

SIGNAL WARRANT ANALYSIS

**HOWLAND BOULEVARD AND FERNANDA DRIVE**  
CITY OF DELTONA, VOLUSIA COUNTY



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TPD No. 5427.2

## PROFESSIONAL ENGINEERING CERTIFICATION

I hereby certify that I am a Professional Engineer properly registered in the State of Florida practicing with Traffic Planning & Design, Inc., a corporation authorized to operate as an engineering business, EB-3702, by the State of Florida Department of Professional Regulation, Board of Professional Engineers, and that I have prepared or approved the evaluations, findings, opinions, conclusions, or technical advice attached hereto for:

**PROJECT:** Fernanda Place – Phase 3  
**LOCATION:** City of Deltona, Volusia County  
**CLIENT:** Galvin Land Services, LLC

I hereby acknowledge that the procedures and references used to develop the results contained in these computations are standard to the professional practice of Transportation Engineering as applied through professional judgment and experience.

**NAME:** Turgut Dervish, P.E.  
**P.E. No.:** 20400  
**DATE:** March 8<sup>th</sup>, 2024

**SIGNATURE:**



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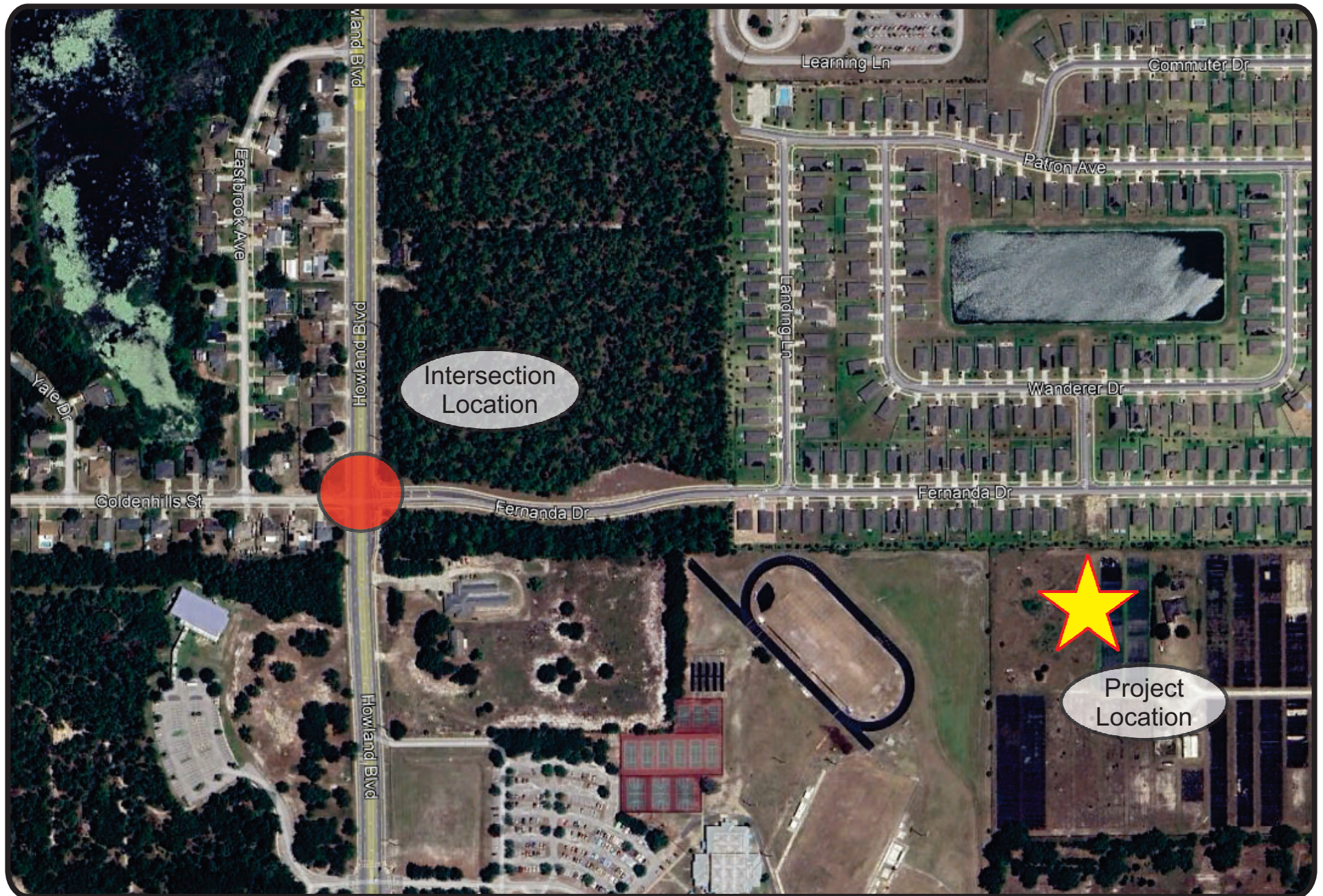
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## INTRODUCTION

This signal warrant analysis was conducted in order to determine the need of and justification for the installation of a traffic signal at the intersection of Howland Boulevard and Fernanda Drive/Goldenhills Street in the City of Deltona, Volusia County. This analysis was performed to determine if a signal would become warranted due to the construction of Phase 3 of the Fernanda Place development, which is accessed via Fernanda Drive. **Figure 1** depicts the intersection location and area roadway network. Fernanda Place is a single family residential development consisting of 251 dwelling units located on the north side of Fernanda Drive, approximately 0.4 miles east of Howland Boulevard. Phase 3 of the development consists of 101 single family dwelling units located on the south side of Fernanda Drive.







Fernanda Place - SWA  
Project No 5427.2  
Figure 1

*Intersection Location*



## EXISTING TRAFFIC CONDITIONS

Howland Boulevard is a four-lane divided roadway with a posted speed limit of 45 mph. Based on FDOT counts made in 2022, it carries a daily traffic volume of approximately 26,500 vehicles per day adjacent to the intersection.

### Intersection Configuration

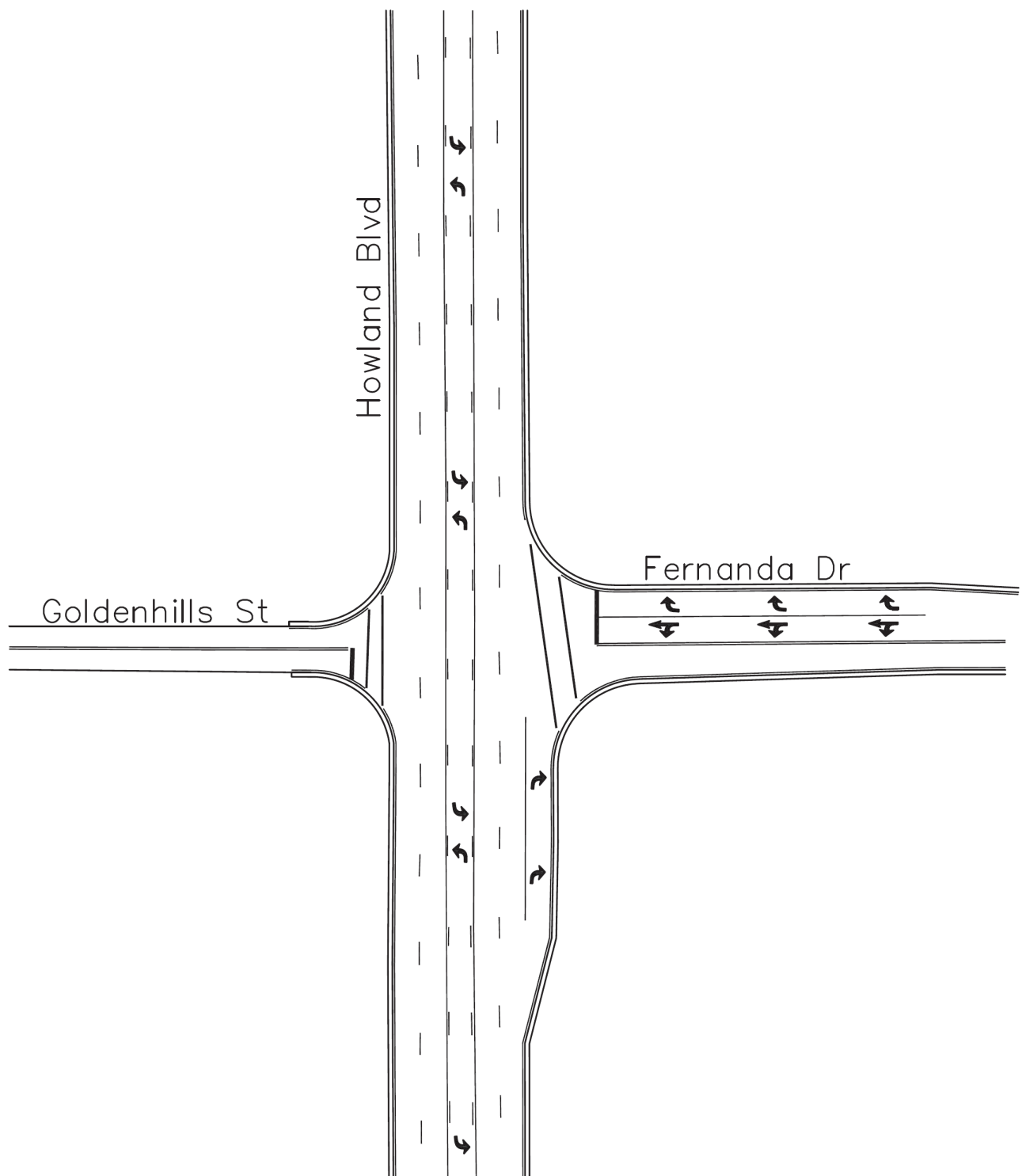
The existing lane configuration at the intersection of Howland Boulevard and Fernanda Drive/Goldenhills Street is illustrated in **Figure 2**. In addition to the two through lanes in each direction, Howland Boulevard has a two-way-left-turn lane in the northbound and southbound directions, and a right-turn lane in the northbound direction. Fernanda Drive has an exclusive right turn lane as well as a shared through/left lane. Goldenhills Street has a single-lane approach.

### Hourly Traffic Counts

Hourly traffic counts were obtained at each intersection approach by TPD personnel. These counts were made on February 20<sup>th</sup>, 2024, by 15-minute intervals and are included in **Appendix A**. The counts, summarized by the hour, are shown in **Table 1** along with the hourly variation of the existing traffic for each approach. Additionally, turning movement counts were collected for the westbound approach of the intersection for the hours of 6 A.M. to 7 P.M. in 15-minute intervals. The turning movement counts are summarized in **Table 2**. These existing traffic volumes will be used in the signal warrant analysis along with trips to be generated by Phase 3 of the development.









**Table 1**  
**Existing Hourly Traffic Volumes**

Time	Approach							
	Northbound (Howland Blvd)		Southbound (Howland Blvd)		Eastbound (Goldenhills St)		Westbound (Fernanda Dr)	
	Volume	% per Hour	Volume	% per Hour	Volume	% per Hour	Volume	% per Hour
12-1 A.M.	45	0.49%	22	0.26%	0	0.00%	2	0.24%
1-2 A.M.	33	0.36%	16	0.19%	1	0.16%	1	0.12%
2-3 A.M.	25	0.27%	24	0.28%	1	0.16%	5	0.60%
3-4 A.M.	20	0.22%	43	0.50%	5	0.80%	7	0.83%
4-5 A.M.	26	0.28%	117	1.37%	1	0.16%	20	2.38%
5-6 A.M.	86	0.94%	331	3.87%	20	3.22%	39	4.64%
6-7 A.M.	150	1.64%	678	7.94%	38	6.11%	56	6.67%
7-8 A.M.	423	4.62%	1,081	12.66%	88	14.15%	124	14.76%
8-9 A.M.	546	5.96%	759	8.89%	68	10.93%	71	8.45%
9-10 A.M.	347	3.79%	471	5.51%	53	8.52%	38	4.52%
10-11 A.M.	370	4.04%	411	4.81%	19	3.05%	43	5.12%
11-12 P.M.	412	4.50%	415	4.86%	17	2.73%	30	3.57%
12-1 P.M.	464	5.07%	425	4.98%	27	4.34%	39	4.64%
1-2 P.M.	475	5.19%	434	5.08%	30	4.82%	28	3.33%
2-3 P.M.	584	6.38%	557	6.52%	27	4.34%	47	5.60%
3-4 P.M.	883	9.65%	562	6.58%	42	6.75%	48	5.71%
4-5 P.M.	981	10.72%	515	6.03%	92	14.79%	55	6.55%
5-6 P.M.	1,127	12.31%	509	5.96%	30	4.82%	61	7.26%
6-7 P.M.	911	9.95%	409	4.79%	31	4.98%	46	5.48%
7-8 P.M.	470	5.13%	240	2.81%	13	2.09%	39	4.64%
8-9 P.M.	283	3.09%	236	2.76%	7	1.13%	17	2.02%
9-10 P.M.	220	2.40%	152	1.78%	6	0.96%	16	1.90%
10-11 P.M.	186	2.03%	92	1.08%	5	0.80%	3	0.36%
11-12 P.M.	88	0.96%	43	0.50%	1	0.16%	5	0.60%
<b>Total:</b>	<b>9,155</b>	<b>100%</b>	<b>8,542</b>	<b>100%</b>	<b>622</b>	<b>100%</b>	<b>840</b>	<b>100%</b>



**Table 2**  
**Turning Movement Count Summary**

Time	Westbound Approach (Fernanda Dr)	
	Left + Thru Lane Volume	Right Lane Volume
6-7 A.M.	43	13
7-8 A.M.	66	58
8-9 A.M.	53	17
9-10 A.M.	28	11
10-11 A.M.	24	19
11-12 P.M.	18	12
12-1 P.M.	24	16
1-2 P.M.	19	9
2-3 P.M.	26	21
3-4 P.M.	27	22
4-5 P.M.	28	25
5-6 P.M.	32	32
6-7 P.M.	23	23
<b>Total:</b>	<b>411</b>	<b>278</b>



## DEVELOPMENT GENERATED TRAFFIC

Phase 3 of the Fernanda Place development will consist of 101 single-family dwelling units. In order to determine the impact of this development to the existing traffic volumes at the study intersection, trip generation and distribution analysis was conducted.

### Trip Generation

In a traffic study conducted in February 2024, trip generation calculations were conducted in order to determine the impact of the traffic generated by the Phase 3 of the development. The trip generation calculations are summarized below in **Table 3**, which shows that Phase 3 of the development will generate 1,018 new daily trips, of which 509 will enter the site and 509 will exit the site. These trips will be combined with the existing traffic for use in the analysis. The detailed ITE worksheets are included in **Appendix B**.

**Table 3**  
**Trip Generation Summary**

ITE Code	Land Use	Size	Daily			
			Rate**	Enter	Exit	Total
210	Single-Family Detached Housing	101 DU*	10.08	509	509	1,018

\* DU = Dwelling Unit

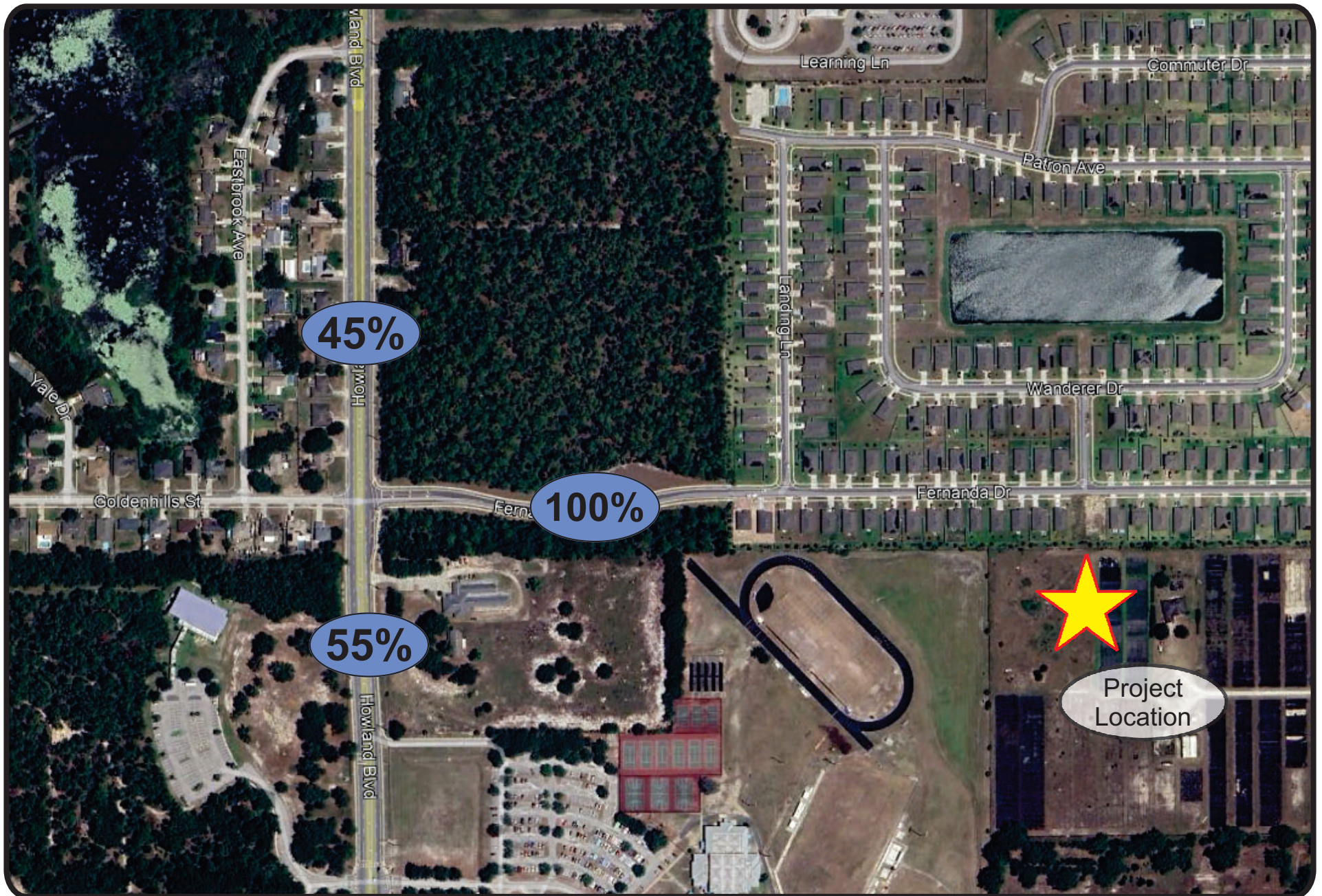
\*\*  $R^2 > 0.75$ , therefore Equations used

### Trip Distribution

The February 2024 traffic study included an estimation of the distribution of the project trips using the CFRPM model. The trip distribution of the project, as shown in **Figure 3**, shows that 45% of the project traffic will enter/exit the site from Howland Boulevard to the north of Fernanda Drive, and 55% of the project traffic will enter/exit the site from Howland Boulevard to the south of Fernanda Drive. This distribution will be used to assign the project trips to the study intersection for use in the analysis. The detailed model output plots are included in Appendix B.







Fernanda Place - SWA  
Project № 5427.2  
Figure 3

*Trip Distribution*





### Hourly Variation of Project Trips

In order to determine the hourly variation of the project trips entering the study intersection, analysis was conducted using both the hourly variation of existing traffic and hourly variation rates obtained from ITE. Fernanda Drive is the only access to the Fernanda Place development; therefore, all 509 exiting project trips will enter the study intersection from Fernanda Drive (the westbound approach). Additionally, it should be noted that Fernanda Drive provides access only to the Fernanda Place development and nothing else, so the existing traffic counts in the westbound direction consist entirely of exiting-trips generated by the completed Fernanda Place dwelling units. The hourly variation of these existing exiting-trips was used to determine the hourly variation of the project trips entering the study intersection from Fernanda Drive. Additionally, the trip distribution obtained from the traffic study was used to distribute the project trips to the left and right lanes of the westbound approach.

Similarly, the project trips entering the study intersection from Howland Boulevard are those trips that are entering the project site. These trips were distributed to the northbound and southbound approaches of the intersection according to the trip distribution determined in the traffic study. It was determined that 280 project trips will enter the study intersection from the northbound approach and 229 project trips will enter the study intersection from the southbound approach per day. While the project trips on Fernanda Drive are those that are exiting the project site, the project trips on Howland Boulevard are those that are entering the project site; therefore, the hourly variation of the existing counts is not applicable to the project trips on Howland Boulevard. Instead, hourly variation rates were obtained from ITE in order to determine the hourly variation of the project trips entering the study intersection from Howland Boulevard. The hourly variation rates obtained from ITE are included in Appendix B.

Summarized in **Table 4** are the hourly variations of the project trips entering the study intersection at each intersection approach. It should be noted that the traffic study did not assign any project trips to Goldenhills Street, therefore no project trips are assigned to the eastbound approach for use in the Signal Warrant Analysis. These project trips will be combined with the existing traffic counts in order to determine the total traffic volumes for use in the analysis. The total traffic volumes per hour are summarized in **Table 5**, along with the total volume of both approaches for the Major Street and the critical volume for the Minor Street, which are the volumes to be used in the analysis.



**Table 4**  
**Hourly Variation of Project Trips**

Time	Northbound (Howland Blvd)		Southbound (Howland Blvd)		Westbound (Fernanda Dr)		
	%*	Volume	%*	Volume	%**	Left + Thru Lane	Right Lane
12-1 A.M.	0.5%	1	0.5%	1	0.24%	1	0
1-2 A.M.	0.2%	1	0.2%	0	0.12%	1	0
2-3 A.M.	0.3%	1	0.3%	1	0.60%	2	1
3-4 A.M.	0.2%	1	0.2%	0	0.83%	2	2
4-5 A.M.	0.3%	1	0.3%	1	2.38%	7	5
5-6 A.M.	0.5%	1	0.5%	1	4.64%	13	11
6-7 A.M.	1.6%	4	1.6%	4	6.67%	19	15
7-8 A.M.	3.1%	9	3.1%	7	14.76%	41	34
8-9 A.M.	3.8%	11	3.8%	9	8.45%	24	19
9-10 A.M.	3.3%	9	3.3%	8	4.52%	13	10
10-11 A.M.	4.2%	12	4.2%	10	5.12%	14	12
11-12 P.M.	5.4%	15	5.4%	12	3.57%	10	8
12-1 P.M.	5.7%	16	5.7%	13	4.64%	13	11
1-2 P.M.	6.1%	17	6.1%	14	3.33%	9	8
2-3 P.M.	7.1%	20	7.1%	16	5.60%	14	14
3-4 P.M.	8.7%	24	8.7%	20	5.71%	16	13
4-5 P.M.	10.5%	29	10.5%	24	6.55%	18	15
5-6 P.M.	10.0%	28	10.0%	23	7.26%	20	17
6-7 P.M.	8.5%	24	8.5%	19	5.48%	15	13
7-8 P.M.	6.1%	17	6.1%	14	4.64%	13	11
8-9 P.M.	6.1%	17	6.1%	14	2.02%	6	4
9-10 P.M.	4.4%	12	4.4%	10	1.90%	6	4
10-11 P.M.	2.1%	6	2.1%	5	0.36%	1	1
11-12 P.M.	1.3%	4	1.3%	3	0.60%	2	1
<b>Total:</b>	<b>100.0%</b>	<b>280</b>	<b>100.0%</b>	<b>229</b>	<b>100.0%</b>	<b>280</b>	<b>229</b>

\* ITE Hourly Variation rates

\*\* Obtained from Existing Counts





**Table 5  
Total Traffic Volumes**

Time	Major Street - Howland Boulevard							Minor Street - Goldenhills Street/Fernanda Drive				
	Northbound			Southbound			Total Both Approaches	Eastbound	Westbound			Critical Volume*
	Existing	Project	Total	Existing	Project	Total		Existing	Existing	Project	Total	
12-1 A.M.	45	1	46	22	1	23	69	0	2	1	3	3
1-2 A.M.	33	1	34	16	0	16	50	1	1	1	2	2
2-3 A.M.	25	1	26	24	1	25	51	1	5	3	8	8
3-4 A.M.	20	1	21	43	0	43	64	5	7	4	11	11
4-5 A.M.	26	1	27	117	1	118	145	1	20	12	32	32
5-6 A.M.	86	1	87	331	1	332	419	20	39	24	63	63
6-7 A.M.	150	4	154	678	4	682	836	38	56	34	90	90
7-8 A.M.	423	9	432	1,081	7	1,088	1,520	88	124	75	199	199
8-9 A.M.	546	11	557	759	9	768	1,325	68	71	43	114	114
9-10 A.M.	347	9	356	471	8	479	835	53	38	23	61	61
10-11 A.M.	370	12	382	411	10	421	803	19	43	26	69	69
11-12 P.M.	412	15	427	415	12	427	854	17	30	18	48	48
12-1 P.M.	464	16	480	425	13	438	918	27	39	24	63	63
1-2 P.M.	475	17	492	434	14	448	940	30	28	17	45	45
2-3 P.M.	584	20	604	557	16	573	1,177	27	47	28	75	75
3-4 P.M.	883	24	907	562	20	582	1,489	42	48	29	77	77
4-5 P.M.	981	29	1,010	515	24	539	1,549	92	55	33	88	92
5-6 P.M.	1,127	28	1,155	509	23	532	1,687	30	61	37	98	98
6-7 P.M.	911	24	935	409	19	428	1,363	31	46	28	74	74
7-8 P.M.	470	17	487	240	14	254	741	13	39	24	63	63
8-9 P.M.	283	17	300	236	14	250	550	7	17	10	27	27
9-10 P.M.	220	12	232	152	10	162	394	6	16	10	26	26
10-11 P.M.	186	6	192	92	5	97	289	5	3	2	5	5
11-12 P.M.	88	4	92	43	3	46	138	1	5	3	8	8

\* Eastbound or Westbound approach volume, whichever is greater



## SIGNAL WARRANT ANALYSIS

The signal warrant analysis was conducted in accordance with the procedures of the **Manual on Uniform Control Devices** (MUTCD) for streets and highways. According to the MUTCD, traffic signals should not be considered for installation unless one or more of the nine warrants specified therein are met and an engineering study justifies the need.

### Applicable Warrants

The warrants applicable to this analysis are Warrant 1 – Eight Hour Vehicular Volume (Conditions A and B) and Warrant 2 – Four Hour Volume.

For Warrant 1, the Minimum Vehicular Volume (Condition A) is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The Interruption Continuous Traffic (Condition B) is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delays or conflict in entering/crossing the major street. The MUTCD specifies that the minimum volume warrants are satisfied when for each of any eight hours of an average day the volumes are greater than the threshold values given in **Table 6**. Since the posted speed limit on Howland Boulevard is greater than 40 mph, the 70% threshold values given in the table will be used in the analysis.

For Warrant 2, the Four-Hour Vehicular volume signal warrant, conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. This warrant is satisfied when for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street approach (one direction only) all fall above the applicable curve in **Figure 4** of the MUTCD for the existing combination of lanes.

The six warrants determined not to be applicable for the intersection under study are:

Warrant 3	-	Peak Hour (not applicable)
4	-	Pedestrian Volume (no pedestrian traffic)
5	-	School Crossing (there is no school crossing)
6	-	Coordinated Signal System (not an objective)
7	-	Crash Experience (data not available)
8	-	Roadway Network (not applicable)
9	-	Intersection Near a Grade Crossing



**Table 6**  
**Warrant 1 – Eight-Hour Vehicular Volume**

Condition A-Minimum Vehicular Volume									
Number of Lanes for Moving Traffic on Each Approach		Vehicles Per Hour on Major Street (Total of both Approaches) *				Vehicles Per Hour on Higher Volume Minor Street (One Direction Only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1 Lane	1 Lane	500	400	350	280	150	120	105	84
2 + Lanes	1 Lane	600	480	420	336	150	120	105	84
2 + Lanes	2 + Lanes	600	480	420	336	200	160	140	112
1 Lane	2 + Lanes	500	400	350	280	200	160	140	112
Condition B-Interruption of Continuous Traffic									
Number of Lanes for Moving Traffic on Each Approach		Vehicles Per Hour on Major Street (Total of both Approaches) *				Vehicles Per Hour on Higher Volume Minor Street (One Direction Only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1 Lane	1 Lane	750	600	525	420	75	60	53	42
2 + Lanes	1 Lane	900	720	630	504	75	60	53	42
2 + Lanes	2 + Lanes	900	720	630	504	100	80	70	56
1 Lane	2 + Lanes	750	600	525	420	100	80	70	56

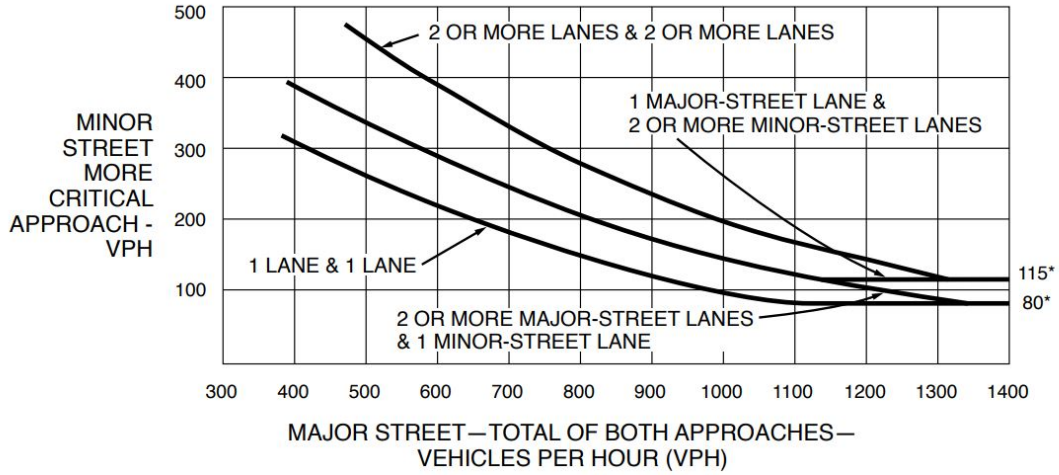
\* When the 85-percentile speed of Major Street exceeds 40 mph, the 70% minimum volume thresholds values are used.

Source: **Manual on Uniform Traffic Control Devices**, 11th Edition, U.S. Department of Transportation, Federal Highway Administration.



**Figure 4**  
**Four-Hour Vehicular Volume Warrant Chart**

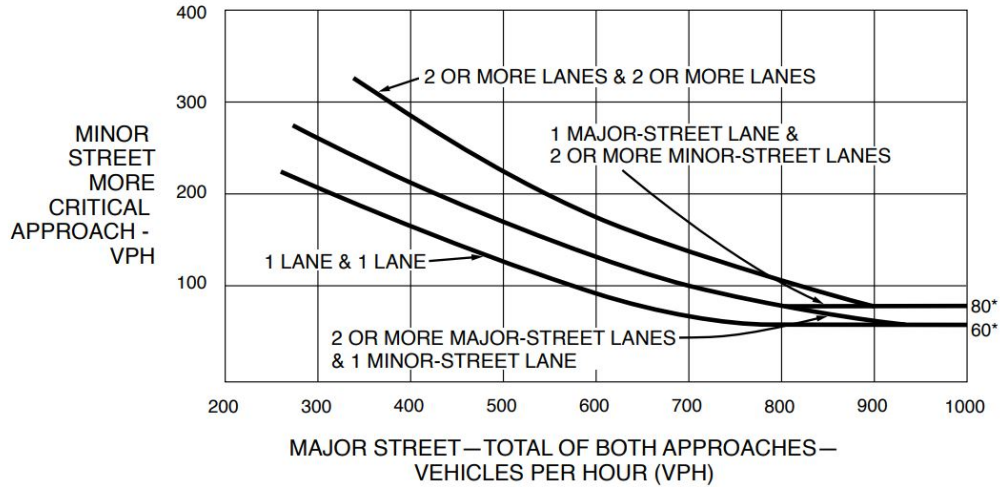
**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**



\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane

**Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)**

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



\*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane



## Warrant Analysis

As described in the Intersection Configuration section of the report, Howland Boulevard has 2 or more approach lanes in each direction, and Fernanda Drive has both a shared through/left lane and an exclusive right turn lane at the study intersection. According to the MUTCD, right-turning traffic should not be considered for a minor street approach with a shared through/left lane and exclusive right turn lane where the right-turning traffic enters the major street with minimal conflict. Therefore, the Signal Warrant analysis was conducted for two scenarios: Dual Lane Minor Approach, and Single Lane Minor Approach. Summarized below in **Table 7** are the hourly traffic volumes from 6:00 A.M. to 7:00 P.M., along with an assessment of the applicable signal warrants for the Dual Lane Minor Approach scenario. As can be seen from the table, the minimum volume requirements of Warrant 1B and Warrant 2 are satisfied for the Dual Lane Minor Approach scenario. Similarly, summarized in **Table 8** are the hourly traffic volumes and assessment of the applicable signal warrants for the Single Lane Minor Approach scenario. As can be seen, the minimum volume requirements are not met for either Warrant 1 or Warrant 2 for this scenario. The completed FDOT Traffic Signal Warrant Summary forms are included in **Appendix C**.

**Table 7**  
**Signal Warrant Analysis – Dual Lane Minor Approach**

Hour	Howland Blvd (Total Both Approaches)	Minor Approach			Warrant		
		Goldenhills St - EB	Fernanda Dr - WB	Critical Volume	1A	1B	2
6-7 A.M.	836	38	90	90		X	
7-8 A.M.	1,520	88	199	199	X	X	X
8-9 A.M.	1,325	68	114	114		X	X
9-10 A.M.	835	53	61	61			
10-11 A.M.	803	19	69	69			
11-12 P.M.	854	17	48	48			
12-1 P.M.	918	27	63	63			
1-2 P.M.	940	30	45	45			
2-3 P.M.	1,177	27	75	75		X	
3-4 P.M.	1,489	42	77	77		X	
4-5 P.M.	1,549	92	88	92		X	X
5-6 P.M.	1,687	30	98	98		X	X
6-7 P.M.	1,363	31	74	74		X	
Hours Required:					8	8	4
Hours Satisfied:					1	8	4



**Table 8**  
**Signal Warrant Analysis – Single Lane Minor Approach**

Hour	Howland Blvd (Total Both Approaches)	Minor Approach					Warrant		
		Goldenhills St - EB	Fernanda Dr - WB			Critical Volume	1A	1B	2
			Existing (Left only)	Project (Left only)	Total Left Lane Volume				
6-7 A.M.	836	38	43	19	62	62		X	
7-8 A.M.	1,520	88	66	41	107	107	X	X	X
8-9 A.M.	1,325	68	53	24	77	77		X	
9-10 A.M.	835	53	28	13	41	53			
10-11 A.M.	803	19	24	14	38	38			
11-12 P.M.	854	17	18	10	28	28			
12-1 P.M.	918	27	24	13	37	37			
1-2 P.M.	940	30	19	9	28	30			
2-3 P.M.	1,177	27	26	15	41	41			
3-4 P.M.	1,489	42	27	16	43	43			
4-5 P.M.	1,549	92	28	18	46	92		X	X
5-6 P.M.	1,687	30	32	20	52	52			
6-7 P.M.	1,363	31	23	15	38	38			
Hours Required:							8	8	4
Hours Satisfied:							1	4	2

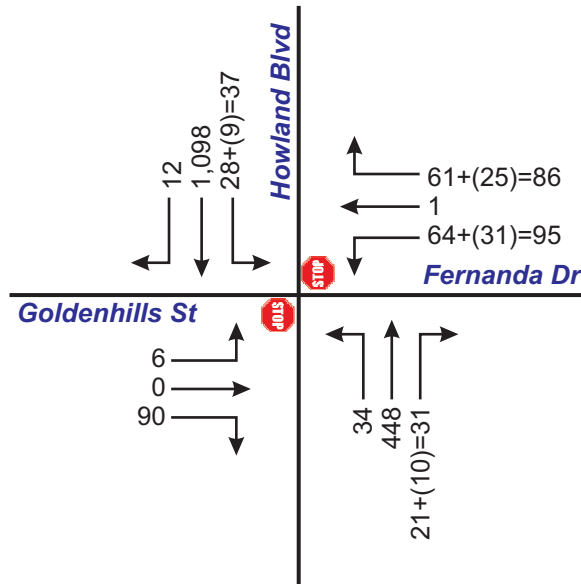
### Intersection Capacity Analysis

In order to determine which scenario is applicable to the study intersection, intersection capacity analysis results were obtained from the February 2024 traffic study. The analysis was conducted using the existing intersection geometry and control, along with projected volumes for the A.M. and P.M. peak hours. The projected peak hour volumes used in the analysis are shown in **Figure 5**, and the results of the analysis are summarized in **Table 9**. As can be seen from the table, the right turn lane on the westbound approach operates at Level of Service “B” with minimal delay; therefore, the right-turning traffic on the westbound approach should not be considered and the Single Lane Minor Approach scenario is more applicable to the study intersection. It should also be noted that all approaches of the study intersection are projected to operate satisfactorily under the existing stop-control. The detailed intersection capacity analysis worksheets are included in **Appendix D**.

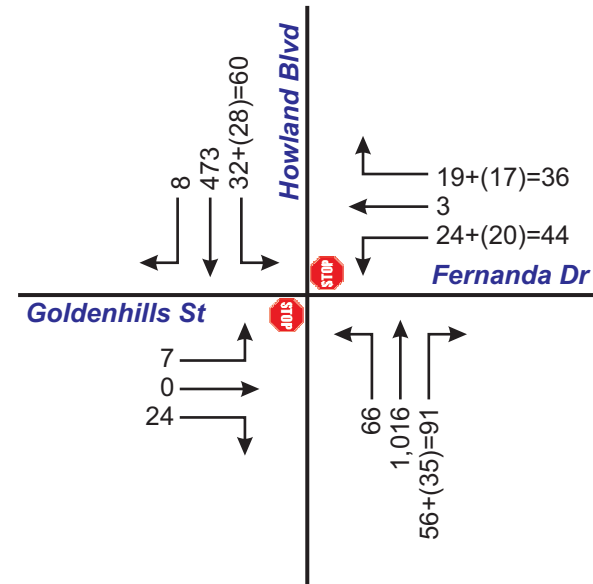




Legend:  
 00+(00)=00  
 Total Traffic  
 Project Trips  
 Background Traffic



A.M. Peak Hour



P.M. Peak Hour



**Table 9**  
**Projected Intersection Capacity Analysis**

Intersection	Control	Time Period	EB		WB				NB		SB	
					Left/Thru Lane		Right Lane					
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Howland Blvd & Fernanda Dr	Stop	A.M.	17.4	C	39.8	E	10.3	B	0.8	A	0.3	A
		P.M.	13.9	B	46.5	E	13.0	B	0.5	A	1.3	A



## **STUDY CONCLUSIONS**

This signal warrant analysis was conducted to determine the need of and justification for the installation of a traffic signal at the intersection of Howland Boulevard and Fernanda Drive/Goldenhills Street in the City of Deltona, Volusia County. This analysis was performed to determine if a signal would become warranted due to the construction of Phase 3 of the Fernanda Place development, which is accessed via Fernanda Drive. The analysis was conducted utilizing existing hourly traffic counts obtained at each approach of the study intersection and hourly project trips based upon data provided by ITE.

The results of the analysis as documented herein revealed that the minimum volumes of the applicable warrants, Warrant 1 and Warrant 2, are satisfied for the Dual Lane Minor Approach scenario. The results of the intersection capacity analysis, however, indicated that the right-turning traffic on the westbound approach of the intersection enters the major street with minor conflict and should not be considered in the analysis. Therefore, the Single Lane Minor Approach scenario is more applicable to the study intersection. The results of the Signal Warrant Analysis revealed that the minimum volume thresholds are not satisfied for Warrant 1 (Condition A or B) or Warrant 2 for the Single Lane Minor Approach scenario. Additionally, the intersection capacity analysis indicated that the study intersection will operate satisfactorily in the A.M. and P.M. peak hours with the existing stop-control at the intersection. Therefore, a traffic signal is not recommended for installation at this location due to Phase 3 of the Fernanda Place development.



## **APPENDICES**

## **APPENDIX A**

### Existing Intersection Approach Volumes

**VOLUME****Howland Blvd & Goldenhills St & Fernanda Dr**

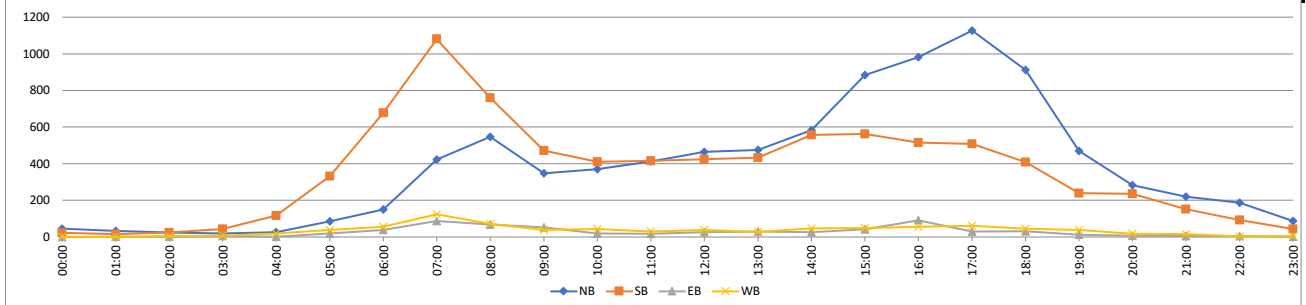
Day: Tuesday

Date: 2/20/2024

City: Deltona

Project #: FL24\_130074\_001

DAILY TOTALS						NB	SB	EB	WB	Total	DAILY TOTALS							
										19,159								
15-Minutes Interval												Hourly Intervals						
TIME	NB	SB	EB	WB	TOTAL	TIME	NB	SB	EB	WB	TOTAL	TIME	NB	SB	EB	WB	TOTAL	
0:00	16	7	0	0	23	12:00	111	118	7	9	245	00:00	01:00	45	22	0	2	69
0:15	13	3	0	0	16	12:15	134	104	9	7	254	01:00	02:00	33	16	1	1	51
0:30	6	7	0	1	14	12:30	98	106	5	18	227	02:00	03:00	25	24	1	5	55
0:45	10	5	0	1	16	12:45	121	97	6	5	229	03:00	04:00	20	43	5	7	75
1:00	7	1	0	0	8	13:00	127	103	7	5	242	04:00	05:00	26	117	1	20	164
1:15	9	4	0	0	13	13:15	103	91	11	6	211	05:00	06:00	86	331	20	39	476
1:30	11	5	1	0	17	13:30	116	128	11	8	263	06:00	07:00	150	678	38	56	922
1:45	6	6	0	1	13	13:45	129	112	1	9	251	07:00	08:00	423	1081	88	124	1716
2:00	7	7	1	1	16	14:00	150	115	3	9	277	08:00	09:00	546	759	68	71	1444
2:15	8	2	0	3	13	14:15	145	138	4	13	300	09:00	10:00	347	471	53	38	909
2:30	4	8	0	0	12	14:30	170	119	8	10	307	10:00	11:00	370	411	19	43	843
2:45	6	7	0	1	14	14:45	119	185	12	15	331	11:00	12:00	412	415	17	30	874
3:00	7	10	1	1	19	15:00	162	135	11	9	317	12:00	13:00	464	425	27	39	955
3:15	3	7	1	3	14	15:15	175	151	9	11	346	13:00	14:00	475	434	30	28	967
3:30	7	9	0	1	17	15:30	314	144	14	15	487	14:00	15:00	584	557	27	47	1215
3:45	3	17	3	2	25	15:45	232	132	8	13	385	15:00	16:00	883	562	42	48	1535
4:00	6	18	0	1	25	16:00	251	113	10	15	389	16:00	17:00	981	515	92	55	1643
4:15	8	23	0	3	34	16:15	249	146	44	9	448	17:00	18:00	1127	509	30	61	1727
4:30	8	29	0	9	46	16:30	247	148	23	19	437	18:00	19:00	911	409	31	46	1397
4:45	4	47	1	7	59	16:45	234	108	15	12	369	19:00	20:00	470	240	13	39	762
5:00	15	71	6	10	102	17:00	285	119	8	15	427	20:00	21:00	283	236	7	17	543
5:15	26	70	4	8	108	17:15	258	123	5	15	401	21:00	22:00	220	152	6	16	394
5:30	22	102	3	10	137	17:30	294	139	2	18	453	22:00	23:00	186	92	5	3	286
5:45	23	88	7	11	129	17:45	290	128	15	13	446	23:00	00:00	88	43	1	5	137
6:00	15	135	4	11	165	18:00	285	114	7	8	414	STATISTICS						
6:15	35	168	6	13	222	18:15	229	98	13	11	351		NB	SB	EB	WB	TOTAL	
6:30	49	185	11	18	263	18:30	207	102	6	16	331	Peak Period	00:00	to	12:00			
6:45	51	190	17	14	272	18:45	190	95	5	11	301	Volume	2483	4368	311	436	7598	
7:00	72	230	19	27	348	19:00	150	81	6	14	251	Peak Hour	7:45	7:15	7:15	7:00	7:15	
7:15	99	255	22	37	413	19:15	118	58	1	10	187	Peak Volume	588	1123	93	124	1848	
7:30	112	297	25	40	474	19:30	99	53	4	6	162	Peak Hour Factor	0.907	0.939	0.930	0.775	0.960	
7:45	140	299	22	20	481	19:45	103	48	2	9	162							
8:00	162	272	24	22	480	20:00	80	56	3	5	144	Peak Period	12:00	to	00:00			
8:15	154	195	15	9	373	20:15	70	76	0	2	148	Volume	6672	4174	311	404	11561	
8:30	132	165	14	18	329	20:30	65	54	3	4	126	Peak Hour	17:00	14:45	16:00	16:30	17:00	
8:45	98	127	15	22	262	20:45	68	50	1	6	125	Peak Volume	1127	615	92	61	1727	
9:00	110	143	26	15	294	21:00	58	34	3	5	100	Peak Hour Factor	0.958	0.831	0.523	0.803	0.953	
9:15	80	114	10	6	210	21:15	48	45	2	3	98							
9:30	91	115	15	6	227	21:30	55	35	0	3	93	Peak Period	07:00	to	09:00			
9:45	66	99	2	11	178	21:45	59	38	1	5	103	Volume	969	1840	156	195	3160	
10:00	105	100	6	10	221	22:00	64	35	2	1	102	Peak Hour	7:45	7:15	7:15	7:00	7:15	
10:15	74	115	8	13	210	22:15	42	24	1	0	67	Peak Volume	588	1123	93	124	1848	
10:30	93	113	2	12	220	22:30	43	20	2	1	66	Peak Hour Factor	0.907	0.939	0.930	0.775	0.960	
10:45	98	83	3	8	192	22:45	37	13	0	1	51							
11:00	101	86	9	8	204	23:00	31	16	0	1	48	Peak Period	16:00	to	18:00			
11:15	87	106	2	7	202	23:15	21	10	1	1	33	Volume	2108	1024	122	116	3370	
11:30	121	108	3	9	241	23:30	16	9	0	2	27	Peak Hour	17:00	16:15	16:00	16:30	17:00	
11:45	103	115	3	6	227	23:45	20	8	0	1	29	Peak Volume	1127	521	92	61	1727	
TOTALS	2483	4368	311	436	7598	TOTALS	6672	4174	311	404	11561	Peak Hour Factor	0.958	0.880	0.523	0.803	0.953	
SPLIT %	33%	57%	4%	6%	40%	SPLIT %	58%	36%	3%	3%	60%							





# National Data & Surveying Services

## Intersection Turning Movement Count

Location: Howland Blvd & Goldenhills St/Fernanda Dr  
City: Deltona  
Control: 2-Way Stop(EB/WB)

Project ID: 24-130074-001  
Date: 2/20/2024

### Data - Totals

NS/EW Streets:	Howland Blvd				Howland Blvd				Goldenhills St/Fernanda Dr				Goldenhills St/Fernanda Dr				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	0 NL	2 NT	1 NR	0 NU	0 SL	2 ST	0 SR	0 SU	0 EL	1 ET	0 ER	0 EU	0.5 WL	0.5 WT	1 WR	0 WU	
6:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	0	10
6:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	10	0	4	0	14
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	15	0	3	0	18
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	9	0	5	0	14
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	16	0	11	0	27
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	15	0	21	0	36
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	18	2	21	0	41
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	15	0	5	0	20
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	14	0	7	0	21
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	7	0	3	0	10
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	13	3	2	0	18
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	14	2	5	0	21
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	11	1	4	0	16
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	5
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	0	7
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	0	11
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	181	9	99	0	289
APPROACH %'s :													62.63%	3.11%	34.26%	0.00%	
PEAK HR :	07:00 AM - 08:00 AM																
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	64	2	58	0	TOTAL
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.889	0.250	0.690	0.000	124
														0.756			0.756

NOON	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	0 NL	2 NT	1 NR	0 NU	0 SL	2 ST	0 SR	0 SU	0 EL	1 ET	0 ER	0 EU	0.5 WL	0.5 WT	1 WR	0 WU	
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	7	0	2	0	10
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	7	0	6	0	13
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	8	0	12
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	3	0	8
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	3	0	8
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	6
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	6	0	10
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	6
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	1	4	0	9
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2	0	8
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	9	0	8	0	17
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	6
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	5
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	6
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	8
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	3	0	9
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	82	3	56	0	141
APPROACH %'s :													58.16%	2.13%	39.72%	0.00%	
PEAK HR :	10:00 AM - 11:00 AM																
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	23	1	19	0	TOTAL
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.821	0.250	0.594	0.000	43
														0.827			0.827

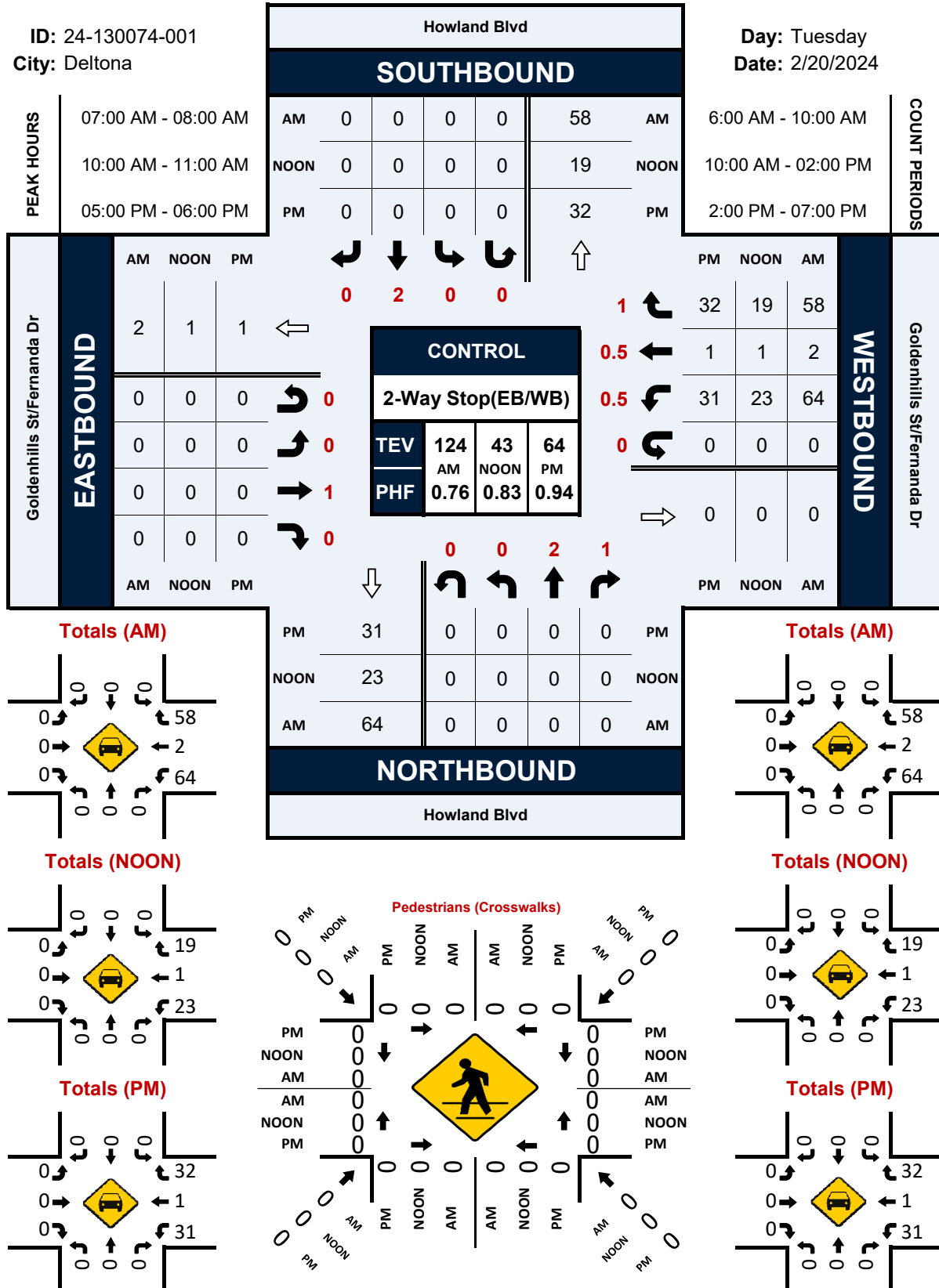
PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	0 NL	2 NT	1 NR	0 NU	0 SL	2 ST	0 SR	0 SU	0 EL	1 ET	0 ER	0 EU	0.5 WL	0.5 WT	1 WR	0 WU	
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	0	9
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	8	1	4	0	13
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	0	10
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	10	0	15
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	9
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	0	10
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	12	0	17
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	7	1	4	1	13
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	2	7	0	15
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	1	4	0	9
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	1	9	0	16
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	8	0	5	0	13
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	7	1	9	0	17
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	11	0	5	0	16
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	11	0	17
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	0	14
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	0	9
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	5	1	5	0	11
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	8	0	7	0	15
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	5	0	11
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	127	8	123	1	259
APPROACH %'s :													49.03%	3.09%	47.49%	0.39%	
PEAK HR :	05:00 PM - 06:00 PM																
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	31	1	32	0	TOTAL
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.705	0.250	0.727	0.000	64
														0.941			0.941

# Howland Blvd & Goldenhills St/Fernanda Dr

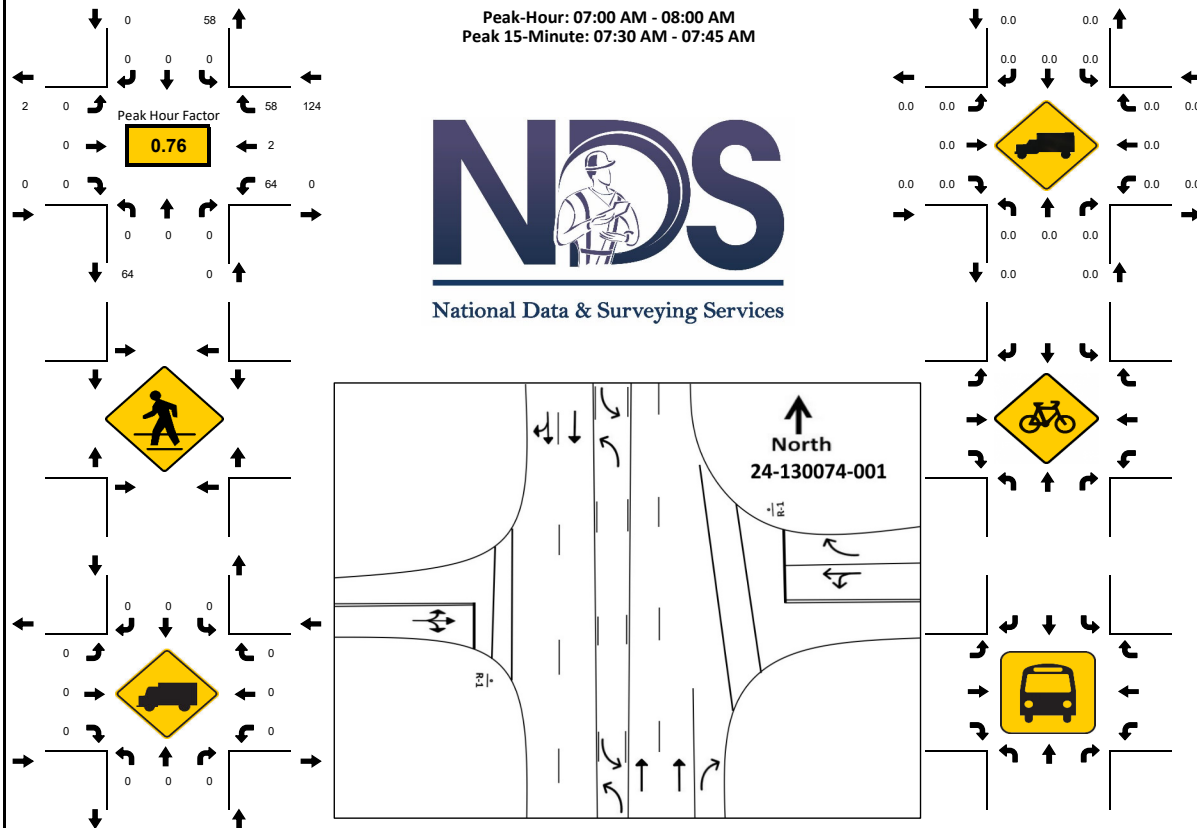
## Peak Hour Turning Movement Count

ID: 24-130074-001  
City: Deltona

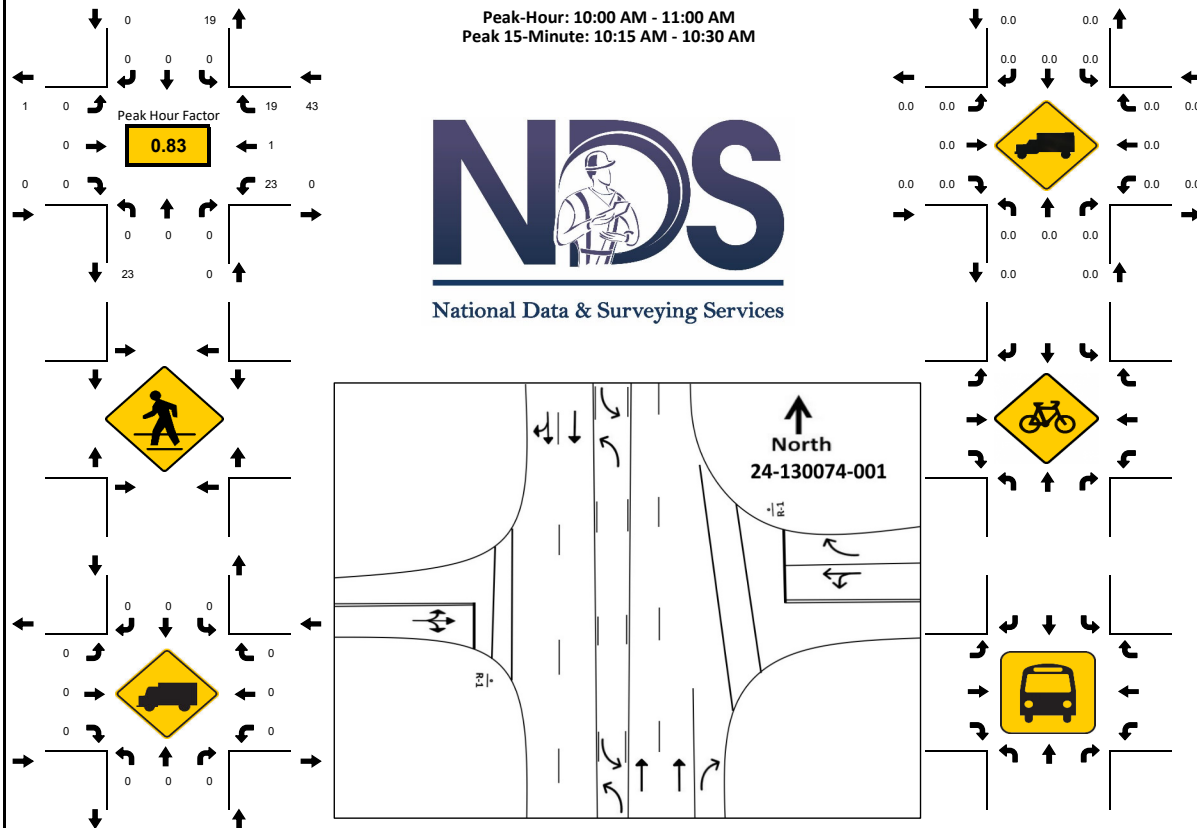
Day: Tuesday  
Date: 2/20/2024



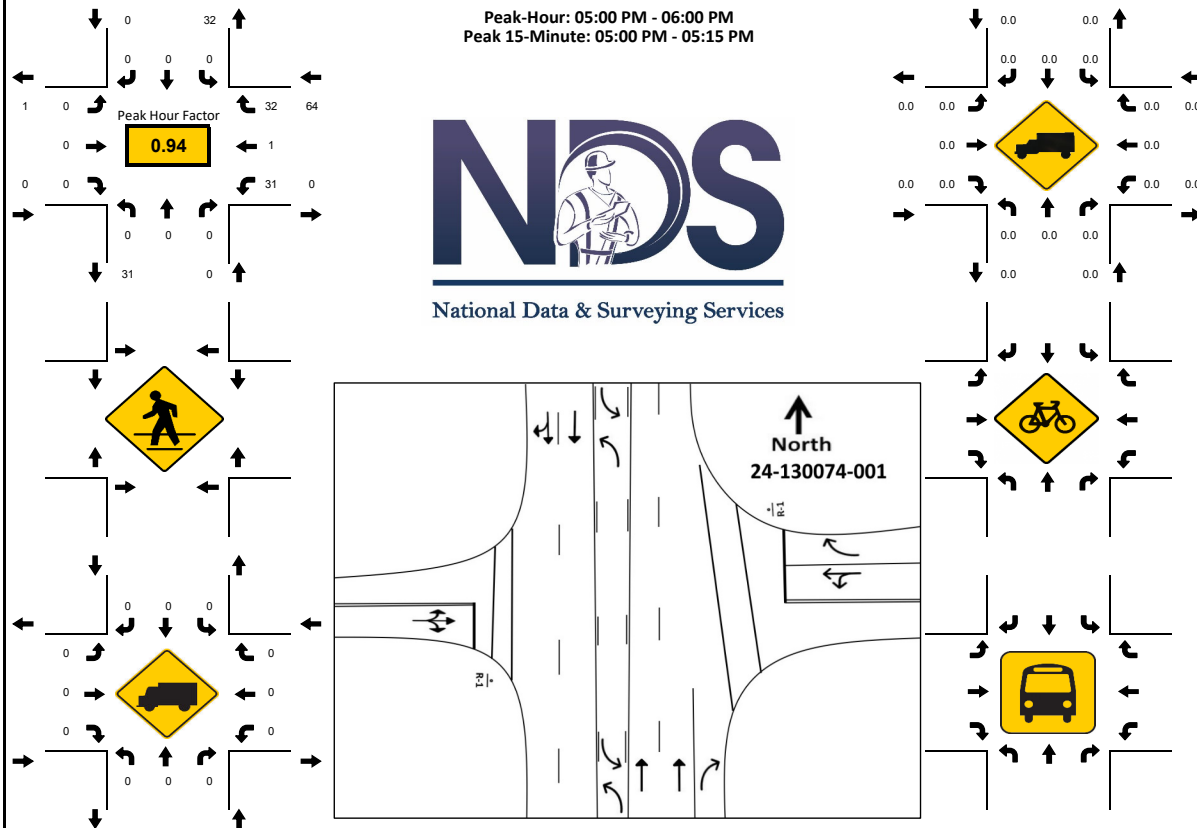
PROJECT ID: 24-130074-001  
DATE: Tue, Feb 20, 2024

[illegible]

**PROJECT ID:** 24-130074-001  
**DATE:** Tue, Feb 20, 2024

[illegible]

**PROJECT ID:** 24-130074-001  
**DATE:** Tue, Feb 20, 2024

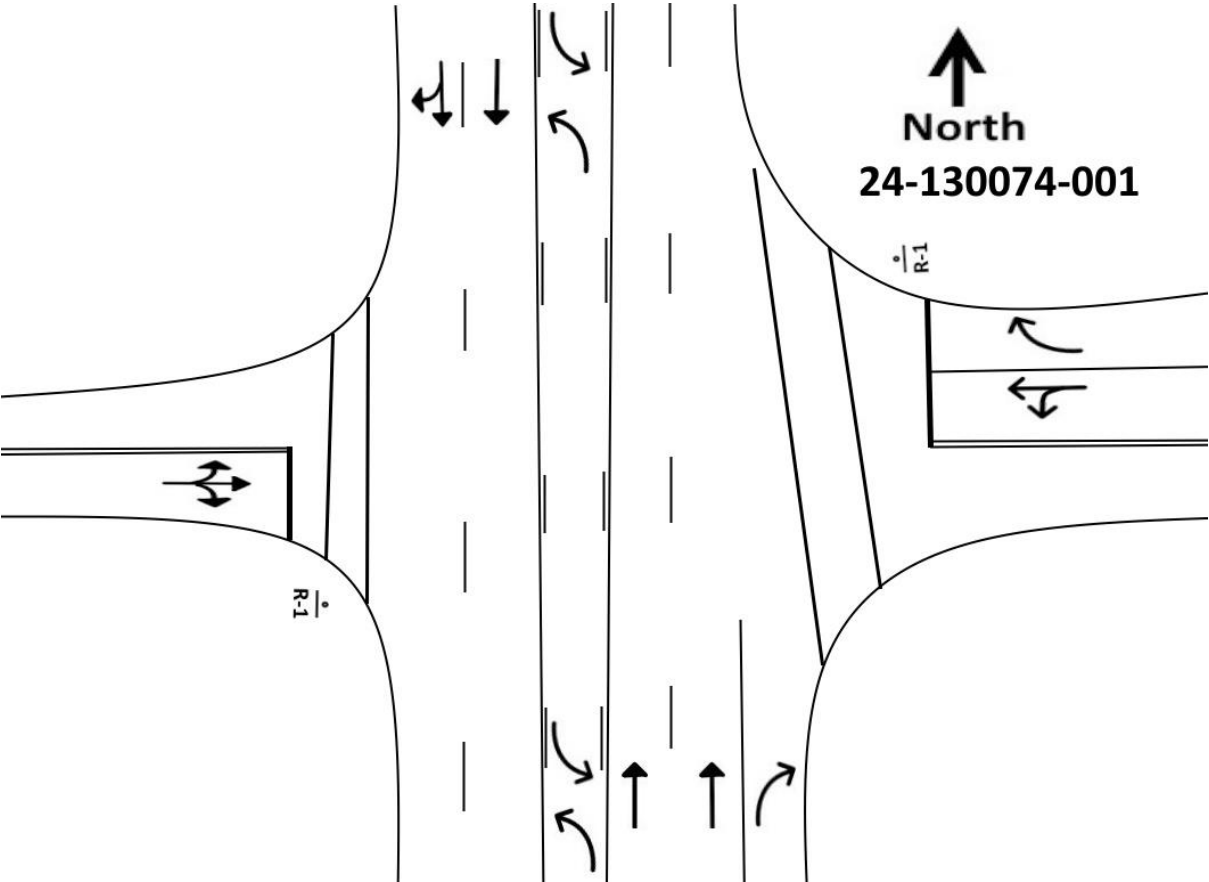
[illegible]



National Data & Surveying Services

Site Code: 24-130074-001  
Date: 02/20/2024  
Weather: Sunny  
City: Deltona  
County: Volusia  
Count Times: 06:00 - 10:00  
10:00 - 14:00  
14:00 - 19:00  
Control: 2-Way Stop(EB/WB)

<b>N↑</b>	N/S Street: <b>Howland Blvd</b>	Speed: <b>40 MPH</b>
-----------	---------------------------------	----------------------



E/W Street: <b>Goldenhills St/Fernanda Dr</b>	Speed: <b>30 MPH</b>
---	----------------------



## **APPENDIX B**

ITE Trip Generation Data, Model Output, ITE Hourly Variation Rates

# Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 174

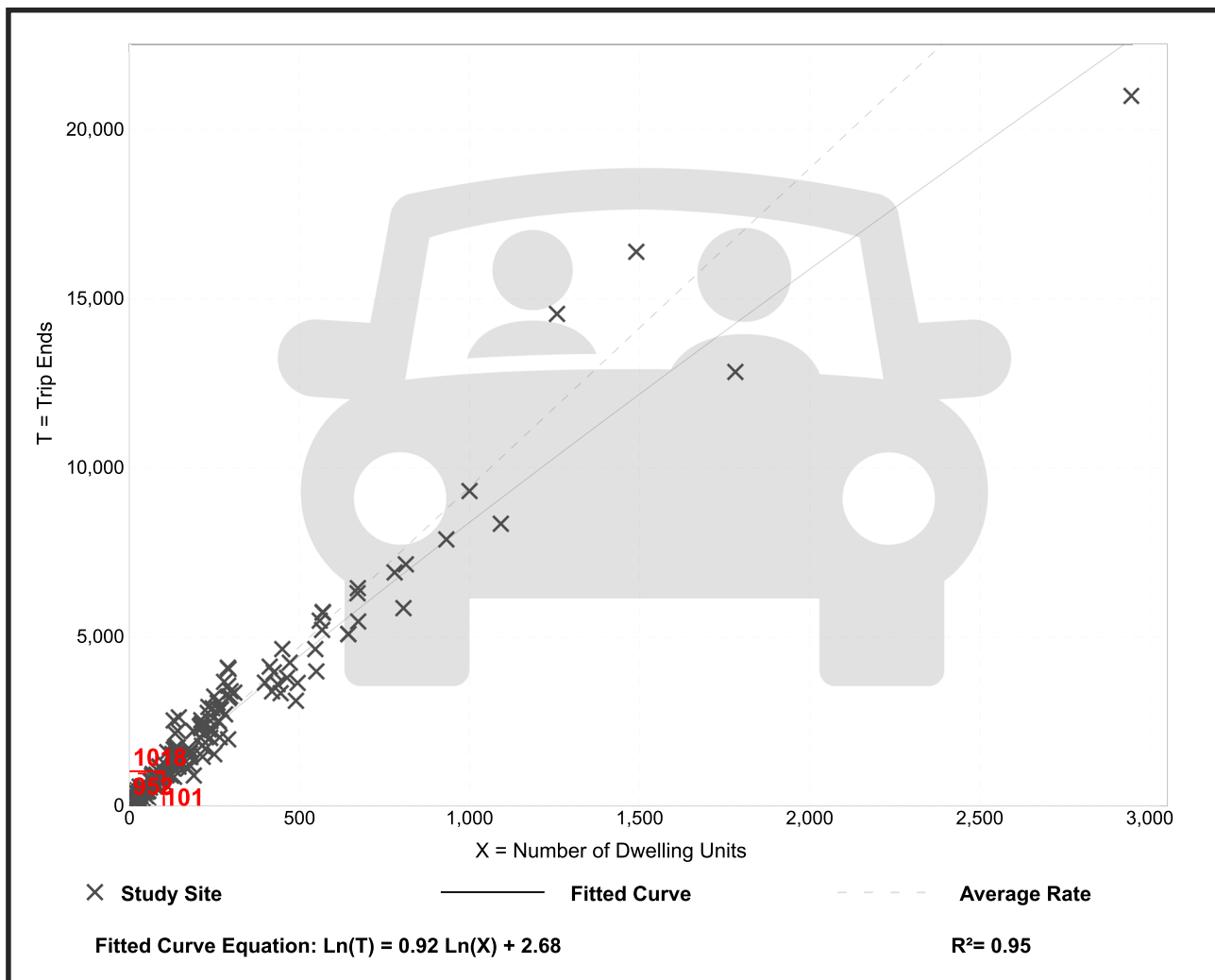
Avg. Num. of Dwelling Units: 246

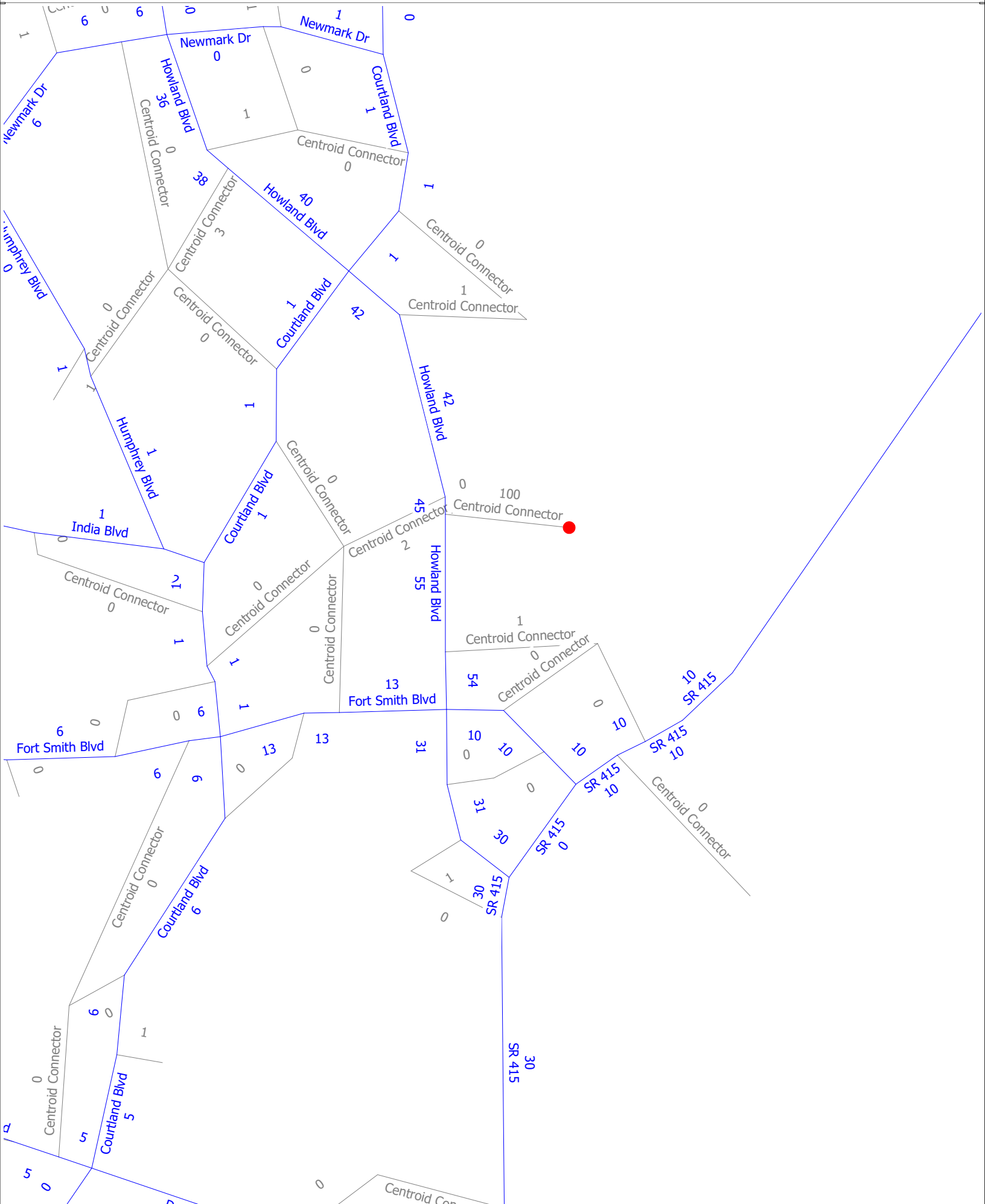
Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

## Data Plot and Equation





### Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use

Source: ITE Trip Generation Manual, 11th Edition

Land Use Code	210			210			210		
Land Use	Single-Family Detached Housing			Single-Family Detached Housing			Single-Family Detached Housing		
Setting	General Urban/Suburban			General Urban/Suburban			General Urban/Suburban		
Time Period	Weekday			Saturday			Sunday		
# Data Sites	7			3			2		
	% of 24-Hour Vehicle Trips			% of 24-Hour Vehicle Trips			% of 24-Hour Vehicle Trips		
Time	Total	Entering	Exiting	Total	Entering	Exiting	Total	Entering	Exiting
12:00 - 1:00 AM	0.3%	0.5%	0.2%	0.8%	0.6%	1.0%	0.6%	0.6%	0.6%
1:00 - 2:00 AM	0.2%	0.2%	0.1%	0.4%	0.6%	0.2%	0.6%	1.2%	0.0%
2:00 - 3:00 AM	0.2%	0.3%	0.1%	0.3%	0.4%	0.2%	0.0%	0.0%	0.0%
3:00 - 4:00 AM	0.2%	0.2%	0.2%	0.5%	0.4%	0.6%	0.3%	0.0%	0.6%
4:00 - 5:00 AM	0.6%	0.3%	0.8%	0.5%	0.6%	0.4%	0.0%	0.0%	0.0%
5:00 - 6:00 AM	1.2%	0.5%	2.0%	1.0%	0.8%	1.2%	1.8%	1.8%	1.8%
6:00 - 7:00 AM	3.7%	1.6%	5.8%	1.0%	0.4%	1.5%	1.5%	1.8%	1.2%
7:00 - 8:00 AM	6.5%	3.1%	10.0%	2.0%	0.8%	3.3%	1.8%	0.6%	3.0%
8:00 - 9:00 AM	6.2%	3.8%	8.5%	3.8%	2.5%	5.2%	4.7%	0.6%	9.0%
9:00 - 10:00 AM	4.6%	3.3%	5.8%	5.5%	5.0%	6.0%	4.7%	3.5%	6.0%
10:00 - 11:00 AM	4.9%	4.2%	5.6%	8.2%	6.2%	10.2%	11.5%	8.8%	14.4%
11:00 - 12:00 PM	5.3%	5.4%	5.1%	7.2%	8.7%	5.8%	7.7%	8.2%	7.2%
12:00 - 1:00 PM	5.7%	5.7%	5.7%	7.7%	7.3%	8.1%	9.2%	10.5%	7.8%
1:00 - 2:00 PM	6.1%	6.1%	6.0%	8.1%	7.1%	9.0%	9.8%	10.5%	9.0%
2:00 - 3:00 PM	6.6%	7.1%	6.1%	8.0%	8.7%	7.3%	5.9%	5.8%	6.0%
3:00 - 4:00 PM	7.5%	8.7%	6.2%	9.2%	9.8%	8.7%	4.4%	5.8%	3.0%
4:00 - 5:00 PM	8.9%	10.5%	7.4%	6.2%	6.9%	5.4%	8.3%	8.2%	8.4%
5:00 - 6:00 PM	8.7%	10.0%	7.3%	8.4%	9.6%	7.1%	9.8%	11.1%	8.4%
6:00 - 7:00 PM	7.2%	8.5%	5.9%	6.0%	7.3%	4.6%	6.2%	5.8%	6.6%
7:00 - 8:00 PM	5.1%	6.1%	4.2%	5.1%	4.8%	5.4%	5.3%	7.0%	3.6%
8:00 - 9:00 PM	4.6%	6.1%	3.1%	4.8%	6.0%	3.7%	4.1%	5.8%	2.4%
9:00 - 10:00 PM	3.3%	4.4%	2.3%	2.4%	2.7%	2.1%	0.3%	0.6%	0.0%
10:00 - 11:00 PM	1.6%	2.1%	1.0%	1.7%	1.5%	1.9%	1.5%	1.8%	1.2%
11:00 - 12:00 AM	1.0%	1.3%	0.6%	1.4%	1.5%	1.3%	0.0%	0.0%	0.0%

## **APPENDIX C**

FDOT Signal Warrant Summary Worksheets

State of Florida Department of Transportation

## TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

City: **Deltona**  
County: **79 – Volusia**  
District: **Five**

Engineer: **SS**  
Date: **March 1, 2024**

Major Street: **Howland Blvd** Lanes: **2** Major Approach Speed: **45**  
Minor Street: **Fernanda Dr** Lanes: **2** Minor Approach Speed: **30**

MUTCD Electronic Reference to Chapter 4: <http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf>

### Volume Level Criteria

1. Is the posted speed or 85th-percentile of major street > 40 mph? ☒ Yes ☐ No
2. Is the intersection in a built-up area of an isolated community with a population < 10,000? ☐ Yes ☒ No
- "70%" volume level **may** be used if Question 1 **or** 2 above is answered "Yes" ☒ MAY ☒ 70% ☐ 100%

### WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied for eight hours. ☐ Yes ☒ No

Warrant 1 is also satisfied if both Condition A and Condition B are "80%" satisfied (should only be applied after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems). ☐ Yes ☒ No

Warrant 1 is satisfied if Condition A or Condition B is "70%" satisfied for eight hours. ☒ Yes ☐ No

#### Condition A - Minimum Vehicular Volume

Condition A is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Applicable: ☒ Yes ☐ No  
100% Satisfied: ☐ Yes ☒ No  
80% Satisfied: ☐ Yes ☒ No  
70% Satisfied: ☐ Yes ☒ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	Minor	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>
1	1	500	400	350	150	120	105
2 or more	1	600	480	420	150	120	105
2 or more	2 or more	600	480	420	200	160	140
1	2 or more	500	400	350	200	160	140

<sup>a</sup> Basic Minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Street	Eight Highest Hours							
	6-7 A.M.	7-8 A.M.	8-9 A.M.	2-3 P.M.	3-4 P.M.	4-5 P.M.	5-6 P.M.	6-7 P.M.
Major	836	1,520	1,325	1,177	1,489	1,549	1,687	1,363
Minor	90	199	114	75	77	92	98	74

Existing Volumes

State of Florida Department of Transportation

## TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

### Condition B - Interruption of Continuous Traffic

Condition B is intended for application where Condition A is not satisfied and the traffic volume on a major street is so heavy that traffic on the minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Applicable:

☒ Yes ☐ No

100% Satisfied:

☐ Yes ☒ No

80% Satisfied:

☐ Yes ☒ No

70% Satisfied:

☒ Yes ☐ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	Minor	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>
1	1	750	600	525	75	60	53
2 or more	1	900	720	630	75	60	53
2 or more	2 or more	900	720	630	100	80	70
1	2 or more	750	600	525	100	80	70

<sup>a</sup> Basic Minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Eight Highest Hours								
Street	6-7 A.M.	7-8 A.M.	8-9 A.M.	2-3 P.M.	3-4 P.M.	4-5 P.M.	5-6 P.M.	6-7 P.M.
Major	836	1,520	1,325	1,177	1,489	1,549	1,687	1,363
Minor	90	199	114	75	77	92	98	74

Existing Volumes

State of Florida Department of Transportation  
**TRAFFIC SIGNAL WARRANT SUMMARY**

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

City: **Deltona**  
County: **79 – Volusia**  
District: **Five**

Engineer: **SS**  
Date: **March 1, 2024**

Major Street: **Howland Blvd** Lanes: **2** Major Approach Speed: **45**  
Minor Street: **Fernanda Dr** Lanes: **2** Minor Approach Speed: **30**

MUTCD Electronic Reference to Chapter 4: <http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf>

**Volume Level Criteria**

1. Is the posted speed or 85th-percentile of major street > 40 mph? ☒ Yes ☐ No
2. Is the intersection in a built-up area of an isolated community with a population < 10,000? ☐ Yes ☒ No

"70%" volume level **may** be used if Question 1 or 2 above is answered "Yes" ☒ MAY ☒ 70% ☐ 100%

**WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME**

*If all four points lie above the appropriate line, then the warrant is satisfied.*

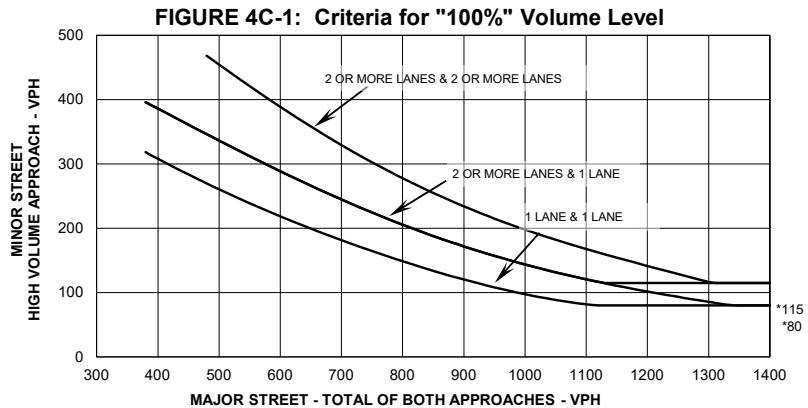
Applicable: ☒ Yes ☐ No

Satisfied: ☒ Yes ☐ No

*Plot four volume combinations on the applicable figure below.*

**100% Volume Level**

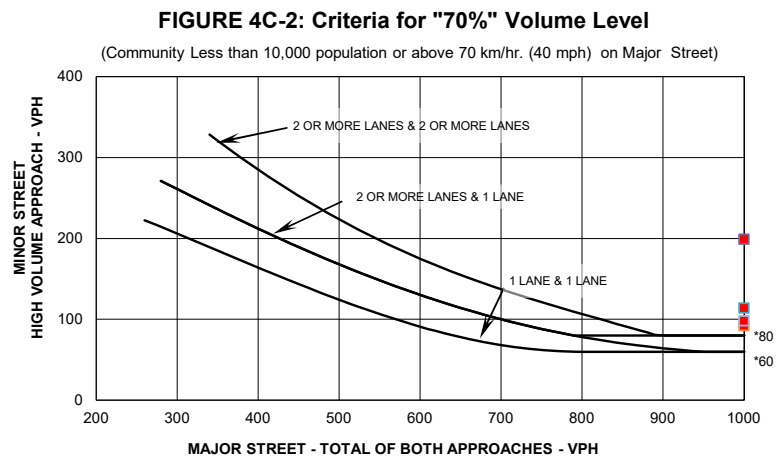
Four Highest Hours	Volumes	
	Major Street	Minor Street



\* Note: 115 ph. applies as the lower threshold volume for a minor street approach with two or more lanes and 80 mph applies as the lower threshold volume threshold for a minor street approach with one lane.

**70% Volume Level**

Four Highest Hours	Volumes	
	Major Street	Minor Street
7-8 A.M.	1520	199
8-9 A.M.	1325	114
4-5 P.M.	1549	92
5-6 P.M.	1687	98



\* Note: 80 ph. applies as the lower threshold volume for a minor street approach with two or more lanes and 60 ph. applies as the lower threshold volume threshold for a minor street approach with one lane.



State of Florida Department of Transportation

## TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

City: **Deltona**  
County: **79 – Volusia**  
District: **Five**

Engineer: **SS**  
Date: **March 1, 2024**

Major Street: **Howland Blvd**  
Minor Street: **Fernanda Dr**

Lanes: **2** Major Approach Speed: **45**  
Lanes: **1** Minor Approach Speed: **30**

MUTCD Electronic Reference to Chapter 4: <http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf>

### Volume Level Criteria

1. Is the posted speed or 85th-percentile of major street > 40 mph? ☒ Yes ☐ No
2. Is the intersection in a built-up area of an isolated community with a population < 10,000? ☐ Yes ☒ No
- "70%" volume level **may** be used if Question 1 **or** 2 above is answered "Yes" ☒ MAY ☒ 70% ☐ 100%

### WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied for eight hours. ☐ Yes ☒ No

Warrant 1 is also satisfied if both Condition A and Condition B are "80%" satisfied (should only be applied after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems). ☐ Yes ☒ No

Warrant 1 is satisfied if Condition A or Condition B is "70%" satisfied for eight hours. ☐ Yes ☒ No

#### Condition A - Minimum Vehicular Volume

Condition A is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Applicable: ☒ Yes ☐ No  
100% Satisfied: ☐ Yes ☒ No  
80% Satisfied: ☐ Yes ☒ No  
70% Satisfied: ☐ Yes ☒ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	Minor	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>
1	1	500	400	350	150	120	105
2 or more	1	600	480	420	150	120	105
2 or more	2 or more	600	480	420	200	160	140
1	2 or more	500	400	350	200	160	140

<sup>a</sup> Basic Minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Street	Eight Highest Hours							
	7-8 A.M.	8-9 A.M.	1-2 P.M.	2-3 P.M.	3-4 P.M.	4-5 P.M.	5-6 P.M.	6-7 P.M.
Major	1,520	1,325	940	1,177	1,489	1,549	1,687	1,363
Minor	107	77	30	41	43	92	52	38

Existing Volumes

State of Florida Department of Transportation

## TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

### Condition B - Interruption of Continuous Traffic

Condition B is intended for application where Condition A is not satisfied and the traffic volume on a major street is so heavy that traffic on the minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Applicable: ☒ Yes ☐ No  
 100% Satisfied: ☐ Yes ☒ No  
 80% Satisfied: ☐ Yes ☒ No  
 70% Satisfied: ☐ Yes ☒ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	Minor	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>
1	1	750	600	525	75	60	53
2 or more	1	900	720	630	75	60	53
2 or more	2 or more	900	720	630	100	80	70
1	2 or more	750	600	525	100	80	70

<sup>a</sup> Basic Minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Eight Highest Hours								
Street	7-8 A.M.	8-9 A.M.	1-2 P.M.	2-3 P.M.	3-4 P.M.	4-5 P.M.	5-6 P.M.	6-7 P.M.
Major	1,520	1,325	940	1,177	1,489	1,549	1,687	1,363
Minor	107	77	30	41	43	92	52	38

Existing Volumes

State of Florida Department of Transportation

## TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01  
TRAFFIC ENGINEERING  
October 2020

City: **Deltona**  
County: **79 – Volusia**  
District: **Five**

Engineer: **SS**  
Date: **March 1, 2024**

Major Street: **Howland Blvd**  
Minor Street: **Fernanda Dr**

Lanes: **2** Major Approach Speed: **45**  
Lanes: **1** Minor Approach Speed: **30**

MUTCD Electronic Reference to Chapter 4: <http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf>

### Volume Level Criteria

- Is the posted speed or 85th-percentile of major street > 40 mph?
- Is the intersection in a built-up area of an isolated community with a population < 10,000?

☒ Yes ☐ No

☐ Yes ☒ No

"70%" volume level **may** be used if Question 1 or 2 above is answered "Yes"

☒ MAY

☒ 70%

☐ 100%

### WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME

*If all four points lie above the appropriate line, then the warrant is satisfied.*

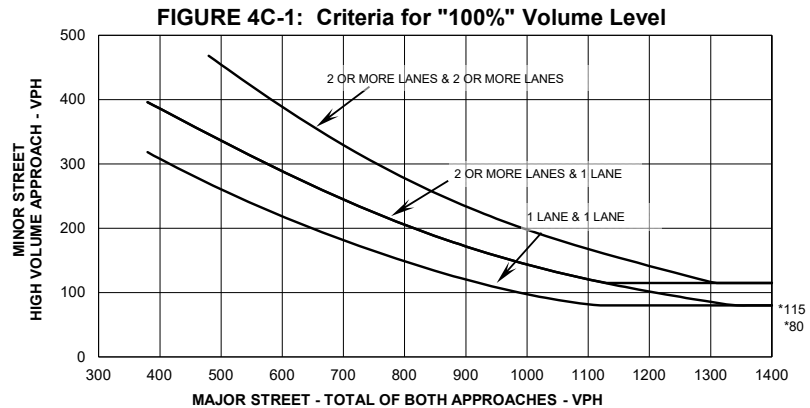
Applicable: ☒ Yes ☐ No

Satisfied: ☐ Yes ☒ No

*Plot four volume combinations on the applicable figure below.*

#### 100% Volume Level

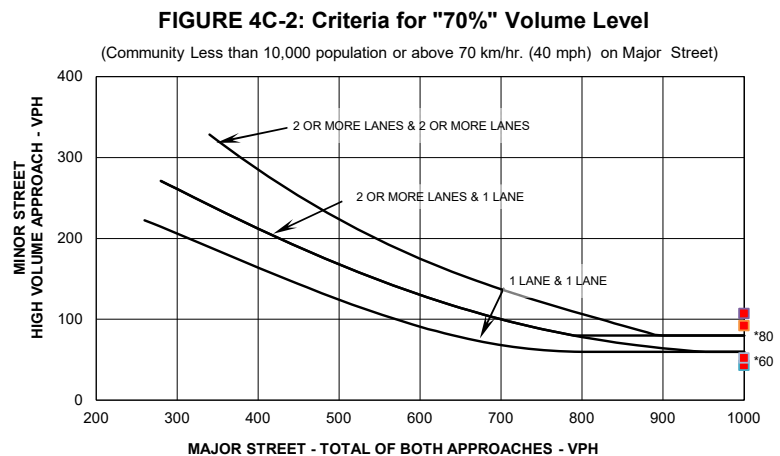
Four Highest Hours	Volumes	
	Major Street	Minor Street



\* Note: 115 ph. applies as the lower threshold volume for a minor street approach with two or more lanes and 80 mph applies as the lower threshold volume threshold for a minor street approach with one lane.

#### 70% Volume Level

Four Highest Hours	Volumes	
	Major Street	Minor Street
7-8 A.M.	1520	107
3-4 P.M.	1489	43
4-5 P.M.	1549	92
5-6 P.M.	1687	52



\* Note: 80 ph. applies as the lower threshold volume for a minor street approach with two or more lanes and 60 ph. applies as the lower threshold volume threshold for a minor street approach with one lane.

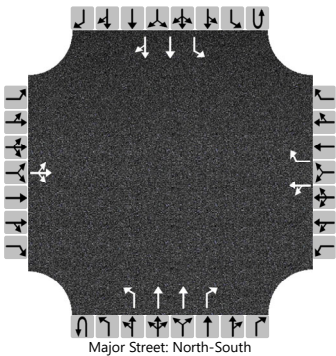
## **APPENDIX D**

### Intersection Capacity Analysis Worksheets

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	SS	Intersection	Howland Blvd & Fernanda Dr
Agency/Co.	TPD, Inc.	Jurisdiction	Deltona
Date Performed	3/5/2024	East/West Street	Fernanda Dr/Goldenhills St
Analysis Year	2025	North/South Street	Howland Blvd
Time Analyzed	Projected AM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	5427.2		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	1	0	1	2	0
Configuration			LTR			LT		R		L	T	R		L	T	TR
Volume (veh/h)		6	0	90		95	1	86	0	34	448	31	0	37	1098	12
Percent Heavy Vehicles (%)		17	0	2		0	0	0	0	6			0	0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No				No							
Median Type   Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.84	6.50	6.94		7.50	6.50	6.90		4.22				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.67	4.00	3.32		3.50	4.00	3.30		2.26				2.20		

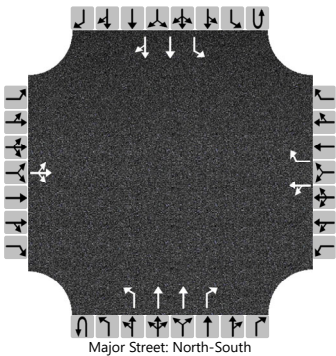
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			101			101		91		36				39		
Capacity, c (veh/h)			390			201		772		571				1071		
v/c Ratio			0.26			0.50		0.12		0.06				0.04		
95% Queue Length, Q <sub>95</sub> (veh)			1.0			2.5		0.4		0.2				0.1		
Control Delay (s/veh)			17.4			39.8		10.3		11.7				8.5		
Level of Service (LOS)			C			E		B		B				A		
Approach Delay (s/veh)	17.4				25.9				0.8				0.3			
Approach LOS	C				D				A				A			

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	SS	Intersection	Howland Blvd & Fernanda Dr
Agency/Co.	TPD, Inc.	Jurisdiction	Deltona
Date Performed	3/5/2024	East/West Street	Fernanda Dr/Goldenhills St
Analysis Year	2025	North/South Street	Howland Blvd
Time Analyzed	Projected PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	5427.2		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	1	0	1	2	0
Configuration			LTR			LT		R		L	T	R		L	T	TR
Volume (veh/h)		7	0	24		44	3	36	0	66	1016	91	0	60	473	8
Percent Heavy Vehicles (%)		0	0	0		0	0	5	0	2			0	0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No				No							
Median Type   Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.50	6.50	6.90		7.50	6.50	7.00		4.14				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.35		2.22				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			32			49		38		69				63		
Capacity, c (veh/h)			439			134		486		1059				613		
v/c Ratio			0.07			0.37		0.08		0.06				0.10		
95% Queue Length, Q <sub>95</sub> (veh)			0.2			1.5		0.2		0.2				0.3		
Control Delay (s/veh)			13.9			46.5		13.0		8.6				11.5		
Level of Service (LOS)			B			E		B		A				B		
Approach Delay (s/veh)	13.9				32.0				0.5				1.3			
Approach LOS	B				D				A				A			