

- C. Convert the SC 41 and Joe Rouse Road intersection to a green t-intersection. This will require signal and geometric modifications. These improvements are illustrated in **Figure 3**.

Figure 3 – Green T- Intersection at SC 41 & Joe Rouse



- D. Extension of a second southbound lane from Joe Rouse Road to US 17.
- E. Implement restricted left-turns from US 17 to Brickyard Parkway and Hamlin Road. Left turns from US 17 to these roads would pass the intersection, make a U-turn at the designated median break, and then turn right at the intersection.

Figure 4 - Geometric Improvements at US 17 & Brickyard Parkway/Hamlin Road Intersection



Modeling Approach

VISSIM 8.00-11 software was used to model the existing (2018) and existing interim improvement (2018) conditions. The modeling approach detailed in the *SC 41 Microsimulation Model Development and Calibration Report* (Stantec, 2019) was used as the foundation for the existing interim improvement (2018) analysis. The calibrated VISSIM model uses an origin-destination (OD) matrix that is created using the CHATS travel demand model and peak hour (6:45 a.m. to 7:45 a.m.) turning movement counts. The road network geometry in the calibrated model was then modified to reflect the strategies listed below:

The following modeling scenarios are combinations of the interim strategies. Each of the following scenarios were modelled and evaluated for existing (2018) AM peak hour conditions:

- **Scenario 1:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection.
 - B. Roundabout at SC 41 & Joe Rouse Road intersection; and
- **Scenario 2:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection;
 - B. Roundabout at SC 41 & Joe Rouse Road intersection; and
 - E. Restricted left-turns from US 17 to Brickyard Parkway and Hamlin Road.
- **Scenario 3:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection;
 - B. Roundabout at SC 41 & Joe Rouse Road intersection;
 - D. Second southbound lane on SC 41 from Joe Rouse to US 17, and;
 - E. Restricted left-turns from US 17 to Brickyard Parkway and Hamlin Road
- F. Scenario 4:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection; and
 - D. Second southbound lane from Joe Rouse Road to US 17.
- G. Scenario 5:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection.
- H. Scenario 6:**
 - A. Phasing/timing improvements at SC 41 & US 17 intersection; and
 - C. Green T- Intersection at SC 41 and Joe Rouse.

For the existing conditions and each of the six interim improvement scenarios, VISSIM simulation was run ten (10) times, each simulation run with a randomly generated seed parameter. The results reported in this memo is an average of those 10 distinct simulations. The Measures of Effectiveness (MOEs) selected were traffic density, travel speed, volumes served, intersection delay/Level of Service (LOS), and travel time.

Data Collection Segments

The locations shown in **Figure 5** are data collection segment locations used for the comparison of these interim strategy scenarios. Segments 1-3 represent SC 41 in the southbound direction. At segments 1 and 2, data was collected for traffic density, speed, and volume of traffic served. At location 3, data was collected only on volume served due to the downstream proximity of the signalized intersection. In addition, intersection delay/LOS was determined at the three intersections shown in this figure.

Comparative Results

The results of the scenarios are summarized in **Table 1** for data collection segments 1, 2, and 3. Intersection operations are shown in **Tables 2, 3 and 4**.

Figure 5 - VISSIM Data Collection Segments

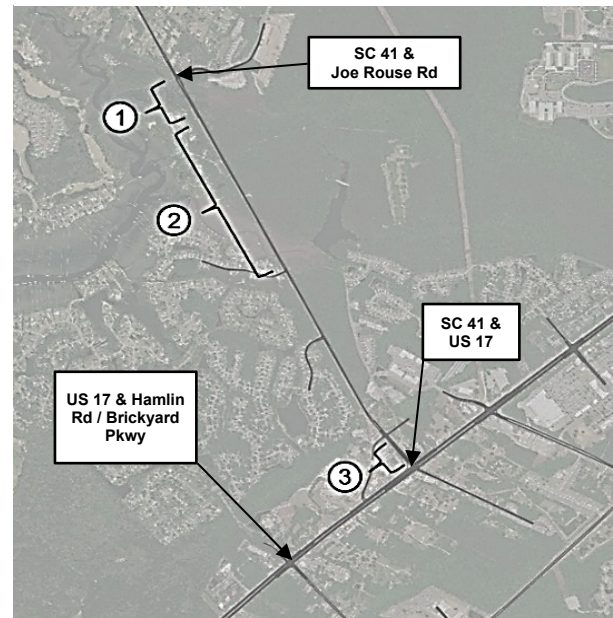


Table 1 - Summary of AM Peak Modeling Results for Southbound Traffic on SC 41

Analysis Scenarios		LOS (Density* [pc/mi/ln])		Speed (mph)		Volume Served (veh)		
		1	2	1	2	1	2	3
Existing		F (102.3)	F (98.8)	10.7	12.5	1,226	1,213	1,111
1	- Phasing/timing improvements at SC 41 & US 17 - Roundabout at SC 41 & Joe Rouse Road	D (26.3)	D (29.4)	36.5	46.2	1,356	1,361	1,241
2	- Phasing/timing improvements at SC 41 & US 17; - Roundabout at SC 41 & Joe Rouse Road; and - Restricted left-turns from US 17 to Brickyard Parkway	C (24.8)	D (29.4)	32.9	46.3	1,358	1,360	1,250
3	- Phasing/timing improvements at SC 41 & US 17; - Roundabout at SC 41 & Joe Rouse Road; - Second southbound lane - Joe Rouse to US 17, and; - Restricted left-turns from US 17 to Brickyard Parkway	B (16.0)	B (14.4)	43.1	47.5	1,355	1,361	1,247
4	- Phasing/timing improvements at SC 41 & US 17, and; - Second southbound lane - Joe Rouse Road to US 17	B (17.2)	B (15.0)	43.2	47.3	1,364	1,362	1,253
5	- Phasing/timing improvements at SC 41 & US 17	D (27.7)	D (29.7)	33.0	45.8	1,367	1,360	1,254
6	- Phasing/timing improvements at SC 41 & US 17; and - Green T- Intersection at SC 41 and Joe Rouse	C (24.4)	D (29.7)	33.0	45.7	1,358	1,356	1,247

* LOS based on density thresholds for Multilane Highways per Highway Capacity Manual 6th Edition (Page 12-19)

Table 2 - Summary LOS Results from AM Peak Modeling at SC 41 and Joe Rouse Road

Movements			Existing				Scenario 1				Scenario 2				Scenario 3				Scenario 4				Scenario 5				Scenario 6			
From	Toward	Type	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall
SC 41 NB	SC 41 NB	Thru	342	B	11.9	E 55.2	341	D	25.3	A 9.6	343	C	23.8	A 9.5	343	A	6.9	A 5.6	344	B	12.1	C 20.3	343	B	12.2	C 21.2	340	B	16.1	B 15.0
	Joe Rouse Road	Right	157	B	12.7		157	A	7.6		158	A	7.4		158	A	4.2		158	B	13.2		157	B	13.7					
SC 41 SB	Joe Rouse Road	Left	23	B	18.3		28	A	6.8		28	A	7.0		28	A	5.2		28	A	8.9		28	A	9.6		28	B	13.9	
	SC 41 SB	Thru	762	D	50.5		887	A	3.5		885	A	3.3		888	A	2.7		886	A	6.1		887	A	6.7		886	A	0.3	
Joe Rouse Road	SC 41 SB	Left	479	F	107.2		476	B	10.6		476	B	11.3		475	B	10.1		479	D	52.5		482	E	55.1		475	D	41.8	
	SC 41 NB	Right	49	E	78.6		49	A	9.0		49	A	9.8		49	A	9.6		49	D	50.3		50	D	44.4		49	B	15.4	

Table 3 - Summary LOS Results from AM Peak Modeling at SC 41 and US 17

Movements			Existing				Scenario 1				Scenario 2				Scenario 3				Scenario 4				Scenario 5				Scenario 6			
From	Toward	Type	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall
US 17 EB	SC 41 NB	Left	463	E	75.2	C 30.1	466	E	60.8	B 19.8	469	E	62.0	B 19.8	469	E	62.8	B 20.2	465	E	59.2	B 19.7	466	E	58.7	B 19.5	465	E	59.9	B 19.1
	US 17 EB	Thru	1662	B	15.5		1669	B	13.6		1674	B	14.1		1673	B	14.2		1668	B	13.5		1668	B	13.2		1668	B	12.7	
	Dingle Road	Right	27	B	13.4		28	B	10.2		28	B	10.2		28	B	10.4		28	B	11.8		28	B	11.4		28	B	10.1	
Dingle Road	US 17 WB	Left	30	F	92.6		30	F	82.4		29	F	81.3		29	F	81.5		30	F	81.3		30	F	82.4		30	F	81.6	
	SC 41 NB	Thru	5	F	91.5		5	E	75.1		5	F	82.7		5	E	79.3		5	E	74.3		5	E	77.6		5	E	74.8	
SC 41 SB	US 17 EB	Left	26	D	44		26	D	35.2		27	D	35.8		27	D	35.5		26	C	34.6		26	C	34.8		26	C	34.5	
	US 17 EB	Left	174	F	107.8		192	F	80.7		198	E	80.0		197	E	79.3		194	F	82.1		194	F	81.5		194	F	80.7	
	Dingle Road	Thru	5	F	131.2		6	E	62.8		6	E	60.6		6	E	66.7		6	E	66		6	E	60.9		6	E	65.4	
US 17 WB	US 17 WB	Right	939	D	51.0		1064	A	3.2		1060	A	3.6		1059	A	4.1		1070	A	4		1068	A	3.6		1062	A	3.4	
	Dingle Road	Left	18	F	86.4		18	F	90.7		19	F	88.8		18	F	89.7		18	F	85.6		18	F	87.5		18	F	90.0	
	US 17 WB	Thru	2033	B	15.3	2039	B	17.3	2039	B	16.3	2042	B	17.0	2035	B	17	2037	B	17.1	2042	B	16.3							
SC 41 NB	Right	148	A	6.2	146	A	7.6	146	A	7.3	145	A	7.2	147	A	7	146	A	7.4	147	A	7.1								

Table 4 - Summary LOS Results from AM Peak Modeling at US 17 and Hamlin Road/Brickyard Parkway

Movements			Existing				Scenario 1				Scenario 2				Scenario 3				Scenario 4				Scenario 5				Scenario 6			
From	Toward	Type	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall	Volume	LOS	Delay	Overall
US 17 EB	Brickyard Pkwy	Left	38	D	47.3	B 15.3	37	E	59.1	B 15.2				A 9.4				A 9.7	38	D	49.9	B 15.0	38	D	49.8	B 14.9	38	D	48.7	B 14.8
	US 17 EB	Thru	1991	B	13.2		1984	B	14.8		2024	A	3.2		2021	A	3.4		1990	B	14.6		1986	B	14.3		1994	B	13.9	
	Hamlin Road	Right	140	A	4.8		140	A	5.1		190	A	2.9		190	A	3.0		141	A	5.3		141	A	5.4		140	A	5.1	
Hamlin Road	US 17 WB	Left	194	F	80.2		194	E	78.0		199	F	103.6		200	F	107.1		194	F	81.3		194	F	80.5		194	F	82.2	
	Brickyard Pkwy	Thru	40	F	89.9		40	F	86.7		40	D	46.2		40	D	48.5		40	F	93.9		40	F	91.2		40	F	92.4	
Brickyard Parkway	US 17 EB	Right	91	A	8.9		98	A	8.8		98	B	10.6		98	B	11.5		98	A	8.6		97	A	8.7		97	A	8.8	
	US 17 EB	Left	97	E	66.6		97	E	65.3		97	E	69.6		97	E	72.3		97	E	65.6		98	E	65.8		97	E	66.8	
	Hamlin Road	Thru	35	F	81		35	F	82.1		34	F	82.9		34	F	84.5		35	F	82.2		35	F	82.1		35	F	82.4	
US 17 WB	US 17 WB	Right	204	D	40.3		204	D	41.8		206	D	40.5		206	D	42.5		205	D	42		205	D	42.2		205	D	41.0	
	Hamlin Road	Left	61	B	14		66	C	21.3							67	B		15.4	65	B		15.2	66	B		14.5			
	US 17 WB	Thru	3005	A	7.9	3107	A	6.7	3203	A	2.9	3198	A	2.7	3116	A	6.4	3120	A	6.5	3113	A	6.4							
Brickyard Pkwy	Right	40	A	3.8	41	A	3.8	75	A	4.3	76	A	4.2	40	A	3.2	40	A	3.6	41	A	3.2								

Travel Time

Two paths were established within the VISSIM model to compare the effects of each of the interim scenarios on travel time. These paths are shown in **Figure 6**.

Both travel time paths begin just north of Harpers Ferry Way. Path 1 ends at Gregory Ferry Road and Path 2 ends just west of Brickyard Parkway on US 17.

Travel times were collected for the southbound AM peak hour traffic for the six (6) interim scenarios. A summary of travel times for each scenario is shown in **Figure 6**.

Figure 6 - VISSIM Travel Time Paths (AM Peak)

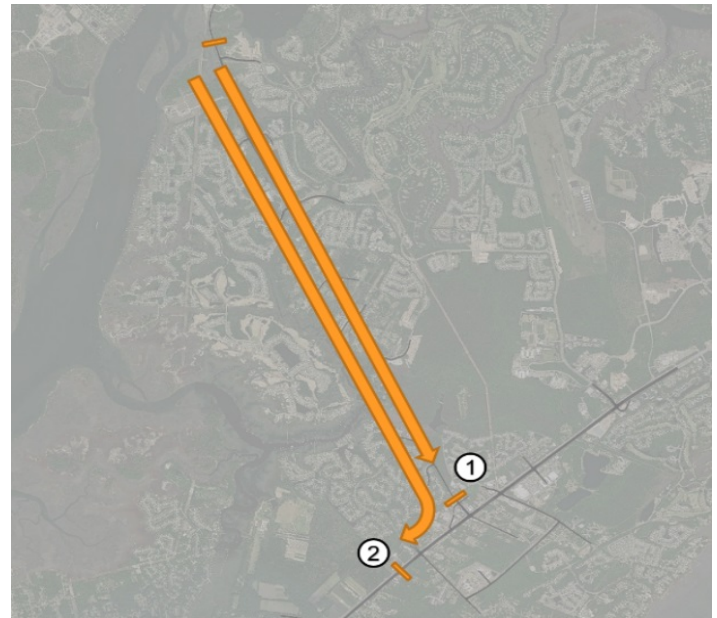
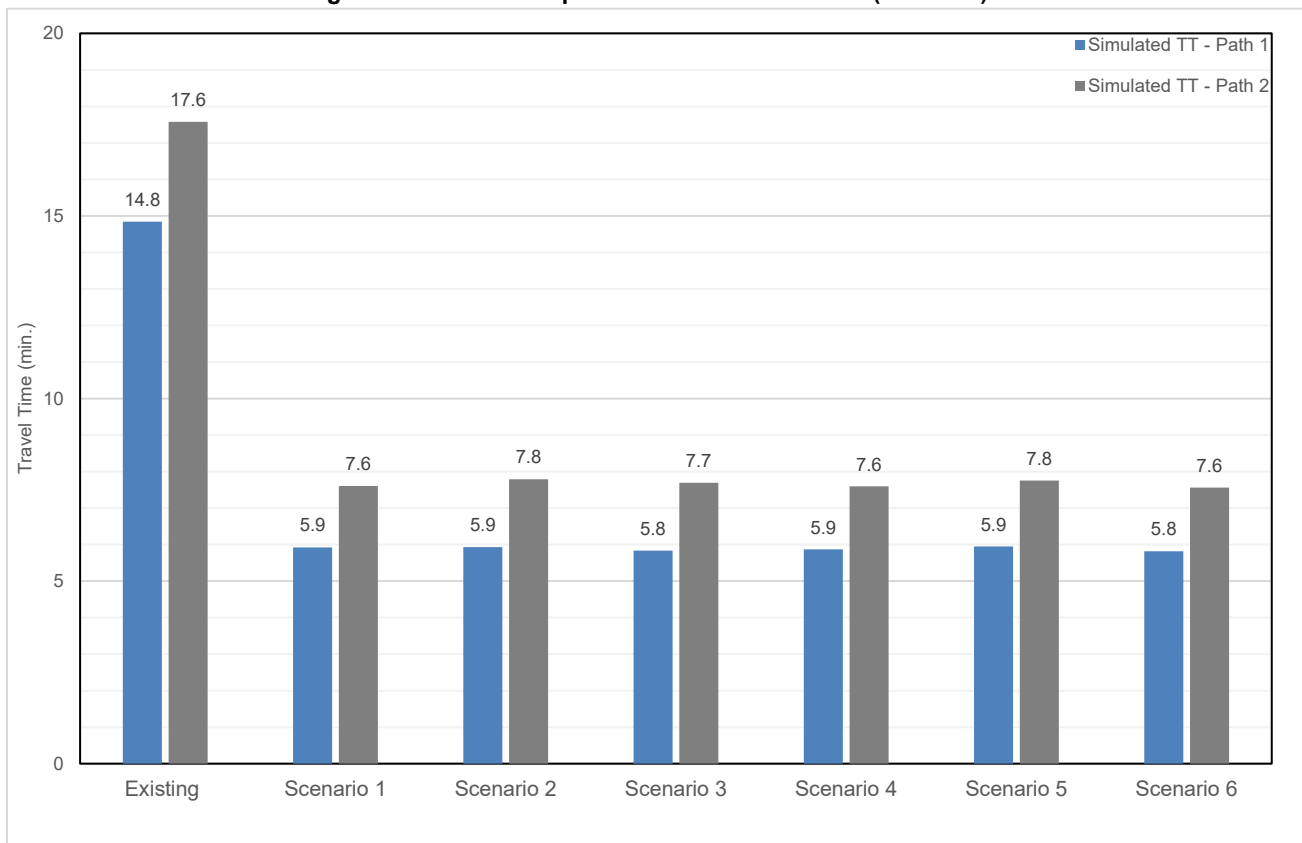


Figure 7 - VISSIM Comparative Travel Time Paths (AM Peak)



Model Observations & Recommendations

The results reported above, and the observations made during the simulation runs indicate are summarized as follows:

- Traffic density and travel speed at Data Collection Point 2 indicate that the intersection of SC 41 and US 17 affects the merge at the southbound lane drop by slowing the traffic south of the merge and the associated reduction in headway. Phasing/timing and geometric improvements at this intersection have a clear impact on traffic up through the Joe Rouse intersection.
- A comparison of intersection delay and LOS for Scenarios 1, 5, and 6 indicates that intersection improvements at SC 41 and Joe Rouse have little impact on the overall southbound SC 41 travel speed and traffic density (**Table 1**). A roundabout or green T-intersection would significantly reduce delay for traffic on the Joe Rouse approach in the AM peak period.
- Compared to signalized alternatives, the roundabout at SC 41 and Joe Rouse Road produces comparable travel speed and volumes served at key data points in the network for the AM peak period. The roundabout and green-T intersection interim alternatives also both provide an acceptable LOS. When selecting the interim improvement type for this intersection, the PM peak period traffic should be considered. Stantec performed a PM peak hour LOS analysis using Synchro for the green-T, and Sidra for the roundabout, and both provide an acceptable LOS.
- The merge at the southbound lane drop on SC 41 is approaching capacity. Once capacity is reached, travel time will degrade rapidly, even after the SC 41 and US 17 improvement is completed.
- Signal timings provided by the Town of Mount Pleasant for the US 17 and Hamlin Road/Brickyard Parkway produce acceptable level of service by this analysis. After the SC 41 and US 17 interim intersection improvements are completed, the US 17 and Hamlin Road/Brickyard Parkway should be monitored, and the Town should be prepared to adjust signal timing as needed to prioritize the southbound US 17 approach in the AM peak.

Stantec recommends that the first interim priority be the signal timing and phasing improvements at the intersection of SC 41 and US 17. Our analysis indicates that this improvement provides a significant reduction in delay on the overall corridor. An interim improvement consisting of either a roundabout or a green-T design will reduce delay at the intersection of SC 41 and Joe Rouse Road. In addition to the traffic analysis results presented in this memorandum, factors such as environmental impacts and compatibility with the full project design should be considered when choosing one of these intersection types. Finally, Stantec recommends that the second southbound lane on SC 41 at Joe Rouse Road be extended to US 17. A year of failure analysis has not been completed for the current lane drop location, however, this merge is approaching capacity. If it is not feasible to complete this lane extension as an interim project, we recommend it be a first priority phase of the full SC 41 project.

We hope this provides the basis needed for proceeding with the interim improvements to improve southbound traffic operations on SC 41. If you have any questions or comments regarding this matter, please do not hesitate to contact me.

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