



December 10, 2020

TECHNICAL MEMORANDUM

**PARTIN-SETTLEMENT ROAD FROM CR 525
(NEPTUNE ROAD) TO LAKESHORE BOULEVARD
PS-20-11504-DG**

LIGHTING JUSTIFICATION REPORT

Submitted to:

Osceola County Transportation & Transit Department

EXECUTIVE SUMMARY

A Lighting Justification Report was completed along Partin-Settlement Road from CR 525 (Neptune Road) to Lakeshore Boulevard. As part of this report, an evaluation was completed to determine the need for continuous lighting throughout the corridor including key intersections along the corridor. The lighting warrants used are based on the Florida Department of Transportation's (FDOT) Manual of Uniform Traffic Studies (MUTS), Chapter 14, Roadway Lighting Justification Procedure.

The lighting justification procedure used is divided into two steps. The first step is to verify that the current conditions warrant the need for new lighting based on the American Association of State Highway and Transportation Officials (AASHTO) and Transportation Association of Canada (TAC) warrants and supplemented with the Lighting Geometric and Operational Factors warrants.

The second step is to justify the need for new lighting based on a net present value. There is currently no roadway lighting along Partin-Settlement Road. The intersection of CR 525 (Neptune Road) has some existing lighting approaching the intersection and on the signal mast arm poles, Cross Prairie Parkway/Shady Lane has existing lighting on the signal mast arm poles, the intersection of US 192 only has existing lighting for the northbound approach, Remington Boulevard has existing lighting on the signal mast arm poles and the intersection of E. Lakeshore Boulevard has a single light on the signal mast arm. Based on the Lighting Geometric and Operational Factors warrants, the Partin Settlement Road segment scored a 45.53 rating out of the 60 needed to warrant lighting. In addition, the net present value calculation for the installation of lighting was calculated to be -\$1,466,289 which is below \$0; therefore, lighting is not warranted.

1.0 INTRODUCTION

This *Technical Memorandum: Lighting Justification Report – Partin-Settlement Road from CR 525 (Neptune Road) to Lakeshore Boulevard* was prepared for the Osceola County Transportation and Transit Department by Johnson, Mirmiran, and Thompson, Inc. (JMT) as part of the Partin-Settlement Road project (PS-20-11504-DG).

This Lighting Justification Report summarizes the existing lighting conditions and evaluates the need for continuous lighting throughout the project corridor. The lighting warrants are based on the Manual of Uniform Traffic Studies (MUTS), Chapter 14, Roadway Lighting Justification Procedure. All crash data was obtained from the Crash Data Management System (CDMS) and the University of Florida’s Signal Four Analytics.

2.0 EXISTING CONDITIONS

This section summarizes the roadway features and traffic characteristics. The results of these summaries provide an understanding of the existing characteristics and conditions of the study limits.

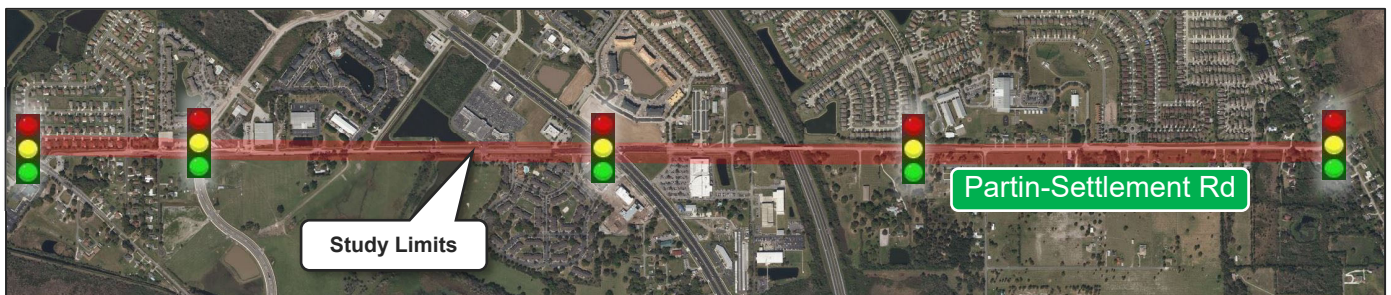
Partin-Settlement Road is an existing two-lane undivided roadway that is being widened/reconstructed. The project includes a four-lane divided roadway with multi-modal accommodations. The roadway segment is approximately 2.7 miles long with a posted speed of 40 to 45 mph. The roadway runs in an east-west direction and is in Kissimmee, Florida.

The 2018 Roadway Network Capacity Report prepared by Osceola County shows Partin-Settlement Road is operating at LOS B and AADT of 8,512. The Osceola County online interactive Traffic Counts Maps shows Partin-Settlement Road being classified as a Collector road operating at LOS B and year 2020 AADT of 8,970. However, recent traffic counts conducted show the AADT of 11,850 within the project limits.

The 2010 Urban Area Boundary and Federal Functional Classification Map prepared by FDOT for Osceola County dated August 14, 2014 shows Partin-Settlement Road as being classified as Rural Major Collector. Lastly, Osceola County classifies Partin-Settlement as Urban Major collector (UMJC).

There are five signalized intersection along the corridor at CR 525 (Neptune Road), Cross Prairie Parkway/Shady Lane, US 192, Remington Boulevard and E. Lakeshore Boulevard. Additionally, Partin-Settlement Road intersects with various unsignalized business driveway entrances and residential development side streets. Sidewalk is present along the north side only, but the reconstruction will include sidewalk along both sides of the road. Existing overhead power lines exist along the south side or north side of the roadway. Single family and multi-family residences are located on both sides along Partin-Settlement Road. Partin-Settlement Road is not served by a bus route and no bus stops are present. See **Figure 1** for the study location map.

Figure 1: Location of Study Area



3.0 NIGHTTIME CRASH DATA ANALYSIS

During the five-year period from January 2015 to January 2020, there was a total of 185 crashes within the study area. Of those 185 crashes, there were 146 crashes (79%) that occurred during the daytime and 39 crashes (21%) occurred outside of daylight conditions (dusk, dawn, and night). The Florida statewide average for crashes occurring during dark lighting conditions is 31%, so this corridor is consistent with the statewide day/night distribution of crashes. **Figure 2** shows the distribution of crashes along the segment during the various lighting conditions and **Figure 3** shows the locations of the crashes along the segment. The crash summary sheets are included in **Appendix A** of this report.

Figure 2: Crash Lighting Conditions

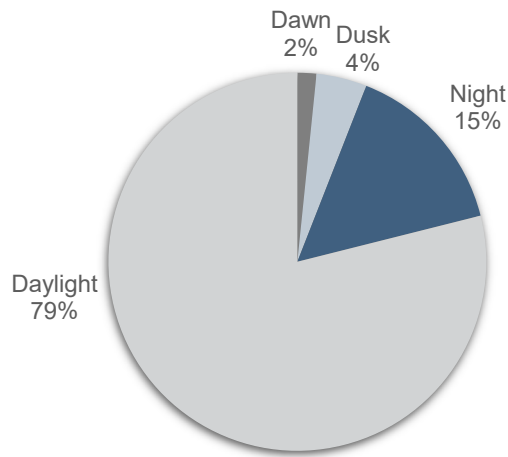
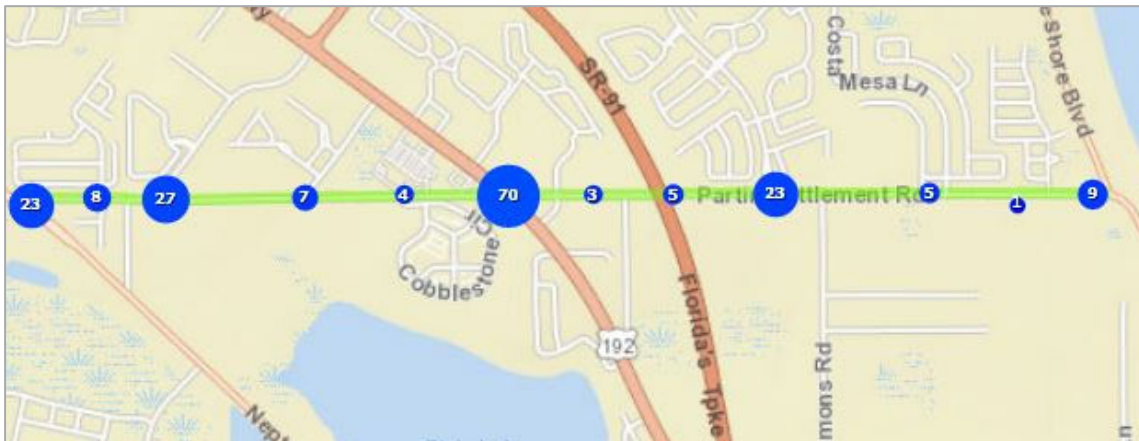


Figure 3: Crash Locations



Of the 39 nighttime crashes during the five-year study period, the most prevalent crash type was rear end (18 crashes, 21%). There were also 7 left turn crashes (18%), 2 angle crashes (5%), 2 run off road crashes (5%), 1 sideswipe crashes (3%), and 1 right turn crash (5%). There was 1 pedestrian (3%) and 1 bicycle (3%) crashes and no nighttime fatalities. There were 18 injury crashes (46%) at night and the remaining 21 (54%) were property damage only crashes. A majority of the nighttime crashes (37 crashes, 95%) occurred in dry conditions with 2 crashes (5%) occurred in wet conditions. **Table 1** below provides a summary of the nighttime crashes.

Table 1: Nighttime Crash Summary

Main Route: Partin Settlement Rd Intersecting Route: CR 525 to Lakeshore Blvd
 Study Period: 1/1/2015 TO 01/01/2020 County: Osceola

No.	Date	Day	Time	Type	Fatal	Injury	Prop. Damage	Day/ Night	Wet/ Dry
1	1/29/2015	Thur.	6:41 AM	Pedestrian		x		Night	Dry
2	2/16/2015	Mon.	6:10 PM	Rear End			x	Night	Dry
3	4/3/2015	Fri.	8:13 PM	Left Turn			x	Night	Dry
4	6/8/2015	Mon.	4:12 AM	Other			x	Night	Dry
5	10/9/2015	Fri.	7:44 PM	Rear End			x	Night	Dry
6	10/27/2015	Tues.	12:35 AM	Off Road		x		Night	Dry
7	12/10/2015	Thur.	1:06 AM	Off Road			x	Night	Dry
8	12/24/2015	Thur.	8:39 PM	Left Turn		x		Night	Dry
9	1/25/2016	Mon.	6:45 PM	Rear End			x	Night	Dry
10	5/3/2016	Tues.	7:28 PM	Rear End			x	Night	Dry
11	6/11/2016	Sat.	5:06 AM	Left Turn			x	Night	Dry
12	8/5/2016	Fri.	8:37 PM	Left Turn		x		Night	Dry
13	9/6/2016	Tues.	8:25 PM	Rear End			x	Night	Dry
14	10/14/2016	Fri.	7:42 AM	Rear End			x	Night	Dry
15	12/24/2016	Sat.	8:06 PM	Rear End			x	Night	Dry
16	5/27/2017	Sat.	11:02 PM	Other		x		Night	Dry
17	8/26/2017	Sat.	8:29 PM	Rear End			x	Night	Wet
18	9/27/2017	Wed.	8:30 PM	Left Turn		x		Night	Dry
19	12/13/2017	Wed.	6:15 PM	Left Turn		x		Night	Dry
20	2/23/2018	Fri.	10:40 PM	Head On		x		Night	Dry
21	4/2/2018	Mon.	6:44 AM	Other		x		Night	Dry
22	7/19/2018	Thur.	7:26 PM	Unknown			x	Night	Dry
23	10/3/2018	Wed.	7:50 AM	Rear End			x	Night	Dry
24	10/14/2018	Sun.	8:10 PM	Rear End		x		Night	Dry
25	11/6/2018	Tues.	5:38 PM	Rear End		x		Night	Dry
26	11/23/2018	Fri.	11:01 PM	Bicycle		x		Night	Dry
27	12/5/2018	Wed.	9:00 PM	Rear End		x		Night	Dry
28	1/23/2019	Wed.	6:15 PM	Angle			x	Night	Dry
29	2/5/2019	Tues.	5:09 PM	Rear End			x	Night	Dry
30	3/13/2019	Wed.	8:20 PM	Rear End		x		Night	Dry
31	4/27/2019	Sat.	8:35 PM	Rear End			x	Night	Dry
32	5/25/2019	Sat.	10:57 PM	Head On		x		Night	Dry
33	8/13/2019	Tues.	6:32 AM	Angle			x	Night	Dry
34	9/9/2019	Mon.	12:18 AM	Sideswipe		x		Night	Dry
35	9/30/2019	Mon.	8:09 PM	Rear End		x		Night	Wet
36	11/16/2019	Sat.	10:45 PM	Rear End			x	Night	Dry
37	11/16/2019	Sat.	7:50 PM	Rear End			x	Night	Dry
38	11/23/2019	Sat.	6:25 PM	Right Turn			x	Night	Dry
39	12/10/2019	Tues.	8:45 PM	Left Turn		x		Night	Dry

Total No.	Fatal	Injury	Property Damage	Rear End	Angle	Left Turn	Rollover	Right Turn	Side Swipe
39	0	18	21	18	2	7	0	1	1
%	0	46	54	46	5	18	0	3	3
Off Road	Pedestrian	Bicycle	Animal	Other	Day	Night	Dry	Wet	Head On
2	1	1	0	4	0	39	37	2	2
5	3	3	0	10	0	100	95	5	5

4.0 LIGHTING WARRANT ANALYSIS

4.1 FDOT'S HIGHWAY LIGHTING JUSTIFICATION PROCEDURE

The FDOT has developed a specific roadway lighting justification procedure described in Chapter 14 of the MUTS Manual. This procedure allows lighting projects to be ranked according to their benefit to the public by means of a net present value analysis. FDOT currently follows the warrants for highway lighting established by the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Association of Canada (TAC). These warrants are based on AADT values, the ratio of night to day crash rates, local government participation in the cost, geometry of the project, and other factors. In conjunction with the AASHTO and TAC warrants, FDOT uses the Lighting Geometric and Operational Factors Form as a supplement for arterials. In addition, lighting is required at signalized intersections with marked crosswalks per the MUTS Manual. Therefore, the signalized intersections meet this requirement and lighting is required at the intersections.

4.1.1 AASHTO and TAC Warrants

The FDOT currently follows the warrants for roadway lighting established by the FHWA Lighting Handbook, which references the AASHTO and TAC warrants. These warrants are general conditions under which lighting may be considered but do not specifically describe sites where lighting is justified. The warrants set forth a description of operational, geometric, and developmental conditions that must be matched or exceeded in order to justify the installation of roadway lighting. However, meeting AASHTO and TAC warrants for highway lighting does not obligate an agency to provide it. The objective is to identify those roadways which should be considered in the process of allocating resources and funding.

4.1.2 Lighting Geometric and Operational Factors

The *Lighting Geometric and Operational Factors Form* attempts to provide more factual, rather than subjective, warrants for roadway lighting. These tables provide a list of geometric, operational, environmental, and crash factors rated from 1 to 5 and adjusted by the differential value of a lighted versus an unlit condition. The sum of these rating scores should be greater than or equal to 60 points for the location to warrant new lighting.

The crash factor used takes into account the night to day crash rate. The following equations were used to calculate the actual nighttime crash rates (NRU) at the intersection and the roadway segment, which were then used to determine the ratio of night to day crash rates. The ADT data and the percentage of ADT at night (%ADT_n) were obtained from existing traffic counts and historical data. The NRU for a roadway segment was calculated using the following formula, which takes into account the number of night crashes, the ADT, the length of the roadway segment, and the number of years of crash data that was used:

The NRU for a roadway segment was calculated using the following formula, which takes into account the number of night crashes, the ADT, and the number of years of crash data that was used:

$$R_{NU} = \frac{NC \times 1,000,000}{ADT \times \%ADTn \times 365 \times NY \times SL} = \frac{39 \times 1,000,000}{11,850 \times 20\% \times 365 \times 5 \times 2.7} = 3.340$$

Where:

R_{NU} = Nighttime crash rate

NC = Number of night crashes during the study period

ADT = Average Daily Traffic along Segment

%ADTn = Percent of ADT at night (%/100)

NY = Study period (Number of Years)

SL = Segment length (Mile)

$$\frac{R_{NU}}{R_{DU}} = \frac{3.340}{3.125} = 1.068$$

Where:

R_{NU} / R_{DU} (*no AADT*) = Ratio of Night to Day Crash Ratio Unlighted (>2.0 warranted)

C_N = Number of night crashes during the study period

C_D = Number of daytime crashes during the study period

As a result of the *Lighting Geometric and Operational Factors Form* analysis, the Partin-Settlement Road segment has a total of 45.53 warranting points, which is below 60.0 threshold and therefore does not meet the criteria to warrant lighting. The ratio of the night to day crash rates (R_{NU} / R_{DU}) is below 2.0, therefore lighting is not warranted. The completed Geometric tables are provided in **Appendix B**.

4.1.3 Net Present Value Analysis

In following the FDOT’s Lighting Justification Procedure, a net present value analysis must be performed after a warranting condition to determine if new lighting is justified from a “benefit vs. cost” approach. Lighting is justified if the resulting net present value is greater than zero. Although segment lighting is not warranted in this case, the net present value analysis calculations are shown in **Appendix C**.

There is partial existing lighting at the evaluated intersections and along the study segment; therefore, all the scenarios were assumed to be new systems for the purpose of the net present value analysis. The net present values are calculated with the following formula for lighting installation.

$$NPV = (Present\ Worth\ of\ Cost\ UNLIGHTED - Present\ Worth\ of\ Cost\ LIGHTED) - (IC + PVMC + PVEC)$$

Where:

IC = Installation cost

PVMC = Present Value of annual Maintenance Cost

PVEC = Present Value of annual Energy Cost

The average crash costs obtained from the *2019 FDOT Design Manual, Volume 1, Table 122.6.1* were used for the net present value analysis. Specifically, the average crash cost (CC) of \$124,618 for the road classification of “2-3 Lane Undivided” was used.

To calculate the installation cost and the annual maintenance cost, it is necessary to estimate the number of poles required for the project length. Assuming a pole spacing of 200’ and lighting on both sides of the road, an estimated number 144 poles was calculated. For the four intersections, it was assumed that sixteen additional poles are required, two for each northbound and southbound approach. It is also assumed that the lighting used will be conventional fixtures consisting of 40-ft. poles and 400-Watt equivalent using light emitting diode (LED) luminaries. The initial construction cost (IC) per pole was assumed at \$15,820 (including pole, luminaire, conduit, and conductors), based on averages of previous construction projects. The electrical cost (PVEC) used in the analysis is the average in Florida at \$0.08/KWH. The maintenance cost (PVMC) per luminaire was estimated at \$100 per year.

The crash modification factor (CMF) was determined to be 0.86 for the study segment of Partin-Settlement Road. This value was obtained from the FDOT CRF Database.

The calculated net present value (NPV) is as follows and the detailed calculation is shown in **Appendix C**:

- Partin-Settlement Road: NPV = -\$1,466,289

5.0 CONCLUSIONS

This Lighting Justification Report was based on the guidelines set forth in the FDOT’s Roadway Lighting Justification Procedure, as presented in Chapter 14 of the *MUTS Manual*. The lighting justification procedure is divided into two steps. The first step is to verify that the current conditions warrant the need for new lighting based on the AASHTO and TAC warrants and supplemented with the *Lighting Geometric and Operational Factors Form* warrants. The second step is to justify the need for new lighting based on a net present value analysis. The AASHTO warrants specify that lighting may be provided for locations or sections of streets and highways where the ratio of night to day crash rates is higher than the statewide average for similar locations, and a lighting justification analysis indicates that lighting would significantly reduce the nighttime crash rate.

The roadway segment along Partin-Settlement Road is below the 60-point threshold and thus does not meet the *Lighting Geometric and Operational Factors Form* warrants for the installation of roadway lighting. The segment analyzed along Partin-Settlement Road has a night to day crash rate ratio of 1.068, which is below the threshold of 2.0. The net present value analysis shows that lighting is not justified for Partin-Settlement Road, since the net present value of

\$-1,466,289, which is less than the threshold of \$0. Lastly, there are four signalized intersections with pedestrian features, so intersection lighting is required per the MUTS. Therefore, lighting is not recommended for Partin-Settlement Road from CR 525 (Neptune Road) to Lakeshore Boulevard but is recommended at each signalized intersection in order to enhance safety.

Table 2: Conclusion Summary

Conclusion Summary	
Category	Roadway Segment
Night to Day crash ratios	N
Overall crash rates	N
FDOT Lighting & Geometrics Form	N
Net present value analysis	N
MUTS Requirement crosswalk light	Y
Lighting Recommended	N*

**but is recommended at each signalized intersection*

APPENDIX A

Crash Data Summary



APPENDIX B

Lighting Geometric and Operational Factors Form



APPENDIX C

Net Present Value Calculation