



**US 278 (Fording Island Road)  
Traffic Signal Retiming**

Final Report

September 2018

Prepared for:

Beaufort County

Prepared by:

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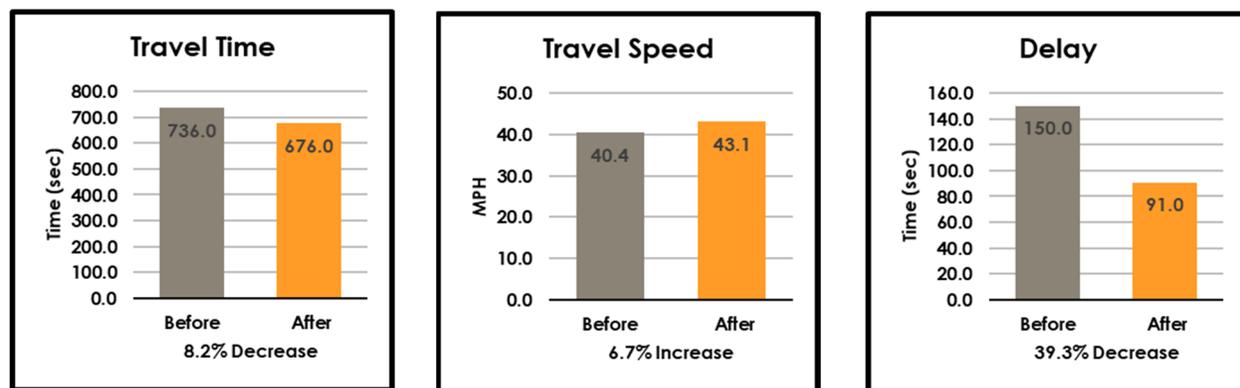
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## Executive Summary

Stantec Consulting Services, Inc. (Stantec), under contract with Beaufort County, has developed and implemented new coordinated traffic signal timing plans for fifteen (15) signals along and adjacent to US 278 (Fording Island Road) in the vicinity of the Town of Bluffton, Beaufort County, South Carolina. The timing plans tasked to be developed for this project include the weekday AM peak period, weekday Midday period, weekday PM peak period, Saturday (off-season) peak period, Saturday (peak-season) outflow peak period, Saturday (peak-season) inflow peak period, and Black Friday.

To determine the effectiveness of the new signal timing plans, travel time studies were performed using GPS for the thirteen (13) signals along the US 278 (Fording Island Road) corridor to review and document the results of the timing plan development process. This report presents the results of the “before” and “after” studies that were conducted along the thirteen (13) intersections included in this project. Two (2) intersections retimed with this project are on adjacent routes and not directly along US 278 (Fording Island Road), therefore, they were not directly considered in the travel time studies but were observed to ensure that the updated timings provided adequate operations.

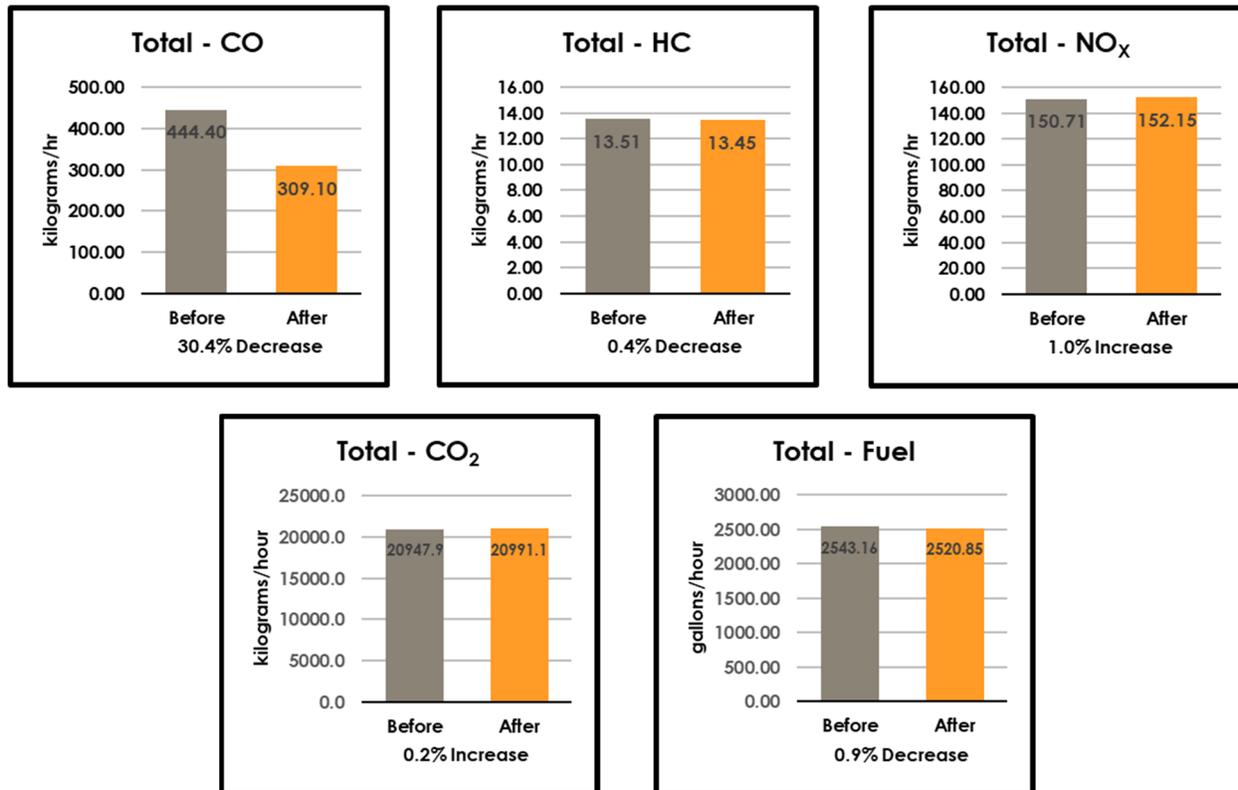
The travel time studies were conducted on typical weekdays during three (3) time periods of the day: AM peak (06:45-09:30), Midday (11:00-13:30), and PM peak (15:45-18:15). The following charts show the average improvements experienced along US 278 (Fording Island Road) for both directions of travel during all three (3) time periods. Charts summarizing the detailed results by each timing plan are presented later in this report. All results shown below were calculated using the Tru-Traffic software (version 10.0).



As evident in the graphs above, improvements were shown in travel time, delay and speed for the US 278 (Fording Island Road) corridor.

Carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NO<sub>x</sub>), which are vehicle emissions regulated by federal law, along with carbon dioxide (CO<sub>2</sub>) emissions and fuel consumption were estimated by processing the travel time runs using the Tru-Traffic software. The following charts show the cumulative average improvements experienced along US 278 (Fording Island Road) for both directions of travel during all three (3) time periods. Charts summarizing the detailed results by each weekday timing plan are present in subsequent sections of this report.

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As evident in the graphs above, improvements were shown in fuel consumption and the emissions of carbon monoxide and hydrocarbons. Estimated emissions of oxides of nitrogen and carbon dioxide along US 278 (Fording Island Road) estimate a minor increase during the three (3) time periods measured.

Delay incurs direct costs upon motorists in the form of increased fuel consumption and the value of their time wasted while waiting in traffic. Motorists using US 278 (Fording Island Road) during the AM, Midday, and PM peak periods are expected to save 55,083 hours each year because of the improved traffic flow due to the new timing plans.

Conservatively assuming a vehicle occupancy of 1.2 persons/vehicle, \$12.00 per hour for the value of motorists' time, and \$2.58 per gallon for gasoline, annual savings to motorists along US 278 (Fording Island Road) are expected to be \$793,200 in the form of reduced delay and \$14,392 decrease in cost due to decreased fuel consumption, for a total annual savings of \$807,592.

Other benefits not considered in this analysis include lower driver frustration levels and a potential reduction of collisions. All of the improvements mentioned in the report are for three (3) hours a day for each weekday during the AM, Midday, and PM peak periods. New signal timing plans were also implemented during the Saturday peak hours. However, because benefit/cost "before" and "after" studies were not conducted during these time periods, additional savings could not be quantified during these periods.

Based on equivalent annual cost of designing, implementing, and documenting signal timing plan improvements, the benefit to cost ratios for interest rates ranging from 4% to 8% were calculated to be between 19.6:1 and 20.7:1 for this project.

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## Introduction

### 1.0 INTRODUCTION

This document describes the development of preliminary timing plans by Stantec for fifteen (15) intersections along and adjacent to US 278 (Fording Island Road) in and around the Town of Bluffton, Beaufort County, South Carolina. The intersections are listed in **Table 1** and shown on the following page in **Figure 1**.

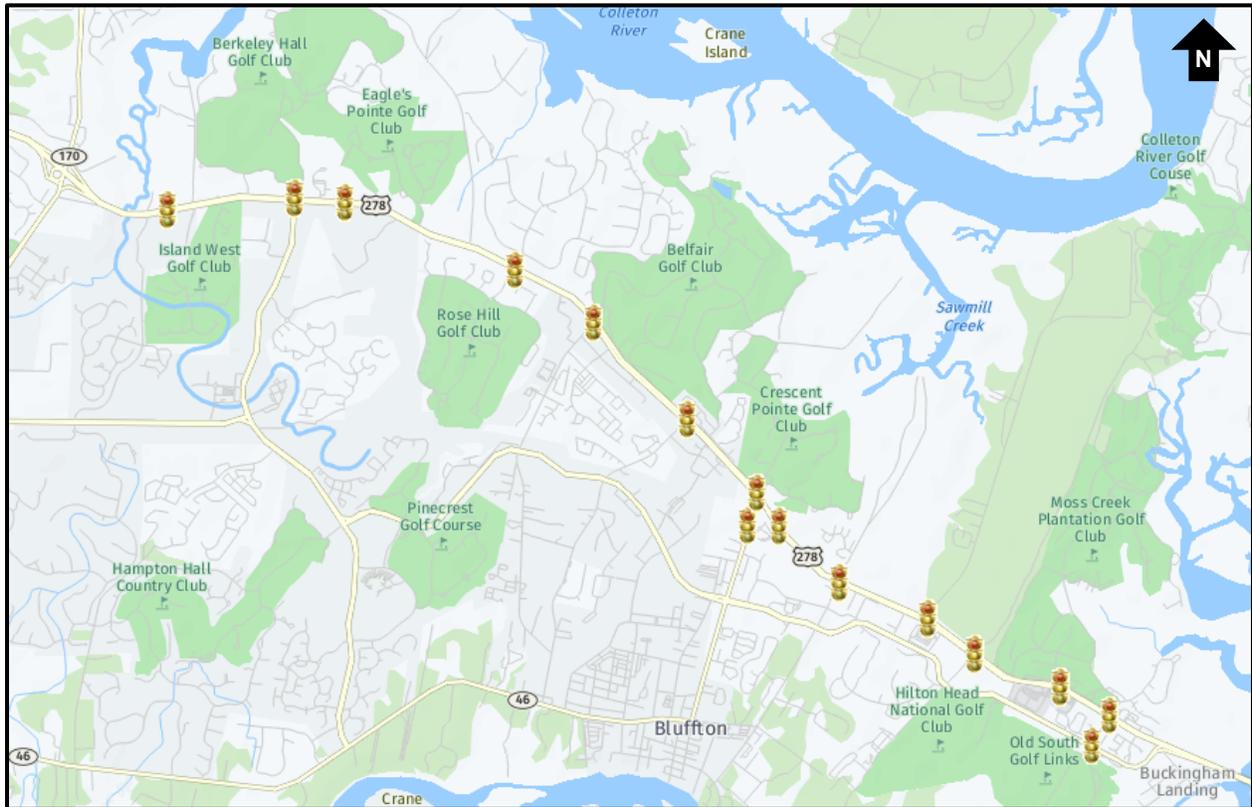
The purpose of this project is to improve traffic flow along the US 278 (Fording Island Road) corridor by developing and implementing coordinated traffic signal timing plans for the following intersections:

**Table 1 – Project Intersections**

Signal ID	Intersection
416	US 278 (Fording Island Road) & Hampton Parkway
417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway
418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory
420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle
421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road
422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road
423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)
104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing
424	US 278 (Fording Island Road) & Home Depot & Target
425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road
426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1
427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road
428	US 278 (Fording Island Road) & Tanger Outlet 2
429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive
321	Bluffton Parkway & Buckingham Plantation Drive

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## Introduction



**Figure 1 – Project Location**

This segment of the US 278 corridor is a principal arterial divided highway with three travel lanes in each direction and is approximately 8.1 miles in length connecting SC 170 and I-95 to the west with Hilton Head Island to the east and provides direct access to the Town of Bluffton along with several other large-scale residential developments. Travelling eastbound toward Hilton Head Island, the speed limit begins at 55 mph and decreases to 45 mph at approximately the midpoint of the corridor where land use adjacent to the highway becomes more commercially developed.

This report is divided into the following sections:

- I. Introduction
- II. Inventory & Data Collection
- III. Local Timing Parameters
- IV. Coordination Parameters
- V. Operational Analysis
- VI. Results Summary
- VII. Effectiveness Evaluation
- VIII. Conclusions

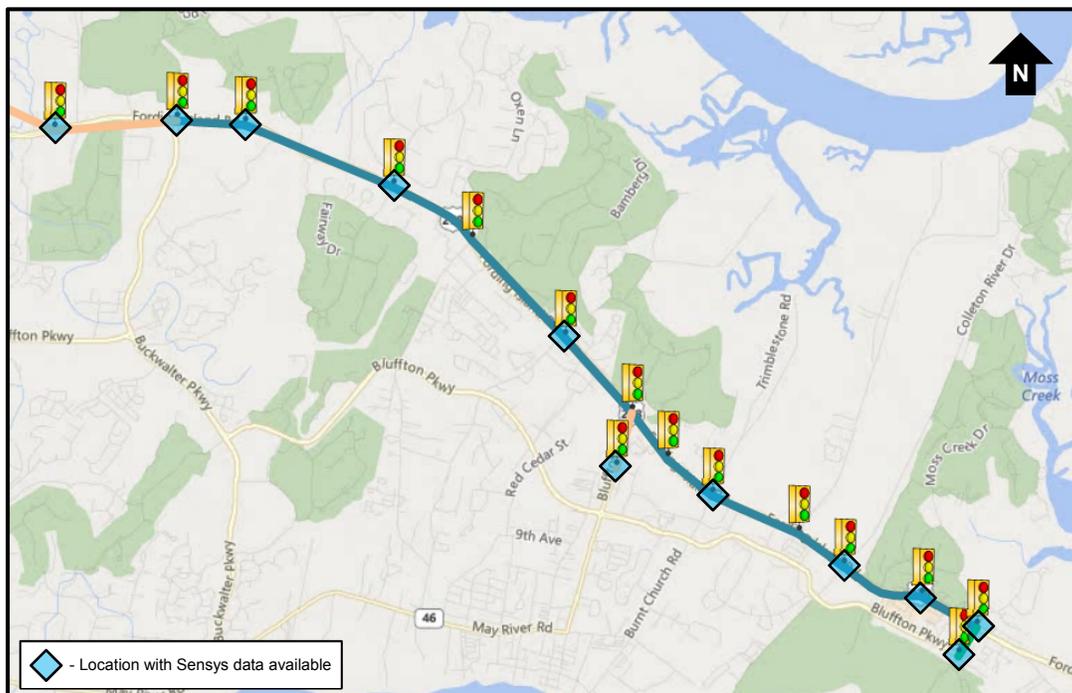
## 2.0 INVENTORY & DATA COLLECTION

### 2.1 INVENTORY

Stantec staff completed an inventory of each of the project intersections. Information obtained consists of the intersection configuration, signing and marking configurations, signal phasing, and pedestrian crossing dimensions. The inventory limits were approximately 500-feet from the intersection along the mainline. The measured clearance distances for each vehicular and pedestrian movement were utilized to calculate new yellow, all-red, and flashing don't walk clearance intervals. The completed form for each intersection is provided in **Appendix A**

### 2.2 DATA COLLECTION

At several intersections within this corridor, Beaufort County has installed devices that record traffic volume and speed by lane. The information recorded by the Sensys detectors can be queried from an online repository and was utilized in lieu of traditional bi-directional tube counts to determine mainline volumes and daily peak periods. Based upon the peak periods identified through the Sensys daily volume data, Stantec collected peak hour turning movement counts. While not all lanes and not all intersections are covered by the Sensys detectors, some historical data was compiled, where available, to supplement or substitute for turning movement counts at signalized intersections along the corridor. **Figure 2** depicts the locations where Sensys data was available and where turning movement counts were conducted for the peak hours. The count data considered for each period is included in **Appendix B**.

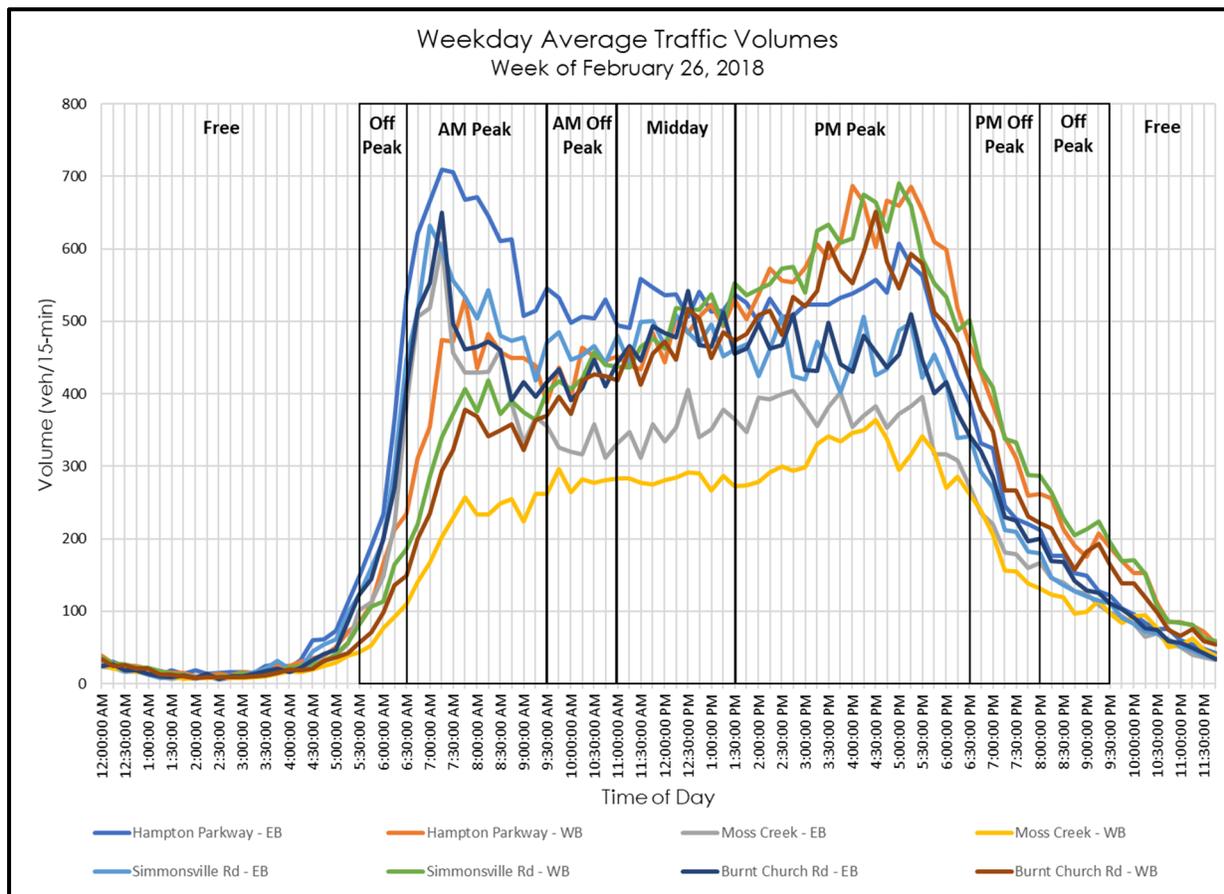


**Figure 2 – Count Program**

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## Inventory & Data Collection

Using the data available for mainline US 278 (Fording Island Road), directional daily traffic volumes were determined at several locations along the corridor. The count data was sampled near the initiation of this project and weekday volumes were averaged for the week beginning February 26, 2018. These traffic volumes, along with the existing time-of-day coordination plan periods, are shown below in **Figure 3**.

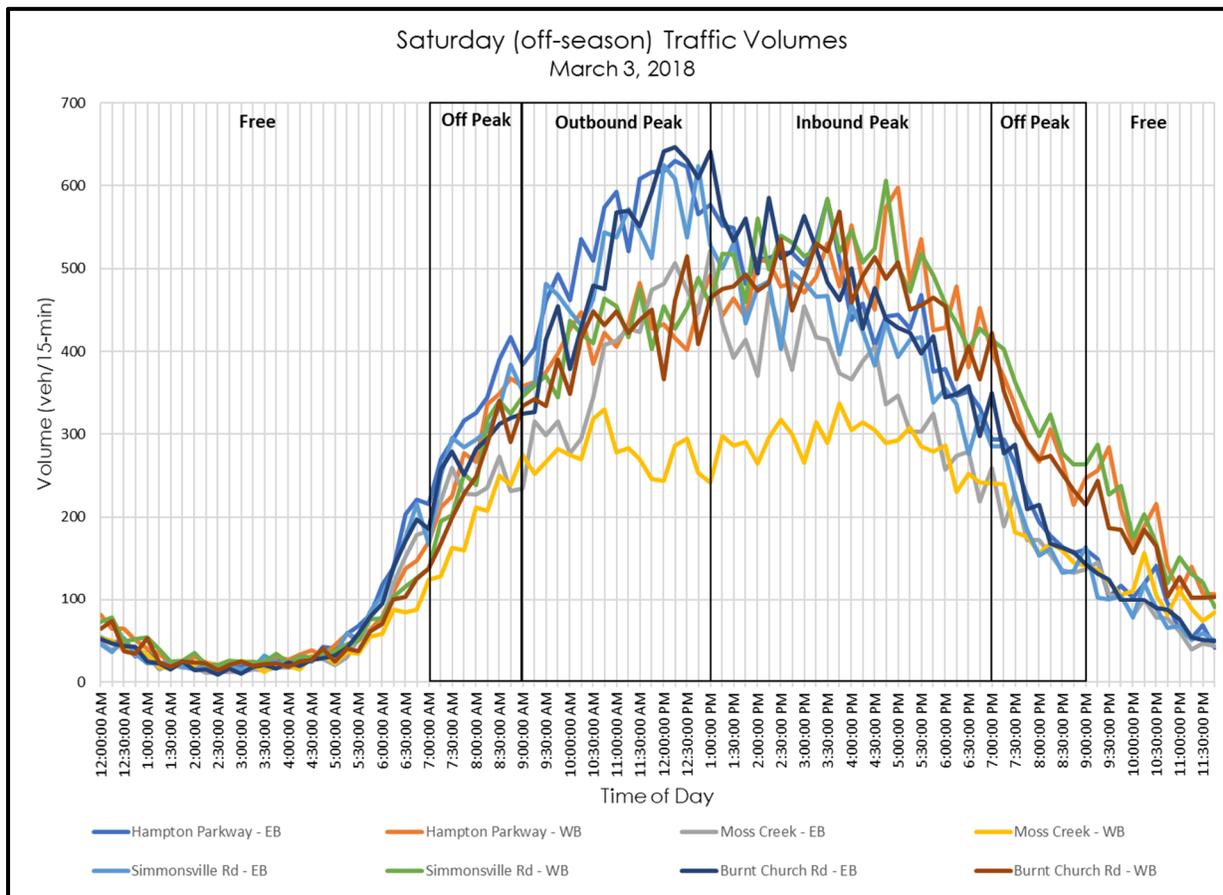


**Figure 3 – Weekday Traffic Volumes (off-season)**

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## Inventory & Data Collection

Using the data available for mainline US 278 (Fording Island Road), directional daily traffic volumes were determined at several locations along the corridor. The count data was sampled near the initiation of this project for Saturday (off-season) daily volumes using March 3, 2018. These traffic volumes, along with the existing time-of-day coordination plan periods, are shown below in **Figure 4**.

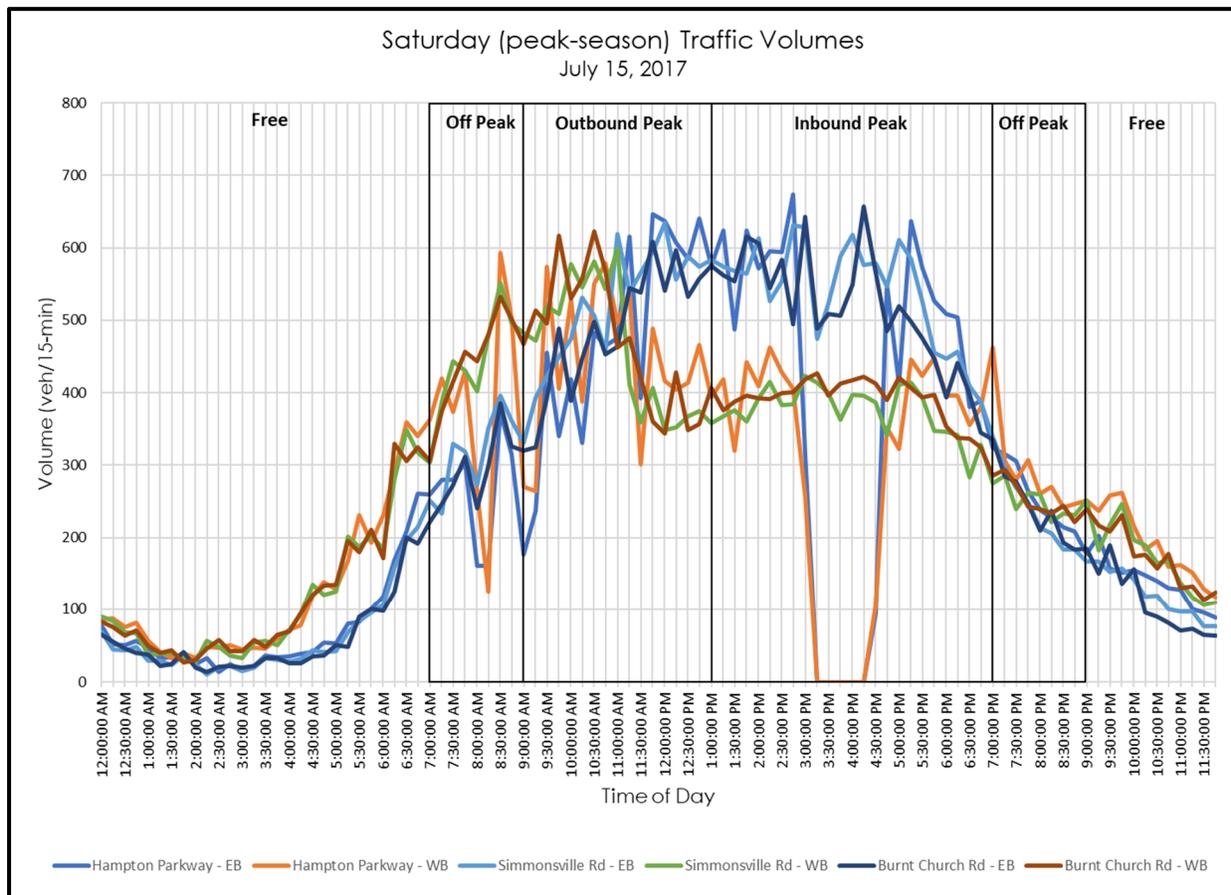


**Figure 4 – Saturday Traffic Volumes (off-season)**

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## Inventory & Data Collection

Using the data available for mainline US 278 (Fording Island Road), directional daily traffic volumes were determined at several locations along the corridor. The count data was sampled from mid-summer 2017 for Saturday (peak-season) daily volumes using July 15, 2017. These traffic volumes, along with the existing time-of-day coordination plan periods, are shown below in **Figure 5**.



Note: The sudden drop in volume recorded at Hampton Parkway is an apparent error and was not considered as representative data due to the continuation of the typical trend before and after the 2:45-4:30 PM period.

**Figure 5 – Saturday Traffic Volumes (peak season)**

Local Timing Parameters

### 3.0 LOCAL TIMING PARAMETERS

Local controller timings were developed for each of the fifteen intersections in this project. **Table 3** details the methods used to develop the controller values that were used for each intersection. Clearance calculations for each intersection are shown in **Appendix A**.

**Table 2 – Local Timing Parameters**

Parameter	Value	
<b>PEDESTRIAN INTERVAL</b>		
Pedestrian Change Interval	((Curb to Curb Distance) / (Walking Speed))	
Walking Speed	3.5 Feet per Second	
Walk	7 Seconds – Also calculated (Push button to far curb distance) / (walking speed of 3.0fps). If this number was greater than the calculated Pedestrian Change Interval then the difference was added to the Walk time.	
Buffer Interval	Following the pedestrian change interval, a buffer interval consisting of a steady UPRAISED HAND (symbolizing DON'T WALK) signal indication shall be displayed for at least 3 seconds prior to the release of any conflicting vehicular movement	
<b>VEHICLE INTERVAL</b>		
Yellow Interval	$t + (V/(2A + 64.4g))$ Minimum of 3 seconds. Rounded up to the nearest tenth second. Left turn clearance calculations based on 20-MPH	t = perception reaction time (1 second)  V = posted speed in feet/second (20 mph for left turn clearances)  A = deceleration rate (10 feet/second/second)  W = intersection width measured from stop bar to the far edge of the last conflict lane (or crosswalk when the crosswalk is greater than 20' from the intersection)  L = length of vehicle (assume 20 feet)  g = The approximate approach grade  n = detection distance / 20  N = number of lanes
All Red Interval	$(W + L) / V$ Minimum of 2.0 seconds. Rounded up to the nearest tenth second	
Minimum Green	Maintain existing	
Volume Density	No Change	
Minimum Cycle Length	90 seconds	
Maximum Cycle Length	240 Seconds	
Offset Reference	End of Green	
Offset Seeking	Short/Long Way	
Free Operation	Late night	
Lead/Lag by TOD?	Yes	
Traffic Responsive Operation	No	
Special Events	No	
<b>CONTACT INFORMATION</b>		
Transportation Engineering Director	Colin Kinton, P.E., Beaufort County	
Law Enforcement	Beaufort County Sheriff's Office	

## 4.0 COORDINATION PARAMETERS

The objective of the proposed signal timing is to provide improved progression at the posted speed limit through the signal system for the mainline while minimizing side-street delay.

The turning movement count inventory data was entered into Synchro 10 using the following guidelines:

- All movements were coded as they appear in the field.
- Signing and marking restrictions were coded as they appear in the field.
- A saturated flow rate of 1,900 vehicles per hour was used.
- Posted speed limits were used for progression speeds.

Multiple runs of Synchro 10 were completed to determine the most appropriate combination of cycle length, splits, and offsets for each signal in the system. The existing plans are contrasted with the existing, proposed, and implemented plans developed as summarized in **Table 3**. Synchro timing reports are included in **Appendix C** and time-space diagrams are included in **Appendix D**.

Coordination Parameters

**Table 3 – Time-of-Day/Day-of-Week Schedule**

Plan Day	Day	HH:MM (Start Time)	Existing			Implemented		
			Plan #	Cycle (sec)	Bias	Plan #	Cycle (sec)	Bias
10	Monday – Friday	00:00	99	Free		99	Free	
10	Monday – Friday	05:30	1*	130		1*	130	
10	Monday – Friday	06:30	5	160	EB	9	170	EB
10	Monday – Friday	09:30	2*	140		3*	140	
10	Monday – Friday	11:00	6	160		2	130	
10	Monday – Friday	13:30	8	170	WB	8	160	WB
10	Monday – Friday	18:30	3*	150		4*	150	
10	Monday – Friday	20:00	1*	130		1*	130	
10	Monday – Friday	21:30	99	Free		99	Free	
11	Saturday (off-season)	00:00	99	Free		99	Free	
11	Saturday (off-season)	07:00	1*	130		1*	130	
11	Saturday (off-season)	09:00	7	160		7	150	EB
11	Saturday (off-season)	13:00	7	160		7	150	EB
11	Saturday (off-season)	19:00	1*	130		1*	130	
11	Saturday (off-season)	21:00	99	Free		99	Free	
14	Saturday (peak-season)	00:00	99	Free		99	Free	
14	Saturday (peak-season)	07:00	1*	130		1*	130	
14	Saturday (peak-season)	09:00	10	210	WB	10	170	WB
14	Saturday (peak-season)	13:00	11	220	EB	11	170	EB
14	Saturday (peak-season)	18:00	7	160		7	150	EB
14	Saturday (peak-season)	19:00	1*	130		1*	130	
14	Saturday (peak-season)	21:00	99	Free		99	Free	

\*These plans were renumbered to maintain agency preferences. No other timing changes were made to these plans as part of this project.

## 4.1 PROPOSED TIMING PLANS

The existing corridor utilizes coordinated timing plans with cycle lengths that range from 130-220 seconds for everyday operation, with some special event plans having longer cycle lengths. Each of the implemented timing plans has some directional bias for either eastbound or westbound due to the flow of traffic to and from Hilton Head Island east of this system. The weekday AM and Saturday (peak-season) implemented plans operate with a 170 second cycle length. The weekday Midday implemented timing plan operates with a 150 second cycle length. The weekday PM implemented timing plan operates with a 160 second cycle length. The Saturday (off-season) implemented plan operates with a 150 second cycle length.

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### Coordination Parameters

The existing weekday AM peak plan has a 160 second cycle length and runs from 06:30 to 09:00. This plan was replaced with a 170 second cycle length plan that runs from 06:30 to 09:30. As shown in **Table 13**, the implemented weekday AM plan reduced the delay at seven (7) of the fifteen (15) signals in coordination and improved or maintained the level of service at eleven (11) of the intersections.

The existing weekday Midday plan runs a 160 second cycle length and runs from 11:00 to 13:30. The implemented weekday Midday plan has a 130 second cycle length and runs from 11:00 to 13:30. As shown in **Table 14**, the implemented Midday plan improved or maintained the level of service at twelve (12) of the fifteen (15) intersections and reduced or had minimal change to the delay at most intersections.

The existing weekday PM peak plan runs from 13:30 to 18:30 and has a cycle length of 170 seconds. This plan has been replaced with a 160 second cycle length that runs from 13:30 to 18:30. As shown in **Table 15**, the implemented PM plan maintained or improved the level of service at twelve (12) of the fifteen (15) intersections and reduced or minimally changed the delay at seven (7) intersections.

The existing Saturday (peak-season) outflow peak plan has a 210 second cycle length and runs from 09:00 to 13:00. The implemented plan runs from 09:00 to 13:00 with a cycle length of 170 seconds. As shown in **Table 16**, the implemented Saturday (peak-season) outflow peak plan maintained or improved the level of service at thirteen (13) of the fifteen (15) intersections and reduced or had nominal change to delay at six (6) intersections.

The existing Saturday (peak-season) inflow peak plan has a 220 second cycle length and runs from 13:00 to 18:00. The implemented plan runs from 13:00 to 18:00 with a cycle length of 170 seconds. As shown in **Table 17**, the implemented Saturday (peak-season) inflow peak plan improved or maintained the level of service at fourteen (14) of the fifteen (15) intersections and reduced or nominally impacted the delay at eleven (11) of the fifteen (15) intersections.

## 5.0 OPERATIONAL ANALYSIS

### 5.1 METHODOLOGY FOR BEFORE AND AFTER STUDIES

The travel time, average speed, and delay studies were conducted in accordance with the procedures given in the *Manual of Transportation Engineering Studies*, published by the Institute of Transportation Engineers. Travel time, average speed, and delay studies were conducted in both the eastbound and westbound directions on US 278 (Fording Island Road) during the weekday AM peak, weekday midday peak, and weekday PM peak periods. A minimum of six runs was made in each direction. The “floating car” technique was used, whereby the driver passes as many cars as pass the driver. The following route were determined along the US 278 (Fording Island Road) system:

- Route 1: US 278 (Fording Island Road), eastbound/westbound between Hampton Parkway and Moss Creek Drive/Buckingham Plantation Drive.

The study vehicle was unmarked and operated as inconspicuously as possible. The operator recorded the stops and travel time experienced during each run. The “before” runs were collected for US 278 (Fording Island Road) on Monday, March 26 and Tuesday, March 27, 2018. The “after” runs were collected for US 278 (Fording Island Road) on Tuesday, June 5 and Wednesday June 6, 2018. Travel run data was collected using a GPS receiver and was processed with Tru-Traffic version 10 software. **Tables 4, 5, 6, and 7** below and on the following pages, summarize the recorded “before” and “after” travel time, average speed, delay, and number of stops. Carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NO<sub>x</sub>), which are vehicle emissions regulated by federal law, along with carbon dioxide (CO<sub>2</sub>) emissions and fuel consumption were estimated by processing the travel time runs using the Tru-Traffic software. These values are summarized for the “before” and “after” runs on the following pages in **Tables 8, 9, 10, 11, and 12**. The data below is shown as the average of multiple runs for each time period and direction of travel. The travel time reports are included in **Appendix E**.

**Table 4 – Average Travel Time (sec)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	852	602	721	757	723	738	805	693	693
After	617	657	637	691	756	723	712	646	679
% Difference	-27.6%	+9.1%	-11.7%	-8.7%	+4.6%	-2.0%	-11.6%	-6.8%	-9.3%

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Operational Analysis

**Table 5 – Average Delay (sec)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	259	23	135	164	144	153	213	114	164
After	24	78	51	98	178	138	119	67	93
% Difference	-90.7%	+239.1%	-62.2%	-40.2%	+23.6%	-9.8%	-44.1%	-41.2%	-43.3%

**Table 6 – Average Speed (mph)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	36.6	48.2	42.7	38.2	40.1	39.2	36.0	42.0	39.0
After	46.8	44.3	45.5	42.0	38.3	40.1	41.2	45.0	43.1
% Difference	+27.9%	-8.1%	+6.6%	+9.9%	-4.5%	+2.3%	+14.4%	+7.1%	+10.5%

**Table 7 – Average Number of Stops**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	3.3	1.2	2.2	3.1	2.6	2.8	4.8	2.4	3.6
After	1.1	2.4	1.8	1.9	4.4	3.1	2.7	1.8	2.2
% Difference	-66.7%	+100.0%	-18.2%	-38.7%	+69.2%	+10.7%	-43.8%	-25.0%	-38.9%

**Table 8 – Average Carbon Monoxide Emissions (kg/hr)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	101.70	32.51	134.21	68.04	126.69	194.73	53.14	62.32	115.46
After	53.76	42.77	96.53	51.80	43.36	95.15	50.31	67.11	117.42
% Difference	-47.1%	+31.6%	-28.1%	-23.9%	-65.8%	-51.1%	-5.3%	+7.7%	+1.7%

US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

Operational Analysis

**Table 9 – Average Oxides of Nitrogen Emissions (kg/hr)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	30.43	17.61	48.04	23.93	22.89	46.82	24.08	31.76	55.85
After	29.35	18.94	48.29	24.27	22.94	47.21	24.24	32.41	56.65
% Difference	-3.6%	+7.5%	+0.5%	+1.4%	+0.2%	+0.8%	+0.7%	+2.0%	+1.4%

**Table 10 – Average Hydrocarbon Emissions (kg/hr)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	2.82	1.45	4.27	2.15	2.32	4.47	2.11	2.66	4.77
After	2.53	1.70	4.23	2.11	1.99	4.10	2.21	2.91	5.13
% Difference	-10.4%	+17.4%	-1.0%	-1.7%	-14.5%	-8.3%	+5.0%	+9.6%	+7.5%

**Table 11 – Average Carbon Dioxide Emissions (kg/hr)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	4,336	2,415	6,751	3348	3007	6355	3443	4398	7841
After	4,073	2,565	6,638	3372	3209	6580	3349	4423	7773
% Difference	-6.1%	+6.2%	-1.7%	+0.7%	+6.7%	+3.5%	-2.7%	+0.6%	-0.9%

**Table 12 – Average Fuel Consumption (gal/hr)**

US 278 (Fording Island Road)									
	AM			MD			PM		
Direction of Travel	EB	WB	All Runs	EB	WB	All Runs	EB	WB	All Runs
Before	528	291	819	406	376	782	414	528	942
After	488	307	796	406	385	791	403	532	935
% Difference	-7.6%	+5.8%	-2.8%	0.0%	+2.3%	+1.1%	-2.8%	+0.8%	-0.8%

## 5.2 LOS AND DELAY ANALYSIS

Synchro 10 was also used to prepare an evaluation of intersection operations to determine the Level of Service (LOS) and average delay of the existing condition (existing geometry, existing signal timings, and existing traffic volumes) and the proposed condition (existing geometry, proposed signal timings, and existing traffic volumes). This capacity analysis methodology is based on the *2010 Highway Capacity Manual* (HCM), a standard guidance for capacity analysis, which defines LOS at signalized intersections in terms of average control delay per vehicle, which is composed of initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. LOS ranges from A to F, with LOS A indicating operations with very low control delay and LOS F describing operations with extremely high average control delay. In the comparison between existing, proposed, and final timings, the LOS and delay should improve for the overall corridor but may increase or decrease at individual intersections depending on what was running before.

Currently, the corridor has very directional peak hour traffic, with the exception of the weekday midday which is more balanced. The primary goal for timing the US 278 (Fording Island Road) corridor was to increase efficiency along the routes during all peaks while providing improved progression and minimizing queuing and delay. The volume-to-capacity (V/C) ratios were also included in the analysis to measure capacity demand of each intersection since delay on side streets and protected-only left-turns can sometimes skew an intersection delay even if the respective queues are under capacity. Overall, corridor offsets looked to reduce queuing and delay.

The results of the existing, proposed, and implemented conditions are shown on the following pages in **Tables 13, 14, 15, 16, and 17**. Reports detailing the Synchro LOS and Delay outputs are included in **Appendix C**. Although some of LOS and delays results under the implemented plans yielded worse values than the existing models, the signal timings have been optimized to accommodate improved progression along US 278 (Fording Island Road) and capacity efficiency throughout the system. Meanwhile, all LOS results remain at 'D' or better with many intersections performing with even better results.

The LOS, delay, and V/C ratios varied in the field upon implementation and fine-tuning of the proposed timing plans. Overall, the US 278 (Fording Island Road) system has numerous volume additions and subtractions at major intersections that result in unbalanced lane utilization and varying speeds in advance of intersections when vehicles are preparing to turn. Consequently, varying speeds, lane utilization, geometric constraints, and volume additions and subtractions between the study intersections contributed various results that can affect the overall progression and flow of the corridor. Adjustments to the splits and offsets were incorporated during fine tuning and also in the weeks following implementation upon observation of actual driver behavior.

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Operational Analysis

**Table 13 – Existing, Proposed, and Implemented Intersection Level of Service and Delay (Weekday AM Peak Period)**

#	ID #	Intersection	Existing		Proposed		Implemented	
			LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
1	416	US 278 (Fording Island Road) & Hampton Parkway	B	14.2	B	15.3	B	13.8
2	417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway	C	26.1	C	32.2	C	33.9
3	418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory	A	9.2	A	4.0	A	4.8
4	420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle	B	10.8	A	6.5	A	7.1
5	421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road	C	32.1	C	21.5	C	21.3
6	422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road	C	21.5	C	20.5	C	23.3
7	423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)	C	21.6	B	14.4	B	15.9
8	104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing	B	19.1	C	29.2	C	29.4
9	424	US 278 (Fording Island Road) & Home Depot & Target	B	16.0	B	10.5	A	5.9
10	425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road	B	14.5	B	12.5	A	8.7
11	426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1	A	5.1	A	7.3	A	7.9
12	427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road	A	8.7	A	7.4	B	10.2
13	428	US 278 (Fording Island Road) & Tanger Outlet 2	A	0.6	A	0.5	A	0.6
14	429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive	B	17.2	C	21.6	C	20.2
15	321	Bluffton Parkway & Buckingham Plantation Drive	A	8.1	B	11.8	B	11.9

Level of Service (LOS)		Change in Intersection Delay
Improved by two letter grades		Delay decreased by more than 2.0 seconds.
Improved by one letter grade		Delay decreased by 1.0 second or more but less than 2.0 seconds.
No change to LOS		Delay changed by less than 1.0 second (+/-)
Degraded by one letter grade		Delay increased by 1.0 second or more but less than 2.0 seconds.
Degraded by two letter grades		Delay increased by 2.0 seconds or more.

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**Table 14 – Existing, Proposed, and Implemented Intersection Level of Service and Delay (Weekday Midday Peak Period)**

#	ID #	Intersection	Existing		Proposed		Implemented	
			LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
1	416	US 278 (Fording Island Road) & Hampton Parkway	B	12.6	B	10.1	B	13.4
2	417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway	C	24.7	B	17.4	C	26.2
3	418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory	A	4.9	A	1.8	A	2.1
4	420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle	A	9.8	A	5.8	A	5.5
5	421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road	B	16.6	B	16.2	C	21.1
6	422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road	D	41.2	C	22.8	C	24.9
7	423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)	D	38.0	C	24.4	C	29.6
8	104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing	C	33.7	D	36.4	D	36.8
9	424	US 278 (Fording Island Road) & Home Depot & Target	C	20.2	B	17.0	C	26.5
10	425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road	B	17.0	B	13.3	B	13.7
11	426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1	B	11.1	A	9.9	B	11.4
12	427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road	B	11.7	B	14.5	B	19.6
13	428	US 278 (Fording Island Road) & Tanger Outlet 2	A	5.3	A	4.5	A	6.0
14	429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive	B	19.8	B	16.5	C	20.3
15	321	Bluffton Parkway & Buckingham Plantation Drive	B	12.1	B	17.3	B	17.0

Level of Service (LOS)		Change in Intersection Delay
Improved by two letter grades		Delay decreased by more than 2.0 seconds.
Improved by one letter grade		Delay decreased by 1.0 second or more but less than 2.0 seconds.
No change to LOS		Delay changed by less than 1.0 second (+/-)
Degraded by one letter grade		Delay increased by 1.0 second or more but less than 2.0 seconds.
Degraded by two letter grades		Delay increased by 2.0 seconds or more.

**US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT**

Operational Analysis

**Table 15 – Existing, Proposed, and Implemented Intersection Level of Service and Delay (Weekday PM Peak Period)**

#	ID #	Intersection	Existing		Proposed		Implemented	
			LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
1	416	US 278 (Fording Island Road) & Hampton Parkway	B	11.7	B	10.0	B	12.6
2	417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway	D	37.5	C	31.3	C	26.4
3	418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory	B	10.9	A	9.6	B	13.4
4	420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle	A	9.7	A	6.1	B	13.3
5	421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road	D	40.0	C	25.7	D	40.6
6	422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road	C	33.9	C	27.8	C	27.5
7	423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)	C	32.7	C	30.1	C	25.2
8	104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing	D	36.3	D	41.4	D	47.3
9	424	US 278 (Fording Island Road) & Home Depot & Target	C	28.7	C	29.1	B	11.3
10	425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road	B	16.4	C	22.0	B	14.6
11	426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1	B	19.6	B	12.1	B	15.8
12	427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road	A	9.0	B	13.7	B	12.4
13	428	US 278 (Fording Island Road) & Tanger Outlet 2	A	4.7	A	5.9	A	4.5
14	429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive	B	19.0	C	25.1	C	23.7
15	321	Bluffton Parkway & Buckingham Plantation Drive	B	13.3	B	17.5	B	18.1

Level of Service (LOS)		Change in Intersection Delay
Improved by two letter grades		Delay decreased by more than 2.0 seconds.
Improved by one letter grade		Delay decreased by 1.0 second or more but less than 2.0 seconds.
No change to LOS		Delay changed by less than 1.0 second (+/-)
Degraded by one letter grade		Delay increased by 1.0 second or more but less than 2.0 seconds.
Degraded by two letter grades		Delay increased by 2.0 seconds or more.

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Operational Analysis

**Table 16 – Existing, Proposed, and Implemented Intersection Level of Service and Delay (Saturday Peak-Season Out-Flow Peak Period)**

#	ID #	Intersection	Existing		Proposed		Implemented	
			LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
1	416	US 278 (Fording Island Road) & Hampton Parkway	A	8.0	A	7.7	A	7.7
2	417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway	C	21.4	C	29.6	C	27.6
3	418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory	A	7.2	A	4.1	A	8.7
4	420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle	A	6.6	A	7.4	B	10.6
5	421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road	C	29.9	C	30.6	D	37.5
6	422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road	C	32.6	C	29.2	C	22.4
7	423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)	D	38.4	C	27.0	C	25.9
8	104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing	D	36.4	D	44.4	D	44.4
9	424	US 278 (Fording Island Road) & Home Depot & Target	D	43.9	C	32.3	C	32.6
10	425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road	C	22.9	C	24.1	C	24.4
11	426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1	C	21.4	B	17.5	B	17.7
12	427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road	C	23.4	C	24.3	C	25.3
13	428	US 278 (Fording Island Road) & Tanger Outlet 2	A	7.3	A	8.4	A	9.0
14	429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive	C	23.4	C	26.4	C	30.6
15	321	Bluffton Parkway & Buckingham Plantation Drive	B	11.6	B	14.4	B	14.4

Level of Service (LOS)		Change in Intersection Delay
Improved by two letter grades		Delay decreased by more than 2.0 seconds.
Improved by one letter grade		Delay decreased by 1.0 second or more but less than 2.0 seconds.
No change to LOS		Delay changed by less than 1.0 second (+/-)
Degraded by one letter grade		Delay increased by 1.0 second or more but less than 2.0 seconds.
Degraded by two letter grades		Delay increased by 2.0 seconds or more.

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Operational Analysis

**Table 17 – Existing, Proposed, and Implemented Intersection Level of Service and Delay (Saturday Peak-Season In-Flow Peak Period)**

#	ID #	Intersection	Existing		Proposed		Implemented	
			LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
1	416	US 278 (Fording Island Road) & Hampton Parkway	B	12.4	B	12.7	B	14.7
2	417	US 278 (Fording Island Road) & Berkeley Hall Boulevard & Buckwalter Parkway	C	31.9	C	27.8	C	31.9
3	418	US 278 (Fording Island Road) & Bluffton Fire/St.Gregory	A	3.8	A	2.3	A	3.0
4	420	US 278 (Fording Island Road) & Rose Hill Way & White Oak Circle	B	14.6	A	7.8	A	6.8
5	421	US 278 (Fording Island Road) & Belfair Plantation & Buck Island Road	D	38.5	C	25.2	C	28.4
6	422	US 278 (Fording Island Road) & Belfair Town Village & Simmonsville Road	C	26.6	C	28.2	C	27.2
7	423	US 278 (Fording Island Road) & Crescent Drive & SC 46 (Bluffton Road)	E	60.3	D	36.8	D	45.0
8	104	SC 46/Bluffton Road & Wal-Mart & Kitties Crossing	D	36.4	D	45.9	D	46.0
9	424	US 278 (Fording Island Road) & Home Depot & Target	D	42.2	D	36.6	C	34.2
10	425	US 278 (Fording Island Road) & Trimblestone Road & Burnt Church Road	C	27.1	B	15.6	B	15.4
11	426	US 278 (Fording Island Road) & Sawmill Creek Road & Tanger Outlet 1	B	15.5	B	19.8	B	16.0
12	427	US 278 (Fording Island Road) & Colleton River Road & Malphrus Road	C	20.8	C	26.4	B	17.0
13	428	US 278 (Fording Island Road) & Tanger Outlet 2	A	7.8	A	5.4	A	6.1
14	429	US 278 (Fording Island Road) & Moss Creek & Buckingham Plantation Drive	C	20.2	C	22.9	C	25.9
15	321	Bluffton Parkway & Buckingham Plantation Drive	B	16.1	C	20.5	C	21.0

Level of Service (LOS)		Change in Intersection Delay
Improved by two letter grades		Delay decreased by more than 2.0 seconds.
Improved by one letter grade		Delay decreased by 1.0 second or more but less than 2.0 seconds.
No change to LOS		Delay changed by less than 1.0 second (+/-)
Degraded by one letter grade		Delay increased by 1.0 second or more but less than 2.0 seconds.
Degraded by two letter grades		Delay increased by 2.0 seconds or more.

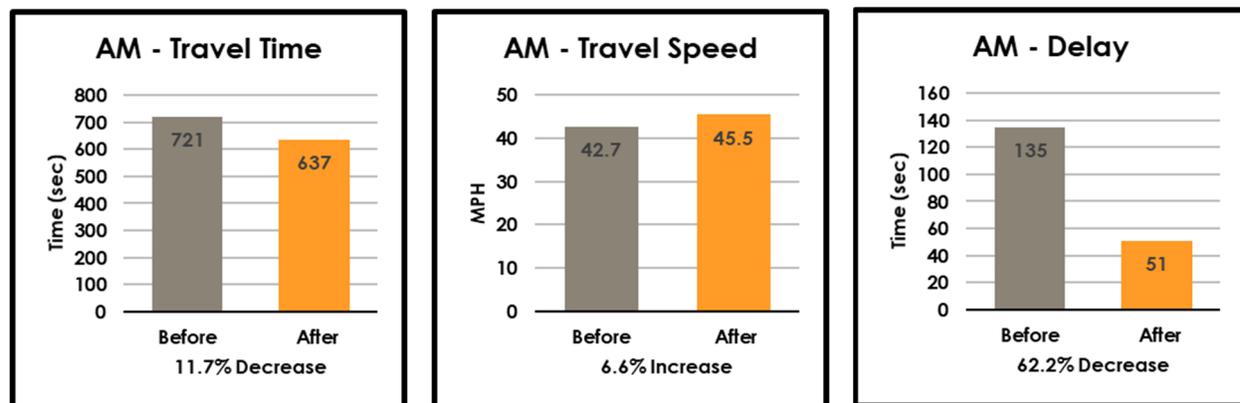
Results Summary

## 6.0 RESULTS SUMMARY

### 6.1 WEEKDAY TIMING PLANS

#### 6.1.1 Weekday AM Peak Plan

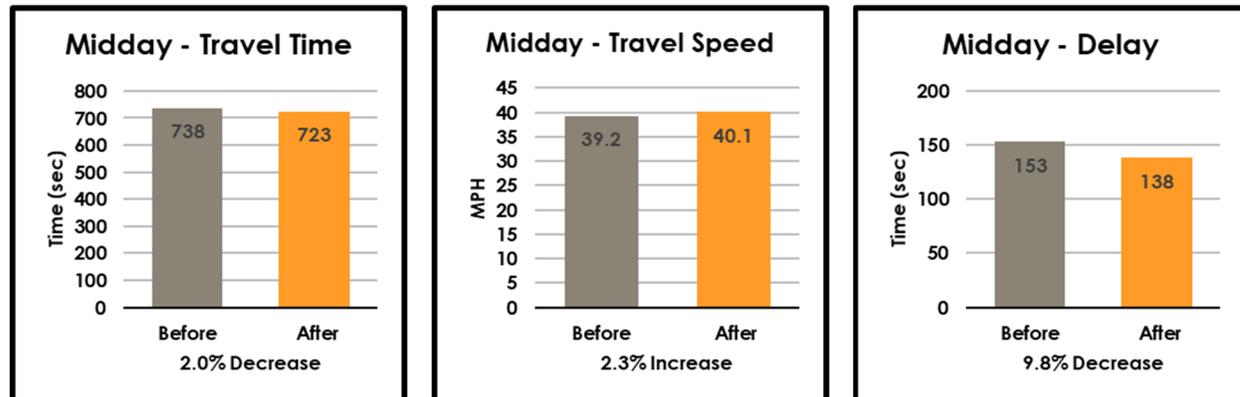
The existing weekday AM peak plan has a 160 second cycle length and runs from 06:30 to 09:00. This plan was replaced with a 170 second cycle length plan that runs from 06:30 to 09:30. As seen in **Figure 3**, the eastbound direction of travel is the predominate flow of traffic throughout the corridor during the weekday AM peak period, with greater than 60 percent of vehicles traveling toward Hilton Head Island. As shown in the charts below, the implemented AM plan improved the combined eastbound and westbound averages of travel time, travel speed, and delay along the corridor. Travel time was reduced by nearly 12 percent, speed was increased by almost 7 percent, and delay was reduced by more than 60 percent.



#### 6.1.2 Weekday Midday Peak Plan

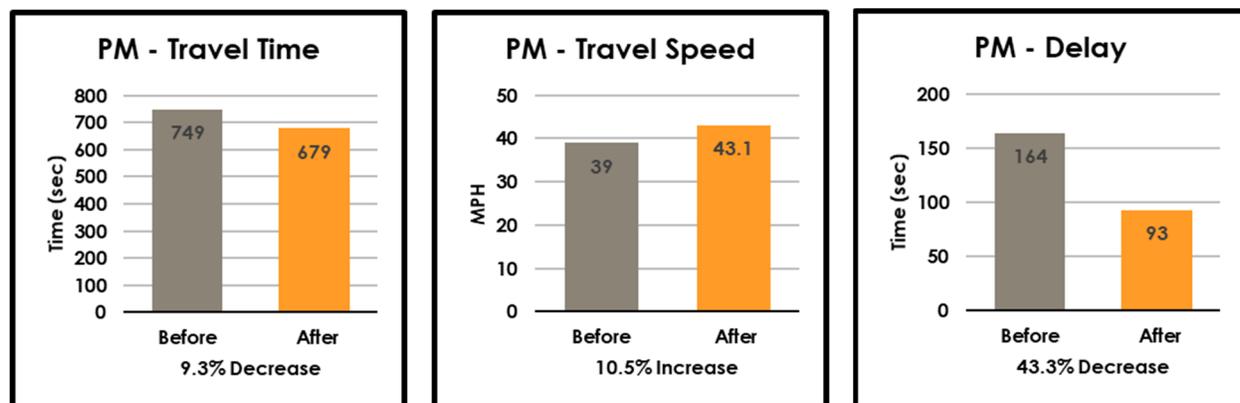
The existing weekday Midday plan runs a 160 second cycle length and runs from 11:00 to 13:30. The implemented weekday Midday plan has a 130 second cycle length and runs from 11:00 to 13:30. As seen in **Figure 3**, the midday traffic volumes are fairly balanced between the eastbound and westbound directions of travel with eastbound volumes being slightly greater during this period. As shown in the charts below, the implemented weekday Midday peak plan improved the combined eastbound and westbound averages of travel time, travel speed, and delay along the corridor. Travel time was reduced by 2 percent, speed was increased by more than 2 percent, and delay was reduced by nearly 10 percent.

Results Summary



### 6.1.3 Weekday PM Peak Plan

The existing weekday PM peak plan runs from 13:30 to 18:30 and has a cycle length of 170 seconds. This plan has been replaced with a 160 second cycle length that runs from 13:30 to 18:30. As seen in **Figure 3**, the predominate flow of traffic throughout the corridor during the weekday PM peak period is westbound, with greater than 55 percent of traffic traveling toward SC 170. As shown in the charts below, the implemented PM plan improved the combined eastbound and westbound averages of travel time, travel speed, and delay along the corridor. Travel time was reduced by 9 percent, speed was increased by more than 10 percent, and delay was reduced by 43 percent.



## 6.2 SATURDAY (PEAK-SEASON) TIMING PLANS

Because this timing project was initiated after the 2017 peak season had ended, traditional before and after studies using the GPS recording data were unable to be performed for the Saturday (peak-season) Outflow Peak plan and Saturday (peak-season) Inflow Peak plan periods. To provide a baseline for Beaufort County to monitor future changes in travel time during peak season Saturdays, Stantec collected travel time runs on Saturday, June 9, 2018 and Saturday, August 11, 2018 during the outflow peak period (AM) and inflow peak period (PM). The results of these travel time runs are summarized below in **Table 18** and **Table 19** and are shown graphically in **Figure 6**. A wreck along eastbound US 278 on the bridges to Hilton Head Island occurred on the afternoon of June 9, 2018 while travel time runs were being collected. Therefore, additional travel time data was not collected for this day.

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Results Summary

**Table 18 – June 9, 2018 Saturday (peak-season) Travel Time Summary**

<b>Saturday, June 9, 2018</b>						
<b>AM Peak Outflow</b>						
	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
Eastbound	9:24:15	708	116	92	40.7	4.0
	9:55:55	668	75	71	43.1	3.0
	10:27:44	653	60	35	44.1	3.0
	11:05:04	740	148	108	38.9	4.0
	11:38:56	637	44	52	45.2	2.0
	Minimum	637	44	35	38.9	2.0
	Average	681	88	72	42.4	3.2
	85th Percentile	708	116	92	44.1	4.0
	Maximum	740	148	108	45.2	4.0
	Std Dev	42	42	29	2.6	0.8
	Westbound	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)
9:38:32		745	167	65	38.7	3.0
10:12:34		729	151	108	39.6	3.0
10:50:05		705	127	23	40.9	1.0
11:23:51		714	135	80	40.4	3.0
11:55:56		812	233	165	35.6	5.0
Minimum		705	127	23	35.6	1.0
Average		741	163	88	39.0	3.0
85th Percentile		745	167	108	40.4	3.0
Maximum		812	233	165	40.9	5.0
Std Dev		43	43	53	2.1	1.4
<b>PM Peak Inflow</b>						
EB	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	2:34:30 PM	2147**	1555	1413	13.4	8.0
WB	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	2:17:22 PM	832	253	140	34.7	5.0

\*\*Saturday, June 9, 2018 Eastbound PM Peak Inflow shows travel time with a wreck on the bridge

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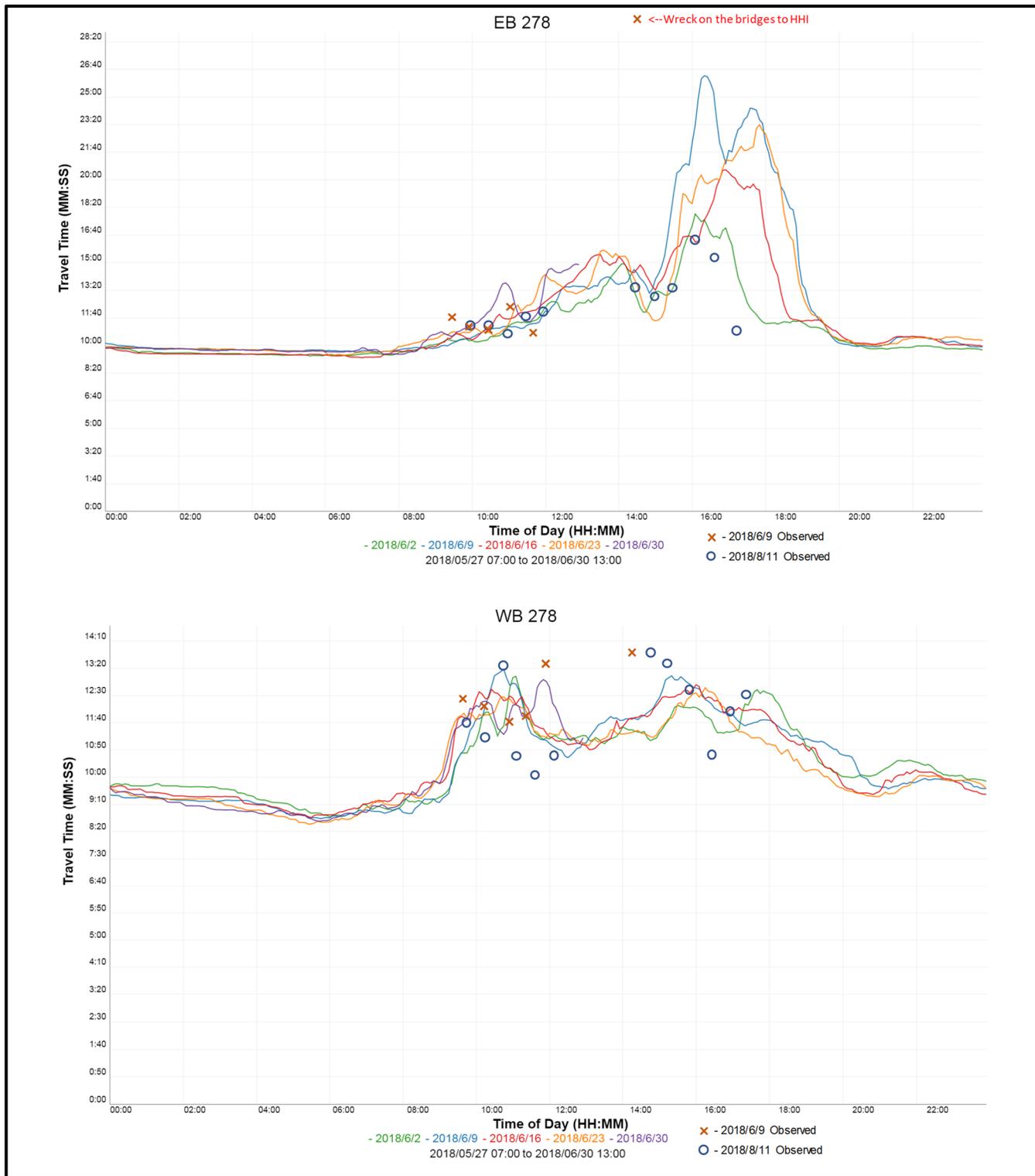
Results Summary

Table 19 – August 11, 2018 Saturday (peak-season) Travel Time Summary

Saturday, August 11, 2018						
AM Peak Outflow						
Eastbound	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	9:59:04	667	74	63	43.2	2.0
	10:27:32	664	72	44	43.3	2.0
	10:56:36	638	45	34	45.1	3.0
	11:26:08	707	114	76	40.7	3.0
	11:54:44	719	127	93	40.0	3.0
	Minimum	638	45	34	40.0	2.0
	<b>Average</b>	<b>679</b>	<b>86</b>	<b>62</b>	<b>42.5</b>	<b>2.6</b>
	85th Percentile	707	114	76	43.3	3.0
	Maximum	719	127	93	45.1	3.0
	Std Dev	33	33	24	2.1	0.5
Westbound	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	9:44:36	698	119	79	41.3	2.0
	10:13:20	675	97	41	42.7	3.0
	10:39:47	807	228	106	35.8	4.0
	11:09:26	739	161	84	39.0	3.0
	11:38:42	710	132	54	40.6	2.0
	12:08:38	742	163	80	38.9	4.0
	Minimum	675	97	41	35.8	2.0
	<b>Average</b>	<b>729</b>	<b>150</b>	<b>74</b>	<b>39.7</b>	<b>3.0</b>
	85th Percentile	742	163	84	41.3	4.0
	Maximum	807	228	106	42.7	4.0
Std Dev	46	46	23	2.4	0.9	
PM Peak Inflow						
Eastbound	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	2:30:11	811	218	128	35.5	3.0
	3:02:51	768	175	114	37.5	2.0
	3:33:32	813	221	133	35.4	3.0
	4:07:24	975	382	216	29.5	6.0
	4:39:55	914	321	234	31.5	3.0
	5:13:01	750	157	94	38.4	3.0
	Minimum	750	157	94	29.5	2.0
	<b>Average</b>	<b>838</b>	<b>246</b>	<b>153</b>	<b>34.6</b>	<b>3.3</b>
	85th Percentile	914	321	216	37.5	3.0
	Maximum	975	382	234	38.4	6.0
Std Dev	88	88	58	3.5	1.4	
Westbound	Start Time	Travel Time (sec)	Delay (sec)	Stop Delay (sec)	Average Speed (mph)	Stops
	2:45:13	832	254	174	34.7	5.0
	3:16:39	809	230	160	35.7	6.0
	3:50:02	764	186	127	37.7	4.0
	4:26:22	643	64	22	44.9	2.0
	4:57:42	727	148	92	39.7	3.0
	5:26:48	752	174	105	38.4	3.0
	Minimum	643	64	22	34.7	2.0
	<b>Average</b>	<b>754</b>	<b>176</b>	<b>113</b>	<b>38.5</b>	<b>3.8</b>
	85th Percentile	809	230	160	39.7	5.0
	Maximum	832	254	174	44.9	6.0
Std Dev	67	67	55	3.6	1.5	

Results Summary

Figure 6 - Saturday (peak-season) Measured Travel Time Runs



# US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

## Results Summary

In response to observations of increased travel time and congestion for eastbound traffic during Saturday (peak-season) afternoons, Stantec reviewed hourly traffic volume data for US 278 as recorded by South Carolina Department of Transportation’s permanent count station near Jenkins Island, several miles east of the Fording Island Road corridor and west of Hilton Head Island. Historical traffic volume data for Saturdays from mid-March through Labor Day were analyzed and compared for the 2017 and 2018 peak seasons. Historical speed data for 2017 was not available from this count station but was considered for 2018 when analyzing the hourly volumes to estimate the critical directional volume where eastbound US 278 is nearing or over capacity. The volume matrices shown below in **Figure 7** and **Figure 8** report the hourly traffic volume by week and are color coded based on the volume thresholds determined by the correlation to speed with green representing 2,000 vehicles per hour (vph) or less, yellow representing volumes near 2,250 vph, and red representing the maximum value recorded.

**Figure 7 - US 278 Westbound Volume Matrix (2017 and 2018)**

		US 278 Westbound Hourly Volumes (2017)																											
Hour Ending		25-Mar	1-Apr	8-Apr	15-Apr	22-Apr	29-Apr	6-May	13-May	20-May	27-May	3-Jun	10-Jun	17-Jun	24-Jun	1-Jul	8-Jul	15-Jul	22-Jul	29-Jul	5-Aug	12-Aug	19-Aug	26-Aug	2-Sep				
1:00		305	279	302	463	256	284	253	281	301	322	287	368	344	342	330	342	401	359	332	309	320	288	267	331				
2:00		171	156	156	316	175	158	135	135	158	190	178	165	201	166	150	242	174	203	217	160	183	174	164	177				
3:00		112	136	165	314	148	171	142	141	127	155	179	172	198	201	172	184	213	212	222	173	164	158	159	138				
4:00		111	114	144	284	174	113	130	139	115	168	154	183	227	231	214	251	226	255	258	206	225	175	164	94				
5:00		159	216	255	326	251	173	143	160	175	188	218	309	384	445	402	468	459	491	444	389	343	305	258	151				
6:00		208	364	429	518	398	281	261	265	301	325	406	512	608	706	716	790	758	837	724	635	551	468	362	236				
7:00		504	623	792	732	755	569	586	599	681	685	772	964	1158	1176	1090	1387	1253	1171	1234	938	1003	812	647	466				
8:00		970	1269	1306	616	1219	1119	1117	1130	1224	1173	1352	1567	1682	1801	1700	1930	1855	1786	1728	1596	1495	1427	1180	894				
9:00		1360	1672	1630	728	1540	1479	1410	1432	1627	1674	1857	2090	2170	2131	2161	2364	2255	2121	2116	1889	1819	1800	1411	1205				
10:00		1805	1977	2113	907	1926	1802	1837	1919	2061	2060	2287	2569	2618	2503	1217	2672	2470	2678	2499	2494	2399	2131	1989	1692				
11:00		2190	2102	2465	981	2126	2122	2110	2300	2281	2279	2600	2625	2757	2755	1214	2941	2795	2698	2765	2758	2781	2448	2314	2008				
12:00		2253	1943	2050	855	1936	2018	1865	2262	1859	2000	1892	1938	2079	1938	1013	2116	1920	2173	2247	2004	2008	1953	1904	1749				
13:00		2122	1941	2088	799	1929	1964	1900	2043	1826	1789	1887	1772	1745	1793	785	1957	1739	1820	1946	1833	1831	1872	2010	1775				
14:00		2148	1957	2027	823	2009	1815	1792	1878	1797	1840	1798	1729	1765	1755	808	1846	1726	1809	1783	1740	1725	1756	1922	1788				
15:00		2078	2035	2044	853	2097	1929	1815	1664	1933	1800	1864	1717	1793	1837	803	1829	1799	1853	1768	1855	1815	1758	1838	1781				
16:00		2130	2130	2074	988	2259	2128	1972	1611	2046	2112	2028	1954	1893	1931	859	1919	2004	1978	1798	2098	1997	2007	1839	1809				
17:00		2220	2186	1972	1024	2329	2026	1933	1577	2149	2171	2110	1985	2102	2153	955	2020	2027	2243	2092	2089	2022	2015	1736	1777				
18:00		1956	2096	1826	1136	2230	1852	1758	1492	1876	1876	1876	1958	1908	1917	884	1815	1990	2016	1670	1759	2018	1766	1502	1616				
19:00		1681	1754	1692	1014	1808	1650	1343	1211	1676	1889	1553	1603	1514	1606	692	1703	1588	1653	1422	1559	1462	1601	1365	1395				
20:00		1293	1513	1332	822	1475	1409	1211	1092	1403	1483	1410	1341	1296	1371	564	1278	1224	1350	1178	1248	1153	1319	1168	1312				
21:00		1073	1230	1040	655	1260	1211	1089	899	1157	1214	1186	1120	1151	1162	582	1113	1035	1118	934	1096	1036	1065	907	1000				
22:00		900	892	898	533	965	1026	1007	806	1031	1109	1031	1146	1054	1162	1045	1019	960	1083	883	939	977	896	780	753				
23:00		771	813	862	481	889	903	847	740	956	934	910	869	1088	981	968	963	898	936	955	994	838	808	654	757				
24:00:00		558	596	601	418	734	642	631	586	626	789	688	674	713	785	834	737	716	785	656	670	631	637	496	599				

		US 278 Westbound Hourly Volumes (2018)																											
Hour Ending		24-Mar	31-Mar	7-Apr	14-Apr	21-Apr	28-Apr	5-May	12-May	19-May	26-May	2-Jun	9-Jun	16-Jun	23-Jun	30-Jun	7-Jul	14-Jul	21-Jul	28-Jul	4-Aug	11-Aug	18-Aug	25-Aug	1-Sep				
1:00		250	252	303	367	283	289	317	290	330	303	295	288	379	371	407	381	301	321	364	388	391	302	299	325				
2:00		149	146	154	179	148	182	168	156	141	194	165	165	178	216	209	217	192	168	210	203	191	201	172	202				
3:00		105	151	139	201	159	139	136	143	172	164	160	160	159	202	231	183	162	184	222	247	188	181	155	128				
4:00		95	124	118	176	103	121	121	145	131	128	146	189	194	238	269	250	239	230	278	207	227	181	164	104				
5:00		121	217	422	167	150	167	151	178	178	195	231	306	414	412	489	510	486	470	476	470	345	346	214	164				
6:00		259	416	659	256	304	303	240	333	313	290	411	481	611	749	784	841	767	755	790	699	701	539	423	290				
7:00		452	684	1070	534	531	531	582	680	622	666	824	974	1113	1202	1279	1383	1298	1139	1238	1026	1053	936	654	564				
8:00		1006	1216	1498	1031	1052	1166	1079	1203	1083	1215	1464	1471	1683	1773	1803	2019	1759	1718	1707	1529	1530	1439	1150	948				
9:00		1302	1487	1887	1339	1390	1440	1452	1594	1472	1487	1911	1976	2121	2148	2262	2360	2185	2099	2096	1920	1977	1730	1526	1299				
10:00		1902	1973	2393	1610	1693	1849	1843	1989	1981	1918	2347	2510	2557	2484	2697	2689	2481	2573	2531	2371	2420	2107	1912	1685				
11:00		2040	2293	2554	1760	2078	1975	2152	2268	2225	2228	2708	2740	2670	2611	2602	2832	2725	2725	2797	2774	2720	2490	2367	1908				
12:00		2006	2115	2224	1595	1982	1962	1840	1957	1908	1916	1925	2102	2122	2078	2301	2411	1863	1891	1986	1955	1979	2033	1921	1662				
13:00		1992	2057	2239	1512	1898	1828	1874	1910	1870	1671	1959	1847	1813	1841	1820	1971	1768	1750	1762	1951	1815	1769	1739	1639				
14:00		2104	2027	2012	1595	1913	1962	1836	1880	1867	1831	1827	1791	1819	1781	1742	2026	1685	1737	1739	1765	1751	1764	1661	1693				
15:00		1973	1996	2084	1721	2091	1930	1852	1989	1869	1949	1863	1880	1898	1739	1714	1990	1730	1863	1868	1798	1783	1831	1712	1697				
16:00		2179	1892	1924	1971	1951	2127	2013	2078	1918	1932	2025	1970	2102	1992	1827	2048	1918	2029	2058	1999	2008	2023	1855	1822				
17:00		2297	2042	1907	2135	1913	2241	2101	2046	2007	2043	2247	1113	2196	2151	1977	1905	2028	2043	2227	2207	1977	2051	1749	1889				
18:00		2096	1789	1597	2239	1768	2062	1719	1974	1840	1898	1956	1794	1882	1844	1916	1932	1886	1965	1952	1808	1915	1816	1566	1816				
19:00		1703	1481	1421	2174	1602	1808	1744	1742	1411	1765	1490	2030	1554	1514	1609	1587	1626	1536	1613	1649	1497	1565	1382	1594				
20:00		1252	1287	1125	1763	1261	1345	1405	1393	1286	1395	1215	1098	1344	1266	1278	1299	1317	1387	1240	1344	1329	1310	1047	1277				
21:00		1052	1078	802	1257	1036	1130	1105	1164	973	1202	805	927	1142	1060	1048	1079	1108	1125	1084	1067	1133	1119	1088	1249				
22:00		987	974	715	1044	875	932	945	1055	1000	1007	921	991	1045	1121	1185	1005	996	1034	1012	976	1056	937	875	1028				
23:00		981	898	677	931	742	977	865	902	886	1008	785	911	966	1040	1081	971	950	992	983	922	864	867	752	878				
24:00:00		644	709	523	700	664	656	577	665	660	750	611	637	679	791	795	755	740	716	723	707	765	619	580	719				

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Results Summary

Figure 8 - US 278 Eastbound Volume Matrix (2017 and 2018)

		US 278 Eastbound Hourly Volumes (2017)																											
Hour Ending		25-Mar	1-Apr	8-Apr	15-Apr	22-Apr	29-Apr	6-May	13-May	20-May	27-May	3-Jun	10-Jun	17-Jun	24-Jun	1-Jul	8-Jul	15-Jul	22-Jul	29-Jul	5-Aug	12-Aug	19-Aug	26-Aug	2-Sep				
1:00		219	242	251	252	257	275	221	246	207	333	236	249	228	206	359	233	243	243	284	189	257	241	234	332				
2:00		127	139	148	147	143	144	171	126	131	186	116	161	121	139	220	133	136	161	107	130	129	123	112	192				
3:00		81	111	81	106	89	76	74	54	103	100	80	85	93	106	115	105	85	112	104	88	86	70	69	88				
4:00		72	84	108	84	103	80	129	83	75	111	88	75	86	105	98	106	101	91	99	93	83	111	84	102				
5:00		120	118	124	142	113	114	143	107	126	119	129	115	125	151	171	134	139	124	141	125	124	143	124	124				
6:00		293	256	283	349	280	300	292	281	297	317	301	318	369	334	335	344	309	330	346	324	322	288	297	295				
7:00		784	786	787	840	735	819	765	743	794	878	847	858	869	844	871	895	866	842	911	863	788	791	743	718				
8:00		1372	992	1458	1416	1385	1405	1330	1197	1422	1410	1547	1491	1518	1522	1506	1579	1519	1489	1530	1615	1412	1426	1343	1268				
9:00		1751	1913	1694	1799	1584	1720	1397	1354	1643	1814	1823	1838	1895	1926	1914	1949	1792	1900	1733	1708	1659	1547	1477	1362				
10:00		1873	1992	1729	2164	1826	1849	1612	1400	1788	2158	1777	1515	1952	1988	1966	2025	1980	2000	1733	1671	1755	1820	1502	1536				
11:00		1895	2109	1868	2452	2023	1849	1594	1469	1898	2289	1991	2019	1962	2081	2175	1984	2089	2126	1625	1741	1804	1675	1478	1580				
12:00		2082	2278	1820	2551	2358	1961	1876	1683	2073	2534	2107	2573	2225	2371	2316	2317	2318	2218	1977	1951	1931	2035	1723	1933				
13:00		2220	2454	2027	2407	2273	2077	2098	1957	2246	2477	2251	2507	2089	2331	2434	2411	2488	2376	2184	2072	2114	2095	1830	2053				
14:00		2317	2508	2173	2330	2456	2141	2293	2136	2353	2509	2422	2492	2572	2521	2538	2458	2494	2522	2487	2488	2254	2168	2066	2278				
15:00		2241	2527	2278	2264	2296	2212	2359	2089	2476	2424	2421	2227	2451	2495	2431	2457	2528	2450	2466	2440	2438	2303	2011	2438				
16:00		2369	2441	2315	2183	2309	2251	2425	2257	2439	2381	2466	2391	2446	2476	2474	2432	2419	2446	2539	2512	2469	2316	2182	2577				
17:00		2147	2411	2400	1861	2003	2111	2318	2384	2350	2441	2391	2387	2469	2488	2447	2446	2452	2440	2223	2450	2363	2262	2022	2201				
18:00		2009	2530	2269	1664	2027	2062	2023	1986	1960	2395	2435	2383	2410	2403	2388	2375	2411	2371	2477	2483	2000	1840	1637	1831				
19:00		1640	2237	1851	1419	1700	1736	1462	1513	1702	2216	2129	2363	2372	2373	2317	2306	2415	2386	2201	2088	1601	1712	1386	1557				
20:00		1285	1304	1443	1252	1367	1227	1226	1182	1288	1363	1327	1558	1742	1766	1766	1652	1488	2068	1389	1326	1314	1396	1134	1198				
21:00		1042	1013	1152	1025	1081	954	1019	900	1048	1134	1096	1065	1120	1169	2022	1075	1049	1273	1106	1234	1160	1073	970	906				
22:00		838	835	880	780	818	769	785	795	840	928	901	879	916	889	1086	873	855	933	843	954	813	876	755	737				
23:00		605	619	689	583	647	568	607	564	634	687	631	671	632	631	632	766	645	646	595	684	597	636	528	482				
24:00:00		420	358	434	355	428	388	371	335	416	417	408	432	399	526	521	383	453	447	401	447	428	407	298	351				

		US 278 Eastbound Hourly Volumes (2018)																											
Hour Ending		24-Mar	31-Mar	7-Apr	14-Apr	21-Apr	28-Apr	5-May	12-May	19-May	26-May	2-Jun	9-Jun	16-Jun	23-Jun	30-Jun	7-Jul	14-Jul	21-Jul	28-Jul	4-Aug	11-Aug	18-Aug	25-Aug	1-Sep				
1:00		272	246	238	259	218	216	224	256	243	334	268	256	273	263	307	244	212	221	216	242	222	222	204	395				
2:00		126	144	112	133	134	130	123	135	102	146	124	123	112	121	166	113	144	117	99	118	113	109	127	201				
3:00		58	85	89	104	72	86	75	96	76	105	91	99	85	100	109	99	69	90	106	83	102	87	79	103				
4:00		98	98	74	69	83	64	78	96	85	112	77	85	99	88	98	60	82	105	100	101	96	81	77	94				
5:00		130	117	127	161	136	125	122	152	148	126	151	123	144	133	158	147	137	121	146	136	131	112	141	153				
6:00		281	278	288	401	280	293	313	306	306	299	302	314	301	364	345	336	306	360	330	328	351	314	311	302				
7:00		765	740	798	754	727	767	777	752	731	823	835	797	886	912	893	923	842	938	892	878	823	787	739	795				
8:00		1438	1369	1483	1449	1330	1409	1374	1264	1305	1375	1618	1399	1599	1581	1625	1596	1674	1614	1603	1634	1565	1488	1430	1334				
9:00		1717	1650	1630	1693	1560	1727	1496	1671	1647	1753	1868	1766	1878	1911	1989	1975	1874	1848	1922	1877	1833	1647	1548	1492				
10:00		1866	1892	1754	2026	1581	1763	1737	1905	1690	1993	1854	1868	2006	2023	2097	2066	1903	1993	1931	1846	1804	1847	1600	1674				
11:00		1848	1744	1706	2283	1719	1909	1843	2049	1697	2154	1932	1877	2064	2077	2136	2031	2030	2086	2021	1891	1789	1742	1418	1859				
12:00		2157	1998	1774	2438	1910	2122	2096	2093	1916	2362	2074	2001	2349	2241	2308	2330	2197	2201	2173	2237	1925	1973	1597	2106				
13:00		2342	2079	1820	2246	2081	2269	2252	2209	2087	2535	2194	2307	2430	2402	2508	2573	2456	2524	2456	2261	2107	2038	1901	2232				
14:00		2526	2437	1797	2173	2102	2264	2225	2243	2231	2481	2416	2404	2506	2542	2488	2465	2512	2585	2430	2356	2252	2134	1977	2178				
15:00		2550	2541	1915	2112	2213	2326	2384	2391	2332	2570	2495	2393	2558	2489	2546	2279	2512	2532	2522	2540	2396	2335	2061	2313				
16:00		2493	2564	1973	2023	2318	2299	2470	2515	2554	2538	2533	2067	2521	2431	2592	2475	2502	2528	2520	2589	2524	2357	2208	2350				
17:00		2434	2612	1898	1668	2174	1951	2273	2426	2340	2536	2561	2157	2475	2474	2505	2562	2436	2502	2534	2520	2517	2107	2050	2135				
18:00		2147	2568	1485	1503	1841	1880	1944	1918	1874	2468	2446	2142	2471	2487	2514	2566	2472	2501	2423	2520	2428	1776	1537	1894				
19:00		1888	2544	1345	1368	1649	1681	1491	1671	1533	1739	1691	2360	2483	2506	2507	2471	2499	2304	2170	2189	1825	1645	1468	1698				
20:00		1262	1732	1006	1083	1225	1213	1232	1313	1225	1329	1294	1670	1578	1836	2236	1434	1736	1408	1385	1377	1251	1308	1087	1243				
21:00		959	1083	858	938	934	873	949	966	890	1041	986	1002	1055	1020	1246	1094	1106	1109	1080	1108	1076	1010	911	958				
22:00		808	793	717	740	749	762	802	838	779	960	797	746	867	943	1007	817	853	810	895	876	876	840	758	698				
23:00		619	576	539	526	628	547	610	672	529	661	599	635	705	630	691	636	679	676	628	652	608	593	564	552				
24:00:00		458	359	340	399	411	400	407	346	394	403	380	447	444	475	469	395	441	413	371	453	406	361	329	373				

As seen in **Figure 8**, the critical volume for eastbound US 278 east of the Fording Island Road corridor spikes during the weekends of spring break, the Heritage, Memorial Day, and Labor Day. For Saturdays during the months of May through August, the critical hourly volume is observed with varying duration and intensity, spanning from just a few hours in early May and late August to nearly seven hours for the Saturdays adjacent to the July 4th holiday. When the critical volume extends across multiple hours of the afternoon, the resulting congestion may spill back toward the mainland.

Stantec was able to obtain historical probe data for this corridor to provide an alternative means for before and after comparison of average travel times from the 2017 and 2018 peak season Saturdays. Based on the trends seen in the analysis of historical traffic volumes and speeds along US 278 east of the Fording Island Road system, the review of travel times for the Saturday (peak-season) Inflow Peak period focused on the 1:00-7:00PM timeframe from the last weekend in May through the first weekend in August. The available travel time data was reviewed to determine the average travel time for the eastbound segment of US 278 from east of SC 170 to Pinckney Island. The minute-by-minute average travel times along the corridor for each Saturday are shown below in **Figure 9** and **Figure 10**.

US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

Results Summary

Figure 9 - 2017 Summer Saturday Inflow Peak Eastbound Travel Times (sec)

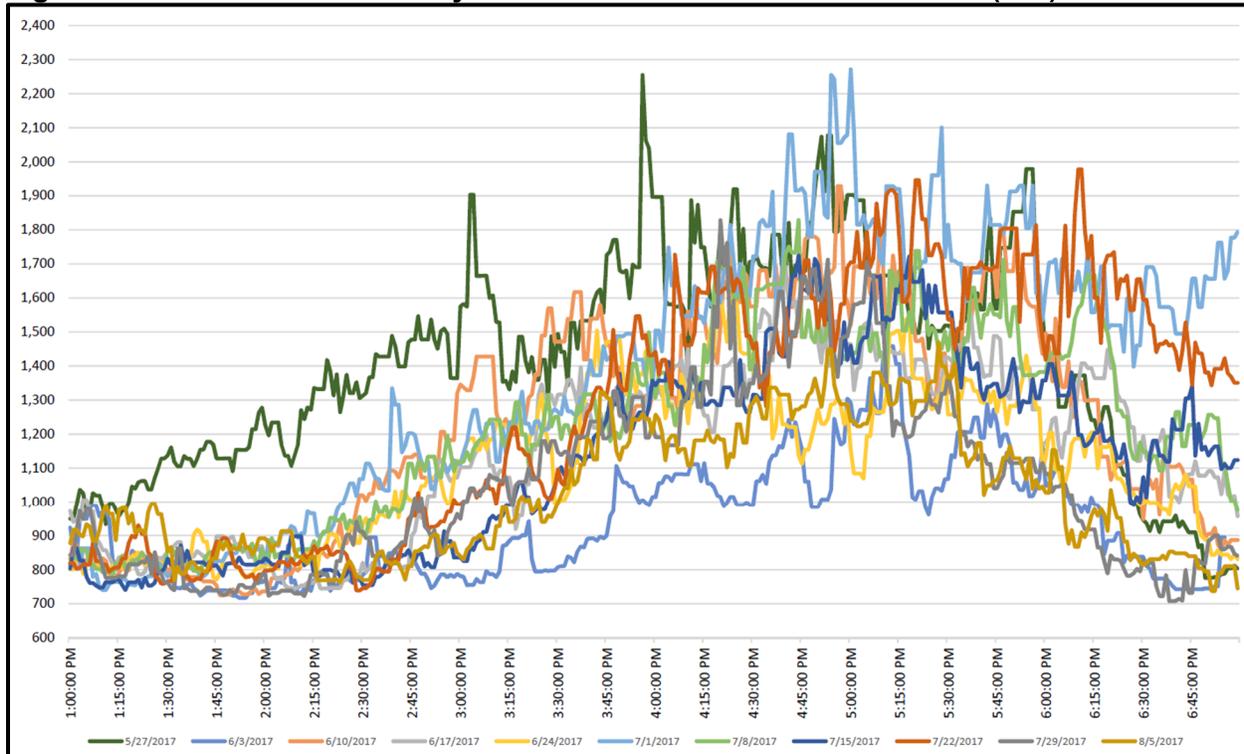
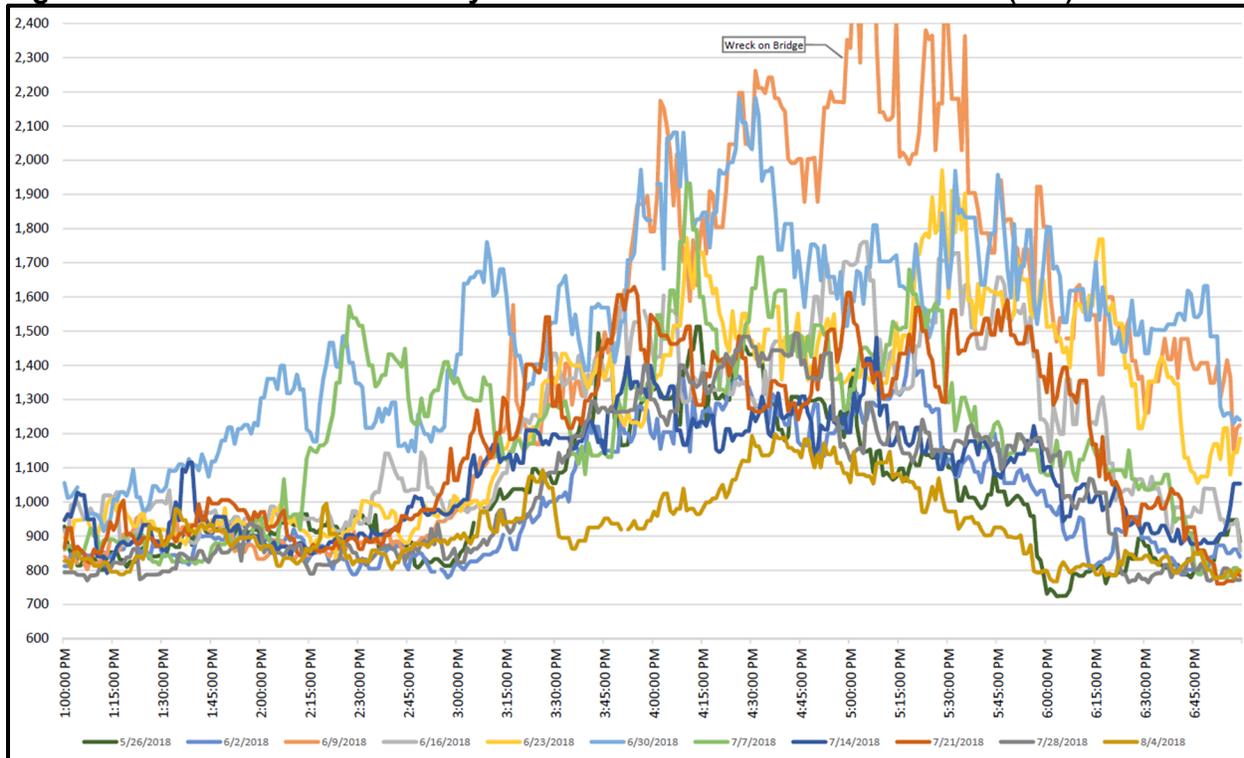


Figure 10 - 2018 Summer Saturday Inflow Peak Eastbound Travel Times (sec)

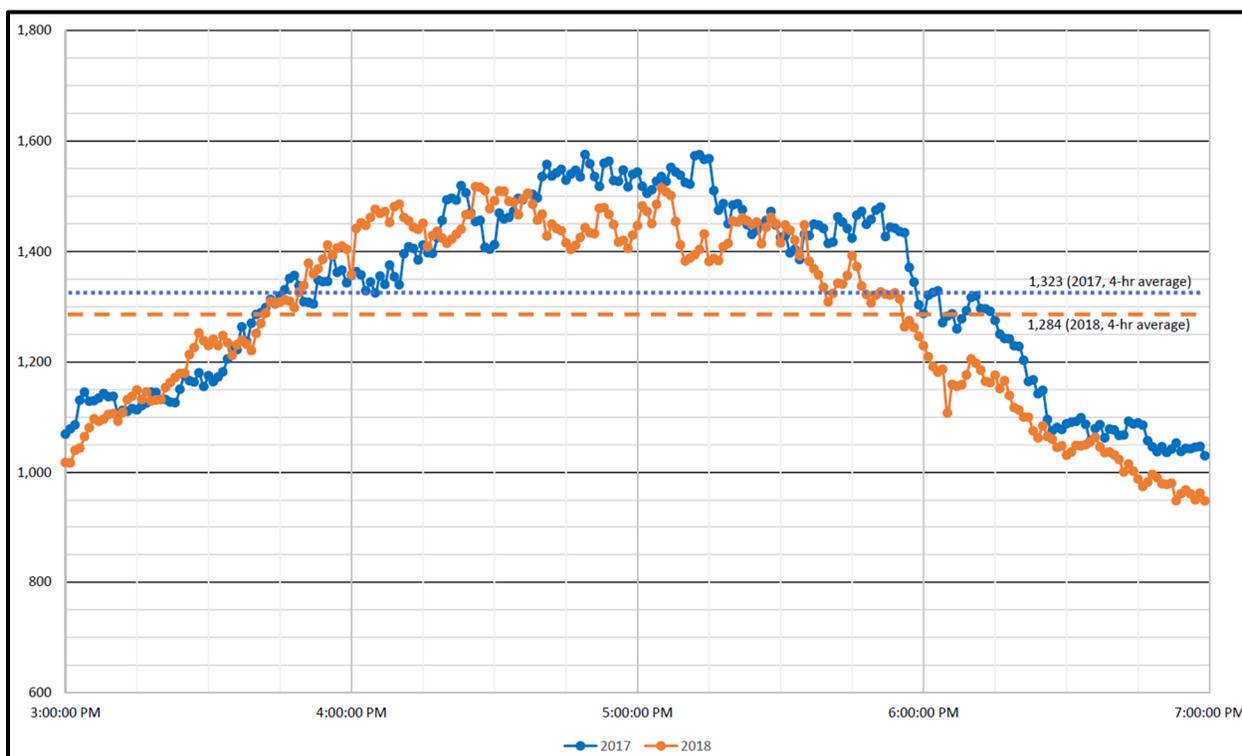


## US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

### Results Summary

It was determined that the highest eastbound travel time occurs during the 3:00-7:00PM period. The eastbound travel time reported for June 9, 2018 appears to be an outlier compared to the other Saturday data points and is believed to be related to a wreck on the bridges to Hilton Head Island that afternoon. The minute-by-minute eastbound travel times for this period were averaged for both 2017 and 2018 and are shown below for the overall corridor in **Figure 11** and **Figure 12**, which excludes the June 9th travel times. The averaged eastbound travel times for the US 278 subsections west of SC 46 and east of SC 46 are shown in Figure H and Figure I, respectively.

**Figure 11 - 2017 and 2018 Summer Saturday Eastbound Average Travel Time (3:00-7:00pm, From east of SC 170 to Pinckney Island) (sec)**



As seen in **Figure 11**, the result of the travel time analysis for the Saturday (peak-season) Inflow Peak plan indicates a reduction of 39 seconds in overall travel time for eastbound US 278. When the outlier data is removed from the analysis, shown in **Figure 12**, the improvement to eastbound average travel time is an 83 second reduction. **Figure 13** and **Figure 14** show further details by subsections of this corridor.

US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

Results Summary

Figure 12 - 2017 and 2018 Summer Saturday Eastbound Average Travel Time (3:00-7:00pm, From east of SC 170 to Pinckney Island, Excluding June 9<sup>th</sup>) (sec)

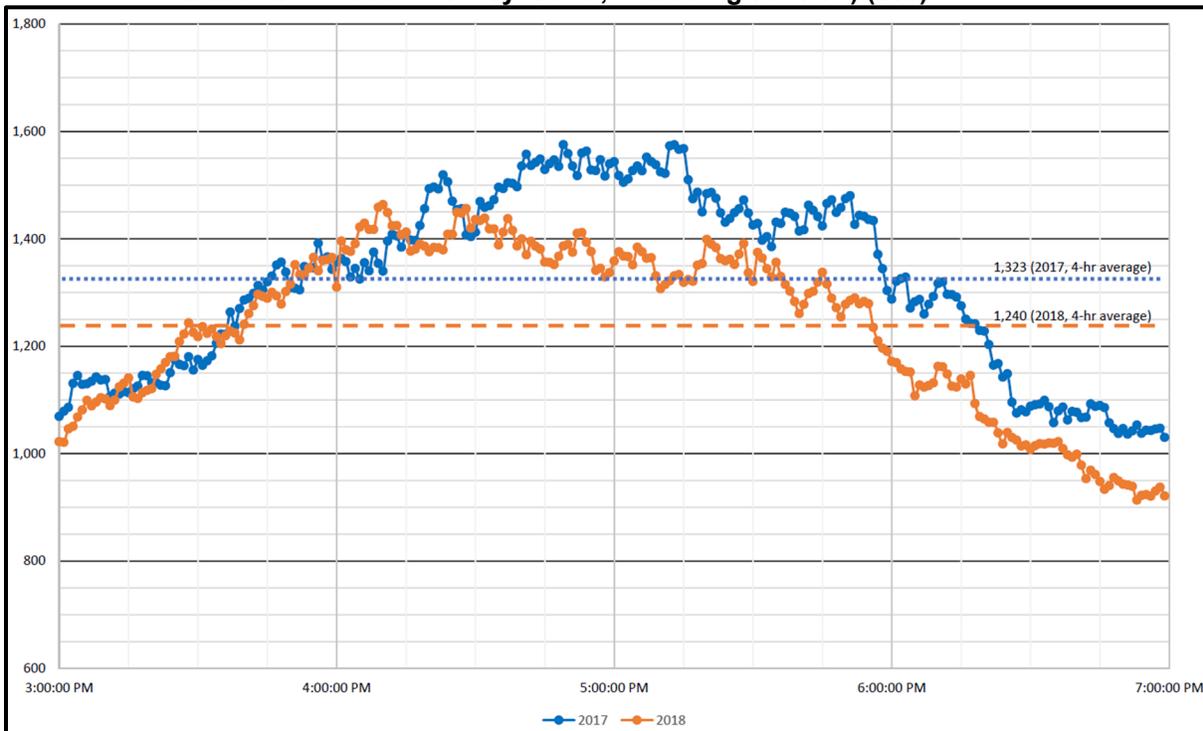
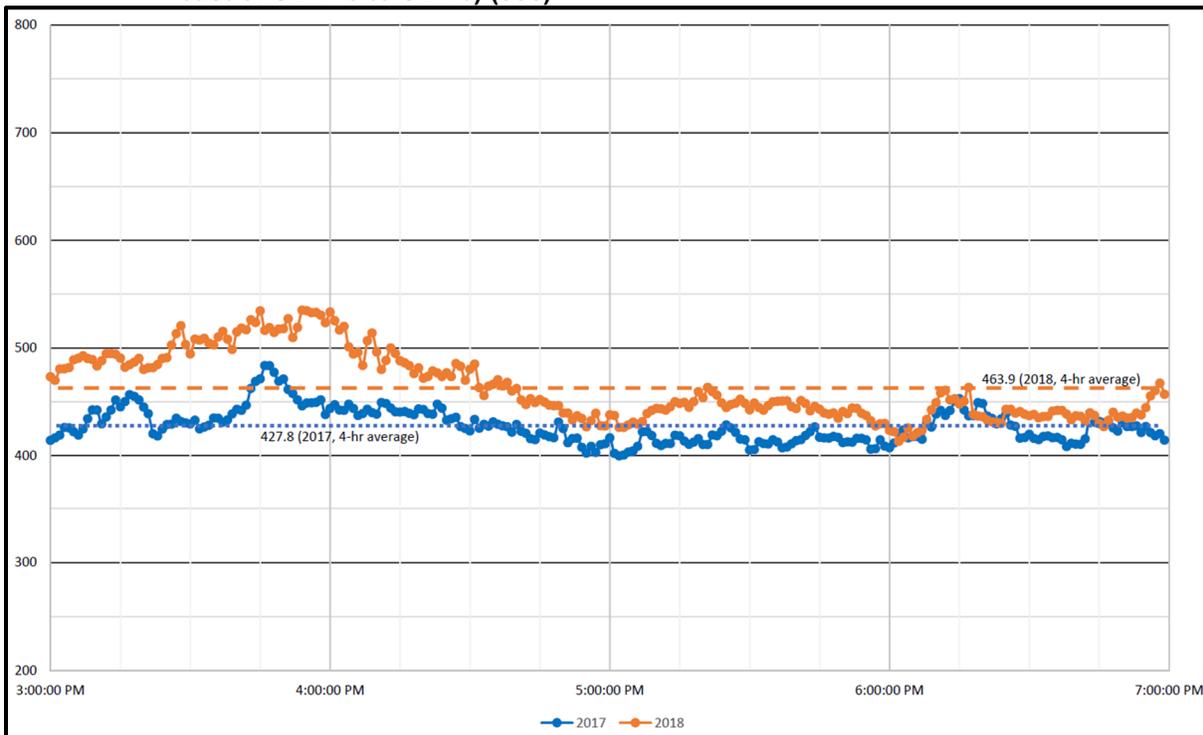


Figure 13 - 2017 and 2018 Summer Saturday Eastbound Average Travel Time (3:00-7:00pm, From east of SC 170 to SC 46) (sec)



Results Summary

**Figure 14 - 2017 and 2018 Summer Saturday Eastbound Average Travel Time (3:00-7:00pm, From SC 46 to Pinckney Island) (sec)**

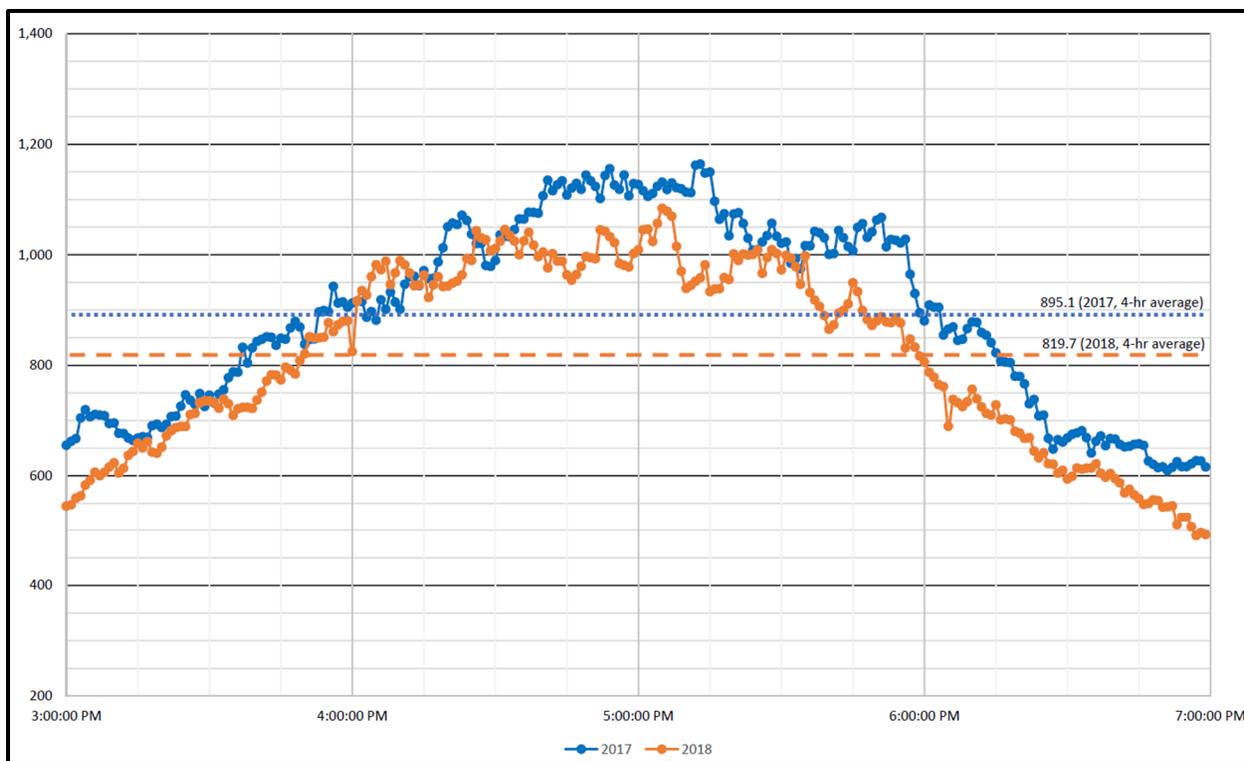


Figure 13 shows how the western half of the corridor experienced increased travel times for 2018, while Figure 14 shows how the eastern half experienced substantially lower travel times for 2018. Both Figure 13 and Figure 14 conservatively include the June 9, 2018 event for 2018.

As seen in Figure 14, during both 2017 and 2018 peak season Saturdays the rise in average travel time is experienced in the eastern half of the corridor, along the segment between SC 46 and Pinckney Island. This increase in average travel time seen in the probe data corresponds with the periods of critical eastbound traffic volume measured near Jenkins Island.

### 6.2.1 Saturday (Peak-Season) Outflow Peak Plan

The existing Saturday (peak-season) outflow peak plan has a 210 second cycle length and runs from 09:00 to 13:00 during the months of April, May, June, July, and August. The implemented plan runs from 09:00 to 13:00 with a cycle length of 170 seconds during the same months. As shown in Table 16, the implemented Saturday (peak-season) outflow peak plan maintained or improved the level of service at thirteen (13) of the fifteen (15) intersections and reduced or had nominal change to delay at six (6) intersections. Saturday (peak-season) outflow peak operations were observed and the splits and offsets were fine-tuned during implementation to ensure that queueing and delay were within acceptable ranges. Before and after studies were not performed for this period, therefore, the changes to travel time, speed, delay, number of stops, and emissions were not quantified.

Results Summary

### 6.2.2 Saturday (Peak-Season) Inflow Peak Plan

The existing Saturday (peak-season) inflow peak plan has a 220 second cycle length and runs from 13:00 to 18:00 during the months of April, May, June, July, and August. The implemented plan runs from 13:00 to 18:00 with a cycle length of 170 seconds during the same months. As shown in **Table 17**, the implemented Saturday (peak-season) inflow peak plan improved or maintained the level of service at fourteen (14) of the fifteen (15) intersections and reduced or nominally impacted the delay at eleven (11) of the fifteen (15) intersections. Saturday (peak-season) inflow peak operations were observed and the splits and offsets were fine-tuned during implementation to ensure that queueing and delay were within acceptable ranges. Based upon historical average travel times, travel time was reduced by an average of 39 seconds during this peak period. Because traditional before and after studies were unable to be performed for this period, the changes to delay, number of stops, and emissions were not quantified.

### 6.3 SATURDAY (OFF-SEASON) PEAK PLAN

The existing Saturday (off-season) peak plan has a 160 second cycle length and runs from 09:00 to 19:00 during the months from September through March. The proposed plan will run from 09:00 to 19:00 with a cycle length of 150 seconds during the same months. The Saturday (off-season) peak plan also operates during the peak-season as a Saturday PM off-peak plan, running from 18:00 to 19:00. While this plan has been implemented, it has not yet been fine-tuned as the plan was developed for off-season through volumes and turning movements. Before and after studies were not performed for this period, therefore, the changes to travel time, speed, delay, number of stops, and emissions will not be evaluated.

### 6.4 BLACK FRIDAY PLAN

The existing Black Friday plan has a 200 second cycle length and runs from 05:00 to 21:00 on weekdays and weekends for approximately one week around both the Thanksgiving and Christmas holidays near the end of November and December. The proposed plan will run during the same hours and days as the existing plan but will operate with a cycle length of 170 seconds. This plan has not yet been implemented but is intended to be pushed out at a predetermined time in advance of the regularly scheduled operations in order to conduct fine-tuning of offsets along the corridor. Due to the narrow timeframe each year when this plan is active, before and after studies were not performed for this period, therefore, the changes to travel time, speed, delay, number of stops, and emissions will not be evaluated.

## 7.0 EFFECTIVENESS EVALUATION

Improvements in traffic signal timing can also be measured using a cost versus benefit ratio. If the financial benefits to the drivers outweigh the financial cost of the project over its lifespan, then the project is worth the investment. The financial benefit to the drivers is seen through decreased driving time and fuel consumption due to improved traffic flow from the signal timing plans.

The signal timing plans will last until changes in volume or roadway characteristics decrease the efficiency of the signal system to move traffic. Development in the area can increase the volume and cause the need for roadway expansion. In order to determine the cost/benefit ratio for this report, the life span of the new signal timing plans was assumed to be 2 years.

### 7.1 ANNUAL COSTS

The cost of designing, implementing, and recording the timing plans and the interest associated with the capital invested are all factors involved in calculating the equivalent annual cost.

The formulas used to determine the project's costs are:

$$E=R \times C$$

Where:

- E = Equivalent Cost
- R = Capital Recovery Cost
- C = Initial Cost

$$R = i(1+i)^n / ((1+i)^n - 1)$$

Where:

- R = Capital Recovery Cost
- i = Annual Interest Rate
- n = Useful Life of Timing Plans

The equivalent annual costs, as calculated, using the above formulas, for US 278 (Fording Island Road) are shown in **Table 20**. The table shows interest rates ranging from 4% to 8%, which are assumed to be reasonable rates for the current market. As stated previously, the useful life of the timing plans was assumed to be 2 years. Based on contracted fees for traffic data collection, development of timing plans, implementing and field tuning of timing plans, the total cost was \$73,486.00.

**Table 20 - Equivalent Annual Cost of Timing Plans**

Annual Interest Rate	Capital Recovery Factor	Equivalent Annual Cost
4%	0.5302	\$38,921
5%	0.5378	\$39,521
6%	0.5454	\$40,082
7%	0.5531	\$40,645
8%	0.5608	\$41,209

\* \$73,486.00 Initial Cost and 2-year Service Life

## 7.2 BENEFITS

Many benefits can be derived from the improved signal timing, including vehicular emissions, reduced vehicular crashes, time savings, and fuel savings. Unfortunately, it is hard to put a dollar value on the public health benefits received by decreased vehicular emissions. Also, this study did not include a crash analysis; therefore, a dollar value for potential decreased vehicular crashes due to improved traffic flow was not included. However, it is possible to assign a dollar value to the time motorists save due to decreased travel time and the decreased fuel usage. The time saved can be measured by a dollar value using the following formula.

$$S = R \times V \times D \times O \times C$$

Where:

- S = Dollars Saved
- R = Travel Time Reduction
- V = Volume
- D = Days Timing in Effect
- O = Average Vehicle Occupancy
- C = Cost of Delay per Person Hour

The days the timings are in effect is assumed to be 250 days. The average vehicle occupancy is assumed to be 1.2, and the cost of delay per person is assumed to be \$12.00 per person-hour.

The values for fuel consumption were obtained from travel run data collected using a GPS receiver and the Tru-Traffic software for the existing timing plans and the final timing plans. The cost of fuel is assumed to be \$2.58 per gallon. **Table 21** shows the annual dollar value of the US 278 (Fording Island Road) signal timing improvements for the three analyzed peak periods.

Other benefits not considered in this analysis include lower driver frustration levels and a potential reduction of accidents. All of the improvements mentioned in the report are for three (3) hours a day for each weekday during the AM, MD, and PM peak hours along US 278 (Fording Island Road).

US 278 (FORDING ISLAND ROAD) TRAFFIC SIGNAL RETIMING – FINAL REPORT

Effectiveness Evaluation

**Table 21 - Annual Travel Time and Fuel Consumption Cost Savings**

Time Period	Volume (veh/hr)	Annual Improvement				
		Travel Time (Veh-Hrs)	Value	Fuel Consumption (gallons)	Value	Total
<b>US 278 (Fording Island Road)</b>						
AM - EB	2,256	36,817	\$530,160	10,050	\$25,928	\$556,088
AM - WB	1,329	(5,076)	(\$73,095)	(4,216)	(\$10,877)	(\$83,972)
MIDDAY - EB	1,791	8,209	\$118,206	50	\$129	\$118,335
MIDDAY - WB	1,601	(3,669)	(\$52,833)	(2,167)	(\$5,590)	(\$58,423)
PM - EB	1,744	11,263	\$162,192	2,884	\$7,440	\$169,632
PM - WB	2,310	7,540	\$108,570	(1,023)	(\$2,638)	\$105,932
<b>Total</b>	<b>11,031</b>	<b>55,083</b>	<b>\$793,200</b>	<b>5,578</b>	<b>\$14,392</b>	<b>\$807,592</b>

Note: Values shown in red and in parentheses represent negative savings.

### 7.3 COST/BENEFIT ANALYSIS

The benefit to cost ratio is a measure of effectiveness for the new signal timing plans. It validates the time and money spent to improve the timing along the corridor. The ratio for the US 278 (Fording Island Road) corridor was obtained by dividing the value of the annual benefits (reduced travel time and fuel consumption) by the equivalent annual cost. A benefit to cost ratio greater than one indicates the project’s benefits outweigh the costs.

The total value of the benefits received by the motorists on US 278 (Fording Island Road) is \$807,592. The equivalent annual cost of designing, implementing, and documenting the improved signal timing plans ranges from \$38,962 at 4% interest to \$41,209 at 8% interest. **Table 22** shows the benefit to cost ratios for the interest rates ranging from 4% to 8%.

**Table 22 - Cost/Benefit Analysis**

Costs		Benefits			Benefit/ Cost Ratio
Interest Rate	Equivalent Annual Cost	Reduced Delay	Reduced Fuel Consumption	Total	
4%	\$38,962	\$793,200	\$14,392	\$807,592	20.7
5%	\$39,521	\$793,200	\$14,392	\$807,592	20.4
6%	\$40,082	\$793,200	\$14,392	\$807,592	20.1
7%	\$40,645	\$793,200	\$14,392	\$807,592	19.9
8%	\$41,209	\$793,200	\$14,392	\$807,592	19.6

As evident in **Table 20**, the benefit to cost ratio ranges from 19.6:1 to 20.7:1. The benefits calculated are only for the weekday AM, weekday Midday, and weekday PM peak hours.

Conclusions

### 8.0 CONCLUSIONS

New coordinated traffic signal timings were developed and implemented for fifteen (15) signals along and surrounding US 278 (Fording Island Road) in and around the Town of Bluffton, Beaufort County, South Carolina. Stantec was tasked with developing six (6) time-of-day plans for regularly occurring peak traffic conditions and one (1) special event plan to be used during the holiday shopping season. These peak periods included: weekday AM peak, weekday Midday peak, weekday PM peak, Saturday (off-season) peak, Saturday (peak-season) Outflow peak, Saturday (peak-season) Inflow peak, and Black Friday.

To determine the effectiveness of the implemented new signal timing plans, travel time studies were performed using a GPS receiver and processed with Tru-Traffic software to evaluate and document the results of the timing plan development process. This report presents the results of the “before” and “after” studies that were conducted along the thirteen (13) intersections included in the travel time studies along the US 278 (Fording Island Road) corridor. The travel time studies were conducted on typical weekdays during three (3) time periods of the day: AM peak (06:45-09:30), Midday (11:00-13:30), and PM peak (15:45-18:15).

The new signal timing plans implemented for the weekday AM peak, weekday Midday peak, and weekday PM peak show improvements along US 278 (Fording Island Road). The new timing plans have decreased travel time and delay and increased the speeds through the corridor. With respect to these time periods, the improvements in traffic flow are expected to result in reduced fuel consumption and decreased emissions of carbon monoxide and hydrocarbons.

Delay incurs direct costs upon motorists in the form of increased fuel consumption and also the value of their time wasted while waiting in traffic. Motorists using US 278 (Fording Island Road) during the weekday AM, weekday Midday, and weekday PM peak periods are expected to save 55,083 hours each year because of the improved traffic flow due to the new timing plans.

Conservatively assuming a vehicle occupancy of 1.2 persons/vehicle, \$12.00 per hour for the value of motorists' time, and \$2.58 per gallon for gasoline, annual savings to motorists along US 278 (Fording Island Road) are expected to be \$793,200 in the form of reduced delay and \$14,392 decrease in cost due to decreased fuel consumption, for a total annual savings of \$807,592.

Other benefits not considered in this analysis include lower driver frustration levels and a potential reduction of accidents. All of the results mentioned in the report are for three (3) hours a day for each weekday during the AM, MD, and PM peak periods, along US 278 (Fording Island Road). New signal timing plans were also implemented during the Saturday peak hours. However, because benefit/cost “before” and “after” studies were not conducted during these time periods, additional savings could not be quantified for these periods.

**The Benefit to Cost ratio is between 19.6:1 and 20.7:1 for the US 278 (Fording Island Road) corridor with consideration of three (3) weekday peak hours.**

# APPENDIX A SIGNAL INVENTORIES AND CLEARANCE CALCULATIONS

# APPENDIX B COUNT DATA

# APPENDIX C SYNCHRO TIMING REPORTS

# APPENDIX D TIME-SPACE DIAGRAMS

# APPENDIX E TRAVEL TIME DATA