



TRAFFIC STUDY

# TRAILHEAD LOGISTICS PARK NORTH

MARION COUNTY, FLORIDA

*Prepared for:*

*TRANSWESTERN DEVELOPMENT COMPANY*

*Prepared by:*

*KIMLEY-HORN AND ASSOCIATES, INC.*

JANUARY 2023

**Kimley»»Horn**



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January 2023  
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## EXECUTIVE SUMMARY

This Traffic Study has been prepared to support a Planned Unit Development (PUD) zoning application for a proposed industrial warehouse / distribution development generally located north of County Road (CR) 484, west of I-75, and east of SW 29<sup>th</sup> Avenue Road. This analysis has been performed in accordance with the City of Ocala/Marion County Traffic Impact Analysis (TIA) guidelines and the methodology, which was approved by Marion County.

The PUD proposes up to 3,600,000 square feet of industrial warehouse/distribution uses within three buildings. A conceptual site plan is included in the **Appendix**. For the purpose of this study, a single buildout year of 2027 was assumed.

Site access will be provided through the following:

- Connection to the south along SW 20<sup>th</sup> Avenue Road, which connects to CR 484 at a signalized intersection
- Connection as a new east leg of the intersection of SW 29<sup>th</sup> Avenue Road and Marion Oaks Trail

SW 20<sup>th</sup> Avenue Road is being constructed from the boundary of the Trailhead North development and Trailhead Logistics Park South site to the existing intersection of SW 20<sup>th</sup> Avenue Road and CR 484. The new roadway extension is being constructed by the Trailhead developer. The new roadway will be a combination of four-lane and two-lane roadway segments. A further extension of SW 20<sup>th</sup> Avenue Road north into the Trailhead North site is proposed as part of the site development. The roadway will continue west to connect to SW 29<sup>th</sup> Avenue Road at the intersection with Marion Oaks Trail.

Florida Department of Transportation (FDOT) has roadway improvements planned and funded for the segment of CR 484 from west of SW 20<sup>th</sup> Avenue Road to east of CR 475A (FPID 433651-1). Construction of these improvements is underway and expected to be complete by 2024, therefore the improvements were utilized when analyzing the roadway network for background traffic conditions. Improvements planned by Marion County at the intersection of Marion Oaks Boulevard and CR 484 (FPID 449277-1) were also included as background improvements prior to the addition of project traffic.

Additional roadway and intersection improvements were identified to be needed within the 2027 timeframe considering background traffic conditions (before the addition of project traffic). These improvements do not require proportionate share mitigation by the Project per Florida Statute. The following improvements were identified to be needed to provide acceptable level of service under future background traffic conditions:

- Widening of CR 484 from Marion Oaks Boulevard to CR 475A from 4 lanes to 6 lanes
- Signalization of the intersection of SW 29<sup>th</sup> Avenue Road at CR 484
- Constructing anticipated buildout geometry of the intersection of SW 20<sup>th</sup> Avenue Road at CR 484 per the prior Marco Polo PUD study

The following additional transportation improvements were found to be needed at project buildout to provide for acceptable level of service and traffic operations

- Lengthening of the westbound left-turn lane on CR 484 at Marion Oaks Boulevard by 120 feet
- Implementing a right-turn overlap for the northbound right-turn movement at the intersection of SW 20<sup>th</sup> Avenue Road and CR 484



Proportionate share mitigation is required for the improvements that are necessary in addition to those under future background traffic conditions to allow for acceptable traffic operations and level of service with the buildout traffic volumes.

SW 29<sup>th</sup> Avenue Road was previously contemplated to be four lanes with the Deltona development agreements. There is 100 feet of right-of-way and portions of the roadway are constructed with four lanes. The projected traffic volumes on SW 29<sup>th</sup> Avenue Road at project buildout do not require widening to four lanes to meet level of service standards; however, the developer has committed to constructing the widening. A traffic signal is shown to be needed at the intersection of SW 29<sup>th</sup> Avenue Road at CR 484 under future background traffic conditions. The developer has committed to constructing a traffic signal at this location, although no proportionate share mitigation is required per Florida Statute. The cost of the improvements to widen SW 29<sup>th</sup> Avenue Road and signalize the intersection with CR 484 will be in excess of the proportionate share requirements identified in this traffic study to mitigate for the traffic impacts of the development. The developer will enter into a Chapter 163 Concurrency Development Agreement and Impact Fee Reimbursement Agreement with Marion County to receive credit against the required proportionate share mitigation and transportation impact fees for the improvements to SW 29<sup>th</sup> Avenue Road.

An interim evaluation was performed for the intersection of SW 20<sup>th</sup> Avenue Road at CR 484 for the time period when the Trailhead Logistics Park North development will be fully built out, but considering that the Marco Polo PUD and Florida Crossroads Commerce Park may not be constructed, nor any associated future improvements at the intersection. The following interim improvements have been identified for the full buildout of the Trailhead Logistics Park North site prior to the full buildout improvements identified to support the Marco Polo PUD development:

- Restriping the north leg of the intersection to have a left-turn lane, shared through/left-turn lane, and right-turn lane
- Implementation of northbound/southbound split phasing and associated timing adjustments

The developer will enter into a Chapter 163 Concurrency Development Agreement with Marion County that will include a requirement to perform an operational study of the intersection with observed traffic volumes for specific development thresholds within the Trailhead Logistics Park North PUD. The findings of the study will be discussed with Marion County to identify if modifications to the north leg of the intersection and/or signal timing and phasing are required.



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## INTRODUCTION

Kimley-Horn has performed this traffic study for the proposed Trailhead Logistics Park North industrial facility. The project site is generally located north of the intersection of SW 20<sup>th</sup> Avenue Road and CR 484, west of I-75 in Marion County, Florida. The proposed industrial park will be built in a single phase with an expected 2027 buildout year.

This traffic study was performed assuming 3,600,000 square feet of industrial uses at full buildout. The study identifies transportation needs within the study area under existing conditions, future background conditions (before the addition of project traffic) and project buildout conditions (with project traffic). The analysis has been performed in accordance with the City of Ocala/Marion County Traffic Impact Analysis guidelines and the methodology, which was approved by Marion County. The approved methodology and methodology correspondence are included in the **Appendix**.

Access to the property is proposed via the existing signalized intersection on CR 484 at SW 20<sup>th</sup> Avenue Road and SW 29<sup>th</sup> Avenue Road at Marion Oaks Trail.

To accommodate the Trailhead Logistics Park South development, SW 20<sup>th</sup> Avenue Road is being constructed as a new roadway north of CR 484 by the Trailhead developer. The new roadway will be a combination of a four-lane roadway near CR 484, transitioning to a two-lane roadway at the north end of the Trailhead Logistics South site. The proposed roadway construction has been discussed with the Marion County Office of the County Engineer and construction plans were prepared concurrently with the site plans for the development.

The Trailhead Logistics Park North development will be responsible for extending SW 20<sup>th</sup> Avenue Road to the SW 29<sup>th</sup> Avenue Road at Marion Oaks Trail intersection. A conceptual site plan is included in the **Appendix**.

The following committed improvements were utilized for the analysis:

- CR 484 Interchange Improvements (from west of SW 20<sup>th</sup> Avenue Road to east of CR 475A)
- Marion Oaks Boulevard at CR 484 intersection improvements
- SW 20<sup>th</sup> Avenue Road at CR 484 improvements

These improvements are expected to be completed before full project buildout of the Trailhead Logistics Park North project and were utilized for the background traffic conditions study area analysis. Excerpts detailing the planned improvements are provided in the **Appendix**.

This study is based on data collected by Kimley-Horn and supplemented by information obtained from City of Ocala, Marion County, and the FDOT sources. The study observed the established procedures found in Institute of Transportation Engineers sources, FDOT sources, and the 2016 Highway Capacity Manual (HCM 2016 or HCM6).



**PROJECT TRAFFIC**

**TRIP GENERATION**

The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11<sup>th</sup> Edition* was used to calculate trip generation potential for the industrial development. ITE Land Use Codes (LUC) 154 (High-Cube Transload and Short-Term Storage Warehouse) and 110 (General Light industrial) were applied in the trip generation calculations. Per the approved methodology, the PM peak hour of generator for ITE LUC 154 was utilized for the trip generation calculations.

No pass-by or internal capture was assumed for the trip generation calculations. Truck traffic was approximated based on information from the ITE Trip Generation Manual (for ITE LUC 110) and the ITE study "High-Cube Warehouse Vehicle Trip Generation Analysis" (for ITE LUC 154). The trip generation calculations are provided in **Table 1**.

**Table 1 – Trip Generation**

Land Use	Intensity			Daily Trips	AM Peak Hour of Adjacent Street			PM Peak Hour of Adjacent Street		
					Total	In	Out	Total	In	Out
NW Building - ITE LUC 154	1,742,000	Sq Ft	GFA	2,439	139	107	32	296	101	195
SW Building - ITE LUC 110	684,000	Sq Ft	GFA	2,622	469	413	56	161	23	138
E Building - ITE LUC 154	1,174,000	Sq Ft	GFA	1,644	94	72	22	200	68	132
<i>Subtotal</i>				6,705	702	592	110	657	192	465
Percent Trucks	Daily	AM	PM							
ITE LUC 154	32.2%	30.8%	21.7%	1,315	72	55	17	108	37	71
ITE LUC 110	0.25 / 1000 SF GFA	0.01 / 1000 SF	0.01 / 1000 SF	171	7	4	3	7	4	3
<b>Buildout Automobile Driveway Trips</b>				<b>5,219</b>	<b>623</b>	<b>533</b>	<b>90</b>	<b>542</b>	<b>151</b>	<b>391</b>
<b>Buildout Truck Driveway Trips</b>				<b>1,486</b>	<b>79</b>	<b>59</b>	<b>20</b>	<b>115</b>	<b>41</b>	<b>74</b>

Note 1: Trip generation calculations were derived from the ITE Trip Generation Manual, 11th Edition.  
 Note 2: The truck percentages for ITE LUC 110 were determined using the truck generation per 1,000 sf published in the ITE Trip Generation Manual, 11th Edition.  
 Note 3: The ITE study "High-Cube Warehouse Vehicle Trip Generation Analysis" (10/2016) study was used to determine the truck percentages for ITE LUC 154.

**General Light Industrial [ITE 110]**

Daily  $T = 3.76*(X) + 50.47$ ; (X is 1000 Sq. Ft. GFA); % trucks = 0.25 / 1000 SF GFA  
 AM Peak Hour of Adjacent Street  $T = 0.68*(X) + 3.81$ ; (X is 1000 Sq. Ft. GFA, 88% in, 12% out); % trucks = 0.01 / 1000 SF GFA (60% in, 40% out)  
 PM Peak Hour of Adjacent Street  $Ln(T) = 0.72*Ln(X) + 0.38$ ; (X is 1000 Sq. Ft. GFA, 14% in, 86% out); % trucks = 0.01 / 1000 SF GFA (50% in, 50% out)

**High-Cube Transload and Short-Term Storage Warehouse [ITE 154]**

Daily  $T = 1.40*(X)$ ; (X is 1000 Sq. Ft. GFA); % trucks = 32.2%  
 AM Peak Hour of Adjacent Street  $T = 0.08*(X)$ ; (X is 1000 Sq. Ft. GFA, 77% in, 23% out); % trucks = 30.8%  
 PM Peak Hour of Generator  $T = 0.17*(X)$ ; (X is 1000 Sq. Ft. GFA, 34% in, 66% out); % trucks = 21.7%

## TRIP EQUIVALENCY MATRIX

A trip equivalency matrix has been developed for the project, which allows for minor changes to land use types and intensities without increasing the PM peak hour external project trips generated by the development. The uses included in the Trip Equivalency Matrix are those allowed by the PUD zoning per the Master Plan. The gross trip rate for each land use was obtained by using the trip generation rates and pass by percentages provided in the *ITE Trip Generation, 11<sup>th</sup> Edition* and based on the trip generation calculations approved during the methodology review process. No internal capture was applied for the trip equivalency matrix calculations. Pass-by capture was applied within the trip equivalency gross trip calculations, based on the pass-by capture rates published in the *ITE Trip Generation, 11<sup>th</sup> Edition* for applicable land uses.

The trip equivalency matrix provides a methodology for conversion of land uses and intensities to result in an equal or lesser number of net new PM peak hour project trips. The trip equivalency matrix is provided in the **Appendix**.

## TRIP DISTRIBUTION, ASSIGNMENT, AND STUDY AREA

The project trip distribution for the site was developed based on Version 7.0 of the Central Florida Regional Planning Model (CFRPM), which is based on the Florida Standard Urban Transportation Model Structure (FSUTMS). The CFRPM model distribution was used to estimate the distribution of automobile trips to and from the site. Manual adjustments were made to the FSUTMS model output based on engineering judgment, understanding of the local transportation network, land uses, and discussions with Marion County. The distribution was approved during the methodology process.

A separate distribution of truck traffic was developed based on the anticipated distribution to and from I-75. The existing traffic volumes on I-75 were utilized to estimate the cardinal distribution of truck traffic along this route. **Figure 1** illustrates the project automobile trip distribution, **Figure 2** illustrates the project truck trip distribution, and **Figure 3** illustrates the site access project traffic assignment on Marion Oaks Trail and SW 20<sup>th</sup> Avenue.

Project traffic was assigned within the study area by applying the external trip distribution to the trip generation potential. The study area for the project included all roadway segments where project traffic consumes three percent (3%) or more of the subject segment's peak hour directional service capacity, plus one segment beyond, consistent with the approved methodology. The service volumes for evaluated roadways were obtained utilizing functional classification and level of service information published by the Ocala Marion Transportation Planning Organization (TPO) and FDOT.

The project significance calculations are provided within the methodology document located in the **Appendix**.

The following roadway segments are included within the study area, and were evaluated for PM peak hour traffic conditions as approved during the methodology process:

- CR 484, from SW 105th Avenue to SR 200 (one segment beyond impact)
- CR 484, from SR 200 to SE 132<sup>nd</sup> Street Road
- SW 29th Avenue Road, from CR 484 to Marion Oaks Trail
- SE 132nd Street Road, from CR 484 to US 301

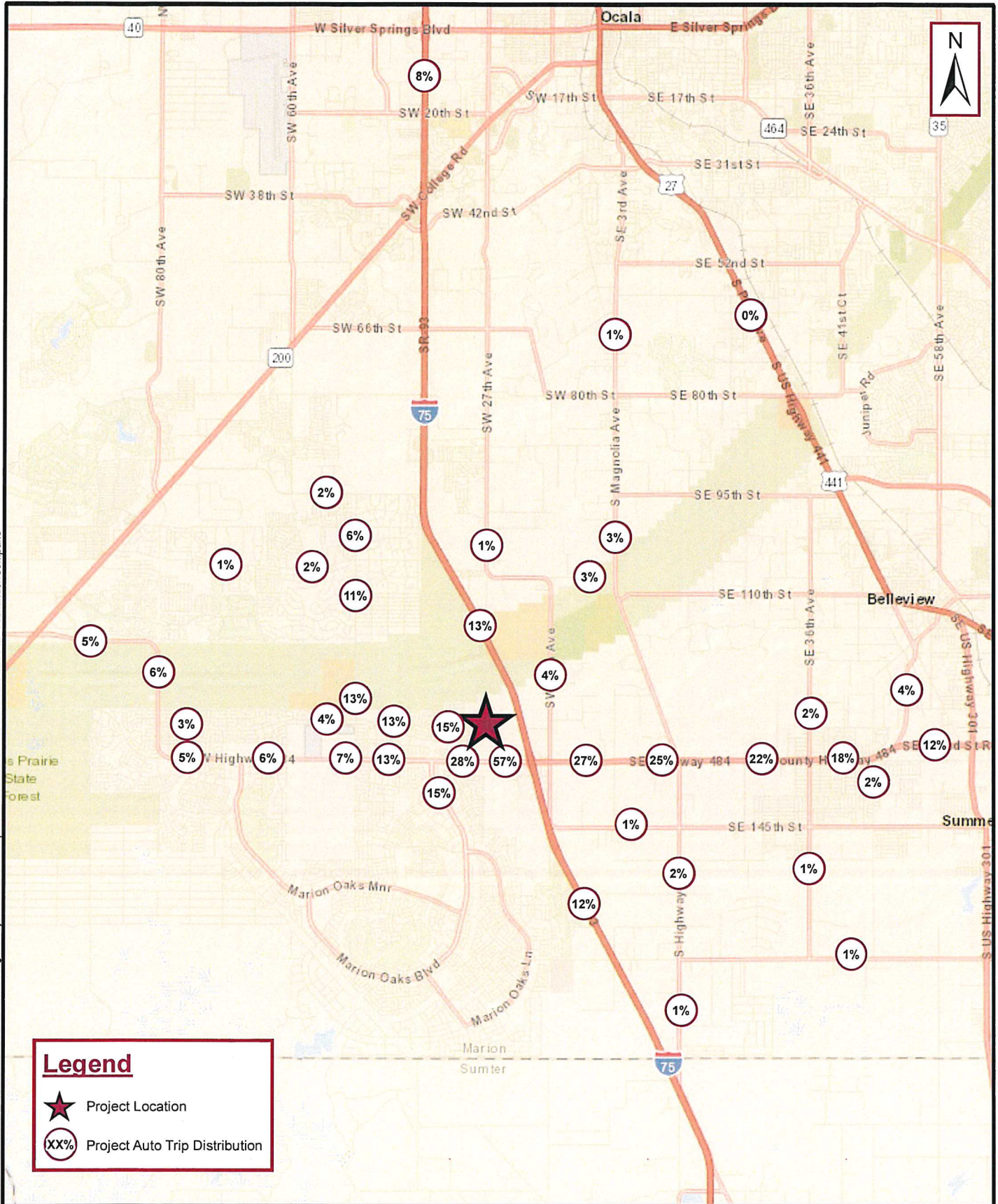


- SE 132nd Street Road, from US 301 to US 441 (one segment beyond impact)
- Marion Oaks Trail, from CR 484 W to SW 49th Avenue (one segment beyond impact)
- Marion Oaks Trail, from Marion Oaks Course to CR 484E

In addition to roadway segment analysis, the following intersections were evaluated for AM and/or PM peak hour traffic conditions, as approved during the methodology process:

- CR 484 & Marion Oaks Boulevard (PM)
- CR 484 & SW 29th Avenue Road (AM and PM)
- CR 484 & SW 20th Avenue Road (AM and PM)
- CR 484 & I-75 Southbound Ramp (AM and PM)
- CR 484 & I-75 Northbound Ramp (AM and PM)
- CR 484 & CR 475A (PM)
- CR 484 & CR 475 (PM)
- SW 29th Avenue Road & Marion Oaks Trail (AM and PM)

**Figure 4** illustrates the project study area utilized for the analysis.



K:\OCA\_GIS\142933003-Transwestern North\Exhibit\TPTO\TIA\2nd submittal\Fig1 - Project Automobile Trip Distribution.mxd - 1/18/2023 2:44:26 PM - Alexander.Campano

**Legend**

-  Project Location
-  Project Auto Trip Distribution

FIGURE 1 - PROJECT AUTOMOBILE TRIP DISTRIBUTION

**TRAILHEAD LOGISTICS PARK NORTH  
MARION COUNTY, FLORIDA**

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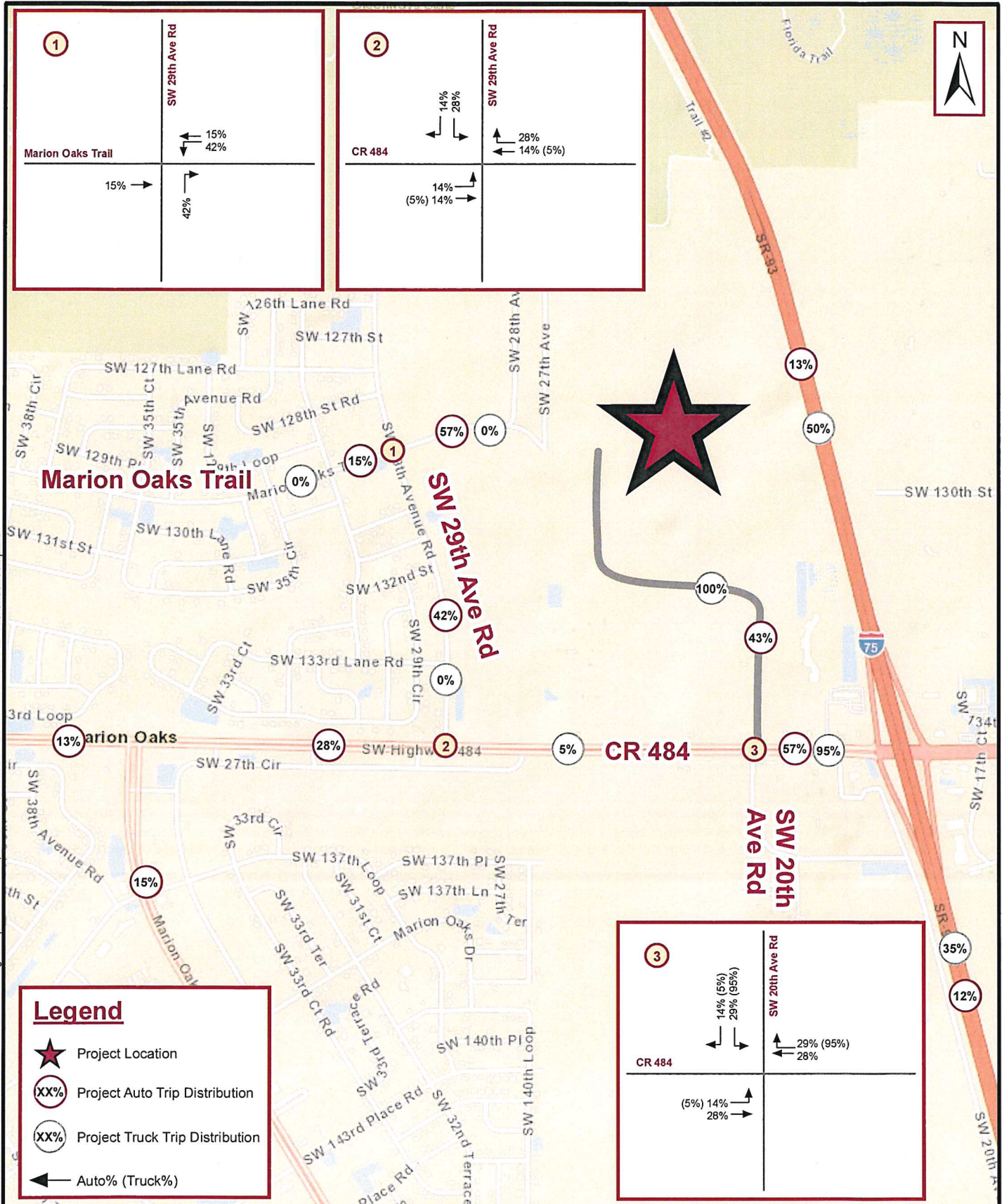
K:\IOCA GIS\142933003-Transwestern North\Exhibit\TPO\TIA\2nd submittal\Fig2 - Project Truck Trip Distribution.mxd - 1/18/2023 2:45:17 PM - Alexander.Campano

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FIGURE 2 - PROJECT TRUCK TRIP DISTRIBUTION

**TRAILHEAD LOGISTICS PARK NORTH  
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**Legend**




-  Project Location
-  Study Area Intersections
-  Study Area Segments

FIGURE 4 - SITE LOCATION, STUDY AREA INTERSECTIONS AND ROADWAY SEGMENTS

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**TRAILHEAD LOGISTICS PARK NORTH**  
**MARION COUNTY, FLORIDA**

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## EXISTING CONDITIONS ANALYSIS

### EXISTING TRAFFIC DATA AND VOLUME DEVELOPMENT

Turning movement counts (TMCs) were collected at the study area intersections during the AM and PM peak periods. AM peak hour TMCs were collected during the peak hour of the adjacent street (7AM – 9AM) and PM peak hour TMCs were collected from 3PM-5PM (which coincides with the 3PM - 4PM peak hour of ITE LUC 154).

An existing year of 2022 was utilized for the analysis. The 2021 peak season factors from FDOT were used to adjust the observed traffic volumes to peak season volumes. The peak season conversion factor report is provided in the **Appendix**.

The PM peak hour peak season approach and departure volumes at the study area intersections were used for the PM peak hour roadway segment analysis for segments near the study area intersections. For roadway segments further from the study area intersections, the existing PM peak hour traffic volumes were derived using annual average daily traffic (AADT) from the Ocala Marion TPO Congestion Management Process (CMP) and applying a K-factor and D-factor published on the FDOT Traffic Online.

The observed right turn on red percentages (RTOR%) and peak hour factors (PHF) were used for the intersection analysis. The TMC heavy vehicle percentages (%HV) were compared to data available from FDOT Traffic Online, the more conservative of the two were used for the intersection analysis. **Table 2** summarizes the %HV for the study area intersections. The intersection volume development sheets located in the **Appendix** detail the volume development for the study area intersections.



Table 2 – Study Area Intersections Percent Heavy Vehicles

Percent Heavy Vehicles, Observed Turning Movement Counts v FDOT Traffic Online													
Intersection	Heavy Vehicle Source	EB Approach			WB Approach			NB Approach			SB Approach		
		Count Station	T <sub>24</sub> FDOT Traffic Online <sup>1</sup>	Design Hour Truck Factor <sup>2</sup>	Count Station	T <sub>24</sub> FDOT Traffic Online <sup>1</sup>	Design Hour Truck Factor <sup>2</sup>	Count Station	T <sub>24</sub> FDOT Traffic Online <sup>1</sup>	Design Hour Truck Factor <sup>2</sup>	Count Station	T <sub>24</sub> FDOT Traffic Online <sup>1</sup>	Design Hour Truck Factor <sup>2</sup>
CR 484 & Marion Oaks Blvd	FDOT Traffic Online	--	--	--	--	--	--	368138	8.50%	4.25%	--	--	--
	AM Turning Movement Counts <sup>3</sup>	--	--	--	--	--	--	--	--	--	--	--	--
	PM Turning Movement Counts <sup>3</sup>	4.90%			3.40%			4.30%					
CR 484 & SW 29th Ave Rd	FDOT Traffic Online	--	--	--	--	--	--	--	--	--	--	--	--
	AM Turning Movement Counts <sup>3</sup>	4.00%			10.00%			32.00%			2.00%		
	PM Turning Movement Counts <sup>3</sup>	7.10%			3.80%			2.00%			6.60%		
CR 484 & SW 20th Ave Rd	FDOT Traffic Online	--	--	--	--	--	--	--	--	--	--	--	--
	AM Turning Movement Counts <sup>3</sup>	4.00%			10.00%			32.00%			--		
	PM Turning Movement Counts <sup>3</sup>	5.80%			3.30%			30.40%			--		
CR 484 & I-75 SB Ramps	FDOT Traffic Online	--	--	--	--	--	--	--	--	--	362002	8.50%	4.25%
	AM Turning Movement Counts <sup>3</sup>	5%			14%			--			12%		
	PM Turning Movement Counts <sup>3</sup>	8%			5%			--			6%		
CR 484 & I-75 NB Ramps	FDOT Traffic Online	--	--	--	--	--	--	362000	9%	4.25%	--	--	--
	AM Turning Movement Counts <sup>3</sup>	4.90%			10.90%			16.80%			--		
	PM Turning Movement Counts <sup>3</sup>	7.20%			5.20%			9.00%			--		
CR 484 & CR 475A	FDOT Traffic Online	--	--	--	--	--	--	--	--	--	368087	5.30%	2.65%
	AM Turning Movement Counts <sup>3</sup>	--	--	--	--	--	--	--	--	--	--	--	--
	PM Turning Movement Counts <sup>3</sup>	9.20%			7.40%			4.30%			5.30%		
CR 484 & CR 475	FDOT Traffic Online	--	--	--	367040	12.40%	6.20%	--	--	--	--	--	--
	AM Turning Movement Counts <sup>3</sup>	--	--	--	--	--	--	--	--	--	--	--	--
	PM Turning Movement Counts <sup>3</sup>	7.60%			5.20%			6.70%			2.40%		
Marion Oaks Trail & SW 29th Ave	FDOT Traffic Online	--	--	--	--	--	--	--	--	--	--	--	--
	AM Turning Movement Counts <sup>3</sup>	2.00%			2.00%			11.00%			2.00%		
	PM Turning Movement Counts <sup>3</sup>	8.70%			2.00%			2.00%			7.70%		

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Notes:

- T<sub>24</sub> Factors derived from the FDOT Traffic Online Historical AADT reports.
- Design hourly truck factor calculated based on the FDOT Traffic Forecasting Handbook (T<sub>24</sub> / 2).
- Turning Movement Counts were observed in the field during traffic data collection utilized for this TIA, a minimum of 2% was utilized for the Synchro analysis.

**EXISTING CONDITIONS ROADWAY SEGMENT ANALYSIS**

Roadway segments within the study area were evaluated to determine the existing PM peak hour levels of service. The adopted service volumes were obtained from the latest Marion County Congestion Management Process (CMP) and the 2020 FDOT Quality/Level of Service Handbook. The roadway segment service volumes were approved during the methodology review process.

All the study area roadway segments are shown to operate within the adopted level of service standard under existing PM peak hour traffic conditions. **Table 3** illustrates the existing PM peak hour traffic volume and level of service for study area roadway segments.



Table 3 – Existing Conditions PM Peak Hour Roadway Segment Analysis

Roadway		ROADWAY ATTRIBUTES <sup>1</sup>									EXISTING PEAK SEASON TRAFFIC CONDITIONS (2022)					
		TPO CMP Station	FDOT Classification <sup>2</sup>	Area Type	Adopted LOS	Number of Lanes	Daily Service Volume	Pk. Hr. Dir. Service Volume	TPO Traffic Counts Growth Rate	TPO CMP Growth Rate	PM Peak Hour <sup>3</sup>					
											NB/EB Volume	SB/WB Volume	NB/EB V/C	SB/WB V/C	NB/EB LOS	SB/WB LOS
From	To															
<b>CR 484</b>																
SW 105 AV	SR 200	2010.0	NS-UA	Urban	E	2	29,340	1,449	6.3%	3.36%	438	498	0.30	0.34	B	B
SR 200	W OF SW 57 AV	2020.1	NS-UA	Urban	E	2	32,600	1,610	16.4%	3.18%	379	431	0.24	0.27	B	B
W OF SW 57 AV	SW 49 AV	2020.1	NS-SA-C1	Urban	E	4	37,810	1,900	--	3.18%	379	431	0.20	0.23	C	C
SW 49 AV	MARION OAKS BLVD	2030.0	NS-SA-C1	Urban	E	4	35,820	1,800	--	3.93%	819	952	0.46	0.53	C	C
MARION OAKS BLVD	SW 20 AV RD	2030.0	NS-SA-C1	Urban	E	4	35,820	1,800	--	3.93%	1,037	1,191	0.58	0.66	C	C
SW 20 AV RD	I-75	2030.0	NS-SA-C1	Urban	E	4	35,820	1,800	1.8%	3.93%	1,148	1,730	0.64	0.96	C	D
I-75	CR 475A	2070.0	NS-SA-C1	Urban	D	4	35,820	1,800	4.3%	6.37%	1,187	1,177	0.66	0.65	C	C
CR 475A	CR 475	2080.0	NS-SA-C1	Urban	D	4	35,820	1,800	1.8%	4.34%	861	724	0.48	0.40	C	C
CR 475	CR 467	2090.0	NS-SA-C1	Urban	D	4	35,820	1,800	5.9%	4.57%	1,044	918	0.58	0.51	C	C
CR 467	SE 132 ST RD	2110.0	NS-SA-C1	Urban	D	4	35,820	1,800	1.5%	6.56%	905	796	0.50	0.44	C	C
<b>SW 29th Avenue Road</b>																
CR 484	MARION OAKS TRL	--	NS-SA-C2	Urban	E	2	10,920	560	--	1.00%	73	59	0.13	0.10	C	C
<b>SE 132nd Street Road</b>																
CR 484	US 301	7165.0	NS-SA-C1	Urban	E	4	35,820	1,800	5.0%	1.00%	555	489	0.31	0.27	C	C
US 301	US 441	7170.0	NS-SA-C1	Urban	E	4	35,820	1,800	8.4%	7.29%	608	535	0.34	0.30	C	C
<b>Marion Oaks Trail</b>																
CR 484 W	SW 49 AV	8150.0	NS-SA-C1	Urban	E	2	15,930	792	--	1.00%	113	85	0.14	0.11	C	C
MARION OAKS CRSE	CR 484 E	8180.0	NS-SC-C1	Urban	E	2	15,930	792	--	1.00%	113	85	0.14	0.11	C	C

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Notes:  
 1. The roadway attributes and AADT were obtained from the most recent Ocala Marion Transportation Planning Organization (TPO) Congestion Management Process (CMP) Database and Ocala Marion TPO 2022 Traffic Counts Report. For SW 29th Avenue Road the roadway attributes were derived using the 2020 FDOT Q/LOS Handbook, 2010 FDOT Functional Classification Map for Marion County, and the adopted level of service from the Marion County Comprehensive Plan (Transportation Element, Policy 2.1.2).  
 2. NS-SA-C1 = non-state, signalized arterial, class 1; NS-UC = non-state, unsignalized collector; NS-SC-C1 = non-state, signalized collector, class 1; ST-UA = state, unsignalized arterial; NS-UA = non-state, unsignalized arterial.  
 3. The existing traffic volumes were derived from the observed turning movement counts. The existing volumes for SW 132nd Street, Marion Oaks Trail, and CR 484 (west of SW 45th Avenue/east of CR 475) were derived using the Ocala Marion TPO CMP AADTs and K/D factors from FDOT Traffic Online (count stations 368136, 368136, 367039, 367040/367046).

## EXISTING CONDITIONS INTERSECTION ANALYSIS

The operating conditions at the study area intersections were analyzed using the Synchro 11 software package, which implements the procedures of the latest Highway Capacity Manual (HCM 6). The existing lane geometry and signal timings (provided by Marion County) were utilized for the analysis.

All study area intersections operate with acceptable overall intersection level of service (LOS) and volume to capacity (V/C) ratios less than 1.0 under existing AM and PM peak hour traffic conditions, with the exception of the stop-controlled approach at the intersection of SW 29<sup>th</sup> Avenue Road at CR 484. The delay experienced for the side-street stop-controlled approach during the AM peak hour represents level of service F for a stop-controlled condition.

The Synchro 11 analysis output is provided in the **Appendix. Table 4** provides a summary of the average delay, level of service, and V/C ratios during the AM peak hour and PM peak hour under existing traffic conditions.

**Table 4 – Existing Conditions Intersection Analysis Summary**

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Max V/C	LOS	Delay (s)	Max V/C
Marion Oaks Blvd & CR 484	--	--	--	B	14.9	0.85
SW 29th Ave Rd & CR 484	F	82.5	0.89	C	22.5	0.24
SW 20th Ave Rd & CR 484	A	9.3	0.82	A	5.4	0.56
I-75 SB Ramp & CR 484	D	44.6	0.83	C	32.8	0.86
I-75 NB Ramp & CR 484	C	22.5	0.88	B	19.1	0.95
CR 475A & CR 484	--	--	--	C	27.0	0.90
CR 475 & CR 484	--	--	--	C	27.8	0.77
SW 29th Ave Rd & Marion Oaks Trail	A/B	8.8/10.2	0.12	A/A	8.8/0.0	0.06

Notes:

1. For stop controlled intersections MOEs were reported for the stop controlled approach(es). For signalized intersections the LOS and delay were reported for the overall intersection.

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## FUTURE TRAFFIC CONDITIONS

### COMMITTED TRANSPORTATION IMPROVEMENTS

There are planned improvements within the study area that have been included as background improvements in the future traffic conditions analysis.

FDOT has programmed improvements along CR 484 west of SW 20<sup>th</sup> Avenue Road to east of CR 475A that will improve local traffic operations. The improvements include access management restrictions, adding turn lanes, and extending turn lanes. Construction is funded for FY 2023-2024 (FPID 433651-1). The following improvements were included in the background evaluation per the FDOT plans:

#### CR 484 Interchange Improvements (from west of SW 20<sup>th</sup> Avenue Road to east of CR 475A)

- Construction of a second southbound right-turn lane on CR 484 at the I-75 SB Ramp
- Construction of a second eastbound left-turn lane on CR 484 at the I-75 NB Ramp
- Construction of a second northbound left-turn from the I-75 NB off-Ramp to CR 484
- Construction of a second eastbound left-turn lane on CR 484 at CR 475A
- Construction of a second northbound left-turn lane on CR 475A at CR 484
- Construction of a southbound right-turn lane on CR 475A at CR 484
- Signal timing adjustments

In addition, the Marion Oaks Boulevard at CR 484 intersection has planned improvements with construction funding from FDOT programmed for FY 2024 (FPID 449277-1). The following improvements were included in the background evaluation per the County plans:

#### Marion Oaks Boulevard at CR 484 intersection improvements

- Construction of dual westbound left-turn lanes
- Construction of dual northbound right-turn lanes
- Northbound right permitted/overlap phasing and signal timing adjustments

SW 20<sup>th</sup> Avenue Road is being extended north of CR 484 as part of the Trailhead Logistics South project. The improvements will be complete by end of 2023. The extension of SW 20<sup>th</sup> Avenue Road will include the following improvements at the intersection with CR 484:

#### SW 20<sup>th</sup> Avenue at CR 484 intersection improvements

- Construction of an eastbound left-turn lane
- Construction of a westbound right- turn lane
- Construction of a north leg of the intersection with a southbound left-turn lane, through lane, and right-turn lane
- Signal timing adjustments



The signal plans for the intersection of SW 20<sup>th</sup> Avenue Road and CR 484 are provided in the **Appendix**. The traffic study for the Marco Polo PUD included additional improvements at the intersection that would be needed for the projected traffic volumes at buildout of the Marco Polo PUD. Because the Marco Polo PUD is considered as a background/vested project per request of Marion County, the improvements identified in that study were included in the background conditions analysis of the intersection. The following buildout geometry was identified in the Marco Polo PUD study:

#### Buildout SW 20<sup>th</sup> Avenue at CR 484 intersection geometry

- One left, two through, and one eastbound through/right lane
- Two left, three through, and one westbound right turn lane
- One left, one through, and one northbound right turn lane
- Two left, and one southbound through/right lane

Additional excerpts detailing the background improvements are provided in the **Appendix**.

## FUTURE TRAFFIC VOLUME DEVELOPMENT

The future traffic volumes within the study area were calculated based on the approved methodology. Future background traffic volumes were calculated using existing peak season traffic volumes and an annual background growth rate applied to the buildout year. A 3.0% background annual growth rate was utilized for the future traffic volume projections. In addition to background growth the following vested developments were added as background traffic:

- Trailhead Logistics Park South
- Gas/Convenience Store at CR 484 & SW 20<sup>th</sup> Ave Rd (included within the Marco Polo PUD)
- Marco Polo PUD
- McGinley Property Phase 2

The total buildout traffic volumes were calculated as the sum of the background traffic volumes and project traffic. For the roadway segment analysis, the PM peak hour project traffic volumes were calculated as an average across the segment length. Project traffic was separated between automobile traffic and truck traffic. A separate trip distribution was applied to each.

Vested traffic excerpts and worksheets detailing the future conditions intersection volume development are contained in the **Appendix**. Buildout total traffic volumes at the study area intersections during the weekday AM and PM peak hours are illustrated in **Figure 5** and **Figure 6**.

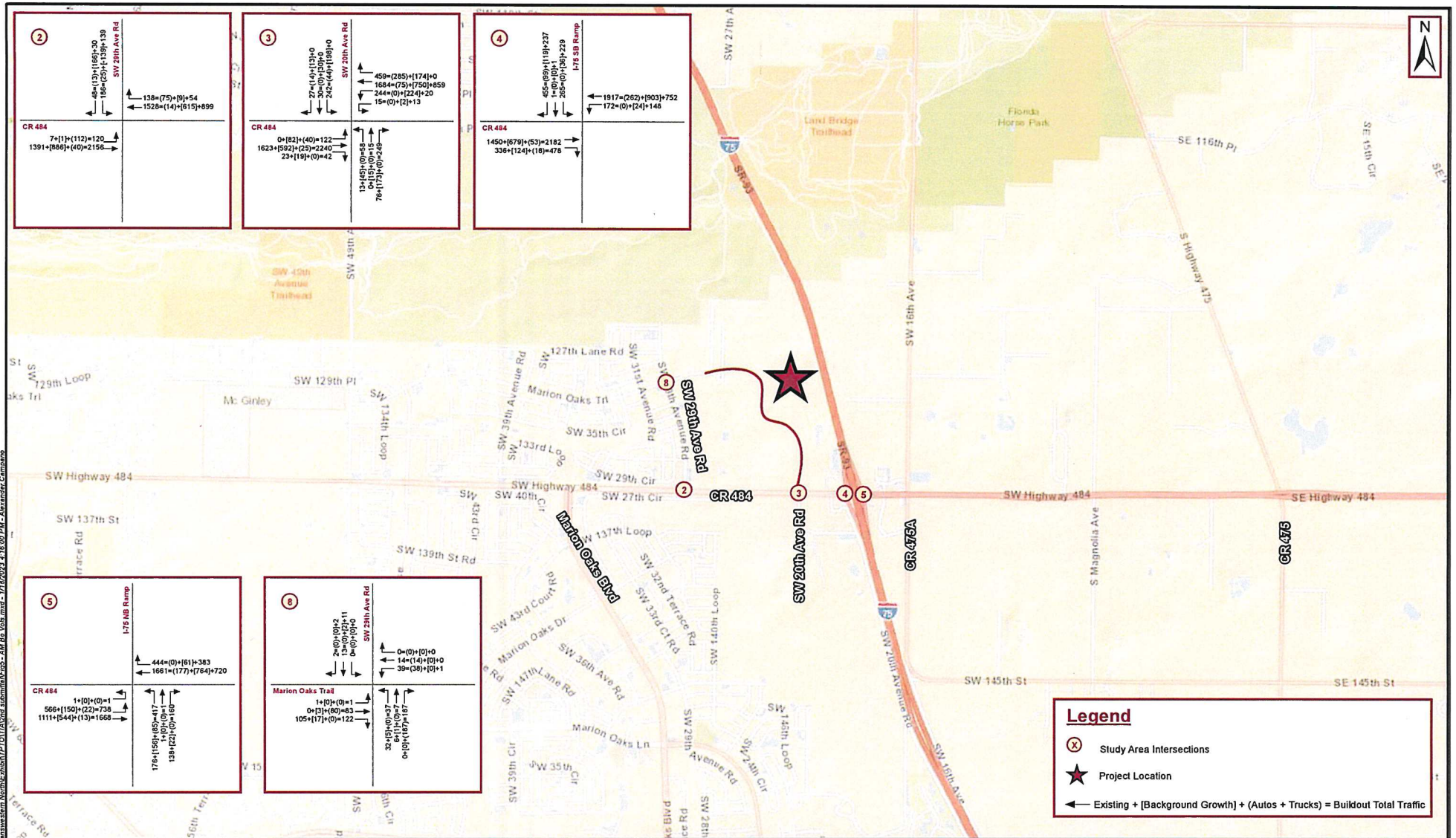


FIGURE 5 - AM PEAK HOUR BUILDOUT TOTAL TRAFFIC VOLUMES

**TRAILHEAD LOGISTICS PARK NORTH  
MARION COUNTY, FLORIDA**

Project No: 142933003

January 2023

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**FUTURE BACKGROUND ROADWAY SEGMENT ANALYSIS**

The roadway segments within the study area were evaluated for level of service under future background traffic conditions (before the addition of project traffic) during the PM peak hour. The service volumes for roadways within the study area were obtained utilizing the most recent Ocala Marion TPO CMP and FDOT Quality/Level of Service Handbook per the approved methodology.

The following roadway segments were found to have V/C ratios greater than 1.0 with the addition of background traffic:

- CR 484, from Marion Oaks Boulevard to SW 20<sup>th</sup> Avenue Road (existing 4-lane roadway)
- CR 484, from SW 20<sup>th</sup> Avenue Road to I-75 (existing 4-lane roadway)
- CR 484, from I-75 to CR 475A (existing 4-lane roadway)

CR 484 is listed within the Ocala Marion TPO Long Range Transportation Plan (LRTP) as needing widening to six lanes from SW 29<sup>th</sup> Avenue to SW 20<sup>th</sup> Avenue Road (project R26) and SW 20<sup>th</sup> Avenue Road to CR 475A (project R27). These improvements are not listed in the cost feasible plan and do not have funding allocated in the current five-year Transportation Improvement Program (TIP). The traffic study performed for the Marco Polo PUD showed a need for CR 484 to be six lanes fronting the Marco Polo PUD.

Marion County has funding in the current five-year TIP for a planning study for widening of CR 484 to two lanes from Marion Oaks Pass to SR 200 (Project C5). No other phases have funding allocated in the five-year TIP.

The other roadway segments within the study area are shown to operate within the adopted service volume with 2027 PM peak hour background traffic conditions. The future background conditions roadway segment analyses are detailed in **Table 5**.



Table 5 – Future Background Conditions PM Peak Hour Roadway Segment Analysis (2027)

Roadway		ROADWAY ATTRIBUTES <sup>1</sup>			EXISTING PEAK SEASON TRAFFIC CONDITIONS (2022)		PM PEAK SEASON BACKGROUND TRAFFIC CONDITIONS (2027)										
		Adopted LOS	Number of Lanes	Pk. Hr. Dir. Service Volume	PM Peak Hour <sup>2</sup>		PM Peak Hour <sup>3</sup>										
					NB/EB Volume	SB/WB Volume	NB/EB Volume	SB/WB Volume	Vested NB/EB	Vested SB/WB	Total NB/EB	Total SB/WB	NB/EB V/C	SB/WB V/C	NB/EB LOS	SB/WB LOS	
From	To																
<b>CR 484</b>																	
SW 105 AV	SR 200	E	2	1,449	438	498	504	573	25	29	529	602	0.37	0.42	C	C	
SR 200	W OF SW 57 AV	E	2	1,610	379	431	436	496	139	216	575	712	0.36	0.44	B	C	
W OF SW 57 AV	SW 49 AV	E	4	1,900	379	431	436	496	691	633	1,127	1,129	0.59	0.59	C	C	
SW 49 AV	MARION OAKS BLVD	E	4	1,800	819	952	942	1,095	524	534	1,466	1,629	0.81	0.91	C	C	
MARION OAKS BLVD	SW 20 AV RD	E	4	1,800	1,037	1,191	1,192	1,369	596	591	1,788	1,960	0.99	1.09	D	F	
SW 20 AV RD	I-75	E	4	1,800	1,148	1,730	1,320	1,989	1,166	752	2,486	2,741	1.38	1.52	F	F	
I-75	CR 475A	D	4	1,800	1,187	1,177	1,364	1,354	713	490	2,077	1,844	1.15	1.02	F	F	
CR 475A	CR 475	D	4	1,800	861	724	990	833	603	417	1,593	1,250	0.89	0.69	C	C	
CR 475	CR 467	D	4	1,800	1,044	918	1,201	1,056	482	330	1,683	1,386	0.94	0.77	C	C	
CR 467	SE 132 ST RD	D	4	1,800	905	796	1,041	915	386	264	1,427	1,179	0.79	0.66	C	C	
<b>SW 29th Avneue Road</b>																	
CR 484	MARION OAKS TRL	E	2	560	73	59	84	67	0	0	84	67	0.15	0.12	C	C	
<b>SE 132nd Street Road</b>																	
CR 484	US 301	E	4	1,800	555	489	638	562	294	202	932	764	0.52	0.42	C	C	
US 301	US 441	E	4	1,800	608	535	699	615	294	202	993	817	0.55	0.45	C	C	
<b>Marion Oaks Trail</b>																	
CR 484 W	SW 49 AV	E	2	792	113	85	130	98	1	2	131	100	0.17	0.13	C	C	
MARION OAKS CRSE	CR 484 E	E	2	792	113	85	130	98	51	8	181	106	0.23	0.13	C	C	

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Notes:  
 1. The roadway attributes and AADT were obtained from the most recent Ocala Marion Transportation Planning Organization (TPO) Congestion Management Process (CMP) Database and Ocala Marion TPO 2022 Traffic Counts Report. For SW 29th Avenue Road the roadway attributes were derived using the 2020 FDOT Q/LOS Handbook, 2010 FDOT Functional Classification Map for Marion County, and the adopted level of service from the Marion County Comprehensive Plan (Transportation Element, Policy 2.1.2).  
 2. The existing traffic volumes were derived from the observed turning movement counts. The existing volumes for SW 132nd Street, Marion Oaks Trail, and CR 484 (west of SW 45th Avenue/east of CR 475) were derived using the Ocala Marion TPO CMP AADTs and K/D factors from FDOT Traffic Online (count stations 368136, 368136, 367039, 367040/367046).  
 3. Background volumes were derived by applying the study area growth rate to the existing volumes and adding vested traffic added.

**FUTURE BUILDOUT ROADWAY SEGMENT ANALYSIS**

The roadway segments within the study area were evaluated for level of service under future buildout traffic conditions during the PM peak hour. The service volumes utilized for the analysis are the same as those utilized for the future background conditions analysis, with the addition of background improvements. The following improvements were identified to be necessary to provide for acceptable level of service with the future background traffic volumes during the PM peak hour:

- CR 484, from Marion Oaks Boulevard to SW 20<sup>th</sup> Avenue Road (existing 4-lane roadway)
- CR 484, from SW 20<sup>th</sup> Avenue Road to I-75 (existing 4-lane roadway)
- CR 484, from I-75 to CR 475A (existing 4-lane roadway)

Service volumes for the improved condition were obtained from the 2020 FDOT Quality/Level of Service Handbook and using the roadway attributes from the Ocala Marion TPO CMP. The roadway segments within the study area are shown to operate within the adopted service volume with PM peak hour buildout traffic volumes and assuming the improvements identified to be needed in the background conditions analysis. No additional roadway widenings were identified to be needed due to the addition of traffic from the proposed Trailhead Logistics Park North site.

The future buildout conditions roadway segment analyses are detailed in **Table 6**.



## FUTURE BACKGROUND CONDITIONS INTERSECTION ANALYSIS

The intersections within the study area were evaluated to determine if improvements are needed to provide an acceptable level of service and intersection operations with future background traffic conditions prior to the addition of project traffic.

Existing signal timings (as obtained from the City of Ocala and Marion County), peak hour factors (as obtained from the traffic counts), and right-turn on red percentages (obtained as previously described in this report) were input into Synchro 11 for analysis. The existing observed percent heavy vehicle percentage was updated for the background conditions analysis to reflect the projected vehicle mix from the addition of background and vested traffic.

Either existing geometry or planned/programmed geometry was utilized based on the committed transportation projects outlined previously.

The intersection of SW 29<sup>th</sup> Avenue Road at CR 484 was evaluated as a directional median opening (all southbound movements are limited to right-turn only) based on input from Marion County on a planned short-term safety improvement. The observed and projected traffic movements at the intersection were re-allocated based on the planned movement restriction at the intersection. Existing / projected southbound left-turn movements were allocated to the southbound right-turn movement and eastbound through movement, assuming these vehicles would make a u-turn at the median opening to the west of the intersection.

The background intersection analysis shows the following improvements are necessary to provide for acceptable level of service and operations with future background traffic volumes:

### SW 29<sup>th</sup> Avenue Road at CR 484

- Signalization is warranted as a result of background traffic during the AM peak hour based on the FDOT Signal Warrant 3 volume thresholds and LOS F for southbound right-turn movement

### SW 20th Avenue Road at CR 484

- Signal timing adjustments and assuming the improvements identified to be needed with the Marco Polo PUD buildout

An AM peak hour and PM peak hour signal warrant analysis was conducted for the intersection of SW 29<sup>th</sup> Avenue at CR 484 using the Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition for peak hour volume Warrant 3 criteria. Based on the Signal Warrant 3 criteria, a traffic signal is warranted for the background AM peak hour traffic conditions. The peak hour signal warrant analysis outputs are provided in the **Appendix**.

The I-75 at CR 484 interchange is currently under construction. The improvements include dual southbound right turn lanes for the southbound ramp terminal and dual northbound left turn lanes for the northbound ramp terminal. The I-75 Southbound Ramp at CR 484 southbound right-turn movement operates at LOS F (and v/c < 1.0) during the background AM peak hour. The I-75 Northbound Ramp at CR 484 northbound left-turn movement operates at LOS F (and v/c <1) during the AM and PM background scenarios.

No background improvements were applied to the intersection of CR 475A at CR 484. With future background traffic volumes, the intersection operates with all V/C ratios less than 1.0 and acceptable LOS for the overall intersection operations, but with LOS F for the eastbound left-turn, northbound left-turn, and



southbound right-turn movements during the PM peak hour. The high delay for these movements is due to the intersection being within the coordinated signal network and having a long cycle length that favors the through traffic on CR 484.

Table 7 summarizes the resultant intersection LOS with future background traffic volumes and existing and/or programmed intersection geometry. Table 8 summarizes the resultant intersection LOS with future background traffic volumes and considering the improvements outlined above. The Synchro 11 output reports are provided in the Appendix.

**Table 7 – Background Conditions Intersection Analysis (2027)**

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Max V/C	LOS	Delay (s)	Max V/C
Marion Oaks Blvd & CR 484	--	--	--	C	29.9	0.88
SW 29th Ave Rd & CR 484	F	50.6	0.77	C	21.9	0.26
SW 20th Ave Rd & CR 484	F	93.9	3.36	F	185.5	5.04
I-75 SB Ramp & CR 484	C	27.1	0.85	D	38.3	0.995
I-75 NB Ramp & CR 484	C	26.9	0.83	C	23.9	0.86
CR 475A & CR 484	--	--	--	C	33.6	0.92
CR 475 & CR 484	--	--	--	D	42.9	0.99
SW 29th Ave Rd & Marion Oaks Trail	A/B	9.1/10.5	0.15	A/B	9.0/10.6	0.07

Notes:  
1. For stop controlled intersections MOEs were reported for the stop controlled approach(es). For signalized intersections the LOS and delay were reported for the overall intersection.

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**Table 8 – Background Conditions with Improvements Intersection Analysis (2027)**

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Max V/C	LOS	Delay (s)	Max V/C
SW 29th Ave Rd & CR 484	B	14.8	0.88	A	7.6	0.75
SW 20th Ave Rd & CR 484	C	28.6	0.92	D	38.5	0.94

Notes:  
1. For stop controlled intersections MOEs were reported for the stop controlled approach(es). For signalized intersections the LOS and delay were reported for the overall intersection.

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## FUTURE BUILDOUT CONDITIONS INTERSECTION ANALYSIS

The intersection operations were evaluated under 2027 buildout traffic conditions. The buildout traffic volumes are a sum of the 2027 background traffic volumes and project traffic volumes from the Trailhead Logistics Park North site. Automobile traffic and truck traffic were assigned separately for the buildout conditions volume development. Buildout percent heavy vehicles were derived by summing the background truck volumes and project truck volumes divided by the total volumes for each approach.

The intersection analysis was performed using the geometry identified to be needed for the 2027 future background conditions analysis. The full buildout intersection geometry identified in the Marco Polo Study for the intersection of SW 20<sup>th</sup> Avenue Road at CR 484 was utilized.

The buildout intersection analysis shows the following improvements are needed to provide for acceptable level of service and traffic operations with the projected buildout traffic:

### Marion Oaks Boulevard at CR 484

- Extend the westbound left-turn lane on CR 484 to 625 feet

### SW 20th Avenue Road at CR 484

- Implement a northbound right-turn permitted/overlap phasing; a R10-16 sign is recommended to warn u-turning vehicles to yield to right-turn vehicles
- Signal timing adjustments

A third westbound through lane was included in the intersection analysis for the intersection of CR 484 at the I-75 southbound ramp based on the identified background improvement need of widening CR 484 to six lanes. This is considered a background traffic improvement based on the need for widening to six lanes to accommodate the future background (prior to the addition of project) traffic volumes.

The study area intersections are expected to operate with acceptable LOS and V/C ratios with the addition of project traffic and the above identified improvements, in addition to those implemented in the future background with improvement scenario.

**Table 9** provides a summary of the intersection operations with buildout traffic volumes and the improvements identified to be needed for future background traffic conditions. **Table 10** provides a summary of the intersection operations with buildout traffic volumes and the additional improvements identified to be needed for the addition of project traffic. The Synchro 11 output reports are provided in the **Appendix**.



Table 9 – Buildout Conditions Intersection Analysis (2027)

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Max V/C	LOS	Delay (s)	Max V/C
Marion Oaks Blvd & CR 484	--	--	--	C	33.4	0.90
SW 29th Ave Rd & CR 484	B	19.3	0.90	B	12.7	0.81
SW 20th Ave Rd & CR 484	C	30.7	0.95	D	52.0	1.14
I-75 SB Ramp & CR 484	C	26.6	0.89	C	32.2	0.95
I-75 NB Ramp & CR 484	C	32.7	0.87	C	26.7	0.87
CR 475A & CR 484	--	--	--	C	34.2	0.92
CR 475 & CR 484	--	--	--	D	39.5	0.96
SW 29th Ave Rd & Marion Oaks Trail	B/B	11.7/13.5	0.32	B/C	10.0/16.6	0.48

Notes:

1. For stop controlled intersections MOEs were reported for the stop controlled approach(es). For signalized intersections the LOS and delay were reported for the overall intersection.

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Table 10 – Buildout Conditions with Improvements Intersection Analysis (2027)

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Max V/C	LOS	Delay (s)	Max V/C
SW 20th Ave Rd & CR 484	C	28.1	0.89	D	52.6	0.99

Notes:

1. For stop controlled intersections MOEs were reported for the stop controlled approach(es). For signalized intersections the LOS and delay were reported for the overall intersection.

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## INTERIM SW 20<sup>TH</sup> AVENUE ROAD AT CR 484 INTERSECTION ANALYSIS

SW 20<sup>th</sup> Avenue Road at CR 484 was evaluated considering an “interim” scenario. The traffic volumes for the interim scenario included:

- Existing observed traffic volumes
- Background growth to a buildout year of 2027
- Trailhead Logistics Park South
- Marco Polo Gas/Convenience Store
- Trailhead Logistics Park North (full buildout)



The planned geometry that is currently under construction with the Trailhead Logistics Park South Project was utilized, which includes the following approach geometries:

- Eastbound – left-turn lane, through lane, through/right-turn lane
- Westbound – left-turn lane, two through lanes, right-turn lane
- Northbound – left-turn lane, through/right-turn lane
- Southbound – left-turn lane, through lane, right-turn lane

Re-striping of the southbound approach to a southbound left-turn lane, southbound through/left-turn lane, and southbound right-turn lane is required to accommodate the full buildout traffic from the Trailhead Logistics Park North project and the background traffic identified above. Due to restrictions on the south side of the intersection, the north leg must have the through movement in the center southbound lane. This geometry will necessitate a split phase for the northbound and southbound movements, which will require less green time for the CR 484 eastbound and westbound movements.

It is recommended that within 30 days of opening a cumulative development program of 500,000 square feet within the Trailhead Logistics Park North that an operational study be performed to determine what configuration and signal timings are required to accommodate future year traffic patterns; to be reviewed and approved by County staff.

The intersection volume development, Synchro outputs, and vested traffic excerpts utilized for the interim analysis are provided in the **Appendix**.

## TURN LANE EVALUATION

The turn lanes at the study area intersections utilized by project traffic were evaluated to determine if the existing or planned/programmed length is sufficient for the traffic at buildout. The planned geometry as provided by the design plans for the committed projects on CR 484 at the I-75 interchange and CR 484 at Marion Oaks Boulevard were used. The existing/planned turn lane length was compared against the required deceleration from the FDOT Greenbook and the reported queue length from the Synchro output. The 50<sup>th</sup> percentile and 95<sup>th</sup> percentile queues from the background (with improvement) and buildout (without improvement) scenarios were utilized. The existing/planned turn lane length is considered sufficient if the turn lane can accommodate the required deceleration plus 50<sup>th</sup> percentile queue and the 95<sup>th</sup> percentile queue length can be contained within the turn lane.

**Table 11** provides a summary of the turn lane evaluation. The turn lanes at the study area intersections that are utilized by project traffic will have sufficient storage to accommodate the buildout traffic volumes, with the exception of the following:

- The planned westbound left-turn lane length on CR 484 at Marion Oaks Boulevard needs to be extended by 120 feet to accommodate the increase in traffic in this movement from the project
- The northbound left-turn lane on CR 475A at CR 484 has deficient length for the future background (prior to project traffic) volumes. Traffic from the Trailhead Logistics Park North project does not change the queue length or create an additional deficiency
- The northbound left-turn lane on CR 475 at CR 484 has deficient length for the future background (prior to project traffic) volumes. Traffic from the Trailhead Logistics Park North project does not change the queue length or create an additional deficiency



Table 11 – Turn Lane Evaluation

Intersection	Speed Limit	Required Deceleration (ft) <sup>1</sup>	Total Turn Lane Length (ft) <sup>2</sup>	AM Peak Hour				PM Peak Hour				Existing / Planned Storage Length Sufficient? (Y/N) <sup>4,5</sup>
				50th Percentile Queue Length (ft) <sup>3</sup>	95th Percentile Queue Length (ft) <sup>3</sup>	Decel L + 50th %tile Queue (ft)	Taper L + 95th %tile queue (ft)	50th Percentile Queue Length (ft) <sup>3</sup>	95th Percentile Queue Length (ft) <sup>3</sup>	Decel L + 50th %tile Queue (ft)	Taper L + 95th %tile queue (ft)	
<b>Marion Oaks Blvd &amp; CR 484</b>												
WBL (background)	45	185	505	--	--	--	--	275	400	460	500	Y
WBL (buildout)	45	185	505	--	--	--	--	400	525	585	625	N
<b>I-75 SB Ramp &amp; CR 484</b>												
SBR (background)	35	-	570	200	250	200	250	475	625	475	625	Y
SBR (buildout)	35	-	570	275	350	275	350	525	700	525	700	Y
<b>I-75 NB Ramp &amp; CR 484</b>												
EBL (background)	45	185	675	350	400	535	500	225	250	410	350	Y
EBL (buildout)	45	185	695	375	400	560	500	275	275	460	375	Y
NBL (background)	35	-	530	225	300	225	300	325	425	325	425	Y
NBL (buildout)	35	-	530	275	400	275	400	350	475	350	475	Y
<b>CR 475A &amp; CR 484</b>												
EBL (background)	45	185	410	--	--	--	--	200	250	385	300	Y
EBL (buildout)	45	185	410	--	--	--	--	225	225	410	275	Y
NBL (background)	45	185	345	--	--	--	--	175	225	360	275	N
NBL (buildout)	45	185	345	--	--	--	--	175	225	360	275	N
<b>CR 475 &amp; CR 484</b>												
EBL (background)	55	350	500	--	--	--	--	75	125	425	175	Y
EBL (buildout)	55	350	500	--	--	--	--	75	150	425	200	Y
NBL (background)	55	350	295	--	--	--	--	75	150	425	200	N
NBL (buildout)	55	350	295	--	--	--	--	100	150	450	200	N

Notes:

1. Based on the 2018 FDOT Green Book (Table 3-31) and FDOT Design Manual (Exhibit 212-1).
2. Turn lane lengths were derived from the existing turn lane lengths. For the intersections of Marion Oaks Blvd, I-75 Ramps, and CR 475A at CR 484, the turn lane lengths were derived from the design plans for those projects. The I-75 off ramp turn lane lengths were not measured to the mainline gore striping, therefore an additional storage length is available (SB Ramp ~690 ft, NB Ramp ~785 ft) to accommodate queued traffic exiting onto CR 484.
3. Based on the 50th and 95th percentile back of queue length (rounded up in 25 foot increments) as reported in Synchro 11.
4. The storage length was determined to be sufficient if the turn lane could accommodate the summation of the required deceleration length and 50th percentile queue length and the storage length could accommodate the 95th percentile queue length plus taper. For interchange off ramps turn lane length was determined to be sufficient if the turn lanes could accommodate the forecasted queue length.
5. The buildout queue lengths were derived from the buildout scenario (without improvements).

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**SITE ACCESS ANALYSIS**

The following access locations are proposed for the Project:

- Connection to the south along SW 20<sup>th</sup> Avenue Road, which connects to CR 484 at a signalized intersection
- Connection as a new east leg of the intersection of SW 29<sup>th</sup> Avenue Road and Marion Oaks Trail

The projected traffic volumes on SW 29<sup>th</sup> Avenue Road do not show a need to widen to four lanes. The widening of SW 29<sup>th</sup> Avenue Road to four lanes was previously contemplated with the Deltona development agreements. There is 100 feet of right-of-way and portions of the roadway are constructed with four lanes. The developer plans to widen the roadway to four lanes, although not shown to be necessary to meet level of service standards with the buildout traffic volumes.

**SW 29<sup>TH</sup> AVENUE ROAD AT MARION OAKS TRAIL**

The planned connection on SW 29<sup>th</sup> Avenue Road at Marion Oaks Trail was evaluated to determine if an ingress northbound right turn lane is warranted to accommodate project traffic. The FDOT Access Management Guidebook (November 2019) was reviewed to determine whether the projected ingress turning volumes warrant an exclusive northbound right-turn lane. The FDOT Guidebook recommends an ingress right-turn lane if turning volumes are between 80 and 125 vehicles per hour for roadways with a speed limit of 45 mph or less. The lower threshold is more appropriate for a higher volume two-lane roadway and the higher threshold is more appropriate for a multi-lane roadway. SW 29<sup>th</sup> Avenue Road serves minimal development north of Marion Oaks Trail, with very little through volumes expected. With the widening of SW 29<sup>th</sup> Avenue Road to four lanes, the outside lane could turn into a dedicated right-turn lane into the site as there a limited number of through volumes north of Marion Oaks Trail expected.

An excerpt from the FDOT Access Management Guidebook is provided in the **Appendix. Table 12** provides a summary of the right-turn lane analysis.

**Table 12 – Right-Turn Lane Analysis**

Access Connection	Buildout NBR Volumes (veh/hr) <sup>1</sup>		Buildout NBT Volumes (veh/hr) <sup>1</sup>		Threshold Right Turn Volumes (veh/hr) <sup>2</sup>	Right Turn Lane Required?
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
<b>SW 29th Ave Rd at Marion Oaks Trail</b>	187	53	7	13	80	NO
Notes: 1. Projected ingress traffic volumes at full buildout of the development. 2. NBR volumes exceed the FDOT recommended threshold, however based on NCRHP 457 guidance an exclusive right turn lane is not recommended.						

**SW 29<sup>TH</sup> AVENUE ROAD AT CR 484**

The intersection of SW 29<sup>th</sup> Avenue Road at CR 484 will be signalized based on the results of the background conditions signal warrant analysis. The southbound approach will include two lanes due to the proposed widening of SW 29<sup>th</sup> Avenue Road. The existing eastbound left-turn lane is 285 feet long. The required deceleration length is 185 feet based on the FDOT Greenbook and the 50<sup>th</sup> percentile queues at buildout are less than 100 feet. The existing eastbound left-turn lane on CR 484 at SW 29<sup>th</sup> Avenue Road has sufficient length for project buildout. The FDOT Design Manual (Chapter 232.2) recommends exclusive right-turn lanes at signalized intersections when peak hour through and right turning volumes each exceed 300 vph. The projected westbound right-turn volume is 138 vehicles during the AM peak hour and 79 vehicles during the PM peak hour; therefore, based on FDOT criteria, an exclusive westbound right-turn lane is not warranted at the future signalized intersection of SW 29<sup>th</sup> Avenue Road at CR 484.

**SW 20<sup>TH</sup> AVENUE ROAD AT CR 484**

The intersection of SW 20<sup>th</sup> Avenue Road at CR 484 has planned improvements for the interim condition (under construction now; implemented prior to full Marco Polo buildout) and buildout condition (full Marco Polo buildout, as identified in the Marco Polo study). The interim improvements include a ±480-foot eastbound left-turn lane and +/- 160-foot westbound right-turn lane on CR 484. The north leg will be constructed to have an exclusive 200-foot southbound left turn lane, and a single southbound through and single southbound right turn lane that extend north of the intersection. The planned improvements illustrating the turn lane lengths are provided in the **Appendix**.

The eastbound left-turn lane on CR 484 at SW 20<sup>th</sup> Avenue Road has sufficient length for the projected queues at buildout. The planned westbound right-turn lane is less than the required deceleration length for a 45mph design speed. However, per feedback from Marion County, the westbound right turn lane cannot be lengthened due to the adjacent Popeye's driveway.

The projected 95<sup>th</sup> percentile queue length for the southbound left-turn movement on SW 20<sup>th</sup> Avenue Road at CR 484 is approximately 1,100 feet for project buildout. There is approximately 920 feet of queue storage for the southbound left-turn movement on SW 20<sup>th</sup> Avenue Road between CR 484 and the first median opening on SW 20<sup>th</sup> Avenue Road to the north. During peak egress traffic periods, the queues will extend past the median opening. A "do not block intersection" sign is recommended to minimize impacts between southbound left-turn movements at CR 484 and northbound left-turn movements at the median opening. A northbound left-turn lane is provided on SW 20<sup>th</sup> Avenue Road at the median opening to allow for left-turning traffic to queue outside of the through lanes. No impacts to the CR 484 traffic operations are anticipated from the occasional queueing during peak periods on SW 20<sup>th</sup> Avenue Road. Furthermore, SW 29<sup>th</sup> Avenue Road will be widened to four lanes with a traffic signal at CR 484, which will allow for an additional egress point during peak egress and queueing periods.

An interim evaluation was performed assuming the Trailhead Logistics Park North site may be operational prior to the Marco Polo development, and associated improvements to the intersection of SW 20<sup>th</sup> Avenue Road at CR 484. The results and recommendations from that evaluation were summarized previously and include restriping the southbound approach to have a left-turn lane, through/left-turn lane, and right-turn lane and converting the northbound and southbound signal phasing to split phasing. The timing of the interim improvements will be based on operational studies to be performed at various buildout stages within the Trailhead Logistics Park North development.

## PROPORTIONATE SHARE

Per Chapter 163.3180 of the Florida Statutes, an acceptable method for a landowner to mitigate their transportation impacts is to pay a proportionate share cost towards subject improvements. Per the Florida Statutes, proportionate share contributions are not required for improvements identified to correct transportation deficiencies that occur prior to the addition of project traffic. Therefore, any transportation improvements identified to be needed in the background conditions analysis are assumed to be in place for the purposes of the proportionate share calculation.

Several transportation improvements were identified as being required within the study area to provide acceptable traffic operations with future background traffic conditions (before the addition of project traffic) and are therefore not subject to proportionate share mitigation. The improvements required to accommodate background traffic are listed in the background intersection analysis and background roadway segments analysis sections of this report. Background intersection and roadway improvements were assumed to be in place for the proportionate share calculations.

Additional transportation improvements were identified as being required within the study area to provide acceptable traffic operations at project buildout. Mitigation required to support project traffic was calculated based on the following methodology:

### Marion Oaks Boulevard at CR 484

- Extend the westbound left-turn lane on CR 484 to 625 feet
- Proportionate share calculated as the project traffic utilizing the westbound left-turn movement (59 trips) divided by the total traffic utilizing the westbound left-turn movement (714 trips) at buildout = 8.26%

### SW 20th Avenue Road at CR 484

- Implement a northbound right-turn permitted/overlap phasing and signal timing adjustments
- Install an R10-16 (U-TURN YIELD TO RIGHT TURN) for the westbound left-turn lane
- Proportionate share calculated as the project traffic at the intersection divided by the increase in capacity generated by the improvement. The total project traffic at the intersection is greater than the increase in capacity generated by the improvement, therefore the proportionate share is 100%.

SW 29th Avenue Road will be widened by the developer to four lanes from CR 484 to Marion Oaks Trail. The widening of SW 29th Avenue Road will include a new traffic signal at the intersection of SW 29th Avenue Road and CR 484. The widening to four lanes was a prior condition of the Deltona development but is not shown to be needed to accommodate project traffic from the Trailhead Logistics Park North site. A traffic signal at the intersection of SW 29th Avenue Road at CR 484 is warranted with future background traffic conditions, prior to the addition of traffic from the Trailhead Logistics Park North site. The cost of the improvements to SW 29th Avenue Road and the intersection with CR 484 will exceed the cost of the required proportionate share transportation mitigation for the project.

## CONCLUSION

This traffic study has been performed to support the PUD rezoning for the Trailhead Logistics Park North industrial development. The traffic analysis provided is consistent with the approved methodology document.

The traffic analysis was performed considering a buildout timeframe of 5 years (2027) for the full proposed development program. The operating conditions within the study area were evaluated for existing, future background (before addition of project traffic) conditions and buildout traffic conditions.

The following offsite transportation improvements were identified to be needed based on the background traffic scenario (prior to the addition of project traffic):

- CR 484 - Widening to six lanes from Marion Oaks Boulevard to CR 475A
- SW 29th Avenue Road at CR 484 - Signalization is warranted with background AM peak hour traffic
- SW 20th Avenue Road at CR 484 - Signal timing adjustments

Additional off-site transportation improvements were identified to be needed due to the addition of project traffic from the Trailhead Logistics Park North development. The following mitigation improvements are needed to support project traffic:

- Marion Oaks Boulevard at CR 484 – extend the westbound left-turn lane to 625 feet (8.26% proportionate share allocation)
- SW 20th Avenue Road at CR 484 – northbound right-turn permitted/overlap phasing with signal timing adjustments and installing an R10-16 (U-TURN YIELD TO RIGHT TURN) sign (100% proportionate share allocation).

The following interim improvements were identified to be needed at the intersection of SW 20<sup>th</sup> Avenue Road at CR 484 to support buildout traffic volumes in advance of the ultimate improvements at the intersection identified within the Marco Polo PUD:

- Re-striping the southbound approach to have a left-turn lane, through/left-turn lane, and right-turn lane
- Implementing split phasing for the northbound and southbound approaches

The developer will enter into a Chapter 163 Concurrency Development Agreement for the widening of SW 29th Avenue Road to four lanes from CR 484 to Marion Oaks Trail and install a traffic signal at the intersection with CR 484. The Concurrency Development Agreement will also address impact fee credits per Section 10-323 of the Marion County Code of Ordinances. The cost of the improvements to SW 29<sup>th</sup> Avenue Road and the intersection with CR 484 will exceed the cost of the required proportionate share transportation mitigation for the project.

The Chapter 163 Concurrency Development Agreement will also require an operational study of the intersection of SW 20<sup>th</sup> Avenue Road at CR 484 at various stages of development to determine the timing of the interim improvements. This traffic impact analysis has been completed based on the standards set forth in the approved methodology and supports the PUD zoning application and future Concurrency Development Agreement for transportation concurrency reservation for the project.