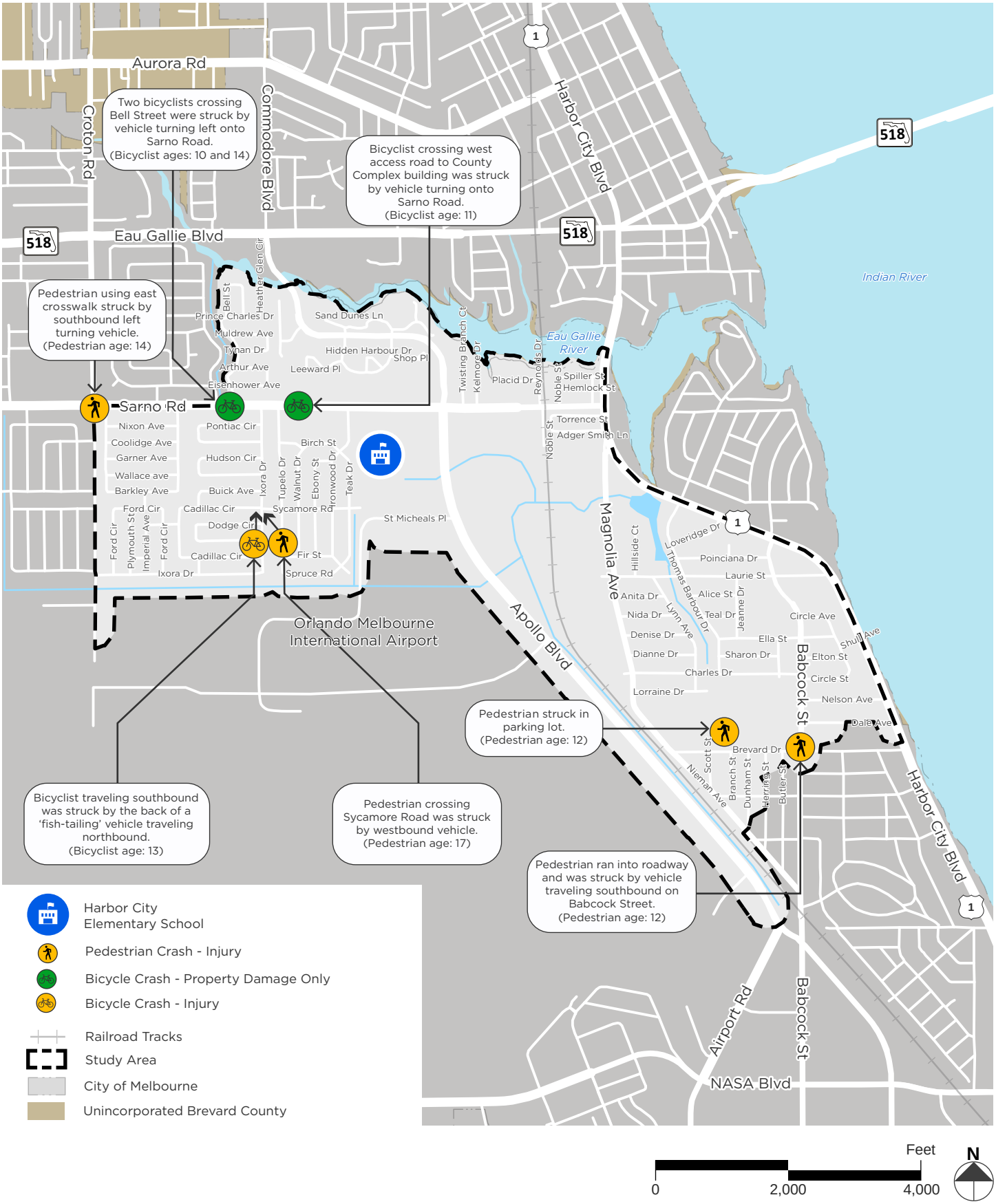


**Figure 18: Bicycle and Pedestrian Crashes (2014 - 2018)**

School Routes Analysis

# Harbor City Elementary School

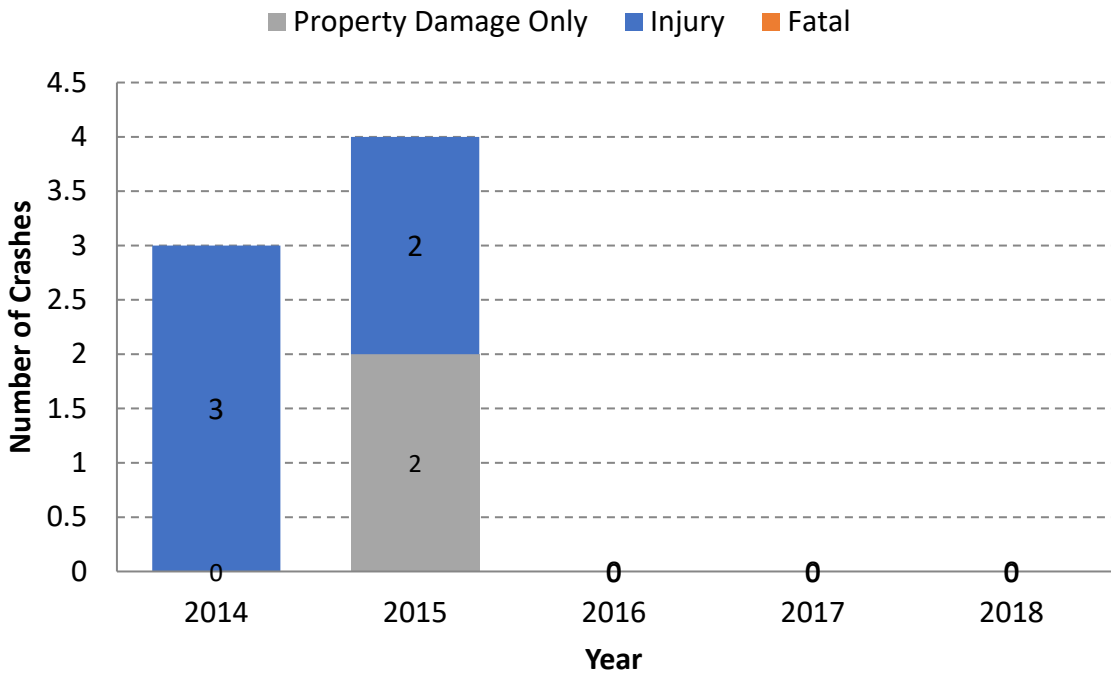


*Figure 19: School-Aged Crashes by Year and Severity*

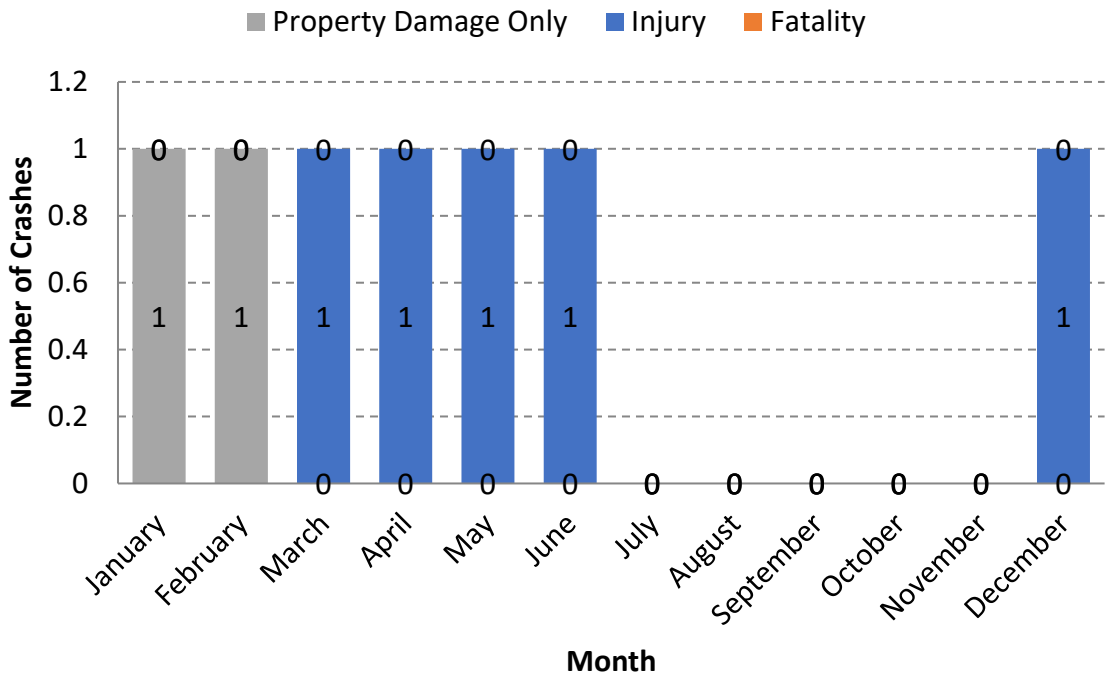


*Figure 20: School-Aged Crashes by Month and Severity*

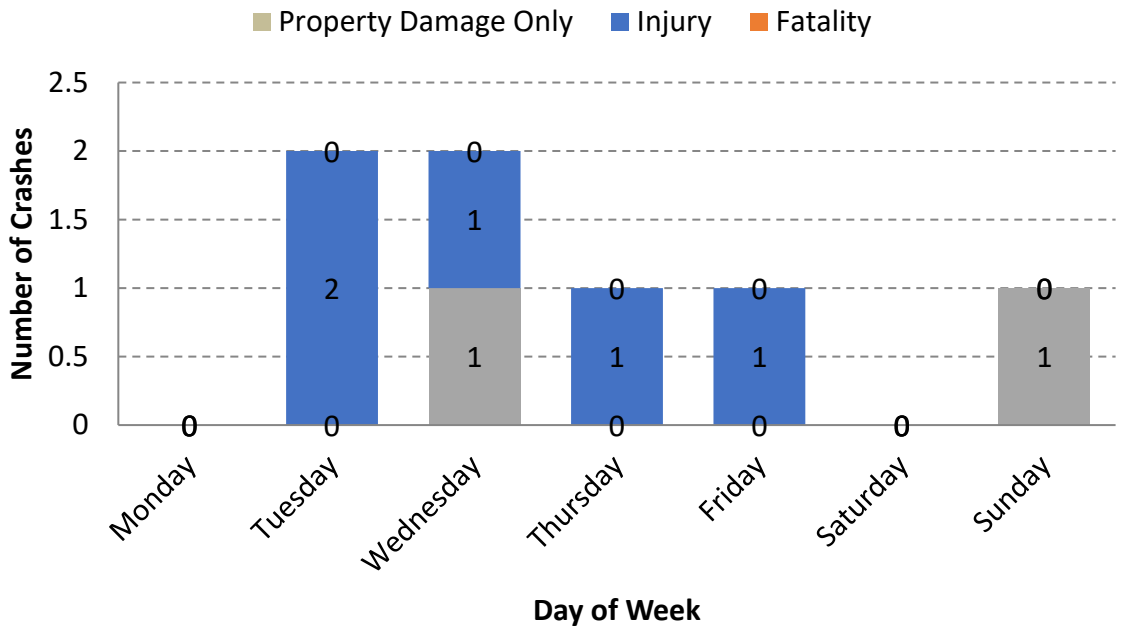


*Figure 21: School-Aged Crashes by Day of Week and Severity*

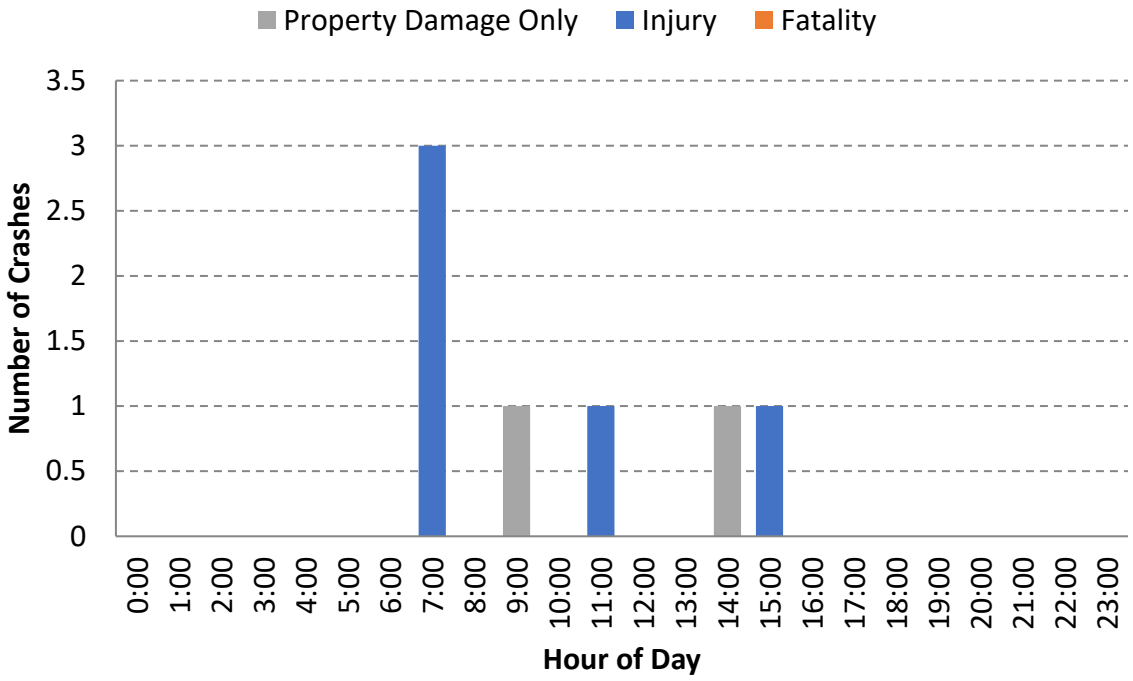


*Figure 22: School-Aged Crashes by Hour of Day and Severity*

The only reported school aged pedestrian and bicycle crashes occurred in 2014 and 2015. There was an average of one crash per month from December to June with no crashes from July to November. Six of the seven crashes occurred during the week, with four occurring on Tuesday (two) and Wednesday (two). By time of day, the highest crash hour was from 7 AM to 8 AM (three).

A few other crash statistics worthy to note:

- Alcohol and/or drug involvement did not account for any of the crashes; and
- Three crashes involved a vehicle making a left or right turn at an intersection (based on the crash reports).

## School-Aged Crash Report Summaries

### *Pedestrian Crashes:*

1. Crash Number: 84290152
    - On April 8, 2014 at 3:44 PM, a crash involving a pedestrian occurred at the school pickup zone at West Shore Junior & Senior High School. The pedestrian was walking in front of a stopped vehicle when the driver's foot slipped from the brake to the accelerator. The vehicle then struck the pedestrian and the car in front of them. The crash resulted in an incapacitating injury. The crash occurred under dry conditions during daylight hours.
2. Crash Number: 84797364
    - On June 18, 2014 at 11:40 AM, a crash involving a pedestrian occurred southbound on Babcock Street just north of Wildcat Alley Drive. The pedestrian's sister started to walk into the street and the pedestrian ran after their sister. This resulted in the pedestrian getting struck by oncoming traffic. The crash resulted in an incapacitating injury. The crash occurred under dry conditions during daylight hours.
3. Crash Number: 84798756
    - On December 2, 2014 at 7:52 AM, a crash involving a pedestrian occurred at the intersection of Croton Road and Sarno Road. The pedestrian was traveling along the east crosswalk when a vehicle making a southbound left turn stuck the pedestrian. The crash resulted in non-incapacitating injuries. The crash occurred under dry conditions during the day.
4. Crash Number: 84799600
    - On March 5, 2015 at 7:36 AM, a crash involving a pedestrian occurred at the intersection of Ixora Drive and Sycamore Road. The pedestrian was traveling along the east crosswalk when a vehicle traveling west on Sycamore Road struck the

pedestrian. The crash resulted in a non-incapacitating injury. The crash occurred under dry conditions during the day.

*Bicycle Crashes:*

1. Crash Number: 84799144
    - On January 14, 2015 at 2:50 PM, a crash involving a bicyclist occurred at the intersection of Sarno Road and the west access road for the County Complex building. The bicyclist was traveling westbound on the southern sidewalk of Sarno Road and was struck by a vehicle turning onto Sarno Road. The crash did not result in any injuries according to the crash report. The crash occurred under dry conditions during the day.
2. Crash Number: 84799362
    - On February 8, 2015 at 9:20 AM, a crash involving two bicyclists occurred at the intersection of Bell Street and Sarno Road. The bicyclists were traveling east on Sarno Road. The driver was traveling south on Bell Street and put up her hand to block the sun in her eyes. The bicyclists thought that the driver was waving them to cross. The driver then attempted to make a left turn on to Sarno Road, striking the two bicyclists. The crash did not result in any injuries according to the crash report. The crash occurred under dry conditions during the day.
3. Crash Number: 86003808
    - On May 29, 2015 at 7:15 AM, a crash involving a bicyclist occurred at the intersection of Ixora Drive and Cadillac Circle. The bicyclist was traveling southbound on Ixora Road and was struck by the back of a “fish-tailing” vehicle traveling northbound. The crash resulted in a non-incapacitating injury. The crash occurred under dry conditions during the day.

## Non-School Aged Pedestrian/Bicycle Crash Statistics

There were 37 total non-school aged pedestrian and bicycle crashes within the study area (17 pedestrian and 20 bicycle). Sixty percent of the crashes occurred in daylight conditions, and 95 percent occurred with dry roadway conditions. The reported crashes are displayed by different measures of time (year, month, day, and hour) in **Figure 23**, **Figure 24**, **Figure 25,** and **Figure 26**.

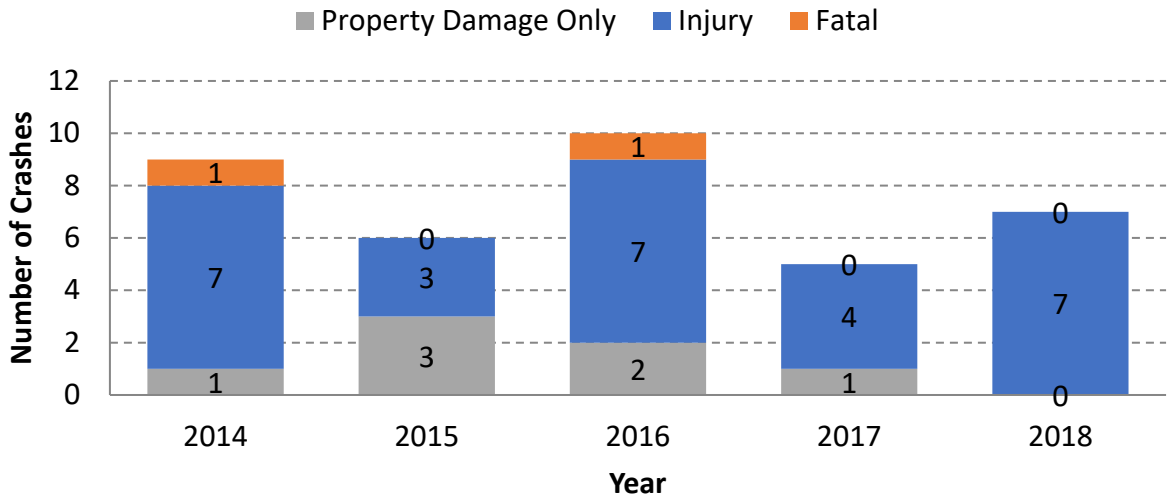


*Figure 23: Non-School Aged Crashes by Year and Severity*

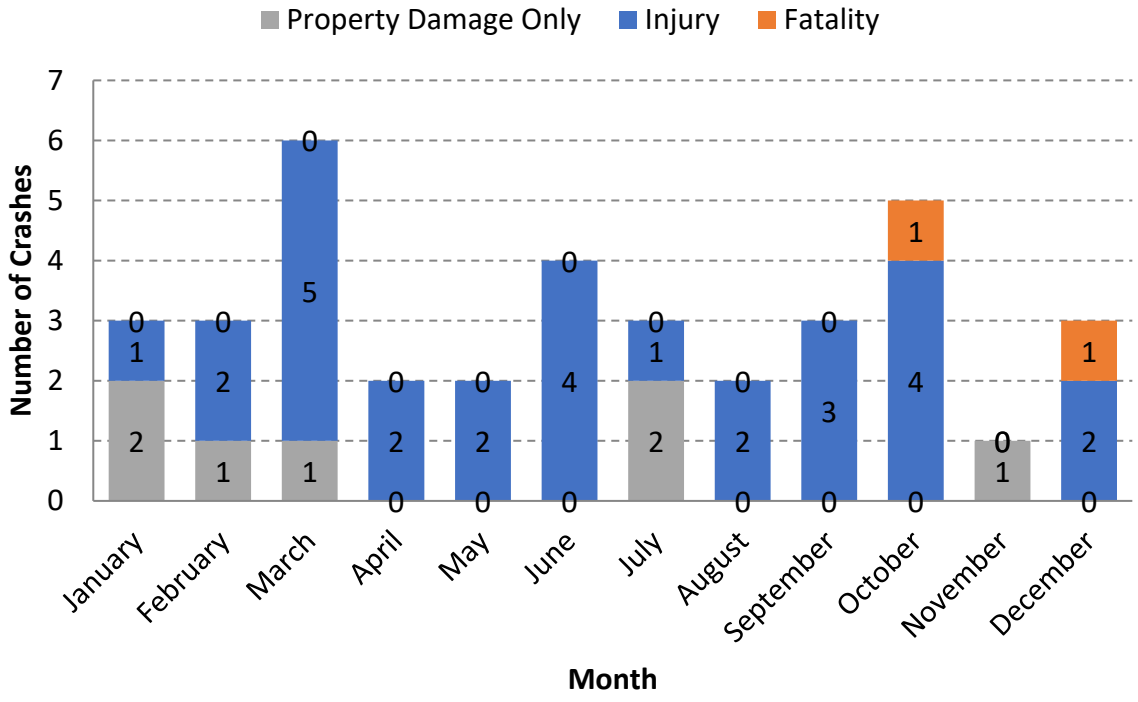


*Figure 24: Non-School Aged Crashes by Month and Severity*

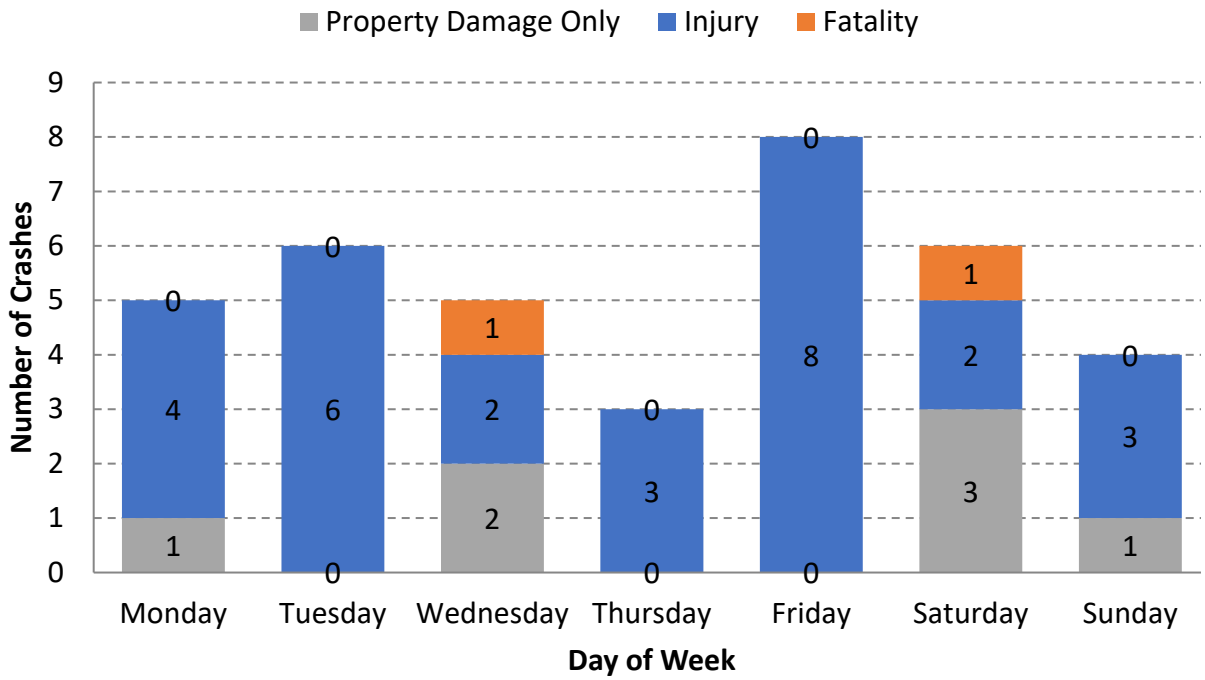


*Figure 25: Non-School Aged Crashes by Day of Week and Severity*

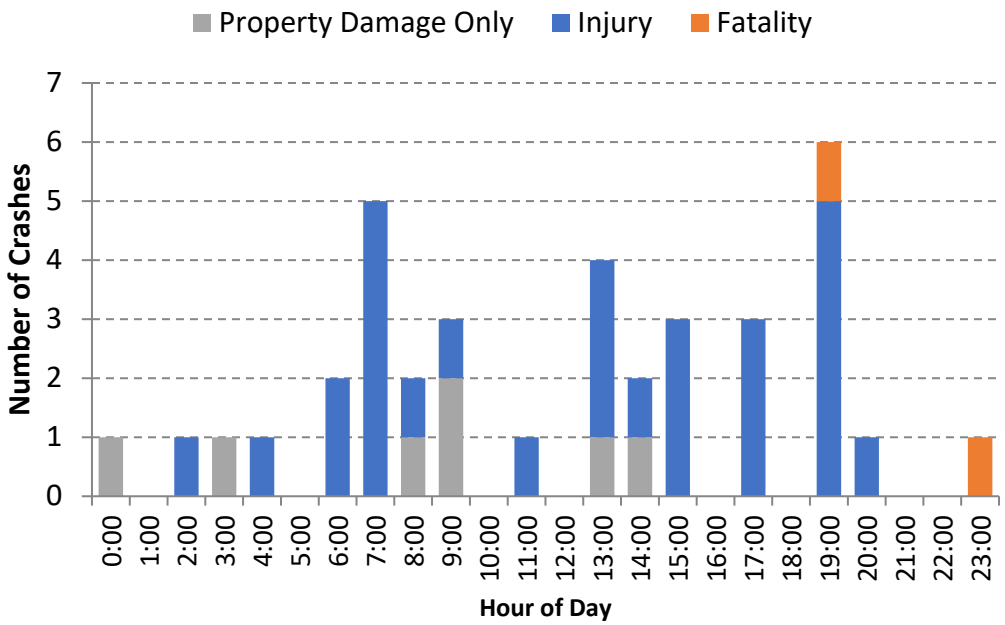


*Figure 26: Non-School Aged Crashes by Hour of Day and Severity*

On average there were seven crashes per year from 2014 to 2018. There was one fatality in 2014 and another in 2016. March was the highest reported crash month with six crashes. Twenty-two percent of crashes occurred on a Friday. By time of day, the two highest crash hours were from 7 AM to 8 AM (five) and 7 PM to 8 PM (six total crashes with one fatality). Alcohol and/or drug involved accounted for 11 percent of crashes.

## Non School-Aged Fatal Crash Report Summaries

1. Crash Number: 84798270
    - On October 4, 2014 at 11:00 PM, a crash involving a pedestrian occurred at the intersection of Sarno Road and the entrance to the County Complex building. The pedestrian was traveling along the west crosswalk when a vehicle traveling westbound on Sarno Road struck the pedestrian. The crash resulted in a pedestrian fatality. The crash occurred under dry conditions at night.
2. Crash Number: 86792342
    - On December 7, 2016 at 7:38 PM, a crash involving a pedestrian occurred at the intersection of Apollo Boulevard and the entrance to the water treatment plant. The pedestrian was traveling along the southern leg of the intersection when a vehicle traveling northbound on Apollo Boulevard struck the pedestrian causing him to fall in the road. Another vehicle traveling northbound on Apollo Boulevard then ran over the fallen pedestrian. The crash resulted in a pedestrian fatality. The crash occurred under dry conditions at night.

## Comparison between School Aged and Non-School Aged Pedestrian/Bicycle Crash Statistics

**Figure 27**, **Figure 28**, **Figure 29**, and **Figure 30** show a comparison of the number of school aged and non-school aged pedestrian and bicycle crashes by different measures (year, month, day, and hour).

There were more non-school aged crashes than school aged crashes from 2014 to 2018. One school aged crash occurred per month from December to June and non-school aged crashes occurred during every month of the year. Most school aged crashes occurred on Tuesday and Wednesday (two) while most non-school aged crashes occurred on Friday (eight). By time of day, most school aged crashes occurred from 7 AM to 8 AM (three) while most non-school aged crashes occurred from 7 PM to 8 PM (six).

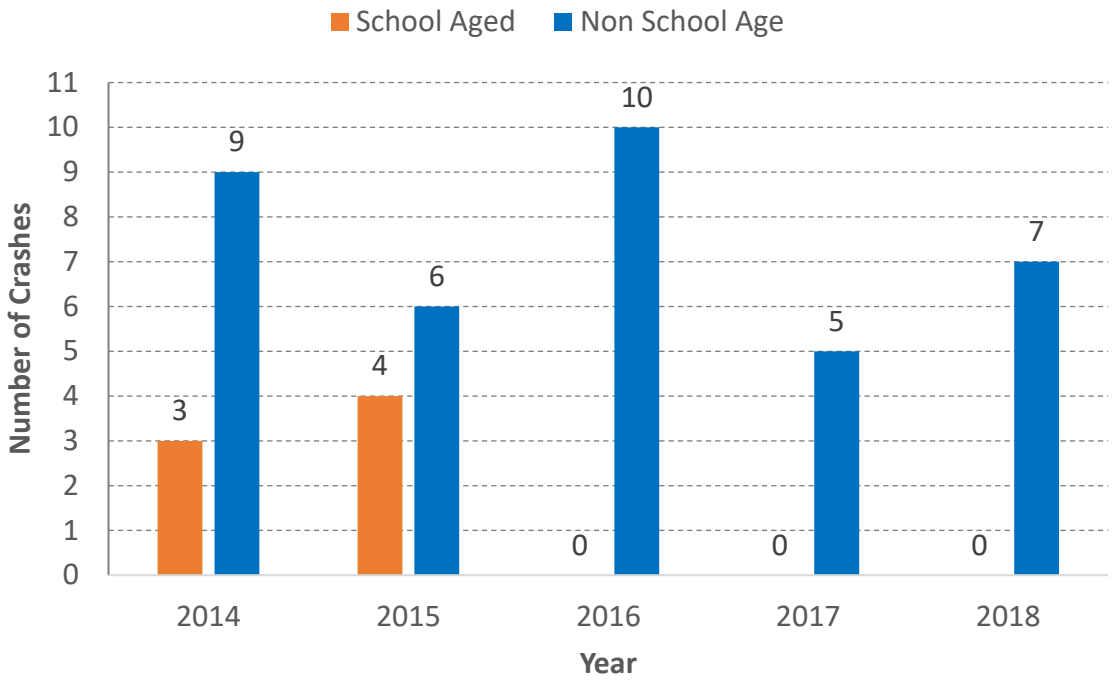


*Figure 27: Comparison of School Aged and Non-School Aged Crashes by Year*

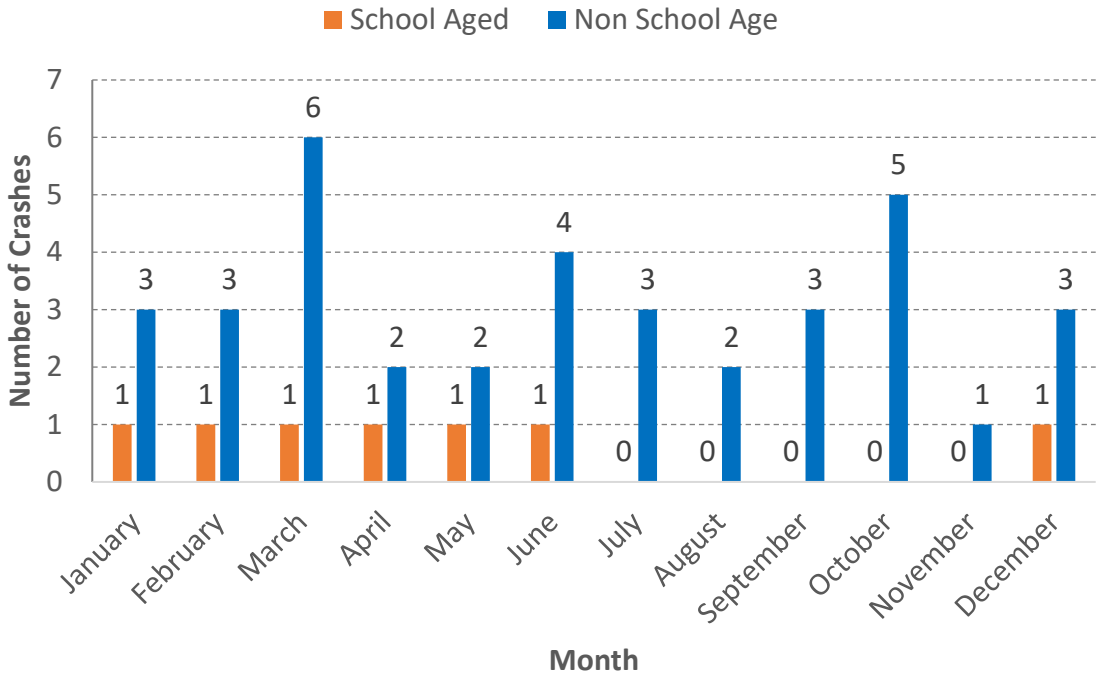


*Figure 28: Comparison of School Aged and Non-School Aged Crashes by Month*

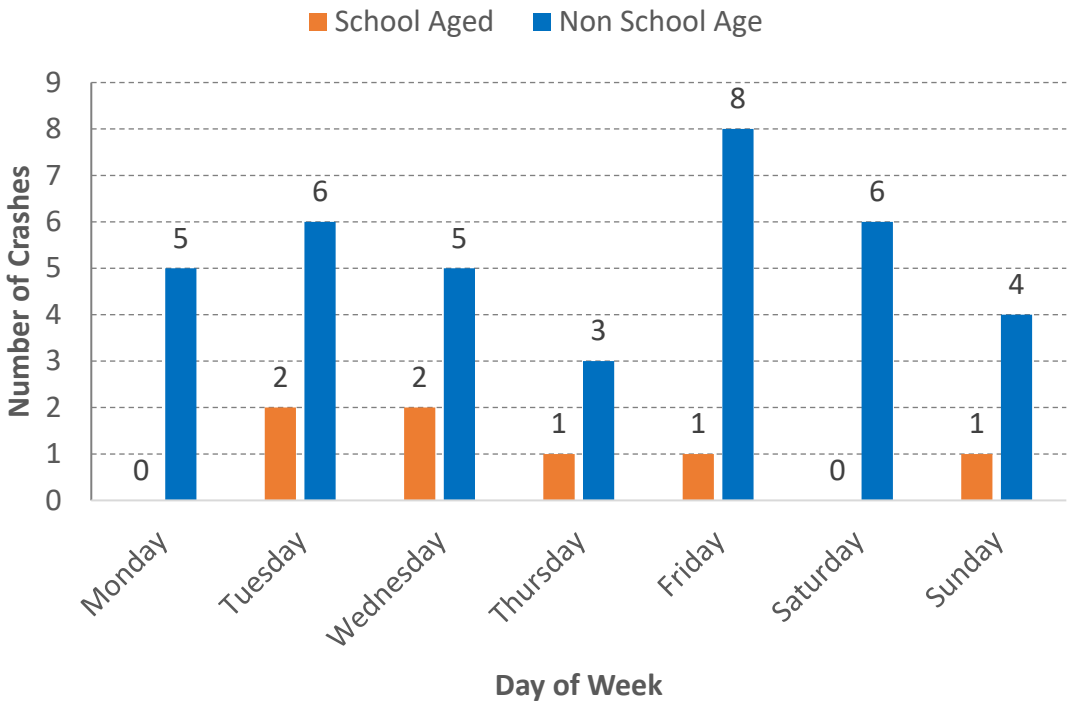


***Figure 29: Comparison of School Aged and Non-School Aged Crashes by Day of Week***

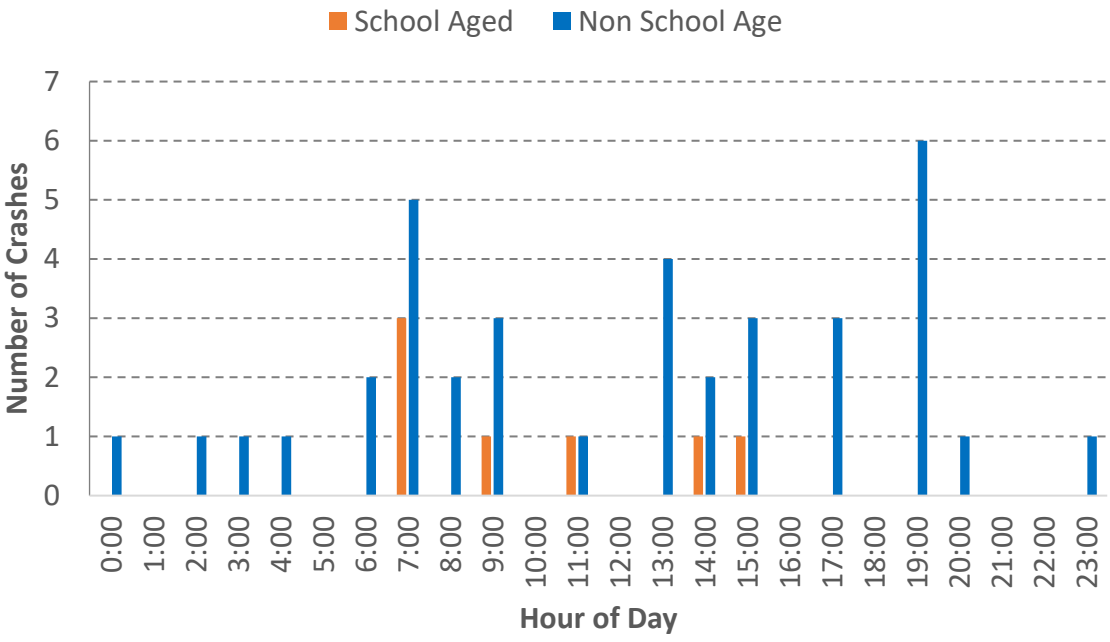


***Figure 30: Comparison of School Aged and Non-School Aged Crashes by Hour of Day***

# School Coordination Meeting

A coordination meeting was held on October 2, 2019 to bring stakeholders together and discuss issues and opportunities related to students walking and biking to the school. Members from Brevard County Schools, City of Melbourne, FDOT, SCTPO, KAI, and Harbor City Elementary School were present at this meeting. Notes from this meeting are summarized below.

## General Notes

Sarah Kraum began the meeting with a short background about the project and initiating introductions. After brief introductions by the attendees, Aditya Inamdar began the discussion with an overview of the project as well as work conducted to date. He briefly introduced the meeting materials included in the attendee handout package. The materials shared with attendees includes the following documents:

- Summary Infographic that included:
    - Student travel mode split based on the Student Travel Survey
    - Pedestrian and bicycle crash summary
    - Information regarding signals and crossings with the study area
    - Summary of previous and ongoing plans within the study area
- Map showing existing and planned bicycle and pedestrian facilities
- Map showing existing conditions traffic data
- Map showing school-aged bicycle and pedestrian crashes (2014 - 2018)

The following section summarizes the discussions during and after the group discussion.

## School Timings

- The school hours are as follows:
    - 8:00 AM to 2:30 PM - Monday through Thursday
    - 8:00 AM to 1:15 PM - Friday
- The peak period of students arriving in the morning is 7:30 AM to 8:00 AM
- Parents begin to queue around 1:15 PM for afternoon pick-up even though the dismissal time is 2:30 PM.

## School Entrances and Circulation

- All entrances to the school campus are on Sarno Road.
- There are five one-way driveways close to each other within 220 feet of school frontage on Sarno Road. Two driveways (one entrance and one egress) serve a 12-space staff parking lot. This lot also functions as a drop-off/pick-up loop around the parking spaces. This loop is in front of the main school entrance and is used by school buses as well as

parent drop-off/pick-up for Grade 4 to Grade 6 students. The egress driveway has left-turn restrictions and only allows right turns on Sarno Road.

- Another set of two driveways (one entrance and one egress) serves the parent drop-off/pick-up loop for kindergarten to Grade 3 students. Students are dropped-off and picked-up at the side school entrance. This same entrance driveway is also used to access 30 space parking lot that is adjacent to the drop-off/pick-up loop.
- The easternmost driveway is a one-way egress driveway that is used by the parking lot to exit the school campus.
- There are two separate circulation patterns for students walking or biking to/from the school.
    - A separate entrance gate is located on Sarno Road, west of the driveways for students walking or biking from the west side of the school. The fenced secure bicycle parking area is located near this entrance.
    - Students walking or biking from the east side use a fenced walkway along the 30 space parking lot to access the side entrance that is used by kindergarten to Grade 3 students that are dropped-off or picked-up by parents in the drop-off/pick-up loop.
    - Many parents park in the adjacent commercial shopping center parking lot and walk their kids along the walkway.
- The school staff repeatedly expressed safety and traffic concerns of having all the entrance and egress driveways on Sarno Road. The school would like to see an additional connection to Apollo Boulevard by extending the driveway from the drop-off/pick-up loop or the parking lot and through the Melbourne Police Department property to St. Michaels Place. An alternative or additional east-west connection to Apollo Boulevard will require easement or ROW on the commercial shopping center property.

## Main Walking and Biking Routes

- Students have to walk or bike along Sarno Road to enter the school.
- Most of the students use Ironwood Drive, Tupelo Drive, or Ixora Drive to walk/bike from/into the Greentree Park and Ixora Park neighborhoods.
- Few students who live in neighborhoods north of Sarno Road cross at the signal located at Sarno Road and Brevard County Government Service Complex entrance and walk/bike along Bell Street.
- Some students who walk or bike from the east side have to cross the Sarno Road and Apollo Boulevard intersection.
- There are two crossing guards present at the intersection of Sarno Road and Apollo Boulevard intersection.

- The school staff mentioned that there is an additional crossing guard present at the Sarno Road and Brevard County Government Service Complex entrance signal. However, the study team did not see any crossing guard at this location during the field review.
- Students use Magnolia Avenue to walk/bike into neighborhoods located on the east side of the railroad tracks.
- In the afternoon, students walk to convenience stores located at Ironwood Drive and Sarno Road on the west side and Cumberland Farms gas station on the east side at the intersection of Sarno Road and Apollo Boulevard. Students have to walk through parking lots to access the Cumberland Farms gas station convenience store.

## Drop-Off/Pick Up

- The school is served by four school buses in the morning and five in the afternoon.
- In the afternoon pick-up period, school buses use the drop-off/pick-up loop first, and once the school buses have left, parents can enter the loop.
- Parents queue in the right-turn lane starting around 1:15 PM and wait until the school buses have left.
- Kindergarten to Grade 3 parent drop-off/pick-up loop gets backed up during the afternoon pick-up period. The eastbound outside lane on Sarno Road is blocked by parents overflowing from the drop-off/pick-up loop.
- Westbound inside lane on Sarno Road occasionally gets blocked due to cars waiting to turn left into the school campus for pick-up.
- Although it is prohibited, a few parents turn left from the school driveways to travel westbound along Sarno Road.

## Recent and Planned Projects

- The school recently demolished a shed to expand staff parking.
- The City of Melbourne will be completing a resurfacing project of Babcock Street that will include filling in sidewalk gaps.
- SCTPO completed the Sarno Road Corridor Study that recommended widening Sarno Road to a five-lane cross-section with two lanes in each direction and a Two-Way Left Turn Lane with spot medians. The study also recommended widening existing sidewalks to eight feet-wide sidewalks on both sides of Sarno Road.
- There is potential to add a new trail on the south side of the school campus on the Melbourne Police Department property connecting the school campus to Sycamore Road.

## Other Issues

- School staff members mentioned that it does not feel safe to walk along or to cross Sarno Road.
- Many drivers do not follow the '20 MPH School Zone' speed limit during active school zone time.
- Flashing beacons on a mast-arm across the multi-lane Sarno Road, instead of the existing beacons on the poles to the sides, may help visibility and compliance.
- The school experiences an on-campus parking shortage.

## Field Review

A field review was conducted on October 3, 2019 to review the existing conditions and to observe student drop-off activity from 7:00 AM to 8:15 AM and student pick-up activity from 1:30 PM to 3:00 PM. Members from the City of Melbourne, FDOT, SCTPO, and KAI were present at this field review. The field review also included interacting with the crossing guard and observing and documenting conditions within the school's study area. Notes from this field review are summarized below.

### Crossing Guards

- There are two crossing guards present at the intersection of Sarno Road and Apollo Boulevard.
- There is no crossing guard at the signal located at Sarno Road and Brevard County Government Service Complex entrance.
- Crossing Guards mentioned that some drivers don't pay attention to the crossing guards and often witness road rage.

### School Campus

- School circulation patterns are designed such that students who walk/bike top school do not have to cross the driveways into the school campus on Sarno Road.
- Students walking/biking from the west side enter through a separate entrance on the west side of driveways.
- Students are walking/biking from the east-side walk through a fenced walkway along the wall separating the school and the shopping center property on the east side.
- Crosswalk marking across the drop-off/pick-up loop and parking lots are faded and require re-striping.
- Three egress driveways lead to limited sight distance and cause drivers to look left and not see the pedestrians approaching from the east.
- There is significant egress traffic from the shopping center parking lot driveway located west of the school campus, where parents park to walk their children to the school entrance. This driveway acts as de-facto 4$^{th}$ egress driveway for the school traffic.

### Study Area

- Pavement marking and crosswalk marking along and across Sarno Road are faded and are almost non-existent. They need re-striping.
- Most of the intersections along Sarno Road are not ADA compliant and some do not have pedestrian ramps or sidewalk connections.
- Sidewalks, pedestrian ramps along Sarno Road and many neighborhood streets are not ADA compliant.

- Sidewalk slope at Ironwood Drive is not ADA compliant.
- Convenience store located on the south side of Sarno Road, just west of Ironwood Drive has a wide extended driveway which may lead to conflicts between pedestrians walking along Sarno Road and cars turning into the driveway.
- An off-road trail exists just east of Sweetwater Bend and connects Apollo Boulevard and Sarno Road between Ixora Drive and Tupelo Drive. Neighborhood residents mentioned that there was an issue with homeless people living on the trial.
- Need to notify City of Melbourne Public Works for maintenance of broken drain inlet at the Ironwood Drive at Sarno Road intersection.

## Morning Observations

- Around 30 to 35 students were observed walking or biking to the school.
- Around six to eight students cross the Apollo Boulevard and Sarno Road intersection, about half of them are on bikes.
- Crossing Guards are at the Apollo Boulevard and Sarno Road intersection from 7:00 AM to 8:15 AM.
- A crossing guard starts in the Northeast corner to walk with three kids, then switches over to the Southwest corner for the rest of the shift in the morning.
- There were ten total bicycles parked in the west bike rack and three in the small bike rack in the east parking lot.
- Helmets were not being worn by many bicyclists, some had them but on handlebars.
- The majority of students walk/bike along Ironwood Drive and Sarno Road from the west side neighborhoods like Greentree Park and Ixora Park. Only one student was observed crossing Sarno Road at the Brevard County Government Service Complex entrance signal.
- Walkers/bikers gate on the western side of the main school entrance opens at 7:30 AM. Students arriving before 7:30 AM have to walk through the main entrance. There is no sidewalk connection from Sarno Road to the main school entrance. Students have to walk through the parking lot - drop-off/pick-up loop.
- Students walking/biking from the east side, walk through the fenced walkway. But they have to cross through the parking lot to get to the school entrance. School staff member escorts students crossing the parent drop-off/pick-up loop but not through the parking lot.
- Approximately only 50% of students coming from the east side are utilizing designated walkways, crossings, and sidewalks on school property. The rest of the students cut through the parking lot.
- Sarno Road backs up causing minor issues with cars leaving the school or trying to turn left into the school. Most of this appears to be an issue with Sarno Road, more than with the school traffic specifically.

- One vehicle exited the school via the sidewalk to the east of the school into the shopping center.
- Drivers don't obey the 'No Turn on Red' signage for southbound right turn at the Apollo Boulevard and Sarno Road intersection.

## Afternoon Observations

- 22 students walked west along Sarno Road. 12 turned on Ironwood Drive, while ten crossed Ironwood Drive and continued on Sarno Road.
- Nine students on bikes went west along Sarno Road. Six turned on Ironwood Drive, while three crossed Ironwood Drive and continued on Sarno Road.
- About half of students walking/biking in the afternoon continue along Sarno Road past Ironwood Drive. Some are going to the convenience store located just west of Ironwood Drive.
- One student was picked up at the Ironwood Drive intersection, another at the convenience store parking lot.
- Interview with the Crossing Guard (Crossing Guard Supervisor for the City of Melbourne).
    - Most of the students crossing the Sarno Road and Apollo Boulevard intersection live in 'The Harbors' located on the north and south side of Apollo Boulevard. The midblock crossing across Apollo Boulevard is an important crossing location to access 'The Harbors'.
    - School Zone signs and 'No Turn on Red' signs need to be added to the mast arms, not as signs on poles on the side of the road. She recommends the 'No Turn on Red - When Children are Present' signs be installed (similar to signs at Wickham Road and Eau Gallie Boulevard intersection).
    - The students are walking through the Cumberland Farms parking lot to go to the store. There are no designated crosswalks, walking paths, or sidewalks through the parking lot.
- A grandmother rides the bus to her home with two grandchildren, who are school students. They board the bus from the bus stop located on the south side of Sarno Road, just east of the school and west of Apollo Boulevard intersection. The bus stop is not ADA compliant and does not have a bench or shelter.
- Around 2:27 PM, queuing began on Sarno Road for the kindergarten through Grade 3 parent pick-up loop.
- In the afternoon pick-up period, school buses use the drop-off/pick-up loop first, and once the school buses have left, parents can enter the loop.
- At 2:33 PM, school buses left, five buses turned right to go east on Sarno Road. However, one bus used the McDonalds strip mall parking area to do a U-turn to continue westbound on Sarno Road.

- By 2:45 PM pick-up activity had cleared.
- Police presence was observed around the school. According to a schoolteacher, Melbourne Police regularly patrol the area.
- The eastbound outside lane on Sarno Road is blocked by parents overflowing from the drop-off/pick-up loop. Westbound inside lane on Sarno Road occasionally gets blocked due to cars waiting to turn left into the school campus for pick-up.
- A few Parents were observed picking up students from the staff parking lot.
- Several parents turn left on Sarno Road to travel westbound even though the driveways have 'No Left-Turn' restriction on Sarno Road.
- Although the pick-up activity in the afternoon is somewhat chaotic, the peak period of the pick-up activity does not last more than ten to 15 minutes. It also seems that parents arriving at the school have a better understanding of what to expect and how to navigate the traffic disorder. Sometimes the controlled chaos is better than trying to make it less congested at dismissal. Likely safer to leave as is.

## Opportunities

- Install ADA compliant sidewalks and pedestrian ramps along Sarno Road and many neighborhood streets.
- Potential for a trail connection south of the school between the school campus and Sycamore Road and Teak Drive intersection. There is an existing dirt trail already being used, likely for utility access and drainage maintenance. A direct road connection can connect to St. Michaels Place.
- Sycamore Road and Ixora Drive is an offset intersection that may have sight distance issues. Traffic calming and safety improvements such as a raised intersection may be helpful.
- Recommend bringing the bus stop up to ADA Compliance and installing a minimum of a bench, if not a shelter. Reference the SCTPO ADA Bus Stop Assessment for full stop recommendations for ADA compliance.
- Consider two inbound lanes for Kindergarten to Grade 3 parents' drop-off/pick up loop. This will allow for more storage length and limit backups on Sarno Road.
- Extend the Kindergarten to Grade 3 parents' drop-off/pick up loop further south into the school campus and consider moving drop-off/pick-up point further south. This will allow for more storage space.
- At the Apollo Boulevard and Sarno Road intersection, add 'No Right Turn on Red' for northbound right and eastbound right turn lanes as well. Add blank out signage for the southbound right, eastbound right, and northbound right turn lanes.


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# Implementation

This section of the report will build on the analysis and observations documented in the Assessment Section to make recommendations. The purpose of this section is to list and describe the issues and recommendations identified for the Harbor City Elementary School study area. Planning level cost estimates, implementation time-frames, and responsible agencies were also listed for the recommendations.

## List & Maps of Recommendations

A list of issues and recommendations was developed based on the input received at the school coordination meeting and field review observations. Planning level cost estimates, implementation time-frame and responsible agency were identified for the recommendations.

Recommendations on the school campus are listed in **Table 2**. Recommendations in the larger study area are listed in **Table 3**. Maps showing the locations of these recommendations are shown in **Figure 31, Figure 32**, and **Figure 33**.

### *Table 2: School Campus Recommendations*

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 1 | School Main Entrance | Build an 8 foot wide sidewalk connection from Sarno Road to the main school entrance door. | Sidewalk | Near-Term | <$10,000 |
| 2 | School Campus East Parking Lot | Extend the fenced walkway and mark a high visibility crosswalk across the parking lot. | Sidewalk | Near-Term | <$10,000 |
| 3 | School Campus Drop-Off/Pick-Up Loops | Re-stripe crosswalks as high-visibility crosswalks and add ADA compliant pedestrian ramps. | Crossing | Maintenance /Near-Term | <$10,000 |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 4 | School Campus Drop-Off/Pick-Up Loops | Rework school internal circulation to push drop-off/pick-up point further south and extend the drop-off/pick-up loop to add more stacking space for cars. | School Circulation | Long-Term | Further study is required |
| 5 | School Driveways along Sarno Road | Construct right-in/right-out channelized islands at school driveways alongside recommendation No. 4. | Sidewalks (Driveways) | Near-Term | $15,000 to $20,000 |

### *Table 3: Study Area Recommendations*

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 6 | Midblock Crossing across Apollo Boulevard near Hidden Harbor Drive | Install RRFB at the midblock crosswalk. | Crossing | Near-Term | $45,000 to $55,000 |
| 7 | Sarno Road from Croton Road to US 1 | Upgrade existing sidewalks to be ADA compliant along Sarno Road. | Sidewalk | Near-Term | Further study is required |
| 8 | Sarno Road from Croton Road to US 1, Croton Road from Sarno Road to End of Roadway, Garfield Street, Ixora Drive, and Within the Brevard County Driver License and Tax Collector Complex | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs of the signalized intersections | Crossing | Near-Term | $65,000 to $75,000 |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 9 | Sarno Road | Implement Sarno Road Corridor Study Recommendations – five lane cross-section with TWLTL, spot medians, access management, and 8 foot wide sidewalks on both sides. | Previous Study (Corridor) | Long-Term | $20,885,000. Further study is required to estimate the cost for access management |
| 10 | Sycamore Road/Cadillac Circle N and Ixora Drive Intersection | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs. | Crossing | Near-Term | $10,000 to $15,000 |
| 11 | Ironwood Drive, Tupelo Drive, Ixora Drive, Cadillac Circle, and Sycamore Road (See **Figure 31** for extents) | Install neighborhood traffic calming treatments such as speed cushions, speed humps, curb extensions, street trees, etc. | Traffic Calming | Near-Term | Further study is required |
| 12 | Bell Street from Sarno Road to Tynan Drive | Build a 5 to 6 foot wide sidewalk on the east side of Bell Street. | Sidewalk | Near-Term | $60,000 to $70,000 |
| 13 | Neiman Avenue from Lorraine Avenue to Babcock Street | Build a 5 to 6 foot wide sidewalk along both sides of Neiman Avenue | Sidewalk | Near-Term | $500,000 to $600,000 |
| 14 | Bus Stop at Sarno Road and Apollo Boulevard | Make an ADA compliant bus stop. Add bench and shelter. | Sidewalk (Transit) | Near-Term | $32,000 |

| No. | Location | Recommendation | Type | Time-Frame | Cost Estimate |
|---|---|---|---|---|---|
| 15 | South and East of the School Campus | Conduct a feasibility study to build a 12 foot wide trail connection south of the school between the school campus and Sycamore Drive and Teak Drive intersection. | Feasibility Study (Trail) | Near-Term | Further study is required |
| 16 | South and East of the School Campus | Conduct a feasibility study to build a new roadway connection south of the school campus to connect to Apollo Boulevard and/or St. Michaels Place | Feasibility Study (Roadway) | Near-Term | Further study is required |
| 17 | Apollo Boulevard and Sarno Road Intersection | Install blank out signage for the south-bound right, east-bound right, and north-bound right turn lanes. These signs would show no right-turn-on-red when the conflicting crosswalk pedestrian push button is activated, but otherwise will stay blank. | Sign/Signal | Near-Term | $25,000 to $30,000 |
| 18 | Sarno Road | Install school zone speed limit flashing beacons on mast arms to replace existing signs on poles. | Sign/Signal | Near-Term | $155,000 to $185,000 |

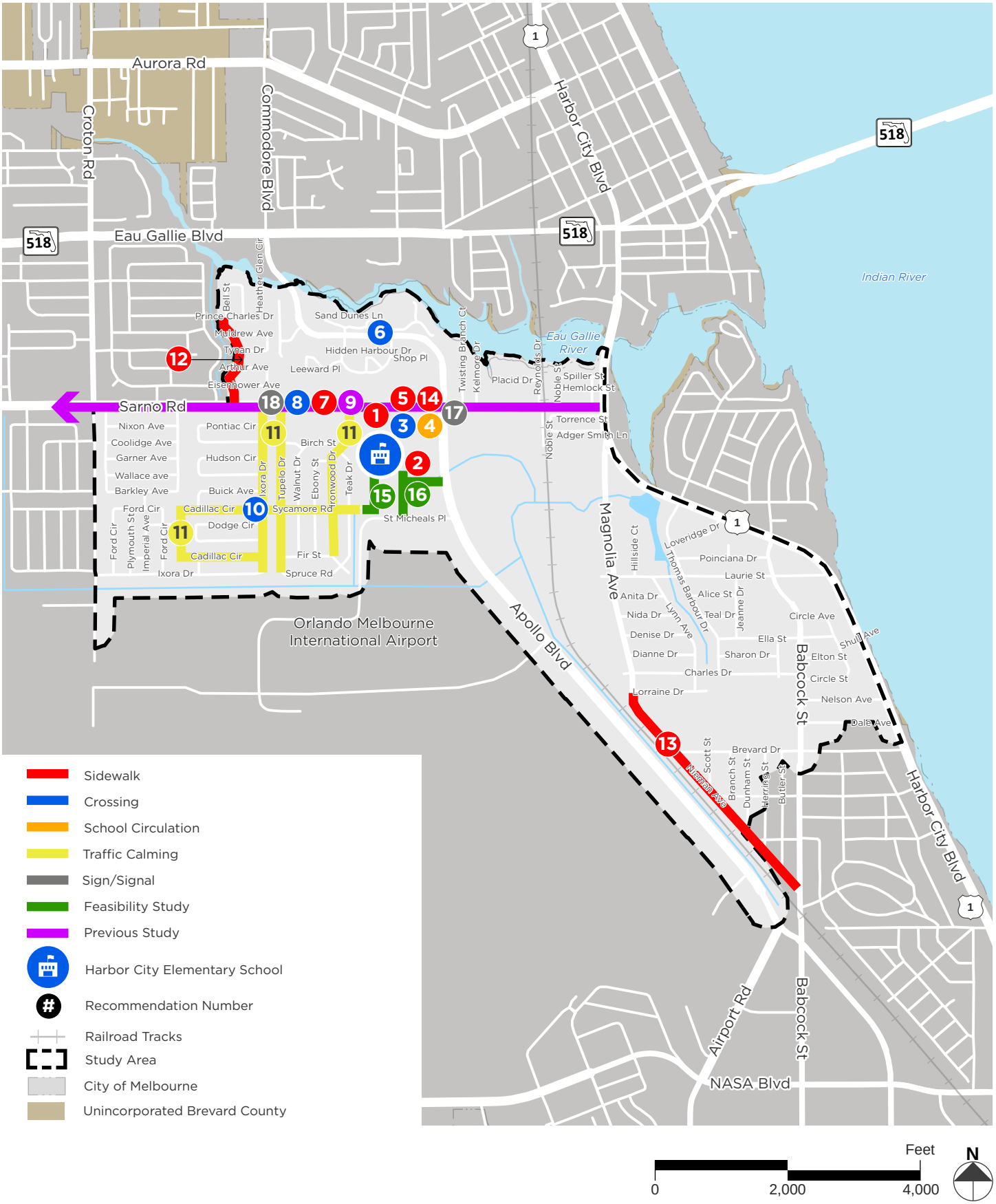



**Figure 31: Recommendations**

School Routes Analysis

# Harbor City Elementary School

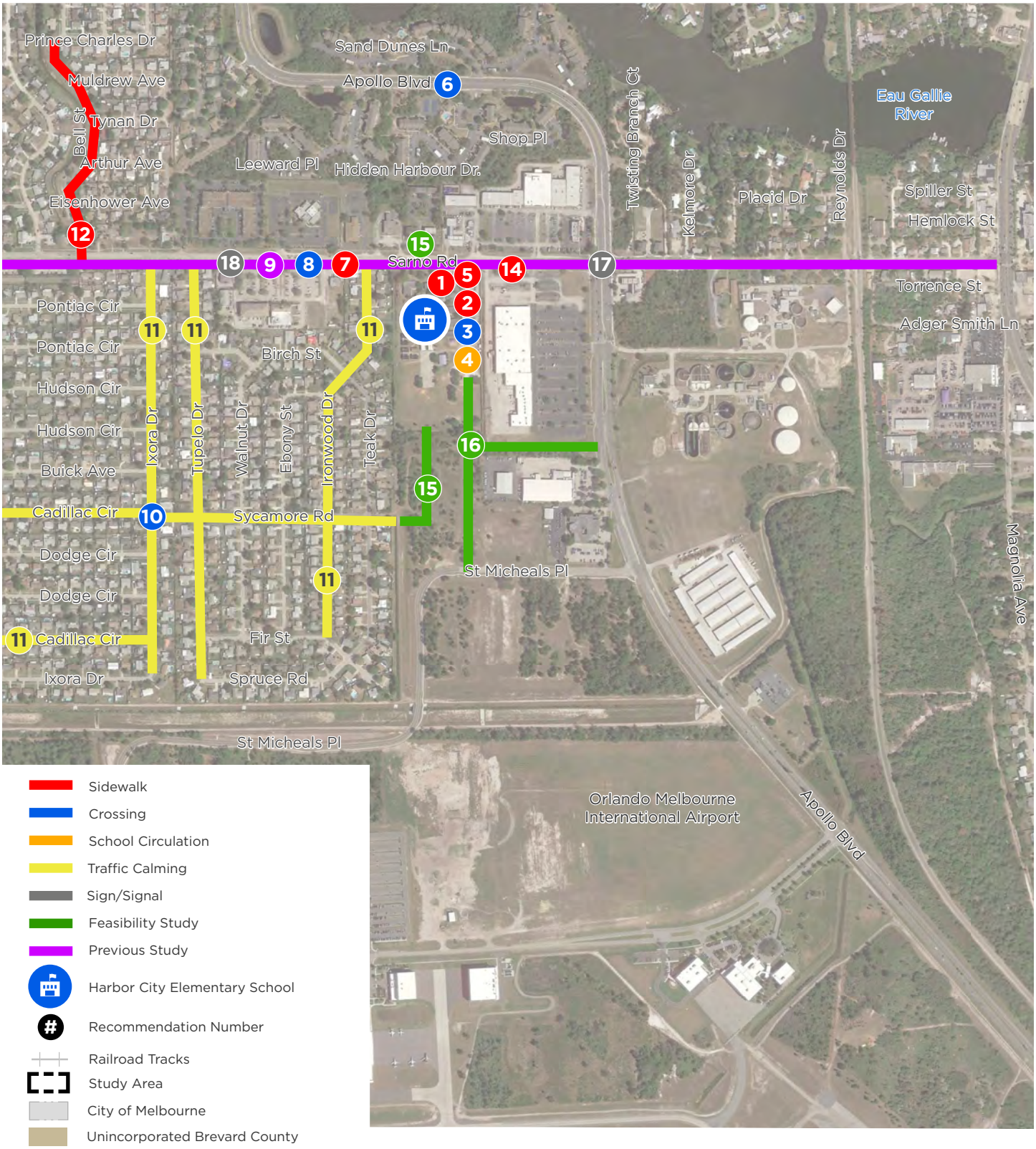



**Figure 32: Recommendations: School Context Aerial Map**

School Routes Analysis

# Harbor City Elementary School

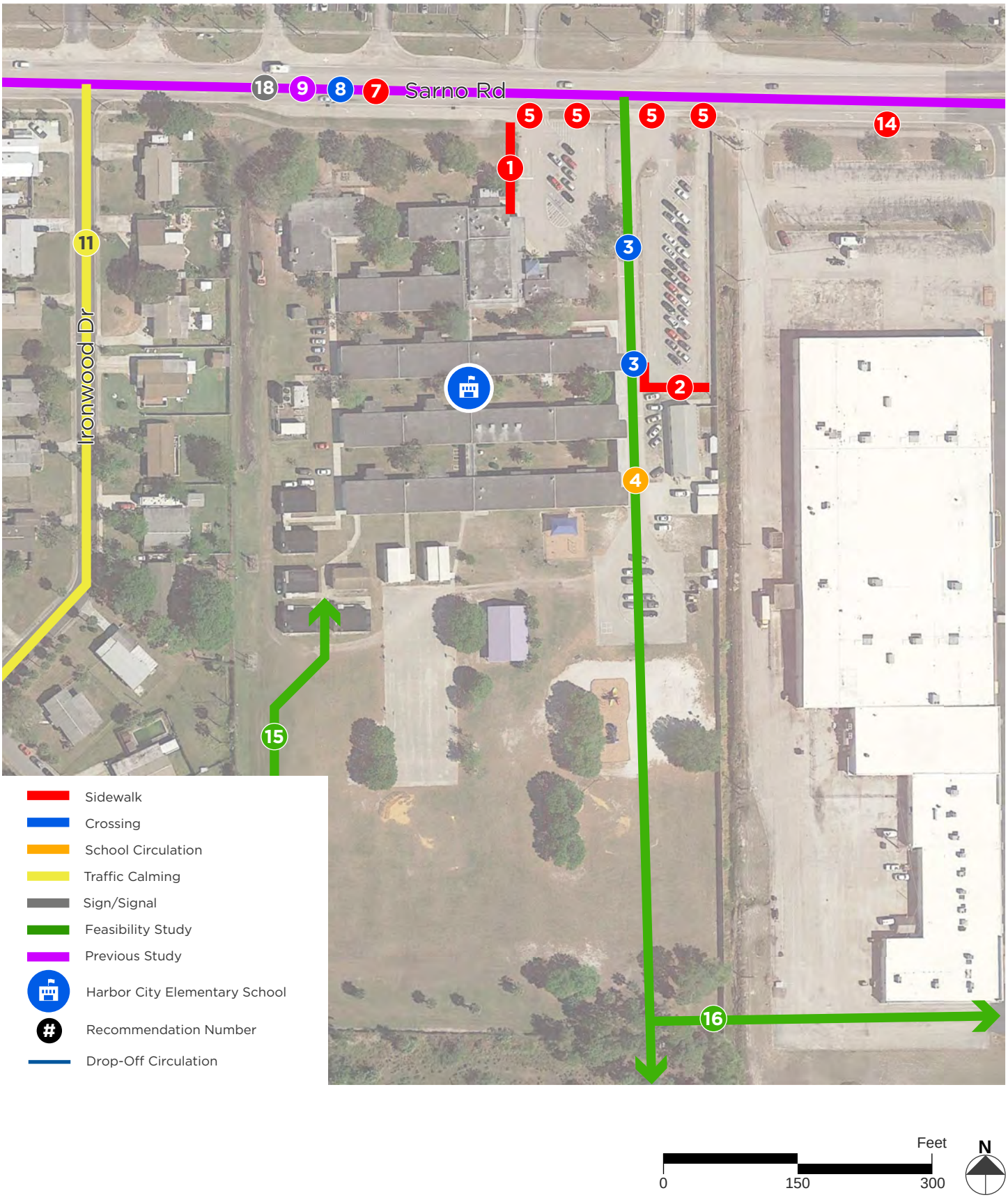



**Figure 33: Recommendations: School Campus Aerial Map**

# Detailed Recommendations

This section lists details for each recommendation including its location, type, issue, recommendation, implementation time-frame, estimated project cost, if right-of-way is needed, if there is anticipated drainage or utility impact, and the responsible agency. The implementation time-frame is listed as "Maintenance", "Near-Term", or "Long-Term" and describes the amount of time it will take for a project to be complete. The responsible agency is the public agency that will be responsible for the implementation of the recommendation.

## Methodology to Calculate Cost Estimates

Cost estimates were calculated for the recommended projects in this section, unless otherwise noted. Cost estimates were not prepared for projects where more information was needed, or further follow up study should be undertaken. The bullets below describe the assumptions made for the cost estimating of the recommended projects:

- Pay items and pay item unit costs were obtained from the FDOT Historical Cost website: *https://www.fdot.gov/programmanagement/estimates/historicalcostinformation/historicalcost.shtm*
    - The most current 12 month (12/01/18 – 11/30/19) moving Statewide and Area 8 (which includes Brevard County) pay item average unit costs were utilized
- Maintenance of traffic was assumed to be 10 percent to 15 percent of the construction cost, depending on the level of impact the recommendation has on adjacent roadway traffic. Maintenance of traffic was assumed to be 0 percent for recommendations on the school campus.
- The mobilization of construction equipment to the work site was assumed to be 15 percent of the construction + maintenance of traffic cost.
- Concepts were not prepared for these recommendations so there is a high degree of unknowns that may affect the project cost once it is designed. To account for these unknowns, a 20 percent and 40 percent "contingency/unknowns" cost was calculated for each project to provide a cost estimate "range" for each project. These contingency/unknown calculations were based on the construction + maintenance of traffic + mobilization cost.
- Design and construction engineering inspection (CEI) were assumed to be 15 percent each. These costs were calculated based on the construction + maintenance of traffic + mobilization + contingency/unknowns (20%) cost and the construction + maintenance of traffic + mobilization + contingency/unknowns (40%) cost.
- The total lower range cost estimate for each recommendation was calculated as construction + maintenance of traffic + mobilization + contingency/unknowns (20%) + design (based on 20% contingency/unknowns) + CEI (based on 20%

contingency/unknowns). The total upper range cost estimate for each recommendation was calculated as construction + maintenance of traffic + mobilization + contingency/unknowns (40%) + design (based on 40% contingency/unknowns) + CEI (based on 40% contingency/unknowns).

- The final lower and upper range were rounded up to the nearest $5K or $10K to provide a conservative estimate of the total project cost.

**Figure 34** below shows an example of the cost estimate process described above.

| Item No. | Description | Unit | Total Quantity | Weighted Average Unit Price | Total Amount |
|---|---|---|---|---|---|
| Roadway Items | | | | | |
| 110-1-1 | CLEARING & GRUBBING | AC | 0.27 | $9,219.13 | $2,516.82 |
| 522-1 | SIDEWALK CONCRETE, 4" THICK | SY | 570.00 | $44.53 | $25,382.10 |
| Subtotal | | | | | $27,898.92 |
| 102-1 | MAINTENANCE OF TRAFFIC | LS | 15% | | $4,184.84 |
| Subtotal | | | | | $32,083.76 |
| 101-1 | MOBILIZATION | LS | 15% | | $4,812.56 |
| Subtotal | | | | | $36,896.32 |
| | CONTINGENCY | LS | 20% | | $7,379.26 |
| | CONTINGENCY | LS | 40% | | $14,758.53 |
| Total Construction Cost (20%) | | | | | $44,275.58 |
| Total Construction Cost (40%) | | | | | $51,654.85 |
| | DESIGN (20%) | LS | 15% | | $6,641.00 |
| | DESIGN (40%) | LS | 15% | | $7,748.00 |
| | C.E.I (20%) | LS | 15% | | $6,641.00 |
| | C.E.I (40%) | LS | 15% | | $7,748.00 |
| Total Cost (20%) | | | | | $57,557.58 |
| Total Cost (40%) | | | | | $67,150.85 |
| Total Cost (20%) - Rounded | | | | | $60,000.00 |
| Total Cost (40%) - Rounded | | | | | $70,000.00 |

***Figure 34: Example Cost Estimate Process***

## Project 1: New sidewalk connection at the main school entrance

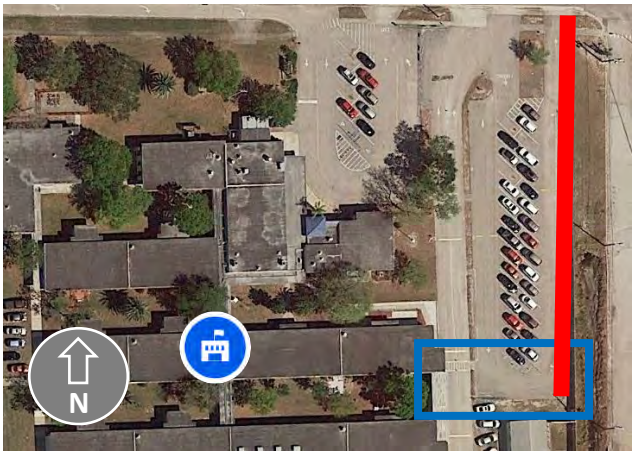
| | |
|---|---|
| **Location** | School Main Entrance |
| **Type** | Sidewalk |
| **Issue** | There are no sidewalks located on the west side of the bus loop. Students were observed walking through the bus loop to enter the school before 7:30 AM. |
| **Recommendation** | Build an 8 foot wide sidewalk connection from Sarno Road to the main school entrance door. |


*Main School Entrance*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | Less than $10,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | Unknown |
| | **Responsible Agency** | Brevard County Public Schools |

## Project 2: Extend fenced walkway and mark crosswalk across parking lot

| | |
|---|---|
| **Location** | School Campus East Parking Lot |
| **Type** | Sidewalk |
| **Issue** | The sidewalk along the southern section of the staff/visitor parking lot along the east side of the school campus does not provide students a connection to enter the school campus. |
| **Recommendation** | Extend the sidewalk to the roadway (shown below in red). Mark a high visibility crosswalk across the drop-off/pick-up loop (shown below in blue). |




*Pedestrian Crossing Across Parking Lot*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | Less than $10,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | No |
| | **Responsible Agency** | Brevard County Public Schools |

## Project 3: Re-stripe crosswalks and add ADA compliant pedestrian ramps

| | |
|---|---|
| **Location** | School Campus Drop-Off/Pick-Up Loops |
| **Type** | Crossing |
| **Issue** | Crosswalks along the drop-off/pick-up loop are faded. Pedestrian ramps are not ADA compliant. |
| **Recommendation** | Restripe crosswalks as high-visibility crosswalks. Add ADA compliant pedestrian ramps. |

*Faded Crosswalks Across Drop-Off/Pick-Up Loop*

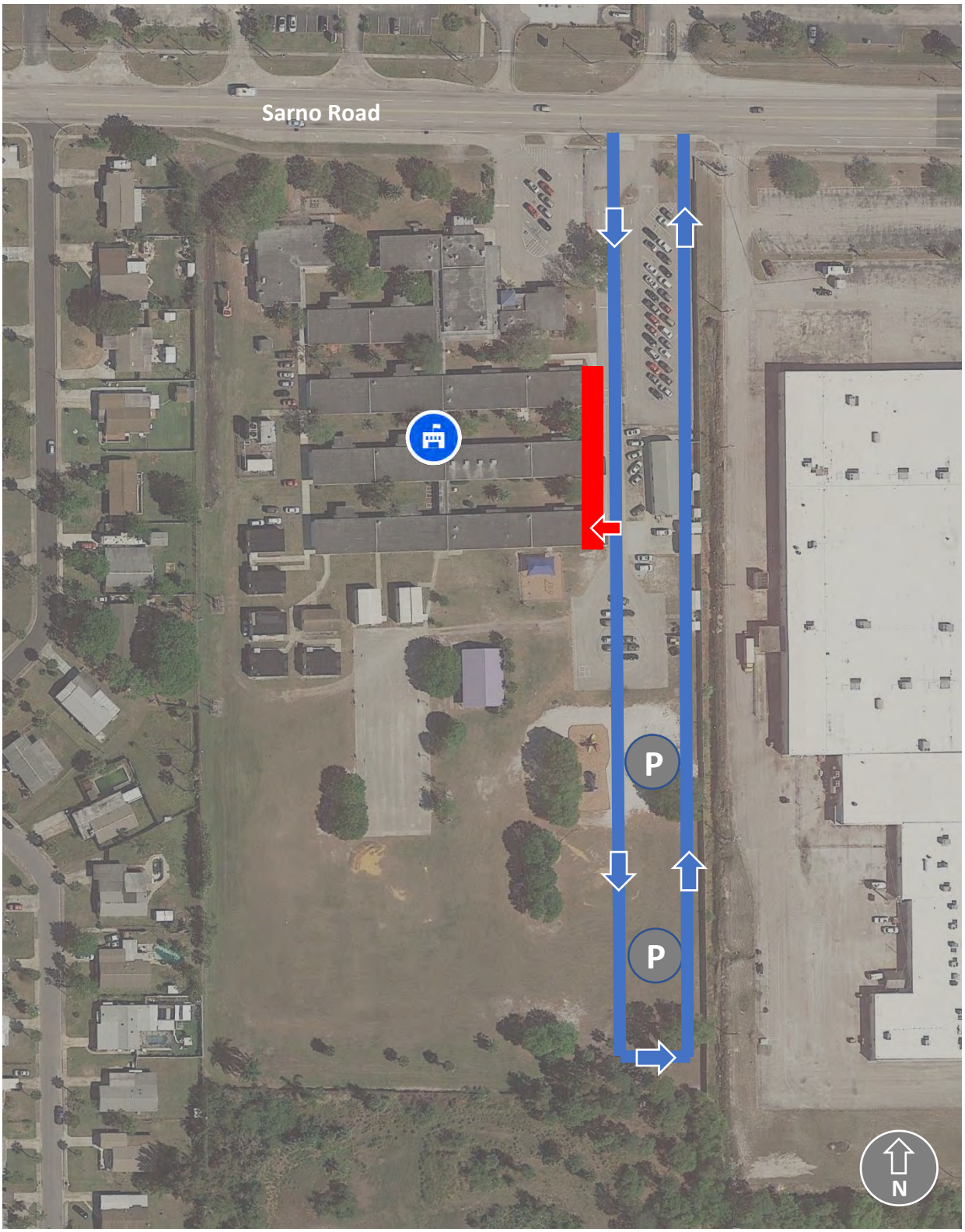
| | | |
|---|---|---|
| | **Implementation Time-Frame** | Maintenance/Near-Term |
| | **Estimated Project Cost** | Less than $10,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | No |
| | **Responsible Agency** | Brevard County Public Schools |

## Project 4: Move Drop-Off/Pick-Up point further south and extend loop

| | |
|---|---|
| **Location** | School Campus Drop-Off/Pick-Up Loops |
| **Type** | School Circulation |
| **Issue** | Queueing occurs along Sarno Road during student drop-off/pick-up. There is insufficient parking for staff and parents. |
| **Recommendation** | Rework school internal circulation to push drop-off/pick-up point further south and extend the drop-off/pick-up loop to add more stacking space for cars. |

*Cars Queued in the Drop-Off/Pick-Up Loop*

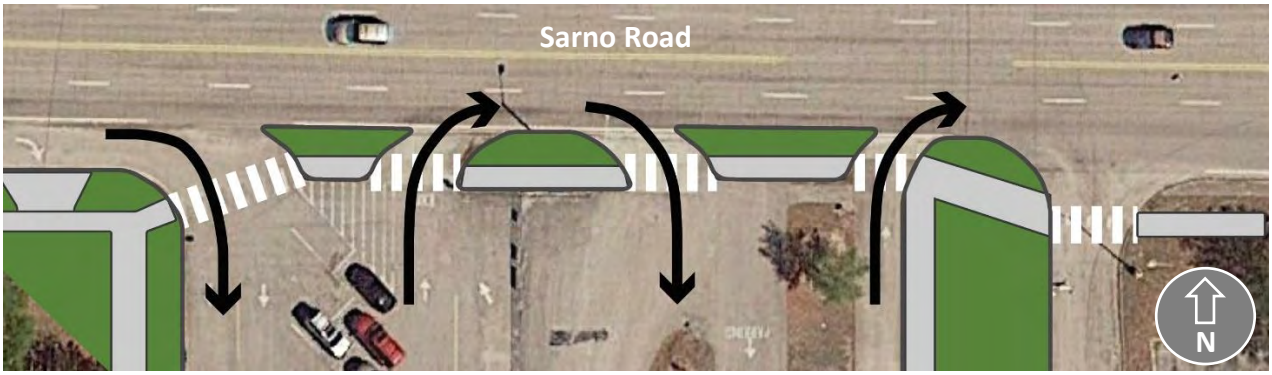
| | | |
|---|---|---|
| | **Implementation Time-Frame** | Long-Term |
| | **Estimated Project Cost** | Further study is required |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | Unknown |
| | **Responsible Agency** | Brevard County Public Schools |




*Relocate Drop-Off/Pick-Up Point, Extend Loop South, and Add Parking*

## Project 5: Build right-in/right-out channelization islands at school driveways

| | |
|---|---|
| **Location** | School Driveways Along Sarno Road |
| **Type** | Sidewalk (Driveways) |
| **Issue** | Parents were observed making prohibited left turns onto Sarno Road. |
| **Recommendation** | Construct right-in/right-out channelized islands at school driveways alongside recommendation No. 4. |

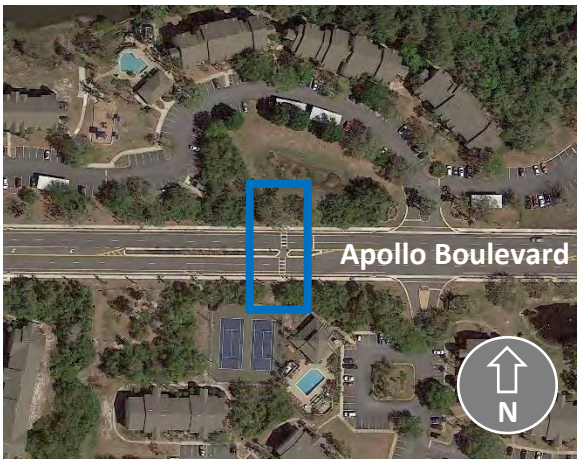


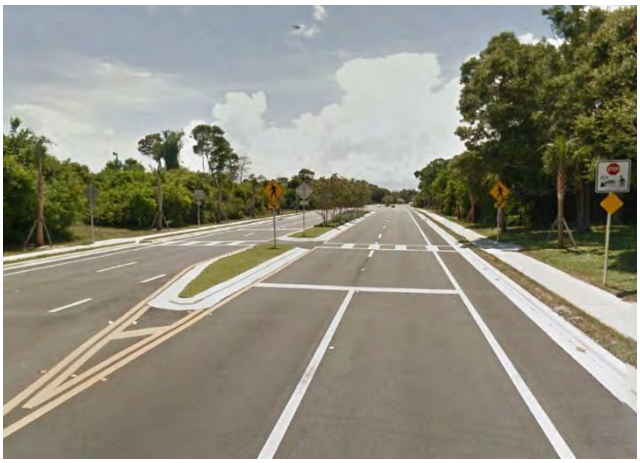

*Reconfigured Right-In/Right-Out School Driveways Along Sarno Road*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | $15,000 to $20,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | Potential drainage impact along roadside with new islands |
| | **Responsible Agency** | Brevard County Public Schools/ City of Melbourne |

## Project 6: Add Rectangular Rapid Flashing Beacon (RRFB) at the midblock crossing on Apollo Boulevard

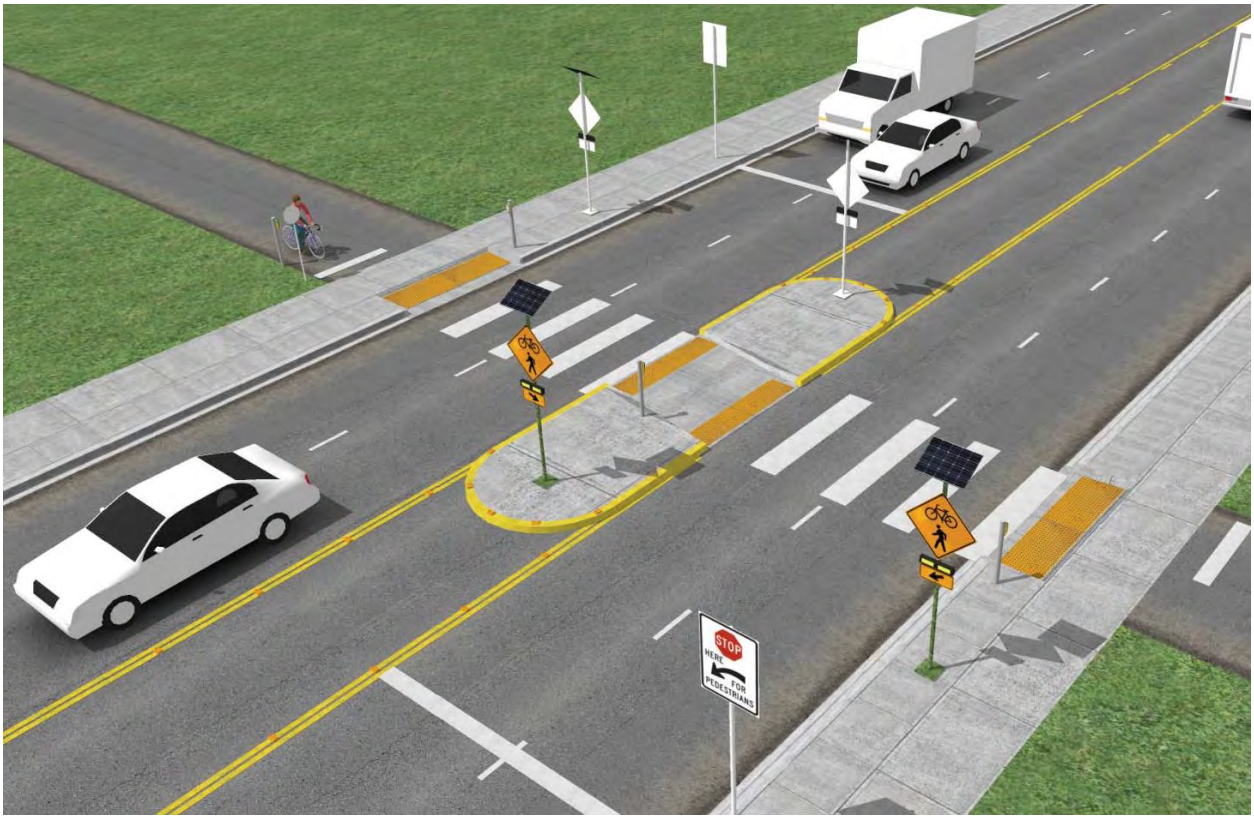
| | |
|---|---|
| **Location** | Mid-block Crossing across Apollo Boulevard near Hidden Harbor Drive |
| **Type** | Crossing |
| **Issue** | Students crossing Apollo Boulevard at the midblock crossing have no way to alert drivers that they are crossing. |
| **Recommendation** | Install RRFB at the midblock crossing. |



*Existing Mid-Block Crossing*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | $45,000 to $55,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | No |
| | **Responsible Agency** | City of Melbourne |




*Typical RRFB At A Mid-Block Crossing*

*Typical RRFB Sign*

## Project 7: Upgrade sidewalks along Sarno Road from Croton Road to US 1 to be ADA compliant

| | |
|---|---|
| **Location** | Sarno Road from Croton Road to US 1 |
| **Type** | Sidewalk |
| **Issue** | Portions of sidewalks along Sarno Road are not ADA compliant. |
| **Recommendation** | Upgrade existing sidewalks to be ADA compliant along Sarno Road. |

*Sarno Road Sidewalks*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | Further study is required |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | Drainage and Utility Impact |
| | **Responsible Agency** | City of Melbourne |

## Project 8: Upgrade pedestrian ramps and crosswalks to be ADA compliant at signalized intersections

| | |
|---|---|
| **Location** | **Along Sarno Road from Croton Road to US 1, Croton Road from Sarno Road to End of Roadway, Garfield Street, Ixora Drive, and Within the Brevard County Driver License and Tax Collector Complex** |
| **Type** | **Crossing** |
| **Issue** | Pedestrian ramps and crosswalk pavement markings have ADA deficiencies at signalized intersections along Sarno Road from Croton Road to US 1, Croton Road from Sarno Road to end of the roadway, Garfield Street, Ixora Drive, and within the Brevard County Driver License and Tax Collector Complex. |
| **Recommendation** | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs of the signalized intersections. |



*No Pedestrian Ramps and Faded Crosswalks Along Sarno Road*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **$65,000 to $75,000** |
| | **Right-of Way Needed?** | **No** |
| | **Drainage or Utility Impact?** | **Unknown** |
| | **Responsible Agency** | **Brevard County/City of Melbourne** |

## *Examples of ADA Compliant Pedestrian Curb Ramps*

*Diagonal Pedestrian Ramp*

*Perpendicular Pedestrian Ramp*

*Unflared Perpendicular Curb Ramps*

## Project 9: Implement Sarno Road Corridor Study recommendations

| | |
|---|---|
| **Location** | Sarno Road |
| **Type** | Previous Study (Corridor) |
| **Issue** | A previous study along Sarno Road was conducted in 2018. |
| **Recommendation** | Implement the recommendations from the Sarno Road Corridor Study including a five-lane cross section with a two way left turn lane, spot medians, access management, and eight foot sidewalks on both sides. |

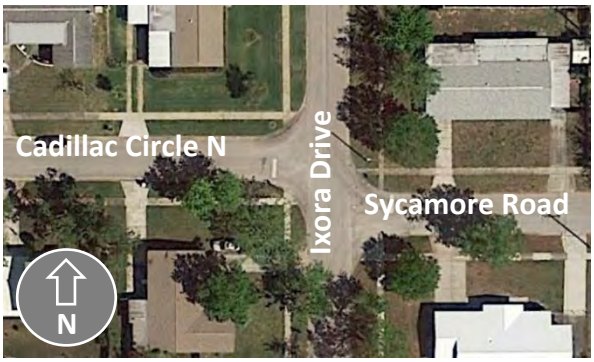

*Existing 4-Lane Undivided Sarno Road*

*Sarno Road Corridor Study Logo*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Long-Term |
| | **Estimated Project Cost** | $18,400,000 for five-lane cross section with TWLTL<br>$35,000 to $50,000 for a raised median west of Wickham Road<br>$2,400,000 for an eight foot sidewalk<br>Further study required for access management |
| | **Right-of Way Needed?** | Unknown |
| | **Drainage or Utility Impact?** | Yes |
| | **Responsible Agency** | Brevard County/City of Melbourne |

## Project 10: Upgrade pedestrian ramps and crosswalks to be ADA compliant, re-stripe crosswalk at Sycamore Road/Cadillac Circle N and Ixora Drive Intersection

| | |
|---|---|
| **Location** | Sycamore Road/Cadillac Circle N and Ixora Drive Intersection |
| **Type** | Crossing |
| **Issue** | Pedestrian ramps and crosswalk pavement markings at the intersection of Sycamore Road/Cadillac Circle N and Ixora Drive have ADA deficiencies. This intersection is offset and has sight distance issues. |
| **Recommendation** | Upgrade/install ADA compliant pedestrian ramps and re-stripe high-visibility crosswalk across all legs. |




*Sycamore Road/Cadillac Circle N and Ixora Drive Intersection*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | $10,000 to $15,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | Unknown |
| | **Responsible Agency** | City of Melbourne |

## Project 11: Install neighborhood traffic calming treatments

| | |
|---|---|
| **Location** | **Along Ironwood Drive, Tupelo Drive, Ixora Drive, Cadillac Circle N, and Sycamore Road (See Figure 31 for extents)** |
| **Type** | **Traffic Calming** |
| **Issue** | Speeding was observed along Ironwood Drive, Tupelo Drive, Ixora Drive, Cadillac Circle, and Sycamore Road. |
| **Recommendation** | Install neighborhood traffic calming treatments such as speed cushions, speed humps, curb extensions, and/or street trees along Ironwood Drive, Tupelo Drive, Ixora Drive, Cadillac Circle N, and Sycamore Road. |

*Ixora Drive*

*Tupelo Drive*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **Further study is required** |
| | **Right-of Way Needed?** | **No** |
| | **Drainage or Utility Impact?** | **Unknown** |
| | **Responsible Agency** | **City of Melbourne** |

## *Typical Neighborhood Traffic Calming Treatments*

*Speed Cushion*

*Speed Hump*

*Street Trees*

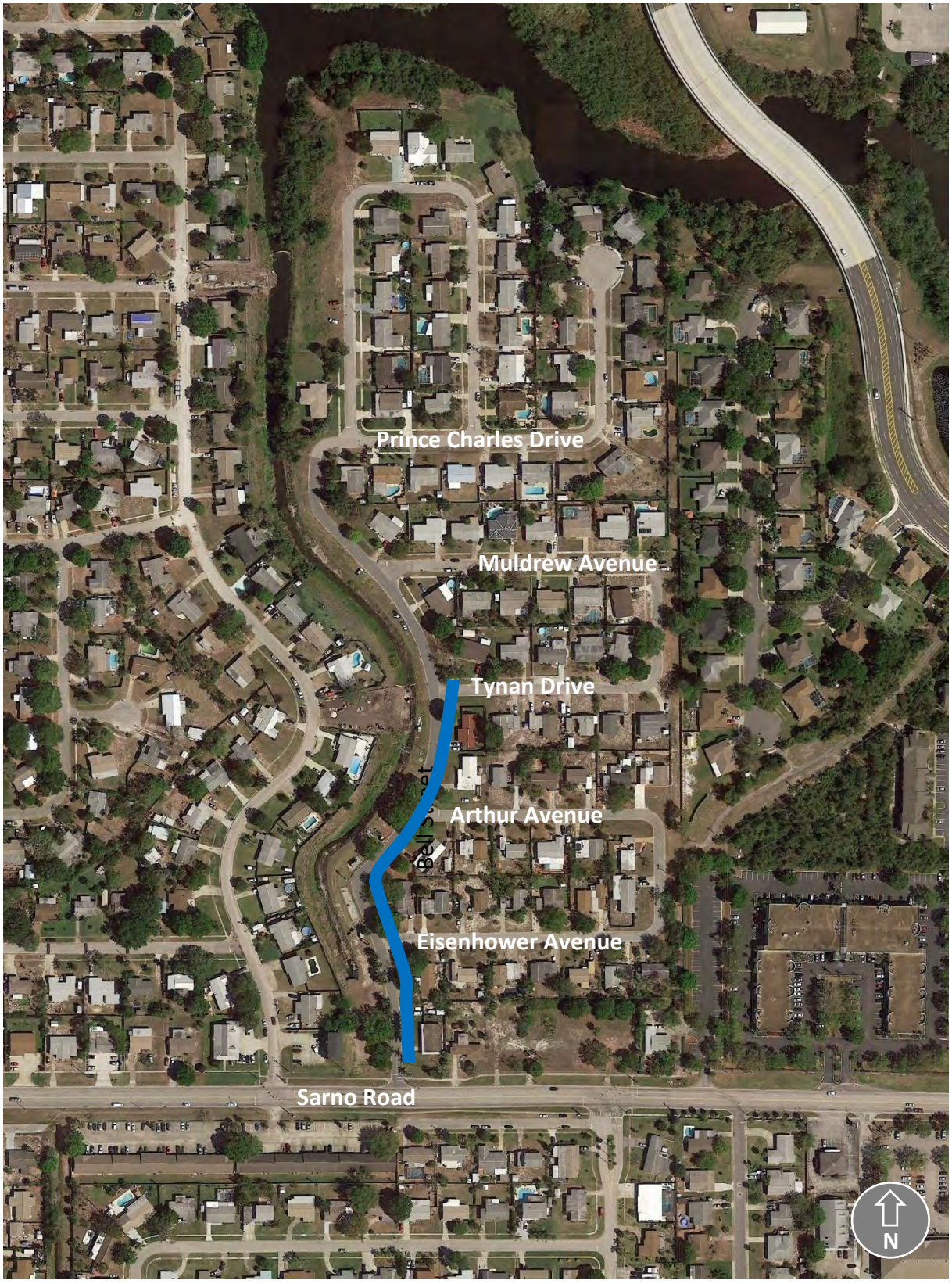
*Curb Extension*

## Project 12: Construct a six foot wide sidewalk on Bell Street

| | |
|---|---|
| **Location** | **Along the East Side of Bell Street from Sarno Road to Tynan Drive** |
| **Type** | **Sidewalk** |
| **Issue** | There is no sidewalk along the east side of Bell Street from Sarno Road to Tynan Drive. |
| **Recommendation** | Construct a six foot wide sidewalk on the east side of Bell Street from Sarno Road to Tynan Drive. |

*Lack of Sidewalk Facilities Along Bell Street*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **$60,000 to $70,000** |
| | **Right-of Way Needed?** | **No** |
| | **Drainage or Utility Impact?** | **Unknown** |
| | **Responsible Agency** | **City of Melbourne** |




*A Six Foot Wide Sidewalk is Recommended Along the Blue Line*

## Project 13: Construct a six foot sidewalk on Neiman Avenue

| | |
|---|---|
| **Location** | **Neiman Avenue from Lorraine Avenue to Babcock Street** |
| **Type** | **Sidewalk** |
| **Issue** | There is no sidewalk along either side of Neiman Avenue. |
| **Recommendation** | Construct a six foot wide sidewalk on both sides of Neiman Avenue from Babcock Street to Lorraine Avenue. |

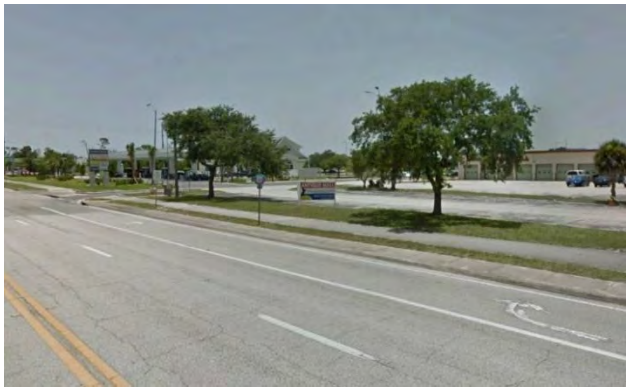
*Lack of Sidewalk Facilities Along Neiman Avenue*

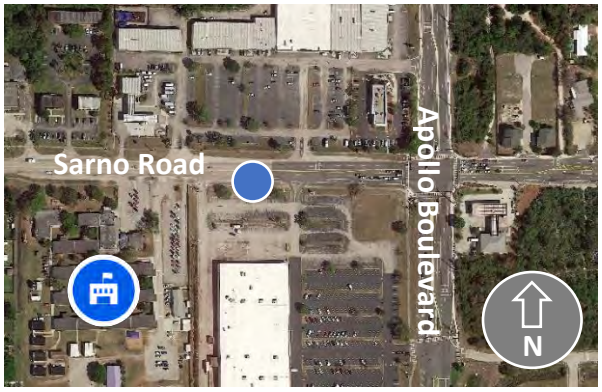
| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **$500,000 to $600,000** |
| | **Right-of Way Needed?** | **Unknown** |
| | **Drainage or Utility Impact?** | **Drainage Impact** |
| | **Responsible Agency** | **City of Melbourne** |


*A Six Foot Wide Sidewalk is Recommended Along the Blue Line*

## Project 14: Upgrade bus stop at Sarno Road and Apollo Boulevard intersection to be ADA compliant

| | |
|---|---|
| **Location** | **Bus Stop at Sarno Road and Apollo Boulevard** |
| **Type** | **Sidewalk (Transit)** |
| **Issue** | The bus stop along Sarno Road just west of Apollo Boulevard has ADA deficiencies. |
| **Recommendation** | Upgrade bus stop with a pedestrian ramp to make it ADA compliant. Add a bench and shelter as per Space Coast Area Transit Bus Stop Accessibility Study. |






*Existing Bus Stop Along Sarno Road*

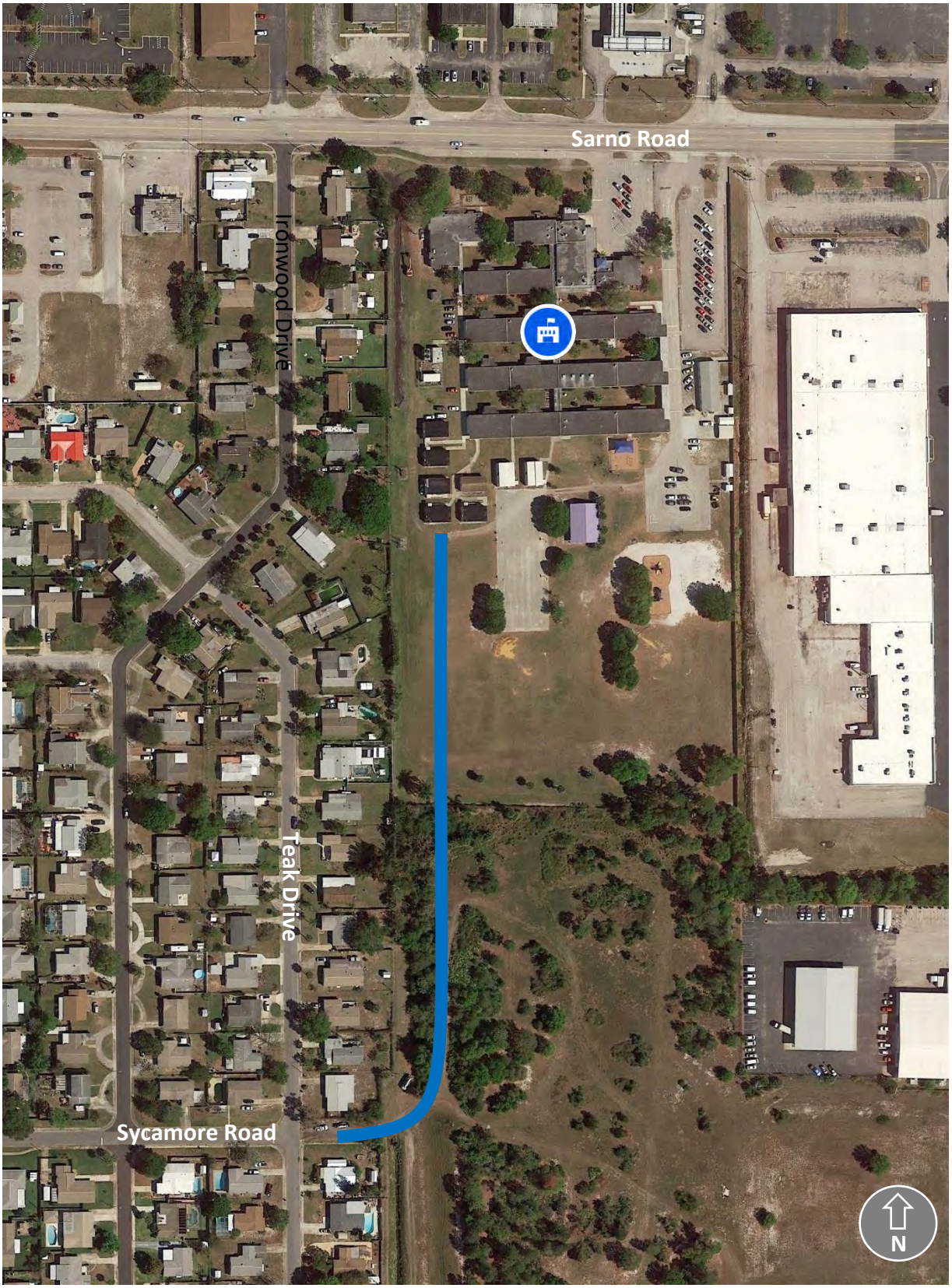
| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **$32,000** |
| | **Right-of Way Needed?** | **No** |
| | **Drainage or Utility Impact?** | **Unknown** |
| | **Responsible Agency** | **SCAT/Brevard County/ City of Melbourne** |

## Project 15: Conduct a feasibility study to construct a trail between the school campus and the intersection of Sycamore Road and Teak Drive

| | |
|---|---|
| **Location** | **South and East of the School Campus** |
| **Type** | **Feasibility Study (Trail)** |
| **Issue** | Students must travel along Sarno Road to travel to and from school. There are no connections along the back side of the school campus. |
| **Recommendation** | Conduct a feasibility study to construct a twelve foot wide trail connection between the school campus and the intersection of Sycamore Road and Teak Drive. |

***Potential Trail Connection at Teak Drive and Sycamore Road Intersection***

| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **Further study required** |
| | **Right-of Way Needed?** | **Yes** |
| | **Drainage or Utility Impact?** | **Drainage Impact** |
| | **Responsible Agency** | **City of Melbourne** |



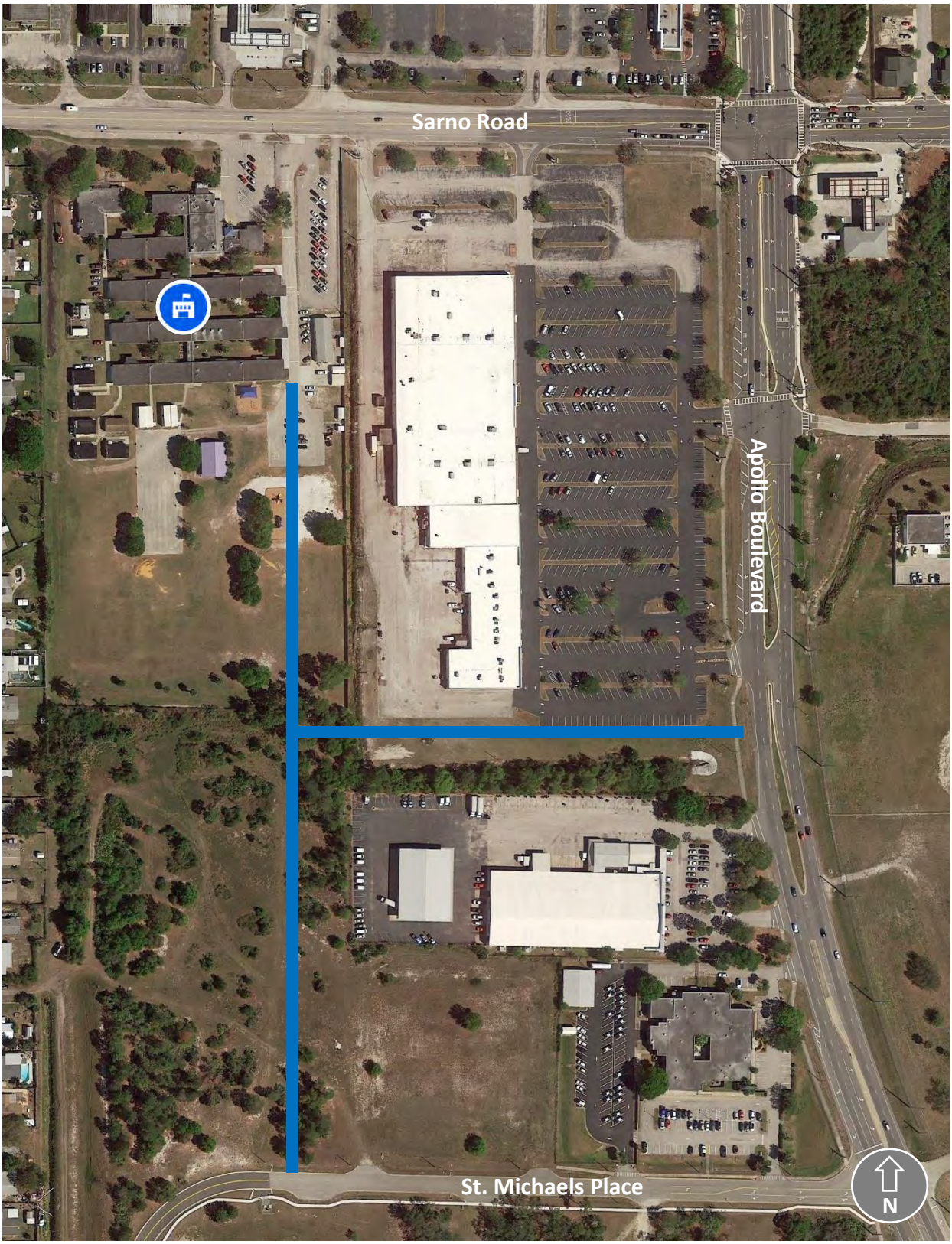

*Potential Trail Alignment is Shown as the Blue Line*

## Project 16: Conduct a feasibility study to construct a new roadway connection from the school campus to Apollo Boulevard and/or St. Michaels Place

| | |
|---|---|
| **Location** | South and East of the School Campus |
| **Type** | Feasibility Study (Roadway) |
| **Issue** | The only entrance to the school campus is along Sarno Road. There is significant queueing along Sarno Road during drop-off/pick-up times. |
| **Recommendation** | Conduct a feasibility study to construct a new roadway connection from the school campus to Apollo Boulevard and/or St. Michaels Place. |

*Potential Alignment for Roadway Extension Just South of Shopping Center Connecting to Apollo Boulevard*

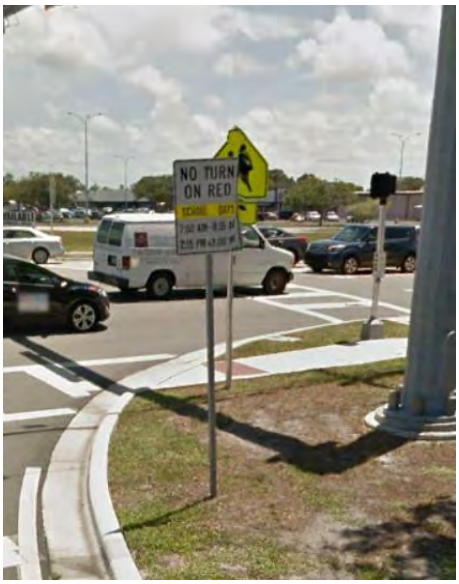
| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | Further study required |
| | **Right-of Way Needed?** | Yes |
| | **Drainage or Utility Impact?** | Drainage Impact |
| | **Responsible Agency** | City of Melbourne |




*Potential Alignment for Roadway Extension Shown as the Blue Line*

## Project 17: Install blank out "No Right Turn on Red" signage

| | |
|---|---|
| **Location** | **Apollo Boulevard and Sarno Road Intersection** |
| **Type** | **Sign/Signal** |
| **Issue** | Vehicles fail to yield to pedestrians crossing when making a right turn at the intersection of Apollo Boulevard and Sarno Road. |
| **Recommendation** | Install blank out signage for the south-bound right, east-bound right, and north-bound right turn lanes. These signs would show no right-turn-on-red when the conflicting crosswalk pedestrian push button is activated, but otherwise will stay blank. |





*Current 'No Turn On Red' Sign* *Recommended Blank Out "No Turn On Red" Sign*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | **Near-Term** |
| | **Estimated Project Cost** | **$25,000 to $30,000** |
| | **Right-of Way Needed?** | **No** |
| | **Drainage or Utility Impact?** | **No** |
| | **Responsible Agency** | **Brevard County/City of Melbourne** |

## Project 18: Install school zone flashing beacons on mast arm at school zone along Sarno Road

| | |
|---|---|
| **Location** | Sarno Road |
| **Type** | Sign/Signal |
| **Issue** | The school zone along Sarno Road does not meet standards found in the FDOT Speed Zoning Manuel. |
| **Recommendation** | Install school zone speed limit flashing beacons on mast arms to replace existing signs on poles. |


*Current School Zone Sign*


*Recommended School Zone Sign on a Mast Arm*

| | | |
|---|---|---|
| | **Implementation Time-Frame** | Near-Term |
| | **Estimated Project Cost** | $155,000 to $185,000 |
| | **Right-of Way Needed?** | No |
| | **Drainage or Utility Impact?** | No |
| | **Responsible Agency** | Brevard County/City of Melbourne |

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