# Pine Ridge Road Corridor Congestion Study

## **TECHNICAL REPORT**

MARCH 27, 2018



Collier County Capital Projects, Planning, Impact Fees & Program Management

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#### **OVERVIEW**

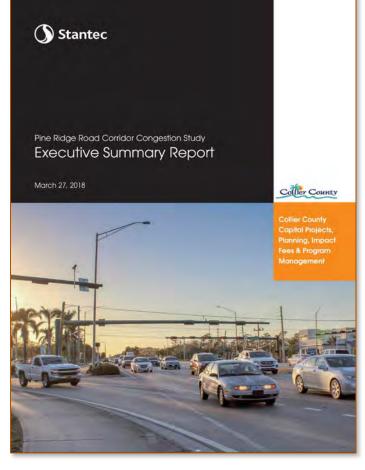
Pine Ridge Road (CR-896) between US 41 and Collier Boulevard serves as one of only four major east/west arterial corridors serving commuters and providing direct connection to one of four I-75 interchanges within the urban area. High peak period traffic volumes experience excessive delay along the entire length of the corridor from US 41 to I-75. 2016 existing volumes between Livingston Road and I-75 plus committed "trip bank" trips from committed developments exceed the adopted level of service (LOS) standard set by the Board of County Commissioners in the Collier County Growth Management Plan (GMP).

To examine this segment of the corridor more closely in hopes of identifying potential countermeasures to the increasing volumes projected in the 2016 Annual Update and Inventory Report (AUIR), the *Capital Project Planning, Impact Fees & Program Management Division* initiated the Corridor Congestion Study to evaluate existing and future traffic conditions and to identify potential improvements within the corridor that would relieve congestion and improve the LOS.

The Pine Ridge Road Corridor Congestion Study documentation is divided into three reports, an Executive Summary Report, this Technical Report, and a Public Involvement Report. This Technical Report is a compendium of the data collection and analysis phase of the includes study. Ιt also the recommendations analysis that identified the preferred alternative concepts for consideration by the Board of County Commissioners.

# STUDY SUMMARY & RECOMMENDATIONS

During the course of the planning study, a future traffic forecast was prepared and analyzed, and potential improvements were developed and evaluated. The "conventional" improvements that would add the capacity needed to relieve future congestion and achieve the adopted LOS standard included increasing the number of through lanes on Pine Ridge



Road from 6 to 8 lanes from west of Livingston Road to east of Napa Boulevard, and adding additional left turn lanes at the intersections.

Recognizing that the "capacity deficiencies" being forecast primarily occur at the intersections within the corridor, three potential "innovative intersection" improvements were identified and

evaluated for the Pine Ridge Road/Livingston Road intersection that were found to improve the operating efficiency of the intersection. The improvements evaluated included a partial-Continuous Flow Intersection (CFI), a Jug-Handle (JH) or quadrant intersection, and Single Point Urban Interchange (SPUI) or overpass/underpass. At Pine Ridge Road and Whippoorwill Lane, a Restricted Crossing U-Turn (RCUT) Intersection was evaluated. A Diverging Diamond Interchange (DDI) concept was considered and evaluated at the I-75 Interchange. Unlike the conventional roadway widening by adding through lanes and additional turn lanes that would require the acquisition of additional right-of-way, the innovative designs minimize the need to acquire additional right-of-way.

A performance evaluation of the innovative improvements indicates that based on an average of the percent increase in capacity at each intersection along Pine Ridge Road, the CFI, RCUT and DDI combination results in a 30% increase in capacity, the JH, RCUT, DDI combination results in a 29% increase, and the SPUI, RCUT, DDI combination results in a 26% increase in system capacity. This is comparable to the 34% increase in capacity gained by widening to 8-lanes through the entire corridor based upon the Florida Department of Transportation (FDOT) Generalized LOS Tables.

At the conclusion of the concept development/analysis phase of work, the preliminary findings were presented to the Metropolitan Planning Organization (MPO), the MPO's Technical and Citizens Advisory Committees, the Development Services Advisory Committee (DSAC), and to the general public in a variety of settings. Consultation with other public agencies, e.g., Florida Department of Transportation (FDOT), North Collier Fire Control & Rescue District, Collier County School District, Collier County Sheriff's Office, etc., rounded out the vetting process.

After consideration of the study findings and public comments, a recommended set of improvements was developed for consideration by the Collier County Board of County Commissioners. The recommended improvements include the following:

- A partial-Continuous Flow Intersection (CFI) at Pine Ridge Road and Livingston Road,
- A Restricted Crossing U-Turn (RCUT) Intersection at Pine Ridge Road at Whippoorwill Lane, and
- A Diverging Diamond Interchange (DDI) at the Pine Ridge Road/I-75 interchange

The study recommends the County conduct a preliminary engineering and environmental assessment to further evaluate the design features, right-of-way needs, and costs of the CFI concept for the intersection of Pine Ridge Road and Livingston Road.

Because the Whippoorwill Lane intersection is in close proximity, and partially included in the I-75 Limited Access Right-of-Way Limits, the study recommends the County pursue an Interchange Modification Report (IMR) with FDOT for the DDI & RCUT portion of the corridor.

## PROJECT APPROACH

Conducting a study of this type involves a systematic approach to identify existing and future conditions, to develop and evaluate options, to engage the public in presenting the study findings and take input, and to develop recommendations to guide decision-makers in advancing future improvements. The Pine Ridge Road Corridor Congestion Study effort consisted of the following tasks, each of which will be discussed further detail in this report, and in the supporting <u>Public Involvement Report</u>:

**Study Area** - The study area defines the limits of the study and includes the infrastructure being evaluated as well as the lands adjacent to the corridor that have a direct impact on the corridor

**Traffic Data Collection** – Collecting 2016 seasonal traffic volume data over a 24-hour period and during the a.m. and p.m. peak periods on the mainline segments between intersections and turning movements at major intersections. Existing traffic data is used to establish a baseline LOS condition, and is used to prepare forecast estimates for future year LOS analyses.

Land Use Analysis – A review of the current land use conditions within the study area revealed several undeveloped sites that would directly, or indirectly, impact the corridor roadway segments and intersections. The study evaluating the future land uses within the corridor to ensure that currently undeveloped lands that would directly impact the corridor were properly accounted for in the traffic forecasts.

**Forecast Travel Estimation** – To evaluate future LOS conditions, with and without improvements, a traffic volumes forecast for two horizon years, 2021 and 2040, was developed for the mainline segments between intersections, and the turning movement volumes at major intersections.

**Forecast Travel Operating Conditions** - The LOS operating conditions within the corridor for the existing and future horizon years were analyzed for the a.m. and p.m. peak periods. This is essentially the "do nothing" alternative, which reveals the LOS operating conditions if no further improvements are made within the corridor.

**Improvement Concept Development & Evaluation** – After evaluating the LOS operating conditions with future traffic with no improvement, various conventional and innovative alternative improvements/countermeasures were evaluated to assess their impact on the LOS operating conditions during the a.m. and p.m. peak periods for the future horizon years.

**Public Involvement/Outreach** – Following the analysis phase, the concepts and study findings were presented to the public in several formats, including Metropolitan Planning Organization (MPO) Board and MPO Committee meetings, a public workshop, and individualized meetings and/or presentations with stakeholders, area residents and business owners/operators.

## STUDY AREA

The study area for the Pine Ridge Road Corridor Congestion Study was established in consultation with Capital Project Planning, Impact Fees & Program Management Division staff, and includes the roadways and intersections shown in **Figure 1**. In addition to the mainline segments of Pine Ridge Road from west of Livingston Road to east of Napa Boulevard, the following signalized intersections within the corridor were included in the analysis:

- Pine Ridge Road at Livingston Road
- Pine Ridge Road at Whippoorwill Lane
- Pine Ridge Road at I-75 Southbound ramps
- Pine Ridge Road at I-75 Northbound Ramps
- Pine Ridge Road at Napa Boulevard

Although technically not part of the Pine Ridge Road infrastructure, a potential interconnection of Whippoorwill Lane and Marbella Lakes Drive was examined during the evaluation of alternatives to determine what, if any, impacts such a connection would have on any of the improvements being considered. All the concepts considered during the evaluation phase were evaluated with and without the potential interconnection. As a component of the potential interconnection, a traffic signal was included at the intersection of Marbella Lakes Drive and Livingston Road.

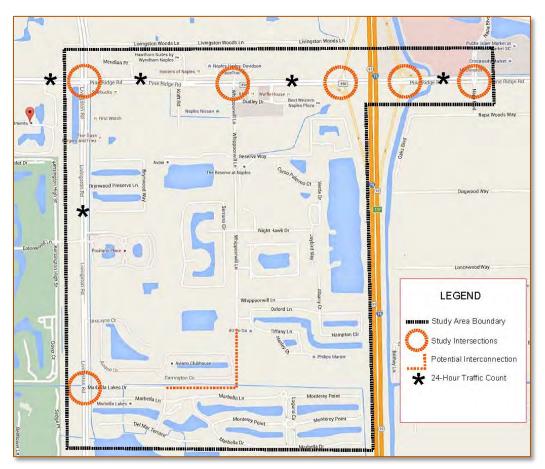


Figure 1: Study Area

The study area boundary also defined the lands that were directly impacting the corridor, and facilitated the gathering of land use data associated with undeveloped lands that could directly impact the corridor in the future.

#### LAND USE ANALYSIS

While existing traffic volumes provide the study with an excellent 2016 baseline condition, to fully understand the potential future traffic conditions (i.e., 2021 and 2040), it is important to recognize the potential impact of lands directly adjacent to the study area roadways and intersections.

All currently undeveloped parcels within the study area, with the potential for future development, were identified from aerial photographic imagery and analyzed for potential future trip generation. Land use data for future developments was acquired from a variety of sources, including Traffic Impact Statements collected by the County's Development Services Division for rezone and site development applications, PUD Monitoring Reports, Zoning Maps, the Future Land Use Map, etc.

All remaining undeveloped lands with the potential for future development were catalogued for evaluation. Vacant lands that were found to be open space/preserves, or otherwise not considered developable, were excluded.

Figure 2 illustrates the vacant lands that were identified within the study area.

**Table 1** reflects the land use analysis of undeveloped parcels, sorted by impact area. The potential future traffic impact was developed based upon current zoning or comprehensive plan entitlement categories, generally at the maximum residential density or non-residential intensity allowed by the entitlement instrument (e.g., PUD document) or land use category/designation (e.g., zoning district or Future Land Use Map designation). Potential trips were identified for daily traffic (AADT), and during the a.m. and p.m. peak hour conditions, and included estimates of traffic entering and exiting each site. Trip generation rates from the Institute of Traffic Engineer's *Trip Generation Manual, Ed. 9* were used in the analysis. The resulting trip generation values were evaluated later as part of the traffic forecasting phase to ensure the potential impacts of the undeveloped lands that would have a direct impact on the corridor were properly accounted for.

What is important to note here is the additional peak hour traffic volumes from potential development on currently undeveloped parcels that must use Whippoorwill Lane north and south of Pine Ridge Road that will have a direct impact on the operation of the Whippoorwill Lane/Pine Ridge Road intersection.

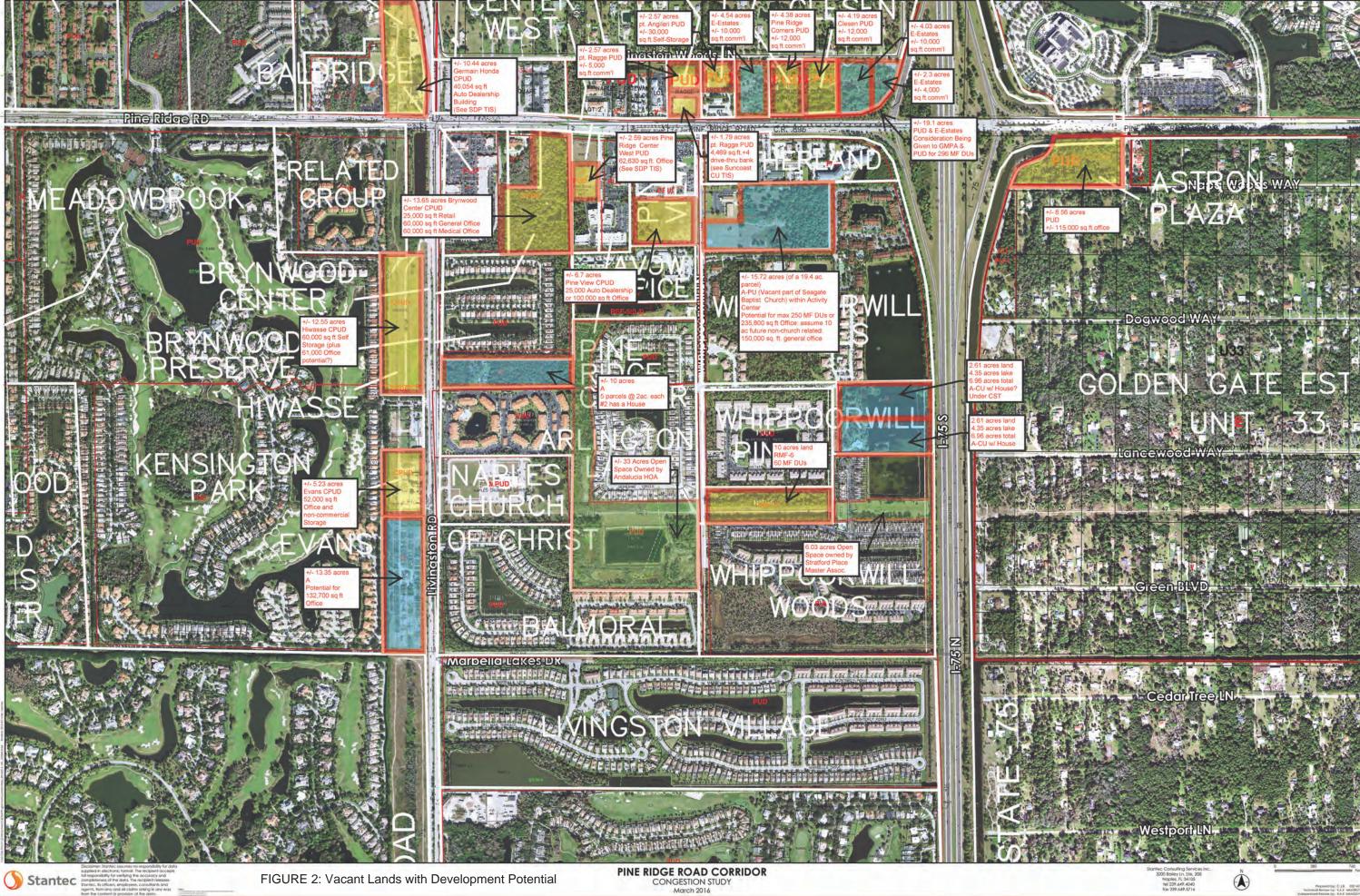


Table 1: Trip Generation Analysis of Vacant Lands

					Maximum					N		(Driveway			Ву	Net N	New Trips (L			
	Name	Zoning	ORD#	Acreage	Approved Sq.Ft.GFA	Realistic Sq.Ft.GFA	Other	Land Use Assumed	Notes	AADT	AM Enter	PkHr Exit	PM Pkl Enter	Hr Exit	-SS	AADT	AM Pki Enter	Hr Exit	PM I Enter	PkHr Exit
	Ragge (part of)	PUD	01-07	2.57		5,000	Other	Retail	Hotes	969	16	9	39		25%	727	12	7	29	32
ection	Suncoast CU (part of Ragge)	PUD	01-07	1.79	195,819	4,469	4	Drive-Thru Bank	Data from SDP Application	557	23	15	64	68	47%	295	12	8	34	36
sec Je R	Angileri (part of)	PUD	97-16	2.57	NA	30,000		Self-Storage	PUD allows 208,025 sqft on entire +/- 5ac	75	2	2	4	4	0%	75	2	2	4	4
Inter	1 Owner	E-Estates		4.54	NA	12,000 (3) (4)		Retail		1,712	27	16	69	76	25%	1,284	20	12	52	57
= = = = = = = = = = = = = = = = = = =	Pine Ridge Corners	PUD	98-61	4.38	12,000	12,000 (3) (4)		Retail		1,712	27	16	69	76	25%	1,284	20	12	52	57
Whippoorwill Intersection North of Pine Ridge Road	Clesen	PUD	05-48	4.19	40,000	12,000 (1) (4)		Retail	<sup>(1)</sup> +/- 175 H/M Units (FAR 0.60)	1,712	27	16	69	76	25%	1,284	20	12	52	57
) ) ) ) )	1 Owner	E-Estates		4.03	NA	12,000 (3) (4)		Retail		1,712	27	16	69	76	25%	1,284	20	12	52	57
Whipp	1 Owner	E-Estates		2.30	NA	6,000 (3) (4)		Retail		1,091	17	11	44	47	25%	818	13	8	33	35
≥ ×	Total									9,540	165	101	428	465		7,051	119	73	308	335
on	Pine View (part of)	CPUD	07-06	6.70	NA	100,000 (2)		Office	No rcent activity on the 25,743 sq ft Auto Dealership (Infinity) SDP last year. Worst case 100,000 sq ft office (15,000 sq ft per acre)	1,313	168	23	32	158	0%	1,313	168	23	32	158
ection	Seagate Baptist Church	A-CU		15.72	NA	235,800		office	10 ac. of Vacant 15.75 Ac.: 150,000 sq ft office (15,000 sq ft /ac)	1,787	233	32	42	204	0%	1,787	233	32	42	204
ers Jge	1 Owner	A-CU		6.96	NA			Existing SF Home Under CST	2.61 land + 4.35 water within AC Density band = 7 DU/ac (land are dictate +/- 20 DUs)	10	1	1	1	1	0%	10	1	1	1	1
Whippoorwill Intersection South of Pine Ridge Road	1 Owner	A-CU		6.96	NA			Existing SF Home	2.61 land + 4.35 water w/house within AC Density band = 7 DU/ac (land area dictates +/- 20 DUs)	-	-	-	-	-	0%	-	-	-	-	-
of Pine	Cayo Whippoorwill	RMF-6	06-81	10.00			60	MF Dwelling Units		412	6	28	27	13	0%	412	6	28	27	13
pood th of	Stratford Place Master Assoc	PUD		6.03	NA	NA			Open Space	-	-	-	-	-	0%	-	-	-	-	-
Whipp South	Andalucia HOA	PUD		33.00	NA	NA			Open Space	-	-	-	-	-	0%	-	-	-	-	-
> 01	Total									3,522	408	84	102	376		3,522	408	84	102	376
Pine Ridge Road	Brynwood Center	CPUD	12-37	13.65	145,000	145,000		25k sq ft Retail 60 K Sq Ft Gen. Office 60 K Sq Ft Med. Uses	Group Housing FAR = 0.60 and H/M 20u/ac, both reduce comm'l GFA by 12,083 sq ft/ac of GA or H/M	5,886	267	70	191	376 (	25% (Only Retail)	5,197	256	64	162	346
ne Rid Road	Pine Ridge Center West (part of)	PUD	01-09	2.59	40,000	62,630		Office	PUD allows 40 K Sq Ft on this parcel SDP Submitted for 62,630 (plus parking garage)	643	75	9	11	65	0%	643	75	9	11	65
Pir	Total									6,529	342	79	202	441		5,840	331	73	173	411
ad	Hiwasse	CPUD	04-75	12.55	91,000	60,000		Self-Storage	Maximum 91,000 sq ft Prof/Medical Office or maximum 200,000 sq ft self-storage; a mix exchange ratio of 1 sq ft office = 2 sq ft self-storage (SDP for 60,000 S-S leaves 61,000 Office avilable - Pre-App notes not clear if this SDP consumes entire parcel)	150	4	4	8	8	0%	150	4	4	8	8
n Rc	Evans	CPUD	07-48	5.23	52,000	52,000		Mixed office and non- comm'l storage uses		799	99	14	23	114	0%	799	99	14	23	114
stoi	Evans	А		13.35	NA	132,700		Mixed office and non- comm'l storage uses	Future GMPA and rezoning to Office/Self-Storage probable (same ratio of sq ft/ac as Evans PUD	1,628	211	29	39	188	0%	1,628	211	29	39	188
Livingston Road	3 Owners	А		10.00	NA		70	MF Dwelling Units	5 @ 2ac. Lots (1 lot w/house); May be within Density band @ 7 Du/ac = 70 DUs	472	7	32	30	15	0%	472	7	32	30	15
==	Naples Chruch of Christ	MPUD	08-62	19.10			200	ALF DUs	Existing Church (22,097 sq ft + 2 DUs); PUD also allows for 200 ALF DUs	454	24	12	29	29	0%	454	24	12	29	29
	Total									3,503	345	91	129	354		3,503	345	91	129	354
West	Germain Honda	CPUD	15-43	10.44	60,000	40,054		Auto Dealership	Data from SDP Application	999	37	(2)	28	40	0%	999	37	(2)	28	40
East	Astron Plaza	PUD	98-10	8.56	115,000	90,000		Medical Office		3,465	113	30	52	132	0%	3,465	113	30	52	132

 $<sup>^{(1)}</sup>$  4.19ac @ 0.60 FAR = 109,510 sq ft X .65 setaside for H/M rooms = 71,182 sq ft 71,182 sq ft / 400sq ft per room = +/- 178 H/M rooms

<sup>(2)</sup> PUD Monitoring Report confirms 51,343 sq ft built but does not indicate what the maximum over the entire site is

 $<sup>^{(3)}</sup>$  Discussions re: 296 MF residential development over entrie parcel

 $<sup>^{(4)}</sup>$  Could be combined together for single +/- 19.44 acre shopping center (+/- 150,000 sq ft)

#### TRAFFIC DATA COLLECTION

To establish a solid baseline of traffic data, a.m. and p.m. peak hour turning movement counts (TMCs) were collected at the six study area intersections. The a.m. and p.m. turning movement counts were conducted on Thursday March 10, 2016. The turning movement counts were taken during the a.m. peak period (7:00 a.m. to 9:00 a.m. and the p.m. peak period (4:00 p.m. to 6:00 p.m.) to quantify existing a.m. and p.m. peak-hour conditions. The turning movement counts at the intersections were then adjusted to peak-season volumes using the Florida Department of Transportation's (FDOT) peak-season conversion factors for Collier County.

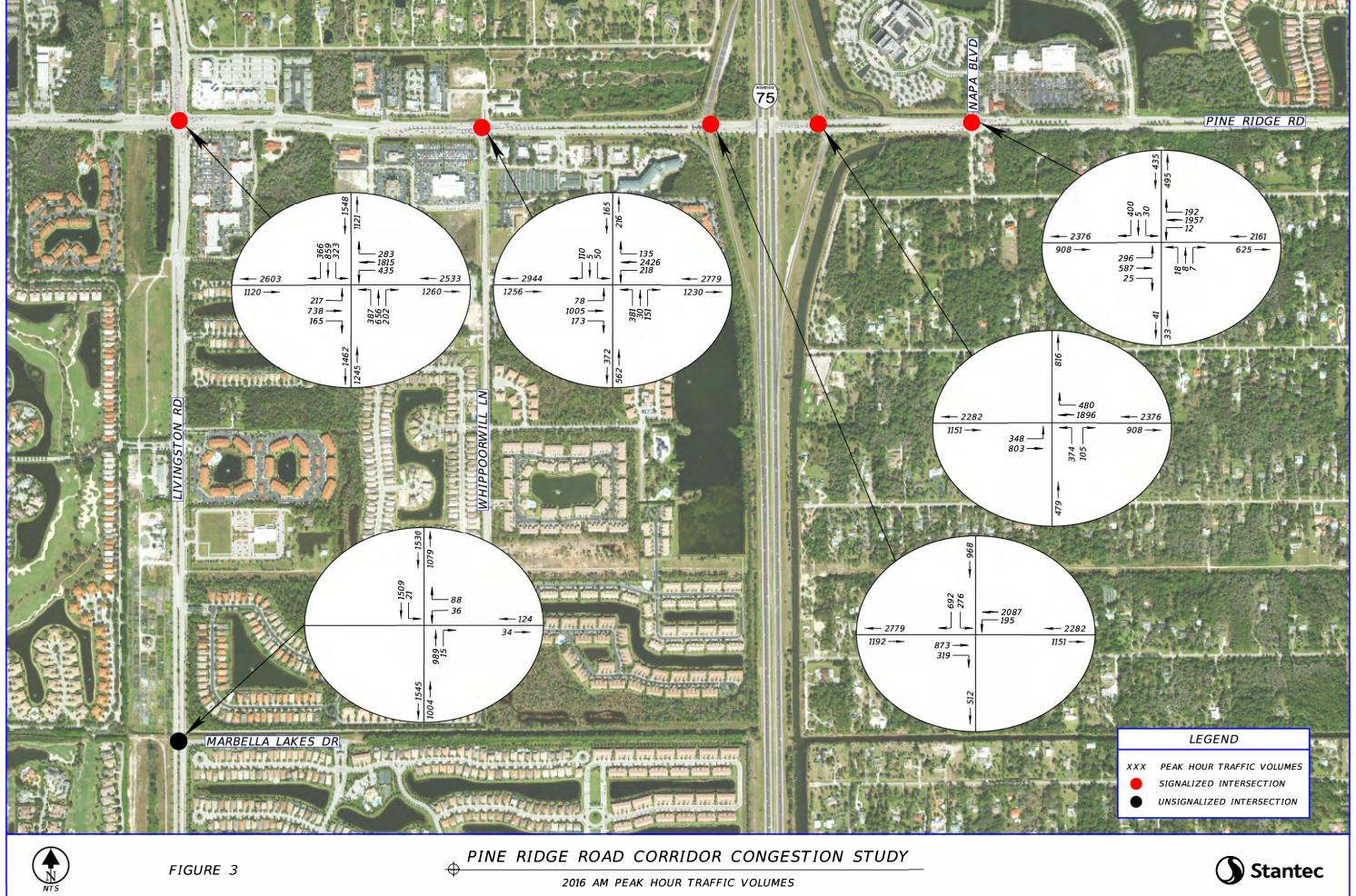
Mainline volumes on Pine Ridge Road were "smoothed" between upstream and downstream intersections where no mid-block driveway connections are present. This was done for the westbound direction between Whippoorwill Lane and Napa Boulevard and the eastbound direction between the I-75 SB Ramps and Napa Boulevard. The existing AM peak-hour peak-season traffic volumes are shown in **Figure 3** and the PM peak-hour peak-season traffic volumes are shown in **Figure 4**. The peak-season factors and turning movement counts are attached in **Appendix A**.

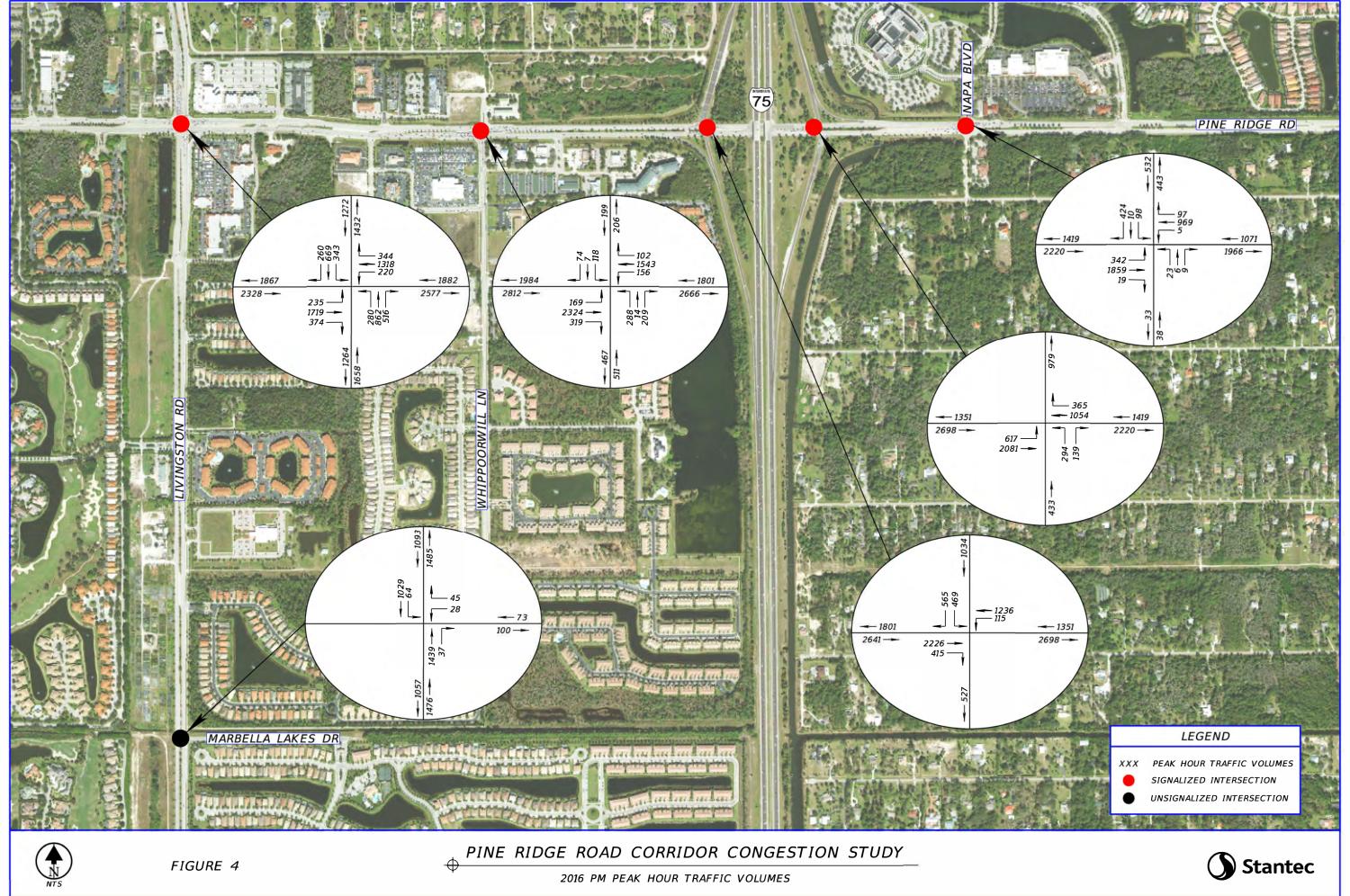
Additionally, 24-hour machine counts were collected at four locations on Pine Ridge Road and one location on Livingston Road. The machine counts were used to establish daily traffic volumes and used as a check that the turning movement volumes were recording demand and not saturated flow. The daily and peak-hour volumes are shown are summarized in **Table 2** and the 24-hour counts are attached in **Appendix B**. As shown in **Table 2**, the turning movement count volumes are in line with the machine count peak-hour volumes, and in the majority of the cases greater than the machine count peak-hour volumes, indicating that the turning movement counts were collecting demand volumes and not saturated flow at the intersection. The video recordings of the turning movement counts were also reviewed and confirmed this.

Table 2: Daily and Peak-Hour Volume Summary

			EB/NB Peak-	Hour Volume	WB/SB Peak-	Hour Volume
Location	2016 ADT	Time Period	From Machine Count <sup>1</sup>	From TMC <sup>12</sup>	From Machine Count <sup>1</sup>	From TMC <sup>2</sup>
Pine Ridge Rd b/t Napa Blvd and	44,200	AM Peak-Hour	932	908	2,269	2,376
I-75 NB Ramps	44,200	PM Peak-Hour	2,148	2,220	1,352	1,419
Pine Ridge Rd west of I-75 SB Ramps	55,500	AM Peak-Hour	1,202	1,211	2,724	2,779
Pille Ridge Rd West Of 1-73 35 Ramps	55,500	PM Peak-Hour	2,531	2,654	1,726	1,801
Pine Ridge Rd west of Kraft Rd	60,000	AM Peak-Hour	1,234	1,258	2,966	2,739
Fille Ruge Ru West of Mait Ru	00,000	PM Peak-Hour	2,611	2,695	1,961	1,933
Pine Ridge Rd west of La Costa Cir	55,200	AM Peak-Hour	1,092	1,120	2,463	2,603
Fille Ridge Rd West Of La Costa Cil	55,200	PM Peak-Hour	2,314	2,328	1,725	1,867
Livingston Rd north of Eatonwood Ln	31,400	AM Peak-Hour	1,197	1,162	1,476	1,496
Livingston Ru Hortif of Eatonwood Eff	31,400	PM Peak-Hour	1,507	1,572	1,121	1,179

- 1. Adjusted to peak-season volumes
- 2. Average of approaching and departing traffic volumes





## **EXISTING CONDITIONS ANALYSIS**

Using the peak-hour turning movement volumes shown in **Figure 3** and **Figure 4**, an existing conditions analysis was performed. The analysis was performed using Trafficware's Synchro 9 Software. As part of the analysis, existing lane geometry and signal timing data was used. The signal timing data is attached in **Appendix C**.

Collier County has adopted an overall intersection level-of-service standard of 'E'. In addition to the overall delay, the approach level of service at the intersection must be 'E' or better with each movement having a volume to capacity (v/c) ratio less than 1.0. The results of the Synchro intersection analysis are summarized in **Table 3** and the Synchro intersection worksheets are attached in **Appendix D**.

**Table 3: 2016 Existing Intersection Conditions** 

latera estica	Time a Dania d	Overall Inter	rsection LOS	Delay	Max v/c	ļ	Approa	ich LO	S
Intersection	Time Period	Standard	Existing	(sec/veh)	Ratio	EB	WB	NB	SB
Pine Ridge Rd &	AM Peak-Hour	E	D	53.5	1.00	D	D	Е	E
Livingston Rd	PM Peak-Hour	E	E	55.3	1.05	D	D	E	E
Pine Ridge Rd &	AM Peak-Hour	E	D	35.6	0.89	С	С	Е	D
Whippoorwill Ln	PM Peak-Hour	E	С	24.7	0.82	В	С	Е	E
Pine Ridge Rd &	AM Peak-Hour	E	D	35.4	0.91	D	С		E
I-75 SB Ramp	PM Peak-Hour	E	С	29.3	0.87	С	С		D
Pine Ridge Rd &	AM Peak-Hour	E	С	29.9	0.92	С	С	E	
I-75 NB Ramp	PM Peak-Hour	E	С	25.1	0.70	В	D	D	
Pine Ridge Rd &	AM Peak-Hour	E	D	39.8	1.20	D	В	D	F
Napa Blvd	PM Peak-Hour	E	С	21.4	0.88	В	В	D	D
Livingston Rd &	AM Peak-Hour	E	n/a	26.2 <sup>1</sup>	0.34		D	2	$C^3$
Marbella Lakes Dr	PM Peak-Hour	E	n/a	57.9 <sup>1</sup>	0.51		F	2	$D^3$

- 1. Delay shown for the worst approach
- 2. No left-turn movement for approach
- 3. Left-turn movement level-of-service

As shown in **Table 3**, the following deficiencies were identified:

- Pine Ridge Road & Livingston Road
  - o During the a.m. peak-hour the SB through movement is operating at LOS F with a v/c ratio of 1.0.
  - o During the p.m. peak-hour the NB through movement is operating at LOS F with a v/c ratio of 1.05.
- Pine Ridge Road & Napa Boulevard
  - o During the a.m. peak-hour the SB right movement is operating at LOS F with a v/c ratio of 1.20.

- Livingston Road & Marbella Lakes Drive
  - o During the p.m. peak-hour the WB approach has an LOS of F, but the v/c ratio is only 0.51, indicating available capacity still exists.

#### FUTURE YEAR TRAFFIC ESTIMATION

Early in the study, to quickly understand the traffic growth that could be expected within the study area, the 2016 AUIR seasonal traffic count data (Station #628) was compared to the Collier MPO's 2040 model peak season daily volume forecast. The comparison revealed between 2016 and 2040, 24-hour traffic volumes on Pine Ridge Road would grow from 55,100 to 75,200, a 37% increase in daily volumes. The 2-way p.m. peak hour traffic (i.e., during evening rush hour) is expected to increase by 25%, from 4,650 to 5,813 over the same period.

Future year traffic volumes were then developed for the interim year 2021, and the horizon year 2040, using the MPO's travel demand model, the Collier County 2016 AUIR's short range forecasts, and historical growth trends. The growth in traffic within the corridor is a combination of traffic heading to and from the interstate, through traffic traveling to from points east and west of the study area, and traffic from additional development within the study area. Future-year volumes were developed for the mainline segments (approaches to the intersections) and for the turning movements at the study area intersections for the year 2021 and the horizon year of 2040.

FDOT has nine count stations within the study area, three on Pine Ridge Road, two on Livingston Road, and one at each of the on/off ramps at the I-75/Pine Ridge Road interchange. Historic growth within the study area indicates an average growth rate of 0.45% annually. Using the FDOT *Traffic Trends Analysis Tool*, the historic count data in conjunction with the FDOT District 1 Regional Planning Model (D1RPM) 2040 future year forecasts indicate an average growth rate of 1.46% annually. The historic and future growth rates are summarized in **Table 4** and the supporting data is attached in **Appendix E**.

**Table 4: Historic and Future Growth Rate Summary** 

Location	Station	2001	2005	2008	2015	2040 FSUTMS AADT <sup>1</sup>	Historic Growth Rate	Future Growth Rate
Pine Ridge Rd, E of Airport Rd	030160	52,500	57,000	46,000	55,500	57,700	0.40%	0.24%
Pine Ridge Rd, E of Livingston Rd	034628			58,500	56,000	62,000	-0.62%	0.56%
Pine Ridge Rd, W of Logan Blvd	034526			39,500	38,500	49,600	-0.37%	1.30%
Livingston Rd, N of Pine Ridge Rd	034575			27,000	24,500	52,200	-1.38%	3.22%
Livingston Rd, N of Golden Gate Pkwy	034690			26,000	23,000	49,300	-1.74%	3.25%
I-75 SB Off-Ramp at Pine Ridge Rd	037024		8,700	9,200	12,000	12,400	3.27%	1.16%
I-75 SB On-Ramp at Pine Ridge Rd	037022		3,300	4,600	5,900	6,400	5.98%	0.81%
I-75 NB On-Ramp at Pine Ridge Rd	037023		8,300	8,700	10,500	15,800	2.38%	2.22%
I-75 NB Off-Ramp at Pine Ridge Rd	037021		3,200	4,200	4,900	5,500	4.35%	0.68%
TOTAL		52,500	80,500	223,700	230,800	310,900	0.45%	1.46%

<sup>1.</sup> Converted to AADT using a model output conversion factor of 0.88

A base growth rate of 1.0% annually was used to estimate future traffic volumes. During the land use analyses phase of the study, trip generation values were developed for all vacant developable land that would have a direct impact on the corridor. This data was used to ensure that the future year forecasts adequately accounted for that additional direct traffic growth, especially at the intersections within the study area. It was assumed that by 2021, 20% of the vacant land trip generation would be present within the study area and by 2040 100% of the vacant land trip generation would be present within the study area. In cases where the trip generation from the vacant land was greater than the forecast with the 1.0% annual growth rate for a specific intersection movement, the annual growth rate was increased to represent the additional growth from the vacant land.

The equivalent future year growth rates from vacant land trip generation at each intersection are attached in **Appendix F**. The 2021 AM peak-hour traffic volumes are shown in **Figure 5**, the 2021 PM peak-hour traffic volumes are shown in **Figure 6**, the 2040 AM peak-hour traffic volumes are shown in **Figure 7**, and the 2040 PM peak-hour traffic volumes are shown in **Figure 8**. The intersection volume tables showing how the volumes were developed are attached in **Appendix G**.

Collier County has long considered a potential interconnection between Marbella Lakes Drive and Whippoorwill Lane. For the context of this study, it was important to understand the impacts, if any, the interconnection would have on future traffic volumes within the study area. The MPO's travel demand model was used to simulate the impacts of interconnecting Marbella Lakes Drive and Whippoorwill Lane. With an interconnection, the model predicts an increase of approximately 2,000 vehicles per day on Marbella Lakes Drive, and Whippoorwill Lane and Livingston Road are estimated to have a decrease in traffic of approximately 7% and 9%, respectively. Based on the modeling, it estimated there will be 10% shift of traffic from the Pine Ridge Road/Whippoorwill Lane intersection to the Livingston Road/Marbella Lakes Drive intersection. The following adjustments were made to future traffic volumes for testing the alternatives with the interconnection in place:

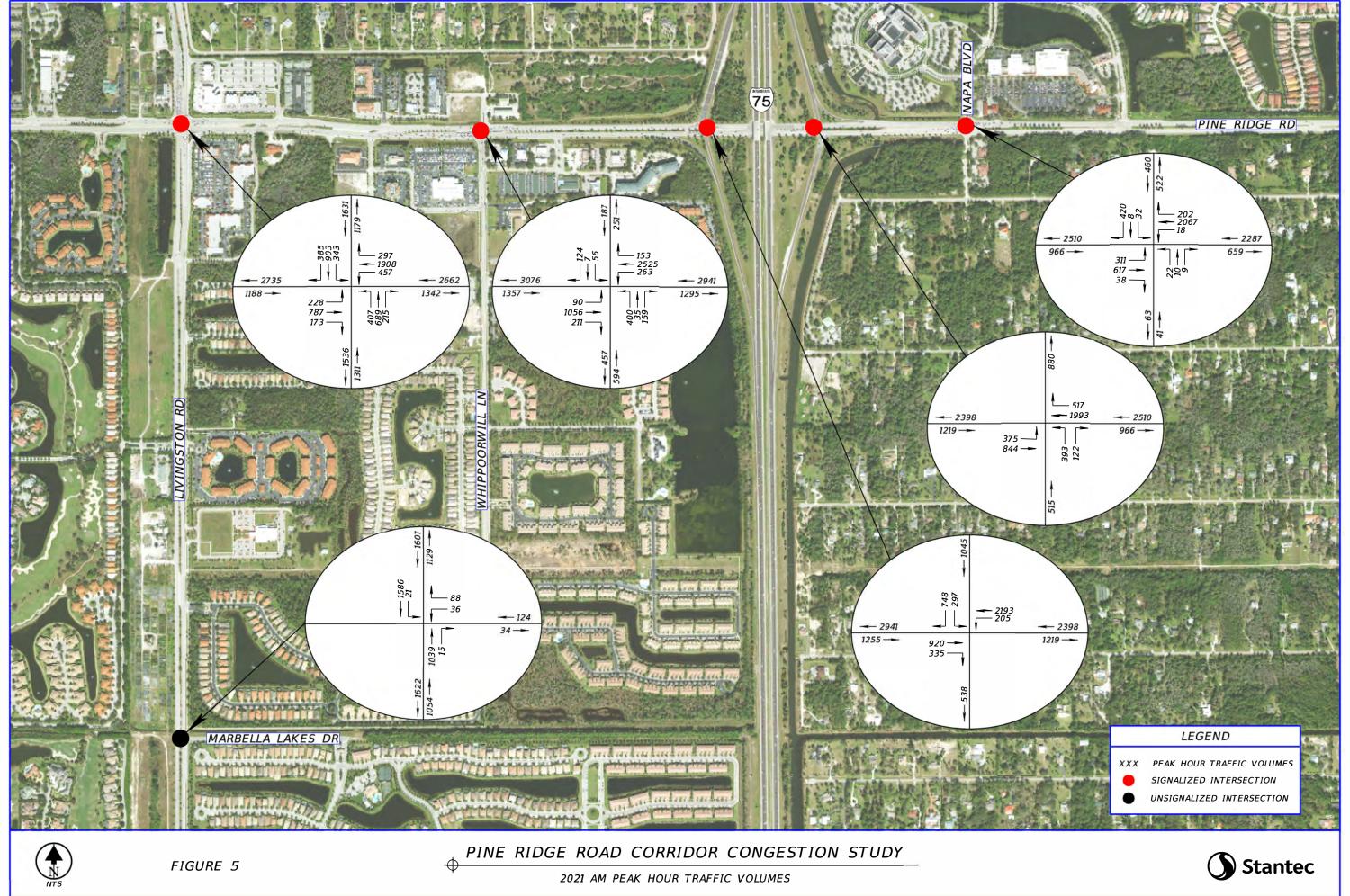
#### Pine Ridge Road/Whippoorwill Lane

Northbound Left: 10% decrease
Eastbound Right: 10% decrease
Westbound Left: 10% increase

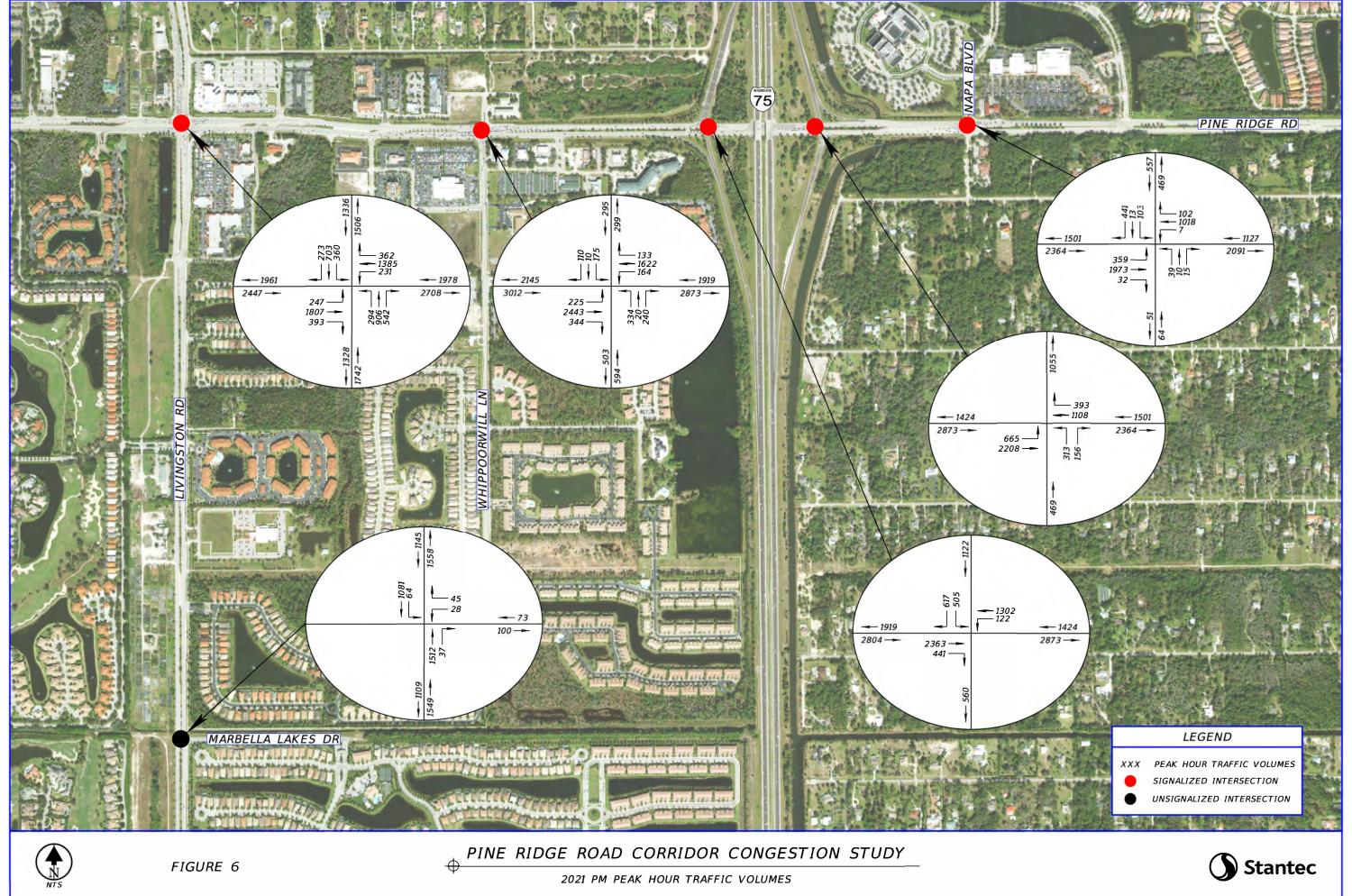
#### Livingston Road/Marbella Lakes Drive

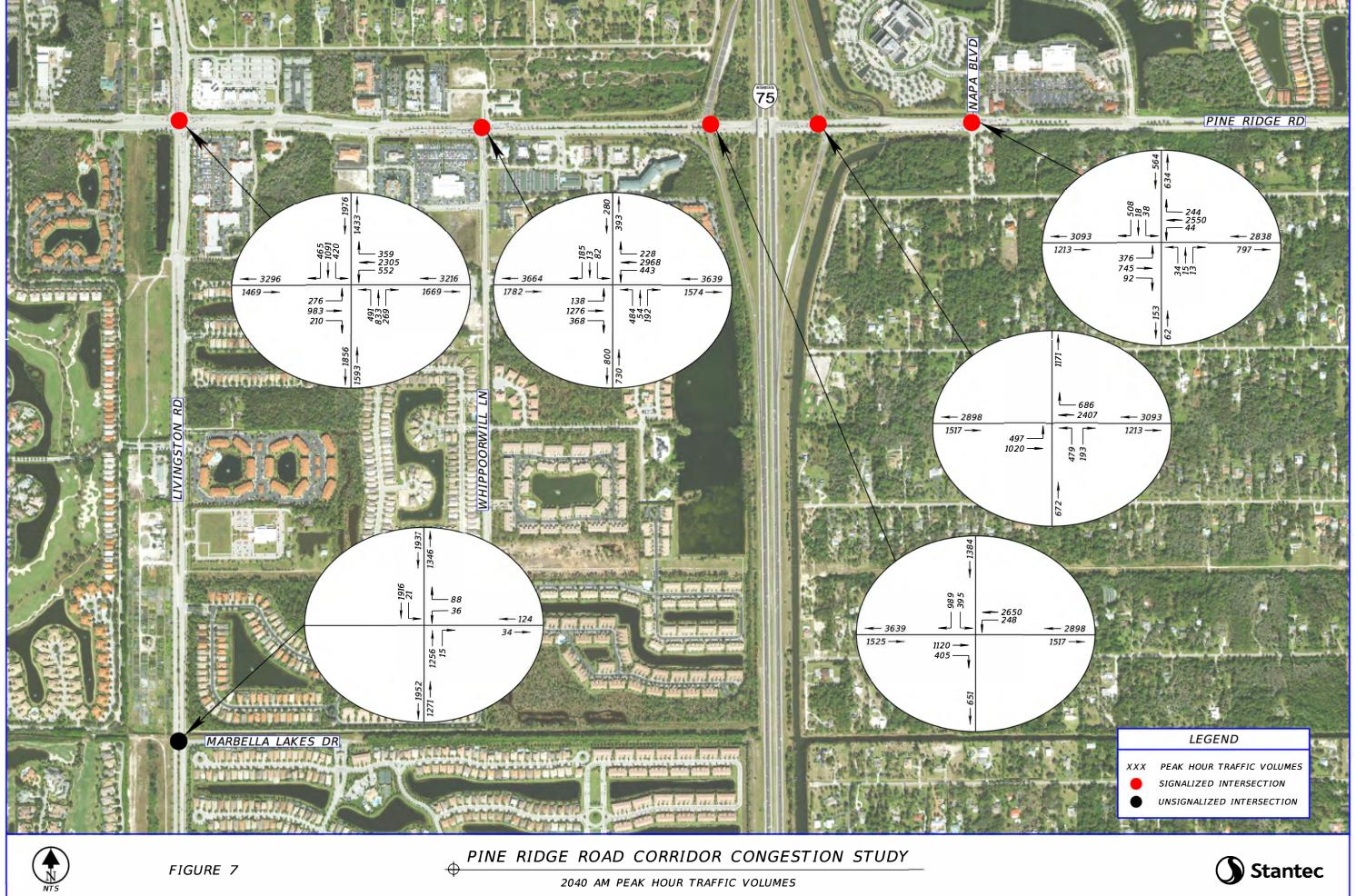
Northbound Right: 10% increase
Southbound Left: 10% decrease
Westbound Left: 10% increase

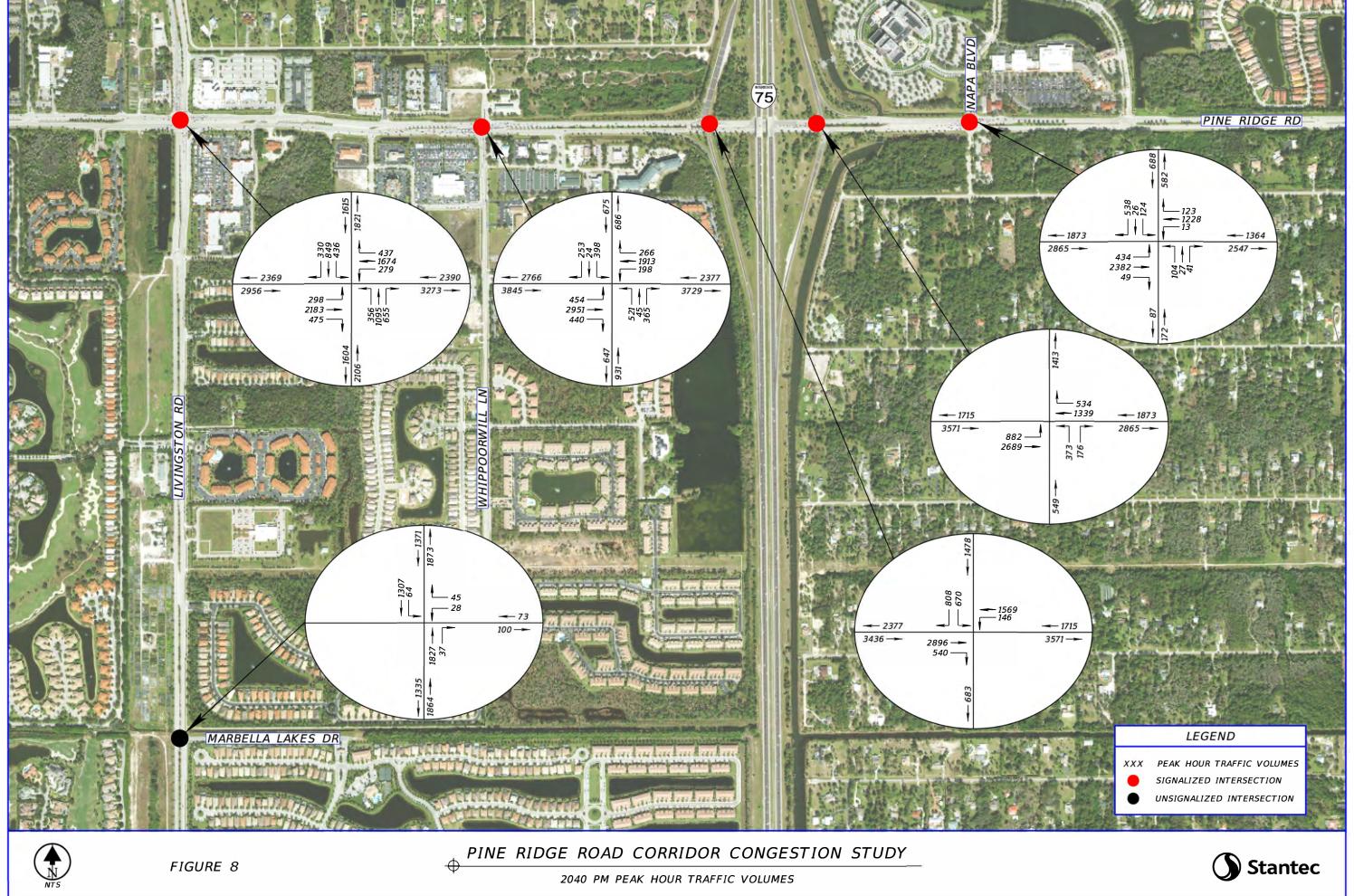
The model plots with and without the interconnection are attached in Appendix E.



12:34:48 PM







#### FUTURE YEAR "NO-BUILD" ANALYSIS

A "no-build" analysis was conducted with the forecasted 2021 and 2040 traffic volumes for each intersection within the study area to better understand the level of congestion in the future if no improvements were made. This analysis serves as the starting point for determining what improvements are needed to return the LOS to acceptable levels. The intersection analysis was again performed using Trafficware's Synchro 9 Software. The future conditions analysis used the same geometry and signal timing as the existing conditions. The results of the 2021 no-build intersection analysis are summarized in **Table 5** and the Synchro intersection worksheets are attached in **Appendix H1**.

Table 5: 2021 No-Build Intersection Conditions

luta va a dia va	Time a Davia d	Overall Inte	rsection LOS	Delay	Max v/c	Þ	Approa	ich LO	s
Intersection	Time Period	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB
Pine Ridge Rd &	AM Peak-Hour	E	E	58.7	1.09	D	D	Е	F
Livingston Rd	PM Peak-Hour	E	E	58.6	1.13	D	D	F	E
Pine Ridge Rd &	AM Peak-Hour	E	D	38.7	0.92	D	С	Е	D
Whippoorwill Ln	PM Peak-Hour	E	С	32.6	0.97	С	С	Е	F
Pine Ridge Rd &	AM Peak-Hour	E	D	37.4	0.99	С	С		E
I-75 SB Ramp	PM Peak-Hour	E	С	33.2	0.93	С	С		D
Pine Ridge Rd &	AM Peak-Hour	E	С	34.0	0.97	С	С	Е	
I-75 NB Ramp	PM Peak-Hour	E	С	26.8	0.74	В	D	Е	
Pine Ridge Rd &	AM Peak-Hour	E	D	46.1	1.34	D	В	E	F
Napa Blvd	PM Peak-Hour	E	С	23.1	0.89	В	В	D	D
Livingston Rd &	AM Peak-Hour	E	n/a	29.0 <sup>1</sup>	0.38		D	2	$C_3$
Marbella Lakes Dr	PM Peak-Hour	E	n/a	72.9 <sup>1</sup>	0.61		F	2	$D^3$

- 1. Delay shown for the worst approach
- 2. No left-turn movement for approach
- 3. Left-turn movement level-of-service

As shown in **Table 5**, the following deficiencies were identified:

- Pine Ridge Road & Livingston Road
  - o During the a.m. peak-hour the SB through movement is operating at LOS F with a v/c ratio of 1.0
  - During the p.m. peak-hour the NB through movement is operating at LOS F with a v/c ratio of 1.05.

- Pine Ridge Road & Whippoorwill Lane
  - o During the p.m. peak-hour the SB left movement is operating at LOS F which causes the southbound approach to fail. The v/c ratio is 0.97 indicating that the movement is at capacity.
- Pine Ridge Road & Napa Boulevard
  - o During the a.m. peak-hour the SB right movement is operating at LOS F with a v/c ratio of 1.34.
- Livingston Road & Marbella Lakes Drive
  - o During the p.m. peak-hour the WB approach has an LOS of F, but the v/c ratio is only 0.61, indicating available capacity still exists.

The deficiencies identified in the 2021 no-build intersection analysis can be mitigated by implementing signal timing adjustments. They include changing the cycle length to 140 seconds, optimizing the phase splits, and optimizing cycle offsets. The results of the changes are shown in **Table 6** and indicate that all intersections are anticipated to operate at acceptable level-ofservice standards. The Synchro intersection worksheets with signal timing adjustments are attached in **Appendix H2**.

Table 6: 2021 No-Build Intersection Conditions with Optimized Signal Timing

Intersection	Time Period	Overall Inte	rsection LOS	Delay	Max v/c	ļ	Approa	ch LO	S
mersection	nime Penoa	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB
Pine Ridge Rd &	AM Peak-Hour	E	D	48.3	0.96	D	С	Е	Е
Livingston Rd	PM Peak-Hour	E	D	45.2	0.95	D	С	E	Е
Pine Ridge Rd &	AM Peak-Hour	Е	С	28.7	0.96	В	С	E	D
Whippoorwill Ln	PM Peak-Hour	E	С	31.7	0.93	С	В	E	Е
Pine Ridge Rd &	AM Peak-Hour	E	С	24.8	0.87	Α	С		D
I-75 SB Ramp	PM Peak-Hour	E	С	20.6	0.93	Α	С		D
Pine Ridge Rd &	AM Peak-Hour	E	С	23.2	0.92	С	В	Е	
I-75 NB Ramp	PM Peak-Hour	E	С	21.3	0.92	В	С	E	
Pine Ridge Rd &	AM Peak-Hour	E	D	36.2	0.97	D	С	D	Е
Napa Blvd	PM Peak-Hour	E	С	22.2	0.90	В	В	D	D

The results of the 2040 no-build intersection analysis are summarized in **Table 7**. As shown in **Table 7**, the following deficiencies were identified:

- Pine Ridge Road & Livingston Road
  - o During the a.m. peak-hour the overall intersection, WB through, NB left, NB through, SB through, and SB right movements are operating at LOS F with v/c ratios greater than 1.0.
  - o During the p.m. peak-hour the overall intersection, EB through, NB through, SB left, and SB through movements are operating at LOS F with v/c ratios greater than 1.0.

- Pine Ridge Road & Whippoorwill Lane
  - o During the a.m. peak-hour the WB left, WB through, and NB left movements are operating at LOS F with v/c ratios greater than 1.0.
  - o During the p.m. peak-hour the overall intersection, EB left, EB through, NB left, NB through, and SB left movements are operating at LOS F with v/c ratios greater than 1.0.
- Pine Ridge Road & I-75 SB Ramp
  - o During the a.m. peak-hour the SB right movement is operating at LOS F with a v/c ratio of 1.31.
  - o During the p.m. peak-hour the EB through and SB right movements are operating at LOS F with v/c ratios greater than 1.0.
- Pine Ridge Road & I-75 NB Ramp
  - o During the a.m. peak-hour the overall intersection, WB through, and NB left movements are operating at LOS F with v/c ratios greater than 1.0.
- Pine Ridge Road & Napa Boulevard
  - o During the a.m. peak-hour the EB left and SB right movements are operating at LOS F with v/c ratios greater than 1.0.
- Livingston Road & Marbella Lakes Drive
  - o During the p.m. peak-hour the WB approach has an LOS of F, but the v/c ratio is only 0.61, indicating available capacity still exists.
  - o During the p.m. peak-hour the WB approach is operating at LOS F with a v/c ration of 1.35.

Table 7: 2040 No-Build Intersection Conditions

lutana atian	Time a Davia d	Overall Inte	rsection LOS	Delay	Max v/c	ļ	Approa	ich LO	S
Intersection	Time Period	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB
Pine Ridge Rd &	AM Peak-Hour	E	F	94.8	1.32	D	Е	F	F
Livingston Rd	PM Peak-Hour	E	F	87.4	1.37	Е	D	F	F
Pine Ridge Rd &	AM Peak-Hour	E	E	73.6	1.12	D	Е	F	E
Whippoorwill Ln	PM Peak-Hour	E	F	107.0	2.22	F	D	F	F
Pine Ridge Rd &	AM Peak-Hour	E	E	55.9	1.31	С	С		F
I-75 SB Ramp	PM Peak-Hour	E	E	70.9	1.14	F	С		E
Pine Ridge Rd &	AM Peak-Hour	E	F	92.4	1.20	С	F	F	
I-75 NB Ramp	PM Peak-Hour	E	D	36.6	0.92	В	E	Е	
Pine Ridge Rd &	AM Peak-Hour	E	E	69.4	1.74	D	С	E	F
Napa Blvd	PM Peak-Hour	E	С	34.7	0.98	С	С	Е	Е
Livingston Rd &	AM Peak-Hour	E	n/a	50.5 <sup>1</sup>	0.61		F	2	$C_3$
Marbella Lakes Dr	PM Peak-Hour	E	n/a	236.3 <sup>1</sup>	1.35		F	2	F <sup>3</sup>

- 1. Delay shown for the worst approach
- 2. No left-turn movement for approach
- 3. Left-turn movement level-of-service

Unlike the 2021 no-build conditions, the deficiencies identified in the 2040 no-build analysis will require major capacity improvements to mitigate the deficiencies. The Synchro intersection worksheets are attached in **Appendix I**.

#### 2040 BUILD ANALYSIS

By first analyzing future no-build conditions, the future operating conditions establish a baseline condition from which to work. Potential solutions/countermeasures to remedy the LOS deficiencies in the year 2040 were identified and divided into "conventional" improvements and "innovative" improvements for evaluation and analysis.

## Conventional Intersection Analysis

Conventional improvements are those types of alternatives customarily associated with increasing highway capacity. The conventional improvements considered included expanding Pine Ridge Road from 6-lanes to 8-lanes from west of Livingston Road to east of Napa Boulevard, and adding additional left turn lanes as needed at the intersections. In addition to adding a fourth eastbound and westbound through lane on Pine Ridge Road, at study area intersections the following additional improvements were identified as being needed to add sufficient capacity to restore an acceptable LOS:

- Pine Ridge Road & Livingston Road
  - o none
- Pine Ridge Road & Whippoorwill Lane
  - o Dual EB left turn lanes
  - o Dual SB left turn lanes
  - o NB right turn lane
- Pine Ridge Road & I-75 SB Ramp
  - o none
- Pine Ridge Road & I-75 NB Ramp
  - o none
- Pine Ridge Road & Napa Boulevard
  - o EB through lane becomes the outside dual left turn lane
  - o Added SB right turn overlap phase
- Livingston Road & Marbella Lakes Drive
  - o Signalize

The intersection analysis was again performed using Trafficware's Synchro 9 Software. The results of the conventional intersection improvements are shown in **Table 8** and indicate that all intersections are anticipated to operate at acceptable level-of-service standards. While the northbound approach at the Pine Ridge Road/Napa Boulevard intersection is operating at level-of-service F during the p.m. peak-hour, the v/c ratio is 0.82 indicating available capacity still exists. The Synchro intersection worksheets are attached in **Appendix J**.

Table 8: 2040 Intersection Conditions with Conventional Improvements

luda wa a alia w	Time a Davia d	Overall Inte	rsection LOS	Delay	Max v/c	ļ	Approa	ch LO	S
Intersection	Time Period	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB
Pine Ridge Rd &	AM Peak-Hour	E	E	60.0	0.99	E	D	E	Е
Livingston Rd	PM Peak-Hour	E	D	54.6	0.97	E	С	E	Е
Pine Ridge Rd &	AM Peak-Hour	E	D	44.0	0.92	D	D	E	E
Whippoorwill Ln	PM Peak-Hour	E	D	44.9	0.98	D	С	E	Е
Pine Ridge Rd &	AM Peak-Hour	E	D	37.6	0.99	В	D		E
I-75 SB Ramp	PM Peak-Hour	E	С	28.8	0.96	В	С		D
Pine Ridge Rd &	AM Peak-Hour	E	С	29.9	0.98	D	В	E	
I-75 NB Ramp	PM Peak-Hour	E	С	24.8	0.90	В	С	E	
Pine Ridge Rd &	AM Peak-Hour	E	D	38.3	0.91	С	D	E	Е
Napa Blvd	PM Peak-Hour	E	С	25.2	0.82	В	С	F	D
Livingston Rd &	AM Peak-Hour	E	А	6.1	0.53		В	Α	Α
Marbella Lakes Dr	PM Peak-Hour	E	А	6.4	0.51		В	Α	Α

In evaluating these alternatives, it was clear that adding additional travel lanes to the mainline, and adding additional turn lanes to the intersections will require a substantial amount of additional right-of-way, impact businesses, and require the expansion of the existing bridge structures over Pine Ridge Road at I-75.

## Innovative Intersection Analysis

To find solutions to minimize impacts to adjacent property owners, the team developed several "innovative intersection" approaches that would reduce the congestion at the intersections and improve overall level-of-service throughout the corridor beyond the 2040 horizon year. Innovative intersections enhance the operational efficiency of the major intersection by reducing or eliminating some of the traffic signal phases that "steal" green time from the main street through movements. A signal's cycle length is the amount of time, e.g., 120 seconds, it takes to serve all protected phases. At a conventional multi-phased signal, the largest volumes of traffic (the main street through movements) are stopped while the protected major street left turn phases and minor street left turn and through phases are served.

As an example, at an intersection like Pine Ridge Road (PRR) and Livingston Road (LR), if a signal with 120 second cycle length had to serve only north/south and east/west through movements (no turns allowed), each through movement direction would be given almost a full minute of green time plus yellow, as shown in **Figure 9**.

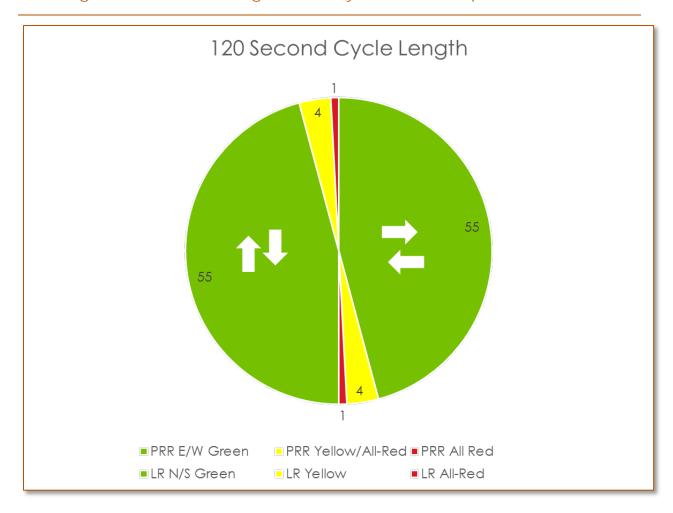


Figure 9: Example 2-Phase Traffic Signal Cycle

However, to accommodate protected left turns, green time is "stolen" from the through movement phases, in this example shown in **Figure 10**, reducing the time given to each through movement's green phase by as much as 30%. It is this stolen green time for the major movements that leads to congestion. Additionally, the more phases during a signal, the more lost time that is experienced by vehicles. Lost time is the time during which no vehicles can pass through an intersection and is made up of two separate elements; start-up lost time and clearance lost time. Recovering that stolen green time and reducing the lost time is the value in the innovative intersection concept.

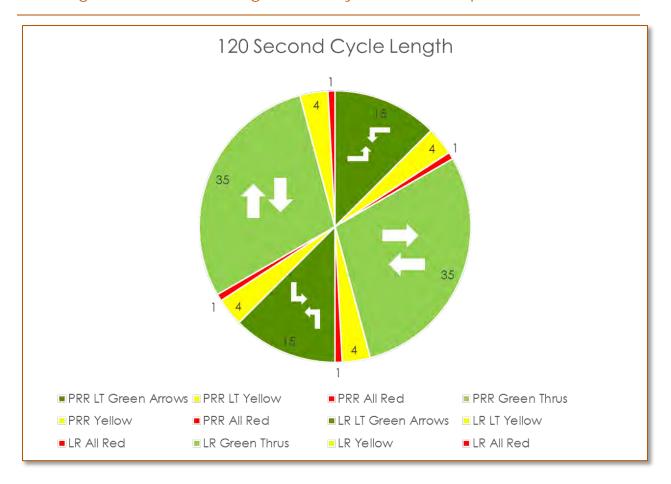


Figure 10: Example 4-Phase Traffic Signal Cycle

While these innovative intersection concepts may be new to Florida, they have demonstrated operational success at locations throughout the Country, and are recognized by State Departments of Transportation and the Federal Highway Administration as viable solutions to the congestion problems faced in urban and suburban areas. Additionally, the innovative concepts generally improve the safety profile of the intersections for motorists and pedestrians/cyclist by reducing the number of conflict points where vehicular (and pedestrian) travel paths cross.

The innovative intersections evaluated include:

- 1. Pine Ridge Road at Livingston Road Intersection
  - Livingston Road Continuous Flow Intersection (CFI) (aka, Displaced Left Turn Intersection)
    - Partial CFI with advance intersections on Livingston Road north and south of the main intersection.
  - Livingston Road Jug Handle Intersection (aka, Quadrant Intersection)
    - Jug Handle created in the southwest quadrant of the intersection with advance intersections on Livingston Road south of the main intersection, and on Pine Ridge Road west of the main intersection.

- Livingston Road Single Point Urban Interchange (SPUI) (aka, Overpass or Underpass)
  - Livingston Road through traffic passes over/under Pine Ridge Road to avoid stopping.
- 2. Pine Ridge Road at Whippoorwill Lane
  - Restricted Crossover U-Turn (RCUT) Intersection (aka, Superstreet), with advance U-turn intersections on Pine Ridge Road east and west of the main intersection.
- 3. Pine Ridge Road at I-75 SB and NB Ramps
  - Diverging Diamond Interchange (DDI)

#### Continuous Flow Intersection

The first innovative solution evaluated included a partial CFI at the Pine Ridge Road/Livingston Road intersection in conjunction with the RCUT and DDI. Because additional through lanes on Pine Ridge Road are not being proposed as part of the innovative solutions, the only improvement evaluated at the Pine Ridge Road/Napa Boulevard intersection was the SB right turn overlap phase. The intersection analysis was again performed using Trafficware's Synchro 9 Software. The results for the innovative intersection set including the CFI, RCUT and DDI are shown in **Table 9**, and indicate that all intersections are anticipated to operate at acceptable level-of-service standards.

Like the conventional intersection analysis, the northbound approach at the Pine Ridge Road/Napa Boulevard intersection is operating at level-of-service F during the p.m. peak-hour, but the v/c ratio is 0.85, indicating available capacity still exists.

It should be noted that the U-turn movement at the advance RCUT intersection east of Whippoorwill Lane is at capacity during the a.m. peak-hour. The Synchro intersection worksheets are attached in **Appendix K1** and **K2**.

Table 9: 2040 Intersection Conditions with Innovative Improvements (CFI, RCUT, DDI)

1	Time a Davida I	Overall Inte	rsection LOS	Delay	Max v/c	F	Approa	ich LO	S
Intersection	Time Period	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB
Advance CFI Int.	AM Peak-Hour	E	В	10.2	0.77		D	Α	Α
N. of Pine Ridge Rd	PM Peak-Hour	E	В	11.6	0.78		D	Α	В
Pine Ridge Rd &	AM Peak-Hour	E	D	47.6	0.95	D	D	D	Е
Livingston Rd	PM Peak-Hour	E	D	46.6	0.94	D	D	E	D
Advance CFI Int.	AM Peak-Hour	E	А	9.6	0.53	D		В	Α
S. of Pine Ridge Rd	PM Peak-Hour	E	В	10.5	0.82	D		Α	Α
Advance RCUT Int. W. of Whippoorwill	AM Peak-Hour	E	А	2.0	0.77	Α	E <sup>1</sup>		
Ln	PM Peak-Hour	E	С	34.1	0.96	D	E <sup>1</sup>		
Pine Ridge Rd &	AM Peak-Hour	E	В	16.5	0.92	В	А	Е	E
Whippoorwill Ln	PM Peak-Hour	E	D	46.2	0.99	E	В	E	E
Advance RCUT Int.	AM Peak-Hour	E	С	24.5	1.00	F <sup>1</sup>	С		
E. of Whippoorwill Ln	PM Peak-Hour	E	А	6.7	0.79	$D^1$	Α		
Pine Ridge Rd &	AM Peak-Hour	E	С	27.8	0.96	D	С		D
I-75 SB Ramp	PM Peak-Hour	E	В	19.5	0.89	С	В		С
Pine Ridge Rd &	AM Peak-Hour	E	В	11.9	0.84	С	В	D	
I-75 NB Ramp	PM Peak-Hour	E	С	25.4	0.90	В	D	С	
Pine Ridge Rd &	AM Peak-Hour	E	D	43.3	0.98	С	D	E	Е
Napa Blvd	PM Peak-Hour	E	С	30.9	0.85	С	С	F	D

<sup>1.</sup> U-turn movement level-of-service; through movement is free-flow

### Jug-Handle

The second innovative solution includes a Jug Handle at the Pine Ridge Road/Livingston Road intersection in conjunction with the RCUT and DDI. The results of the Jug Handle analysis are shown in **Table 10** and indicate that the intersection is anticipated to operate at acceptable level-of-service standards. The Synchro intersection worksheets are attached in **Appendix K3**.

Table 10: 2040 Intersection Conditions with Innovative Improvements (Jug Handle)

Intersection	Time Period	Overall Inte	rsection LOS	Delay	Max v/c	Approach LOS					
intersection	ilme Pelloa	Standard	Future	(sec/veh)	Ratio	EB	WB	NB	SB		
Jughandle Int. W.	AM Peak-Hour	E	В	18.6	0.87	В	В	D			
of Livingston Rd	PM Peak-Hour	E	С	23.2	0.74	С	Α	E			
Pine Ridge Rd &	AM Peak-Hour	E	D	45.3	0.95	D	D	D	E		
Livingston Rd	PM Peak-Hour	E	D	49.0	0.97	D	D	E	E		
Jughandle Int. S. of	AM Peak-Hour	E	В	11.7	0.75	E	_	В	А		
Pine Ridge Rd	PM Peak-Hour	E	В	11.4	0.85	D		Α	Α		

#### Single Point Urban Interchange

The third innovative solution includes a SPUI at the Pine Ridge Road/Livingston Road intersection in conjunction with the RCUT and DDI. It was assumed that 10% of the Livingston Road northbound/southbound would utilize the SPUI to access the businesses at the corner of the intersection instead of bypassing the intersection on the overpass/underpass. The results of the SPUI analysis are shown in **Table 11** and indicate that the intersection is anticipated to operate at acceptable level-of-service standards. The Synchro intersection worksheets are attached in **Appendix K4**.

Table 11: 2040 Intersection Conditions with Innovative Improvements (SPUI)

Intersection	Time Period	Overall Intersection LOS		Delay	Max v/c	Approach LOS					
mersection	lime Peliou	Standard	Future	(sec/veh)	Ratio	EB	WB	NB <sup>1</sup>	SB <sup>1</sup>		
Pine Ridge Rd &	AM Peak-Hour	E	D	53.2	0.98	D	D	E	Е		
Livingston Rd	PM Peak-Hour	E	D	50.5	0.94	D	D	E	Е		

<sup>1.</sup> Level-for-service for at grade approach

A summary of the percent reduction in delay and maximum v/c ratios at each intersection for the various 2040 build alternatives over the 2040 no-build alternative is shown in **Table 12** through **Table 14**. As shown in **Table 12**, of the four alternatives evaluated at the Pine Ridge Road/Livingston Road intersection, the Jug Handle has the largest reduction during the a.m. peak-hour and the CFI has the largest reduction during the p.m. peak-hour. The conventional widening was the least effective improvement during both the a.m. and p.m. peak hours.

Table 12: Pine Ridge Road/Livingston Road Percent Reduction in Delay and v/c Ratio

		No-Build		Conventional Imp.		CFI		Jug Handle		SPUI	
Intersection	Time Period	Delay (sec/veh)	Max v/c Ratio		% v/c Reduction	% Delay Reduction	% v/c Reduction	% Delay Reduction	% v/c Reduction	% Delay Reduction	% v/c Reduction
Pine Ridge Rd &	AM Peak-Hour	94.8	1.32	36.7%	25.0%	49.8%	28.0%	52.2%	28.0%	43.6%	25.8%
Livingston Rd	PM Peak-Hour	87.4	1.37	37.5%	29.2%	46.7%	31.4%	43.9%	29.2%	41.1%	30.7%

As shown in **Table 13**, of the two alternatives evaluated at the Pine Ridge Road/Whippoorwill Lane intersection, the RCUT has a substantially larger reduction in delay and v/c ratio during the a.m. peak-hour, while the conventional widening has a slightly larger reduction in delay and v/c ratio during the p.m. peak-hour. Taking into consideration both the a.m. and p.m. peak-hour reductions, the RCUT has the greater overall reduction in delay and maximum v/c ratios.

Table 13: Pine Ridge Road/Whippoorwill Lane Percent Reduction in Delay and v/c Ratio

		No-Build		Conventi	onal Imp.	RCUT	
Intersection	Time Period	Delay (sec/veh)	Max v/c Ratio	% Delay Reduction	% v/c Reduction	% Delay Reduction	% v/c Reduction
Pine Ridge Rd & Whippoorwill Ln	& AM Peak-Hour	73.6	1.12	40.2%	17.9%	77.6%	17.9%
	.n PM Peak-Hour	107.0	2.22	58.0%	55.9%	56.8%	55.4%

As shown in **Table 14**, of the two alternatives evaluated at the Pine Ridge Road/I-75 interchange, the DDI has a substantially larger reduction in delay and v/c ratios at the SB Ramp intersection during the a.m. and p.m. peak-hour, and during the a.m. peak-hour at the NB Ramp intersection. The conventional widening has a slightly larger reduction during the p.m. peak-hour at the NB Ramp intersection. Taking into consideration both intersection and time period reductions, the DDI has the greater overall reduction.

Table 14: Pine Ridge Road/I-75 Percent Reduction in Delay and v/c Ratio

Ī			No-Build		Conventi	onal Imp.	DDI		
	Intersection	Time Period	Delay (sec/veh)	Max v/c Ratio	% Delay Reduction	% v/c Reduction	% Delay Reduction	% v/c Reduction	
	Pine Ridge Rd & I-75 SB Ramp	AM Peak-Hour	55.9	1.31	32.7%	24.4%	50.3%	26.7%	
		PM Peak-Hour	70.9	1.14	59.4%	15.8%	72.5%	21.9%	
	Pine Ridge Rd & I-75 NB Ramp	AM Peak-Hour	92.4	1.20	67.6%	18.3%	87.1%	30.0%	
		PM Peak-Hour	36.6	0.92	32.2%	2.2%	30.6%	2.2%	

## Whippoorwill Lane to Marbella Lakes Drive Interconnection Analysis

While evaluating the conventional and innovative improvements, consideration was given to the impacts of interconnecting Whippoorwill Lane to Marbella Lakes Drive. The County has long considered this potential interconnection, and in the context of this study, it was important to understand what, if any, impacts the interconnection would have, if constructed, on any of the concepts being considered on Pine Ridge Road.

All conceptual improvements were evaluated with and without the Whippoorwill Lane/Marbella Lakes Drive Connection. The analyses indicated that interconnection between Whippoorwill Lane and Marbella Lakes Drive, would have no adverse impact on the operations of any of the concepts.

Further, it was determined that such an interconnection would provide no significant benefit in relieving future congestion within the Pine Ridge Road corridor on its own.

Improvements to all the study area intersections on Pine



Whippoorwill Lane-Marbella Lakes Drive Potential Interconnection

Ridge Road west of I-75 are needed to resolve existing and future congestion problems, regardless of whether an interconnection is made. The summary tables for the various interconnection scenarios as well as the Synchro intersection worksheets are attached in **Appendix L**.

## INNOVATIVE INTERSECTION CONCEPT DEVELOPMENT

Evaluating "conventional" improvements, e.g., adding additional thru-lanes and turn-lanes at intersections, revealed an improvement in the LOS to acceptable levels in managing 2040 traffic. However, as demonstrated in the 2040 level-of-service analysis, the innovative intersections provide a greater reduction in delay compared to the no-build conditions than the conventional improvements do. That benefit in conjunction with the cost benefit afforded by the innovative concepts (less right-of-way impacts and construction costs), concept plans for the innovative intersection improvements/countermeasures were developed. The following potential innovative intersection solutions were reviewed internally by Collier County transportation agencies and preliminarily with FDOT, have been vetted in numerous public forums, and are being presented to the Board of County Commissioners for consideration and direction.

## Livingston Road Continuous Flow Intersection (CFI) (a.k.a., Displaced Left Turn Intersection)

The Continuous Flow Intersection (CFI), shown in **Figure 11**, recovers the stolen green time at the main intersection by moving the Livingston Road northbound and southbound left-turning vehicles to the left side of the approaching through vehicles at a protected left turn signal in advance of the main intersection. By shifting the left-turn vehicles prior to the main intersection, they may proceed through the intersection, turning left at the same time as the north/southbound through movements are occurring. Because there is no longer a protected left-turn phase dedicated to the northbound and southbound left turning vehicles, the recovered green time is distributed to the other movements, increasing the intersections thru-put and operational efficiency. Because the new advance signal allows the advanced left turns at the same time as the east-west through movements are occurring, there is no additional delay experienced by the northbound and southbound through traffic.

In this implementation, the improvement is considered a partial-CFI because it is only deployed on the Livingston Road approaches. All the Pine Ridge Road movements, right, left, and through movements, occur exactly as the do today with no change. Only the Livingston Road northbound and southbound left turns on to Pine Ridge Road are affected by the design. Like all innovative design concepts, advance signage and lane markings are important to the safe operation of this design.

An additional feature of this design, added after learning of an issue at the first public workshop, was the incorporation of a northbound Livingston Road U-turn lane at the new advance signal south of the main intersection. This feature allows motorists exiting the shopping center in the south-east quadrant to make a U-turn to proceed south on Livingston Road, a movement that today is problematic.

Pedestrian and bicycle features are included in the design. An added benefit to this intersection design, is the potential reduction in crashes, by reducing the total number of conflict points for both motorists and pedestrians. The advantages and disadvantages to the CFI concept are summarized in **Table 15** and the cost estimate is attached in **Appendix M**.

### **TABLE 15: Continuous Flow Intersection – Advantages and Disadvantages**

CFI - Construction Cost: \$6.6 Million <sup>1</sup>	
Advantages	Disadvantages
Minimizes Right-of-Way Takes	Unusual Traffic Pattern May Be Confusing to Some Drivers and Visitors
Minimizes Business Damages	
Advance Signals Control NB & SB Left Turns	
without Additional Delay	
Accommodates Shopping Center U-Turns	
Accommodates Bicycle & Pedestrian	
Movements	
Reduces Delay	
Increases Thru-Put	
Reduces Travel Time	
Improves Safety by Reducing Conflict Points	

<sup>1.</sup> Cost estimates shown are basic construction costs developed using FDOT unit cost factors, to establish a relative cost that allows the cost of the different concepts to be compared. The construction costs do not include the cost of any right-of-way that might be needed, or costs associated with design, permitting, mitigation, etc.





## Livingston Road Jug-Handle (JH) Intersection

The Jug-handle Intersection (JH), shown in **Figure 12**, similarly eliminates the Livingston Road left-turns from the main intersection. Two new advance signals are deployed, one on Livingston Road south of the main intersection to handle northbound left turns, and one on Pine Ridge Road, west of the main intersection. Motorists traveling south on Livingston Road that want to make a left turn to go east, are directed by advance signage to travel through the main intersection and enter a loop ramp in the south-west quadrant that will take them around to the new signal at the Pine Ridge Road, where they will turn right to head east through the main intersection. Northbound Livingston Road traffic will turn left at the new advance signal and travel along the ramp to the Pine Ridge Road advance signal before turning left, effectively bypassing the main intersection in its entirety.

This "quadrant loop" concept is not unlike the type of movement that motorist use at interstate clover-leaf interchanges where the motorist passes under the interstate to enter a quadrant loop ramp that takes them around to the right, to enter the mainline travel stream. Like the CFI, advance signage and lane markings are important to the safe operation of this design.

As with the CFI, all Pine Ridge Road through and turning movements remain unchanged, this design only affects the Livingston Road left-turns. Also, as with the CFI, the removal of the protected left-turn phase at the main intersection allows the recovered green time to be redistributed to the remaining movements, increasing the overall efficiency of the intersection. An identical northbound Livingston Road U-turn feature is also included in this design to allow motorists existing the shopping center to make a U-turn to return south on Livingston Road.

Pedestrian and bicycle features are included in the design. An added benefit to this intersection design, is the potential reduction in the number of crashes, by reducing the total number of conflict points for both motorists and pedestrians. The advantages and disadvantages to the JH concept are summarized in **Table 16** and the cost estimate is attached in **Appendix M**.

TABLE 16: Jug-Handle Intersection - Advantages and Disadvantages

JH - Construction Cost: \$7.3 Million <sup>1</sup>					
Advantages	Disadvantages				
Minimizes Right-of-Way Takes	Unusual Traffic Pattern may be Confusing to Some Drivers and Visitors				
Minimizes Business Damages	Not favored by North Collier Fire Control & Rescue District (NCFCRD) because of Additional Signal on Pine Ridge				
Advance Signals Control Northbound & Southbound Left Turns without Additional Delay	Road – Potential to Negatively Impact Response Times				
Accommodates Shopping Center U-Turns					
Accommodates Bicycle & Pedestrian Movements					
Reduces Delay					
Increases Thru-Put					
Reduces Travel Time					
Improves Safety by Reducing Conflict Points					

Cost estimates shown are basic construction costs developed using FDOT unit cost factors, to establish a relative
cost that allows the cost of the different concepts to be compared. The construction costs do not include the cost
of any right-of-way that might be needed, or costs associated with design, permitting, mitigation, etc.



#### Livingston Road Single Point Urban Interchange (SPUI, a.k.a. Overpass)

The SPUI concept developed for the Livingston Road intersection at Pine Ridge Road shown in Figure 13, carries four (4) lanes of through-traffic up and over Pine Ridge Road. Unlike the CFI and JHI, which remove left turns from the main intersection, the SPUI removes the majority of the Livingston Road through movements from the intersection, reducing the amount of time the phase requires and shifting the "north/south green time" to the remaining phases. All the Pine Ridge Road through and turning movements, and all the Livingston Road turning movements would occur at grade just as they do today, albeit under the Livingston Road through travel lanes.

This concept is the same design that was deployed with success at the Golden Gate Parkway and Airport-Pulling Road intersection. At the Pine Ridge Road-Livingston Road intersection, the decision to take Livingston Road over Pine Ridge Road was made in large part because only four (4) through lanes were needed to handle the Livingston Road 2040 through volumes, and the resulting 4-lane overpass footprint minimized the need to acquire additional right-of way. Additionally, the lack of driveway connections and traffic signals on Livingston Road up-stream and down-stream of the main intersection creates less impedance that would otherwise affect the free-flow conditions of the north/south through movements. If the County wishes to pursue this option, a follow-up evaluation can evaluate the cost benefits of 4-lanes vs. 6-lanes, as well as the alternative of taking Pine Ridge Road over Livingston Road.

Pedestrian and bicycle features are included in the design concept. An added benefit to this intersection design, is the potential reduction in the number of crashes, by reducing the total number of conflict points for both motorists and pedestrians. The advantages and disadvantages to the SPUI concept are summarized in **Table 17** and the cost estimate is attached in **Appendix M**.

TABLE 17: Single Point Urban Interchange - Advantages and Disadvantages

SPUI - Construction Cost: \$13.3 Million (4-lanes) <sup>1</sup>	
Advantages	Disadvantages
4-Lane Overpass Minimizes Right-of-Way Takes	6-Lane Overpass - Additional R/W Cost
4-Lane Overpass Minimizes Business Damages	6-Lane Overpass – Additional Business Damages
Traffic Pattern is Not Unusual	6-Lane Overpass – Additional Construction Cost (\$4.3m)
Accommodates Shopping Center U-Turns	May Involve Adjacent Land Access Limitations
Accommodates Bicycle & Pedestrian Movements	Not favored by North Collier Fire Control & Rescue District (NCFCRD) because of Crash Location Description Problem - Potential to Negatively Impact Response Times
Reduces Delay	Generally Considered "Unfriendly" by Adjacent Businesses
Increases Thru-Put	May Increase Noise Impacts to Adjacent/Nearby Properties
Reduces Travel Time	

cost estimates shown are basic construction costs developed using FDOT unit cost factors, to establish a relative
cost that allows the cost of the different concepts to be compared. The construction costs do not include the cost
of any right-of-way that might be needed, or costs associated with design, permitting, mitigation, etc.



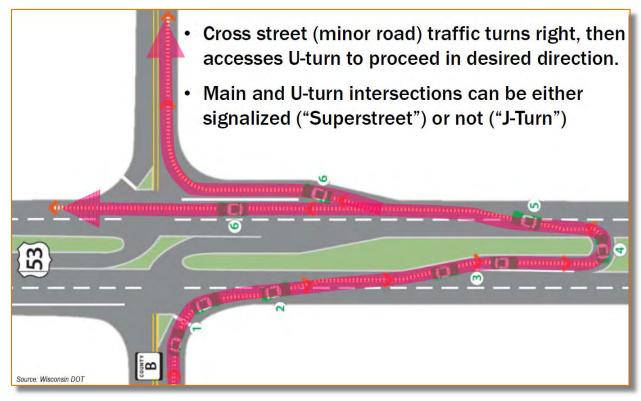




# Whippoorwill Lane Restricted Crossing U-Turn (RCUT) Intersection (a.k.a. "Superstreet")

The Whippoorwill Lane – Pine Ridge Road intersection, located approximately midway between Livingston Road and the I-75 ramps, serves residential and commercial/non-residential land uses on the two dead-end local streets, north and south of Pine Ridge Road. Access into and out of Whippoorwill is frequently constrained in large part by the need to service the mainline Pine Ridge Road through movement with sufficient signal green time to try to minimize back-ups at the I-75 southbound ramps and Livingston Road as much as possible. Finding a solution requires close coordination with the proposed improvements at Livingston Road and at the I-75 ramp terminals.

At the Pine Ridge Road and Whippoorwill Lane intersection, a Restricted Crossing U-Turn (RCUT) concept, shown in **Figure 15**, was developed, and tested. In this concept, all Pine Ridge Road through movements, and the right/left turn movements from Pine Ridge Road to Whippoorwill Lane are handled at the traffic signal exactly as they are today. This concept removes the Whippoorwill through and left turn movements from the intersection, requiring all left turning vehicles approaching Pine Ridge Road to turn right and proceed downstream to a U-turn lane at a protected U-turn traffic signal (**Figure 14**).



Source: FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

Figure 14: Restricted Left Turns





By removing the through and left turn phases from the signal, nearly doubles the green time allocated to the through movements. Since the right-turns exiting Whippoorwill Lane occur at the same time as the Pine Ridge Road left-turns are occurring, no additional delay is added to the through movements.

The advanced U-turn signals upstream of the main intersection only affect a single Pine Ridge Road approach, and are coordinated with the main signal to minimize any additional delay of the movements. The through phase plan for the RCUT is shown in Figure 16.

Some additional right-of-way may be necessary to accommodate the U-turn

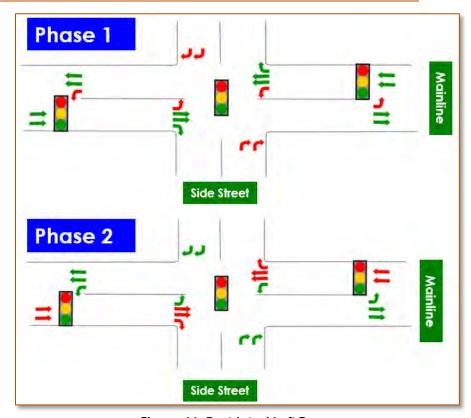


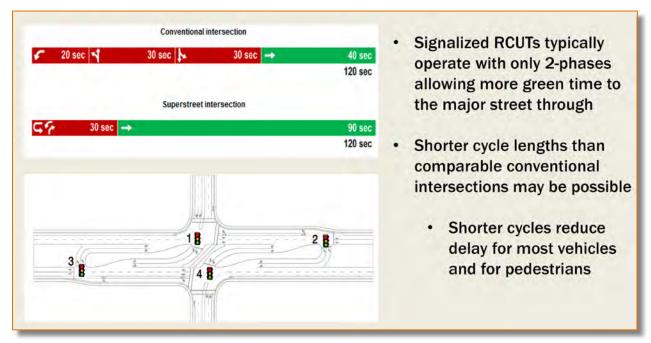
Figure 16: Restricted Left Turns

lanes, however, unlike the conventional improvements of adding through lanes and additional turn lanes at intersections, the RCUT minimizes the need for additional right-of-way at the intersection of Whippoorwill Lane.

The RCUT, or "superstreet", intersection design was first developed in the United States in the mid-1980s, and according to the Federal Highway Administration's <u>Restricted Crossing U-Turn Intersection Informational Guide</u> (August 2014) this concept has been successfully deployed in Texas, Alabama, North Carolina, Maryland, Ohio, Indiana, Michigan, and Minnesota.

The RCUT intersection signal requires only two phases (**Figure 17**), which minimizes the loss time at the intersection. More green time is recovered by eliminating the left turn and the minor street through phases from the signal cycle.

When coordinated with other signals within the corridor, the signalized RCUT intersection can provide favorable progression along Pine Ridge Road. Efficient progression can be provided in both directions with any speed or signal spacing.

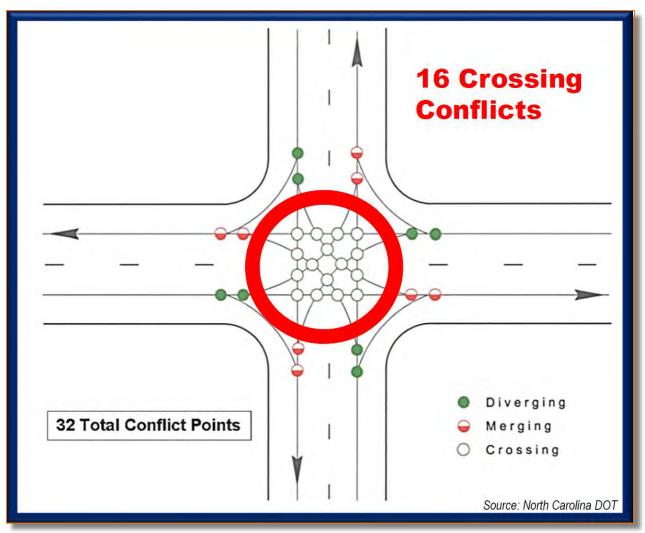


Source: FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

Figure 17: Conventional vs. RCUT Signal Phases

The conventional improvement alternative, in this instance, would require the addition of one through lane in each direction on Pine Ridge Road to increase the Pine Ridge Road through-put, plus additional left turn lanes at all the approaches to the Whippoorwill intersection to increase the left turn capacity without stealing more green time from the major street. Given the existing right-of-way constraints, this would necessitate the acquisition of additional right-of-way, not only along the mainline segment of Pine Ridge (to accommodate the two new through lanes) but would also require the acquisition of the additional right-of way needed at the intersection to accommodate the new turn lanes. Right-of-way acquisition and the likely assessment of business damages make the conventional improvements an extremely expensive alternative.

While improving the operation efficiency and adding capacity to the intersection is the primary objective, another important benefit to this innovative design is the improvement in the safety profile of the intersection. A conventional signalized intersection has a total of 32 conflict points, 16 of which are "crossing conflicts" which contribute to the most severe type of crash (**Figure 18**).



FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

Figure 18: Crossing Conflicts - Conventional Intersection

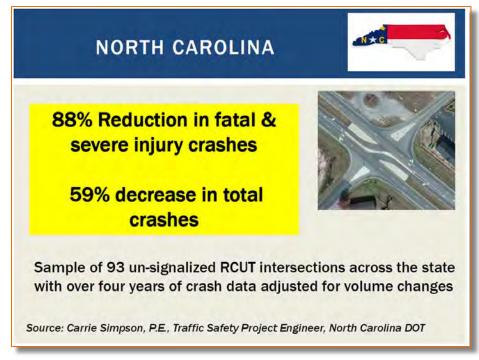
The RCUT intersection reduces the total number of conflict points from 32 to 24, and reduces the number of the most dangerous crossing-type conflicts from 16 to 4 (**Figure 19**).



Source: FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

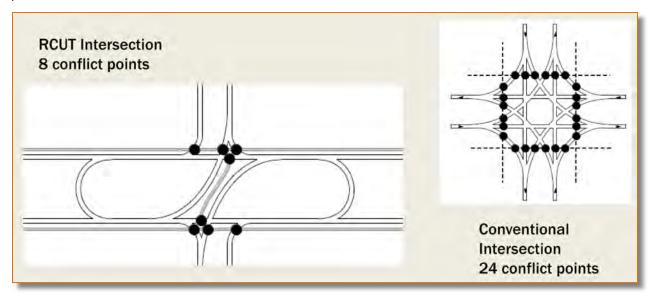
Figure 19: Crossing Conflicts - RCUT Intersection

An analysis of 4-years of crash data of 93 RCUT locations across North Carolina, revealed an 88% reduction in fatal and sever injury crashes, and a 59% decrease in total crashes.



Source: FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

Pedestrian and bicycle features are included in the design. To cross Pine Ridge Road, pedestrians and cyclists cross Whippoorwill Lane and Pine Ridge Road in a "Z" pattern (**Figure 20**). An added benefit to this intersection design, is the potential reduction in the most serious type of crashes, by reducing the total number of conflict points for both motorists and pedestrians.



Source: FDOT Reduced Left-Turn Conflict Intersections Presentation (by FHWA)

Figure 20: "Z" Pedestrian Crossing Pattern



"Z" Pattern Crosswalk at an RCUT

The advantages and disadvantages to the RCUT concept are summarized in **Table 18** and the cost estimate is attached in **Appendix M**.

TABLE 18: Restricted Crossing U-Turn Intersection – Advantages and Disadvantages

RCUT - Construction Cost: \$4.8 Million <sup>1</sup>	
Advantages	Disadvantages
Increases Thru-Put - achieve similar service levels as adding additional through lanes	Generally considered "unfriendly" by adjacent businesses
Provides potential for shorter signal cycle lengths	Generally considered "unfriendly" by area residents
Reduces side street delay	Requires some right-turning vehicles to weave across lanes to enter the U-Turn lane
Reduces delay and travel time for arterial through traffic	Increases travel distance (and potentially travel time) for minor street left turn and through movements
Improves pedestrian safety by reducing conflict points by using "Z" pattern to cross	Provisions for bicycle facilities may be very different from conventional intersections, and may result in reduced convenience.
Minimizes the need for additional right-of-way	Requires pedestrians to cross in two stages in some cases, which could add delay and reduce convenience
Creates the possibility for the largest possible progression bands in both directions of the arterial at any speed with any signal spacing	Creates longer pedestrian crossing distances for some movements, which could add delay and reduce convenience
Improves safety by reducing conflict points; turning crashes reduced; angle conflicts are completely eliminated	Increased potential for sideswipe crashes
Each direction of a superstreet may operate independently allowing for: different cycle lengths in each direction, progression of traffic at different speeds, and signal spacing	
Allows larger portion of signal cycle to be allocated to the arterial through movement	

<sup>1.</sup> Cost estimates shown are basic construction costs developed using FDOT unit cost factors, to establish a relative cost that allows the cost of the different concepts to be compared. The construction costs do not include the cost of any right-of-way that might be needed, or costs associated with design, permitting, mitigation, etc.

#### I-75 Diverging Diamond Interchange (DDI)

At the easternmost edge of the study area, the I-75/Pine Ridge Road interchange serves as one of the two central-most access points from the interstate highway serving the greater Naples Area. The expected increase in traffic volumes entering and exiting the Interstate from Pine Ridge Road, plus the anticipated growth in through traffic serving points east and west of the interstate, threatens the integrity of the interchange. As revealed in the "no build" analysis" the two signalized intersections will be unable to adequately handle the expected increase in traffic with motorist incurring substantial delays during peak periods.

While converting the current "tight diamond" to "conventional" cloverleaf interchange to gain ramp access capacity is possible, the amount of additional right-of-way and business damages that would be required would likely make the project cost prohibited (absent any "better" solutions). Adding additional through lanes and turn lanes at the signals to increase capacity, would require additional right-of-way and require the reconstruction of the existing overpass, likewise increasing the cost of this alternative.

A less expensive alternative, finding success throughout the Country, and recently in Sarasota County at University Parkway and I-75, is the Diverging Diamond Interchange (DDI). The DDI concept, shown in **Figure 22**, retains the same two traffic signals, but they no longer required to manage left turning vehicles that would otherwise have to cross opposing streams of traffic.

As the motorist approaches the traffic signal, they are directed to diverge to the left side of the median as they travel under the overpass lanes of I-75. After passing under I-75, the motorist reaches the other signal and is diverted back to the right side of the median. Between the two traffic signals, the through lanes are now adjacent to the interstate ramp terminals, so I-75 ramp traffic enters to or exits from Pine Ridge Road without interrupting the opposing through movements. Signals at the end of the ramp ensure the safe merging of I-75 ramp traffic to Pine Ridge Road. Because the two main traffic signals no longer need the left-turn phases to

accommodate the ramp traffic, it allows for the signals to be operated with only two phases creating substantial improvement in the thru-put and operational efficiency. The phase plan for the DDI is shown in Figure 21. Advance signage and lane markings assist managing the proper flow through the intersections.

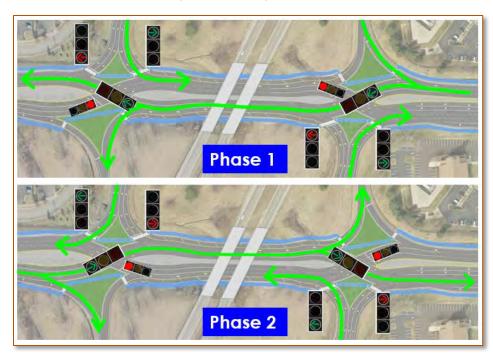


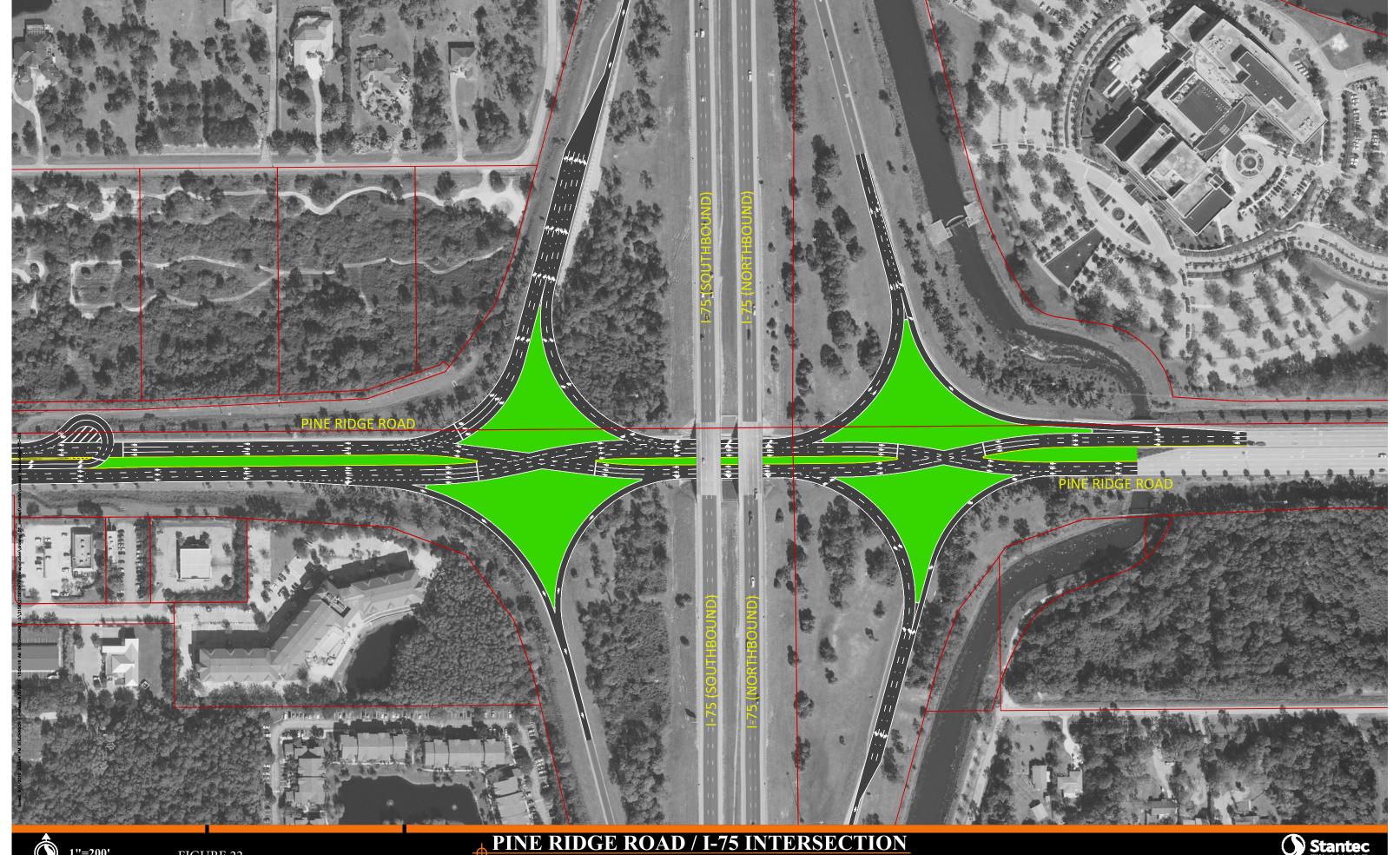
Figure 21: DDI Phase Plan

Additionally, the DDI's footprint will fit within the existing right-of-way, and the new lane configuration will fit beneath the existing overpass, avoiding the need to reconstruct the bridges. Sufficient existing right-of-way will permit pedestrian and bicycle features to be included in the design. An added benefit to this intersection design, is the potential reduction in crashes, by reducing the total number of conflict points for both motorists and pedestrians. The advantages and disadvantages to the DDI concept are summarized in **Table 19** and the cost estimate is attached in **Appendix M**.

TABLE 19: Diverging Diamond Interchange - Advantages and Disadvantages

DDI - Construction Cost: \$8.8 Million <sup>1</sup>	
Advantages	Disadvantages
Eliminates Turn Lane Phases from the Signalized	Unusual Traffic Pattern may be Confusing to Some
Intersection	Drivers and Visitors
Reduces Through Movement Delay	
Increases Thru-Put	
Reduces Travel Time	
Improves Safety by Reducing Conflict Points	
Accommodates Bicycle & Pedestrian	
Movements	
Eliminates the Need for Additional Right-of-Way	

<sup>1.</sup> Cost estimates shown are basic construction costs developed using FDOT unit cost factors, to establish a relative cost that allows the cost of the different concepts to be compared. The construction costs do not include the cost of any right-of-way that might be needed, or costs associated with design, permitting, mitigation, etc.



#### **CONCLUSIONS & RECOMMENDATIONS**

The level of service within the Pine Ridge Road Corridor between I-75 and Livingston Road currently exceeds the County's adopted standard (2016 and 2017), and with traffic volumes expected to increase 35% by 2040, steps must be taken to mitigate the exiting failing conditions in a way that expands the capacity of the existing network as much as possible. During the planning study, the future traffic forecast was developed and analyzed, and potential improvements to resolve deficiencies were developed and evaluated.

The "conventional" improvements that would add the capacity needed to relieve future congestion and achieve the adopted LOS standard included increasing the number of through lanes on Pine Ridge Road from 6 to 8 lanes from west of Livingston Road to east of Napa Boulevard, and adding additional left turn lanes at the intersections.

Three "innovative" intersection improvements were identified and evaluated for the Pine Ridge Road-Livingston Road intersection that were found to improve the operating efficiency of the intersection. When taken collectively with a Restricted Crossing U-Turn (RCUT) Intersection at Pine Ridge Road and Whippoorwill Lane, and a Diverging Diamond Interchange (DDI) concept at the I-75 Interchange, the set of innovative improvements generally performed better than their conventional counterparts at reducing delay and the v/c ratios throughout the corridor.

The evaluation also revealed, unlike the conventional roadway widening by adding through lanes and additional turn lanes requiring the acquisition of additional right-of-way, the innovative designs minimize the need to acquire additional right-of-way, while generally providing a better level of service.

After consideration of the study findings and public input received, a recommended set of improvements for consideration by the Collier County Board of County Commissioners includes the following:

- A partial-Continuous Flow Intersection (CFI) at Pine Ridge Road and Livingston Road,
- A Restricted Crossing U-Turn (RCUT) Intersection at Pine Ridge Road at Whippoorwill Lane, and
- A Diverging Diamond Interchange (DDI) at the Pine Ridge Road/I-75 interchange

The study recommends the County conduct a preliminary engineering and environmental assessment to further evaluate the design features, right-of-way needs, and costs of the CFI concept for the intersection of Pine Ridge Road and Livingston Road.

While the intersection of Pine Ridge Road and Whippoorwill Lane is considered a County maintained intersection, because the recommended improvement at Whippoorwill Lane is partially within the I-75 Limited Access (LA) right-of-way Limits, the study recommends the County pursue an Interchange Modification Report (IMR) with FDOT for the DDI and the RCUT portion of the corridor.

## **APPENDICES**