

Intersection Analysis

**Florida Department of Transportation (FDOT)
District Five**



**SR 46 at Richmond Avenue
(Section 77040, M.P. 4.065)**

Seminole County, Florida

Prepared by:



Districtwide Traffic Safety Studies and Highway Design; Contract Number CAD06

Financial Project ID Number: 237995-1-32-20

July 2023

PROFESSIONAL ENGINEER CERTIFICATION

Intersection Analysis

I hereby certify that I am a registered professional engineer in the State of Florida practicing with **Inwood Consulting Engineers, Inc.**, authorized to operate as an engineering business, Certification of Authorization No. 7074, by the State of Florida Department of Professional Regulation, Board of Professional Engineers, and that I have prepared or approved the methodology, evaluation, findings, opinions, conclusions, or technical advice hereby reported for:

Project: Districtwide Traffic Safety Studies and Highway Design
SR 46 at Richmond Avenue Intersection Analysis

County: Seminole County

Financial Project ID: 237995-1-32-20

I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of transportation engineering as applied through professional judgement and experience.

Name: Christine N. Lofye, PE

P.E. No: 48129

Date: July 7, 2023

This item has been digitally signed and sealed by *Christine N. Lofye, P.E.* on the date adjacent to the seal.

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Section 1.0

Introduction

Inwood Consulting Engineers, Inc. has been retained by the Florida Department of Transportation (FDOT), District Five, to conduct an intersection analysis for SR 46 at Richmond Avenue located in Seminole County. The purpose of this study is to evaluate the need for safety improvements at the intersection of SR 46 and Richmond Avenue (MP 4.065), which is the location of a fatality in December 2022.

The analysis methods used in completing this study are consistent with the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD 2009), the FDOT Traffic Engineering Manual (TEM), the FDOT Manual on Uniform Traffic Studies (MUTS), the FDOT Design Manual (FDM), the FDOT Standard Plans, and engineering judgment. This document contains existing conditions, vehicle/pedestrian/bicycle counts, crash analysis, a qualitative assessment, improvement alternatives and final recommendations.

The location of this study is shown in the project location map as **Figure 1-1**.

1.1 Methodology

This study used the methodology outlined and described in the scope of services for each task. The following Composite Study Type IV tasks were performed, per the scope of services:

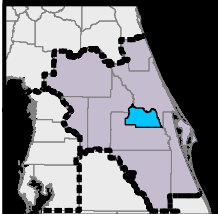
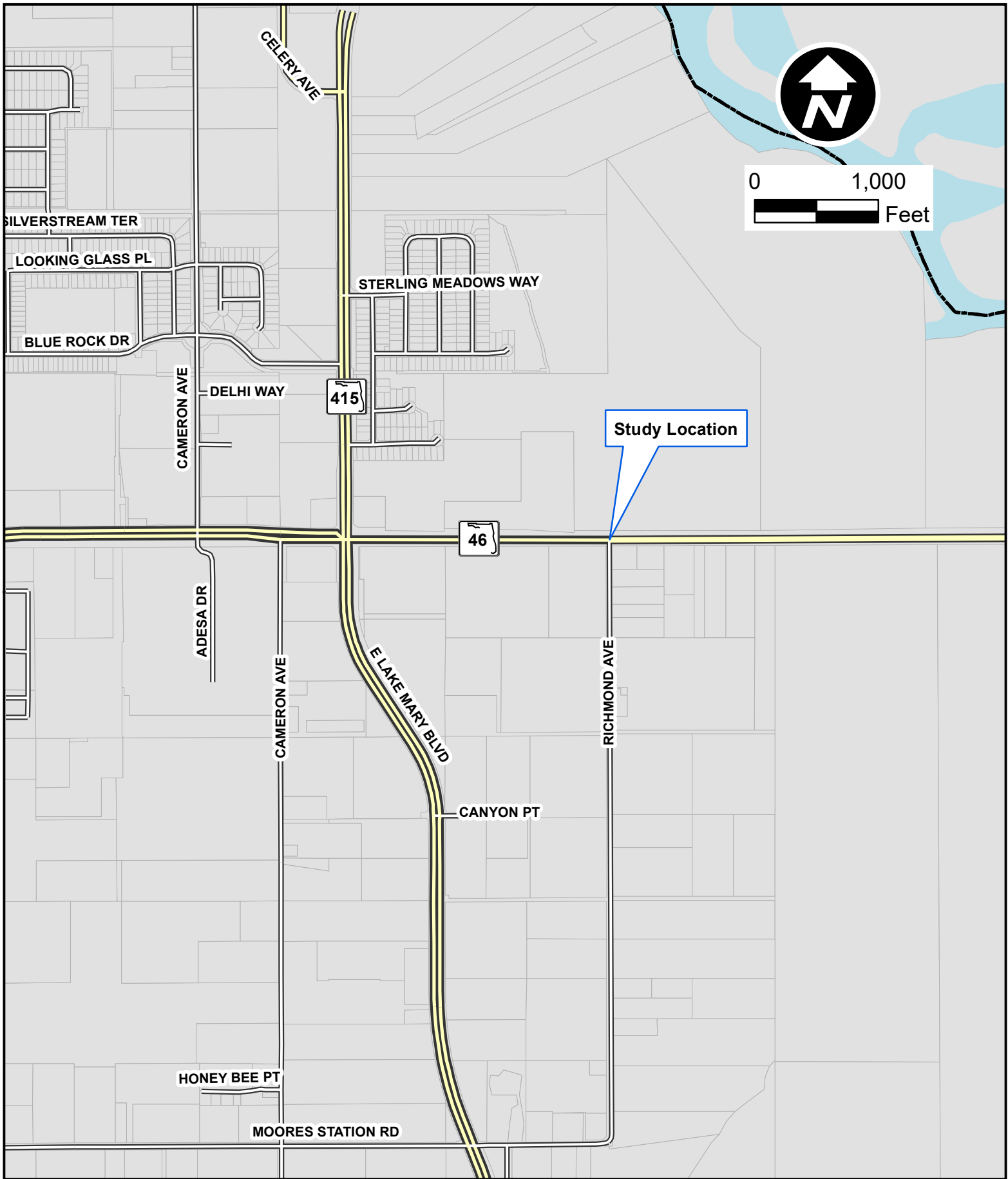
Task 1: 8-Hour Turning Movement Counts (with Bicycles & Pedestrians)

Task 12: Collision Analysis (Collision Summary and Diagrams)

Task 13: Qualitative Assessment of Intersection Operation

Task 16: Development of Alternatives and Recommendations

Task 16 includes one practical design alternative and any maintenance items to be addressed within the influence area of the project.



SR 46 at Richmond Avenue Intersection Analysis

Seminole County, Florida

Financial Project ID: 237995-1-32-20

Federal Project No: TBD

PROJECT LOCATION MAP

Figure

1-1

Section 2.0

Existing Conditions

The existing conditions for the SR 46 at Richmond Avenue intersection were identified from straight-line diagrams (SLD), the Seminole County Property Appraiser website, desktop analysis, and field reviews conducted by the project team.

SR 46, within the limits of this study, is a two-lane undivided rural principal arterial that runs in an east-west direction. The subject intersection is east of the signalized intersection of SR 415 (E. Lake Mary Boulevard), and is just outside the urban area boundary into the rural area.

The 2022 daily traffic volume on SR 46 at traffic count site 770299, 0.4 miles west of the St. Johns River Bridge at MP 5.291 was 13,240 AADT.

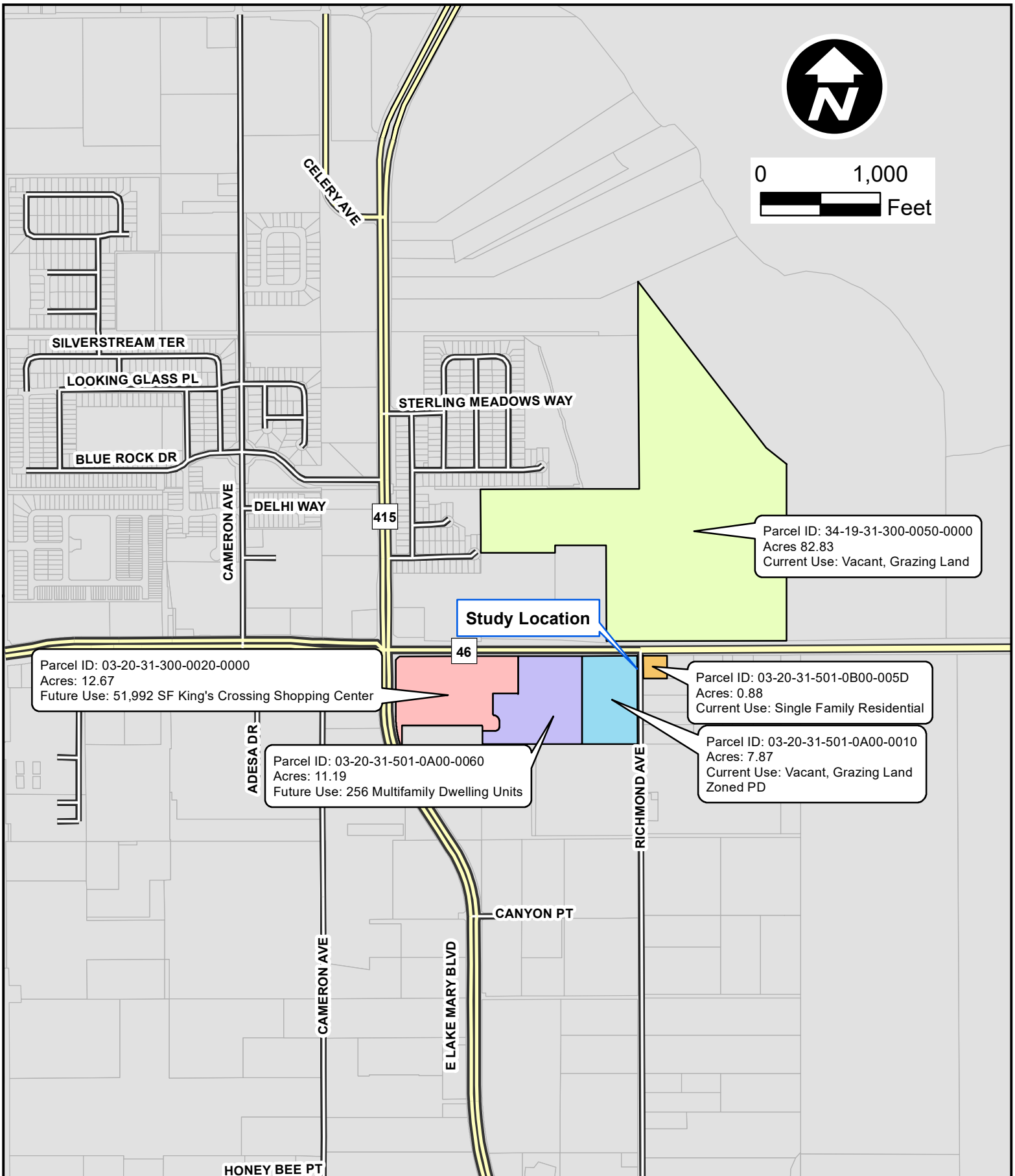
SR 46 has two 12-foot travel lanes and 4-foot paved shoulders and a posted speed of 55 miles per hour. There is auditory/vibratory treatment on both the edge lines and the centerlines.

Richmond Avenue is also a two-lane undivided local roadway; however, it does not have any paved shoulder. It is a county-maintained roadway with a posted speed of 35 miles per hour.

The intersection of SR 46 with Richmond Avenue is a 3-legged T-intersection with stop-control on the Richmond Avenue approach. There are currently no turn lanes on any approach.

SR 46 (Roadway ID 77040000) is designated as context classification C2 Rural. The 82.83-acre parcel (parcel ID# 34-19-31-300-0050-0000) on the north side of the intersection is vacant, zoned as agricultural, and used as grazing land. The 0.88-acre parcel in the southeast corner of the intersection (parcel ID# 03-20-31-501-0B00-005D) contains a single-family residence, and is part of the platted Browns Subdivision of Beck Hammock. The 7.87-acre parcel (parcel ID# 03-20-31-501-0A00-0010) in the southwest corner of the intersection is vacant but is zoned PD, and is also part of the platted Browns Subdivision of Beck Hammock. It is currently used for grazing land. **Figure 2-1** illustrates the surrounding parcels adjacent to the project intersection.

West of the intersection, the area transitions to commercial uses at the E. Lake Mary Boulevard intersection within the urban area and the limits of the City of Sanford. Between E. Lake Mary Boulevard and Richmond Avenue, the 51,992 SF Kings Crossing shopping center is currently under construction on parcel ID# 03-20-31-300-0020-000. In the adjacent parcel to the east (parcel ID# 03-20-31-501-0A00-0060), an apartment complex is also under development which will include a total of 256 multi-family dwelling units. A summary of the existing conditions of the project area is found in **Table 2-1**. The condition diagram is presented as **Figure 2-2**.



**SR 46 at Richmond Avenue
Intersection Analysis**

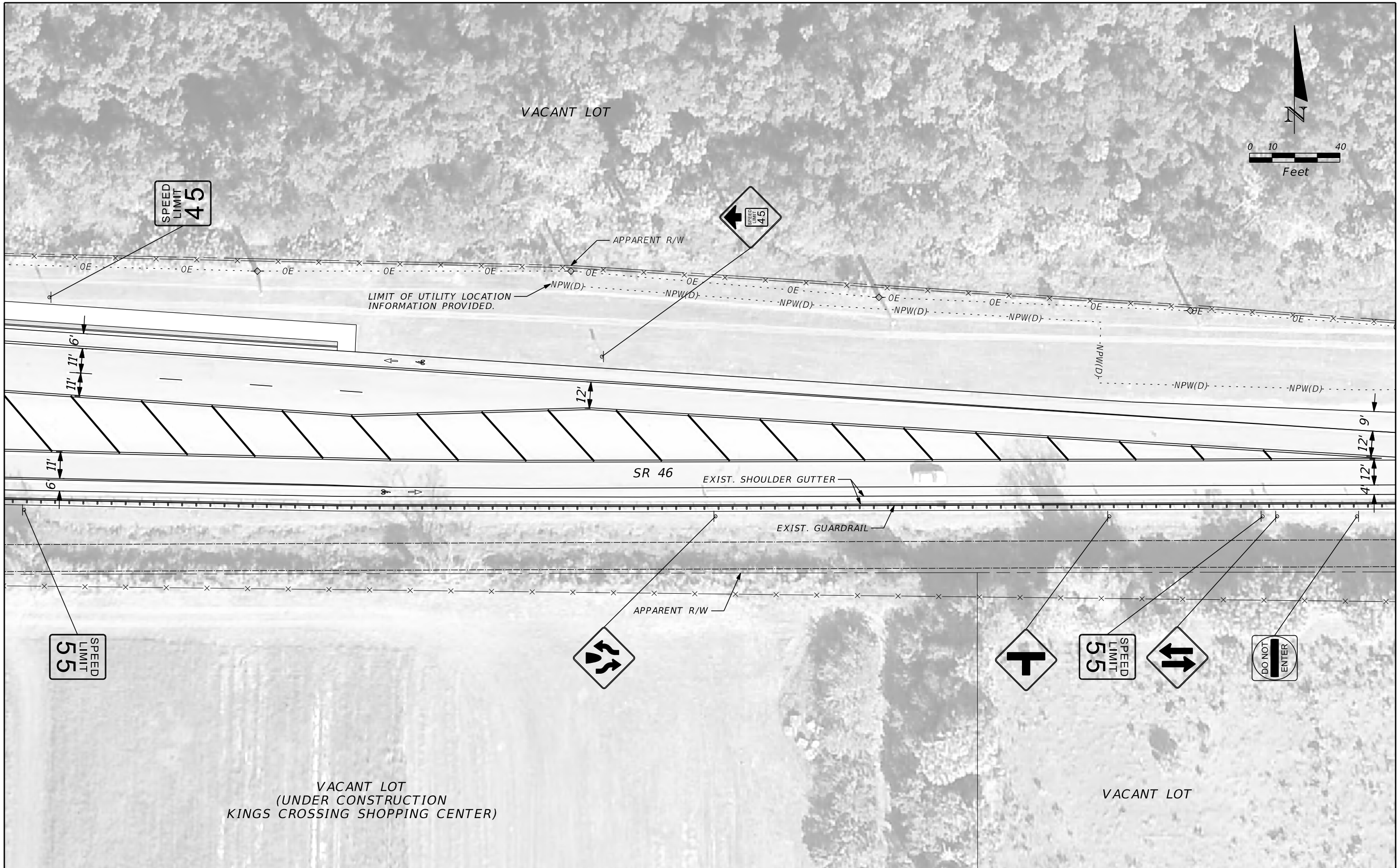
Seminole County, Florida
Financial Project ID: 237995-1-32-20
Federal Project No: TBD

**PARCEL
LOCATION MAP**

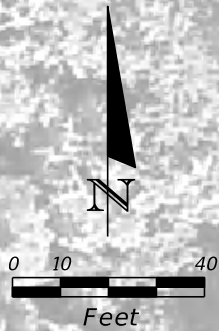
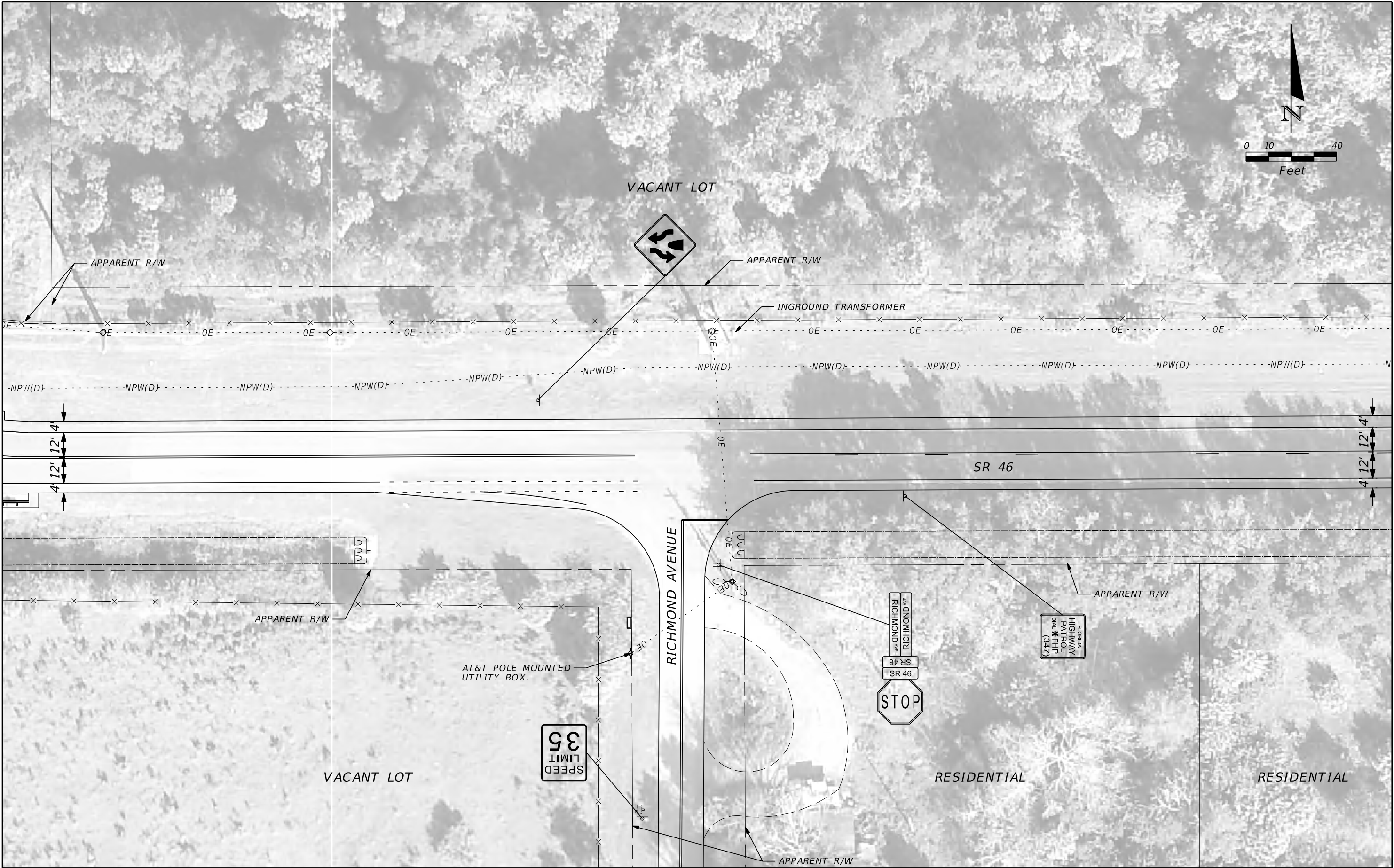
**Figure
2-1**



Table 2-1
Summary of Existing Conditions

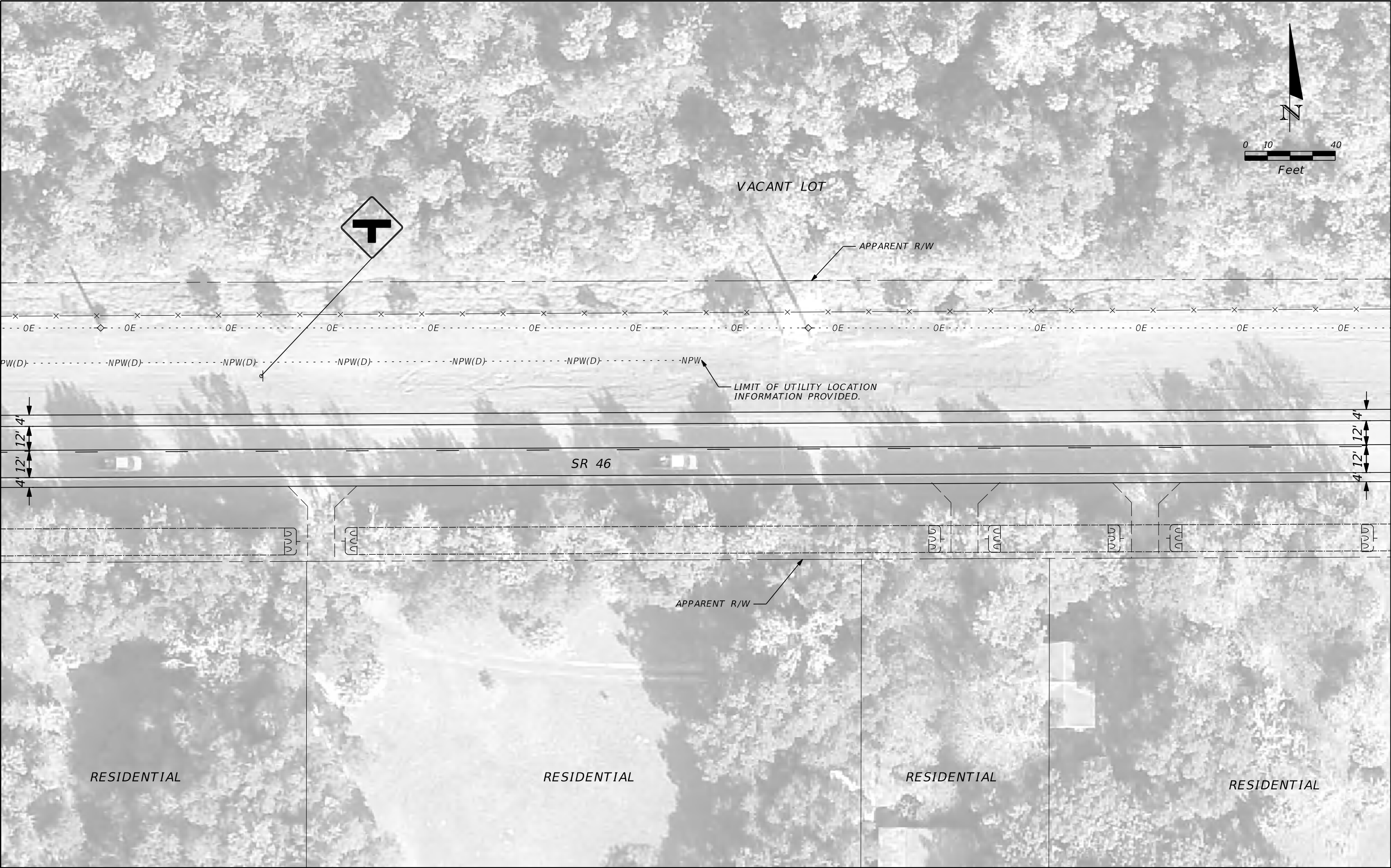
Feature	Description
Major Street	<ul style="list-style-type: none"> • SR 46
Minor Street	<ul style="list-style-type: none"> • Richmond Avenue
Location	<ul style="list-style-type: none"> • 0.41 mile east of E Lake Mary Blvd (Seminole County)
Land Uses	<ul style="list-style-type: none"> • Northwest – Agricultural, vacant/grazing land • Northeast – Agricultural, vacant/grazing land • Southwest – Planned Development, vacant/grazing land and future commercial and residential development • Southeast – Residential Single-Family Home
Type of Traffic Control	<ul style="list-style-type: none"> • Unsignalized with stop control on northbound Richmond Ave
Adjacent Signalized Intersections	<ul style="list-style-type: none"> • Toward the north - n/a • Toward the south - n/a • Toward the west – E Lake Mary Blvd, approx. 2,138 feet • Toward the east – N County Rd 426, approx. 6.967 miles
SR 46 East/West roadway	<ul style="list-style-type: none"> • Functional Classification – Rural Principal Arterial • Cross section – Rural 2-lane undivided • Speed Limit – 55 mph • Eastbound approach – 1 through • Westbound approach – 1 through • Horizontal alignment – no curvature present through intersection • Vertical alignment - generally flat • Pedestrian Facilities - none • Bike Facilities - shoulder use • Overhead Utilities – north side of SR 46 • Street Lighting - none
Richmond Avenue North/South roadway	<ul style="list-style-type: none"> • Functional Classification - local road • Cross section – Rural 2-lane undivided • Speed Limit – 35 mph • Northbound approach – 1 left/right • Southbound approach - n/a • Horizontal alignment - straight • Vertical alignment - generally flat • Pedestrian Facilities - none • Bike Facilities - none • Overhead Utilities – east side of Richmond Ave • Street Lighting – none
Pedestrian Generators	<ul style="list-style-type: none"> • None
Other Notable Features	<ul style="list-style-type: none"> • Near the Sanford International Airport



LEGEND			STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 2-2 CONDITION DIAGRAM		SHEET NO.	
—x—	FENCE	⌒	EXISTING SIGN	ROAD NO.	COUNTY			1 of 4	
- - - -	CANAL	⌒	EXISTING LUMINAIRE	SR 46	SEMINOLE	FINANCIAL PROJECT ID			
⌒	ELECTRICAL CABINET	⌒	UTILITY POLE			237995-1-32-20			
⌒	UTILITY POLE	⌒	UTILITY POLE						



LEGEND				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 2-2 CONDITION DIAGRAM	SHEET NO.
—X— FENCE	 DRAINAGE	⌋ EXISTING SIGN		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		2 of 4
- - - - CANAL	 ELECTRICAL CABINET	⌋ EXISTING LUMINAIRE		SR 46	SEMINOLE	237995-1-32-20		
	 UTILITY POLE	⊖ UTILITY POLE						



LEGEND				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 2-2 CONDITION DIAGRAM	SHEET NO.
—x— FENCE	 DRAINAGE	 EXISTING SIGN	ROAD NO.		COUNTY	FINANCIAL PROJECT ID		3 of 4
----- CANAL	 ELECTRICAL CABINET	 EXISTING LUMINAIRE	SR 46		SEMINOLE	237995-1-32-20		
	 UTILITY POLE	 UTILITY POLE						



LEGEND			STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 2-2 CONDITION DIAGRAM	SHEET NO.
—x— FENCE	 DRAINAGE	⌋ EXISTING SIGN	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		4 of 4
- - - CANAL	 ELECTRICAL CABINET	⌋ EXISTING LUMINAIRE	SR 46	SEMINOLE	237995-1-32-20		
 UTILITY POLE	 UTILITY POLE						

Section 3.0

Traffic Data Collection

3.1 Traffic Counts

Eight-hour turning movement counts were collected at the intersection of SR 46 at Richmond Avenue on Wednesday, May 3rd, 2023. The counts were collected in 15-minute intervals for the following hours:

- 7:00 AM and 9:00 AM
- 11:00 AM – 1:00 PM
- 2:00 PM – 6:00 PM

Counts were broken down by total volume (all vehicles), heavy vehicles, and pedestrians and bicyclists.

Table 3-1 summarizes the seasonally adjusted 8-hour turning movement counts. These counts were determined by multiplying the raw turning movement counts by the vehicle season adjustment factor. The raw turning movement counts in 15-minute intervals are provided in **Appendix A**. The vehicle season adjustment factor is provided in **Appendix B**.

Table 3-1
Intersection Turning Movement Counts

HOUR	SR 46						Major Street Total	Richmond Ave		Minor Street Total	Intersection Total
	Eastbound			Westbound				Northbound			
	U-Turn	TH	RT	U-Turn	LT	TH		LT	RT		
7-8 AM	0	510	5	0	7	543	1065	5	8	13	1078
8-9 AM	0	440	7	0	8	499	954	9	3	12	966
11-12 AM	0	330	4	0	9	392	735	2	5	7	742
12-1 PM	2	361	6	0	9	356	734	5	6	11	745
2-3 PM	1	438	10	0	11	485	945	6	7	13	958
3-4 PM	0	522	5	1	10	519	1057	8	11	19	1076
4-5 PM	0	598	7	0	2	585	1192	2	29	31	1223
5-6 PM	0	602	9	0	7	627	1245	4	13	17	1262

Section 4.0

Qualitative Assessment

Inwood conducted a field review of SR 46 at Richmond Avenue on Wednesday, May 10, 2023, during the AM peak hour (7:15 AM to 8:15 AM) and the PM peak hour (4:45 PM to 5:45 PM). During the AM peak hour, the weather was clear and the roadway conditions were dry. During the PM peak hour, the weather consisted of light rain and roadway conditions were wet due to a storm occurring before the peak hour.

Photos of the approaches to the intersection are provided in **Figure 4-1** through **Figure 4-3**.

4.1 Intersection Infrastructure Observations

4.1.1 Drainage

West of Richmond Avenue, construction was underway on the adjacent parcel 03-20-31-300-0020-000 with dewatering of the site occurring. This led to the presence of standing water in the mitered end sections adjacent to Richmond Avenue (**Figure 4-4**) but did not indicate poor drainage under normal conditions. During the PM peak hour observation while conditions were wet, drainage appeared sufficient. Mitered end sections are present 120 feet west of the Richmond Avenue edge of pavement and 10 feet east of the Richmond Avenue edge of pavement.

The ditch on the south side of SR 46 east of Richmond Avenue was found to be located within the 36-foot clear zone. The field measured distance from the eastbound edge line to the shoulder break point was approximately 12 feet. The measured slope for the paved and unpaved shoulder appeared to meet slope criteria (6% and 1:4 or flatter, respectively) within this distance. However, the ditch had very steep slopes that would be considered non-traversable.

4.1.2 Signing and Pavement Markings

Pavement markings on the northbound approach to the intersection indicate a need for refreshment due to fading and cracking. This was particularly evident at the stop bar on Richmond Avenue (**Figure 4-5**). Additionally, reflective pavement markers (RPMs) are missing on Richmond Avenue from the stop bar to approximately 45 feet south of the stop bar (**Figure 4-6**). Audible and vibratory treatment is present along the centerline of SR 46 as well as along the edge lines. Passing is permitted in the eastbound direction from Richmond Avenue to approximately 940 feet east of the intersection on SR 46 via a skip gap yellow centerline. A dotted extension line is present at the SR 46 eastbound approach as a keyhole for right turn conflicts with shoulder bicycle use. A double solid yellow centerline is present along Richmond Avenue and no edge lines are present.

A county-installed stop sign (R1-1) located 20 feet from the stop bar on Richmond Avenue with a June 2005 installation date should be replaced. An eastbound 55 mph posted speed limit sign (R2-1) is located approximately 360 feet west of the intersection, obstructing the view of a two-way

traffic sign (W6-3) located approximately 8 feet behind it (**Figure 4-7**). A westbound divided highway sign (W6-1) incorrectly installed upside down approximately 60 feet west of the intersection along SR 46 should be rotated (**Figure 4-8**).

4.1.3 Pavement

Pavement conditions along SR 46 and Richmond Avenue were adequate. However, pavement edge failure was present along the right turn radii on Richmond Avenue due to erosion and potential over tracking (**Figure 4-9**). Edge failure was also present southbound on Richmond Avenue at the intersection (**Figure 4-10**).

4.1.4 Utilities

Overhead transmission lines were present along the north side of SR 46, with overhead distribution lines present along the east side of Richmond Avenue. An AT&T utility box was located on the west side of Richmond Avenue approximately 90 feet from the intersection, with an electrical cabinet located approximately 70 feet from the intersection. An AT&T splice vault was located approximately 40 feet from the edge of pavement of SR 46 on the north side. Next to the utility pole, located 36 feet from the north edge of pavement along SR 46 is an inground transformer.

4.1.5 Lighting

Lighting is present at the intersection via utility mounted fixtures in the southeast quadrant of the project intersection. The lighting is maintained and operated by the utility agency and provides minimal illumination at the intersection. Since this intersection does not have marked pedestrian crossings or signalized intersection control, there are no requirements for illumination per the FDM. Likewise, night-time collisions are not overrepresented at the intersection. Since night-time crashes represented only 19 percent of total crashes, additional intersection lighting was not considered necessary at this time.

4.2 Operational Observations

4.2.1 AM Peak Period

During the AM peak period the peak direction was observed to be westbound on SR 46.

The maximum number of queued vehicles at the stop-controlled northbound Richmond Avenue approach was observed to be three vehicles.

The westbound left movement on SR 46 to Richmond Avenue appeared to have sufficient gaps in opposing traffic to accommodate this movement. However, in one instance, it was observed that as a vehicle waited for an appropriate gap to perform the movement, a queue formed with a length of the observable distance from the intersection (**Figure 4-11**). This movement appeared to create a

shockwave event, causing queueing. Another observed instance of the westbound left movement created a queue length of seven vehicles.

4.2.2 PM Peak Period

The peak direction during the PM peak was determined to be eastbound. Traffic on SR 46 flowed in platoons from the signalized intersection adjacent to the Richmond Avenue intersection.

The maximum queue length at the stop-controlled northbound approach on Richmond Avenue was observed to be two vehicles.

The westbound left movement on SR 46 continued to appear to have sufficient gaps in opposing traffic to accommodate the movement. One notable incident occurred during the observation period when a vehicle (V01) attempted to perform a westbound left movement, resulting in what appeared to be a near rear-end collision with the vehicle behind it (V02). It appeared that to avoid collision, V02 departed the pavement and passed V01 by utilizing the unpaved shoulder on the north side of SR 46 before returning to pavement and continuing westbound. Two more vehicles that were behind V02 performed this maneuver as well to pass V01. V01 completed the westbound left movement, but narrowly avoided being hit by opposing traffic in the process.

Figure 4-1
SR 46 West Leg Photographs

Facing EB Toward the Intersection



Facing WB Away from the Intersection



Figure 4-2
SR 46 East Leg Photographs

Facing WB Toward the Intersection



Facing EB Away from the Intersection



Figure 4-3
Richmond Avenue Photographs

Facing NB Toward the Intersection



Facing SB Away from the Intersection



Figure 4-4
Drainage Structure East of Richmond Avenue



Figure 4-5
Stop Bar at Northbound Richmond Avenue



Figure 4-6
Missing RPMS on Richmond Avenue

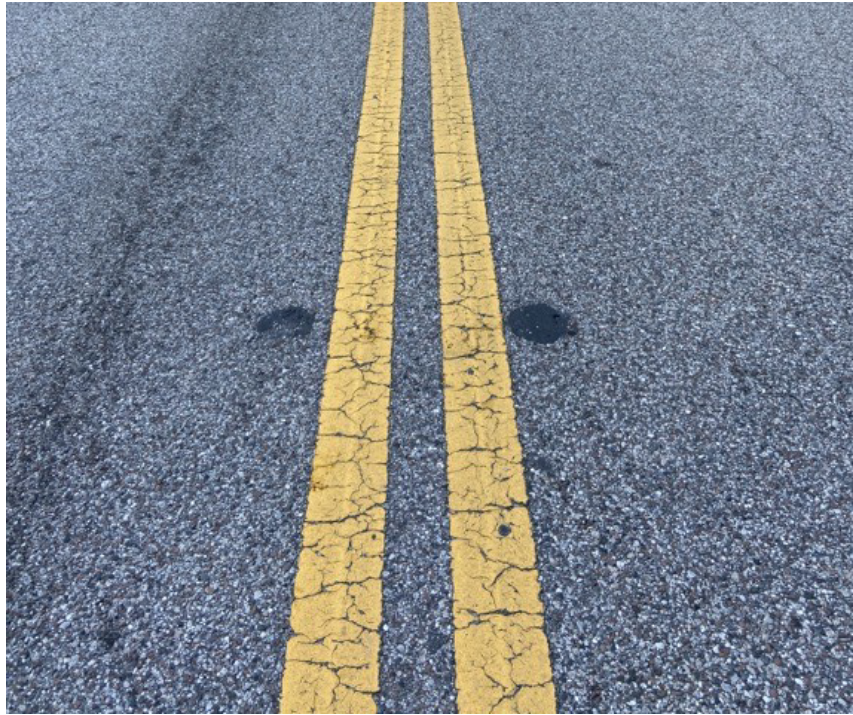


Figure 4-7
Two-way Traffic Sign Obstructed by Speed Limit Sign on Eastbound SR 46



Figure 4-8
Divided Highway Sign Upside Down on Westbound SR 46



Figure 4-9
Edge Failure on Richmond Avenue East Edge of Pavement



Figure 4-10
Edge Failure on Richmond Avenue West Edge of Pavement



Figure 4-11
Queuing Caused by Westbound Left Movement



Section 5.0

Collision Analysis

5.1 Crash Data Collection

Crash data was collected from Signal Four Analytics for the full years of 2016 through 2022, and 2023 for January 1st through March 8th, the most recent date crash data was available.

5.2 Collision Summary and Diagrams

Both a collision summary and collision diagram were prepared and are included as **Table 5-1** and **Figure 5-1**, respectively.

In the time period analyzed, a total of fifteen crashes occurred. Eight of these crashes resulted in injury, with one of these resulting in an incapacitating injury. Six crashes were considered to have only property damage. One crash resulted in a fatality.

Thirteen of the recorded crashes (or 87%) occurred during daylight hours, with the majority (thirteen or 87%) of the crashes occurring during dry conditions.

Of the fifteen crashes, there were seven rear-end crashes, three left turn crashes, one angle crash, one right turn crash, one animal crash, one pedestrian crash, and one classified as “other.”

Nine crashes were the result of careless driving. Two crashes (crash 8, HSMV Report #88204683, and crash 15, HSMV Report #25029835) occurred due to failure to yield the right of way. Both incidents occurred when a vehicle was attempting to perform a westbound left turn from SR 46 onto Richmond Avenue, and both incidents resulted in an injury or fatality. A few notable additional contributing causes were the loss of control of a motorcycle (crash 6, HSMV Report #87506904) and a vehicle impact with a deer (crash 4, HSMV Report #85600887). One crash (crash 1, HSMV Report #85160948) resulted from running the stop sign at the northbound approach on Richmond Avenue.

The pedestrian crash (crash 5, HSMV Report #8735002) occurred when a pedestrian unexpectedly and suddenly darted across SR 46, resulting in their severe injury. This pedestrian was working on a construction crew. The driver was found not at fault in this case.

The fatal crash (crash 15, HSMV Report #25029835) occurred on December 18th, 2022, and is the most recent crash recorded. It resulted as a westbound vehicle attempting to turn left onto Richmond Avenue from SR 46 (V01), colliding with a vehicle traveling eastbound (V02). The front of V02 struck the right side of V01, then V01 entered the ditch in the southeast corner of the intersection.

Two additional left turn crashes (crash 8, HSMV Report #88204683, and crash 12, HSMV Report #24891788) occurred as a westbound vehicle attempted to turn left onto Richmond Avenue and collided with an opposing eastbound vehicle. A total of five injured persons and one fatality was reported for the three westbound left turn crashes. Two resulted in the left turning vehicle entering

the ditch in the southeast corner after impact: the fatal crash 15 and crash 8, HSMV Report #88204683.

Five of the eight rear-end collisions were a result of a vehicle traveling westbound on SR 46 and attempting to turn left onto Richmond Avenue.

**Table 5-1
Collision Summary**

Form 750-020-05k
TRAFFIC ENGINEERING
September 2020

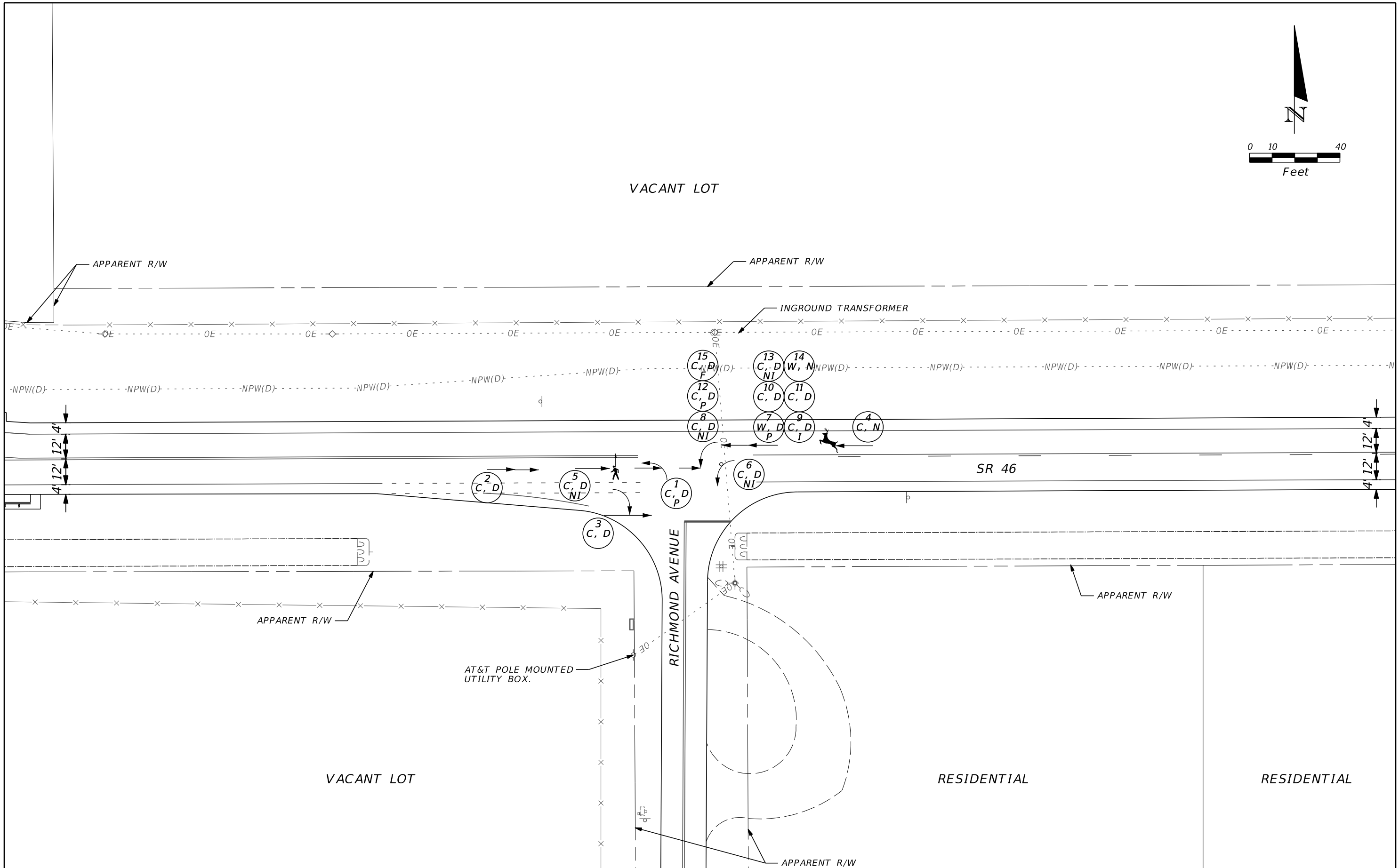
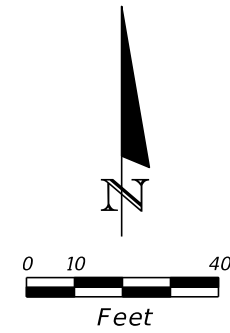
State of Florida Department of Transportation

COLLISION SUMMARY

General Information

Section/Roadway ID:	77040000	State Road:	46	
Intersecting Route:	Richmond Ave	Study Period:	1/1/16	To: 3/8/23
Milepost:	4.065	Data by:	Brenna Boylan	
County:	Seminole	Date:	Monday, May 8, 2023	

Number	HSMV Report No.	Date	Day	Time		Severity		Property Damage	Crash Type	Day / Night	Wet / Dry	Contributing Cause
						Fatal	Injury					
1	85160948	4/3/16	Sunday	6:35 PM		0	5	\$12,000	Angle	Day	Dry	Ran Stop Sign
2	86788967	1/24/17	Tuesday	9:13 AM		0	0	\$500	Rear End	Day	Dry	Careless Driving
3	87351103	7/13/17	Thursday	1:56 PM		0	0	\$2,000	Right Turn	Day	Dry	Careless Driving
4	85600887	11/1/17	Wednesday	4:01 AM		0	0	\$10,000	Animal	Night	Dry	Other
5	87353002	12/18/17	Monday	4:04 PM		0	1	\$600	Pedestrian	Day	Dry	Darting
6	87506904	4/18/18	Wednesday	7:35 AM		0	1	\$5,000	Other	Day	Dry	Lost Control
7	89273687	10/7/19	Monday	4:11 PM		0	1	\$15,300	Rear End	Day	Wet	Careless Driving
8	88204683	10/20/19	Sunday	12:50 PM		0	3	\$25,000	Left Turn	Day	Dry	Failed To Yield ROW
9	88403740	1/4/21	Monday	11:10 AM		0	4	\$20,000	Rear End	Day	Dry	Careless Driving
10	24246030	5/27/21	Thursday	6:47 PM		0	0	\$5,500	Rear End	Day	Dry	Careless Driving
11	24567087	12/6/21	Monday	5:40 PM		0	0	\$10,000	Rear End	Day	Dry	Careless Driving
12	24891788	1/29/22	Saturday	5:14 PM		0	1	\$11,000	Left Turn	Day	Dry	Careless Driving
13	24567861	3/6/22	Sunday	9:48 AM		0	1	\$3,000	Rear End	Day	Dry	Careless Driving
14	24901972	3/8/22	Tuesday	7:45 PM		0	0	\$9,000	Rear End	Night	Wet	Careless Driving
15	25029835	12/18/22	Sunday	9:36 AM		1	1	\$15,000	Left Turn	Day	Dry	Failed to Yield ROW
TOTAL						1	18	\$143,900				
Total No.	Fatal	Injury	PDO	Rear End	Head-on	Animal	Left Turn	Right Turn	Angle	Backed Into	Pedestrian	Other
15	1	8	6	7	0	1	3	1	1	0	1	1
PERCENT	7%	53%	40%	47%	0%	7%	20%	7%	7%	0%	7%	7%
Contrib. Cause	Day	Night	PAVEMENT CONDITIONS			Darting	DUI	Careless Driving	Improper Lane Change	Failed to Yield ROW	Lost Control	Other
			Wet	Dry	Unknown							
TOTAL	13	2	2	13	0	1	0	9	0	2	1	2
PERCENT	87%	13%	13%	87%	0%	7%	0%	60%	0%	13%	7%	13%
Total Vehicles Entering/ADT:							Collision Rate:					



LEGEND

CRASH NUMBER
CLEAR (C) OR WET (W)
WEATHER CONDITION
DAY (D), NIGHT (N)
POSSIBLE (P), NON-INC. (NI),
INC. (I), OR FATALITY (F)

REAR END
HIT ANIMAL
HIT PED.
LOST CONTROL

ANGLE
LEFT TURN

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 46	SEMINOLE	237995-1-32-20

FIGURE 5-1
COLLISION DIAGRAM

SHEET NO.
1 of 1

aburnett

6/29/2023 3:01:38 PM Default

F:\Projects\DT5-032-01\TWO 3 SR 46 at Richmond Avenue\roadway\PLANRD02_COLLISION_DIAGRAM.dgn

Section 6.0

Evaluation of Improvements

6.1 Short-term Maintenance Improvements

During the field observation, several short-term maintenance items were identified.

6.1.1 Seminole County Maintenance Improvements

- The stop bar at Richmond Avenue needs to be refreshed.
- The missing RPMs should be replaced on Richmond Avenue.
- The stop sign (R1-1) located at Richmond Avenue needs to be replaced.

6.1.2 FDOT Maintenance Improvements

- The eastbound 55-mph posted speed limit sign (R2-1) located approximately 360 feet west of the intersection is a duplicate speed limit sign and is obstructing the view of two-way traffic sign (W6-3). It should be removed.
- The westbound divided highway sign (W6-1) located 60 feet west of the intersection should be rotated 180 degrees due to incorrect installation.
- Street name subplates (W16-8P) are recommended to be added to the intersection warning signs (W2-2) in both directions.
- Install minor street termination signing on the north side of SR 46 to include the two-direction large arrow sign (W1-7) and three object markers (OM1-3)
- The pavement edge failure located on both the west and east edges of pavement of Richmond Avenue at the intersection should be repaired.

6.2 Long-Term Improvements

Long-term safety improvements were evaluated, along with any special needs required for implementation.

6.2.1 Addition of Westbound Left Turn Lane

Based on the crash history and field observations, the addition of a westbound left turn lane along SR 46 at Richmond Avenue is recommended. Large queues were witnessed when a westbound vehicle attempted to turn left onto Richmond Avenue and some drivers were observed driving off the pavement to go around the left turning vehicle. These conditions can cause left turning drivers to accept insufficient gaps in opposing traffic. The addition of a left turn lane will provide a separation of the westbound left turn movement from the mainline westbound through movement reducing the potential for rear-end crashes. Additional benefits include providing the westbound left turn movement the ability to select an adequate gap in opposing traffic without delaying the westbound through movement, ultimately providing additional capacity and operational benefits, as well as a safer experience for all users at the intersection.

6.2.2 Addition of Guardrail

Two of the three westbound left crashes resulted in the left turning vehicle being pushed into the ditch in the southeast corner of the intersection, due to the impact of the eastbound vehicle. One of the crashes resulted in a fatality and the other resulted in several injuries. Therefore, clear zone and roadside slopes were evaluated to determine whether the ditch meets criteria. SR 46 has a 55-mph posted speed and a 60-mph design speed within the project limits. This 60-mph design speed requires 36 feet of clear zone width. Field investigation confirmed that the ditch, which is located within the clear zone, has non-traversable slopes.

FDM 215.3.2 defines a canal hazard as an open ditch parallel to the roadway for a minimum distance of 1,000 feet and with a seasonal water depth in excess of 3 feet for extended periods of time (i.e., 24 hours or more). Inwood obtained permit documents for the SR 46 from Mellonville Road to SR 415 project (FPID 240216-52-01) which included seasonal high-water data indicating that west of our project, the canal criteria was likely met. For that project, the canal was shielded with guardrail the entire length of the project. We believe this ditch likely meets FDM criteria for classification as a canal within our project limits as well. Due to the crash history, Inwood recommends that the canal be shielded.

FDM Figure 215.4.6 depicts lateral offset to guardrail criteria. For flush shoulder roadways without shoulder gutter, the lateral offset for this project is full shoulder width (10 feet) plus 2 feet, or 12 feet total. Based upon our field review, the existing unpaved shoulder and front slope along the canal was field measured at approximately 1:4. Per the standard plans index 536-001, the recommended miscellaneous asphalt needs to be constructed with a 1:10 max slope to the 2-foot slope break point, followed by a 1:2 slope tying to the existing ground. Leaving the road at the existing location and adding guardrail at the 12-foot offset would result in impacts to the canal. Based on our preliminary analysis, the roadway would need to be shifted 3 feet to the north and a deep post guardrail option utilized to reduce the 2-foot setback to the slope break point, thereby eliminating impacts to the canal. With the additional roadway shift, the need for milling and resurfacing with cross slope correction using overbuild will also be required to shift the existing crown to the new inside travel lane.

The existing guardrail west of the intersection currently terminates at the end of the shoulder gutter within a 45-mph design segment and does not extend further east to the existing mitered end section within the 60-mph design segment. Since this area is constrained, Deep Post guardrail is also proposed at this location. Both locations east and west of the intersection will require coordination with the District Drainage Engineer and the District Maintenance Engineer during design. To be conservative, the construction cost estimate includes guardrail from Richmond Avenue eastward to the first driveway, and from the existing terminus of guardrail west of Richmond Avenue eastward past the mitered end section a minimum of 25 feet.

6.2.3 Cross Drain Extension

In the southeast corner of the intersection, the top of the mitered end section is very close to the edge of travel (less than 10 feet) for the northbound Richmond Avenue through lane. It is recommended to wrap the guardrail around the radius using an 8-foot radius CRT System (Standard Index 536-001, sheet 12 of 24), and extend the cross drain 25 feet to the east. Note 2 of Standard

Index 536-001, sheet 12 of 14 requires a minimum clear area of 25 feet behind the CRT to fixed objects and above ground hazards. There are no fixed objects or above ground hazards within that distance. However, these improvements shield the canal and increase the distance from the guardrail to the canal, greatly improving safety over existing conditions. Per FAC 62-330.051(9)(c), this cross drain extension would be exempt from permitting as its impact is less than 0.10 acre.

6.2.4 Corner Radius Reduction

It is recommended to reduce the radius in the southeast corner of the intersection to a 25-foot radius. This would both increase the distance between the northbound approach and the guardrail proposed to wrap around the southeast corner of the intersection, as well as improve the line of sight to the stop sign.

6.2.5 Right-of-Way Needs

Proposed long-term improvements can be constructed within existing right-of-way. No additional right-of-way is required.

6.2.6 Utility Relocation Needs

There are six utility agency/owners (UAOs) identified on the project from our Sunshine 811 design ticket and preliminary utility research. A list of the UAOs and general description of facilities is shown in Table 6-1.

There are no gas transmission or hazardous liquid lines in the project area. Identified utility facilities of significance include an overhead transmission line on the north side of SR 46, approximately forty feet from the edge of pavement, and a 20-inch reclaimed water main with varying offset from the north edge of pavement, and a 12-inch stub out toward Richmond Avenue that does not cross SR 46. The need for utility relocations is not evident based on information provided by the UAOs at this time, and will need to be confirmed during design.

**Table 6-1
Utility Agency/Owners**

Utility Agency/Owner	Description of Facilities
1. AT&T Distribution	Telephone
2. Charter Communications	CATV/Fiber/Phone
3. City of Sanford Public Works	Lighting
4. City of Sanford Utilities Dept.	Sewer/Water
5. Florida Power & Light - Seminole	Electric
6. Florida Power & Light - Transmission	Electric Transmission

6.2.7 Environmental and Drainage Permitting Needs

The proposed study area is located within a partially developed area, including residential, agricultural, upland, and wetland land uses.

The undeveloped area north of the intersection of SR 46 and Richmond Avenue contains some areas of wetlands, particularly the portion east of Richmond Avenue. Vegetation observed includes American elm (*Ulmus americana*), cabbage palm (*Sabal palmetto*), Brazilian pepper (*Schinus terebinthifolia*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), saltbush (*Atriplex pentandra*), swamp bay (*Persea palustris*), wild taro (*Colocasia esculenta*), Peruvian primrose willow (*Ludwigia peruviana*), Carolina ash (*Fraxinus caroliniana*), and sweet scent (*Pluchea odorata*). This wetland extends into the right-of-way of SR 46, approximately 10 feet roadward of the fence line in most areas. Vegetation observed in this area of the right-of-way includes saltbush, Peruvian primrose willow, wild taro, pennywort (*Hydrocotyle* spp.), frostweed (*Verbesina virginica*), dogfennel (*Eupatorium capillifolium*), sweet scent, and goldenrod (*Solidago* spp.). Impacts to this area should be avoided to meet permitting exemption criteria.

A roadside swale is present on the north side of SR 46. This conveyance system was constructed prior to the need to obtain a permit under part IV of Chapter 373, Florida Statutes. The proposed project includes widening SR 46 to the north in order to add a turn lane. This turn lane will be less than 0.25 mile in length. The existing swale will be regraded to accommodate the widening and a new swale will be added to prevent additional runoff. The proposed safety improvements are exempt from Environmental Resource Permitting in accordance with Chapter 62-330.051(4)(c) Florida Administrative Code (F.A.C.). The modification and reconstruction of the existing swale is exempt under Chapter 62-330.051(15) F.A.C.

The project will have no encroachment into floodplains as identified by the Federal Emergency Management Agency Flood Insurance Rate Map. Proposed project activities will not impact any Outstanding Florida Waters. The project area is not within the Coastal Construction Control Line. Section 4(f) does not apply to this project.

The project area is entirely within the United States Fish and Wildlife Service's (USFWS) Consultation Area for the Audubon's crested caracara (*Caracara cheriway*), Florida scrub-jay (*Alphelocoma coerulescens*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and West Indian manatee (*Trichechus manatus*). No habitat for the Audubon's crested caracara, Florida scrub-jay, Everglade snail kite, or West Indian manatee occurs within or immediately adjacent to the project area.

Additional wildlife considerations include the gopher tortoise (*Gopherus polyphemus*). No gopher tortoise burrows were observed during the field review, and due to the limited impact area, it is unlikely that any gopher tortoise burrows will be impacted. The project is not located within the 660-foot buffer of any bald eagle (*Haliaeetus leucocephalus*) nests. According to the Audubon Center for Birds of Prey EagleWatch Program, the nearest bald eagle nest to the project (Nest SE051) is approximately 1,500 feet from the project limits. No bald eagle nests or individuals were observed during a pedestrian survey of the project area.

No other federally listed threatened or endangered species, proposed threatened or endangered species, or designated or proposed critical habitat are known to occur within or adjacent to the limits of construction. In addition, the proposed project has no other known potential state-listed species or species that are otherwise protected by regulation occurring in or near the project area.

The proposed project will not impact listed species and impacts to the permitted stormwater management system in the southeast corner of the intersection are minimal. Based on the concept, the work is expected to be exempt from permitting through the SJRWMD per 62-330.051 F.A.C.

6.2.8 Variations and Exceptions

Inwood anticipates the need for one design variation for the recommended improvements.

The existing distance from the edge of travel to the existing utility poles for the overhead transmission line on the north side of SR 46 is approximately 40 feet. Per FDM Table 215.2.2, the minimum lateral offset requirement is outside clear zone for above ground utilities on a flush shoulder roadway. The 60-mph design speed requires 36 feet of clear zone width.

With north side widening proposed to add the westbound left turn lane, the minimum lateral offset criteria of 36 feet will not be met. However, there have been no road departure crashes for westbound vehicles during the study period, indicating a low risk that reducing the lateral offset will lead to an increase in crashes into the utility poles. Any risk would be offset by the improved safety that will be achieved by constructing the left turn lane, which is expected to reduce both left turn and rear-end crashes.

A design variation will be required for the lateral offset criteria on the north side of SR 46 to the above ground utility poles.

6.3 Construction Cost Estimate (Long Range Estimate)

The cost of the proposed long-term improvements was derived using the FDOT Long Range Estimate (LRE) system. Included in the LRE are assumptions for MOT, mobilization, and project unknown costs at 10% each, as well as an initial contingency. After providing project specific edits, the resulting construction cost for widening and adding the westbound left turn lane, as well as adding guardrail, is estimated to be \$1,250,503.30. The LRE construction cost estimate can be found in **Appendix C**.

6.4 Detailed Design Fee

Similarly, a design staff hour estimate (SHE) was generated to develop the design fee associated with the proposed long-term improvement. Using current contract personnel rates, the design fee was estimated at \$299,846.65. This value includes earthwork, roadway, shoulder, drainage, and signing and pavement marking components adjusted within the LRE template to fit the proposed improvements. An additional 11.35% of the construction cost (\$141,932.12) has been included for CEI services resulting in a grand total of \$441,778.71 for design and CEI services.

6.5 B/C & NPV Analysis

A benefit/cost (B/C) analysis was completed for the long-term improvements using the FDOT Office of Roadway Design spreadsheet found on the Quality Assurance-Tools webpage.

A crash reduction factor (CRF) of 55% was sourced from the CMF Clearinghouse website (CMF ID 255). This CRF, for providing a left turn lane on one major road approach, is applicable to all fatal and injury crashes of all crash types. Therefore, one fatal crash, one incapacitating injury crash, four non-incapacitating injury crashes, and three possible injury crashes are correctible at the intersection of SR 46 at Richmond Avenue using this CRF. The 5-year districtwide average crash cost of \$558,273 for a rural 2-3 lane undivided roadway was used in the analysis. The CMF ID 255 detail is provided as **Appendix D**.

The analysis resulted in an annual “benefit” of \$383,813 and an annual “cost” of \$124,552 which resulted in a B/C ratio of 3.08.

The Net Present Value (NPV) analysis was completed using the Department’s preferred spreadsheet. The Department provided FY 2025 as the year design funding will be programmed, and FY 2027 as the likely year construction funding will be programmed. An additional 11.35% of the construction cost (\$141,932.12) has been included for CEI services resulting in a grand total of \$1,392,436 for construction and CEI services.

Consistent with the benefit/cost analysis, a discount rate of 4% was used. Construction will likely be completed one year after funds are available. Applying the yearly benefit of \$383,813 for the lifecycle of the improvements (20 years beginning in FY 2028) the resulting NPV is \$2,991,297.

The B/C ratio of 3.08 and the NPV of \$2,991,297 indicate that the proposed improvements are financially justified. The results of the B/C and NPV analysis can be found in **Appendix E**.

Section 7.0

Final Recommendations

Recommendations for the intersection of SR 46 at Richmond Avenue are summarized and separated into short-term maintenance improvements that can be implemented immediately, and ultimate improvements that may take 1-2 years to design and construct once funding is allocated.

7.1 Short-Term Maintenance Improvements

During the field observation, several items were identified that should be improved through maintenance

7.1.1 Seminole County Maintenance Improvements

- The stop bar at Richmond Avenue needs to be refreshed.
- The missing RPMs should be replaced on Richmond Avenue.
- The stop sign (R1-1) located at Richmond Avenue needs to be replaced.

7.1.2 FDOT Maintenance Improvements

- Pavement markings should be refreshed within the project limits, including centerlines and edge lines.
- The eastbound 55-mph posted speed limit sign (R2-1) located approximately 360 feet west of the intersection is a duplicate speed limit sign and is obstructing the view of two-way traffic sign (W6-3). It should be removed.
- The westbound divided highway sign (W6-1) located 60 feet west of the intersection should be rotated 180 degrees due to incorrect installation.
- Street name subplates (W16-8P) are recommended to be added to the intersection warning signs (W2-2) in both directions.
- Install minor street termination signing on the north side of SR 46 to include the two-direction large arrow sign (W1-7) and three object markers (OM1-3)
- The pavement edge failure located on both the west and east edges of pavement of Richmond Avenue at the intersection should be repaired.

A short-term maintenance improvements concept plan is shown in **Figure 7-1**.

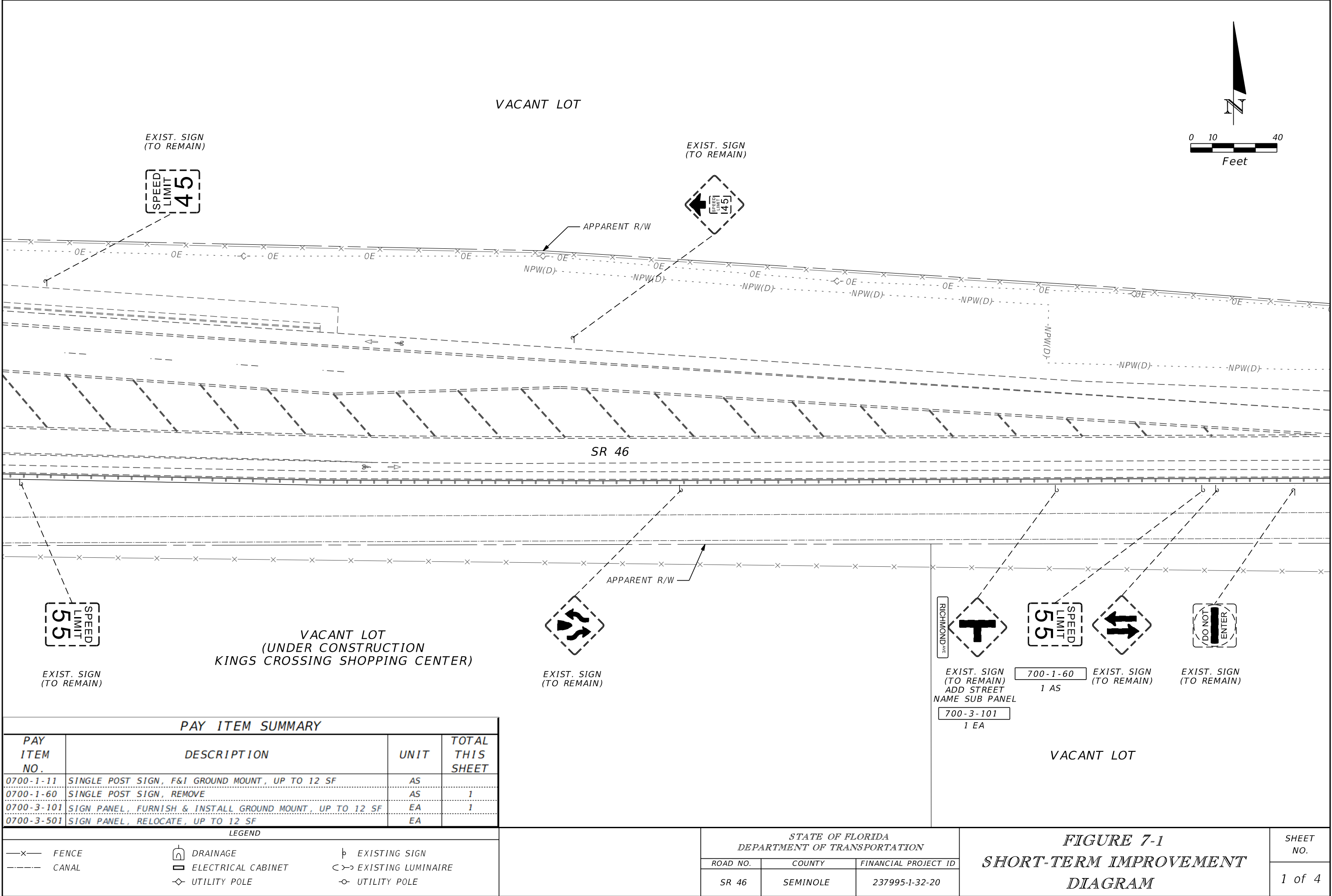
7.2 Ultimate Improvements

Based on the analysis in this report, the following long-term improvements are recommended:

- Add a westbound left turn lane at the intersection of SR 46 and Richmond Avenue

- Install guardrail around the radius of the southeast corner of the intersection, extending on the south side of SR 46 east approximately 400 feet along the canal to the first residential driveway, as well as extending guardrail along the canal west of Richmond Avenue from the existing terminus eastward past the mitered end section a minimum of 25 feet
- Extend the cross drain in the southeast corner of the intersection 25 feet to the east to increase separation between the guardrail proposed to wrap around the southeast corner of the intersection and the canal
- Reduce the radius in the southeast corner of the intersection to 25 feet to increase the distance between the northbound approach and the guardrail proposed to wrap around the southeast corner of the intersection, as well as improve the line of sight to the stop sign

A concept of the proposed improvements is depicted in **Figure 7-2**. Please note, this concept may need to be modified during design based on survey.

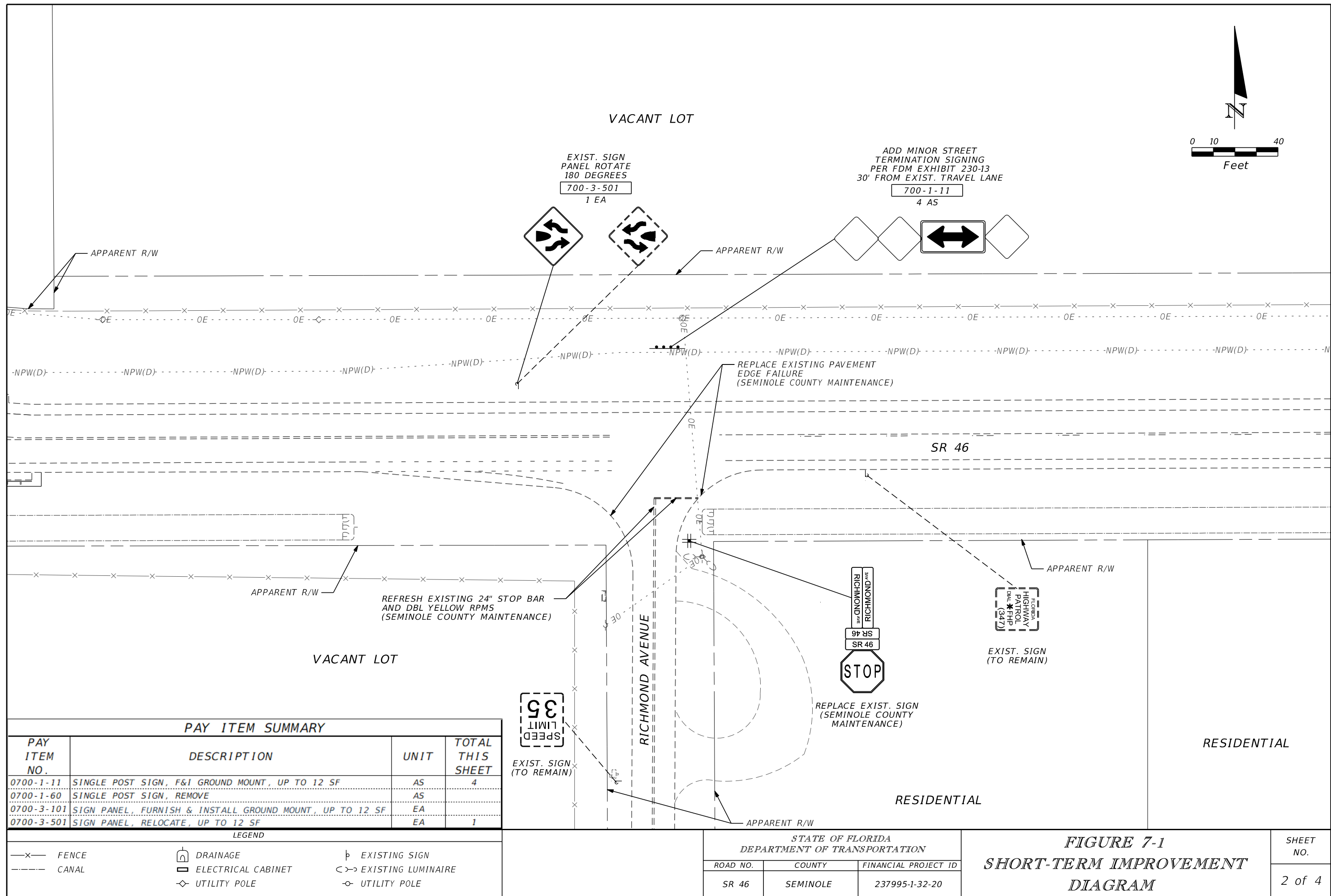


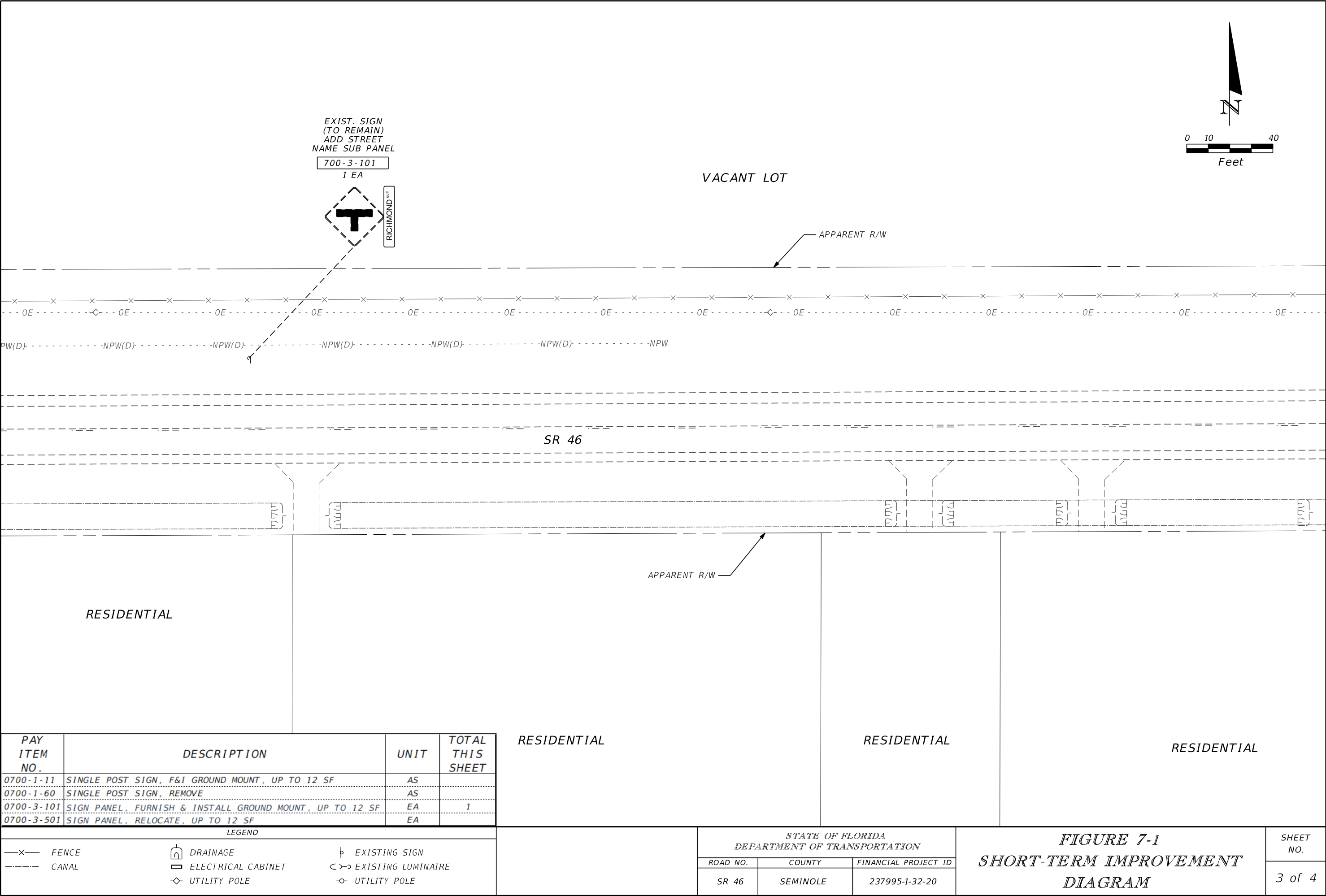
PAY ITEM SUMMARY			
PAY ITEM NO.	DESCRIPTION	UNIT	TOTAL THIS SHEET
0700-1-11	SINGLE POST SIGN, F&I GROUND MOUNT, UP TO 12 SF	AS	
0700-1-60	SINGLE POST SIGN, REMOVE	AS	1
0700-3-101	SIGN PANEL, FURNISH & INSTALL GROUND MOUNT, UP TO 12 SF	EA	1
0700-3-501	SIGN PANEL, RELOCATE, UP TO 12 SF	EA	

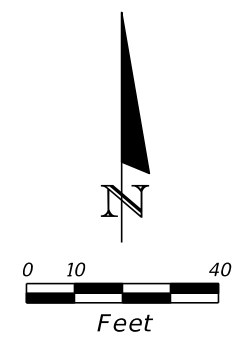
LEGEND			
—x—	FENCE	⌋	DRAINAGE
- - - -	CANAL	⌋	ELECTRICAL CABINET
		⌋	EXISTING SIGN
		⌋	EXISTING LUMINAIRE
		⌋	UTILITY POLE

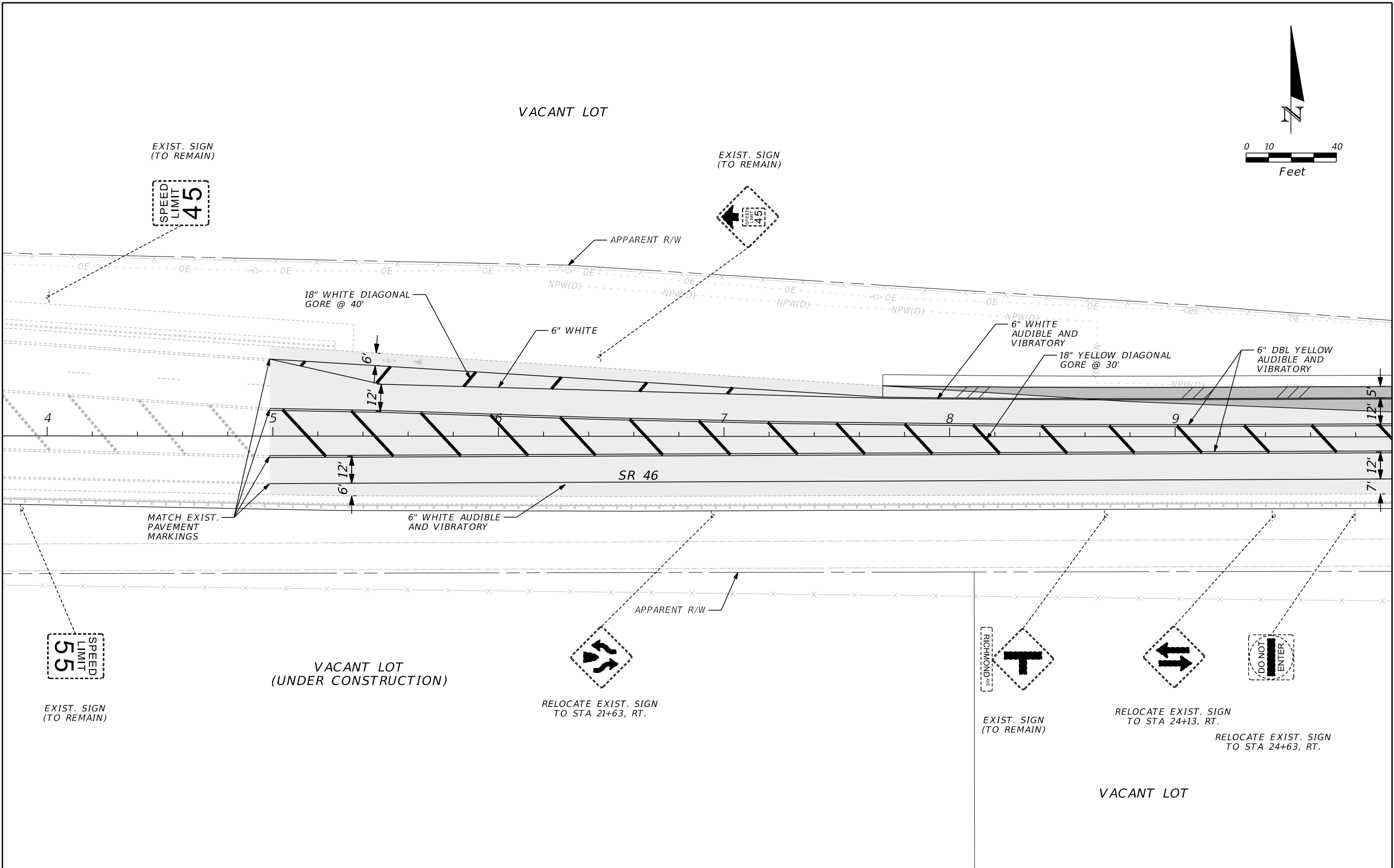
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 46	SEMINOLE	237995-1-32-20

FIGURE 7-1 SHORT-TERM IMPROVEMENT DIAGRAM		SHEET NO.
		1 of 4

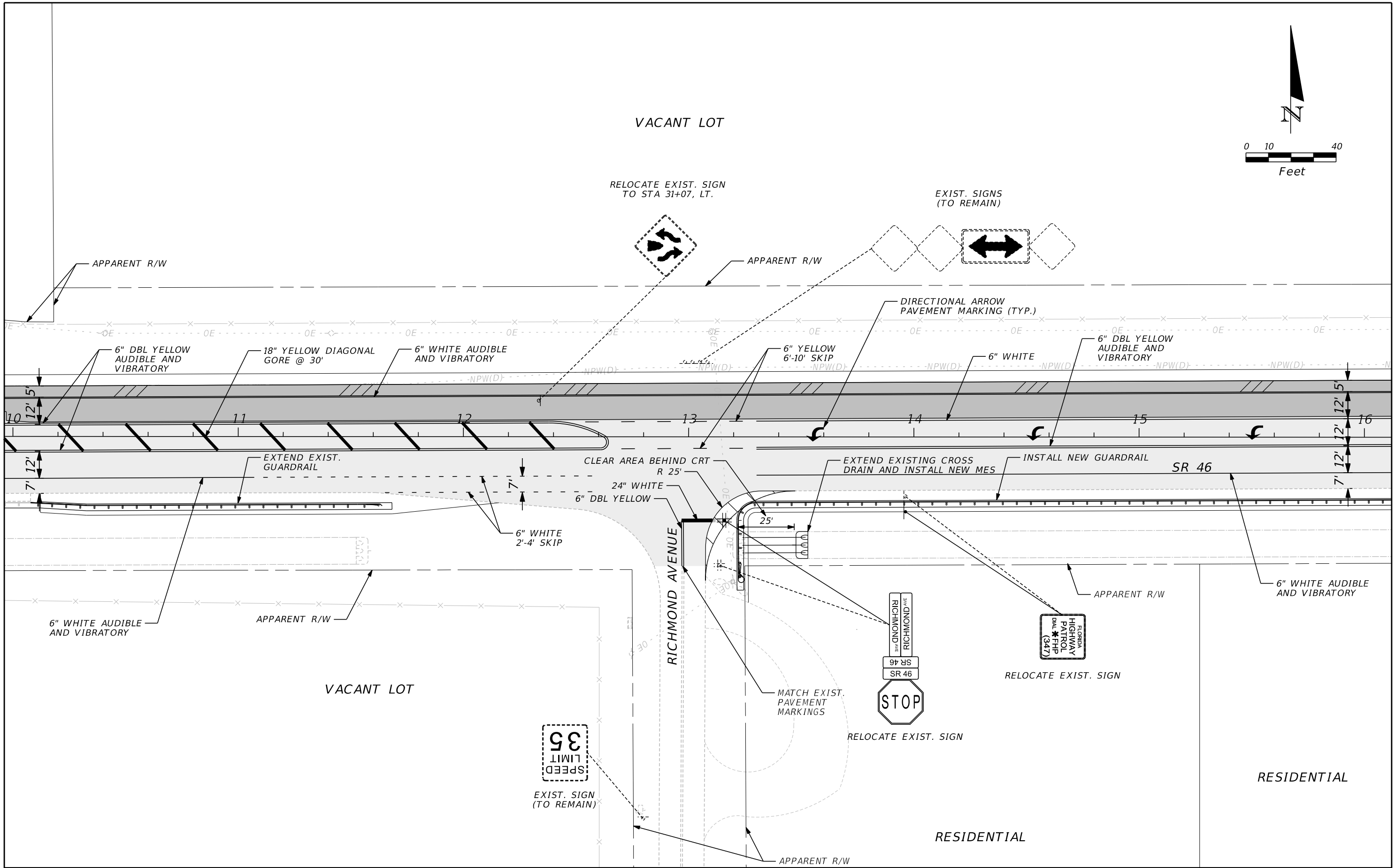




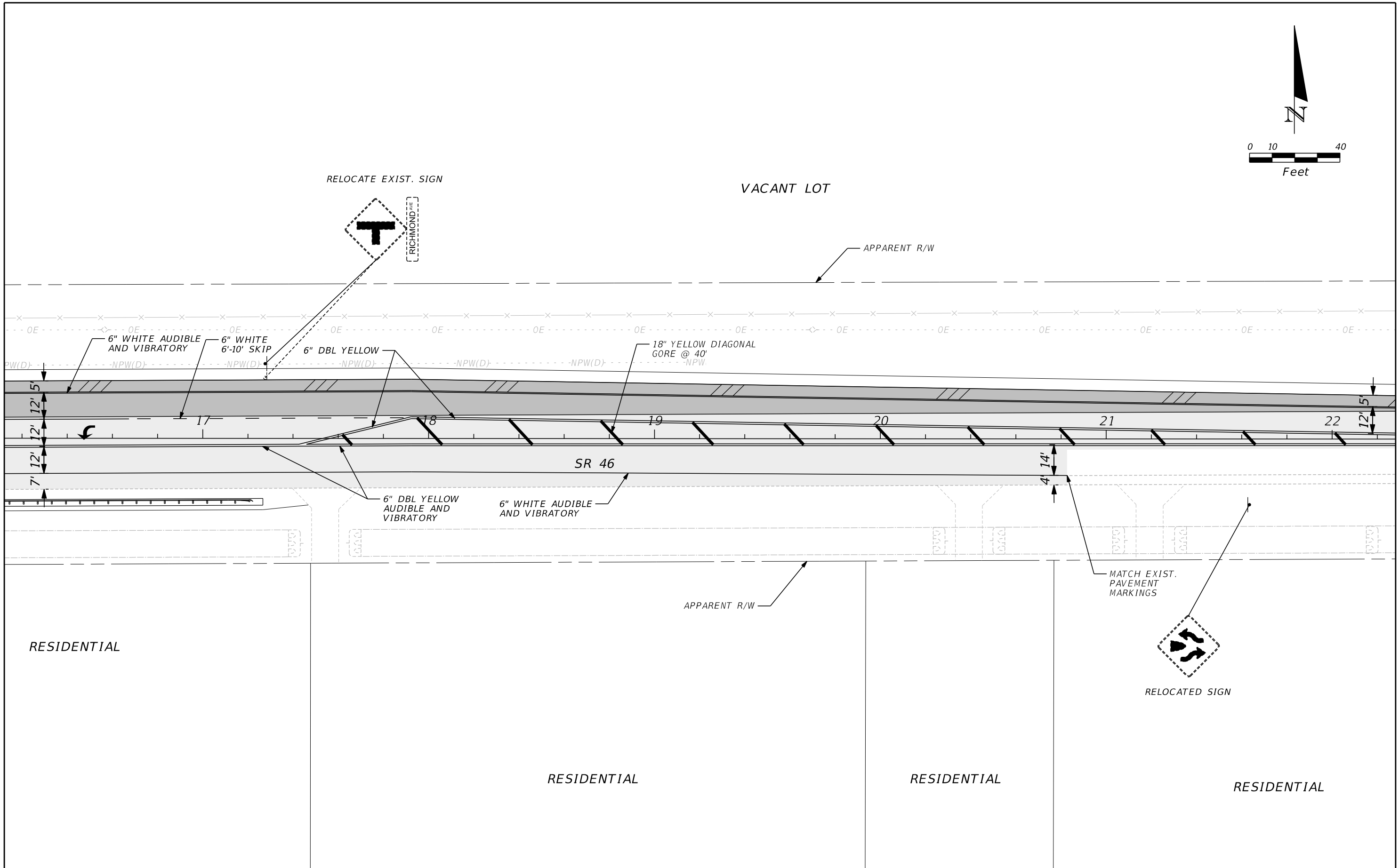
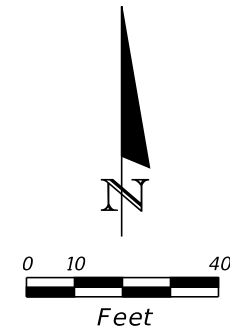




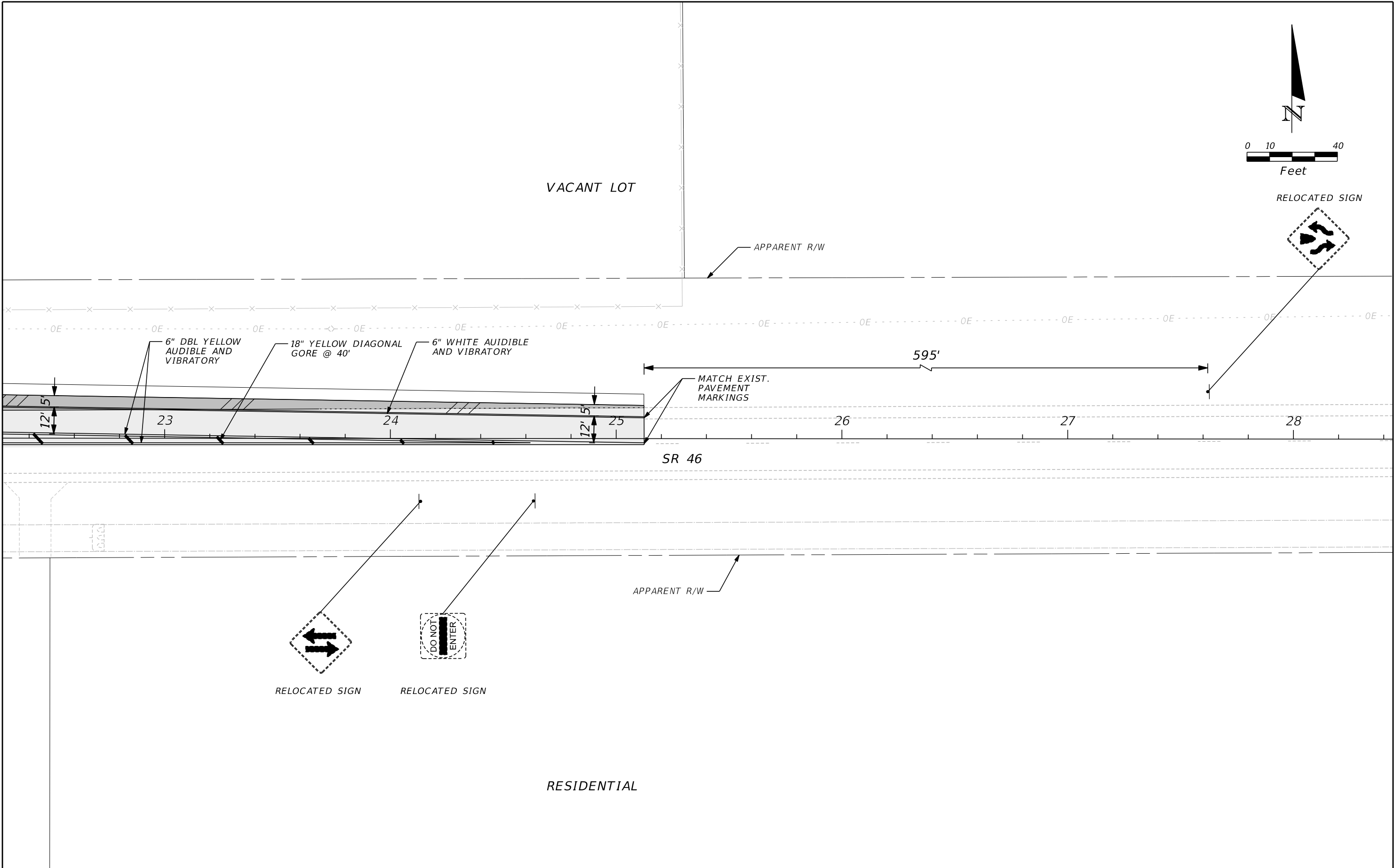
LEGEND			STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 7-2 ULTIMATE IMPROVEMENT DIAGRAM	SHEET NO. 1 of 4
—x—	FENCE	▨	SHOULDER	◇	UTILITY POLE		
- - -	CANAL	▨	ASPHALT REMOVAL	⊥	EXISTING SIGN		
▨	WIDENING	⊥	DRAINAGE	⊥	EXISTING LUMINAIRE	ROAD NO.	COUNTY
▨	RESURFACING	⊥	ELECTRICAL CABINET	⊥	UTILITY POLE	SR 46	SEMINOLE
						FINANCIAL PROJECT ID	
						237995-1-32-20	



LEGEND			STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 7-2 ULTIMATE IMPROVEMENT DIAGRAM	SHEET NO. 2 of 4
—x—	FENCE	◇ UTILITY POLE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
---	CANAL	⌒ EXISTING SIGN	SR 46	SEMINOLE	237995-1-32-20		
▨	WIDENING	⌒ EXISTING LUMINAIRE					
▨	RESURFACING	○ UTILITY POLE					



LEGEND			STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 7-2 ULTIMATE IMPROVEMENT DIAGRAM	SHEET NO.
—x—	FENCE	▨	SHOULDER	◇	UTILITY POLE		3 of 4
----	CANAL	▨	ASPHALT REMOVAL	⌋	EXISTING SIGN		
▨	WIDENING	▨	DRAINAGE	⌋	EXISTING LUMINAIRE		
▨	RESURFACING	▨	ELECTRICAL CABINET	⌋	UTILITY POLE		



LEGEND				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			FIGURE 7-2 ULTIMATE IMPROVEMENT DIAGRAM	SHEET NO. 4 of 4
—x—	FENCE		SHOULDER	◇	UTILITY POLE	ROAD NO.		
- - -	CANAL		ASPHALT REMOVAL	⌋	EXISTING SIGN	COUNTY		
	WIDENING		DRAINAGE	⌋~	EXISTING LUMINAIRE	FINANCIAL PROJECT ID		
	RESURFACING		ELECTRICAL CABINET	○	UTILITY POLE			

Appendix A

8-Hour Intersection Turning Movement Counts

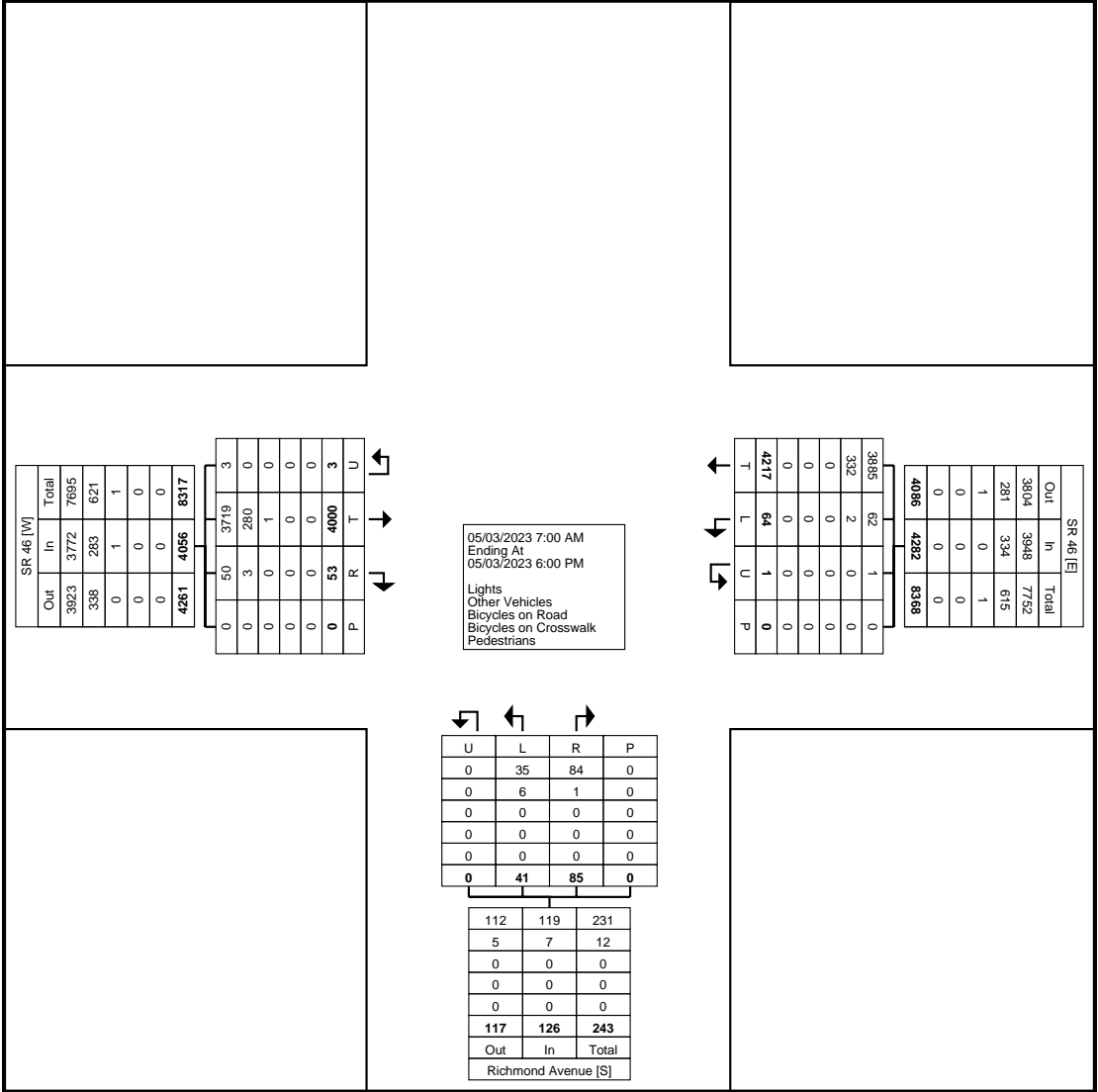
Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 1

Start Time	SR 46 Eastbound					SR 46 Westbound					Richmond Avenue Northbound					Int. Total
	U-Turn	Thru	Right	Peds	App. Total	U-Turn	Left	Thru	Peds	App. Total	U-Turn	Left	Right	Peds	App. Total	
7:00 AM	0	115	2	0	117	0	4	118	0	122	0	1	3	0	4	243
7:15 AM	0	154	1	0	155	0	3	134	0	137	0	1	1	0	2	294
7:30 AM	0	135	0	0	135	0	0	163	0	163	0	3	2	0	5	303
7:45 AM	0	133	2	0	135	0	0	157	0	157	0	0	2	0	2	294
Hourly Total	0	537	5	0	542	0	7	572	0	579	0	5	8	0	13	1134
8:00 AM	0	119	0	0	119	0	4	152	0	156	0	3	0	0	3	278
8:15 AM	0	129	1	0	130	0	3	149	0	152	0	1	1	0	2	284
8:30 AM	0	133	1	0	134	0	1	117	0	118	0	2	1	0	3	255
8:45 AM	0	82	5	0	87	0	0	107	0	107	0	3	1	0	4	198
Hourly Total	0	463	7	0	470	0	8	525	0	533	0	9	3	0	12	1015
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	0	89	1	0	90	0	3	111	0	114	0	2	1	0	3	207
11:15 AM	0	82	1	0	83	0	3	87	0	90	0	0	2	0	2	175
11:30 AM	0	83	1	0	84	0	2	98	0	100	0	0	2	0	2	186
11:45 AM	0	93	1	0	94	0	1	117	0	118	0	0	0	0	0	212
Hourly Total	0	347	4	0	351	0	9	413	0	422	0	2	5	0	7	780
12:00 PM	0	84	1	0	85	0	3	101	0	104	0	1	1	0	2	191
12:15 PM	0	96	1	0	97	0	3	95	0	98	0	3	0	0	3	198
12:30 PM	1	119	2	0	122	0	3	98	0	101	0	0	3	0	3	226
12:45 PM	1	81	2	0	84	0	0	81	0	81	0	1	2	0	3	168
Hourly Total	2	380	6	0	388	0	9	375	0	384	0	5	6	0	11	783
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2:00 PM	0	109	2	0	111	0	3	109	0	112	0	1	1	0	2	225
2:15 PM	0	119	1	0	120	0	4	138	0	142	0	0	1	0	1	263
2:30 PM	1	122	4	0	127	0	3	144	0	147	0	2	0	0	2	276
2:45 PM	0	111	3	0	114	0	2	119	0	121	0	3	5	0	8	243
Hourly Total	1	461	10	0	472	0	12	510	0	522	0	6	7	0	13	1007
3:00 PM	0	120	1	0	121	0	2	128	0	130	0	1	4	0	5	256
3:15 PM	0	154	3	0	157	0	1	146	0	147	0	2	1	0	3	307
3:30 PM	0	135	1	0	136	1	5	128	0	134	0	2	4	0	6	276
3:45 PM	0	140	0	0	140	0	2	144	0	146	0	3	3	0	6	292
Hourly Total	0	549	5	0	554	1	10	546	0	557	0	8	12	0	20	1131
4:00 PM	0	129	3	0	132	0	0	143	0	143	0	1	5	0	6	281
4:15 PM	0	154	2	0	156	0	1	149	0	150	0	1	10	0	11	317
4:30 PM	0	163	2	0	165	0	0	164	0	164	0	0	10	0	10	339
4:45 PM	0	183	0	0	183	0	1	160	0	161	0	0	5	0	5	349
Hourly Total	0	629	7	0	636	0	2	616	0	618	0	2	30	0	32	1286
5:00 PM	0	164	2	0	166	0	1	154	0	155	0	0	5	0	5	326
5:15 PM	0	159	3	0	162	0	1	159	0	160	0	1	0	0	1	323
5:30 PM	0	167	4	0	171	0	3	191	0	194	0	2	4	0	6	371
5:45 PM	0	144	0	0	144	0	2	156	0	158	0	1	5	0	6	308
Hourly Total	0	634	9	0	643	0	7	660	0	667	0	4	14	0	18	1328
Grand Total	3	4000	53	0	4056	1	64	4217	0	4282	0	41	85	0	126	8464
Approach %	0.1	98.6	1.3	-	-	0.0	1.5	98.5	-	-	0.0	32.5	67.5	-	-	-
Total %	0.0	47.3	0.6	-	47.9	0.0	0.8	49.8	-	50.6	0.0	0.5	1.0	-	1.5	-
Lights	3	3719	50	-	3772	1	62	3885	-	3948	0	35	84	-	119	7839
% Lights	100.0	93.0	94.3	-	93.0	100.0	96.9	92.1	-	92.2	-	85.4	98.8	-	94.4	92.6
Other Vehicles	0	280	3	-	283	0	2	332	-	334	0	6	1	-	7	624
% Other Vehicles	0.0	7.0	5.7	-	7.0	0.0	3.1	7.9	-	7.8	-	14.6	1.2	-	5.6	7.4
Bicycles on Road	0	1	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Bicycles on Road	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Seminole County:
Weekday TMC:

Vanasse Hangen Brustlin, Inc.
225 East Robinson Street, Suite 300
Landmark Center Two
Orlando, Florida, United States 32801
407-839-4006 rsabbisetti@vhb.com

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 2



Turning Movement Data Plot

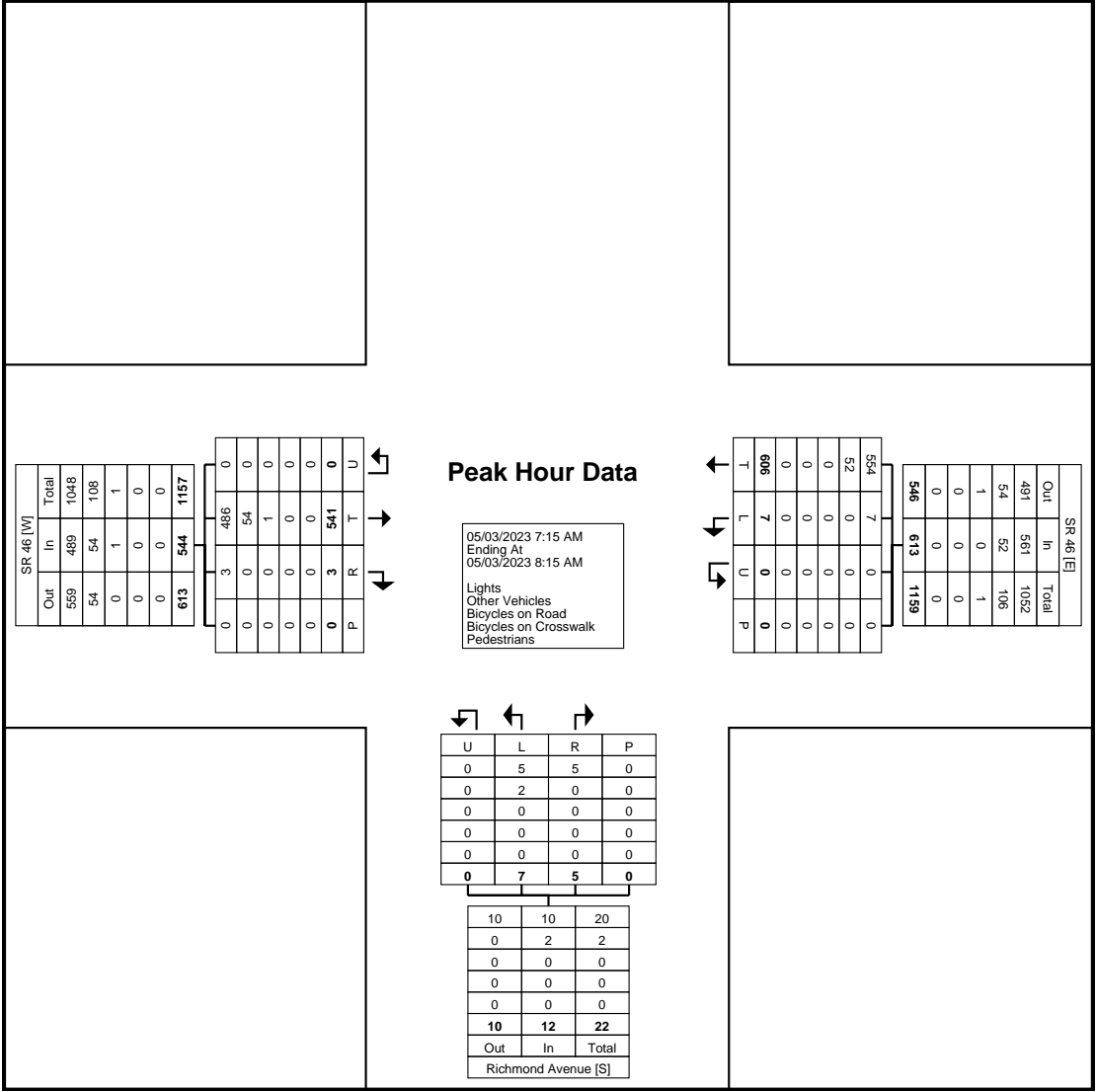
Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 3

[illegible]

Seminole County:
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407-839-4006 rsabbisetti@vhb.com

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 4



Turning Movement Peak Hour Data Plot (7:15 AM)

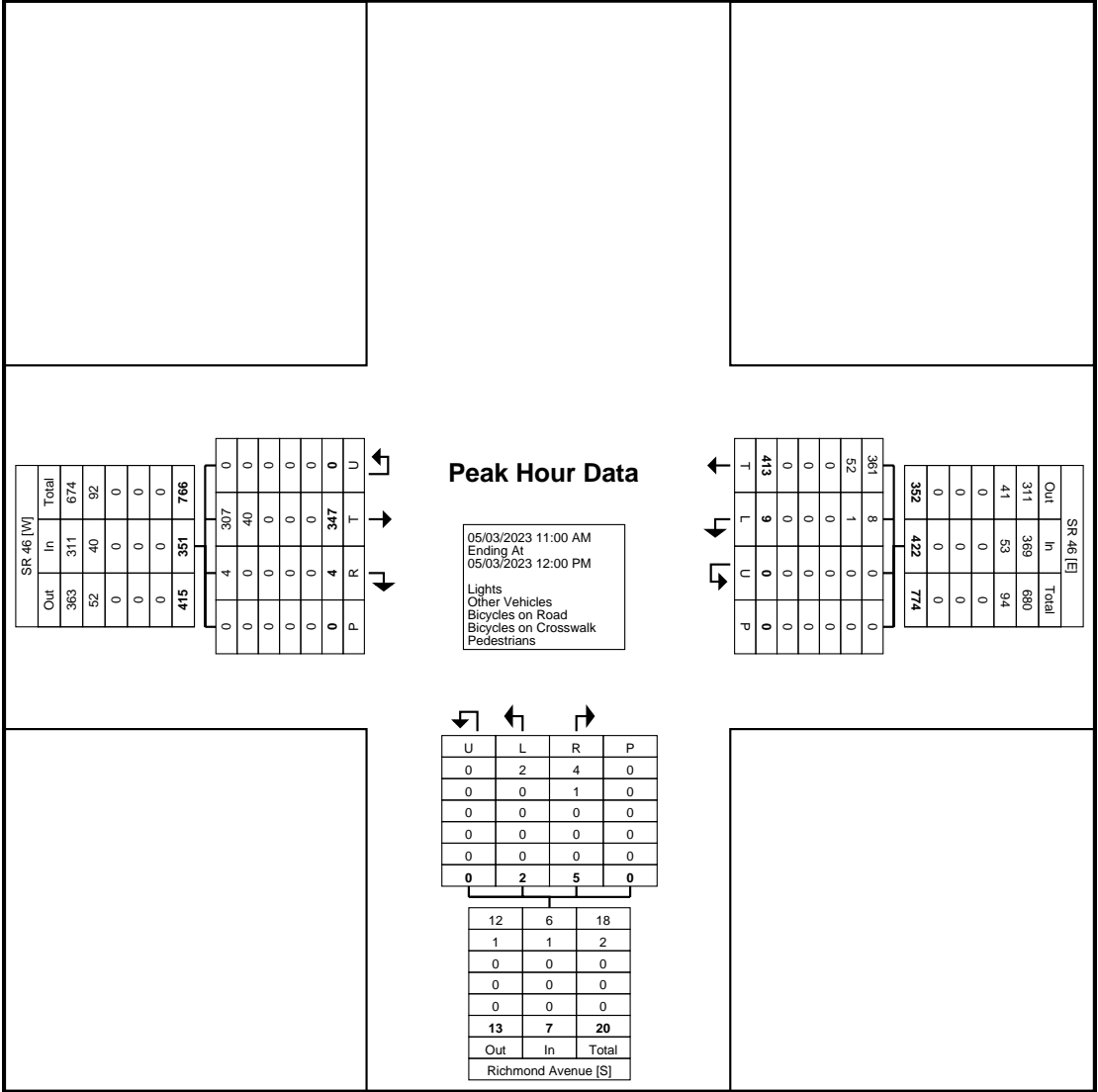
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Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 5

[illegible]

Seminole County:
Weekday TMC:

Vanasse Hangen Brustlin, Inc.
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Landmark Center Two
Orlando, Florida, United States 32801
407-839-4006 rsabbiseti@vhb.com

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 6



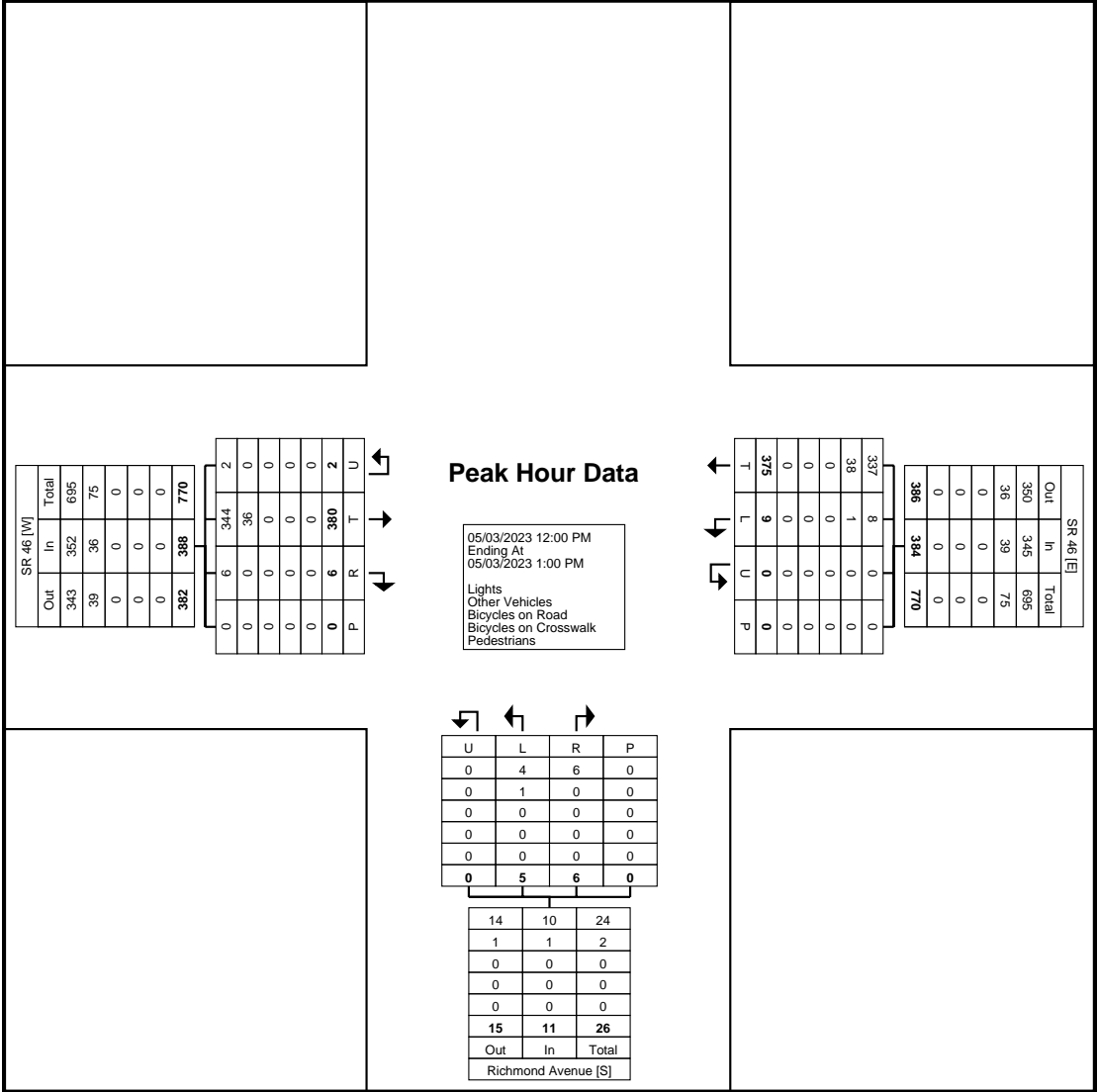
Turning Movement Peak Hour Data Plot (11:00 AM)

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 7

Seminole County:
Weekday TMC:

Vanasse Hangen Brustlin, Inc.
225 East Robinson Street, Suite 300
Landmark Center Two
Orlando, Florida, United States 32801
407-839-4006 rsabbisetti@vhb.com

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 8



Turning Movement Peak Hour Data Plot (12:00 PM)

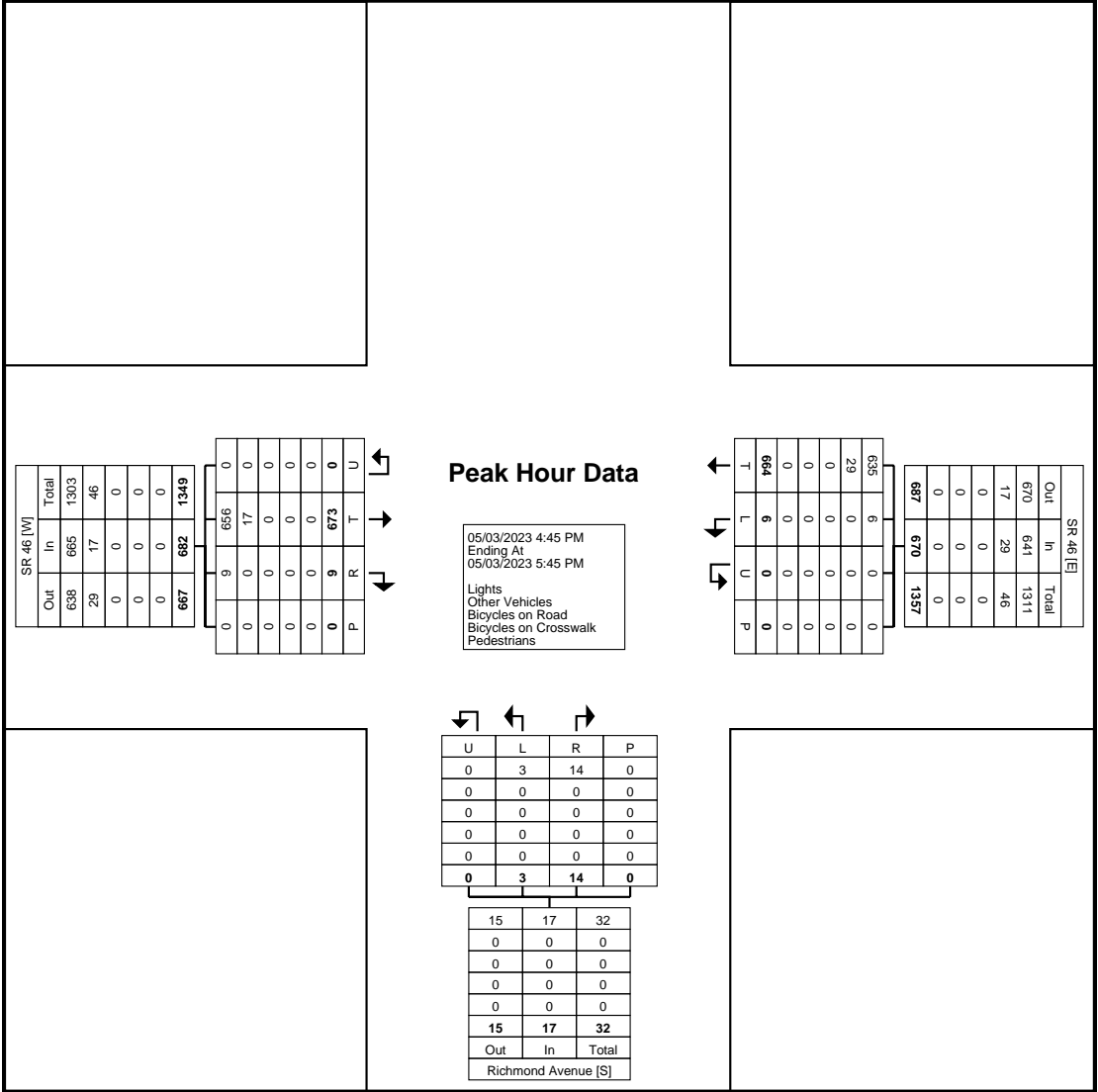
Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 9

Start Time	SR 46 Eastbound					SR 46 Westbound					Richmond Avenue Northbound					Int. Total
	U-Turn	Thru	Right	Peds	App. Total	U-Turn	Left	Thru	Peds	App. Total	U-Turn	Left	Right	Peds	App. Total	
4:45 PM	0	183	0	0	183	0	1	160	0	161	0	0	5	0	5	349
5:00 PM	0	164	2	0	166	0	1	154	0	155	0	0	5	0	5	326
5:15 PM	0	159	3	0	162	0	1	159	0	160	0	1	0	0	1	323
5:30 PM	0	167	4	0	171	0	3	191	0	194	0	2	4	0	6	371
Total	0	673	9	0	682	0	6	664	0	670	0	3	14	0	17	1369
Approach %	0.0	98.7	1.3	-	-	0.0	0.9	99.1	-	-	0.0	17.6	82.4	-	-	-
Total %	0.0	49.2	0.7	-	49.8	0.0	0.4	48.5	-	48.9	0.0	0.2	1.0	-	1.2	-
PHF	0.000	0.919	0.563	-	0.932	0.000	0.500	0.869	-	0.863	0.000	0.375	0.700	-	0.708	0.923
Lights	0	656	9	-	665	0	6	635	-	641	0	3	14	-	17	1323
% Lights	-	97.5	100.0	-	97.5	-	100.0	95.6	-	95.7	-	100.0	100.0	-	100.0	96.6
Other Vehicles	0	17	0	-	17	0	0	29	-	29	0	0	0	-	0	46
% Other Vehicles	-	2.5	0.0	-	2.5	-	0.0	4.4	-	4.3	-	0.0	0.0	-	0.0	3.4
Bicycles on Road	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Bicycles on Road	-	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Seminole County:
Weekday TMC:

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407-839-4006 rsabbiseti@vhb.com

Count Name: SR 46 at
Richmond Avenue
Site Code:
Start Date: 05/03/2023
Page No: 10



Turning Movement Peak Hour Data Plot (4:45 PM)

Appendix B

Vehicle Seasonal Adjustment Factor

2022 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: ALL
 CATEGORY: 7700 SEMINOLE COUNTYWIDE

WEEK	DATES	SF	MOCF: 0.93 PSCF
1	01/01/2022 - 01/01/2022	1.00	1.08
2	01/02/2022 - 01/08/2022	1.03	1.11
3	01/09/2022 - 01/15/2022	1.05	1.13
4	01/16/2022 - 01/22/2022	1.03	1.11
5	01/23/2022 - 01/29/2022	1.01	1.09
6	01/30/2022 - 02/05/2022	0.98	1.05
7	02/06/2022 - 02/12/2022	0.96	1.03
* 8	02/13/2022 - 02/19/2022	0.94	1.01
* 9	02/20/2022 - 02/26/2022	0.93	1.00
*10	02/27/2022 - 03/05/2022	0.93	1.00
*11	03/06/2022 - 03/12/2022	0.92	0.99
*12	03/13/2022 - 03/19/2022	0.91	0.98
*13	03/20/2022 - 03/26/2022	0.92	0.99
*14	03/27/2022 - 04/02/2022	0.92	0.99
*15	04/03/2022 - 04/09/2022	0.93	1.00
*16	04/10/2022 - 04/16/2022	0.93	1.00
*17	04/17/2022 - 04/23/2022	0.94	1.01
*18	04/24/2022 - 04/30/2022	0.94	1.01
*19	05/01/2022 - 05/07/2022	0.95	1.02
*20	05/08/2022 - 05/14/2022	0.95	1.02
21	05/15/2022 - 05/21/2022	0.96	1.03
22	05/22/2022 - 05/28/2022	0.97	1.04
23	05/29/2022 - 06/04/2022	0.98	1.05
24	06/05/2022 - 06/11/2022	0.99	1.06
25	06/12/2022 - 06/18/2022	1.00	1.08
26	06/19/2022 - 06/25/2022	1.00	1.08
27	06/26/2022 - 07/02/2022	1.00	1.08
28	07/03/2022 - 07/09/2022	0.99	1.06
29	07/10/2022 - 07/16/2022	0.99	1.06
30	07/17/2022 - 07/23/2022	0.99	1.06
31	07/24/2022 - 07/30/2022	0.98	1.05
32	07/31/2022 - 08/06/2022	0.98	1.05
33	08/07/2022 - 08/13/2022	0.97	1.04
34	08/14/2022 - 08/20/2022	0.97	1.04
35	08/21/2022 - 08/27/2022	0.99	1.06
36	08/28/2022 - 09/03/2022	1.01	1.09
37	09/04/2022 - 09/10/2022	1.02	1.10
38	09/11/2022 - 09/17/2022	1.04	1.12
39	09/18/2022 - 09/24/2022	1.10	1.18
40	09/25/2022 - 10/01/2022	1.16	1.25
41	10/02/2022 - 10/08/2022	1.22	1.31
42	10/09/2022 - 10/15/2022	1.28	1.38
43	10/16/2022 - 10/22/2022	1.23	1.32
44	10/23/2022 - 10/29/2022	1.18	1.27
45	10/30/2022 - 11/05/2022	1.14	1.23
46	11/06/2022 - 11/12/2022	1.09	1.17
47	11/13/2022 - 11/19/2022	1.04	1.12
48	11/20/2022 - 11/26/2022	1.03	1.11
49	11/27/2022 - 12/03/2022	1.02	1.10
50	12/04/2022 - 12/10/2022	1.01	1.09
51	12/11/2022 - 12/17/2022	1.00	1.08
52	12/18/2022 - 12/24/2022	1.03	1.11
53	12/25/2022 - 12/31/2022	1.05	1.13

* PEAK SEASON

23-FEB-2023 09:11:22

830UPD

5_7700_PKSEASON.TXT

Appendix C

LRE Construction Cost Estimate

FDOT Long Range Estimating System - Production

R3: Project Details by Sequence Report

Project: INWOOD-1-52-03**Letting Date:** 01/2099**Description:** SR 46 @ Richmond Avenue - Intersection Improvements**District:** 05**County:** 77 SEMINOLE**Market Area:** 08**Units:** English**Contract Class:****Lump Sum Project:** N**Design/Build:** N**Project Length:** 0.361 MI**Project Manager:** Anthony Nosse**Version 1-P Project Grand Total****\$1,250,503.30****Description:** SR 46 @ Richmond Avenue - Intersection Improvements (Updated by KNICEAB on 6/9/2023)**Sequence:** 1 WUR - Widen/Resurface, Undivided, Rural**Net Length:**

0.361 MI

1,906 LF

Description: SR 46 @ Richmond Avenue Intersection Improvements

EARTHWORK COMPONENT

User Input Data

Description	Value
Standard Clearing and Grubbing Limits L/R	36.00 / 36.00
Incidental Clearing and Grubbing Area	0.00
Alignment Number	1
Distance	0.361
Top of Structural Course For Begin Section	101.50
Top of Structural Course For End Section	101.50
Horizontal Elevation For Begin Section	100.00
Horizontal Elevation For End Section	100.00
Existing Front Slope L/R	4 to 1 / 4 to 1
Existing Outside Shoulder Cross Slope L/R	6.00 % / 6.00 %
Front Slope L/R	6 to 1 / 6 to 1
Outside Shoulder Cross Slope L/R	6.00 % / 6.00 %
Roadway Cross Slope L/R	2.00 % / 2.00 %

Pay Items

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
110-1-1	CLEARING & GRUBBING	3.15 AC	\$85,704.67	\$269,969.71
120-2-2	BORROW EXCAVATION, TRUCK MEASURE	499.82 CY	\$45.28	\$22,631.85
Earthwork Component Total				\$292,601.56

ROADWAY COMPONENT

User Input Data

Description	Value
Number of Lanes	3
Existing Roadway Pavement Width L/R	12.00 / 12.00
Structural Spread Rate	165
Friction Course Spread Rate	80
Widened Outside Pavement Width L/R	15.00 / 0.00
Widened Structural Spread Rate	330
Widened Friction Course Spread Rate	80

Pay Items

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
160-4	TYPE B STABILIZATION	7,412.53 SY	\$11.82	\$87,616.10
285-709	OPTIONAL BASE,BASE GROUP 09	3,246.69 SY	\$32.11	\$104,251.22
327-70-11	MILLING EXIST ASPH PAVT,2 1/4" AVG DEPTH	5,082.88 SY	\$2.76	\$14,028.75
334-1-53	SUPERPAVE ASPH CONC, TRAF C, PG76-22	524.17 TN	\$123.54	\$64,755.96
334-1-53	SUPERPAVE ASPH CONC, TRAF C, PG76-22	419.34 TN	\$123.54	\$51,805.26
337-7-25	ASPH CONC FC,INC BIT,FC-5,PG76-22	203.32 TN	\$161.29	\$32,793.48
337-7-25	ASPH CONC FC,INC BIT,FC-5,PG76-22	127.07 TN	\$161.29	\$20,495.12

X-Items

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
339-1	MISCELLANEOUS ASPHALT PAVEMENT	20.20 TN	\$529.92	\$10,704.38
	Comment: Under required guardrail.			
536-1-1	GUARDRAIL- ROADWAY, GEN TL-3	587.50 LF	\$27.61	\$16,220.88
	Comment: Barrier for shielding of canal along eastern side.			
536-7-1	SPECIAL GUARDRAIL POST- DEEP POST FOR SL	94.00 EA	\$111.45	\$10,476.30
	Comment: Special posts for entire run of proposed guardrail.			
536-85-20	GUARDRAIL END TREAT- TRAILING ANCHORAGE	2.00 EA	\$1,809.35	\$3,618.70
	Comment: End treatment for two runs of proposed guardrail.			
536-85-26	GUARDRAIL END TREATMENT- TYPE CRT	1.00 EA	\$2,438.35	\$2,438.35
	Comment: CRT system at Richmond Ave.			
710-11-101	PAINTED PAVT MARK,STD,WHITE,SOLID,6"	0.42 GM	\$1,339.45	\$562.57
	Comment: PROPOSED 6" WHITE			
710-11-125	PAINTED PAVT MARK,STD,WHITE,SOLID,24"	14.00 LF	\$1.81	\$25.34
	Comment: PROPOSED STOP BAR			
710-11-141	PAINTED PAVT MARK,STD,WH,DOT GUIDE, 6"	0.02 GM	\$626.44	\$12.53
	Comment: PROPOSED 6'-10' SKIP FOR RICHMOND WB TURN LANE			
710-11-201	PAINTED PAVT MARK,STD,YELLOW,SOLID,6"	1.31 GM	\$1,320.62	\$1,730.01
	Comment: PROPOSED DOUBLE YELLOW			
710-11-224	PAINTED PAVT MARK,STD,YELLOW,SOLID,18"	685.00 LF	\$1.20	\$822.00
	Comment: PROPOSED GORE WEST OF RICHMOND (475') AND EAST OF RICHMOND (210')			
710-11-231	PAINTED PAVT MARK,STD,YELLOW,SKIP,6"	0.05 GM	\$512.13	\$25.61
	Comment: PROPOSED 6'-10' SKIP FOR RICHMOND INTERSECTION			
711-11-125	THERMOPLASTIC, STD, WHITE, SOLID, 24"	14.00 LF	\$5.99	\$83.86
	Comment: PROPOSED STOP BAR			

711-11-141	THERMOPLASTIC, STD, WHITE, DOT GUIDE, 6"	0.02 GM	\$1,948.46	\$38.97
	Comment: PROPOSED 6'-10' SKIP FOR RICHMOND WB TURN LANE			
711-11-224	THERMOPLASTIC, STD, YELLOW, SOLID, 18"	685.00 LF	\$4.18	\$2,863.30
	Comment: PROPOSED GORE WEST OF RICHMOND (475') AND EAST OF RICHMOND (210')			
711-14-141	THERMOPLASTIC, PREF, WHI, DOT GUIDE, 6"	0.04 GM	\$6,428.25	\$257.13
	Comment: PROPOSED WHITE 2'-4' SKIP FOR BIKE LANE WEST OF RICHMOND AVE			
711-14-170	THERMOPLASTIC, PREFORMED, WHITE, ARROW	4.00 EA	\$108.90	\$435.60
	Comment: PROPOSED LEFT TURN LANE ARROWS			
711-15-101	THERMOPLASTIC, STD-OP, WHITE, SOLID, 6"	0.42 GM	\$4,798.18	\$2,015.24
	Comment: PROPOSED 6" WHITE			
711-15-201	THERMOPLASTIC, STD- OP,YELLOW, SOLID, 6"	1.31 GM	\$4,775.35	\$6,255.71
	Comment: PROPOSED DOUBLE YELLOW			
711-15-231	THERMOPLASTIC, STD-OP, YELLOW, SKIP, 6"	0.05 GM	\$1,908.03	\$95.40
	Comment: PROPOSED 6'-10' SKIP FOR RICHMOND INTERSECTION			

Pavement Marking Subcomponent

Description	Value
Include Thermo/Tape/Other	Y
Pavement Type	Asphalt
Solid Stripe No. of Paint Applications	1
Solid Stripe No. of Stripes	1
Skip Stripe No. of Paint Applications	1
Skip Stripe No. of Stripes	2

Pay Items

Pay item	Description	Quantity	Unit	Unit Price	Extended Amount
706-1-3	RAISED PAVMT MARK, TYPE B	195.00	EA	\$3.95	\$770.25
710-11-101	PAINTED PAVT MARK,STD,WHITE,SOLID,6"	0.36	GM	\$1,339.45	\$482.20
711-15-101	THERMOPLASTIC, STD-OP, WHITE, SOLID, 6"	0.36	GM	\$4,798.18	\$1,727.34

Roadway Component Total \$437,407.56

SHOULDER COMPONENT

User Input Data

Description	Value
Existing Total Outside Shoulder Width L/R	0.00 / 10.00
New Total Outside Shoulder Width L/R	10.00 / 10.00
Total Outside Shoulder Perf. Turf Width L/R	5.00 / 5.00
Existing Paved Outside Shoulder Width L/R	0.00 / 4.00
New Paved Outside Shoulder Width L/R	5.00 / 5.00
Structural Spread Rate	110
Friction Course Spread Rate	80
Total Width (T) / 8" Overlap (O)	T
Rumble Strips i/c ½No. of Sides	2

Pay Items

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
285-701	OPTIONAL BASE,BASE GROUP 01	2,257.65 SY	\$24.14	\$54,499.67
327-70-6	MILLING EXIST ASPH PAVT,1 1/2" AVG DEPTH	847.15 SY	\$2.57	\$2,177.18
334-1-13	SUPERPAVE ASPHALTIC CONC, TRAFFIC C	116.48 TN	\$127.56	\$14,858.19
337-7-25	ASPH CONC FC,INC BIT,FC-5,PG76-22	84.71 TN	\$161.29	\$13,662.88
546-72-3	GROUND-IN RUMBLE STRIPS, 8" SIN	0.72 GM	\$2,188.84	\$1,575.96
570-1-2	PERFORMANCE TURF, SOD	2,117.87 SY	\$4.34	\$9,191.56

Erosion Control**Pay Items**

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
104-10-3	SEDIMENT BARRIER	4,383.98 LF	\$1.78	\$7,803.48
104-11	FLOATING TURBIDITY BARRIER	36.10 LF	\$16.06	\$579.77
104-12	STAKED TURBIDITY BARRIER-NYL REINF PVC	36.10 LF	\$4.79	\$172.92
104-15	SOIL TRACKING PREVENTION DEVICE	1.00 EA	\$3,161.52	\$3,161.52
104-18	INLET PROTECTION SYSTEM	1.00 EA	\$103.50	\$103.50
107-1	LITTER REMOVAL	0.87 AC	\$44.55	\$38.76
107-2	MOWING	0.87 AC	\$74.96	\$65.22

Shoulder Component Total

\$107,890.60

DRAINAGE COMPONENT**Pay Items**

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
430-174-124	PIPE CULV, OPT MATL, ROUND,24"SD	56.00 LF	\$93.25	\$5,222.00
430-175-136	PIPE CULV, OPT MATL, ROUND, 36"S/CD	88.00 LF	\$171.97	\$15,133.36
430-984-129	MITERED END SECT, OPTIONAL RD, 24" SD	4.00 EA	\$2,299.18	\$9,196.72
570-1-1	PERFORMANCE TURF	4,840.00 SY	\$2.61	\$12,632.40

X-Items

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
425-1-521	INLETS, DT BOT, TYPE C, <10'	1.00 EA	\$3,028.00	\$3,028.00
	Comment: Proposed DBI for Modified Ditch on the north side			
430-982-138	MITERED END SECT, OPTIONAL RD, 36" CD	3.00 EA	\$5,583.46	\$16,750.38
	Comment: Triple 36" MES for extension of cross drain.			

Drainage Component Total

\$61,962.86

SIGNING COMPONENT**Pay Items**

Pay item	Description	Quantity Unit	Unit Price	Extended Amount
----------	-------------	---------------	------------	-----------------

700-1-11	SINGLE POST SIGN, F&I GM, <12 SF	4.00 AS	\$478.85	\$1,915.40
700-1-60	SINGLE POST SIGN, REMOVE	4.00 AS	\$44.48	\$177.92
Signing Component Total				\$2,093.32
<hr/>				
Sequence 1 Total				\$901,955.90
<hr/>				

FDOT Long Range Estimating System - Production

R3: Project Details by Sequence Report

Project: INWOOD-1-52-03

Letting Date: 01/2099

Description: SR 46 @ Richmond Avenue - Intersection Improvements

District: 05

County: 77 SEMINOLE

Market Area: 08

Units: English

Contract Class: Lump Sum **Project:** N

Design/Build: N

Project Length: 0.361 MI

Project Manager: Anthony Nosse

Version 1-P Project Grand Total

\$1,250,503.30

Description: SR 46 @ Richmond Avenue - Intersection Improvements (Updated by KNICEAB on 6/9/2023)

Project Sequences Subtotal	\$901,955.90
-----------------------------------	---------------------

102-1	Maintenance of Traffic	10.00 %	\$90,195.59
101-1	Mobilization	10.00 %	\$99,215.15

Project Sequences Total	\$1,091,366.64
--------------------------------	-----------------------

Project Unknowns	10.00 %	\$109,136.66
Design/Build	0.00 %	\$0.00

Non-Bid Components:

Pay item	Description	Quantity	Unit	Unit Price	Extended Amount
999-25	INITIAL CONTINGENCY AMOUNT (DO NOT BID)		LS	\$50,000.00	\$50,000.00

Project Non-Bid Subtotal	\$50,000.00
---------------------------------	--------------------

Version 1-P Project Grand Total

\$1,250,503.30

Appendix D

Crash Modification Factor Detail Summary

CMF / CRF Details

CMF ID: 255

CMF Name: Provide a left-turn lane on one major-road approach

Description:

Prior Condition: No Prior Condition(s)

Category: Intersection geometry

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

Star Quality Rating	
Star Quality Rating:	4 Stars

Crash Modification Factor (CMF)	
Value:	0.45
Adjusted Standard Error:	0.1
Unadjusted Standard Error:	0.08

Crash Reduction Factor	
Value:	55
Adjusted Standard Error:	10
Unadjusted Standard Error:	8

Applicability	
Crash Type:	All
Crash Severity:	K (fatal),A (serious injury),B (minor injury),C (possible injury)
Roadway Types:	Not Specified
Minimum Number of Lanes:	
Maximum Number of Lanes:	
Number of Lanes Direction:	
Number of Lanes Comment:	
Road Division Type:	
Minimum Speed Limit:	
Maximum Speed Limit:	
Speed Unit:	
Speed Limit Comment:	
Area Type:	Rural
Traffic Volume:	
Average Traffic Volume:	
Time of Day:	
<i>If countermeasure is intersection-based.</i>	
Intersection Type:	Roadway/roadway (not interchange related)
Intersection Geometry:	3-leg
Traffic Control:	Stop-controlled
Major Road Traffic Volume:	Minimum of 1600 to Maximum of 32400 Average Daily Traffic (ADT)
Minor Road Traffic Volume:	Minimum of 50 to Maximum of 11800 Average Daily Traffic (ADT)

Average Major Road Volume:	
Average Minor Road Volume:	

Development Details	
Date Range of Data Used:	
Municipality:	
State:	
Country:	
Type of Methodology Used:	Before/after using empirical Bayes or full Bayes

Other Details	
Included in HSM:	Yes. HSM lists this CMF in font to indicate that it has the highest
Date Added to Clearinghouse:	Dec 01, 2009
Comments:	Countermeasure name changed to match HSM The number of crashes in the after period were not reported in this study, however, they have been recorded as 300 to give 10 points as a benefit of doubt for one or more of the following: (1) number of miles/sites in the reference/treatment group, (2) number of crashes in the references/treatment group, (3) reporting AADTs for the aggregate dataset but not for the disaggregate dataset used for CMF development.

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Appendix E

Benefit/Cost Analysis

Net Present Value Analysis

Benefit-Cost Analysis

District: **Five**

County: **77 - Seminole**

Date Prepared: **07/06/23**

Location: **SR 46 at Richmond Avenue**

Section : **040000**

Beg. Milepost : **4.065**

End Milepost : **N/A**

Rdway Type: **2 - 3 Lanes Rural UnDivided**

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

Add westbound left turn lane to the unsignalized intersection of SR 46 at Richmond Avenue

ANNUAL COST OF IMPROVEMENTS

Type	Cost	Service Life	Capital Recovery Factor	Total
ROW	\$ -	100	0.0408	\$ -
P.E.C.E.I.	\$ 441,778.77	20	0.0736	\$ 32,514.92
Structure	\$ -	75	0.0425	\$ -
Roadway (w/ Earthwork)	\$ 837,899.72	20	0.0736	\$ 61,669.42
Drainage	\$ 61,962.86	20	0.0736	\$ 4,560.47
Signal	\$ -	20	0.0736	\$ -
Other (SAPM & Misc.)	\$ 350,640.72	20	0.0736	\$ 25,807.16
Sub-Total	\$ 1,692,282.08			\$ 124,551.96
Annual Cost =				\$ 124,551.96

Total number of crashes = 15
 # of correctable crashes, PC = 9
 # of years of crash data, YD = 7.2
 PC/YD = 1.25
 Crash reduction factor, CRF = 55.00%
 CRF x (PC/YD) = 0.69
 Cost per crash, CPC = \$558,273.00
 Benefit = \$383,813

Primary crash reduction factor (%): 55
 Provide a left turn lane on one major-road approach, CMF ID 255

Additional crash reduction factor:

Additional crash reduction factor:

BENEFIT/COST RATIO

$$\frac{\text{Benefit}}{\text{Cost}} = \frac{\$383,812.69}{\$124,551.96} = \mathbf{3.08}$$

This crash reduction factor applies to fatal, serious injury, minor injury, and possible injury crashes of all types for a rural, 3-leg, stop-controlled intersection. Correctable crashes are crash #s 1, 5, 6, 7, 8, 9, 12, 13, and 15. The cost per crash (CPC) value has been selected from the CAR System output for District 5 districtwide crash costs over the past 5 years.

Prepared by: **ACB**

[illegible]