COMPOSITE STUDY

For

Reed Canal Road and Sauls Street
South Daytona, Volusia County

Prepared for:

VOLUSIA TPO
TRANSPORTATION PLANNING ORGANIZATION
VISION - PLAN - IMPLEMENT

Professional Consulting Services Related To
Traffic Operations Studies and Transportation Engineering Services
TEDS Contract Number: 10210
Task Work Order: 2011-1-1

Traffic Engineering Data Solutions, Inc.

Traffic Engineering Data Solutions, Inc.
156 McGregor, Unit A
DeLand, Florida 32720

October 2011

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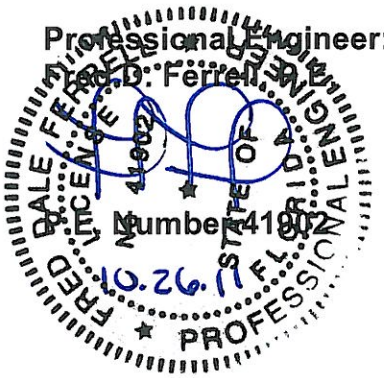

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EXECUTIVE SUMMARY

Traffic Engineering Data Solutions, Inc. (TEDS) under a professional traffic engineering services contract conducted a study to determine the need for the installation of a traffic signal or multi-way stop sign at the intersection of Reed Canal Road and Sauls Street in the City of South Daytona, Volusia County, Florida. Additionally, overall operations and safety was evaluated. The results of the study are summarized below:

- Vehicular or pedestrian volumes are not high enough to satisfy any traffic signal warrants.

- None of the crashes in the past twelve months are considered correctable with the installation of a traffic signal, therefore the crash warrant is not satisfied.

- Total delay for Reed Canal Road and Sauls Street are below requirements to satisfy any signal warrants. Additionally, the installation of a traffic signal would increase side street delay compared to existing conditions.

- Installation of a traffic signal would likely increase the potential for rear-end crashes at the intersection along Reed Canal Road.

- None of the nine (9) warrants required for consideration as documented in the Manual on Uniform Traffic Control Devices (MUTCD) or Manual on Uniform Traffic Studies (MUTS) are met.

- Criteria were not met for the installation of a multi-way stop sign according to MUTCD guidelines.

Based on engineering judgment and the standards and guidelines set forth by the MUTCD and MUTS, installation of a traffic signal or multi-way stop sign at the intersection of Reed Canal Road and Sauls Street is not recommended. The intersection is operating safely and efficiently under existing conditions and no improvements are recommended at this time.

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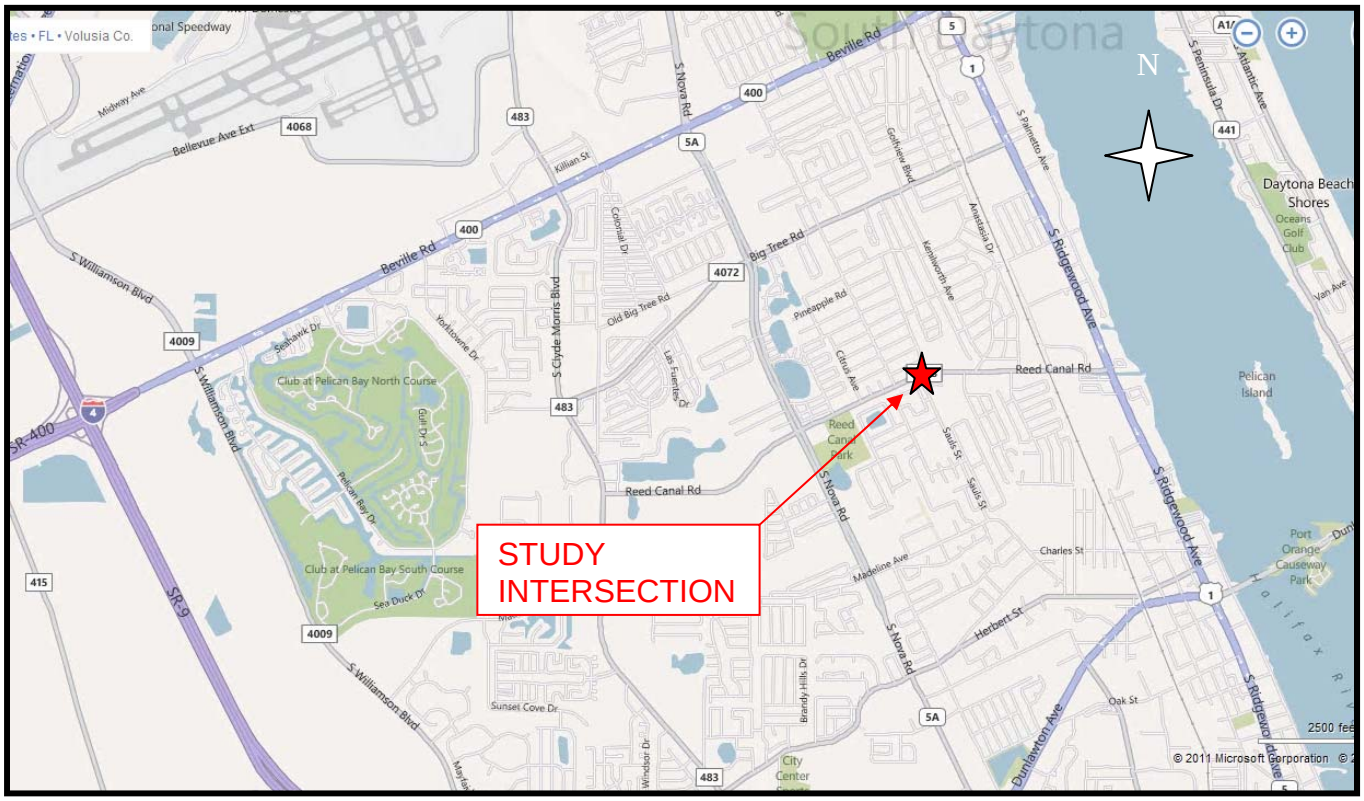
INTRODUCTION

Traffic Engineering Data Solutions, Inc. (TEDS) was retained on behalf of Volusia Transportation Planning Organization (VTPO) to conduct a composite study at the intersection of Reed Canal Road and Sauls Street. Located in the City of South Daytona, Volusia County, the study intersection is approximately 0.9 miles west of US 1 as shown in Figure 1. The study is to determine the need for the installation of a traffic signal or multi-way stop sign. Additionally, overall operations and safety shall be evaluated, any issues identified, and cost effective counter measures developed.

Figure 1
General Location Map
Reed Canal Road and Sauls Street



(Source: Bing Maps)

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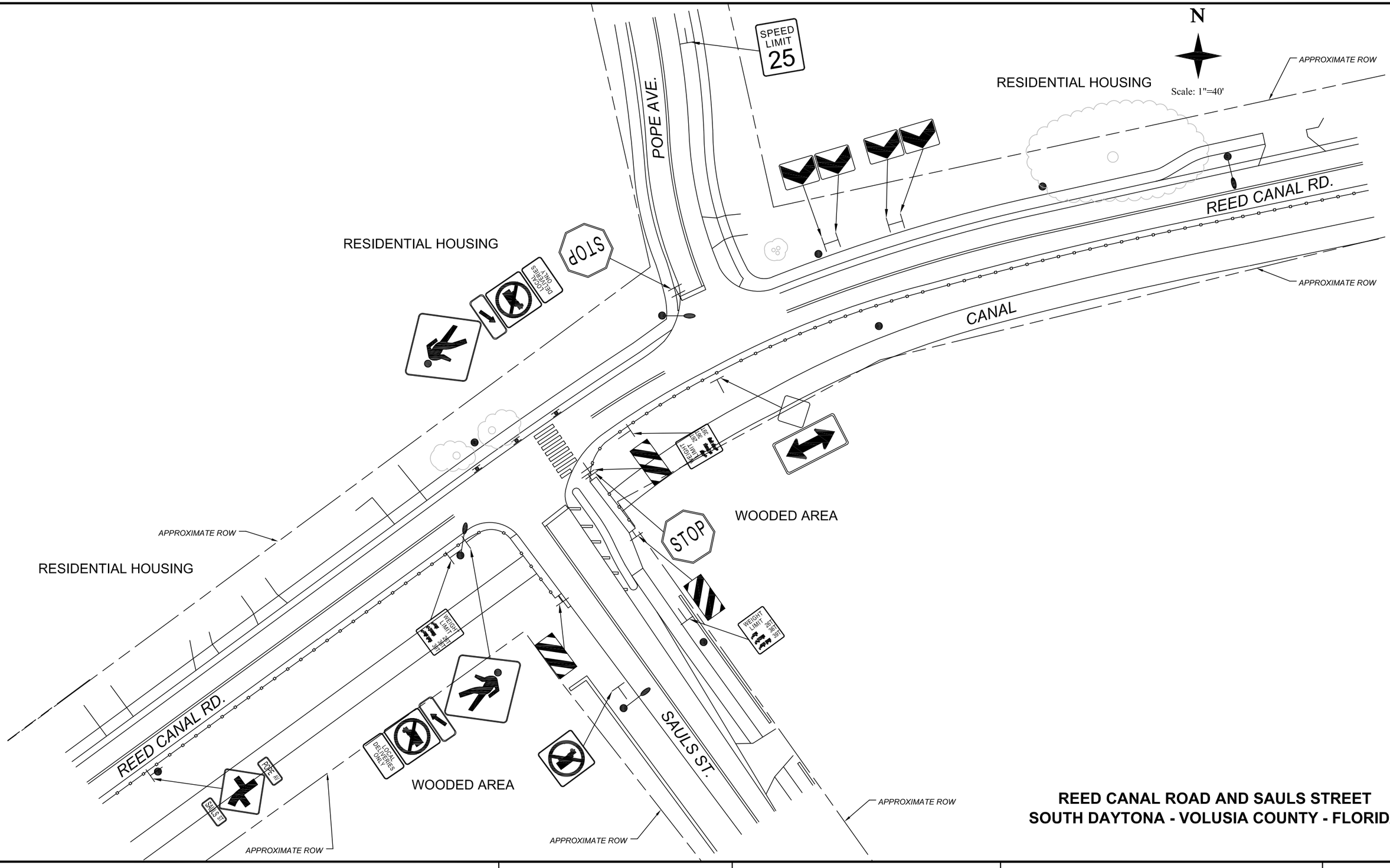
EXISTING CONDITIONS

Reed Canal Road is a two-lane collector traveling in the east-west direction connecting State Road 5A (Nova Road) to US 1(Ridgewood Boulevard). Sauls Street is a two-lane local road that serves multiple residential developments. Table 1 provides summarized information about existing roadway conditions and land uses of the surrounding area to the intersection. An existing condition diagram shown in Figure 2 includes pavement markings, traffic signs, land use, and roadway geometry. Additionally, photographs were taken at each approach to provide a detailed view of the intersection as shown in Figures 3-8.

Table 1
Existing Conditions
Reed Canal Road and Sauls Street

Feature	Description
Main Street	• Reed Canal Road
Side Street	• Sauls Street
Area Location	• Volusia County, Florida; 0.9 miles west of US 1
Adjacent Land Uses	• Northeast: Residential house • Northwest: Residential house • Southwest: Reed Canal • Southeast: Reed Canal
Traffic Control	• Reed Canal Road has the right of way with no restrictive control • Sauls Street is stop controlled
Adjacent Signalized Intersections	• US 1 is 0.9 miles east of study intersection. • State Road 5A is 0.6 miles west of study intersection.
Reed Canal Road	• Cross Section: 2-lane urban collector • Posted Speed Limit: 30 mph • Eastbound Approach Lanes: 1 shared left-turn / through / right-turn lane • Westbound Approach Lanes: 1 shared left-turn / through / right-turn lane • Pedestrian Crossings: East approach • Alignment: Adjacent to horizontal curve • Sidewalks: North side of the roadway • Utilities: Located on south side of the roadway • Street Lighting: Multiple luminaries located along south side of roadway
Sauls Street	• Cross Section: 2-lane local roadway • Posted Speed Limit: 30 mph • Northbound Approach Lanes: 1 shared left-turn / through / right-turn lane • Pedestrian Crossings: None • Alignment: Forms T-shaped intersection with Reed Canal Road • Sidewalks: Located on east side of the roadway • Utilities: Located on west side of the roadway • Street Lighting: Multiple luminaires located along west side of roadway



REED CANAL ROAD AND SAULS STREET
SOUTH DAYTONA - VOLUSIA COUNTY - FLORIDA

Symbols:

- Utility Pole
- Traffic Sign
- Street Name Sign
- Traffic Controller Cabinet
- Ditch Bottom Inlet
- Mast Arm Signal Pole
- Pedestrian Signal Pole
- Mitered End Section

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VOLUSIA TRANSPORTATION PLANNING ORGANIZATION

FIGURE 2
EXISTING CONDITION DIAGRAM

PAGE NO.
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Figure 3
Photograph of Eastbound Approach
(Looking Toward Intersection)
Reed Canal Road at Sauls Street

Figure 4
Photograph of Eastbound Approach
(Looking Away from Intersection)
Reed Canal Road at Sauls Street

Figure 5
Photograph of Westbound Approach
(Looking Toward Intersection)
Reed Canal Road at Sauls Street

Figure 6
Photograph of Westbound Approach
(Looking Away from Intersection)
Reed Canal Road at Sauls Street

Figure 7
Photograph of Northbound Approach
(Looking Toward Intersection)
Sauls Street at Reed Canal Road

Figure 8
Photograph of Westbound Approach
(Looking Away from Intersection)
Sauls Street at Reed Canal Road

TRAFFIC VOLUMES

Manual turning movement counts were collected at the intersection based on twenty-four hour automatically collected traffic volume data. The twenty-four hour count identified the eight (8) highest hours of volume entering the intersection which determined the periods of time to conduct manually collected turning movement counts.

According to the twenty-four hour count, the intersection has a total daily traffic volume of 10,463 vehicles consisting of 1,527 northbound; 3,951 eastbound; and 4,985 westbound that entered the intersection.

Eight (8) hours of manual turning movement counts were collected from 7:00 a.m. to 9:00 a.m., 11:00 a.m. to 1:00 p.m., and 2:00 p.m. to 6:00 p.m. The data collected generated the following results:

- The intersection peak hour occurred from 4:00 p.m. to 5:00 p.m. 898 vehicles were counted entering the intersection during this peak hour with the following characteristics:
    - 803 vehicles entered the intersection on Reed Canal Road
        - 441 vehicles were eastbound movements with the following distribution:
            - 371 through and 70 right turn movements
        - 362 vehicles were westbound movements with the following distribution:
            - 92 left turn and 270 through
    - 95 vehicles were northbound movements from Sauls Street with the following distribution:
        - 38 left turn and 57 right turn movements
- Additionally a volume distribution and approach percentage summary for the eight (8) hours of manually collected turning movement counts has been included in Table 2.

Table 2
Turning Movement Counts and Distribution Summary
Reed Canal Road and Sauls Street

Movement		NB	EB	WB
Left	Min - Max	20 - 79	0 - 0	26 - 92
	App % Avg	45%	0%	19%
Through	Min - Max	0 - 0	169 - 371	208 - 305
	App % Avg	0%	85%	81%
Right	Min - Max	49 - 98	29 - 70	0 - 0
	App % Avg	55%	15%	0%

- Forty-four bicycles were observed entering the study intersection during the eight (8) hours of manually collected turning movement counts. Twenty-three of the bicyclists crossed Reed Canal Road while the rest traveled east-west along the north side of the roadway.
- Twenty pedestrians were observed traversing the study intersection during the manually collected turning movement counts. Most of the pedestrians were teenagers, however, it is not known if the traffic generator is the local school or the multiple residential developments.

COLLISION DATA

Volusia County Traffic Engineering provided Florida Traffic Crash Reports for the period between 10/01/2007 and 9/30/2010. A crash analysis was performed and the results are shown in Figure 7. Ten (10) crashes were reported which resulted in five (5) injures and 37,280 dollars of estimated property damage. The two (2) angle crashes are considered correctable while the other collisions are not. Installation of a traffic signal likely will reduce angle crashes at the expense of an increased risk of rear-end crashes.

A detailed collision summary including crash type, time, date, roadway conditions, weather, and contributing cause of each individual crash is provided in Table 3.

Table 3
Collision Summary
Reed Canal Road and Sauls Street

NO.	DATE	DAY	TIME	FATAL	INJURY	PROPERTY DAMAGE	HARMFUL EVENT	DUI	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE
1	10/24/07	Wednesday	7:30	0	0	$2,250	Angle	N	Day	Dry	FTYRW
2	01/17/08	Thursday	15:17	0	1	$10,000	Fixed Object	N	Day	Wet	Careless Driving
3	04/04/08	Friday	8:47	0	0	$2,100	Rear-End	N	Day	Dry	Careless Driving
4	04/18/08	Friday	7:42	0	0	$2,500	Angle	N	Day	Dry	FTYRW
5	03/04/09	Wednesday	12:04	0	2	$130	Bicycle	N	Day	Dry	Improper Lane Change
6	03/11/09	Wednesday	16:58	0	1	$2,000	Rear-End	N	Day	Dry	Followed Too Closely
7	11/01/09	Sunday	18:20	0	0	$3,000	Head-On	N	Day	Dry	Drove Left of Center
8	03/05/10	Friday	20:00	0	1	$10,000	Fixed Object	Y	Night	Dry	Excess Speed
9	05/19/10	Wednesday	Unk	0	0	$300	Fixed Object	N	Unk	Dry	Drove Left of Center
10	06/09/10	Wednesday	15:38	0	0	$5,000	Rear-End	N	Day	Dry	Careless Driving
TOTAL				**0**	**5**	**$37,280**					

Total No.	Fatal	Injury	Property Damage	Angle	Head-On	Bicycle	Rear-End	Right Turn	Fixed Object	Backed Into	Left Turn
10	0	4	6	2	1	1	3	0	3	0	0
PERCENT	0%	40%	60%	20%	10%	10%	30%	0%	30%	0%	0%

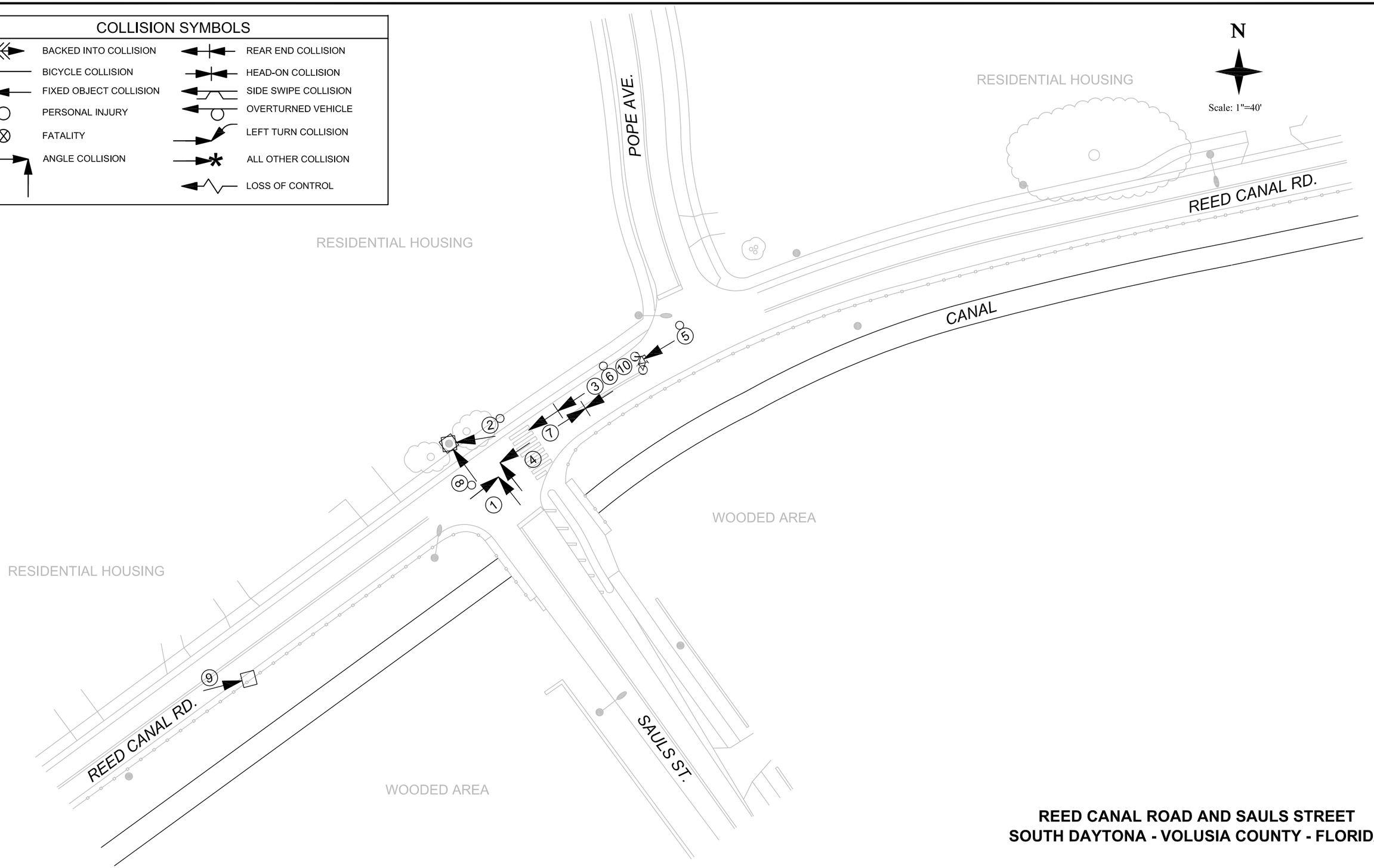
CONTRIB-CAUSE	Day	Night	PAVEMENT CONDITION			Excess Speed	Improper Lane Change	Careless Driving	FTYRW	Drove Left of Center	Followed Too Closely
			Wet	Dry	?						
TOTAL	8	1	1	9	0	1	1	3	2	2	1
PERCENT	80%	10%	10%	90%	0%	10%	10%	30%	20%	20%	10%

COLLISION SYMBOLS

- BACKED INTO COLLISION
- BICYCLE COLLISION
- FIXED OBJECT COLLISION
- PERSONAL INJURY
- FATALITY
- ANGLE COLLISION
- REAR END COLLISION
- HEAD-ON COLLISION
- SIDE SWIPE COLLISION
- OVERTURNED VEHICLE
- LEFT TURN COLLISION
- ALL OTHER COLLISION
- LOSS OF CONTROL

N

Scale: 1"=40'



REED CANAL ROAD AND SAULS STREET
SOUTH DAYTONA - VOLUSIA COUNTY - FLORIDA

SYMBOLS:

⊢ Traffic Sign ┼ Street Name Sign ◄■ Signal Head ■ Signal Pole

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VOLUSIA TRANSPORTATION PLANNING ORGANIZATION

FIGURE 9
COLLISION DIAGRAM
(10/1/2007 - 9/30/2010)

INTERSECTION DELAY

Intersection delay studies were performed for the northbound and westbound left-turn approaches of the intersection. Procedures from the Manual on Uniform Traffic Studies (MUTS) were applied to determine the summarized results presented in Table 4.

Table 4
Summary of Delay Studies
Reed Canal Road and Sauls Street

Movement	Period	Time	Maximum Queue (Veh)	Average Delay per Vehicle (Sec)	Volume (Veh/Hr)	Total Delay (Veh-Sec)	Total Delay (Veh-Hr)
Northbound Left Turn	AM	7:00 - 8:00 AM	5	10.79	156	1683	0.47
	OFF	12:00 - 1:00 PM	4	10.54	90	949	0.27
	PM	5:00 - 6:00 PM	4	15.43	81	1250	0.36
Westbound Left Turn	AM	8:00 - 9:00 AM	1	4	3	12	0.01
	OFF	12:00 - 1:00 PM	2	7.2	10	72	0.02
	PM	5:00 - 6:00 PM	2	8.05	21	169	0.05

As shown in Table 4, average vehicle delay is significantly less than could be expected if the intersection was signalized.

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QUALITATIVE ASSESSMENT

The intersection of Reed Canal Road and Sauls Street was observed during AM, mid-day and PM peak hours by a registered professional engineer to determine the intersection's current operational efficiency and safety and identify any issues

GENERAL SITE INFORMATION:

- The intersection of Reed Canal Road and Sauls Street is T-shaped, with the major road being Reed Canal Road and Sauls Street as the minor road.
- Reed Canal Road is a two lane urban collector that connects Clyde Morris Boulevard to US 1.
- Sauls Street provides access to multiple residential developments which is the primary traffic generator for the street. Additionally, Sugar Mill Elementary school is located on Madeline Avenue near the south end of Sauls Street.
- Sight distance entering Reed Canal Road from Sauls Street is adequate based on the posted speed limit.
- Side road warning signs are in place both eastbound and westbound on Reed Canal Road approaching Sauls Street. These signs provide additional warning to motorists traveling east-west of the potential for vehicles to be entering from across the canal.
- Pedestrian access has been enhanced by the separation between vehicles and pedestrians with a concrete separator in place across the bridge on Sauls Street. Pedestrian warning signs are also in place at the intersection on Reed Canal Road.

OPERATIONS:

Observations: The following observations were made with respect to the operations of the study intersection:

- Traffic flow along Reed Canal Road near Sauls Street is randomly distributed with minimal platooning. Each direction of Reed Canal Road has abundant gaps available, however simultaneous gaps in both directions is available however not as abundant. Gaps in Sauls Street also exhibit a randomly distributed traffic flow.
- The predominant movements at the study intersection are the Reed Canal Road through movements. During the peak hour period (5:00 – 6:00PM), 441 vehicles eastbound and 362 westbound travelled through the intersection utilizing Reed Canal Road.
- Horizontal curvature warning signs are located along Reed Canal Road providing information of the upcoming intersection for drivers without prior knowledge. However, the warning advisory speed and the posted speed of the roadway are the same at 30 MPH. Typically the advisory speed is lower than the posted speed limit as the warning signs are information of an upcoming situation that could require the driver to reduce speed ahead.
- Vehicular delay at the intersection was determined for the northbound and westbound left turn approach. The results shown previously in the report reveal that the installation of a traffic signal would likely increase overall delay of the intersection.
- Sauls Street is offset approximately 120 feet west of Pope Avenue. While not ideal with respect to desired geometry, no issues were noted with turning vehicles during the various observations.
- Pedestrian traffic counted by the technician and observed by the engineer(s) appears to be teenage children. These children's origin or destination is unknown, however, they were observed on both Sauls Street and along Reed Canal Road.
- Pavement markings and signing at the study intersection were observed to be in good condition.

SAFETY

Observations: The following observations were made with respect to the safety of the study intersection and any field observations that coincided with the crash reports:

- Volusia County Traffic Engineering provided hard copies of the Florida Traffic Crash Reports for the thirty-six month period ending 9/30/2010. Ten (10) crashes were reported for the intersection of Reed Canal Road and Sauls Street. A crash analysis was performed to determine and/or verify crash type, injury severity, location, and contributing cause. The data was then summarized and plotted on a collision diagram.
- The ten (10) vehicular crashes consisted of three (3) fixed object, three (3) rear-end, two (2) angle, one (1) head-on, and one (1) bicycle related which resulted in five (5) injuries.
- Two (2) of the ten (10) crashes are considered correctable by installing a traffic signal, however, these did not occur in the most recent twelve months.
- One (1) collision involved a bicyclist and a motorcyclist. The bicyclist traveling westbound along the north side of the sidewalk decided to cross Reed Canal Road without determining whether it was safe to cross resulting in the bicycle colliding with a motorcycle causing two (2) injuries and $132 of property damage.
- Three (3) rear end collisions occurred along Reed Canal Road and would likely increase with the installation of a traffic signal.
- There were no pedestrian related crashes that occurred during the 36 month period that ended September 2010.

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SIGNAL WARRANT ANALYSIS

The traffic volumes, geometric conditions, and crash data at the intersection were analyzed summarized, and then compared with the warrants for the installation of a traffic signal contained within the Manual on Uniform Traffic Control Devices (MUTCD 2009) and Manual on Uniform Traffic Studies (MUTS).

The Signal Warrant Analysis assumes that the major road Reed Canal Road and the minor road Sauls Street are one (1) lane approaches and 50% of right turning vehicles are omitted. Additionally, based on the critical speed of thirty (30) mph on Reed Canal Road the 100% volume criteria were applied to the analysis. Table 5 summarizes the results of the warrant analysis which is included in Appendix.

Table 5
Signal Warrant Analysis Summary
Reed Canal Road and Sauls Street

Warrant		Applicable	Satisfied	Comments
1A	Minimum Vehicular Volume	Yes	No	The side street traffic volumes do not meet the 100% or 80% requirements of this warrant.
1B	Interruption of Continuous Traffic	Yes	No	The side street traffic volumes do not meet the 100% or 80% requirements of this warrant.
2	Four Hour Vehicular Volume	Yes	No	The side street traffic volumes do not meet the requirements of this warrant.
3A	Peak Hour Delay	No	No	This warrant is not applicable as no unusual traffic generator exists such as factory or school.
3B	Peak Hour Volume	No	No	This warrant is not applicable as no unusual traffic generator exists such as factory or school.
4	Pedestrian Volume	Yes	No	The pedestrian volumes do not satisfy this warrant.
5	School Crossing	No	No	This warrant is not applicable, as no school zone exists at the intersection.
6	Coordinated Signal System	No	No	This warrant is not applicable as this intersection is not within a coordinated signal system.
7	Crash Experience	Yes	No	This warrant is not satisfied as there were not at least five (5) crashes potentially correctable by a traffic signal that occurred within the 12-month study period.
8	Roadway Network	No	No	This warrant is not applicable, as this intersection is not considered to be part of a coordinated network.
9	Rail Crossing	No	No	This warrant is not applicable, as this intersection is not near a rail crossing

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MULTI-WAY STOP SIGN WARRANT ANALYSIS

The traffic volumes, geometric conditions, and crash data at the intersection were analyzed summarized, and then compared with the warrants for multi-way stop sign contained within the Manual on Uniform Traffic Control Devices (MUTCD 2009). Below is a summary of the results:

- The study intersection does not currently meet the requirements for the installation of a traffic signal.
- Major street (Reed Canal Road) meets the volume requirement of 300 vehicles per hour for any eight (8) hours of a day.
- Minor street (Sauls Street) does not meet the volume requirement of 200 vehicles / pedestrians / bicyclists per hour for any eight (8) hours of a day. Additionally, it does not meet the 80% criteria requirements necessary for a combination warrant.
- Average delay does not meet 30 second per vehicle during the highest hour requirement to satisfy the warrant.
- None of the necessary five (5) or more crashes occurred within a twelve month period to satisfy the warrant.
- Utilizing the posted speed limit (30 mph) as the 85th percentile speed, traffic does not meet the requirement to use 70% criteria for the volume criteria.

Therefore, criteria for the installation of a multi-way stop sign is not satisfied outright nor does it meet the requirements for a combination warrant.

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RECOMMENDATIONS

The study was conducted to determine the need for the installation of a traffic signal or a multi-way stop sign at the intersection of Reed Canal Road and Sauls Street in the City of South Daytona, Volusia County, Florida. Additionally, overall operations and safety was evaluated.

The intersection does not satisfy any of the traffic signal warrants. Installation of a traffic signal would likely increase vehicular delay and rear-end crashes at the intersection. The multi-way stop sign warrant was applied and found not to meet the requirements necessary for an effective installation. Additionally, the intersection is operating safely and efficiently under existing conditions Therefore, based on engineering judgment and the standards and guidelines set forth by the MUTCD and MUTS, installation of a traffic signal or multi-way stop sign or any additional improvements at the intersection of Reed Canal Road and Sauls Street are not recommended at this time.

APPENDIX

Traffic Engineering Data Solutions Inc
VOLUME SUMMARY
Thu 9/1/2011

Site Reference: 082909457453 File: NB.prn
Site ID: 000000000006 City:
Location: County:

TIME	1 NORTH	Total
01:00	4	4
02:00	3	3
03:00	1	1
04:00	2	2
05:00	3	3
06:00	12	12
07:00	43	43
08:00	146	146
09:00	122	122
10:00	104	104
11:00	95	95
12:00	98	98
13:00	113	113
14:00	77	77
15:00	114	114
16:00	93	93
17:00	115	115
18:00	126	126
19:00	73	73
20:00	68	68
21:00	44	44
22:00	34	34
23:00	21	21
24:00	16	16
DAY TOTAL	1527	1527
PERCENTS	100.0%	100%
AM Times	07:30	
AM Peaks	171	
PM Times	16:30	
PM Peaks	129	
GRAND TOTAL	1527	1527
PERCENTS	100.0%	100%

Traffic Engineering Data Solutions Inc
VOLUME SUMMARY
Tue 8/30/2011

Site Reference: 000000006825 File: EB.prn
Site ID: 000000000005 City:
Location: County:

TIME	1 EAST	Total
01:00	35	35
02:00	23	23
03:00	8	8
04:00	11	11
05:00	16	16
06:00	19	19
07:00	50	50
08:00	171	171
09:00	203	203
10:00	199	199
11:00	225	225
12:00	257	257
13:00	257	257
14:00	276	276
15:00	288	288
16:00	359	359
17:00	315	315
18:00	366	366
19:00	319	319
20:00	180	180
21:00	134	134
22:00	108	108
23:00	88	88
24:00	44	44
DAY TOTAL	3951	3951
PERCENTS	100.0%	100%
AM Times	11:15	
AM Peaks	257	
PM Times	17:45	
PM Peaks	379	
GRAND TOTAL	3951	0 3951
PERCENTS	100.0%	100%

Traffic Engineering Data Solutions Inc
VOLUME SUMMARY
Tue 8/30/2011

Site Reference: Reed Canal
Site ID: 000000000000
Location: Reed Canal Rd. West Bound Approach

File: WB.prn
City:
County:

TIME	1 WEST	Total
01:00	25	25
02:00	21	21
03:00	16	16
04:00	14	14
05:00	27	27
06:00	44	44
07:00	177	177
08:00	360	360
09:00	333	333
10:00	267	267
11:00	289	289
12:00	302	302
13:00	338	338
14:00	310	310
15:00	374	374
16:00	410	410
17:00	320	320
18:00	345	345
19:00	324	324
20:00	244	244
21:00	204	204
22:00	109	109
23:00	83	83
24:00	62	62
DAY TOTAL	4998	4998
PERCENTS	100.0%	100%
AM Times	07:45	
AM Peaks	385	
PM Times	14:45	
PM Peaks	435	
GRAND TOTAL	4998	4998
PERCENTS	100.0%	100%

FLORIDA DEPARTMENT OF TRANSPORTATION

SUMMARY OF VEHICLE MOVEMENTS

SECTION | **CITY** South Daytona | **COUNTY** Volusia

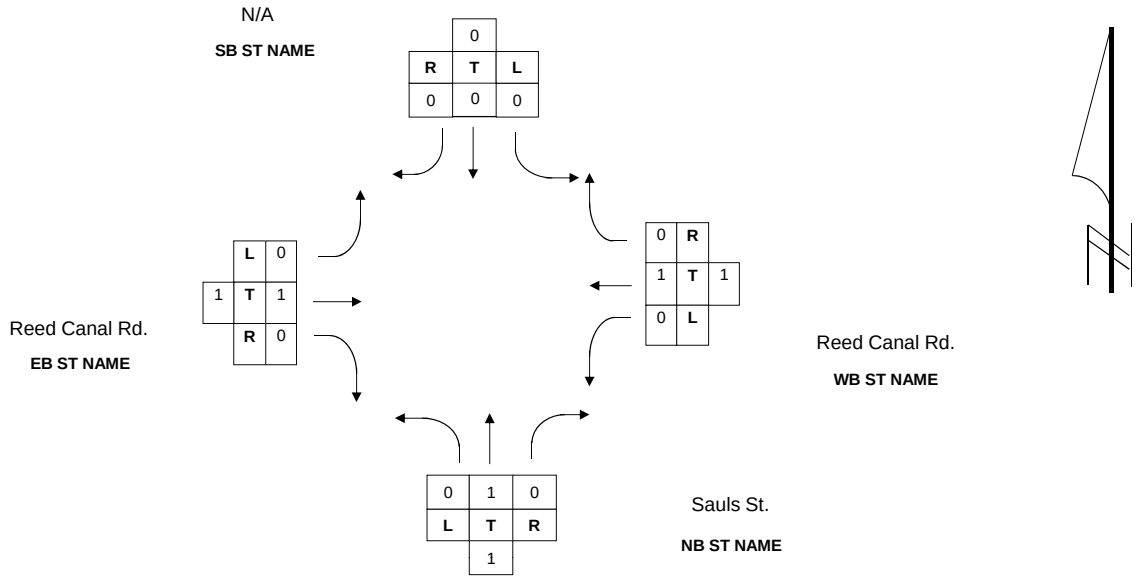
STATE ROUTE Reed Canal Road | **INTERSECTING ROUTE** Sauls Street

OBSERVER DM | **DATE** 9/8/2011 | **MILEPOST**

WEATHER Sunny | **ROAD CONDITION** Good

REMARKS

FORM COMPLETED BY PHF | **DATE** 09/09/11



TIME	NORTHBOUND					SOUTHBOUND					TOTAL	EASTBOUND					WESTBOUND					TOTAL
BEGIN/END	R	T	L	U	TOT	R	T	L	U	TOT	N/S	R	T	L	U	TOT	R	T	L	U	TOT	E/W
7 - 8	98	0	79	0	**177**	0	0	0	0	**0**	**177**	29	169	0	0	**198**	0	305	26	0	**331**	**529**
8 - 9	57	0	48	0	**105**	0	0	0	0	**0**	**105**	25	171	0	0	**196**	0	264	27	0	**291**	**487**
11 - 12	51	0	35	0	**86**	0	0	0	0	**0**	**86**	37	198	0	0	**235**	0	208	40	0	**248**	**483**
12 - 1	60	0	24	0	**84**	0	0	0	0	**0**	**84**	35	253	0	0	**288**	0	259	54	0	**313**	**601**
2 - 3	61	0	43	0	**104**	0	0	0	0	**0**	**104**	36	263	0	0	**299**	0	267	52	0	**319**	**618**
3 - 4	49	0	20	0	**69**	0	0	0	0	**0**	**69**	46	287	0	0	**333**	0	271	55	0	**326**	**659**
4 - 5	65	0	39	0	**104**	0	0	0	0	**0**	**104**	52	320	0	0	**372**	0	263	68	0	**331**	**703**
5 - 6	57	0	38	0	**95**	0	0	0	0	**0**	**95**	70	371	0	0	**441**	0	270	92	0	**362**	**803**
TOTAL	498	0	326	0	**824**	0	0	0	0	**0**	**824**	330	2032	0	0	**2362**	0	2107	414	0	**2521**	**4883**

FLORIDA DEPARTMENT OF TRANSPORTATION

PEDESTRIAN MOVEMENT SUMMARY

SECTION | **CITY** South Daytona | **COUNTY** Volusia

STATE ROUTE Reed Canal Road | **INTERSECTING ROUTE** Sauls Street

OBSERVER DM | **DATE** 9/8/2011

REMARKS

FORM COMPLETED BY PHF **DATE** 09/09/11

N/A

SB ST NAME

7 - 8	8 - 9	11 - 12	12 - 1	2 - 3	3 - 4	4 - 5	5 - 6	Total
1	1	0	0	0	1	0	1	**4**
0	0	0	0	1	8	3	0	**12**
1	**1**	**0**	**0**	**1**	**9**	**3**	**1**	**16**

7 - 8	0	0	**0**
8 - 9	0	0	**0**
11 -12	0	0	**0**
12 - 1	0	0	**0**
2 - 3	0	0	**0**
3 - 4	0	0	**0**
4 - 5	0	0	**0**
5 - 6	0	0	**0**
Total	**0**	**0**	**0**

Reed Canal Rd.

EB ST NAME

7 - 8	0	1	**1**
8 - 9	0	0	**0**
11- 12	0	0	**0**
12 - 1	0	0	**0**
2 - 3	0	0	**0**
3 - 4	0	0	**0**
4 - 5	0	0	**0**
5 - 6	2	1	**3**
Total	**2**	**2**	**4**

Reed Canal Rd.

WB ST NAME

7 - 8	8 - 9	11 - 12	12 - 1	2 - 3	3 - 4	4 - 5	5 - 6	Total
0	0	0	0	0	0	0	0	**0**
0	0	0	0	0	0	0	0	**0**
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Sauls St.

NB ST NAME

FLORIDA DEPARTMENT OF TRANSPORTATION

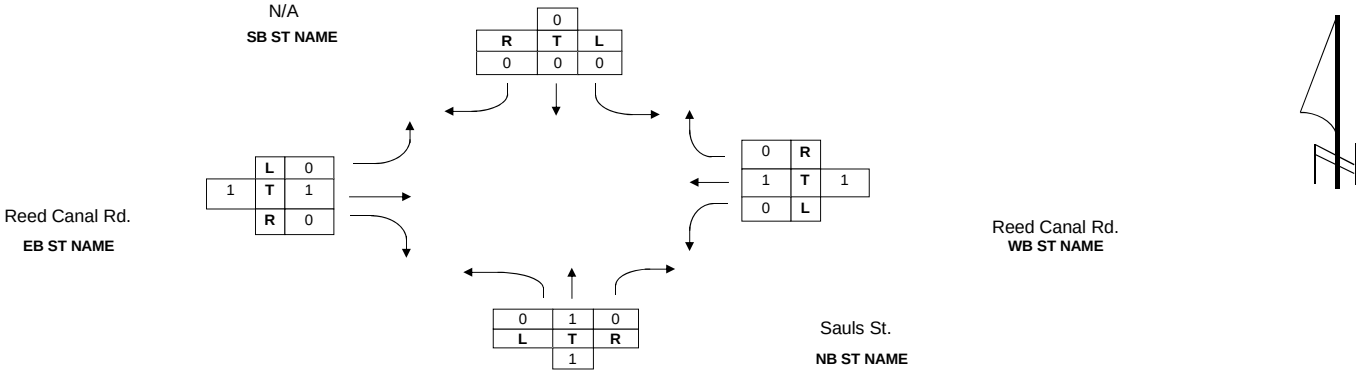
SUMMARY OF BICYCLE MOVEMENTS

SECTION
STATE ROUTE Reed Canal Road
OBSERVER DM
WEATHER Sunny
REMARKS

CITY South Daytona
INTERSECTING ROUTE Sauls Street
DATE 9/8/2011
ROAD CONDITION Good

COUNTY Volusia
MILEPOST

FORM COMPLETED BY PHF **DATE** 09/09/11



TIME	NORTHBOUND					SOUTHBOUND					TOTAL	EASTBOUND					WESTBOUND					TOTAL
BEGIN/END	L	T	R	U	TOT	L	T	R	U	TOT	N/S	L	T	R	U	TOT	L	T	R	U	TOT	E/W
7 - 8		0			0		0			0	0		2			2		3			3	5
8 - 9		1			1		3			3	4		0			0		1			1	1
11 - 12		3			3		1			1	4		1			1		2			2	3
12 - 1		2			2		0			0	2		1			1		0			0	1
2 - 3		1			1		2			2	3		1			1		0			0	1
3 - 4		0			0		0			0	0		3			3		0			0	3
4 - 5		2			2		2			2	4		2			2		3			3	5
5 - 6		4			4		2			2	6		2			2		0			0	2
TOTAL	0	13	0	0	13	0	10	0	0	10	23	0	12	0	0	12	0	9	0	0	9	21

Exhibit 4

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **October 4, 2011**

Major Street: **Reed Canal Road** Lanes: **1** Critical Approach Speed: **30**
Minor Street: **Sauls Street** Lanes: **1**

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☐ Yes ■ No
2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ■ No

If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ■ 100%

WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Applicable: ■ Yes ☐ No
Satisfied: ☐ Yes ■ No

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied.
Warrant is also satisfied if both Condition A and Condition B are "80%" satisfied.

Condition A - Minimum Vehicular Volume

100% Satisfied: ☐ Yes ■ No
80% / 56% Satisfied: ☐ Yes ■ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets)				Eight Highest Hours							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	800	900	1200	1300	1400	1500	1600	1700
Both Approaches on Major Street	500 (400)	350 (280)*	600 (480)	420 (336)*	529	487	483	601	618	659	703	803
Highest Approach on Minor Street	150 (120)	105 (84)*	200 (160)	140 (112)*	128	77	61	54	74	45	72	67

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours . Condition is (80%) / (56%) satisfied if parenthetical volumes are met for eight hours.*

Condition B - Interruption of Continuous Traffic

Condition B is intended for application where the traffic volume is so heavy that traffic on the minor street suffers excessive delay or conflict.

Applicable: ■ Yes ☐ No
Excessive Delay/Conflict: ■ Yes ☐ No
100% Satisfied: ☐ Yes ■ No
80% / 56% Satisfied: ☐ Yes ■ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets) {56% Shown in Brackets}				Eight Highest Hours							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	800	900	1200	1300	1400	1500	1600	1700
Both Approaches on Major Street	750 (600)	525 (420)*	900 (720)	630 (504)*	529	487	483	601	618	659	703	803
Highest Approach on Minor Street	75 (60)	53 (42)*	100 (80)	70 (56)*	128	77	61	54	74	45	72	67

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours . Condition is (80%) / (56%) satisfied if parenthetical volumes are met for eight hours.*

Source: Revised from NCHRP Report 457

Exhibit 5

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **October 4, 2011**

Major Street: **Reed Canal Road** Lanes: **1** Critical Approach Speed: **30**
Minor Street: **Sauls Street** Lanes: **1**

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☐ Yes ■ No
2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ■ No

If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ■ 100%

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME

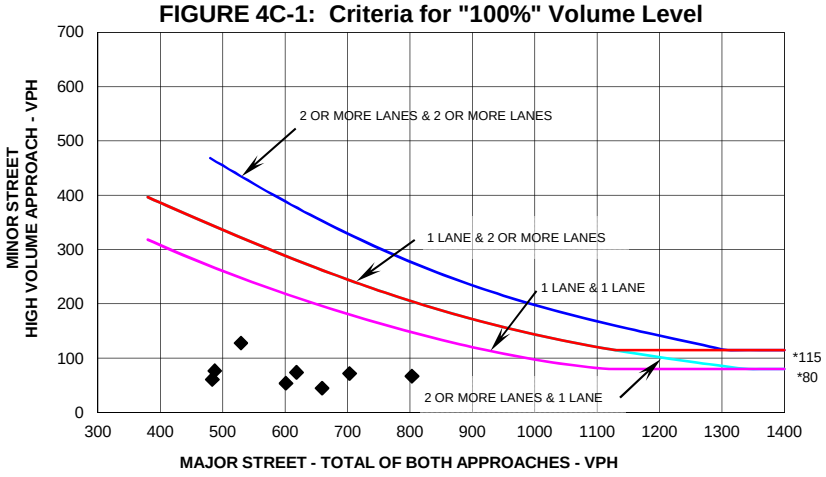
If any four points lie above the appropriate line, then the warrant is satisfied.

Applicable: ■ Yes ☐ No
Satisfied: ☐ Yes ■ No

Plot four volume combinations on the applicable figure below.

Warranting Volumes			Met	
Hour	Major Street	Minor Street	100%	70%
800	529	128		■
900	487	77		
1200	483	61		
1300	601	54		
1400	618	74		
1500	659	45		
1600	703	72		■
1700	803	67		■

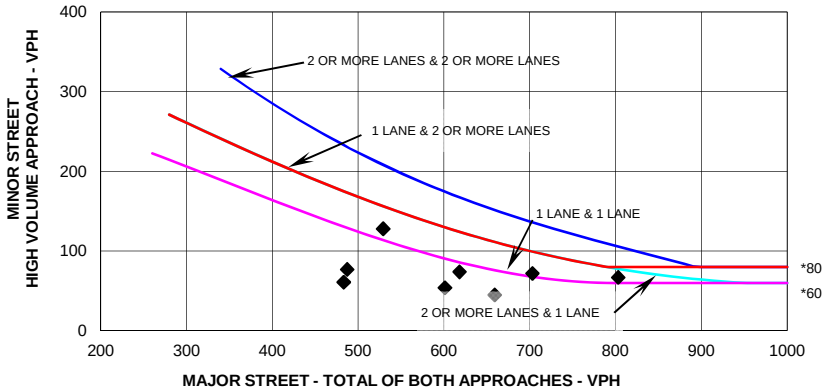
FIGURE 4C-1: Criteria for "100%" Volume Level



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

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



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

Source: Revised from NCHRP Report 457

Exhibit 6

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **October 4, 2011**

Major Street: **Reed Canal Road** Lanes: **1** Critical Approach Speed: **30**
Minor Street: **Sauls Street** Lanes: **1**

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☐ Yes ■ No
2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ■ No

If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ■ 100%

WARRANT 3 - PEAK HOUR

Applicable: ☐ Yes ■ No
Satisfied: ☐ Yes ■ No

If all three criteria are fullfilled or any of the plotted points lie above the appropriate line, then the warrant is satisfed.

Unusual condition justifying use of warrant:

None

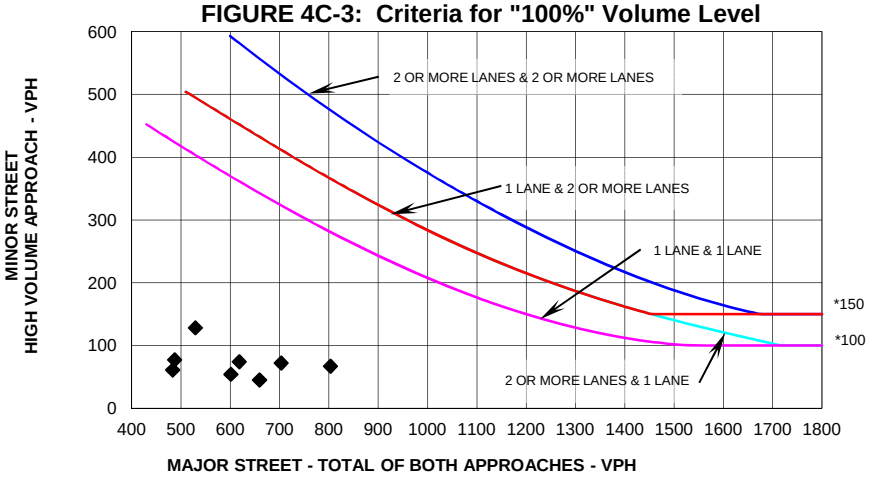
Record hour when criteria are fulfilled and the corresponding delay or volume in boxes provided.

Warranting Volumes			100%	70%
800	529	128		
900	487	77		
1200	483	61		
1300	601	54		
1400	618	74		
1500	659	45		
1600	703	72		
1700	803	67		

1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*	0.0	0.0
Fulfilled?: ☐ Yes ■ No		
2. Volume on Minor Approach *(vehicles per hour)		
Approach Lanes	1	2
Volume Criteria*	100	150
Volume*	0	0
Fulfilled?: ☐ Yes ■ No		
3. Total Entering Volume *(vehicles per hour)		
No. of Approaches	3	4
Volume Criteria*	650	800
Volume*	0	0
Fulfilled?: ☐ Yes ■ No		

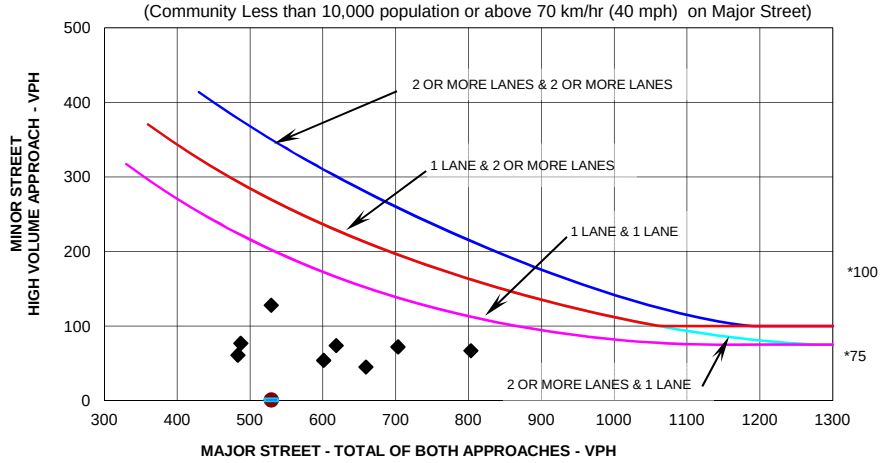
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume threshold for a minor street approach with one lane.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume threshold for a minor street approach with one lane.*

Source: Revised from NCHRP Report 457

Exhibit 7

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **October 4, 2011**

Major Street: **Reed Canal Road** Lanes: **1** Critical Approach Speed: **30**
Minor Street: **Sauls Street** Lanes: **1**

WARRANT 4 - PEDESTRIAN VOLUME

Applicable: ■ Yes ☐ No
Satisfied: ☐ Yes ■ No

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	800	1	0		■
	1600	3	0		
	1700	0	0		
	1800	0	0		
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	1600	3	0		■
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				■	

WARRANT 5 - SCHOOL CROSSING

Applicable: ☐ Yes ■ No
Satisfied: ☐ Yes ■ No

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria				Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 0	Hour: 0			■
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.		Minutes: 0	Gaps: 0		■
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				■	

WARRANT 6 - COORDINATED SIGNAL SYSTEM

Applicable: ☐ Yes ■ No
Satisfied: ☐ Yes ■ No

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		■
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		■

Source: Revised from NCHRP Report 457

Exhibit 8

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **October 4, 2011**

Major Street: **Reed Canal Road** Lanes: **1** Critical Approach Speed: **30**
Minor Street: **Sauls Street** Lanes: **1**

WARRANT 7 - CRASH EXPERIENCE

Applicable: ■ Yes ☐ No
Satisfied: ☐ Yes ■ No

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				■		
	Warrant 1, Condition B (80% satisfied)				■		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour	800	1		■		■
		1600	2				
		1700	0				
		1800	0				
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	None				■
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:	0				■

WARRANT 8 - ROADWAY NETWORK

Applicable: ☐ Yes ■ No
Satisfied: ☐ Yes ■ No

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria								Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.				Entering Volume: 898				■		■
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.			Warrant:	1	2	3		■		
				Satisfied?:	NO	NO	NO				
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)	N/A	N/A	N/A	N/A	N/A	← Hour					■
	N/A	N/A	N/A	N/A	N/A	← Volume					

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:		■		■
	Minor Street:		■		
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:		■		
	Minor Street:		■		
3. Appears as a major route on an official plan.	Major Street:		■		
	Minor Street:		■		

CONCLUSIONS

Warrants Satisfied: | | | | | | | | |

Remarks: _____

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: **South Daytona** Engineer: **MDM**
County: **Volusia** Date: **10.4.2011**

Major Street: **Reed Canal Road**
Minor Street: **Sauls Street**

Number of Minor Street Approach Lanes Crossing RXR Tracks: **0**
Clear Storage Distance (D) feet:

Applicability Criteria

Is there a railroad grade crossing in the proximity of the intersection? ☐ Yes ☒ No

None of the conditions described in the other eight traffic signal warrants are met. ☒ Yes ☐ No

Adequate consideration has been given to other alternatives or a trial of an alternative has failed to alleviate the safety concerns associated with the grade crossing. Among the alternatives that were considered or tried are:

A. Providing additional pavement that would enable vehicles to clear the track or that would provide space for an evasive maneuver, or

B. Reassigning the stop controls at the intersection to make the approach across the track a non-stopping approach. ☐ Yes ☐ No

Warrant Applicable: ☐ Yes ☒ No

WARRANT 9 - INTERSECTION NEAR A GRADE CROSSING

If there is a railroad grade crossing on an approach controlled by a STOP or YIELD sign and the center of the track nearest the intersection is within 140 feet of the stop line or yield line on the approach, and any point lies above the appropriate line, then the warrant is satisfied.

Warrant Satisfied: ☐ Yes ☐ No

Warranting Volumes			Met	
Hour	Major Street	Minor St. Equiv.	1 LN	2 LN
700				
800				
900				
1100				
1400				
1500				
1600				
1700				
		Satisfied		

Adjustment Factor for Daily Frequency of Rail Traffic	
Adjustment Factor for Percentage of High Occupancy Buses	
Adjustment Factor for Percentage of Tractor-Trailer Trucks	

Figure 4C-9. Warrant 9 Intersection Near a Grade Crossing (One Approach Lane at the Track Crossing)

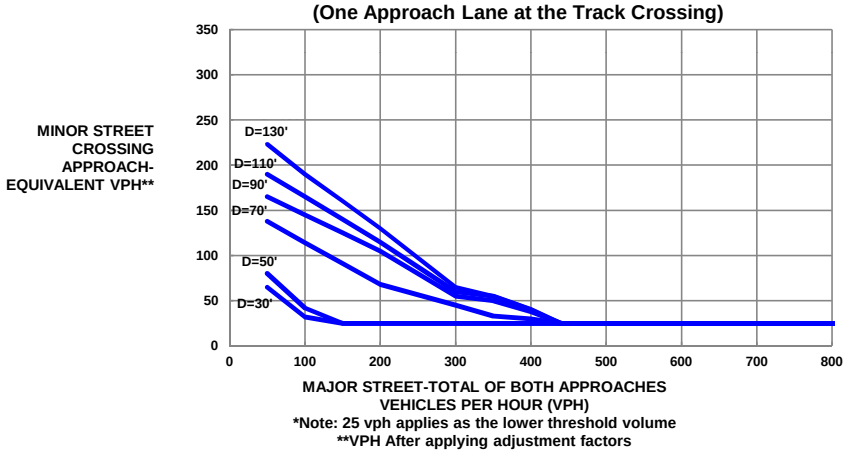
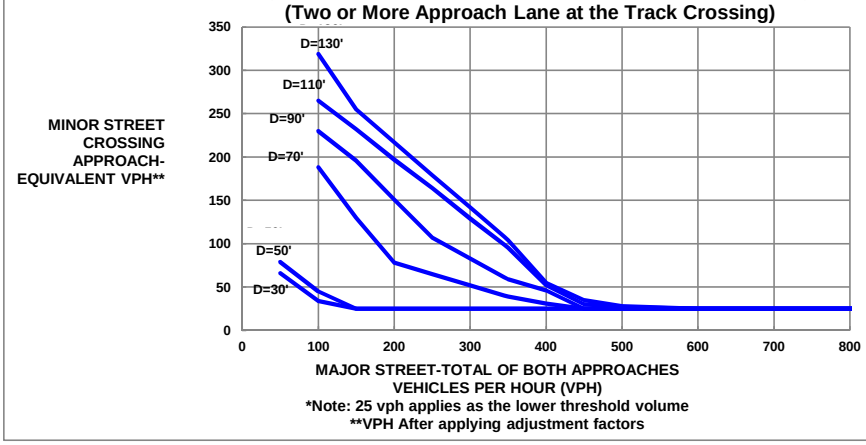


Figure 4C-10. Warrant 9 Intersection Near a Grade Crossing (Two or More Approach Lane at the Track Crossing)



Source: 2009 MUTCD