

# Dunlawton Avenue at S Swallow Tail Drive - Eastbound Right Turn Lane Feasibility Study

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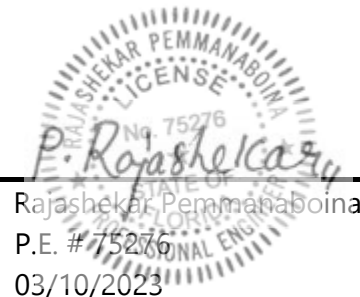
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## Executive Summary

This report presents the results of a feasibility analysis completed for the intersection of Dunlawton Avenue at S Swallow Tail Drive, located in the City of Port Orange, Volusia County, Florida. This report was prompted by an application by the City of Port Orange in March 2022 to evaluate the feasibility of construction of an exclusive eastbound right turn lane along Dunlawton Avenue to improve traffic flow, reduce delays, and improve intersection safety.

The proposed turn lane is intended to segregate right turning traffic from through traffic. As stated in the Feasibility Study Application, right turning vehicles currently stack in the outer eastbound through lane, impeding traffic flow, causing adverse safety conditions, and causing the intersection to congest during peak hours. The construction of this improvement would add roadway capacity at the study intersection with intent to reduce delays for traffic traveling eastbound through on Dunlawton Avenue and traffic turning eastbound right at the intersections of Dunlawton Avenue at S Swallow Tail Drive and Dunlawton Avenue at Nova Road, just east of S Swallow Tail Drive.

The estimated cost for the eastbound right turn lane at the intersection of Dunlawton Avenue at S Swallow Tail Drive is \$119,177.64 (present day value) and it has a corresponding annualized cost amounting to \$8,771.47. The service life for the modification is assumed 20 years and the interest rate used in the calculation of annualized costs is assumed 4%, which is a value frequently used by the Florida Department of Transportation (FDOT) in their benefit cost computations.

The operational benefits based on synchro MOE's (Total Delay, Stops and Fuel Consumption) were calculated for 300 days in a year for 12 hours per day (4 hours each for AM, Mid-day and PM peak periods) accounting for reduced benefits anticipated due to lower traffic volumes during the weekend. The crash reduction benefits were estimated based on the expected reduction of rear end crashes along Dunlawton Avenue because of the addition of a right turn lane.

The calculated Benefit/Cost (B/C) ratio of **12.84** at the study intersection indicates that the anticipated benefits outweigh the estimated costs for the proposed modification, with benefits derived through reduced costs associated with lower delay, stops, fuel consumption, and crashes.

Based upon the crash analysis, qualitative assessment, field observations, intersection analysis, B/C analysis, and engineering judgment, following considerations are recommended to improve the safety and operation of the study intersection:

- Provide an exclusive eastbound right turn lane
- Consider improving lighting at the study intersection
- Consider implementing special emphasis crosswalks
- In the long term, consider installing a signal, which will not only help with safe completion of eastbound/westbound left turn movements but also provide an additional pedestrian/bicycle opportunity at the study intersection. Based on the input received from FDOT, another option that can be explored is restricting the westbound left turning movement at the study intersection, which can instead be accomplished using the westbound left turn lane at Dunlawton Avenue and Woodbriar Trail intersection. Please note that additional analysis (as required) will need to be conducted for these two options – installing a half signal or removing the westbound left turning movement at the study intersection.

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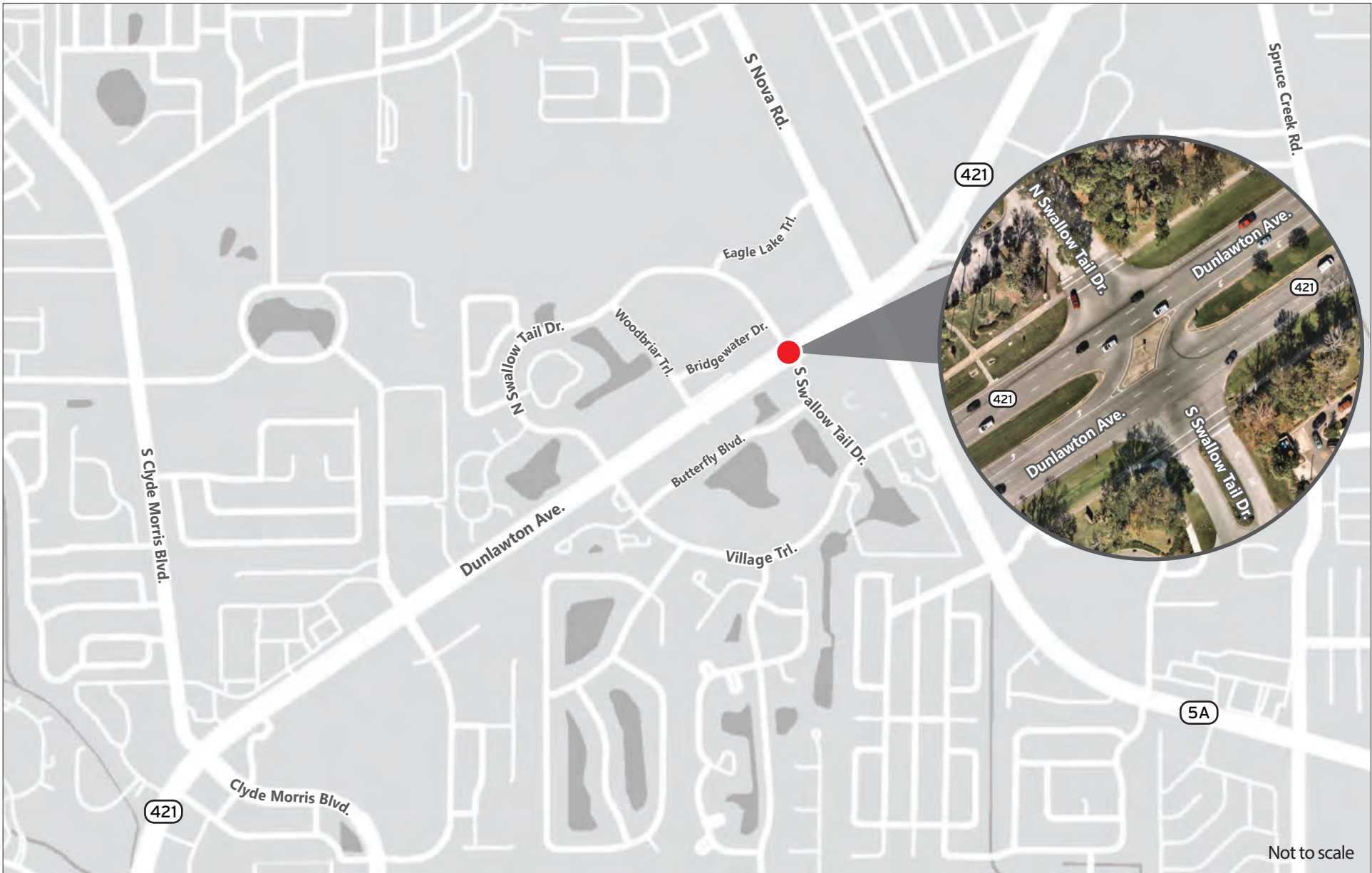
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# 1 Introduction

VHB, Inc. was retained to perform a feasibility analysis study for an exclusive eastbound right turn lane at the Dunlawton Avenue and S Swallow Tail Drive intersection (a bi-directional median opening) located in the City of Port Orange, Volusia County, Florida, as illustrated in **Figure 1-1**. This report was prompted by an application by the City of Port Orange (March 2022) to evaluate the feasibility of construction of an exclusive eastbound right turn lane along Dunlawton Avenue to improve traffic flow, reduce delays, and improve intersection safety.

The proposed turn lane is intended to segregate right turning traffic from through traffic. As stated in the Feasibility Study Application, right turning vehicles currently stack in the outside eastbound through lane, impeding traffic flow, causing adverse safety conditions, and causing the intersection to congest during peak hours. The construction of this improvement would add roadway capacity at the study intersection with intent to reduce delays for traffic traveling eastbound through on Dunlawton Avenue and traffic turning eastbound right at the intersections of Dunlawton Avenue at S Swallow Tail Drive and Dunlawton Avenue at Nova Road, just east of S Swallow Tail Drive.

The analysis methods used in completing this study are consistent with the Manual on Uniform Traffic Control Devices (MUTCD), the Manual on Uniform Traffic Studies (MUTS), the Traffic Engineering Manual (TEM), and engineering judgment. The remainder of this report documents existing conditions, vehicle, pedestrian, and bicycle counts, qualitative assessment, crash analysis, intersection analysis, B/C analysis, and recommendations. The analysis will consider the benefits and feasibility of implementing the proposed exclusive eastbound right turn lane at the study intersection. This final document is revised based on comments received from the City of Port Orange, FDOT, and TPO. The responses to the comments are provided in **Appendix A-1**.



  Project Location

N.T.S.



Figure 1-1

**Project Location Map**  
Dunlawton Avenue at  
S Swallow Tail Drive

## 2 Existing Conditions

### 2.1 Field Inventory

The intersection of Dunlawton Avenue and S Swallow Tail Drive is located in the City of Port Orange, Volusia County, Florida. The characteristics of the study intersections are presented in **Table 1**. A condition diagram was developed (see **Figure 2-1**) depicting the existing conditions at the study intersection, including the general roadway geometry, pavement markings, signage, and utilities. The conditions stated in this report reflect conditions as observed on the date of the qualitative assessment.

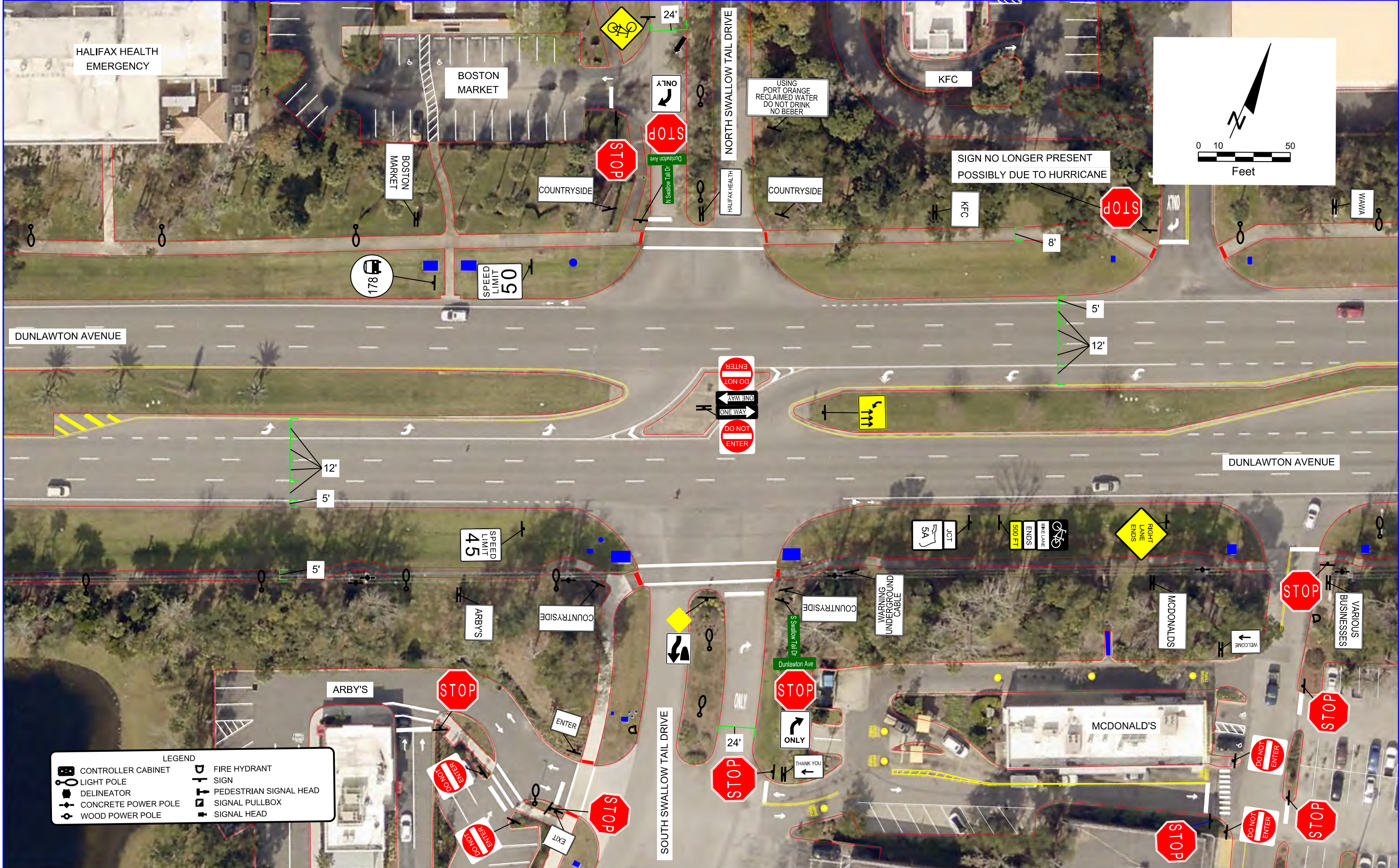
### 2.2 Traffic Volume Data

24-hour approach volume counts were collected along Dunlawton Avenue, west of S Swallow Tail Drive, and on S Swallow Tail Drive, south of Dunlawton Avenue, on Wednesday, December 7, 2022 (while schools were in session), representing a typical commuter weekday. 8-hour vehicular, pedestrian, and bicycle turning movement counts (TMCs) were collected between 7:00 AM – 9:00 AM and 12:00 PM – 6:00 PM at the study intersection, representing the highest eight hours obtained from the volume counts. From the TMC data, the AM, Mid-day, and PM peak traffic hours were found to occur from 7:45 AM to 8:45 AM, 12:00 PM to 1:00 PM, and 3:30 PM to 4:30 PM, respectively. The turning movement counts revealed that the traffic along Dunlawton Avenue peaks in the eastbound direction during the AM peak and in the westbound direction during the PM peak. The raw 24-hour approach volume counts, 8-hour TMCs along with pedestrian/bicycle counts are provided in **Appendix A-2**. The following **Table 2** summarizes the distribution of turning movements at the study intersection.



**Table 1 Field Inventory**

<b>Features</b>	<b>Dunlawton Avenue at S Swallow Tail Drive</b>
Major Street	› Dunlawton Avenue (east-west); six-lane divided urban principal arterial
Minor Street	› S Swallow Tail Drive (north-south); three-lane divided (north leg), two-lane divided (south leg)
Intersection Type	› Bi-Directional Median Opening
Number of Intersection Approach Lanes	› Northbound – 1 right lane
	› Southbound – 1 right lane
	› Eastbound – 1 left lane, 2 through lanes, 1 shared through & right lane
	› Westbound – 1 left lane, 2 through lanes, 1 shared through & right lane
Traffic Control	› Two-Way Stop Control
Speed Limit	› Dunlawton Avenue - 45 mph
	› S Swallow Tail Drive - 15 mph
Sidewalks	› Dunlawton Avenue - on both sides of the roadway
	› S Swallow Tail Drive - on west side of the roadway
Surrounding Development	› Northwest: Boston Market, Halifax Health Emergency Department
	› Northeast: KFC, Wawa
	› Southwest: Arby's
	› Southeast: McDonald's, Shopping Plaza
	› Several medical centers are located just east and west of the intersection.
Nearest Signalized Intersections	› Dunlawton Avenue and S Nova Road – 0.15 miles to the east
	› Dunlawton Avenue and N Swallow Tail Drive – 0.35 miles to the west
Roadway Lighting	› Sidewalk Lighting – along Dunlawton Avenue on both sides of the roadway
	› Street Lighting – along the north leg of S Swallow Tail Drive in the roadway median
Transit Stops	› Votran Bus Station in Northwest quadrant of intersection – Route 17B
	› Votran Transfer Station along S Swallow Tail Drive south of intersection – Routes 4, 7, 12, 17B, 40



**LEGEND**

	CONTROLLER CABINET		FIRE HYDRANT
	LIGHT POLE		SIGN
	DELINEATOR		PEDESTRIAN SIGNAL HEAD
	CONCRETE POWER POLE		SIGNAL PULLBOX
	WOOD POWER POLE		SIGNAL HEAD

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	VOLUSIA	

<b>DUNLAWTON AVENUE AT S SWALLOW TAIL DRIVE CONDITION DIAGRAM</b>
---

FIGURE NO.
2-1

**Table 2 8-Hour Turning Movement Percentages (All Vehicles)**

<b>Study Intersection</b>	<b>Movement</b>	<b>Northbound</b>	<b>Southbound</b>	<b>Eastbound</b>	<b>Westbound</b>
Dunlawton Avenue at S Swallow Tail Drive	Left/U-Turn	-	-	2.8%	6.8%
	Through	-	-	95.1%	91.6%
	Right Turn	100.0%	100.0%	2.1%	1.6%

## 3 Qualitative Assessment

A field visit was conducted for the study intersection on a typical commuter weekday while schools were in session, on Thursday December 8, 2022. Three schools were identified within the vicinity, including Sweetwater Elementary School, Silver Sands Middle School, and Spruce Creek High School, and drop-off/pick-up times were noted. The following subsections describe conditions observed during the visit.

### 3.1 Field Observations

- Vehicles travelling eastbound through were observed to generally avoid the outside (right-most) through lane (see **Figure 3-1**). There is currently a sign along eastbound Dunlawton Avenue, east of S Swallow Tail Drive as well as east of Nova Road, which reads “RIGHT LANE ENDS”. It appears that most drivers are aware of the upcoming lane drop and seldom use the outside lane before Nova Road. However, there are cases where the outside lane utilization is comparable to the two inside lanes.
- **Figures 3-2** and **3-3** show the downstream eastbound outside through lane and right turn lane during peak queueing (PM peak) conditions. During most cycles, the outer through lane would be clear to allow for right turn lane access (**Figure 3-2**). The turn lane access would be blocked on occasion for some of the heavier cycles (**Figure 3-3**). As a result of drivers avoiding the outside eastbound through lane, queues extend longer in the inside two lanes compared to the outside lane.
- Few Votran and several school buses were observed along Dunlawton Avenue throughout the day. Votran buses were observed accessing S Swallow Trail Drive via the eastbound right and westbound left movements. A Votran bus transfer station is provided on S Swallow Trail Drive approximately 550 feet south of Dunlawton Avenue.
- The downstream McDonald’s/Countryside Shopping Center driveway (right-in/right-out along eastbound Dunlawton Avenue) was noted as a major attractor during all the three peaks (am, mid-day and pm).

- Very few pedestrians or cyclists were observed along Dunlawton Avenue. Sidewalks are provided on both sides of Dunlawton Avenue and on the west side of S Swallow Tail Drive. Five-foot marked bike lanes are provided along Dunlawton Avenue in both directions.
- Drivers were generally found obeying the speed limit and pavement markings along Dunlawton Avenue and S Swallow Tail Drive.
- It was noted that in the PM peak hour only, drivers in the eastbound queue (which extended past the median opening) would commonly allow gaps for westbound left turning (or U-turning) drivers. Since the eastbound outside through lane does not backup as frequently as the other two inside through lanes, westbound left turning vehicles sometimes had issues judging the gaps in the eastbound outside through lane.

Figure 3-1 Queuing Observations



Figure 3-2 Eastbound Right Turn Lane at Downstream Nova Road Intersection (Clear)



Figure 3-3 Eastbound Right Turn Lane at Downstream Nova Road Intersection (Blocked)



***(AM Peak Hour 7:45 AM to 8:45 AM)***

- In general, no notable right turn queues were observed at the study intersection in the AM peak hour. It was noted that relatively few drivers were making eastbound or westbound right turns at the study intersection.
- Substantial eastbound through queues from the downstream intersection of Dunlawton Avenue and Nova Road extended up to approximately 650 feet from the stop bar. During this time, through queues were not observed to block the westbound left turn median opening. The eastbound approach signal at Nova Road was found to operate with moderate delay, however, was noted to clear vehicle queues on every cycle.
- Moderate queues of up to approximately 125 feet were observed at the westbound left turn median opening on to S Swallow Tail Drive. Platooning along Dunlawton Ave resulted in sufficient gaps allowing drivers to safely cross.
- No notable queues were observed at the eastbound left turn median opening, as gaps were generally available.

***(Mid-day Peak Hour 12:00 PM to 1:00 PM)***

- In general, conditions during the Mid-day peak hour were very similar to the AM peak. Similar queue lengths were noted as traffic volumes were sustained from the AM peak.

***(PM Peak Hour 3:30 PM to 4:30 PM)***

- The observations on the westbound approach were similar to the AM observations, however it was noted that through queues from the downstream eastbound approach at Nova Road extended further at 850 feet from the stop bar, past the median openings at S Swallow Tail Drive.
- Similar to the AM and Mid-day conditions, drivers would generally avoid the eastbound outside through lane, resulting in longer queues in the inside through lanes.
- Due to the substantial eastbound queueing, westbound left turning traffic was often blocked momentarily during the peak queue.

## 3.2 Paint, Signage, and Lighting

- Paint and signage were clearly visible and legible at the intersection and its surroundings. It was also noted that reflective backplates were installed on the downstream signal heads at S Nova Road for better visibility.
- As mentioned, a 'RIGHT LANE ENDS' sign is provided on the south side of Dunlawton Avenue, easily visible to eastbound drivers.
- Lighting is provided on both sides of Dunlawton Avenue and in the median along S Swallow Tail Drive. No lighting is provided along N Swallow Tail Drive.
- It was observed that the southbound approach stop sign at the Wawa right-in/right-out driveway (just east of N Swallow Tail Drive) is missing from its post. This is noted in the condition diagram.

## 3.3 ADA Concerns

- Pedestrian curb ramps across S Swallow Tail Drive are present and at an acceptable slope, with tactile warning pads provided only on the east side of N Swallow Tail Drive and the west side of S Swallow Tail Drive.



## 4 Historical Crash Analysis

The latest available six years of crash data (from January 1, 2017 to December 31, 2022) at the study intersection was obtained from Signal Four Analytics. Raw crash data is included in **Appendix B**.

### 4.1 Historical Crash Summary

As shown in **Table 3**, there were 51 crashes reported within the influence area of this intersection. The crashes consisted of 19 rear end, eight (8) sideswipe, seven (7) angle, nine (9) left turn, three (3) right turn, two (2) off road, and three (3) pedestrian/bicyclist crashes. The crashes caused 30 injuries (from 22 crashes), and total property damage amounted to approximately \$294,950. One (1) fatality was reported. 42 of the crashes occurred in daylight and the remaining nine (9) crashes occurred in dark, dusk, or dawn conditions. Pavement condition was dry for 47 of the crashes and wet conditions for the remaining four (4) crashes.

#### 4.1.1 Fatal Crashes

##### ***Pedestrian Crash #89398757 – Sunday, 6/27/2021 9:42PM***

A vehicle travelling eastbound along Dunlawton Avenue within the innermost lane struck a pedestrian who was running across the center of the study intersection from south to north. The pedestrian was wearing all black clothes and the driver stated that they did not see them due to the light conditions at the time of the incident. The pedestrian was pronounced deceased at the scene of the incident. Roadway conditions at the time of the incident were dry pavement in dark lighted conditions.

**Table 3 Dunlawton Avenue at S Swallow Tail Drive - Crash Summary**

Year	2017	2018	2019	2020	2021	2022	Total	Proportion
<b>Crash Type</b>								
Rear End	2	3	2	2	4	6	19	37.3%
Head On	0	0	0	0	0	0	0	0.0%
Sideswipe	1	2	0	1	2	2	8	15.7%
Roll Over	0	0	0	0	0	0	0	0.0%
Angle	0	0	1	0	5	1	7	13.7%
Left Turn	3	1	0	2	2	1	9	17.6%
Right Turn	1	0	1	0	1	0	3	5.9%
Off Road	0	1	0	0	1	0	2	3.9%
Pedestrian & Bicycle	0	0	0	0	2	1	3	5.9%
Animal	0	0	0	0	0	0	0	0.0%
Other	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>
<b>Crash Severity</b>								
Fatality	0	0	0	0	1	0	1	2.0%
Injury	3	3	2	3	6	5	22	43.1%
Property Damage Only	4	4	2	2	10	6	28	54.9%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>
<b>Pavement Condition</b>								
Wet	2	1	0	0	1	0	4	7.8%
Dry	5	6	4	5	16	11	47	92.2%
Slippery	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>
<b>Light Condition</b>								
Daylight	6	6	1	3	15	11	42	82.4%
Dusk	0	0	0	0	1	0	1	2.0%
Dawn	1	0	0	0	0	0	1	2.0%
Dark	0	1	3	2	1	0	7	13.7%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

## 4.1.2 Pedestrian and Bicycle Crashes

### ***Bicycle Crash #89400637 – Monday, 11/28/2022 3:39PM***

A vehicle travelling westbound along Dunlawton Avenue struck a bicyclist traveling eastbound along the north sidewalk while attempting to turn right into the Wawa driveway just east of the study intersection. Another vehicle was attempting to turn right out of Wawa, obscuring the entering vehicles view of the bicyclist. The bicyclist was riding an electric bicycle and maneuvered behind the vehicle attempting to exit the driveway before being struck. The bicyclist was found at fault and was checked on the scene by the Port Orange Fire Rescue for minor injuries. Roadway conditions at the time were dry pavement with day light conditions.

### ***Pedestrian Crash #89398453 – Wednesday, 3/31/2021 3:52PM***

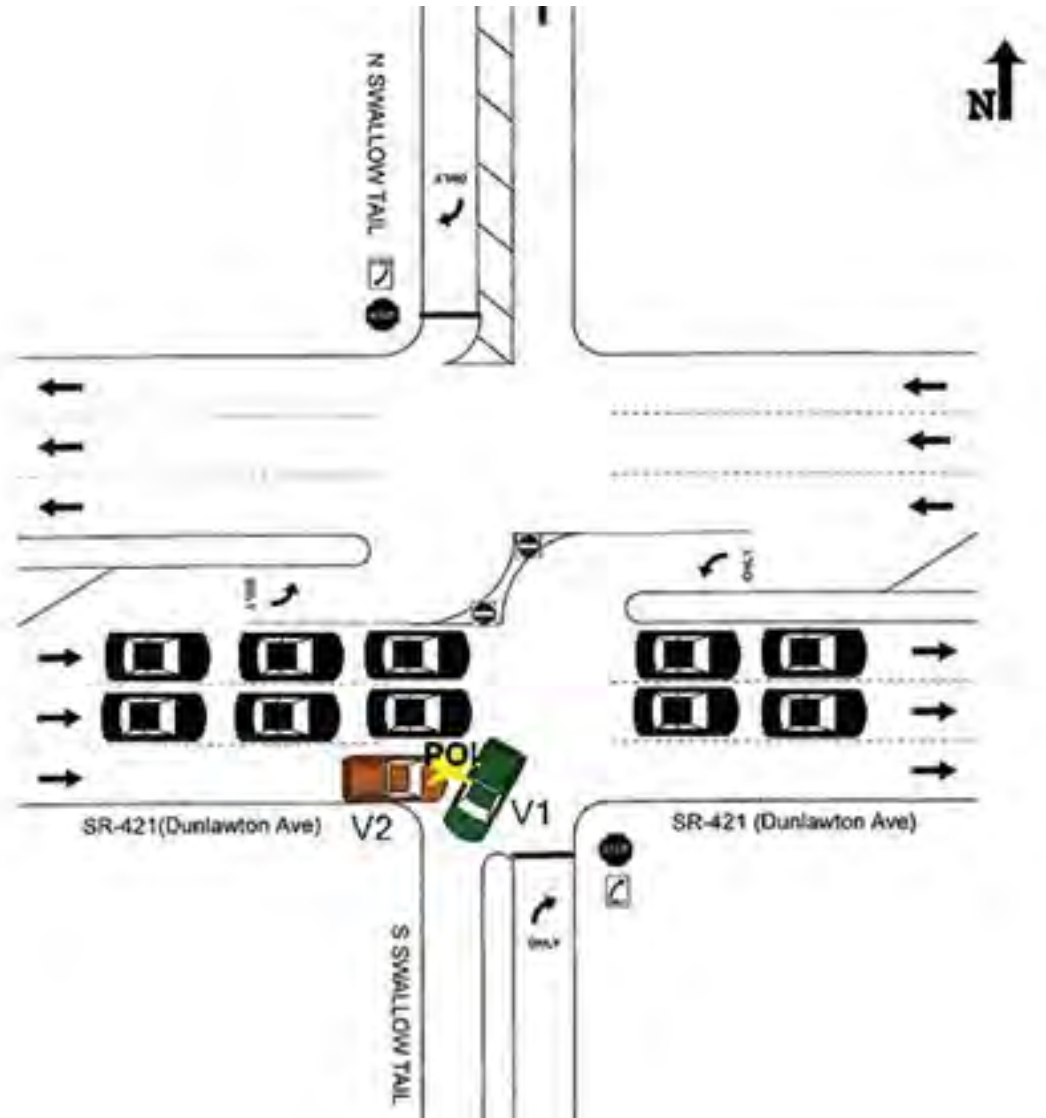
A vehicle traveling southbound along N Swallow Tail Drive approaching the study intersection struck a pedestrian travelling westbound within the crosswalk on a motorized wheelchair. The driver of the vehicle stated that they were distracted by a vehicle exiting the nearby Arby's driveway. The driver of the vehicle was found at fault and the pedestrian was transported to Halifax Medical Center with minor injuries. Roadway conditions at the time of the incident were dry pavement with day light conditions.

## 4.2 Crash Patterns

As shown in **Table 3**, nine (9) left turn crashes were observed during the study period. Based on field observations of the peak conditions at the study intersection, it was noted that traffic in the inside and middle through lanes at this intersection tend to stop to allow westbound left crossing movements due to queueing from the downstream intersection of Dunlawton Avenue at S Nova Road. It was noted that because of this, the stopped traffic sometimes blocks the sight-line between left turning vehicles and faster moving traffic in the eastbound outside lane. Assessment of the left turn crash reports revealed that all nine (9) left turn crash narratives indicate that the crashes were a result of this sight-line blockage, as illustrated in **Figure 4-1** below. A potential solution is to provide a traffic signal at this intersection in the long term that will not only improve westbound left turn movement safety but also provide an additional location for pedestrian/bicycle crossing.

The signal would operate with two phases – one for the eastbound/westbound throughs and another for all the other movements.

Figure 4-1 Westbound Left Turn Crash Scenario – Crash Report Illustration



## 5 Feasibility Analysis

The following chapter summarizes the traffic operational and benefit-cost analyses by comparing before-and-after operating conditions and anticipated project benefits and costs in monetary terms.

### 5.1 Proposed Improvement - Eastbound Right Turn Lane

The latest FDOT Design Manual (2023) guidance was used to determine the appropriate turn lane length based on design speed and 95<sup>th</sup> percentile queue length (worst-case scenario) for the eastbound right turn lane. A total storage length of 315 feet was used for the eastbound right turn lane in the proposed scenario. Relevant excerpts are provided in **Appendix C**.

### 5.2 Operational Analysis – Build vs. No-Build

An operational analysis was performed using procedures from the Highway Capacity Manual (HCM) 6<sup>th</sup> Edition in the latest version of Synchro software. For each scenario, the analysis was performed for the AM, Mid-day, and PM peak hours based on the field collected TMC data. Raw TMC data was adjusted based on the latest FDOT Peak Season Factor Category Report for Volusia County. The weekly seasonal factor (SF) for the data collection date (December 7, 2022) was found to be 1.01, indicating that counts were collected in off-peak season. Therefore, TMCs were grown to peak season values by applying the SF. The turning movement volumes (adjusted TMCs) are shown in **Figure 5-1**. Two (2) scenarios were considered:

- No-Build Scenario: This scenario maintains the existing geometry at the intersection
- Build Scenario: This scenario includes the proposed exclusive eastbound right turn lane

No-Build and Build analysis results are provided in the following **Table 4**. As shown in the table, northbound and southbound right turn movements and the eastbound left turn movement operate at acceptable LOS in all peak hours. However, the westbound left turn movement is shown to fail in the Mid-day and PM peak hours. The addition of the exclusive eastbound right turn lane under the Build Scenario results in reduction of delay for the westbound left turn and northbound right turn movements as shown in **Table 4**. The HCM 6<sup>th</sup> Edition outputs for two-way stop-controlled intersections are provided in **Appendix D**.

**Table 4 Dunlawton Avenue at S Swallow Tail Drive - Operational Analysis**

Peak Hour	AM		Mid-Day		PM	
Movement	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
<b>No-Build (Existing Geometry)</b>						
EBL	18.8	C	29.6	D	34.0	D
WBL	33.6	D	58.7	F	60.5	F
NBR	19.1	C	22.7	C	22.6	C
SBR	16.4	C	22.3	C	26.3	D
<b>Build (With Exclusive Eastbound Right Turn Lane)</b>						
EBL	18.8	C	29.6	D	34.0	D
WBL	33.3 (-)	D	56.4 (-)	F	58.8 (-)	F
NBR	18.8 (-)	C	21.6 (-)	C	22.0 (-)	C
SBR	16.4	C	22.3	C	26.3	D

*Note: The (-) symbol represents a reduction in delay as compared to the No-Build scenario.*

### 5.3 Site Assessments for Proposed Improvements

This section provides a brief assessment of the sites that can be considered before constructing the proposed improvement. In order to construct an exclusive eastbound right turn lane, the following elements will need to be accounted for:

- Swale along the southwest quadrant would need to be re-worked, and the cross drain extended to not conflict with the additional lane. Due to the additional impervious surface area from the new eastbound turn lane and the reduced size of the drainage swale, the re-worked swale should be analyzed to determine if it can accommodate the additional water.
- Southwest quadrant of the intersection would require a manhole to be adjusted vertically.
- Speed limit sign need to be relocated.
- Both a mitered end section and detectable warning would need to be reconstructed.

Survey was not provided for the Improvement Diagram; however, from lot and parcel lines pulled from the Volusia County Property Appraiser’s web page, it appears that the turn lane could fit within the existing right of way. The overhead utility lines that run along the south side of Dunlawton Avenue would not need to be relocated.

## 5.4 Benefit-Cost Analysis

A Benefit-Cost (B/C) analysis was performed for the study intersections based on traffic operational benefits as well as anticipated crash reduction benefits.

### 5.4.1 Traffic Operational Benefits

To estimate the operational benefits of the proposed intersection improvements, Synchro was used. The benefits are defined in terms of annualized cost savings associated with reductions in the following three measures of effectiveness (MOEs):

- Delay Reduction for westbound left and northbound right turn movements (Vehicle-Hours)
- Stops
- Fuel consumption (Gallons)

The benefits were calculated for 300 days in a year for 12 hours per day (4 hours each for AM, Mid-day and PM peak periods) accounting for reduced benefits anticipated due to lower traffic volumes during the weekend. **Table 5** summarizes the unit value of each MOE in a tabular format along with its source.

**Table 5 Unit Value of MOEs**

MOE Values	Unit Value	Source
Stops (\$)	0.014	Transyt 7F
Delay (\$)	20.17	2021 Urban Mobility Report published by Texas A&M Transportation Institute (TTI)
Fuel (\$/gal.)	3.263	<a href="https://gasprices.aaa.com/?state=FL#state-metro">https://gasprices.aaa.com/?state=FL#state-metro</a> (as of 1/13/2023)
Days per Year	300	Average days with observable AM & PM peaking characteristics

### 5.4.2 Crash Reduction Benefits

For the purpose of this study, the Historical Crash Method (HCM) was used to calculate the B/C ratio for the proposed improvements. This method can be used for sites with a crash history. The annualized conversion will show whether the projected expenditure of funds for the crash benefit will exceed the direct cost for the-

improvement. Historical crash method as specified in the 2023 Florida Design Manual (FDM) was used to calculate the safety benefits of the proposed turn lane improvements. For this study, the crash reduction benefits were estimated based on the expected reduction of rear end crashes along eastbound Dunlawton Avenue because of addition of and exclusive right turn lane. A Crash Modification Factor (CMF) of 14% was used based on Crash Modification Factor (CMF) ID 285 from the cmfclearinghouse.org for reduction of rear end crashes with providing an exclusive right turn lane on major street approach. It is important to note that the CMF used in this study is based on historical data for similar roadway geometries and traffic characteristics. The CMF (for locations reasonably similar to the study corridor) used in this study is provided in **Appendix E**.

### 5.4.3 Improvement Construction Costs

The estimated costs for proposed turn lane improvements at the study intersection used in the B/C analysis is provided in **Appendix E**. The estimated cost for the Dunlawton Avenue at S Swallow Tail Drive intersection modification is \$119,177.64 (2022 value) and it has a corresponding annualized cost amounting to \$8,771.47. Based on input received from the TPO, lighting improvement cost at the study intersection is provided as a separate item in the cost estimate included in **Appendix E**. Please note that the lighting improvement cost is not considered in the B/C analysis. The service life for the modification is assumed 20 years and the interest rate used in the calculation of annualized costs is assumed 4%, which is a value frequently used by FDOT in their benefit cost computations. In addition, **Table 6** summarizes the cost estimate in today's (2022) dollar value as well for the next three years based on the latest available FDOT highway construction cost inflation factors published on July 1, 2021.

**Table 6 Dunlawton Avenue at S Swallow Tail Drive - B/C Analysis Results**

Fiscal Year	Inflation Factor	Multiplier	Adjusted Cost
2022	Base	1.000	\$119,177.64
2023	2.70%	1.027	\$122,395.44
2024	2.80%	1.056	\$125,851.59
2025	2.90%	1.086	\$129,426.92



**Table 7** summarizes the B/C analysis for the study intersections. The analysis yields a B/C ratio of 12.84 for the study intersection of Dunlawton Avenue at S Swallow Tail Drive. The calculated B/C ratio at the study intersection indicates that the anticipated benefits outweigh the estimated costs for the proposed modification, with benefits derived through reduced costs associated with lower delay, stops, fuel consumption and crashes. The operational annual user benefits calculations can be found in **Appendix E**.

**Table 7 Dunlawton Avenue at S Swallow Tail Drive - B/C Analysis Results**

Annual User Benefit			Annual Construction Cost	B/C Ratio
Operational Annual User Benefit	Crash Reduction Annual User Benefit	Total		
\$80,936	\$31,723	\$112,659	\$8,771.47	12.84

*Notes:*

- 1) The service life of the improvements was kept at 20 years.
- 2) Interest rate of 4% was used to determine the annual cost of improvements.
- 3) Traffic operational annual user benefit was calculated for 300 days in a year for 12 hours per day (3 hours each for AM, Mid-day and PM peak periods).
- 4) Additional right-of-way is not anticipated for this improvement

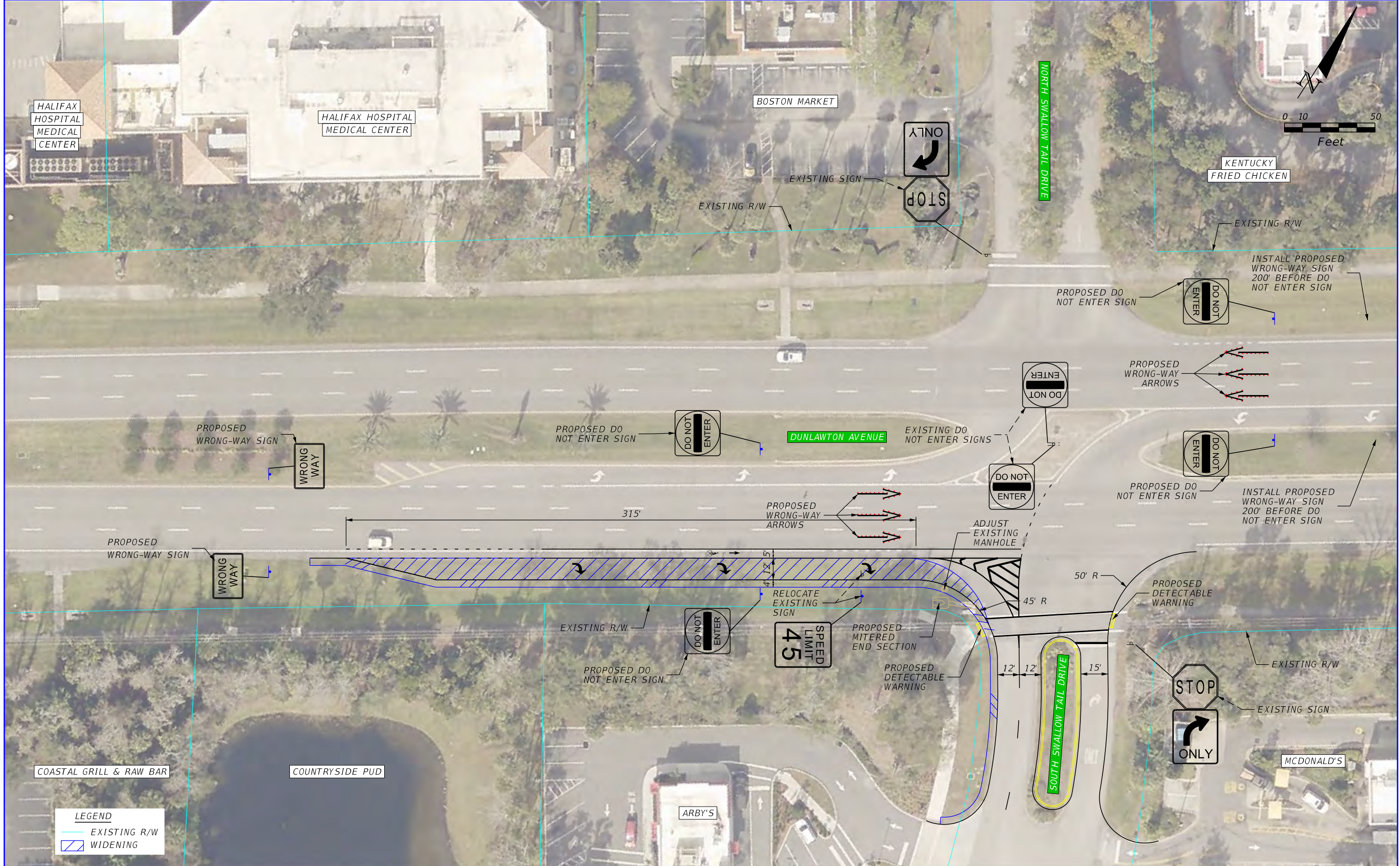
## 6 Recommendations

Based upon the crash analysis, qualitative assessment, field observations, intersection analysis, B/C analysis and engineering judgment, the following modifications are recommended to improve the safety and operation of the study intersections:

- Provide an exclusive eastbound right turn lane
- Consider improving lighting at the study intersection
- Consider implementing special emphasis crosswalks
- In the long term, consider installing a signal, which will not only help with safe completion of eastbound/westbound left turn movements but also provide an additional pedestrian/bicycle opportunity at the study intersection. Based on the input received from FDOT, another option that can be explored is restricting the westbound left turning movement at the study intersection, which can instead be accomplished using the westbound left turn lane at Dunlawton Avenue and Woodbriar Trail intersection. Please note that additional analysis (as required) will need to be conducted for these two options – installing a half signal or removing the westbound left turning movement at the study intersection.

This improvement is based on the input provided in the application for a feasibility study completed by the City of Port Orange. This modification can be implemented at an approximate cost of \$119,177.64 and yields a B/C ratio of **12.84**, which indicates that the anticipated benefits outweigh the estimated costs for the proposed modifications.

The team presented the study findings to all the stakeholders on January 19<sup>th</sup>, 2023. The relevant presentation is provided in the **Appendix F**. The proposed eastbound right turn lane improvement concept is shown in **Figure 6-1**.



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

--

<b>RIVER TO SEA TPO</b>		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 421	VOLUSIA	

<b>IMPROVEMENT DIAGRAM FOR DUNLAWTON AVENUE AND SWALLOW TAIL DRIVE</b>
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<b>Figure 6-1</b>
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## Appendix A-1 – Responses to Comments

## **Responses to Comments**

### **Comments from the City of Port Orange (Margaret Tomlinson)**

1. In the last paragraph on page 16 sentence says "The westbound left turn movement is shown to fail in the mid-day and PM peak hours." But is not elaborated on. Data presented shows an overall improvement but do models predict this issue becoming worse in the peak PM and mid-day times in the Build Scenario?

**Response:** This comment is noted. As mentioned in the Report and as shown in Table 4, both westbound left and northbound right turning movements have a reduced delay in the Build scenario (with the eastbound right turn lane). This is clarified in the revised report.

2. See markup in the improvement diagram.

**Response:** The improvement diagram is revised to show the correct orientation of the proposed signs.

### **Comments from FDOT District 5 (Chad T. Lingenfelter)**

1. Two (2) lane ingress so that westbound left turn drivers are not managing a fourth eastbound lane;
2. Add a four (4) foot wide shoulder along the turn lane;
3. Closely examine the manhole and mitered end section to be adjusted to determine the intersecting slope, clear zone, and costs associated;
4. Ensure that the turning movements accommodate 40 foot buses;
5. Remove the proposed Yield sign; and
6. Spin the Do Not Enter and Wrong Way signs for proper orientation.

**Response to Comments 1-6:** These comments are noted, and the improvement diagram is updated as needed. We have verified that the eastbound right turning movement accommodates a 40-foot bus.

### **Comments from FDOT District 5 (Michael Sanders)**

1. Stephan, no comments related to proposed EB right turn lane at Swallow Tail. The long term recommendation for a half signal there would require additional analysis. While it may not be well received, removing the WB left turn movement could be another option to prevent the potential for good samaritan type crashes. There is a warning sign we have used elsewhere designating crossing three opposing lanes I'll share with VHB if merit to installing here.

**Response:** The revised report added a note to mention that a half signal will need additional analysis (which is out of the scope for this study). The report will also add that removing the WB left turn lane can be explored as well in the recommendations section. However, this recommendation needs additional analysis as well (which is out of the scope for this study). The warning sign – designating crossing three opposing lanes is already part of the existing signage at the study intersection.

# Dunlawton Avenue at S Swallow Tail Drive - Eastbound Right Turn Lane Feasibility Study

PREPARED FOR

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River to Sea Transportation Planning  
Organization (TPO)

2  
2570 W. International Speedway Blvd,  
Suite 100  
Daytona Beach, FL, 32114-8145

Task Work Order TOF-VHB-07

PREPARED BY

---



250 E. Robinson St  
Orlando, FL, 32803


3  
JANUARY 2023

# Summary of Comments on DraftFeasibilityStudyReport\_Dunlawton-SSwallowTail\_01272023-TPO Comments.pdf


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Page: 1


---

 Number: 1 Author: SHarris Subject: Sticky Note Date: 3/3/2023 3:13:14 PM  
Final Report


---

 Author: VHB Subject: Sticky Note Date: 3/8/2023 9:48:58 AM  
The report is revised accordingly


---

 Number: 2 Author: SHarris Subject: Sticky Note Date: 3/3/2023 2:17:49 PM  
Use the River to Sea TPO's new address: 1 Deuce Court Suite 100 Daytona Beach, FL 32124


---

 Author: VHB Subject: Sticky Note Date: 3/8/2023 9:49:01 AM  
The report is revised accordingly

---

 Number: 3 Author: SHarris Subject: Sticky Note Date: 3/3/2023 3:13:42 PM  
March 2023

---

 Author: VHB Subject: Sticky Note Date: 3/8/2023 9:49:07 AM  
The report is revised accordingly

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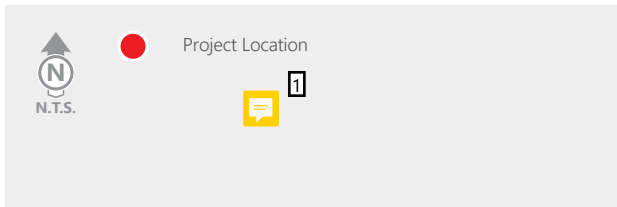




Figure 1-1

**Project Location Map**  
Dunlawton Avenue at  
S Swallow Tail Drive

---

 Number: 1 Author: SHarris Subject: Sticky Note Date: 3/3/2023 3:16:47 PM  
Include scale

 Author: VHB Subject: Sticky Note Date: 3/8/2023 9:51:12 AM  
This figure is a graphical representation of the study area and is not to scale. The revised report includes a note - "This figure is not to scale"



---

Number: 1 Author: SHarris Subject: Sticky Note Date: 3/3/2023 2:11:04 PM  
Include lighting recommended on page 21 in cost estimate.

Author: VHB Subject: Sticky Note Date: 3/8/2023 9:53:09 AM  
Lighting cost is included as a separate cost in the Appendix.

---

Number: 2 Author: SHarris Subject: Sticky Note Date: 3/3/2023 2:12:59 PM  
Pay items in cost column are not totaling \$76,273.69. Please recalculate.

Author: VHB Subject: Sticky Note Date: 3/8/2023 9:53:38 AM  
The rows with Pavement markings were hidden. An updated cost sheet is included in the revised report.

---

Number: 3 Author: SHarris Subject: Sticky Note Date: 3/3/2023 2:14:05 PM  
River to Sea TPO does not program contingency amounts. Please remove.

Author: VHB Subject: Sticky Note Date: 3/8/2023 9:57:38 AM  
Contingency cost is an other word the project unknowns, which is generally included in all planning-level cost estimates and is requested specifically by the City in previous projects. The word "contingency" will be replaced with "unknowns".

---

Number: 4 Author: SHarris Subject: Sticky Note Date: 3/3/2023 3:54:00 PM  
Consider requiring a survey.

Author: VHB Subject: Sticky Note Date: 3/8/2023 9:58:31 AM  
Survey cost is included in the Design Phase of the cost estimate.

---

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## Appendix A-2 – Data Collection

# Roadway Count Summary

*Vanasse Hangen Brustlin, Inc.*

Start Date : December 7, 2022  
 Stop Date : December 7, 2022  
 County : Volusia

Start Time : 00:00  
 Stop Time : 24:00  
 Station Number : 1  
 Equipment ID : 17

Location : Dunlawton Ave, EB APPROACH

7-Dec-22		Eastbound Volume										
End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	29	16	8	10	13	19	57	203	387	339	336	416
30	20	11	8	3	13	31	104	296	338	357	389	356
45	11	22	7	11	21	43	123	351	366	377	394	455
00	9	11	6	10	25	61	194	418	410	414	381	425
<b>Hr Total</b>	<b>69</b>	<b>60</b>	<b>29</b>	<b>34</b>	<b>72</b>	<b>154</b>	<b>478</b>	<b>1,268</b>	<b>1,501</b>	<b>1,487</b>	<b>1,500</b>	<b>1,652</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	458	416	364	422	415	430	311	239	166	128	82	38
30	458	373	447	446	414	368	341	201	195	113	61	54
45	405	410	444	429	391	319	263	242	134	102	57	31
00	436	421	424	462	391	358	298	184	129	97	44	27
<b>Hr Total</b>	<b>1,757</b>	<b>1,620</b>	<b>1,679</b>	<b>1,759</b>	<b>1,611</b>	<b>1,475</b>	<b>1,213</b>	<b>866</b>	<b>624</b>	<b>440</b>	<b>244</b>	<b>150</b>

24 Hour Total : 21,742  
 AM Peak Hour begins : 11:30 AM Peak Volume : 1,796 AM Peak Hour Factor : 0.98  
 PM Peak Hour begins : 15:00 PM Peak Volume : 1,759 PM Peak Hour Factor : 0.95

7-Dec-22		Lane 2										
End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
00	0	0	0	0	0	0	0	0	0	0	0	0
<b>Hr Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
00	0	0	0	0	0	0	0	0	0	0	0	0
<b>Hr Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

24 Hour Total : 0  
 AM Peak Hour begins : AM Peak Volume : 0 AM Peak Hour Factor :  
 PM Peak Hour begins : PM Peak Volume : 0 PM Peak Hour Factor :

7-Dec-22		Total Volume for All Lanes										
End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	29	16	8	10	13	19	57	203	387	339	336	416
30	20	11	8	3	13	31	104	296	338	357	389	356
45	11	22	7	11	21	43	123	351	366	377	394	455
00	9	11	6	10	25	61	194	418	410	414	381	425
<b>Hr Total</b>	<b>69</b>	<b>60</b>	<b>29</b>	<b>34</b>	<b>72</b>	<b>154</b>	<b>478</b>	<b>1,268</b>	<b>1,501</b>	<b>1,487</b>	<b>1,500</b>	<b>1,652</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	458	416	364	422	415	430	311	239	166	128	82	38
30	458	373	447	446	414	368	341	201	195	113	61	54
45	405	410	444	429	391	319	263	242	134	102	57	31
00	436	421	424	462	391	358	298	184	129	97	44	27
<b>Hr Total</b>	<b>1,757</b>	<b>1,620</b>	<b>1,679</b>	<b>1,759</b>	<b>1,611</b>	<b>1,475</b>	<b>1,213</b>	<b>866</b>	<b>624</b>	<b>440</b>	<b>244</b>	<b>150</b>

24 Hour Total : 21,742  
 AM Peak Hour begins : 11:30 AM Peak Volume : 1,796 AM Peak Hour Factor : 0.98  
 PM Peak Hour begins : 15:00 PM Peak Volume : 1,759 PM Peak Hour Factor : 0.95

# Roadway Count Summary

*Vanasse Hangen Brustlin, Inc.*

Start Date : December 7, 2022  
 Stop Date : December 7, 2022  
 County : Volusia

Start Time : 00:00  
 Stop Time : 24:00  
 Station Number : 2  
 Equipment ID : 90

Location : Swallow Tail Dr, NB APPROACH

**7-Dec-22 Northbound Volume**

End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	1	0	0	0	0	2	2	10	10	9	8	5
30	0	0	0	0	0	1	4	4	8	3	4	9
45	1	0	0	0	1	2	3	3	2	6	4	9
00	2	0	0	1	1	0	5	2	5	5	2	10
<b>Hr Total</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>14</b>	<b>19</b>	<b>25</b>	<b>23</b>	<b>18</b>	<b>33</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	11	9	8	5	7	9	5	7	3	3	2	1
30	11	12	11	6	9	9	12	4	5	4	4	0
45	17	12	10	6	8	8	9	6	2	1	2	1
00	12	12	15	8	5	3	9	9	0	2	1	4
<b>Hr Total</b>	<b>51</b>	<b>45</b>	<b>44</b>	<b>25</b>	<b>29</b>	<b>29</b>	<b>35</b>	<b>26</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>6</b>

24 Hour Total : 463  
 AM Peak Hour begins : 11:45 AM Peak Volume : 49 AM Peak Hour Factor : 0.72  
 PM Peak Hour begins : 12:00 PM Peak Volume : 51 PM Peak Hour Factor : 0.75

**7-Dec-22 Lane 2**

End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
00	0	0	0	0	0	0	0	0	0	0	0	0
<b>Hr Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
00	0	0	0	0	0	0	0	0	0	0	0	0
<b>Hr Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

24 Hour Total : 0  
 AM Peak Hour begins : AM Peak Volume : 0 AM Peak Hour Factor :  
 PM Peak Hour begins : PM Peak Volume : 0 PM Peak Hour Factor :

**7-Dec-22 Total Volume for All Lanes**

End Time	00	01	02	03	04	05	06	07	08	09	10	11
15	1	0	0	0	0	2	2	10	10	9	8	5
30	0	0	0	0	0	1	4	4	8	3	4	9
45	1	0	0	0	1	2	3	3	2	6	4	9
00	2	0	0	1	1	0	5	2	5	5	2	10
<b>Hr Total</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>14</b>	<b>19</b>	<b>25</b>	<b>23</b>	<b>18</b>	<b>33</b>

End Time	12	13	14	15	16	17	18	19	20	21	22	23
15	11	9	8	5	7	9	5	7	3	3	2	1
30	11	12	11	6	9	9	12	4	5	4	4	0
45	17	12	10	6	8	8	9	6	2	1	2	1
00	12	12	15	8	5	3	9	9	0	2	1	4
<b>Hr Total</b>	<b>51</b>	<b>45</b>	<b>44</b>	<b>25</b>	<b>29</b>	<b>29</b>	<b>35</b>	<b>26</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>6</b>

24 Hour Total : 463  
 AM Peak Hour begins : 11:45 AM Peak Volume : 49 AM Peak Hour Factor : 0.72  
 PM Peak Hour begins : 12:00 PM Peak Volume : 51 PM Peak Hour Factor : 0.75

### VEHICLE TURNING MOVEMENT COUNT

SECTION: 63308.07  
 STATE ROUTE: Dunlawton Avenue  
 OBSERVER: VHB  
 WEATHER: Good

CITY: Port Orange  
 INTERSECTING ROUTE: S Swallow Tail Drive  
 DATE OF COUNT: 12/7/22  
 ROAD CONDITION: Good  
 COUNT PERIODS:

COUNTY: Volusia  
 MILEPOST: 0.000  
 COMPLETED BY: AF  
 DATE COMPLETED: 12/15/22

#### ALL VEHICLES / ALL MOVEMENTS

Direction	Northbound						Southbound						NS Total	Eastbound						Westbound						EW Total	Grand Total
	NBU	NBL	NBT	NBR	NBRTOR	Total	SBU	SBL	SBT	SBR	SBRTOR	Total		EBU	EBL	EBT	EBR	EBRTOR	Total	WBU	WBL	WBT	WBR	WBRTOR	Total		
8:00 AM	0	0	0	10	0	10	0	0	0	6	0	6	16	1	15	349	9	0	374	12	15	268	5	0	300	674	690
8:15 AM	0	0	0	3	0	3	0	0	0	3	0	3	6	1	7	349	2	0	359	6	18	275	5	0	304	663	669
8:30 AM	0	0	0	4	0	4	0	0	0	10	0	10	14	1	10	341	4	0	356	11	8	266	4	0	289	645	659
8:45 AM	0	0	0	6	0	6	0	0	0	9	0	9	15	0	14	410	4	0	428	9	14	272	10	0	305	733	748
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>23</b>	<b>0</b>	<b>23</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>28</b>	<b>0</b>	<b>28</b>	<b>51</b>	<b>3</b>	<b>46</b>	<b>1,449</b>	<b>19</b>	<b>0</b>	<b>1,517</b>	<b>38</b>	<b>55</b>	<b>1,081</b>	<b>24</b>	<b>0</b>	<b>1,198</b>	<b>2,715</b>	<b>2,766</b>
10:00 AM	0	0	0	4	0	4	0	0	0	4	0	4	8	0	5	354	8	0	367	9	9	322	7	0	347	714	722
10:15 AM	0	0	0	5	0	5	0	0	0	14	0	14	19	0	6	317	4	0	327	12	11	376	1	0	400	727	746
10:30 AM	0	0	0	0	0	0	0	0	0	5	0	5	5	0	7	372	7	0	386	12	11	378	6	0	407	793	798
10:45 AM	0	0	0	4	0	4	0	0	0	10	0	10	14	2	11	397	9	0	419	7	4	347	7	0	365	784	798
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>0</b>	<b>33</b>	<b>46</b>	<b>2</b>	<b>29</b>	<b>1,440</b>	<b>28</b>	<b>0</b>	<b>1,499</b>	<b>40</b>	<b>35</b>	<b>1,423</b>	<b>21</b>	<b>0</b>	<b>1,519</b>	<b>3,018</b>	<b>3,064</b>
11:00 AM	0	0	0	5	0	5	0	0	0	8	0	8	13	2	10	353	17	0	382	8	10	375	1	0	394	776	789
11:15 AM	0	0	0	9	0	9	0	0	0	10	0	10	19	3	6	373	4	0	386	7	11	382	5	0	405	791	810
11:30 AM	0	0	0	11	0	11	0	0	0	14	0	14	25	2	15	392	8	0	417	4	17	369	6	0	396	813	838
11:45 AM	0	0	0	7	0	7	0	0	0	11	0	11	18	0	18	408	16	0	442	13	21	358	8	0	400	842	860
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>32</b>	<b>0</b>	<b>32</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>43</b>	<b>0</b>	<b>43</b>	<b>75</b>	<b>7</b>	<b>49</b>	<b>1,526</b>	<b>45</b>	<b>0</b>	<b>1,627</b>	<b>32</b>	<b>59</b>	<b>1,484</b>	<b>20</b>	<b>0</b>	<b>1,595</b>	<b>3,222</b>	<b>3,297</b>
12:00 PM	0	0	0	13	0	13	0	0	0	19	0	19	32	3	11	398	14	0	426	10	24	384	4	0	422	848	880
12:15 PM	0	0	0	9	0	9	0	0	0	15	0	15	24	4	14	393	10	0	421	9	20	350	8	0	387	808	832
12:30 PM	0	0	0	13	0	13	0	0	0	19	0	19	32	2	12	425	24	0	463	8	19	375	12	0	414	877	909
12:45 PM	0	0	0	14	0	14	0	0	0	14	0	14	28	1	8	405	10	0	424	17	13	423	11	0	464	888	916
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>49</b>	<b>0</b>	<b>49</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>67</b>	<b>0</b>	<b>67</b>	<b>116</b>	<b>10</b>	<b>45</b>	<b>1,621</b>	<b>58</b>	<b>0</b>	<b>1,734</b>	<b>44</b>	<b>76</b>	<b>1,532</b>	<b>35</b>	<b>0</b>	<b>1,687</b>	<b>3,421</b>	<b>3,537</b>
1:00 PM	0	0	0	10	0	10	0	0	0	7	0	7	17	3	14	362	14	0	393	18	18	386	9	0	431	824	841
1:15 PM	0	0	0	10	0	10	0	0	0	13	0	13	23	1	5	373	10	0	389	13	11	365	8	0	397	786	809
1:30 PM	0	0	0	9	0	9	0	0	0	10	0	10	19	3	7	404	11	0	425	2	17	406	8	0	433	858	877
1:45 PM	0	0	0	14	0	14	0	0	0	18	0	18	32	1	11	370	8	0	390	13	20	357	5	0	395	785	817
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>43</b>	<b>0</b>	<b>43</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>0</b>	<b>48</b>	<b>91</b>	<b>8</b>	<b>37</b>	<b>1,509</b>	<b>43</b>	<b>0</b>	<b>1,597</b>	<b>46</b>	<b>66</b>	<b>1,514</b>	<b>30</b>	<b>0</b>	<b>1,656</b>	<b>3,253</b>	<b>3,344</b>
2:00 PM	0	0	0	5	0	5	0	0	0	7	0	7	12	1	9	359	11	0	380	11	13	399	4	0	427	807	819
2:15 PM	0	0	0	12	0	12	0	0	0	10	0	10	22	1	11	422	9	0	443	13	14	431	8	0	466	909	931
2:30 PM	0	0	0	12	0	12	0	0	0	13	0	13	25	3	14	450	12	0	479	8	13	389	10	0	420	899	924
2:45 PM	0	0	0	10	0	10	0	0	0	7	0	7	17	2	5	435	6	0	448	11	21	413	3	0	448	896	913
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>37</b>	<b>0</b>	<b>37</b>	<b>76</b>	<b>7</b>	<b>39</b>	<b>1,666</b>	<b>38</b>	<b>0</b>	<b>1,750</b>	<b>43</b>	<b>61</b>	<b>1,632</b>	<b>25</b>	<b>0</b>	<b>1,761</b>	<b>3,511</b>	<b>3,587</b>
3:00 PM	0	0	0	5	0	5	0	0	0	13	0	13	18	1	7	372	8	0	388	11	21	396	8	0	436	824	842
3:15 PM	0	0	0	5	0	5	0	0	0	15	0	15	20	4	13	429	13	0	459	11	18	359	6	0	394	853	873
3:30 PM	0	0	0	4	0	4	0	0	0	18	0	18	22	2	3	465	14	0	484	8	22	377	3	0	410	894	916
3:45 PM	0	0	0	10	0	10	0	0	0	10	0	10	20	2	7	434	11	0	454	14	13	459	5	0	491	945	965
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>56</b>	<b>0</b>	<b>56</b>	<b>80</b>	<b>9</b>	<b>30</b>	<b>1,700</b>	<b>46</b>	<b>0</b>	<b>1,785</b>	<b>44</b>	<b>74</b>	<b>1,591</b>	<b>22</b>	<b>0</b>	<b>1,731</b>	<b>3,516</b>	<b>3,596</b>
4:00 PM	0	0	0	9	0	9	0	0	0	20	0	20	29	1	11	351	6	0	369	12	17	417	10	0	456	825	854
4:15 PM	0	0	0	8	0	8	0	0	0	14	0	14	22	3	6	408	5	0	422	14	16	423	5	0	458	880	902
4:30 PM	0	0	0	6	0	6	0	0	0	7	0	7	13	4	8	394	2	0	408	6	24	375	7	0	412	820	833
4:45 PM	0	0	0	7	0	7	0	0	0	11	0	11	18	0	10	363	8	0	381	8	15	393	4	0	420	801	819
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>0</b>	<b>30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>52</b>	<b>0</b>	<b>52</b>	<b>82</b>	<b>8</b>	<b>35</b>	<b>1,516</b>	<b>21</b>	<b>0</b>	<b>1,580</b>	<b>40</b>	<b>72</b>	<b>1,608</b>	<b>26</b>	<b>0</b>	<b>1,746</b>	<b>3,326</b>	<b>3,408</b>



**VEHICLE TURNING MOVEMENT COUNT**

SECTION: 63308.07  
 STATE ROUTE: Dunlawton Avenue  
 OBSERVER: VHB  
 WEATHER: Good

CITY: Port Orange  
 INTERSECTING ROUTE: S Swallow Tail Drive  
 DATE OF COUNT: 12/7/22  
 ROAD CONDITION: Good  
 COUNT PERIODS:

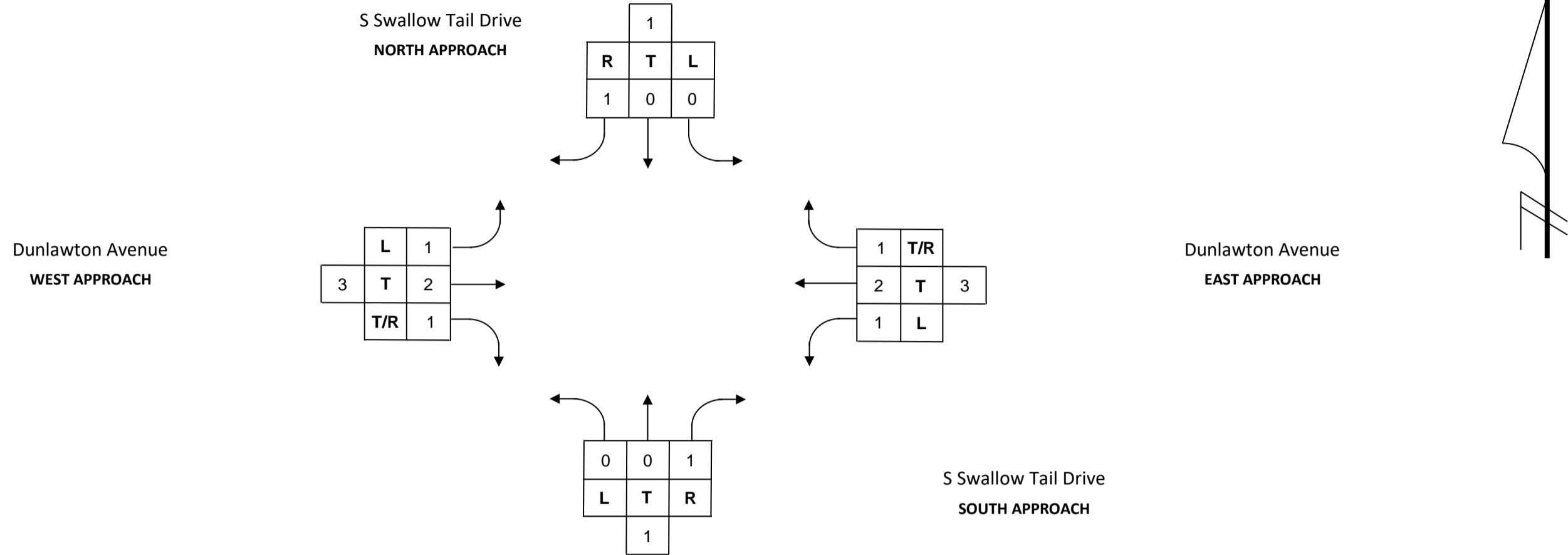
COUNTY: Volusia  
 MILEPOST: 0.000  
 COMPLETED BY: AF  
 DATE COMPLETED: 12/15/22

**HEAVY VEHICLES (TRUCKS + BUSES)**

Direction	Northbound						Southbound						NS Total	Eastbound						Westbound						EW Total	Grand Total
	NBU	NBL	NBT	NBR	NBRTOR	Total	SBU	SBL	SBT	SBR	SBRTOR	Total		EBU	EBL	EBT	EBR	EBRTOR	Total	WBU	WBL	WBT	WBR	WBRTOR	Total		
8:00 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	13	1	0	14	0	1	13	0	0	14	28	29
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7	0	0	10	0	0	10	17	17	
8:30 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	12	1	0	13	1	1	11	2	0	15	28	29
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	11	0	0	7	0	0	7	18	18	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>43</b>	<b>2</b>	<b>0</b>	<b>45</b>	<b>1</b>	<b>2</b>	<b>41</b>	<b>2</b>	<b>0</b>	<b>46</b>	<b>91</b>	<b>93</b>
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	0	10	0	2	9	0	0	11	21	21	
10:15 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	10	0	0	10	1	0	15	0	0	16	26	27
10:30 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	10	1	0	11	0	2	8	1	0	11	22	23
10:45 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	6	1	0	8	0	0	6	0	0	6	14	15
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>35</b>	<b>3</b>	<b>0</b>	<b>39</b>	<b>1</b>	<b>4</b>	<b>38</b>	<b>1</b>	<b>0</b>	<b>44</b>	<b>83</b>	<b>86</b>
11:00 AM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	7	1	0	8	0	2	14	0	0	16	24	25
11:15 AM	0	0	0	0	0	0	0	0	0	3	0	3	3	0	0	6	1	0	7	1	1	19	1	0	22	29	32
11:30 AM	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	13	0	0	13	0	1	9	0	0	10	23	24
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	2	0	14	1	0	11	1	0	13	27	27
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>37</b>	<b>4</b>	<b>0</b>	<b>42</b>	<b>2</b>	<b>4</b>	<b>53</b>	<b>2</b>	<b>0</b>	<b>61</b>	<b>103</b>	<b>108</b>
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	0	12	0	3	12	0	0	15	27	27	
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	15	0	0	10	0	0	10	25	25	
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	9	0	2	12	0	0	14	23	23	
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14	0	0	10	0	0	10	24	24	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>47</b>	<b>2</b>	<b>0</b>	<b>50</b>	<b>0</b>	<b>5</b>	<b>44</b>	<b>0</b>	<b>0</b>	<b>49</b>	<b>99</b>	<b>99</b>	
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	13	0	2	10	0	0	12	25	25	
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	1	0	20	0	0	7	0	0	7	27	27	
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	21	0	1	8	0	0	9	30	30	
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	1	0	19	1	0	13	0	0	14	33	33	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>70</b>	<b>2</b>	<b>0</b>	<b>73</b>	<b>1</b>	<b>3</b>	<b>38</b>	<b>0</b>	<b>0</b>	<b>42</b>	<b>115</b>	<b>115</b>	
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	0	12	0	1	11	0	0	12	24	24	
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	9	0	1	15	0	0	16	25	25	
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	0	8	0	1	11	0	0	12	20	20	
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7	0	0	8	1	0	9	16	16	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>3</b>	<b>0</b>	<b>36</b>	<b>0</b>	<b>3</b>	<b>45</b>	<b>1</b>	<b>0</b>	<b>49</b>	<b>85</b>	<b>85</b>	
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	3	13	0	0	16	20	20	
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	0	10	0	0	14	0	0	14	24	24	
3:30 PM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	7	1	0	8	0	1	8	1	0	10	18	19
3:45 PM	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	4	0	0	4	0	1	6	0	0	7	11	12
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>2</b>	<b>0</b>	<b>26</b>	<b>0</b>	<b>5</b>	<b>41</b>	<b>1</b>	<b>0</b>	<b>47</b>	<b>73</b>	<b>75</b>
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	5	0	0	8	0	0	8	13	13	
4:15 PM	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	6	0	0	7	1	1	9	0	0	11	18	19
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6	0	2	6	0	0	8	14	14	
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	5	0	0	9	0	0	9	14	14	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>20</b>	<b>2</b>	<b>0</b>	<b>23</b>	<b>1</b>	<b>3</b>	<b>32</b>	<b>0</b>	<b>0</b>	<b>36</b>	<b>59</b>	<b>60</b>

**FLORIDA DEPARTMENT OF TRANSPORTATION  
SUMMARY OF VEHICLE MOVEMENTS**

<b>SECTION:</b> 63308.07	<b>CITY:</b> Port Orange	<b>COUNTY:</b> Volusia
<b>STATE ROUTE:</b> Dunlawton Avenue	<b>INTERSECTING ROUTE:</b> S Swallow Tail Drive	<b>MILEPOST:</b> 0.000
<b>OBSERVER:</b> VHB	<b>DATE:</b> 12/7/22	<b>COMPLETED BY:</b> AF
<b>WEATHER:</b> Good	<b>ROAD CONDITION:</b> Good	<b>DATE COMPLETED:</b> 12/15/22
<b>REMARKS:</b>		



TIME	NORTHBOUND						SOUTHBOUND						TOTAL N/S	EASTBOUND						WESTBOUND						TOTAL E/W
	U	L	T	R	RTOR	TOT	U	L	T	R	RTOR	TOT		U	L	T	R	RTOR	TOT	U	L	T	R	RTOR	TOT	
8:00 - 9:00	0	0	0	23	0	23	0	0	0	28	0	28	51	3	46	1,449	19	0	1,517	38	55	1,081	24	0	1,198	2,715
10:00 - 11:00	0	0	0	13	0	13	0	0	0	33	0	33	46	2	29	1,440	28	0	1,499	40	35	1,423	21	0	1,519	3,018
11:00 - 12:00	0	0	0	32	0	32	0	0	0	43	0	43	75	7	49	1,526	45	0	1,627	32	59	1,484	20	0	1,595	3,222
12:00 - 13:00	0	0	0	49	0	49	0	0	0	67	0	67	116	10	45	1,621	58	0	1,734	44	76	1,532	35	0	1,687	3,421
13:00 - 14:00	0	0	0	43	0	43	0	0	0	48	0	48	91	8	37	1,509	43	0	1,597	46	66	1,514	30	0	1,656	3,253
14:00 - 15:00	0	0	0	39	0	39	0	0	0	37	0	37	76	7	39	1,666	38	0	1,750	43	61	1,632	25	0	1,761	3,511
15:00 - 16:00	0	0	0	24	0	24	0	0	0	56	0	56	80	9	30	1,700	46	0	1,785	44	74	1,591	22	0	1,731	3,516
16:00 - 17:00	0	0	0	30	0	30	0	0	0	52	0	52	82	8	35	1,516	21	0	1,580	40	72	1,608	26	0	1,746	3,326
<b>TOTAL</b>	0	0	0	325	0	325	0	0	0	460	0	460	785	75	422	16,498	362	0	17,357	434	688	15,907	265	0	17,294	34,651

<b>Percentage</b>	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	N/A	0.4%	2.4%	95.1%	2.1%	0.0%	100.0%	2.5%	4.0%	92.0%	1.5%	0.0%	100.0%	N/A
<b>Maximum</b>	0	0	0	49	0	49	0	0	0	67	0	67	116	12	49	1,700	58	0	1,785	46	85	1,632	35	0	1,761	3,516
<b>Minimum</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Heavy Veh</b>	0	0	0	4	0	4	0	0	0	16	0	16	20	8	391	26	0	425	51	427	9	0	487	912		
<b>% Heavy Veh</b>	0.0%	0.0%	0.0%	1.2%	0.0%	1.2%	0.0%	0.0%	0.0%	3.5%	0.0%	3.5%	2.5%	1.6%	2.4%	7.2%	2.4%	2.4%	4.5%	2.7%	3.4%	0.0%	0.0%	2.8%	2.6%	

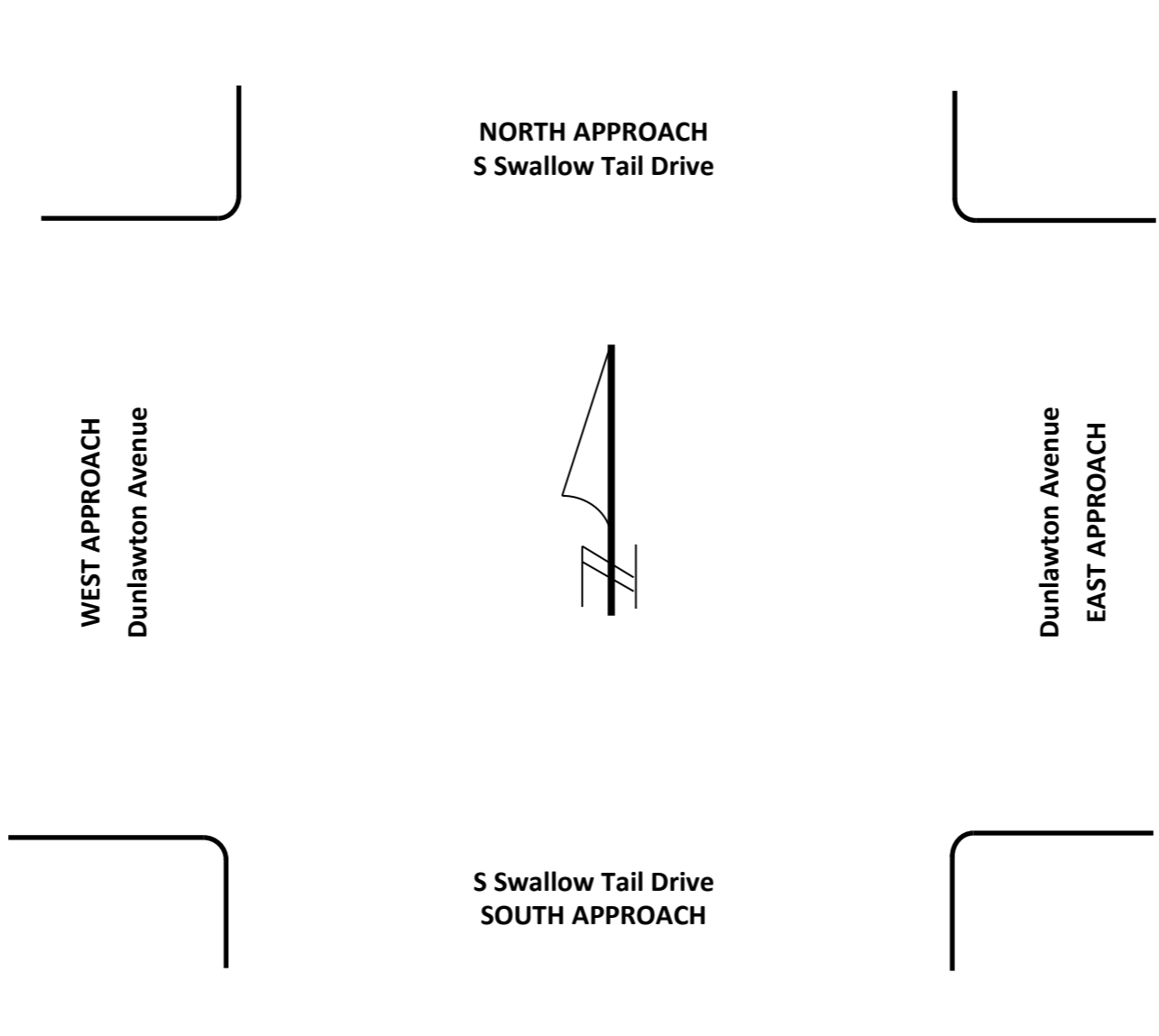
**FLORIDA DEPARTMENT OF TRANSPORTATION  
PEDESTRIAN MOVEMENT SUMMARY**

**SECTION** 63308.07  
**STATE ROUTE** Dunlawton Avenue  
**OBSERVER** VHB  
**COUNTY** Volusia  
**MILEPOST** 0.000  
**COUNT HOURS**

**CITY** Port Orange  
**INTERSECTING ROUTE** S Swallow Tail Drive  
**DATE OF COUNT** 12/7/22  
**WEATHER** Good  
**COMPLETED BY** AF  
**DATE** 12/15/22

0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
0	0	0	0	0	0	0	2	4	4	2	2	6	0	6	2	2	4	0	0	0	0	0	0	34
0	0	0	0	0	0	0	0	4	0	0	2	4	0	2	4	4	4	0	0	0	0	0	0	24
0	0	0	0	0	0	0	2	8	4	2	4	10	0	8	6	6	8	0	0	0	0	0	0	58

0-1	1-2	2-3	3-4
0	0	0	0
1-2	0	0	0
2-3	0	0	0
3-4	0	0	0
4-5	0	0	0
5-6	0	0	0
6-7	0	0	0
7-8	0	2	2
8-9	2	0	2
9-10	2	0	2
10-11	0	0	0
11-12	0	0	0
12-13	4	4	8
13-14	0	0	0
14-15	0	0	0
15-16	0	0	0
16-17	0	0	0
17-18	0	0	0
18-19	0	0	0
19-20	0	0	0
20-21	0	0	0
21-22	0	0	0
22-23	0	0	0
23-24	0	0	0
<b>Total</b>	<b>8</b>	<b>6</b>	<b>14</b>



0-1	1-2	2-3	3-4
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1-2	0	0	0
2-3	0	0	0
3-4	0	0	0
4-5	0	0	0
5-6	0	0	0
6-7	0	0	0
7-8	0	0	0
8-9	0	4	4
9-10	0	0	0
10-11	0	0	0
11-12	0	0	0
12-13	0	0	0
13-14	0	0	0
14-15	0	0	0
15-16	0	0	0
16-17	0	0	0
17-18	0	0	0
18-19	0	0	0
19-20	0	0	0
20-21	0	0	0
21-22	0	0	0
22-23	0	0	0
23-24	0	0	0
<b>Total</b>	<b>0</b>	<b>4</b>	<b>4</b>

0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
0	0	0	0	0	0	0	6	4	4	0	0	4	0	0	0	2	2	0	0	0	0	0	0	22
0	0	0	0	0	0	0	2	8	6	4	4	2	4	0	0	2	6	0	0	0	0	0	0	38
0	0	0	0	0	0	0	8	12	10	4	4	6	4	0	0	4	8	0	0	0	0	0	0	60

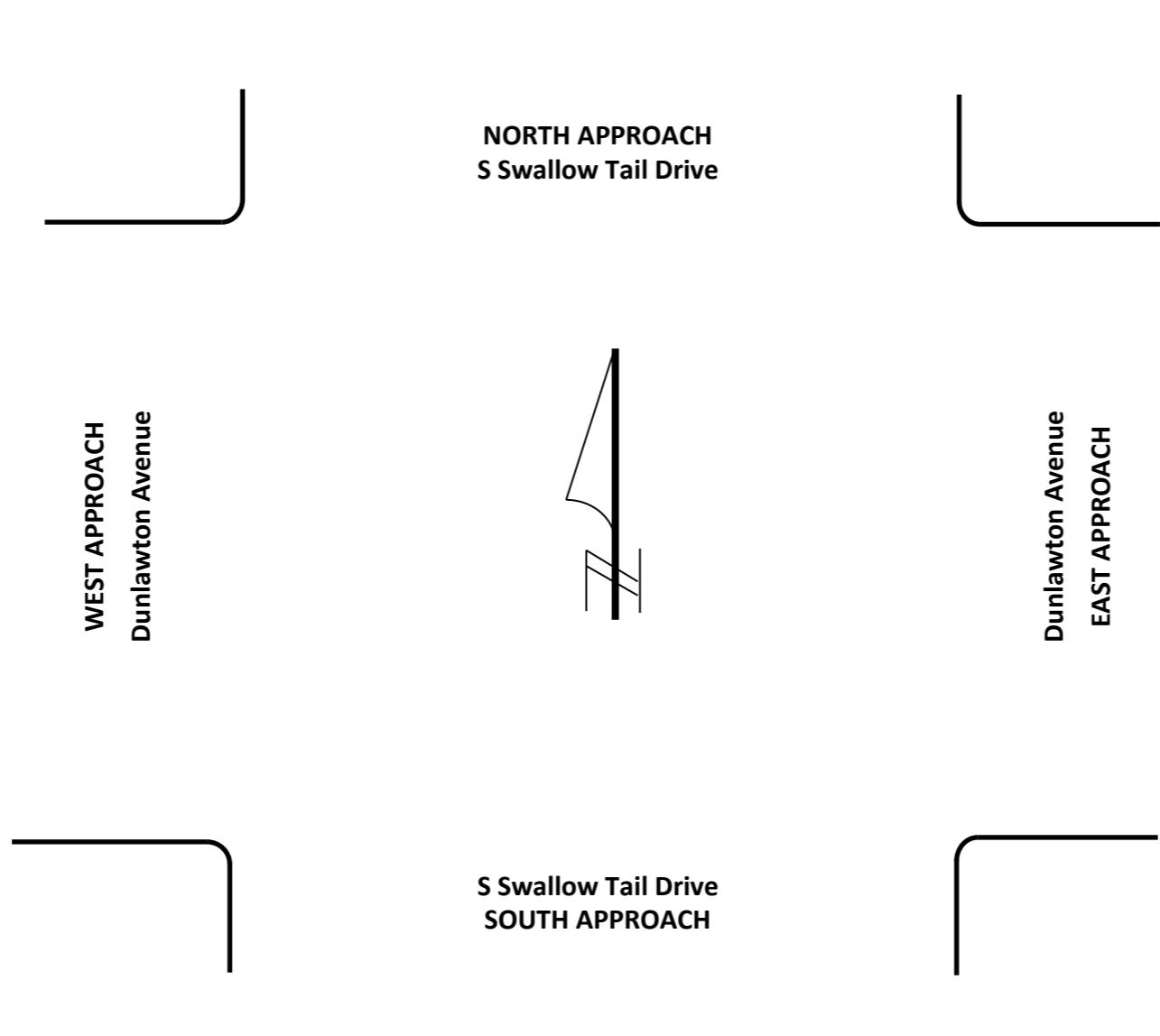
**FLORIDA DEPARTMENT OF TRANSPORTATION  
BICYCLE MOVEMENT SUMMARY**

**SECTION** 63308.07  
**STATE ROUTE** Dunlawton Avenue  
**OBSERVER** VHB  
**COUNTY** Volusia  
**MILEPOST** 0.000  
**COUNT HOURS**

**CITY** Port Orange  
**INTERSECTING ROUTE** S Swallow Tail Drive  
**DATE OF COUNT** 12/7/22  
**WEATHER** Good  
**COMPLETED BY** AF  
**DATE** 12/15/22

12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
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0	0	0	0	0	0	0	0	2	0	0	6	2	2	0	2	0	2	0	0	0	0	0	0	16

0-1	0	0	0
1-2	0	0	0
2-3	0	0	0
3-4	0	0	0
4-5	0	0	0
5-6	0	0	0
6-7	0	0	0
7-8	0	0	0
8-9	0	2	2
9-10	0	0	0
10-11	0	0	0
11-12	0	0	0
12-13	0	0	0
13-14	0	0	0
14-15	0	2	2
15-16	0	0	0
16-17	0	0	0
17-18	0	0	0
18-19	0	0	0
19-20	0	0	0
20-21	0	0	0
21-22	0	0	0
22-23	0	0	0
23-24	0	0	0
<b>Total</b>	<b>0</b>	<b>4</b>	<b>4</b>



0-1	0	0	0
1-2	0	0	0
2-3	0	0	0
3-4	0	0	0
4-5	0	0	0
5-6	0	0	0
6-7	0	0	0
7-8	0	0	0
8-9	0	0	0
9-10	0	0	0
10-11	0	0	0
11-12	0	0	0
12-13	0	0	0
13-14	0	0	0
14-15	0	0	0
15-16	0	0	0
16-17	0	0	0
17-18	0	0	0
18-19	0	0	0
19-20	0	0	0
20-21	0	0	0
21-22	0	0	0
22-23	0	0	0
23-24	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>

12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
0	0	0	0	0	0	0	2	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	2	0	2	0	2	2	0	0	0	0	2	0	0	0	0	0	0	10
0	0	0	0	0	0	0	4	0	2	4	6	2	0	0	0	0	2	0	0	0	0	0	0	20

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## Appendix B – Crash Data

**Crash Data Summary - Dunlawton Avenue at South Swallow Tail Drive**

No.	Crash ID	Date	Day	Time	Hour	Year	Crash Type	Crash Severity	Fatalities	Injuries	Property Damage	Total Damage	Day/Night	Wet/Dry	Alcohol Related	Drug Related	Contributing Cause		
1	89400637	11/28/2022	Monday	3:39 PM	15	2022	Bicycle	Injury	0	1	\$200	\$2,200	Daylight	Dry	N	0	N	0	NA
2	24033397	2/27/2021	Saturday	2:47 PM	14	2021	Left Turn	Injury	0	3	\$0	\$18,000	Daylight	Dry	N	0	N	0	IMPROPER LEFT TURN
3	89398837	7/22/2021	Thursday	8:30 AM	08	2021	Rear End	No Injury	0	0	\$0	\$3,000	Daylight	Dry	N	0	N	0	NA
4	8738617	9/27/2018	Thursday	10:32 AM	10	2018	Rear End	No Injury	0	0	\$0	\$10,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
5	24032330	12/11/2020	Friday	7:15 PM	19	2020	Sideswipe	No Injury	0	0	\$0	\$2,000	Dark - Lighted	Dry	N	0	N	0	IMPROPER CHANGE OF LANE-SAME DIRECTION
6	87740705	1/6/2020	Monday	11:04 AM	11	2020	Rear End	Injury	0	1	\$0	\$4,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
7	89398644	5/27/2021	Thursday	12:00 PM	12	2021	Angle	No Injury	0	0	\$0	\$500	Daylight	Dry	N	0	N	0	NA
8	85315350	5/21/2019	Tuesday	12:20 AM	00	2019	Right Turn	Serious Injury	0	2	\$0	\$9,000	Dark - Lighted	Dry	Y	1	Y	1	DUI 3RD VIOL W/IN 10 YEARS (FELONY)
9	86396222	3/10/2017	Friday	4:02 PM	16	2017	Left Turn	Injury	0	1	\$0	\$20,000	Daylight	Dry	N	0	N	0	FAIL TO YIELD MAKING LEFT TURN
10	87509755	11/20/2017	Monday	8:07 AM	08	2017	Right Turn	Injury	0	1	\$0	\$15,000	Daylight	Dry	N	0	N	0	FAIL YIELD VEH. ENTERING F/ DRIVE/ALLEY
11	89399642	2/28/2022	Monday	5:06 PM	17	2022	Sideswipe	Injury	0	1	\$0	\$10,500	Daylight	Dry	N	0	N	0	IMPROPER RIGHT TURN
12	89399733	3/23/2022	Wednesday	4:08 PM	16	2022	Rear End	Injury	0	2	\$0	\$600	Daylight	Dry	N	0	N	0	CARELESS DRIVING
13	89398757	6/27/2021	Sunday	9:42 PM	21	2021	Pedestrian	Fatality	1	0	\$0	\$3,000	Dark - Not Lighted	Dry	N	0	N	0	NA
14	89400668	9/22/2022	Thursday	2:01 PM	14	2022	Rear End	No Injury	0	0	\$0	\$3,500	Daylight	Dry	N	0	N	0	CARELESS DRIVING
15	87510064	5/25/2018	Friday	12:32 PM	12	2018	Sideswipe	No Injury	0	0	\$0	\$0	Daylight	Dry	N	0	N	0	NA
16	86751459	3/31/2017	Friday	1:58 PM	13	2017	Left Turn	No Injury	0	0	\$0	\$8,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
17	24032289	10/20/2020	Tuesday	4:09 PM	16	2020	Left Turn	Injury	0	1	\$0	\$7,000	Daylight	Dry	N	0	N	0	NA
18	89399486	1/14/2022	Friday	1:01 PM	13	2022	Angle	Injury	0	2	\$0	\$10,000	Daylight	Dry	N	0	N	0	VEHICLE IN INTERSECTION - ALL OTHERS MUST YIELD
19	89398388	3/8/2021	Monday	10:50 AM	10	2021	Rear End	No Injury	0	0	\$0	\$2,500	Daylight	Dry	N	0	N	0	CARELESS DRIVING
20	87510028	3/30/2018	Friday	9:57 AM	09	2018	Rear End	No Injury	0	0	\$0	\$7,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
21	87738648	9/26/2018	Wednesday	1:22 PM	13	2018	Sideswipe	No Injury	0	0	\$0	\$2,000	Daylight	Dry	N	0	N	0	IMPROPER CHANGE OF LANE-SAME DIRECTION
22	24032611	10/30/2020	Friday	4:35 PM	16	2020	Left Turn	Injury	0	1	\$0	\$12,000	Daylight	Dry	N	0	N	0	NA
23	89398979	4/27/2022	Wednesday	1:25 PM	13	2022	Sideswipe	No Injury	0	0	\$0	\$3,500	Daylight	Dry	N	0	N	0	CARELESS DRIVING
24	89398533	4/29/2021	Thursday	11:26 AM	11	2021	Angle	No Injury	0	0	\$0	\$4,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
25	89399062	9/22/2021	Wednesday	12:18 PM	12	2021	Angle	No Injury	0	0	\$0	\$10,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING
26	89398453	3/31/2021	Wednesday	3:52 PM	15	2021	Pedestrian	Serious Injury	0	1	\$100	\$100	Daylight	Dry	N	0	N	0	NA
27	89399371	12/15/2021	Wednesday	7:40 AM	07	2021	Rear End	Injury	0	1	\$0	\$500	Daylight	Dry	N	0	N	0	CARELESS DRIVING
28	86751912	4/6/2018	Friday	4:25 PM	16	2018	Injury	Injury	0	1	\$0	\$4,000	Daylight	Dry	N	0	N	0	NA
29	87739007	1/12/2019	Saturday	1:36 PM	13	2019	Rear End	No Injury	0	0	\$0	\$7,500	Daylight	Dry	N	0	N	0	FOLLOWING TOO CLOSELY
30	89399598	2/17/2022	Thursday	1:30 PM	13	2022	Rear End	No Injury	0	0	\$0	\$3,000	Daylight	Dry	N	0	N	0	NA
31	89399659	2/28/2022	Monday	5:26 PM	17	2022	Rear End	No Injury	0	0	\$0	\$13,000	Daylight	Dry	N	0	N	0	NA
32	89398944	8/20/2021	Friday	1:02 PM	13	2021	Angle	Serious Injury	0	2	\$0	\$8,000	Daylight	Dry	N	0	N	0	NA
33	89399181	10/22/2021	Friday	3:10 PM	15	2021	Rear End	Injury	0	1	\$0	\$10,000	Daylight	Dry	N	0	N	0	NA
34	87738533	11/5/2018	Monday	2:50 PM	14	2018	Off Road	Serious Injury	0	1	\$250	\$750	Daylight	Dry	N	0	N	0	NA
35	86751649	10/17/2017	Tuesday	7:45 AM	07	2017	Rear End	Injury	0	2	\$0	\$200	Daylight	Wet	N	0	N	0	NA
36	89399067	9/24/2021	Friday	8:06 AM	08	2021	Angle	Serious Injury	0	1	\$0	\$5,000	Daylight	Dry	N	0	N	0	NA
37	89398526	4/27/2021	Tuesday	4:57 PM	16	2021	Right Turn	No Injury	0	0	\$0	\$10,000	Daylight	Dry	N	0	N	0	FAILED TO YIELD - TO ONCOMING TRAFFIC/VEHICLE PASSING ON LEF
38	87510001	3/23/2019	Saturday	6:30 AM	06	2019	Rear End	No Injury	0	0	\$0	\$1,200	Dark - Lighted	Dry	N	0	N	0	NA
39	87509910	12/15/2017	Friday	7:06 AM	07	2017	Sideswipe	No Injury	0	0	\$0	\$600	Dawn	Dry	N	0	N	0	NA
40	89399785	4/1/2022	Friday	3:17 PM	15	2022	Left Turn	No Injury	0	0	\$0	\$6,000	Daylight	Dry	N	0	N	0	NA
41	89400208	8/6/2022	Saturday	1:35 PM	13	2022	Rear End	No Injury	0	0	\$0	\$800	Daylight	Dry	N	0	N	0	NA
42	89398889	8/6/2021	Friday	8:09 PM	20	2021	Off Road	No Injury	0	0	\$0	\$2,000	Dusk	Wet	N	0	N	0	NA
43	89398454	3/30/2021	Tuesday	12:45 PM	12	2021	Left Turn	No Injury	0	0	\$0	\$8,000	Daylight	Dry	N	0	N	0	VEHICLE IN INTERSECTION - ALL OTHERS MUST YIELD
44	89398443	3/29/2021	Monday	3:47 PM	15	2021	Sideswipe	No Injury	0	0	\$0	\$3,500	Daylight	Dry	N	0	N	0	IMPROPER-CHANGE-OF-LANE, PULLING OUT IN FRONT OF VEHICLE GOI
45	89398420	3/22/2021	Monday	3:25 PM	15	2021	Sideswipe	No Injury	0	0	\$0	\$1,500	Daylight	Dry	N	0	N	0	NA
46	87739626	7/8/2019	Monday	8:59 PM	20	2019	Angle	Injury	0	1	\$0	\$10,000	Dark - Lighted	Dry	N	0	N	0	NA
47	86752172	12/29/2017	Friday	12:51 PM	12	2017	Left Turn	No Injury	0	0	\$0	\$10,000	Daylight	Wet	N	0	N	0	FAIL TO YIELD MAKING LEFT TURN
48	86752282	3/11/2018	Sunday	8:30 PM	20	2018	Rear End	Injury	0	2	\$0	\$4,500	Dark - Lighted	Wet	N	0	N	0	PROOF OF INS.REQRD.(BY OWNERS/LESSEE VEH.)
49	86751703	5/12/2017	Friday	9:01 AM	09	2017	Rear End	No Injury	0	0	\$0	\$4,500	Daylight	Dry	N	0	N	0	CARELESS DRIVING
50	89399632	2/25/2022	Friday	12:43 PM	12	2022	Rear End	Injury	0	1	\$0	\$10,000	Daylight	Dry	N	0	N	0	CARELESS DRIVING

## Dunlawton Avenue at South Swallow Tail Drive

Crash Type	2017	2018	2019	2020	2021	2022	Total	Proportion
Rear End	2	3	2	2	4	6	19	37.3%
Head On	0	0	0	0	0	0	0	0.0%
Sideswipe	1	2	0	1	2	2	8	15.7%
Rollover	0	0	0	0	0	0	0	0.0%
Angle	0	0	1	0	5	1	7	13.7%
Left Turn	3	1	0	2	2	1	9	17.6%
Right Turn	1	0	1	0	1	0	3	5.9%
Off Road	0	1	0	0	1	0	2	3.9%
Pedestrian & Bicycle	0	0	0	0	2	1	3	5.9%
Animal	0	0	0	0	0	0	0	0.0%
Other	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

Crash Severity	2017	2018	2019	2020	2021	2022	Total	Proportion
Fatality	0	0	0	0	1	0	1	2.0%
Injury	3	3	2	3	6	5	22	43.1%
Property Damage Only	4	4	2	2	10	6	28	54.9%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

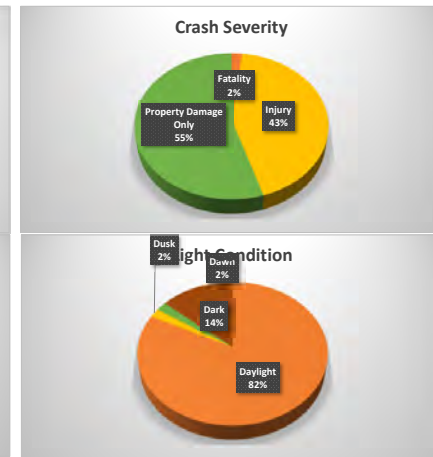
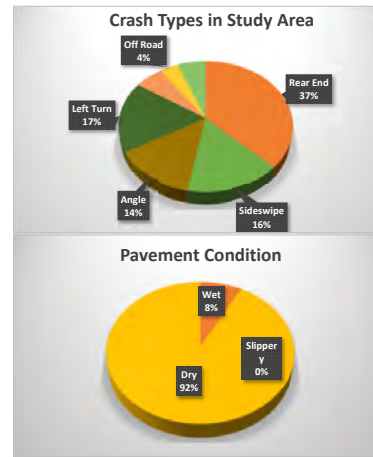
Pavement Condition	2017	2018	2019	2020	2021	2022	Total	Proportion
Wet	2	1	0	0	1	0	4	7.8%
Dry	5	6	4	5	16	11	47	92.2%
Slippery	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

Light Condition	2017	2018	2019	2020	2021	2022	Total	Proportion
Daylight	6	6	1	3	15	11	42	82.4%
Dusk	0	0	0	0	1	0	1	2.0%
Dawn	1	0	0	0	0	0	1	2.0%
Dark	0	1	3	2	1	0	7	13.7%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

Under the Influence	2017	2018	2019	2020	2021	2022	Total	Proportion
Alcohol	0	0	1	0	0	0	1	2.0%
Drugs	0	0	1	0	0	0	1	2.0%
<b>Total</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3.9%</b>

Property Damage	2017	2018	2019	2020	2021	2022	Total	Proportion
\$0 - \$500	7	7	4	5	17	11	51	100.0%
\$501 - \$1,000	0	0	0	0	0	0	0	0.0%
\$1,001 - \$2,500	0	0	0	0	0	0	0	0.0%
\$2,501+	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

Total Damage	2017	2018	2019	2020	2021	2022	Total	Proportion
\$0 - \$5,000	3	5	1	3	11	6	29	56.9%
\$5,001 - \$10,000	2	2	3	1	5	3	16	31.4%
\$10,000 - \$25,000	2	0	0	1	1	2	6	11.8%
\$25,001+	0	0	0	0	0	0	0	0.0%
<b>Total</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>17</b>	<b>11</b>	<b>51</b>	<b>100.0%</b>

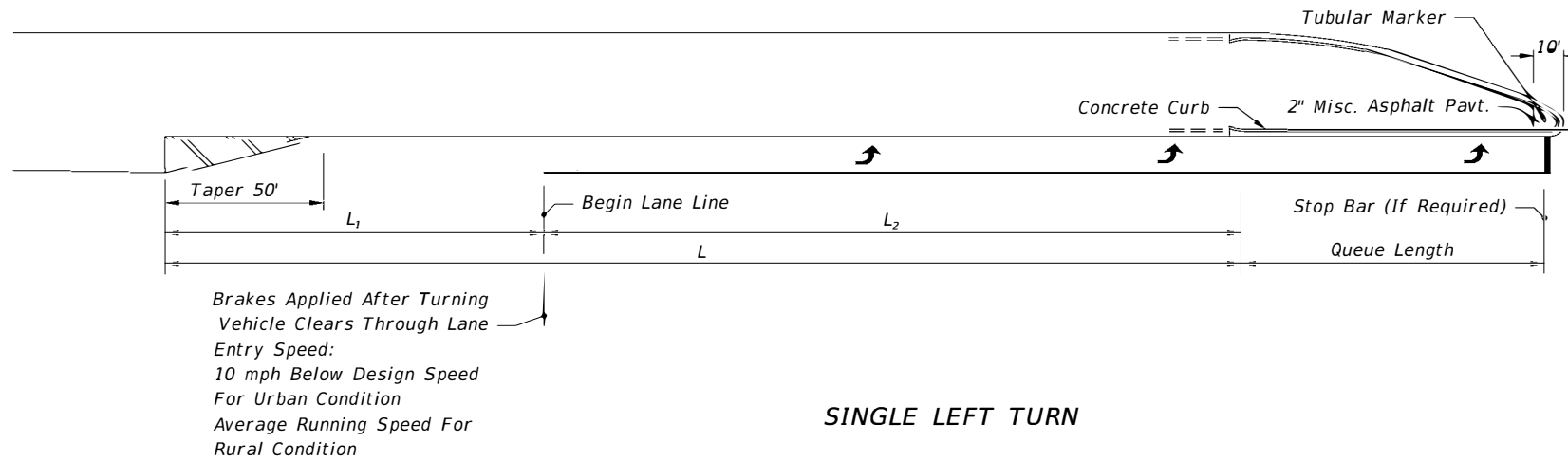
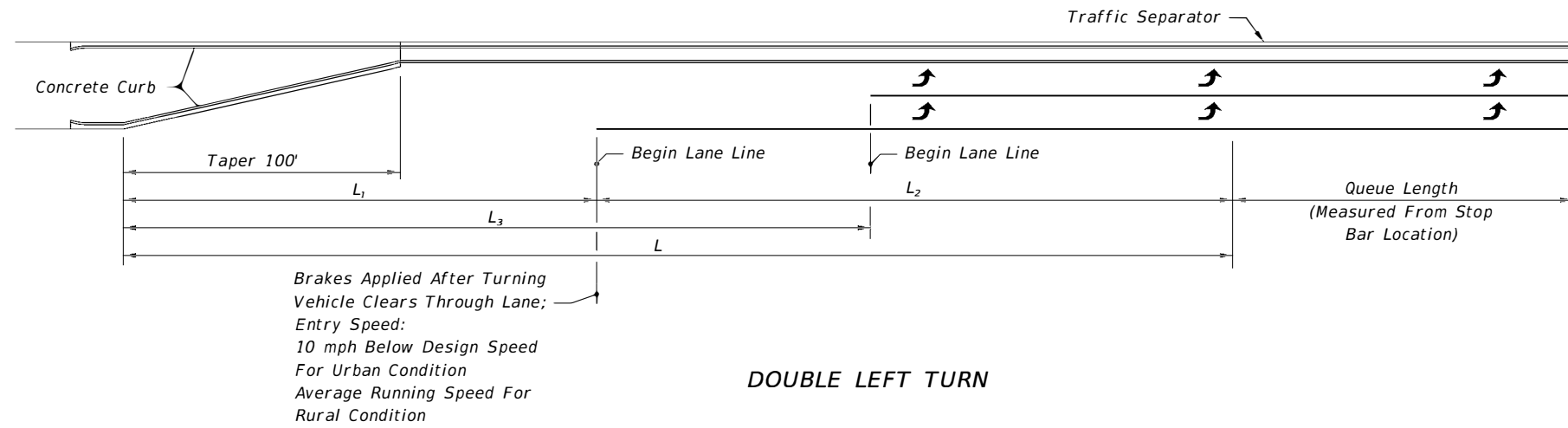


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## Appendix C – FDOT Excerpts



# MEDIAN TURN LANES MINIMUM DECELERATION LENGTHS



MEDIAN TURN LANES								
Design Speed (mph)	Entry Speed (mph)	Clearance Distance L <sub>1</sub> (ft.)	URBAN CONDITIONS			RURAL CONDITIONS		
			Brake To Stop Distance L <sub>2</sub> (ft.)	Total Decel. Distance L (ft.)	Clearance Distance L <sub>3</sub> (ft.)	Brake To Stop Distance L <sub>2</sub> (ft.)	Total Decel. Distance L (ft.)	Clearance Distance L <sub>3</sub> (ft.)
35	25	70	75	145	110	—	—	—
40	30	80	75	155	120	—	—	—
45	35	85	100	185	135	—	—	—
50	40/44	105	135	240	160	185	290	160
55	48	125	—	—	—	225	350	195
60	52	145	—	—	—	260	405	230
65	55	170	—	—	—	290	460	270

NOT TO SCALE

### When Not to Consider Exclusive Right-Turn Lanes

- Dense or built-out corridors with limited space
- Right-turn lane that would negatively impact pedestrians or bicyclists
- Vehicular movements from driveways or median openings that cross the right-turn lane resulting in multiple threat crashes
- Context classifications C2T, C4, C5, or C6

### When Exclusive Right-Turn Lanes are Beneficial

There are instances when adding an exclusive right-turn lane for unsignalized driveways are beneficial to traffic operations and safety. **Table 27** provides some guidance for this situation based on the speed limit of the roadway and how many right turns occur per hour. Locations where the Auto and Truck Modal Emphasis is "High" may be appropriate for consideration of Exclusive Right Turn Lanes.

*Table 27 – Recommended Guidelines for Exclusive Right-Turn Lanes to Unsignalized Driveway<sup>10</sup>*

Roadway Posted Speed Limit	Number of Right Turns Per Hour
45 mph or less	80 – 125 <sup>1</sup>
Over 45 mph	35 – 55 <sup>2</sup>
<i>Note: A posted speed limit of 45 mph may be used with these thresholds if the operating speeds are known to be over 45 mph during the time of peak right turn demand.</i>	
<i>Note on traffic projections: Projecting turning volumes is, at best, a knowledgeable estimate. Keep this in mind especially if the projections of right turns are close to meeting the guidelines. In that case, consider requiring the turn lane.</i>	
<sup>1</sup> <i>The lower threshold of 80 right-turn vehicles per hour would be most used for higher volume (greater than 600 vehicles per hour, per lane in one direction on the major roadway) or two-lane roads where lateral movement is restricted. The 125 right-turn vehicles per hour upper threshold would be most appropriate on lower volume roadways, multilane highways, or driveways with a large entry radius (50 feet or greater).</i>	
<sup>2</sup> <i>The lower threshold of 35 right-turn vehicles per hour would be most appropriately used on higher volume two-lane roadways where lateral movement is restricted. The 55 right-turn vehicles per hour upper threshold would be most appropriate on lower volume roadways, multilane highways, or driveways with large entry radius (50 feet or greater).</i>	

Source: [NCHRP Report 420 \(Impacts of Access Management Techniques\)](#)

These recommendations are primarily based on the research done in [NCHRP Report 420, Impacts of Access Management Techniques, Chapter 4 – Unsignalized Access Spacing \(Technique 1B\)](#), and [Use of Speed Differential as a Measure to Evaluate the Need for Right-Turn Deceleration Lane at Unsignalized Intersections](#).

In the *NCHRP Report 420*, the observed high-speed roads, 30 to 40 right-turn vehicles per hour caused evasive maneuvers on 5 - 10 percent of the following through vehicles. For lower speed roadways, 80 to 110 right-turn vehicles caused 15 - 20 percent of the following through vehicles to make evasive maneuvers. The choice of acceptable percentages of through vehicles impacted is a decision based on reasonable expectations of the different roadways.

In this study, by modeling speed differentials, a better understanding of the impacts of through volume and driveway radius was discovered.

<sup>10</sup> May not be appropriate for signalized locations where signal phasing plays an important role in determining the need for right turn lanes.

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## Appendix D – Synchro Results

Intersection															
Int Delay, s/veh	1.8														
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		S ↑↑↑				S ↑↑↑						↑			↑
Traffic Vol, veh/h	3	48	1466	22	40	57	1100	15	0	0	24	0	0	24	
Future Vol, veh/h	3	48	1466	22	40	57	1100	15	0	0	24	0	0	24	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None	
Storage Length	-	315	-	-	-	305	-	-	-	-	0	-	-	0	
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92	92	92	
Heavy Vehicles, %	0	2	3	9	3	4	4	13	0	0	0	0	0	21	
Mvmt Flow	3	52	1593	24	43	62	1196	16	0	0	26	0	0	26	

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	885	1212	0	0	1181	1617	0	0	-	-	809	-	-	606
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.34	-	-	5.66	5.38	-	-	-	-	7.1	-	-	7.52
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.12	-	-	2.33	3.14	-	-	-	-	3.9	-	-	4.11
Pot Cap-1 Maneuver	517	309	-	-	345	191	-	-	0	0	281	0	0	342
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	316	316	-	-	228	228	-	-	-	-	281	-	-	342
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	2.7	19.1	16.4
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	281	316	-	-	228	-	-	342
HCM Lane V/C Ratio	0.093	0.175	-	-	0.462	-	-	0.076
HCM Control Delay (s)	19.1	18.8	-	-	33.6	-	-	16.4
HCM Lane LOS	C	C	-	-	D	-	-	C
HCM 95th %tile Q(veh)	0.3	0.6	-	-	2.2	-	-	0.2

Intersection															
Int Delay, s/veh	3.2														
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		S ↑↑↑				S ↑↑↑						↑			↑
Traffic Vol, veh/h	10	45	1637	59	44	77	1547	35	0	0	49	0	0	68	
Future Vol, veh/h	10	45	1637	59	44	77	1547	35	0	0	49	0	0	68	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None	
Storage Length	-	315	-	-	-	305	-	-	-	-	0	-	-	0	
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97	97	97	
Heavy Vehicles, %	0	2	3	3	0	7	3	0	0	0	0	0	0	0	
Mvmt Flow	10	46	1688	61	45	79	1595	36	0	0	51	0	0	70	

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	1191	1631	0	0	1276	1749	0	0	-	-	875	-	-	816
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.34	-	-	5.6	5.44	-	-	-	-	7.1	-	-	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.12	-	-	2.3	3.17	-	-	-	-	3.9	-	-	3.9
Pot Cap-1 Maneuver	351	192	-	-	314	158	-	-	0	0	254	0	0	278
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	202	202	-	-	183	183	-	-	-	-	254	-	-	278
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	4.2	22.7	22.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	254	202	-	-	183	-	-	278
HCM Lane V/C Ratio	0.199	0.281	-	-	0.682	-	-	0.252
HCM Control Delay (s)	22.7	29.6	-	-	58.7	-	-	22.3
HCM Lane LOS	C	D	-	-	F	-	-	C
HCM 95th %tile Q(veh)	0.7	1.1	-	-	4.1	-	-	1

HCM 6th TWSC  
 3: S Swallow Tail Dr/N Swallow Tail Dr & Dunlawton Ave

Existing PM Peak  
 01/23/2023

Intersection															
Int Delay, s/veh	2.9														
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		S ↑↑↑				S ↑↑↑						↑			↑
Traffic Vol, veh/h	8	27	1675	36	48	69	1693	23	0	0	31	0	0	63	
Future Vol, veh/h	8	27	1675	36	48	69	1693	23	0	0	31	0	0	63	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None	
Storage Length	-	315	-	-	-	305	-	-	-	-	0	-	-	0	
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94	94	94	
Heavy Vehicles, %	0	4	1	6	2	4	2	4	0	0	3	0	0	3	
Mvmt Flow	9	29	1782	38	51	73	1801	24	0	0	33	0	0	67	

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	1333	1825	0	0	1329	1820	0	0	-	-	910	-	-	913
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.38	-	-	5.64	5.38	-	-	-	-	7.16	-	-	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.14	-	-	2.32	3.14	-	-	-	-	3.93	-	-	3.93
Pot Cap-1 Maneuver	292	150	-	-	288	151	-	-	0	0	237	0	0	235
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	161	161	-	-	180	180	-	-	-	-	237	-	-	235
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	3.9	22.6	26.3
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	237	161	-	-	180	-	-	235
HCM Lane V/C Ratio	0.139	0.231	-	-	0.691	-	-	0.285
HCM Control Delay (s)	22.6	34	-	-	60.5	-	-	26.3
HCM Lane LOS	C	D	-	-	F	-	-	D
HCM 95th %tile Q(veh)	0.5	0.9	-	-	4.2	-	-	1.1

HCM 6th TWSC  
 3: S Swallow Tail Dr/N Swallow Tail Dr & Dunlawton Ave

Build AM Peak  
 01/23/2023

Intersection														
Int Delay, s/veh	1.8													
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔ ↑↑↑	↔ ↑↑↑	↔ ↑		↔ ↑↑↑	↔ ↑↑↑				↔ ↑			↔ ↑
Traffic Vol, veh/h	3	48	1466	22	40	57	1100	15	0	0	24	0	0	24
Future Vol, veh/h	3	48	1466	22	40	57	1100	15	0	0	24	0	0	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	315	-	135	-	305	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	2	3	9	3	4	4	13	0	0	0	0	0	21
Mvmt Flow	3	52	1593	24	43	62	1196	16	0	0	26	0	0	26

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	885	1212	0	0	1163	1617	0	0	-	-	797	-	-	606
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.34	-	-	5.66	5.38	-	-	-	-	7.1	-	-	7.52
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.12	-	-	2.33	3.14	-	-	-	-	3.9	-	-	4.11
Pot Cap-1 Maneuver	517	309	-	-	353	191	-	-	0	0	286	0	0	342
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	316	316	-	-	230	230	-	-	-	-	286	-	-	342
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	2.7	18.8	16.4
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	286	316	-	-	230	-	-	342
HCM Lane V/C Ratio	0.091	0.175	-	-	0.458	-	-	0.076
HCM Control Delay (s)	18.8	18.8	-	-	33.3	-	-	16.4
HCM Lane LOS	C	C	-	-	D	-	-	C
HCM 95th %tile Q(veh)	0.3	0.6	-	-	2.2	-	-	0.2

Intersection														
Int Delay, s/veh	3.1													
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔ ↑↑↑	↔ ↑↑↑	↔ ↑		↔ ↑↑↑	↔ ↑↑↑				↔ ↑			↔ ↑
Traffic Vol, veh/h	10	45	1637	59	44	77	1547	35	0	0	49	0	0	68
Future Vol, veh/h	10	45	1637	59	44	77	1547	35	0	0	49	0	0	68
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	315	-	135	-	305	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	2	3	3	0	7	3	0	0	0	0	0	0	0
Mvmt Flow	10	46	1688	61	45	79	1595	36	0	0	51	0	0	70

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	1191	1631	0	0	1232	1749	0	0	-	-	844	-	-	816
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.34	-	-	5.6	5.44	-	-	-	-	7.1	-	-	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.12	-	-	2.3	3.17	-	-	-	-	3.9	-	-	3.9
Pot Cap-1 Maneuver	351	192	-	-	333	158	-	-	0	0	267	0	0	278
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	202	202	-	-	186	186	-	-	-	-	267	-	-	278
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	4	21.6	22.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	267	202	-	-	186	-	-	278
HCM Lane V/C Ratio	0.189	0.281	-	-	0.671	-	-	0.252
HCM Control Delay (s)	21.6	29.6	-	-	56.4	-	-	22.3
HCM Lane LOS	C	D	-	-	F	-	-	C
HCM 95th %tile Q(veh)	0.7	1.1	-	-	4	-	-	1



Intersection														
Int Delay, s/veh	2.9													
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔ ↑↑↑	↔	↔		↔ ↑↑↑	↔				↔			↔
Traffic Vol, veh/h	8	27	1675	36	48	69	1693	23	0	0	31	0	0	63
Future Vol, veh/h	8	27	1675	36	48	69	1693	23	0	0	31	0	0	63
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	315	-	135	-	305	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	0	4	1	6	2	4	2	4	0	0	3	0	0	3
Mvmt Flow	9	29	1782	38	51	73	1801	24	0	0	33	0	0	67

Major/Minor	Major1			Major2			Minor1			Minor2				
Conflicting Flow All	1333	1825	0	0	1301	1820	0	0	-	-	891	-	-	913
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	5.6	5.38	-	-	5.64	5.38	-	-	-	-	7.16	-	-	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.3	3.14	-	-	2.32	3.14	-	-	-	-	3.93	-	-	3.93
Pot Cap-1 Maneuver	292	150	-	-	299	151	-	-	0	0	244	0	0	235
Stage 1	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	161	161	-	-	183	183	-	-	-	-	244	-	-	235
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	3.8	22	26.3
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	244	161	-	-	183	-	-	235
HCM Lane V/C Ratio	0.135	0.231	-	-	0.68	-	-	0.285
HCM Control Delay (s)	22	34	-	-	58.8	-	-	26.3
HCM Lane LOS	C	D	-	-	F	-	-	D
HCM 95th %tile Q(veh)	0.5	0.9	-	-	4.1	-	-	1.1

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## Appendix E – Benefits & Costs

Operational Benefits Summary				
Benefit Period		Measures of Effectiveness		
		Total Stops	Total Delay (veh-hrs)	Fuel Consumption (gal)
AM Peak Hour	2023 No Build	346	1.033	14.0
	2023 Build	48	1.023	10.0
Mid Peak Hour	2023 No Build	545	2.282	18.0
	2023 Build	117	2.190	12.0
PM Peak Hour	2023 No Build	455	2.161	18.0
	2023 Build	94	2.100	13.0
Estimated Daily (AM + Mid + PM)	2023 No Build	1,346	5.475	50.0
	2023 Build	259	5.313	35.0
Estimated Daily Savings [4*(AM+Mid+PM)]		4,348	0.651	60.0
Estimated Unit Cost		\$0.014	\$20.170	\$3.263
Daily User Benefit by MOE		\$60.872	\$13.133	\$195.780
Daily User Benefit Total		269.78		
<b>Annual User Benefit</b>		<b>\$80,935.47</b>		
The service life of the improvement was kept as twenty (20) years.				
Interest rate of 4% was used in arriving at the annual cost of improvements.				

Project Cost (2022)				
		Roadway	Signal	Total
<b>Sub-Total</b>		\$76,273.69	\$0.00	<b>\$119,177.64</b>
<b>Design</b>	25%	\$19,068.42	\$0.00	
<b>Contingency</b>	0%	\$0.00	\$0.00	
<b>Unknowns</b>	25%	\$23,835.53	\$0.00	
<b>Initial Contingency Amount</b>	-	-	-	
<b>Total</b>		<b>\$119,177.64</b>	<b>\$0.00</b>	

Adjusted Project Costs					
Fiscal Year	Inflation Factor	Multiplier	Roadway Cost	Signal Cost	Total
2022	Base	1.000	\$119,177.64	\$0.00	<b>\$119,177.64</b>
2023	2.70%	1.027	\$122,395.44	\$0.00	<b>\$122,395.44</b>
2024	2.80%	1.056	\$125,851.59	\$0.00	<b>\$125,851.59</b>
2025	2.90%	1.086	\$129,426.92	\$0.00	<b>\$129,426.92</b>



# CMF / CRF Details

CMF ID: 285

Provide a right-turn lane on one major-road approach

Description:

Prior Condition: *No Prior Condition(s)*

Category: Intersection geometry

Study: [\*Safety Effectiveness of Intersection Left- and Right-Turn Lanes, Harwood et al., 2002\*](#)

Star Quality Rating:	
	<input type="text" value="X"/>

Crash Modification Factor (CMF)	
Value:	0.86
Adjusted Standard Error:	0.06
Unadjusted Standard Error:	0.05

Crash Reduction Factor (CRF)	
Value:	14 (This value indicates a <b>decrease</b> in crashes)
Adjusted Standard Error:	6
Unadjusted Standard Error:	5

## Applicability

**Crash Type:**

All

**Crash Severity:**

All

**Roadway Types:**

Not Specified

**Number of Lanes:**

**Road Division Type:**

**Speed Limit:**

**Area Type:**

All

**Traffic Volume:**

**Time of Day:**

### *If countermeasure is intersection-based*

**Intersection Type:**

Roadway/roadway (not interchange related)

**Intersection Geometry:**

3-leg,4-leg

**Traffic Control:**

Stop-controlled

**Major Road Traffic Volume:**

1500 to 40600 Average Daily Traffic (ADT)

**Minor Road Traffic Volume:**

25 to 26000 Average Daily Traffic (ADT)

## Development Details

**Date Range of Data Used:**

**Municipality:**

**State:**

**Country:**

**Type of Methodology Used:**

2

**Sample Size Used:**

**Other Details**

**Included in Highway Safety Manual?**

Yes. HSM lists this CMF in **bold** font to indicate that it has the highest reliability since it has an adjusted standard error of 0.1 or less.

**Date Added to Clearinghouse:**

Dec-01-2009

**Comments:**

Countermeasure name changed to match HSM The number of crashes in the after period were not reported in this study, however, they have been recorded as 300 to give 10 points as a benefit of doubt for one or more of the following: (1) number of miles/sites in the reference/treatment group, (2) number of crashes in the references/treatment group, (3) reporting AADTs for the aggregate dataset but not for the disaggregate dataset used for CMF development.

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This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center

*The information contained in the Crash Modification Factors (CMF) Clearinghouse is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in the CMF Clearinghouse. The information contained in the CMF Clearinghouse does not constitute a standard, specification, or regulation, nor is it a substitute for sound engineering judgment.*

### Eastbound Dunlawton Avenue at Swallow Tail Drive Right-Turn Lane Cost Estimate

PAY ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
101-1	Mobilization	LS	1	\$ 6,356.14	\$ 6,356.14
102-1	Maintenance of Traffic	LS	1	\$ 6,356.14	\$ 6,356.14
110-1-1	Clearing and Grubbing	AC	0.2	\$ 25,956.42	\$ 5,191.28
120-1	Regular Excavation	CY	425.0	\$ 16.83	\$ 7,152.75
120-6	Embankment	CY	140.0	\$ 21.99	\$ 3,078.60
160-4	Type B Stabilization	SY	625.0	\$ 13.99	\$ 8,743.75
285-709	Optional Base, Base Group 09	SY	450.0	\$ 29.41	\$ 13,234.50
334-152	Superpave Asphalt Concrete Friction Course, Traffic B, PG76-22 (165 lb/yd^2)	TN	37.0	\$ 96.97	\$ 3,587.89
337-7-81	Asphalt Concrete Friction Course, Traffic B, FC-12,5, PG 76-22 (165 lb/yd^2)	TN	37.0	\$ 123.27	\$ 4,560.99
425-5	Manhole, Adjust	EA	1	\$ 912.36	\$ 912.36
430-175-124	Pipe Culvert, Optional Material, Round, 24" S/CD	LF	10.0	\$ 395.00	\$ 3,950.00
430-982-129	Mitered End Section, Optional Round, 24" CD	EA	1	\$ 2,944.22	\$ 2,944.22
527-2	Detectable Warnings	SF	16.0	\$ 40.13	\$ 642.08
700-1-11	Single Post Sign, F&I Ground Mount, 12-20 SF	AS	8	\$ 512.12	\$ 4,096.96
700-1-50	Single Post Sign, Relocate	AS	1	\$ 350.54	\$ 350.54
710-11-123	Painted Pavement Marking, Standard, White, Solid, 12"	LF	0.20	\$ 996.77	\$ 199.35
710-11-124	Painted Pavement Marking, Standard, White, Solid for Diagonal or Chevron, 18"	LF	0.20	\$ 996.77	\$ 199.35
710-11-125	Painted Pavement Markings, Standard, White, Solid for Stop Line or Crosswalk, 24"	LF	0.20	\$ 996.77	\$ 199.35
710-11-131	Painted Pavement Marking, Standard, White, Skip, 6"	GM	0.20	\$ 996.77	\$ 199.35
711-11-102	Thermoplastic, Standard, White, 8" for Interchange and Urban Island	GM	0.02	\$ 10,484.74	\$ 209.69
711-11-124	Thermoplastic, Standard, White, Solid, 18" for Diagonals and Chevrons	LF	80.00	\$ 5.93	\$ 474.40
711-11-141	Thermoplastic, Standard, White, 2-4 Dotted Guideline/ 6-10 Gap Extension, 6"	GM	0.05	\$ 3,265.22	\$ 163.26
711-11-160	Thermoplastic, Standard, White, Message or Symbol	EA	11	\$ 237.81	\$ 2,615.91
711-15-101	Thermoplastic, Standard-Open Graded Asphalt Surfaces White, Solid, 6"	GM	0.15	\$ 5,698.68	\$ 854.80
				<b>Construction Cost:</b>	<b>\$ 76,273.69</b>
				<b>Design Phase (25%):</b>	<b>\$ 19,068.42</b>
				<b>Project Unknowns (25%):</b>	<b>\$ 23,835.53</b>
				<b>TOTAL PROJECT COST:</b>	<b>\$ 119,177.64</b>

### Eastbound Dunlawton Avenue at Swallow Tail Drive Lighting Improvement Cost Estimate

PAY ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
715-1-12	LIGHTING CONDUCTORS, F&I, INSULATED, NO.8 - 6	LF	3,576	\$ 2.20	\$ 7,867.20
715-4-13	LIGHT POLE COMPLETE, FURNISH & INSTALL STANDARD POLE STANDARD FOUNDATION, 40' MOUNTING HEIGHT	EA	8	\$ 9,220.00	\$ 73,760.00
715-4-70	LIGHT POLE COMPLETE, REMOVE POLE AND FOUNDATION	EA	8	\$ 800.00	\$ 6,400.00
715-500-1	POLE CABLE DISTRIBUTION SYSTEM, FURNISH AND INSTALL, CONVENTIONAL	EA	8	\$ 725.00	\$ 5,800.00
				<b>Lighting Cost:</b>	<b>\$ 93,827.20</b>

**Benefit-Cost Analysis**

District: **Five** County: **79 - Volusia** Date Prepared: **01/13/22**

Location: **Dunlawton Ave and Swallow Tail Dr**

Section : \_\_\_\_\_ Beg. Milepost : \_\_\_\_\_ End Milepost : \_\_\_\_\_

Rdway Type: **6+ Lanes Urban Divided**

Control Element: **Other (describe in box below)**

Turn Lane Improvement

**ANNUAL COST OF IMPROVEMENTS**

Type	Cost	Service Life	Capital Recovery Factor	Total
ROW		100	0.0408	\$ -
P.E.C.E.I. Structure		15	0.0899	\$ -
Roadway	\$ 119,177.64	75	0.0425	\$ -
Drainage		20	0.0736	\$ 8,771.47
Signal	\$ -	20	0.0736	\$ -
Other		20	0.0736	\$ -
<b>Sub-Total</b>	<b>\$ 119,177.64</b>			<b>\$ 8,771.47</b>
<b>Annual Cost =</b>				<b>\$ 8,771.47</b>

Total number of crashes = <b>51</b>	Primary crash reduction factor (%): <b>14</b>
# of correctable crashes, PC = <b>11</b>	Install Right Turn Lane on one Major Road Approach
# of years of crash data, YD = <b>6</b>	
PC/YD = <b>1.83</b>	Additional crash reduction factor:
Crash reduction factor, CRF = <b>14.00%</b>	
CRF x (PC/YD) = <b>0.26</b>	Additional crash reduction factor:
Cost per crash, CPC = <b>\$123,598.00</b>	
Safety Benefit = <b>\$31,723</b>	Additional crash reduction factor:
Operational Benefit = <b>\$80,936</b>	

**BENEFIT/COST RATIO**

$$\frac{\text{Benefit}}{\text{Cost}} = \frac{\$112,659.49}{\$8,771.47} = \mathbf{12.84}$$

1) A Crash Reduction Factor of 14% was used based CMF ID 285 from the cmfclearinghouse.org (SAFETY EFFECTIVENESS OF INTERSECTION LEFT- AND RIGHT-TURN LANES, HARWOOD ET AL., 2002); 2) Rear End crashes were assumed to be correctable because of the capacity improvement; 3) Operations benefits of \$80,936 was added to the safety benefits to get the overall B/C Ratio; 4) Construction cost is represented in 2022 dollar value.

Prepared by: **VHB**



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## Appendix F – Stakeholder Presentation



# **Dunlawton Avenue at South Swallow Tail Drive**

## **Feasibility Study for Eastbound Right-Turn Lane**

**January 19, 2023**

# Meeting Agenda

- **Study Introduction**
- **Background**
- **Existing Conditions**
- **Feasibility Analysis**
- **Questions**

# Introduction/Background

## *Study Purpose*

*"Improve traffic flow, reduce delays for through and turning traffic, and improve intersection safety."*

- **Feasibility Study Application:**
  - City of Port Orange in March 2022
- **Problem Statement:**
  - Eastbound through traffic along Dunlawton Avenue is impeded by vehicles turning right onto S Swallow Tail Drive
  - Results in excess delays, adverse safety conditions, and congestion during peak hours
- **Proposed Improvement:**
  - Construct an exclusive eastbound right-turn lane at the study intersection
  - Allows for segregation between vehicles traveling through on Dunlawton Avenue and vehicles turning right onto S Swallow Tail Drive

# Study Intersection



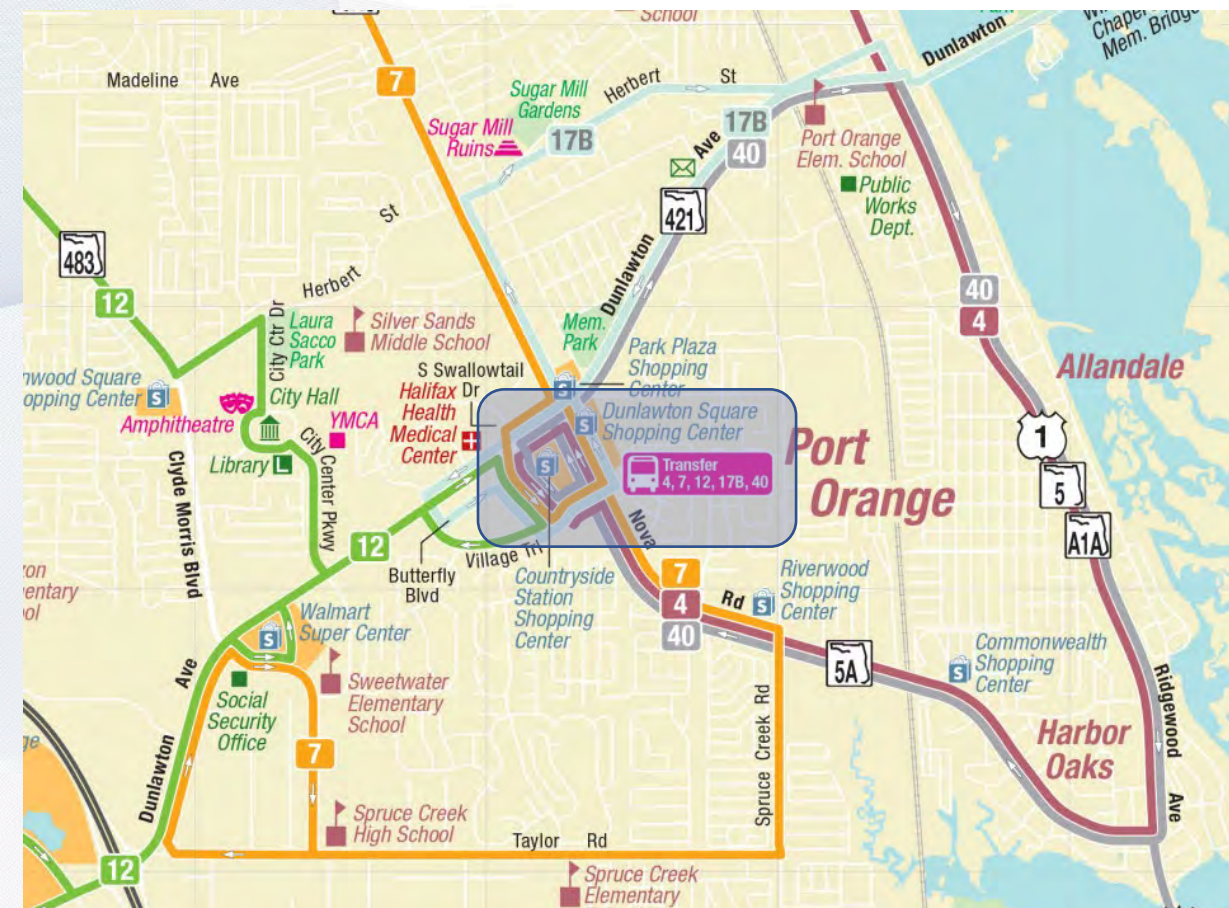


# Existing Conditions – Data Collection

## Data was collected in the field on a typical weekday

- Wednesday December 7th, 2022 (schools in session, early release)
- Weather – Clear
- **Turning Movement Counts (TMCs)**
  - Peak Travel Hours: 7-9 AM & 12-6 PM
- **Volume Counts**
  - 24-Hour Counts
  - Dunlawton Avenue Eastbound - west of S Swallow Tail Drive
  - S Swallow Tail Drive Northbound - south of Dunlawton Avenue
- **Dunlawton Avenue from Williamson Boulevard to SR A1A (Signal Retiming)**

# Existing Conditions – Votran Transfer Station



**Routes – 4, 7, 12, 17B, and 40**  
**Total Frequency – 6 per hour**



# Existing Conditions – Field Observations

## • Dunlawton Avenue

- Congestion in the eastbound direction (towards Nova Road)
- Longest queues form in the midday and PM peak travel hours
- “RIGHT LANE ENDS” sign on eastbound approach to Nova Road
- Traffic generally avoids the eastbound outside lane
- Queues backup sometimes in the eastbound outside lane

## • South Swallow Tail Drive

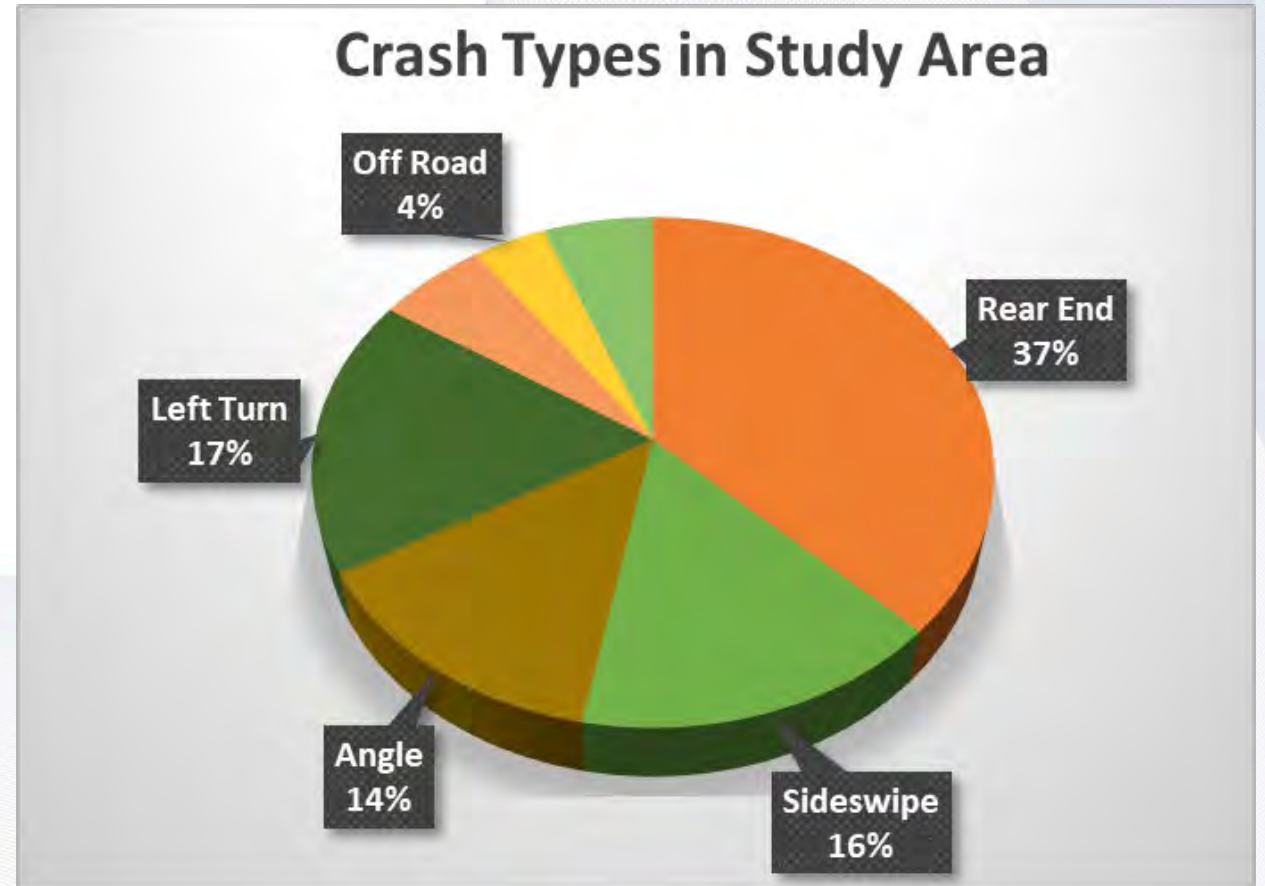
- Generally uncongested on the northbound approach (towards Dunlawton Avenue)
- Westbound left experiences delay because of queues on eastbound Dunlawton Avenue



# Historical Crash Analysis

## January 2017 – December 2022

- **Total – 51 crashes in 6 years**
  - Majority – Rear end crashes
    - 11 out of 19 rear end crashes on the EB approach
  - Left-turn crashes are second most common
    - Majority of them on EB approach
  - One (1) fatality – pedestrian crash
  - 22 injuries (43.1% of crashes)
  - Three (3) pedestrian/bicyclist crashes



# Existing Conditions - Turning Movement Patterns

## 8-Hour Turning Movement Percentages (All Vehicles)

Study Intersection	Movement	Northbound	Southbound	Eastbound	Westbound
Dunlawton Avenue at South Swallow Tail Drive	Left/U-Turn	-	-	2.8%	6.8%
	Through	-	-	95.1%	91.6%
	Right Turn	100.0%	100.0%	2.1%	1.6%

- In general, westbound left-turning traffic represents the highest turning movement at this intersection.
- Heaviest traffic occurs in the PM Peak Hour



PM Peak Hour	
Dunlawton Avenue ← 63	↖ 23 ← 1,693 ↘ 69 ↻ 48
	↻ 8 ↗ 27 → 1,675 ↘ 36 ↗ 31 South Swallow Tail Drive

# Operational Analysis

## Two Scenarios were considered

- No-Build: Maintain the existing intersection geometry
- Build: Implement the proposed exclusive eastbound right-turn lane
- Build Conditions - minor delay reductions

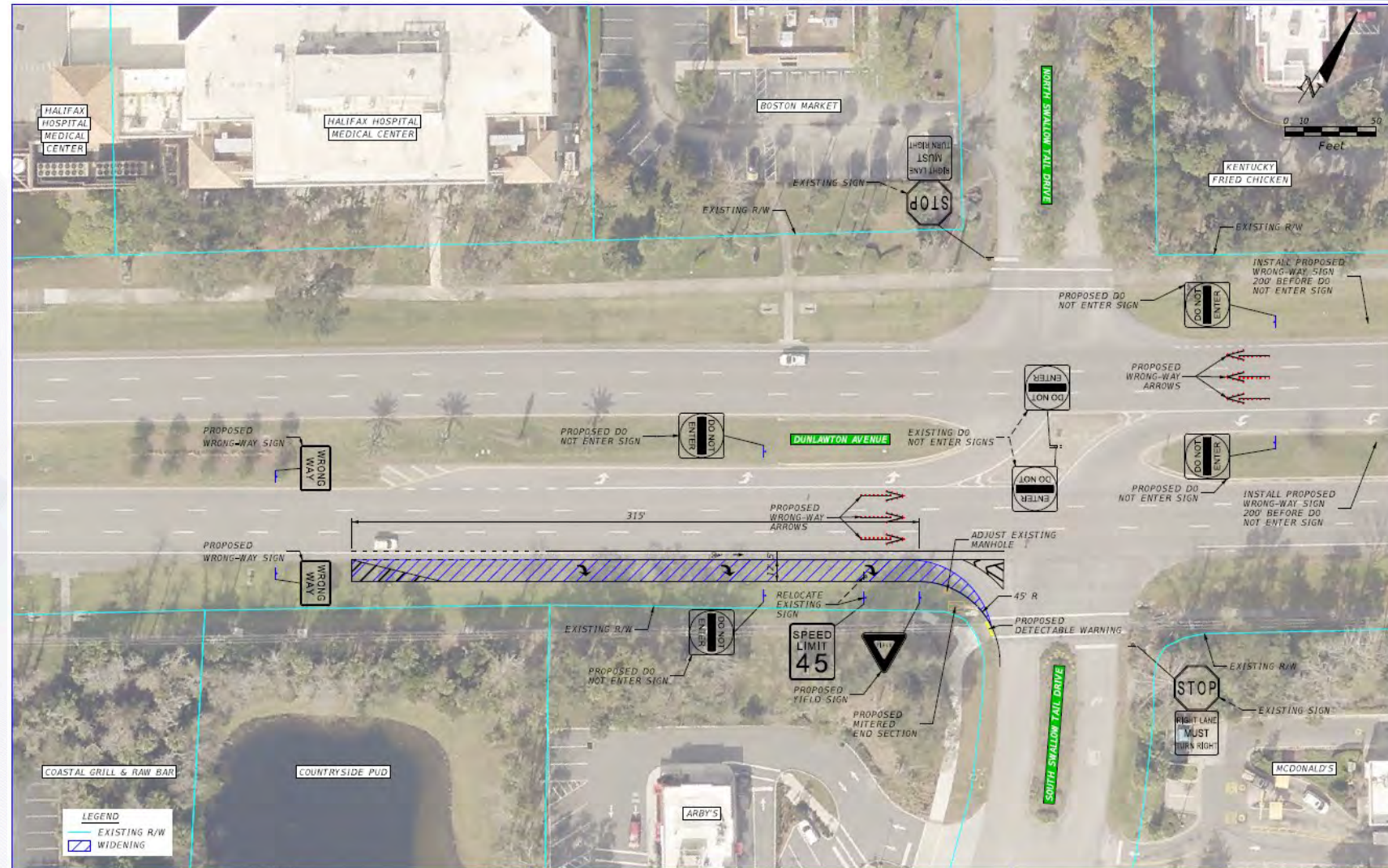
### Dunlawton Avenue at South Swallow Tail Drive – Operational Analysis

Peak Hour	AM		Mid-Day		PM	
Movement	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
<b>No-Build (Existing Geometry)</b>						
EBL	18.8	C	29.6	D	34.0	D
WBL	33.6	D	58.7	F	60.5	F
NBR	19.1	C	22.7	C	22.6	C
SBR	16.4	C	22.3	C	26.3	D
<b>Build (Exclusive Eastbound Right Turn)</b>						
EBL	18.8	C	29.6	D	34.0	D
WBL	33.3 (-)	D	56.4 (-)	F	58.8 (-)	F
NBR	18.8 (-)	C	21.6 (-)	C	22.0 (-)	C
SBR	16.4	C	22.3	C	26.3	D

*Note: The (-) symbol represents a reduction in delay as compared to the No-Build Scenario*

# Proposed Improvements

- **Cost Estimate**
  - \$120,000
- **B/C Ratio ~ 13**
  - Operational + Safety Benefits
- **Crash Reduction Potential**
  - 14% (CMFClearinghouse)



# Other Considerations

- **Lighting improvements**
- **Special emphasis crosswalks**
- **Long-term - Signalization**
  - Will help eastbound/critical westbound left turn movements
  - Will help with safe completion of westbound left turn movement
  - Will provide an opportunity to cross

# Questions & Discussion

