GEORGIA DEPARTMENT OF TRANSPORTATION

TRAFFIC STUDY

SR 9 Widening From Fulton/Forsyth County Line to SR 141

Project No. CSSTP-0007-00(843)
Project No. CSSTP-0007-00(844)
Project No. CSSTP-0008-00(357)

P. I. No. 0007843
P. I. No. 0007844
P. I. No. 0008357

Forsyth County

September, 2014

Prepared by

PARSONS

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1. Introduction

The purpose of this study is to facilitate the concept development for Atlanta Highway (SR 9) widening. The project is located in Forsyth County in Georgia. The study area includes SR 9 from the Fulton/Forsyth County Line for a distance of about 7 miles to its intersection with Peachtree Parkway (SR 141). Traffic data was collected and capacity analysis was performed for the project to identify the deficiencies of the existing condition and appropriate future improvements.

2. Existing Conditions

Currently SR 9 is a two-lane road with turning lanes at some individual intersections and a two-way-left-turning lane for some sections. There are multiple intersections (cross roads and driveways) with SR 9 within the project extents; nine of which are currently signalized and all other intersections are unsignalized (stop controls for the minor approaches). SR 9 is a north-south road for about 2 miles into the project and then orients as an east-west road for the remaining 5 miles. For the purposes of this report, SR 9 is considered an east-west highway and all cross roads are considered north-south roads. The posted speed limit for SR 9 is 45 miles per hour (mph) between A Street and Woodbine Way (mph) and 55 mph between Woodbine Way and SR 141. The current highest annual daily traffic (ADT) for SR 9 is 24640 vehicles per day (vpd). The ADT for other cross roads are shown in the volume diagrams enclosed in Appendix A. Existing intersection lane configurations are also attached in Appendix B.

3. Projects in Area

The following nearby projects were identified

- P.I. 721780 - Fulton County – SR 9 Widening from Academy Street to Windward Parkway.
- P.I. 0007838 - Fulton County – SR 9 Widening from Windward Parkway to Forsyth County Line.
- P.I. 0007846 - Forsyth County – CR 458 / McFarland Road Widening from SR 400 to SR 9.
- P.I. 0006915- Forsyth County – SR 371 Widening from SR 9 to CR 5/ Kelly Mill Road.
- P.I. 0006727 - Fulton County – ITS Installation for SR 9 / Roswell Road from Abernathy Road to Forsyth County line.
- P.I. 0007999 - Forsyth County – SR 141/SR 9 intersection improvements.
- P.I. 141880 - Forsyth County – CR 455 / Bethelview Road Widening from SR 9 to SR 8 / Castleberry Road.
- P.I. 121690 - Forsyth County – SR 9 Widening from North of SR 141 to North of SR 20.

4. Crash Analysis

Historical crash data was obtained from Critical Analysis Reporting Environment (CARE 9) software and database for the three-year period of 2007-2009 for SR 9 within the project limits. Crash history by crash type and crash rates for the project limits are summarized in Tables 1 and 2 respectively.

Table 1 Crash History by Crash Type

Year	Angle	Head On	Rear End	Sideswipe	Other	Total
2007	102	5	160	15	22	304
2008	76	7	99	21	30	233
2009	52	6	84	9	16	167
Total	230	18	343	45	68	704
Percentage	33%	3%	49%	6%	10%	100%

Table 2 Crash History by Rate & Comparison with Statewide Average

Year	No. of Crashes			All Crashes		Injuries		Fatalities	
	Crashes	Injuries	Fatalities	Rate (100MVM)	Statewide Average Rate (100MVM)	Rate (100MVM)	Statewide Average Rate (100MVM)	Rate (100MVM)	Statewide Average Rate (100MVM)
2007	304	99	0	731	513	238	190	0	1.48
2008	233	63	1	562	469	152	176	2.41	1.47
2009	167	55	1	403	463	133	173	2.41	1.10

Table 3 Lighting Conditions Crash History

Condition	2007	2008	2009	Total
Daylight	254	182	140	576
Dusk	6	1	1	8
Dawn	9	6	3	18
Dark - lighted	15	11	9	35
Dark – not lighted	20	33	14	67
Total	***304***	***233***	***167***	***704***
% Dark – not lighted	**1%**	**10%**	**17%**	

The historical crash data indicated that 304, 233, and 167 crashes occurred on SR 9 in 2007, 2008, and 2009 respectively. In total, 704 crashes occurred on SR 9 during the three-year period. Rear end collisions accounted for 49 percent of the crashes while angle collisions accounted for

33 percent of all crashes. Angle crashes accounted for 34, 33 and 31 percent of crashes for 2007, 2008 and 2009 respectively while rear-end crashes accounted for 53, 42 and 50 percent for 2007, 2008 and 2009 respectively. The high percentage of rear-end crashes and angle crashes is an indication of congestion and high turning movements at intersections.

Crash rates were calculated and compared with the statewide averages rate for urban minor arterial, as shown in Table 2.The crash rate information shown in Table 2 showed that the overall crash rates for SR 9 were 1.4 times and 1.2 times higher than the statewide average in both 2007 and 2008, respectively but was lower than the statewide average in 2009. The injury rate was 1.3 times higher than the statewide average in 2007 while the injury rates for 2008 and 2009 were lower than the statewide average rates. A fatal crash occurred in both 2008 and 2009; as a result, the fatality rates for 2008 and 2009 were 1.6 and 2.2 times, respectively higher than the statewide average rates.

For each analysis year, less than 20 percent of the crashes occurred during dark-non lighted conditions. Out of the 704 crashes occurring in the three year analysis, 632 (90%) involved motor vehicles in motion, 15 (2.13%) involved a ditch, 12 (1.7%) involved deer with all other harmful events each accounting for less than 1 percent each. There was only one crash involving a pedestrian.

Tables 4 to 6 show the crash date along SR 9 excluding intersection crash data, Tables 7 to 10 summarize the crash data for signalized intersections within the project limits while Tables 11 to 14 provide the crash data summary for unsignalized intersections within the project limits.

Table 4 Crash History by Crash Type - Non-Intersection Data

Year	Angle	Head On	Rear End	Sideswipe	Other	Total
2007	26	3	48	4	13	94
2008	24	1	35	7	12	79
2009	17	3	26	1	9	56
Total	67	7	109	12	34	229
Percentage	29%	3%	48%	5%	15%	100%

Table 5 Injury & Fatal Crash History - Non-Intersection Data

Year	No. of Crashes		
	Crashes	Injury Crashes	Fatal Crashes
2007	94	25	0
2008	79	15	0
2009	56	13	1
Total	**229**	**53**	**1**

Table 6 Lighting Conditions Crash History – Non-Intersection Data

Condition	2007	2008	2009	Total
Daylight	74	65	48	187
Dusk	2	0	1	3
Dawn	3	1	1	5
Dark - lighted	7	1	2	10
Dark – not lighted	8	12	4	24
Total	***94***	***79***	***56***	229
% Dark – not lighted	**9%**	**15%**	**7%**	

Crash data for 2010 and 2011 was not used in this analysis due to the lack of statewide averages for those years. The historical crash data indicated that for crashes not occurring at intersections, 94, 79, and 56 crashes occurred on SR 9 in 2007, 2008, and 2009 respectively. In total, 229 crashes occurred on SR 9 mainline during the 3 year period. Rear end collisions accounted for 48 percent of the crashes while angle collisions accounted for 29 percent of all crashes. Rear-end crashes accounted for 51, 44 and 46 percent of crashes for 2007, 2008 and 2009 respectively while angle crashes accounted for 28, 30 and 30 percent for 2007, 2008 and 2009 respectively. The high percentage of rear-end crashes is an indication of congestion along the SR 9 mainline. 53 of the 229 crashes resulted in injuries and only one crash resulted in a fatality with no more than 15 percent of the crashes occurring in dark-not lighted conditions for each analysis year. 5 crashes involved deer (2 each in 2007 and 2008 and 1 in 2009); all occurring between the intersections with Bettis Rd and Kentmere Drive under dark non-lighted conditions. No crash involved pedestrians.

Table 7 Crash History – Signalized Intersections

Year	McFarland Rd	Francis Rd / Grassland Pkwy	Hamby Rd	Campground Rd / Francis Cir	SR 371/ Mullinax Rd	Castleberry Rd/ Carolene Way	Majors Rd / Shiloh Rd	SR 141 / Bethelview Rd	Total
2007	22	15	10	3	18	27	22	59	173
2008	24	12	5	6	21	16	11	35	130
2009	21	15	3	7	8	13	8	22	97
Total	**67**	**42**	**18**	**16**	**47**	**56**	**41**	**116**	**400**

Table 8 Crash Type History – Signalized Intersections

Crash Type	McFarland Rd		Francis Rd / Grassland Pkwy		Hamby Rd		Campground Rd / Francis Cir		SR 371/ Mullinax Rd		Castleberry Rd/ Carolene Way		Majors Rd / Shiloh Rd		SR 141 / Bethelview Rd	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Angle	16	24%	19	45%	10	56%	4	25%	16	34%	15	27%	30	73%	37	32%
Head On	1	1%	1	2%	1	6%	1	6%	1	2%	2	4%	1	3%	1	1%
Rear End	44	66%	19	45%	6	33%	9	56%	22	47%	29	52%	3	7%	64	55%
Sideswipe	4	6%	2	5%	0	0%	2	13%	7	15%	1	2%	3	7%	10	9%
Other	2	3%	1	2%	1	6%	0	0%	1	2%	9	16%	4	10%	4	3%
Total	**67**	**100%**	**42**	**100%**	**18**	**100%**	**16**	**100%**	**47**	**100%**	**56**	**100%**	**41**	**100%**	**116**	**100%**

Table 9 Injury and Fatal Crash History – Signalized Intersections

Year	McFarland Rd		Francis Rd / Grassland Pkwy		Hamby Rd		Campground Rd / Francis Cir		SR 371/ Mullinax Rd		Castleberry Rd/ Carolene Way		Majors Rd / Shiloh Rd		SR 141 / Bethelview Rd	
	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality
2007	0	0	3	0	1	0	0	0	4	0	6	0	12	0	7	0
2008	0	0	1	0	1	0	0	0	6	0	6	1	4	0	3	1
2009	0	0	3	0	0	0	2	0	1	0	1	0	6	0	3	0
Total	**0**	**0**	**7**	**0**	**2**	**0**	**2**	**0**	**11**	**0**	**13**	**1**	**22**	**0**	**13**	**1**

Table 10 Lighting Conditions Crash History – Signalized Intersections

Condition	McFarland Rd	Francis Rd / Grassland Pkwy	Hamby Rd	Campground Rd / Francis Cir	SR 371/ Mullinax Rd	Castleberry Rd/ Carolene Way	Majors Rd / Shiloh Rd	SR 141 / Bethelview Rd	Total
Daylight	61	33	15	12	39	44	33	93	330
Dusk	0	0	0	0	0	0	2	2	4
Dawn	2	3	0	0	4	1	1	2	13
Dark - lighted	3	2	0	1	2	0	0	15	23
Dark – not lighted	1	4	3	3	2	11	5	4	33
Total	***67***	***42***	***18***	***16***	***47***	***56***	***41***	***116***	***403***
% Dark – not lighted	**1%**	**10%**	**17%**	**19%**	**4%**	**20%**	**12%**	**3%**	

The highest number of crashes for the three-year period was recorded at the SR 141/SR 9 intersection with rear end crashes accounting for 55 percent of the total crashes. The McFarland Rd/ SR 9 intersection recorded 67 crashes; the second highest number of crashes for the three year period with rear end crashes accounting for 66 percent of the total crashes. The Castleberry Rd/SR 9 intersection recorded 56 crashes; the third highest number of crashes for the three-year period with rear end crashes accounting for 52 percent of the total crashes. It is noted that the Castleberry Rd/SR 9 intersection is currently signalized; it was however an unsignalized intersection during the 2007-2009 analysis period. 2 fatal crashes were recorded for the three-year period with one each occurring at SR 9 intersections with SR 141 and Castleberry Rd/Carolene Way. 82 injury crashes were recorded accounting for 21 percent of the crashes at signalized intersections. For each intersection, less than 21 percent of the crashes occurred during dark-not lighted conditions indicating that poor lighting is not a contributory factor in the crash occurrences at the signalized intersections within the project limits.

Table 11 Crash History – Unsignalized Intersections

Year	Tidwell Rd	Strickland Rd	Martin Dr	Creamer Dr	9 N Dr	Mauldin Dr	Oakmont Bend Dr	Fowler Rd	Mars Hill Rd	Majors Fork Rd	Lake Rd	Glen Wallace Dr	Glover Dr	Bethelview Dr
2007	3	0	1	1	5	3	4	6	1	1	2	1	2	4
2008	3	4	1	3	3	0	1	4	1	1	0	0	1	2
2009	1	2	3	0	0	1	0	5	0	0	0	0	0	2
Total	**7**	**6**	**5**	**4**	**8**	**4**	**5**	**15**	**2**	**2**	**2**	**1**	**3**	**8**

Table 12 Crash Type History – Unsignalized Intersections

Crash Type	Tidwell Rd		Strickland Rd		Martin Dr		Creamer Dr		9 N Dr		Mauldin Dr		Oakmont Bend Dr	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Angle	4	575	1	17%	3	60%	0	0%	3	38%	1	25%	1	20%
Head On	1	14%	0	0%	0	0%	0	0%	0	05	0	0%	0	0%
Rear End	1	14%	4	67%	1	20%	2	50%	4	50%	3	75%	4	80%
Sideswipe	0	0%	0	0%	0	0%	2	505	1	135	0	0%	0	0%
Other	1	14%	1	17%	1	20%	0	0%	0	0%	0	0%	0	0%
Total	**7**	**100%**	**6**	**100%**	**5**	**100%**	**4**	**100%**	**8**	**100%**	**4**	**100%**	**5**	**100%**

Table 13Crash Type History – Unsignalized Intersections (cont.)

Crash Type	Fowler Rd		Mars Hill Rd		Major Forks Rd		Lake Rd		Glen Wallace Dr		Glover Dr		Bethelview Dr / Bagwell Dr	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Angle	2	13%	0	0%	0	0%	0	0%	0	0%	0	0%	1	13%
Head On	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	13%
Rear End	10	67%	1	50%	0	0%	2	100%	1	100%	2	67%	3	38%
Sideswipe	0	0%	0	0%	0	0%	0	0%	0	0%	1	33%	0	0%
Other	3	20%	1	50%	2	100%	0	0%	0	0%	0	0%	3	38%
Total	**15**	**100%**	**2**	**100%**	**2**	**100%**	**2**	**100%**	**1**	**100%**	**3**	**100%**	**8**	**100%**

Table 14 Injury and Fatal Crash History – Unsignalized Intersections

Year	Tidwell Rd		Strickland Rd		Martin Dr		Creamer Dr		9 N Dr		Mauldin Dr		Oakmont Bend Dr		Fowler Rd	
	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality
2007	0	0	0	0	0	0	0	0	1	0	1	0	1	0	2	0
2008	0	0	1	0	0	0	1	0	2	0	0	0	0	0	1	0
2009	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0
Total	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**3**	**0**	**2**	**0**	**1**	**0**	**6**	**0**

Table 15 Injury and Fatal Crash History – Unsignalized Intersections (cont.)

Year	Mars Hill Rd		Major Forks Rd		Lake Rd		Glen Wallace Dr		Glover Dr		Bethelview Dr / Bagwell Dr	
	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality
2007	1	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	1	0
2009	0	0	0	0	0	0	0	0	0	0	1	0
Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**

Table 16 Lighting Conditions Crash History– Unsignalized Intersections

Year	Tidwell Rd	Strickland Rd	Martin Dr	Creamer Dr	9 N Dr	Mauldin Dr	Oakmont Bend Dr	Fowler Rd	Mars Hill Rd	Majors Fork Rd	Lake Rd	Glen Wallace Dr	Glover Dr	Bethelview Dr
Daylight	6	6	3	4	7	4	4	12	2	0	2	1	2	6
Dusk	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Dawn	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dark - lighted	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Dark – not lighted	0	0	1	0	1	0	0	3	0	2	2	0	1	2
Total	***7***	***6***	***5***	***4***	***8***	***4***	***5***	***15***	***2***	***2***	***0***	***1***	***3***	***8***
% Dark – not lighted	**0%**	**0%**	**20%**	**0%**	**13%**	**0%**	**0%**	**20%**	**0%**	**100%**	**0%**	**0%**	**33%**	**25%**

For unsignalized intersections, the highest number of crashes for the three-year period was recorded at the Fowler Rd / SR 9 intersection with rear end crashes accounting for 67 percent of the total crashes. The 9 N Dr/ SR 9 and Bethelview Dr/Bagwell Dr/SR 9 intersections both recorded 8 crashes each. The Castleberry Rd/SR 9 intersection recorded 56 crashes (shown in Table 7 for the three-year period with rear end crashes accounting for 52 percent of the total crashes. It is noted that the Castleberry Rd/SR 9 intersection is currently signalized; it was however an unsignalized intersection during the 2007-2009 analysis period. No fatal crashes were recorded for the three-year period at the unsignalized intersections within the project limits. 25 percent of the 72 crashes occurring at unsignalized intersections resulted in injuries. 8 out of the 14 intersection had no crash occurring during dark-not lighted conditions; 5 intersections had no more than 33 percent occurring during dark-not lighted conditions. The intersection of SR 9 and Majors Fork Rd had both crashes occurring during dark-not lighted conditions and between the hours of 12:00 and 2:00 a.m. Both crashes involved deer and there was no collision with a motor vehicle.

5. Traffic Forecast

Traffic forecast was performed for opening year (2020) and design year (2040) for SR 9. Existing traffic count data was collected in January 2012 and used as the basis for traffic forecast. Future traffic growth rate was provided by GDOT Office of Planning.

5.1. Existing Traffic Data

Twenty-four (24) hours traffic count data for SR 9 and peak hour turning movement count data for selected intersections was collected. The 24 hour truck percentage is approximately 8 percent with 7 percent of single-unit trucks and 1 percent of tractor trailer trucks. The peak hour truck percentage is approximately 10 percent.

5.2. Traffic Growth Rate and Forecast

Based on the traffic forecast for related projects collected from and discussion with the GDOT Office of Planning, the determined average traffic growth rates for the project are summarized in Table 17 below. The opening year (2020) and design year (2040) traffic volumes were developed and are included in Appendix A.

Table 17 Traffic Growth Rate

Scenario/ Year	Growth Rate/Year
No-Build (2012-2020)	2.0 %
Build (2012-2020)	2.5 %
No-Build (2020-2040)	1.0 %
Build (2020-2040)	1.5 %

6. Capacity Analysis

Capacity analysis is a set of procedures for estimating traffic-carrying ability of facilities over a range of defined operational conditions. It provides tools to assess facilities and to plan and design improved facilities [Highway Capacity Manual 2010]. Level of service (LOS) is a quality measure describing operational conditions, which is represented by six letters, from A to F, with LOS A representing the best operating conditions and LOS F the worst. For intersection capacity analysis, control delay is the measure of effectiveness (MOE) for determining LOS. The LOS criteria for signalized and unsignalized intersections and urban arterials defined in Highway Capacity Manual 2010 are included in Tables 18, 19 and 20, respectively. For these analyses, SR 9 is considered an east-west highway and all cross roads are considered as north-south roads.

Table 18 LOS Criteria for Signalized Intersections

Level of Service	Control Delay Per Vehicle (sec/veh)
A	<=10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

Table 19 LOS Criteria for Unsignalized Intersections

Level of Service	Control Delay Per Vehicle (sec/veh)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Table 20 Urban Street LOS

Travel Speed as Percentage of Base Free flow speed (%)	LOS
>85	A
>67-85	B
>50-67	C
>40-50	D
>30-40	E
≤ 30	F

Capacity analysis was performed for a.m. and p.m. peak hours for existing (2012) condition, opening year (2020) and design year (2040) no-build and build conditions in this study. *Synchro plus SimTraffic 7* software was used for analyzing intersections and roadway. The Synchro analysis reports are included in Appendix C.

6.1. Existing Condition

Capacity analysis was performed for the existing conditions and the analysis results are included in Tables 21 to 23.

Table 21 Capacity Analysis Results for Intersections (Existing 2012)

Intersection	Approach / Movement	AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Tidwell Rd	Westbound	0.1	A	0.1	A
	Northbound	20.7	C	31.0	D
Strickland Rd	Westbound	2.1	A	1.9	A
	Northbound	12.0	B	13.3	B
Martin Dr	Northbound	13.8	B	13.4	B
	Westbound	8.4	A	8.9	A
Windsor Lane	Southbound	13.1	B	13.2	B
	Eastbound	0.3	A	0.4	A
McFarland Rd*	-	37.6	D	41.7	D
Creamer Dr	Westbound	9.9	A	11.8	B
	Northbound	13.1	B	150.7	F
Crested Moss Dr	Northbound	77.3	F	79.9	F
	Westbound	8.8	A	12.6	B
Gateway Dr	Northbound	42.0	E	26.9	D
	Westbound	0.6	A	0.8	A
Francis Rd/ Grassland Pkwy*	-	49.4	D	36.8	D
Suntrust Bank Driveway	Southbound	15.9	C	#	F
	Northbound	13.6	B	55.0	F
	Eastbound	0.0	A	0.1	A
	Westbound	1.7	A	8.2	A
Shirlee Industrial Way	Southbound	19.0	C	22.9	C
	Eastbound	12.3	B	9.5	A
Commerce Blvd*	-	4.9	A	12.5	B
9 N Drive	Southbound	26.8	D	#	F
	Northbound	21.7	C	68.1	F
	Eastbound	15.9	C	8.9	A
	Westbound	8.6	A	19.0	C
Hamby Rd*	-	24.4	C	13.5	B
Mauldin Dr	Southbound	19.0	C	22.1	C
	Eastbound	10.5	B	9.5	A
Campground Pkwy / Francis Cir*	-	34.1	C	23.0	C
Midway Shopping Center Driveway	Eastbound	10.6	B	10.9	B
	Westbound	9.5	A	10.7	B
	Northbound	19.7	C	22.9	C
	Southbound	24.3	C	28.7	D
SR 371*	-	42.9	D	56.6	E
Midway Elementary School Driveway	Eastbound	0.0	A	0.0	A
	Westbound	10.8	B	10.4	B
	Northbound	401.9	F	38.5	E
Woodbine Way	Eastbound	9.0	A	9.1	A
	Westbound	0.0	A	0.0	A
	Southbound	20.2	C	23.2	C
Fowler Rd	Eastbound	0.0	A	0.0	A
	Westbound	11.9	B	9.9	A
	Northbound	251.0	F	79.6	F
Castleberry Rd/Carolene Way*	-	18.8	B	14.0	B
Mars Hill Rd	Westbound	0.1	A	0.3	A
	Northbound	18.4	C	24.0	C
Majors Rd/Shiloh Rd*	-	22.8	C	24.4	C

Intersection	Approach / Movement	AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Majors Fork Rd	Eastbound	0.0	A	0.1	A
	Southbound	23.2	C	37.0	E
Crosscreek Ct	Eastbound	9.5	A	8.9	A
	Westbound	8.6	A	10.0	A
	Northbound	21.4	C	24.6	C
	Southbound	29.0	D	35.1	E
Whitfield Ave	Eastbound	9.6	A	9.2	A
	Southbound	26.3	D	32.4	D
Bethelview Dr / Bagwell Dr	Eastbound	0.4	A	0.4	A
	Westbound	0.1	A	0.1	A
	Northbound	17.9	C	15.5	C
	Southbound	17.3	C	15.2	C
Bethelview Rd / SR 141*	-	88.0	F	54.3	D

* Signalized intersections

Table 22 SR 9 EB Roadway Capacity Analysis Results (Existing 2012)

Intersection	AM			PM		
SR 9 @	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
McFarland Rd*	30	66%	C	29	65%	C
Francis Rd/ Grassland Pkwy*	36	80%	B	28	63%	C
Commerce Blvd*	33	72%	B	29	65%	C
Hamby Rd*	28	63%	C	28	62%	C
Campground Pkwy / Francis Cir*	25	55%	C	29	64%	C
SR 371*	22	49%	D	23	52%	C
Castleberry Rd/Carolene Way*	44	80%	B	47	85%	B
Majors Rd/Shiloh Rd*	43	78%	B	37	66%	C
Bethelview Rd / SR 141*	32	58%	C	33	60%	C

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
# Capacity exceeded
BFFS = Base Free Flow Speed; SR 9 posted speed limit is 45 mph to Woodbine Way and 55 mph to SR 141.

Table 23 SR 9 WB Roadway Capacity Analysis Results (Existing 2012)

Intersection	AM			PM		
SR 9 @	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
Bethelview Rd / SR 141*	6	11%	F	9	16%	F
Majors Rd/Shiloh Rd*	47	85%	A	49	89%	A
Castleberry Rd/Carolene Way*	46	83%	B	41	74%	B
SR 371*	35	77%	B	28	63%	C
Campground Pkwy / Francis Cir*	21	46%	D	36	79%	B
Hamby Rd*	24	53%	C	30	67%	B
Commerce Blvd*	33	73%	B	27	60%	C
Francis Rd/ Grassland Pkwy*	13	30%	F	18	41%	D
McFarland Rd*	33	74%	B	31	70%	B

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
BFFS = Base Free Flow Speed; SR 9 posted speed limit is 45 mph to Woodbine Way and 55 mph to SR 141.

The intersection capacity analysis indicates that currently, most intersections operate at LOS D or better with the exception of the SR 9 unsignalized intersections with Creamer Drive, Crested Moss Drive, Gateway Drive, Suntrust Bank Driveway, 9 N Drive, Midway Elementary School Driveway, Fowler Road, Majors Fork Road and Crosscreek Court where the minor-road approaches operate at LOS E or F and at its signalized intersection with SR 371/Post Road where it operates at LOS E in the p.m. peak period and at Bethelview Road/SR 141where it operates at LOS F in the a.m. peak period.

From the roadway capacity analysis results summary in Tables 22 and 23, it is observed that the eastbound approach operates at LOS D or better at all signalized intersections while the westbound approach operates at LOS F at its signalized intersections with Bethelview Road/SR 141 and Francis Road/Grassland Parkway.

6.2. No-Build Condition

Capacity analysis with optimized signals was performed for the no-build conditions for the opening year (2020) and design year (2040). The analysis results are included in Tables 24 to 26.

Table 24 Capacity Analysis Results for Intersections (No-Build)

Intersection	Approach / Movement	2020				2040			
		AM		PM		AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Tidwell Rd	Westbound	0.1	A	0.1	A	0.1	A	0.1	A
	Northbound	27.4	D	53.5	F	49.9	E	179.8	F
Strickland Rd	Westbound	2.6	A	2.3	A	3.5	A	3.1	A
	Northbound	13.2	B	15.0	B	15.4	C	18.4	B
Martin Dr	Northbound	15.8	C	15.0	B	20.3	C	17.9	C
	Westbound	8.7	A	9.3	A	9.1	A	10.0	A
Windsor Lane	Southbound	14.5	B	14.8	B	18.1	C	17.9	C
	Eastbound	0.4	A	0.5	A	0.5	A	0.7	A
McFarland Rd*	-	38.5	D	38.8	D	47.1	D	70.2	E
Creamer Dr	Westbound	10.9	B	14.2	B	13.2	B	19.9	C
	Northbound	14.7	B	485.2	F	17.9	C	9999.0	F
Crested Moss Dr	Northbound	232.2	F	301.0	F	#	F	#	F
	Westbound	9.2	A	15.6	C	10.0	B	23.7	C
Gateway Dr	Northbound	229.3	F	312.5	F	#	F	#	F
	Westbound	1.5	A	1.7	A	0.1	A	3.3	A
Francis Rd/ Grassland Pkwy*	-	89.1	F	70.3	E	174.3	F	138.0	F
Suntrust Bank Driveway	Southbound	19.6	C	#	F	24.1	D	#	F
	Northbound	15.9	C	343.6	F	20.2	C	#	F
	Eastbound	0.0	A	0.3	A	0.0	A	1.0	A
	Westbound	2.7	A	32.4	D	4.9	A	492.3	F
Shirlee Industrial Way	Southbound	29.4	C	56.2	F	142.2	F	991.5	F
	Eastbound	19.3	C	10.2	B	54.7	F	11.7	B
Commerce Blvd*	-	6.0	A	13.3	B	14.8	B	15.2	B
9 N Drive	Southbound	49.5	E	#	F	#	F	#	F
	Northbound	410.6	F	585.2	F	#	F	#	F
	Eastbound	25.2	D	9.4	A	203.8	F	10.4	B
	Westbound	8.9	A	48.8	E	9.5	A	71.9	F

Intersection	Approach / Movement	2020				2040			
		AM		PM		AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Hamby Rd*	-	28.8	C	22.4	C	82.8	F	35.3	D
Mauldin Dr	Southbound	23.8	C	48.4	E	36.4	E	949.5	F
	Eastbound	11.4	B	10.0	A	13.2	B	10.9	B
Campground Pkwy / Francis Cir*	-	43.7	D	55.2	E	122.3	F	328.3	F
Midway Shopping Center Driveway	Eastbound	12.2	B	12.6	B	16.1	C	16.4	C
	Westbound	10.1	B	11.7	B	11.1	B	13.3	B
	Northbound	32.3	D	31.9	D	#	F	110.6	F
	Southbound	40.4	E	50.3	F	172.5	F	334.2	F
SR 371*	-	59.7	D	85.9	F	106.3	F	142.5	F
Midway Elementary School Driveway	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	12.8	B	11.8	B	18.3	C	15.1	C
	Northbound	#	F	159.4	F	#	F	#	F
Woodbine Way	Eastbound	9.5	A	9.5	A	10.2	B	10.2	B
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
	Southbound	25.7	D	30.4	D	38.1	E	47.6	E
Fowler Rd	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	14.3	B	10.7	B	22.4	C	12.0	B
	Northbound	#	F	226.9	F	#	F	582.9	F
Castleberry Rd/Carolene Way*	-	30.6	C	23.4	C	66.5	E	37.8	D
Mars Hill Rd	Westbound	0.1	A	0.4	A	0.2	A	0.4	A
	Northbound	22.3	C	32.3	D	30.9	D	60.6	F
Majors Rd/Shiloh Rd*	-	43.7	D	31.1	C	99.6	F	53.7	D
Majors Fork Rd	Eastbound	0.0	A	0.1	A	0.0	A	0.1	A
	Southbound	33.7	D	78.0	F	65.9	F	508.4	F
Crosscreek Ct	Eastbound	10.0	A	9.3	A	11.0	B	9.8	A
	Westbound	8.9	A	10.7	B	9.4	A	12.0	B
	Northbound	32.6	D	38.9	E	99.8	F	105.8	F
	Southbound	37.8	E	55.1	F	63.7	F	122.2	F
Whitfield Ave	Eastbound	10.2	B	9.6	A	11.4	B	10.4	B
	Southbound	36.5	E	52.4	F	71.9	F	139.7	F
Bethelview Dr / Bagwell Dr	Eastbound	0.5	A	0.5	A	0.9	A	1.0	A
	Westbound	0.1	A	0.2	A	0.2	A	0.2	A
	Northbound	20.8	C	17.9	C	27.1	D	22.1	C
	Southbound	20.1	C	17.5	C	26.6	D	22.3	C
****Bethelview Rd / SR 141***	-	51.3	D	35.8	D	99.6	F	49.2	D

* Signalized intersections
Optimized signals for no-build conditions
Capacity exceeded
** Project P.I. 0007999 to be in place by 2013. Incorporated into 2020 and 2040 models. Project provides SR 141 and Bethelview Rd and SR 9 with two through lanes, two left turn lane, a right turn lane and free right turn pockets. Design year 2032

Table 25 SR 9 EB Roadway Capacity Analysis Results (No-Build)

Intersection	2020						2040					
	AM			PM			AM			PM		
SR 9	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
McFarland Rd*	28	62%	C	25	56%	C	23	51%	C	20	44%	D
Francis Rd/ Grassland Pkwy*	34	76%	B	22	49%	D	31	69%	B	13	29%	F
Commerce Blvd*	33	73%	B	28	62%	C	34	76%	B	27	60%	C
Hamby Rd*	31	69%	B	24	52%	C	30	67%	C	15	34%	E
Campground Pkwy / Francis Cir*	28	63%	C	28	61%	C	21	47%	D	15	34%	E
SR 371*	17	38%	E	17	38%	E	12	27%	F	11	25%	F
Castleberry Rd/Carolene Way*	41	74%	B	46	84%	B	35	63%	C	46	84%	B
Majors Rd/Shiloh Rd*	29	53%	C	34	62%	C	18	33%	E	27	50%	D
Bethelview Rd / SR 141*	33	60%	C	40	73%	B	34	61%	C	37	68%	B

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
BFFS = Base Free Flow Speed; SR 9 posted speed limit is 45 mph to Woodbine Way and 55 mph to SR 141.

Table 26 SR 9 WB Roadway Capacity Analysis Results (No-Build)

Intersection	2020						2040					
	AM			PM			AM			PM		
SR 9	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
Bethelview Rd / SR 141*	9	16%	F	13	24%	F	9	15%	F	12	21%	F
Majors Rd/Shiloh Rd*	44	79%	B	47	85%	A	34	62%	C	45	82%	B
Castleberry Rd/Carolene Way*	37	67%	C	36	65%	C	29	53%	C	32	58%	C
SR 371*	28	61%	C	23	51%	C	22	49%	D	17	39%	E
Campground Pkwy / Francis Cir*	24	53%	C	33	73%	B	12	27%	F	24	54%	C
Hamby Rd*	27	61%	C	26	58%	C	14	31%	E	30	66%	C
Commerce Blvd*	31	69%	B	34	75%	B	24	54%	C	31	70%	B
Francis Rd/ Grassland Pkwy*	12	27%	F	11	25%	F	6	12%	F	7	15%	F
McFarland Rd*	30	67%	C	32	71%	B	30	66%	C	27	61%	C

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
BFFS = Base Free Flow Speed; SR 9 posted speed limit is 45 mph to Woodbine Way and 55 mph to SR 141.

The analysis indicates that by the no-build opening (2020) and design (2040) years, more intersections deteriorate to LOS E or F. Six out of nine signalized intersections operate at LOS F by 2040 while 2 operate at LOS E. For signalized intersections, McFarland Road operates at LOS E by the 2040 p.m. peak hour, Francis Road/Grassland Parkway operates at LOS F and E by 2020 a.m. and p.m. respectively and deteriorates to LOS F for both peak periods by 2040, Hamby Road operates at LOS F by 2040 a.m. peak, Campground Parkway/Francis Circle operates at

LOS F for both peak periods by 2040, SR 371/Mullinax Road operates at LOS F for both peak periods by 2040 and the intersections with Majors Road/Shiloh Road and SR 141/Bethelview Road also operate at LOS F by 2040 a.m. peak period. Multiple unsignalized intersections record LOS F by 2040; however LOS F is recorded on the minor approaches for most except at the intersections with Suntrust Bank Driveway and 9 N Drive/Walmart Driveway where the SR 9 westbound approach records LOS F and at Shirlee Industrial Way and 9 N Drive/Walmart Driveway where the SR 9 eastbound approach records LOS F.

From the roadway capacity analysis results summary in Tables 25 and 26, it is observed that SR 9 roadway deteriorates to LOS E and F by 2040 for its eastbound approaches at Francis Road/Grassland Parkway, Hamby Road, Campground Parkway/Francis Circle, SR 371/Mullinax Road and Majors Road/Shiloh Road. Deteriorating LOS is also recorded at three additional signalized intersections for the westbound approach by 2040.

6.3. Build Condition

The build condition includes the removal of the existing two-way left turn lane and addition of a proposed median along SR with median breaks provided at the existing signalized intersections and other intersection locations. The median width varies between 2 ft and 16 ft within the project limits. The proposed improvements to the intersections are summarized in Table 27 and the proposed intersection lane configuration is shown in Appendix B.

Capacity analysis with optimized signals was performed for the build conditions for the opening year (2020) and design year (2040). The analysis results are included in Tables 28 to 30.

Table 27 Summary of Intersection Improvements

Intersection SR 9 @	Improvement
Tulip Plantation Rd	Provide westbound right-turn lane to a full width length of 175 ft
Strickland Rd	Provide eastbound U-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
Martin Dr	Provide eastbound U-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
McFarland Rd	Provide eastbound U-turn/left-turn lane to a full width length of 235 ft
	Provide dual westbound U-turn/left-turn lanes to a full width length of 300 ft
	Provide eastbound right-turn lane to a full width length of 450 ft
	Provide westbound right-turn lane to a full width length of 175 ft
Crested Moss Dr	Provide eastbound U-turn lane to a full width length of 250 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
Gateway Dr	Provide eastbound right-turn lane to a full width length of 175 ft
Francis Rd/ Grassland Pkwy	Provide eastbound U-turn/left-turn lane to a full width length of 350 ft
	Provide westbound U-turn/left-turn lane to a full width length of 350 ft

Intersection SR 9 @	Improvement
	Extend northbound left-turn lane to a full width length of 150 ft
	Extend southbound left-turn lane to a full width length of 150 ft
	Provide northbound right-turn lane to a full width length of 250 ft
	Provide southbound right-turn lane to a full width length of 250 ft
Commerce Blvd	Provide eastbound U-turn/left-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 350 ft
	Provide eastbound right-turn lane to a full width length of 175 ft
Hamby Rd	Provide eastbound U-turn/left-turn lane to a full width length of 300 ft
	Provide westbound U-turn lane to a full width length of 235 ft
	Provide westbound right-turn lane to a full width length of 250 ft
Mauldin Dr	Provide westbound right-turn lane to a full width length of 300 ft
Campground Pkwy / Francis Cir	Provide eastbound U-turn/left-turn lane to a full width length of 350 ft
	Provide westbound U-turn/left-turn lane to a full width length of 350 ft
	Provide westbound right-turn lane to a full width length of 175 ft
	Provide northbound left-turn lane to a full width length of 62 ft
	Provide southbound left-turn lane to a full width length of 250 ft
SR 371	Provide eastbound dual U-turn/left-turn lane to a full width length of 350 ft
	Provide westbound U-turn/left-turn lane to a full width length of 250 ft
	Provide westbound right-turn lane to a full width length of 400 ft
	Provide northbound left-turn lane to a full width length of 200 ft
	Provide southbound right-turn lane to a full width length of 250 ft
	Provide southbound left-turn lane to a full width length of 310 ft
Midway Elem. School Driveway	Provide eastbound right-turn lane to a full width length of 175 ft
	Provide westbound left-turn lane to a full width length of 235 ft
Waterbrooke Crossing / Woodbine Way	Provide eastbound U-turn/left-turn lane to a full width length of 235 ft
	Provide westbound U-turn lane to a full width length of 235 ft
	Provide westbound right-turn lane to a full width length of 175 ft
Fowler Rd	Provide eastbound U-turn lane to a full width length of 235 ft
	Provide westbound U-turn/ left-turn lane to a full width length of 300 ft
	Extend northbound right-turn lane to a full width of 250 ft
Castleberry Rd/Carolene Way	Provide eastbound U-turn/left-turn lane to a full width length of 350 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
	Provide eastbound right-turn lane to a full width length of 175 ft
	Provide westbound right-turn lane to a full width length of 175 ft
Mars Hill Rd	Provide eastbound U-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
Majors Rd/Shiloh Rd	Provide eastbound U-turn/left-turn lane to a full width length of 310 ft
	Provide westbound U-turn/left-turn lane to a full width length of 310 ft
	Provide eastbound right-turn lane to a full width length of 250 ft
	Provide westbound right-turn lane to a full width length of 250 ft
	Provide northbound left-turn lane to a full width length of 250 ft

Intersection SR 9 @	Improvement
	Provide southbound left-turn lane to a full width length of 180 ft
Crosscreek Ct	Provide eastbound U-turn/left-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft
	Provide eastbound right-turn lane to a full width length of 200 ft
Bethelview Dr / Bagwell Dr	Provide eastbound U-turn/left-turn lane to a full width length of 235 ft
	Provide westbound U-turn/left-turn lane to a full width length of 235 ft

* SR 9 is considered an east-west road and all cross roads are considered north-south roads.

Table 28 Capacity Analysis Results for Intersections (Build)

Intersection	Approach/ Movement	2020				2040			
		AM		PM		AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Tidwell Rd	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
	Northbound	10.3	B	12.5	B	11.3	B	14.8	B
Strickland Rd	Westbound	8.8	A	9.4	A	9.6	A	10.7	B
	Northbound	11.6	B	13.8	B	14.5	B	20.0	C
Martin Dr	Northbound	15.7	C	17.0	C	25.4	C	29.1	D
	Westbound	8.6	A	9.6	A	9.3	A	11.1	B
Windsor Lane	Southbound	10.4	B	10.6	B	10.7	B	10.1	B
	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
McFarland Rd*	-	37.5	D	37.2	D	58.7	E	97.9	F
Creamer Dr	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
	Northbound	10.5	B	15.6	B	11.2	B	26.5	D
Crested Moss Dr	Northbound	47.8	E	64.7	F	232.1	F	485.0	F
	Westbound	9.4	A	13.5	B	10.2	B	19.9	C
Gateway Dr	Northbound	10.9	B	15.9	C	12.2	B	22.3	C
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
Francis Rd/ Grassland Pkwy*	-	23.2	C	20.6	C	64.7	E	50.3	D
Suntrust Bank Driveway	Southbound	13.5	B	11.9	B	17.1	C	13.9	B
	Northbound	9.2	A	12.2	B	9.8	A	15.1	C
	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
Shirlee Industrial Way	Southbound	11.7	B	11.0	B	12.0	B	12.0	B
	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
Commerce Blvd*	-	3.6	A	14.3	B	4.7	A	28.9	C
9 N Drive	Southbound	10.0	A	9.9	A	10.7	B	10.4	B
	Northbound	10.6	B	11.4	B	10.8	B	18.8	C
	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
Hamby Rd*	-	14.4	B	8.9	A	27.8	C	10.6	B
Mauldin Dr	Southbound	14.4	B	12.6	B	19.2	C	15.4	C
	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
Campground Pkwy / Francis Cir*	-	20.8	C	18.6	B	42.3	D	29.9	C
Midway Shopping Center Driveway	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
	Northbound	12.5	B	15.2	C	15.1	B	20.9	C

Intersection	Approach/ Movement	2020				2040			
		AM		PM		AM		PM	
SR 9 @		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
	Southbound	9.8	A	9.8	A	10.4	B	10.8	B
SR 371*	-	36.6	D	60.6	E	77.0	E	127.6	F
Midway Elementary School Driveway	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	9.8	A	9.5	A	11.6	B	10.9	B
	Northbound	45.3	E	15.3	C	506.9	F	28.6	D
Woodbine Way	Eastbound	10.0	B	10.1	B	11.8	B	11.9	B
	Westbound	0.0	A	0.0	A	0.0	A	0.0	A
	Southbound	21.2	C	28.3	D	38.1	E	61.5	F
Fowler Rd	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Westbound	13.1	B	11.4	B	25.6	D	14.6	B
	Northbound	302.1	F	57.6	F	#	F	344.7	F
Castleberry Rd/Carolene Way*	-	14.5	B	20.7	C	25.1	C	29.6	C
Mars Hill Rd	Westbound	9.5	A	10.4	B	10.6	B	12.3	B
	Northbound	18.0	C	28.4	D	27.7	D	53.0	F
Majors Rd/Shiloh Rd*	-	24.0	C	18.6	B	75.5	E	52.3	D
Majors Fork Rd	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Southbound	12.4	B	11.3	B	14.8	B	12.9	B
Crosscreek Ct	Eastbound	10.6	B	9.7	A	12.7	B	11.0	B
	Westbound	9.2	A	11.3	B	10.1	B	14.3	B
	Northbound	16.7	C	21.5	C	31.3	D	46.8	E
	Southbound	24.4	C	30.0	D	55.2	F	68.8	F
Whitfield Ave	Eastbound	0.0	A	0.0	A	0.0	A	0.0	A
	Southbound	12.6	B	11.5	B	15.4	C	13.4	B
Bethelview Dr / Bagwell Dr	Eastbound	10.7	B	9.9	A	13.0	B	11.4	B
	Westbound	9.4	A	11.2	B	10.4	B	13.9	B
	Northbound	35.8	E	13.0	C	71.4	F	15.7	C
	Southbound	35.8	E	21.4	C	91.9	F	41.1	E
****Bethelview Rd / SR 141***	-	48.1	D	36.0	D	107.0	F	68.1	E

* Signalized intersections

Capacity exceeded

** Project P.I. 0007999 to be in place by 2013. Incorporated into 2020 and 2040 models. Project provides SR 141 and Bethelview Rd and SR 9 with two through lanes, two left turn lane, a right turn lane and free right turn pockets. Design year 2032

Table 29 SR 9 EB Roadway Capacity Analysis Results (Build)

Intersection	2020						2040					
	AM			PM			AM			PM		
SR 9	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
McFarland Rd*	32	70%	B	29	65%	C	28	61%	C	19	42%	D
Francis Rd/ Grassland Pkwy*	30	67%	B	34	76%	B	33	73%	B	23	52%	C
Commerce Blvd*	31	69%	B	27	60%	C	31	70%	B	20	44%	D
Hamby Rd*	34	76%	B	32	71%	B	29	65%	C	34	76%	B
Campground Pkwy / Francis Cir*	28	61%	C	33	74%	B	28	62%	C	32	70%	B
SR 371*	27	60%	C	26	57%	C	26	58%	C	20	45%	D
Castleberry Rd/Carolene Way*	41	90%	A	43	96%	A	39	86%	A	43	96%	A
Majors Rd/Shiloh Rd*	35	77%	B	34	76%	B	21	46%	D	25	54%	C
Bethelview Rd / SR 141*	31	68%	B	31	69%	B	29	64%	C	24	54%	C

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
BFFS = Base Free Flow Speed; Design BFFS is 45mph

Table 30 SR 9 WB Roadway Capacity Analysis Results (Build)

Intersection	202						2040					
	AM			PM			AM			PM		
SR 9	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS	Travel speed (mph)	% of BFFS	LOS
Bethelview Rd / SR 141*	10	21%	F	11	24%	F	8	18%	F	8	18%	F
Majors Rd/Shiloh Rd*	40	89%	A	40	90%	A	36	80%	B	37	83%	B
Castleberry Rd/Carolene Way*	38	84%	B	33	73%	B	34	76%	B	30	66%	C
SR 371*	32	71%	B	25	55%	C	23	52%	C	20	44%	D
Campground Pkwy / Francis Cir*	35	77%	B	30	67%	B	31	69%	B	25	56%	C
Hamby Rd*	34	75%	B	36	80%	B	28	62%	C	33	74%	B
Commerce Blvd*	36	81%	B	29	64%	C	35	78%	B	36	80%	B
Francis Rd/ Grassland Pkwy*	27	60%	C	31	68%	B	14	32%	E	18	40%	D
McFarland Rd*	34	76%	B	31	69%	B	34	75%	B	24	52%	C

* Signalized intersections
** SR 9 is considered an east-west road and all cross roads are considered north-south roads.
BFFS = Base Free Flow Speed; Design BFFS is 45mph

The analysis indicates that by the build opening (2020) and design (2040) years, most intersections operate at LOS D or better. Fewer intersections operate at LOS E or F as compared to the no-build scenarios with only three out of nine signalized intersections operating at LOS F by 2040. For signalized intersections, McFarland Road, SR 371/Post Road/ Mullinax Road and Bethelview Road/SR 141 operate at LOS F by 2040. Seven unsignalized intersections record LOS F by 2040; however the LOS F is recorded on the minor approaches for the intersections. Although these intersections record LOS F in both no-build and build conditions, the observed

delay is less in the build conditions in comparison to the no-build condition except at the Woodbine Way/Waterbrooke Crossing and Bethelview Drive/Bagwell Drive intersections which operate at LOS F and E in the 2040 build and no-build conditions respectively.

From the roadway capacity analysis results summary in Tables 29 and 30, it is observed that for its eastbound approach, SR 9 operates at LOS D or better at all signalized intersections. For the westbound approach, SR 9 operates at LOS E at Francis Road/Grassland Parkway by 2040 and operates at LOS F at Bethelview Road/SR 141 by 2020.

6.4. Build Condition with Improvements

It is observed from the build condition analysis that while most intersections and roadway approaches operate at LOS D or better, there are some locations that still operate at LOS E or F. This section identifies further improvements to highlighted intersections that could be incorporated into the build condition to improve operating conditions at these locations.

The capacity analysis results presented in Table 31 and the additional proposed improvements to the intersections are summarized in Table 32.

Table 31 Capacity Analysis Results for Intersections - 2040 (Build with Improvements)

Intersection	2040 Build				2040 Build (with improvements)			
	AM		PM		AM		PM	
SR 9 @	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
McFarland Rd	58.7	E	97.9	F	41.3	D	35.3	D
SR 371/Post Road/Mullinax Road	77.0	E	127.6	F	39.3	D	51.6	D
Fowler Rd - Westbound	25.6	D	14.6	B	24.0	C	28.9	C
Fowler Rd - Northbound	#	F	344.7	F				
Majors Road/Shiloh Road	75.5	E	52.3	D	33.4	C	25.0	C
Bethelview Rd/SR 141	107.0	F	68.1	E	64.5	E	50.1	D

Capacity exceeded

Table 32 Summary of Proposed Intersection Improvements

Intersection SR 9 @	Improvement
McFarland Rd	Provide full length acceleration/auxiliary lane for SR 9 EB to Creamer Drive for free right turn operation for McFarland Road NB
SR 371/Post Road/Mullinax Road	Widen Mullinax Road NB to two through lanes for a full width length of 300ft
	Widen Post Road SB to two through lanes for a full width length of 200ft
Fowler Rd	Signalize intersection
	Extend Fowler Rd northbound right-turn lane to a full width length of 250ft
Majors Road/Shiloh Road	Widen Shiloh Road NB to two through lanes for a full width of 150 ft
	Widen Majors Road SB to two through lanes for a full width of 200 ft
Bethelview Rd/SR 141*	Widen Bethelview Road SB and SR 141 NB to 3 through lanes

*Intersection is east of the project limit of construction. All recommendations to be checked with project P.I. 121690.

The analysis indicates that with the additional improvements to the build conditions, the three signalized intersections operating at LOS F in the build condition will now operate at LOS D. It is noted that the analysis and proposed improvements at Bethelview Road/SR 141 are provided for informational purposes only as it is east of the project limit of construction. Any improvements for this location should be verified with any recommendations from Project P.I. 121690. A signal is proposed at the intersection of SR 9 and Fowler Road as analyses show that it is warranted under existing conditions and by 2020 no-build and build conditions under Warrant 2 Four-hour volumes. A planning level capacity analysis of a roundabout at this intersection was also completed and results show that the intersection LOS is acceptable in existing (2012) conditions. However, by 2020 in the no-build condition the SR 9 WB leg in the a.m. peak hour and the Fowler Road NB leg in the PM peak hour are at failing levels of service with a single lane roundabout. By 2040, two out of 3 legs are at LOS F for both peak periods. Results from the analysis are presented in the *TE Summary Report* enclosed in Appendix D. No improvements are proposed at the unsignalized intersection of SR 9 and Crested Moss Drive as the worst LOS is recorded on the minor approach, a non-critical movement at the intersection and the analysis showed that it did not warrant a signal. Similarly, no improvement is proposed at the intersections with the Midway Elementary School, Woodbine Way/Waterbrooke Crossing, Mars Hill Road, Crosscreek Court and Bethelview Drive/Bagwell Drive.

7. Conclusion

Traffic analysis indicates that for the Build Alternative, more intersections/critical movements and roadway sections would operate at an acceptable LOS D or better in comparison to the no-build scenarios. However, certain intersections still operate at LOS E or F in the build condition. The Build with Improvements Alternative proposes geometric improvements at three existing signalized intersections and proposes the signalization of another to bring the level of operation to an acceptable LOS D or better.