

TECHNICAL MEMORANDUM

Scott's Hill Apartments

New Hanover County, NC

*Prepared for
Evolve Acquisition, LLC*





Technical Memorandum

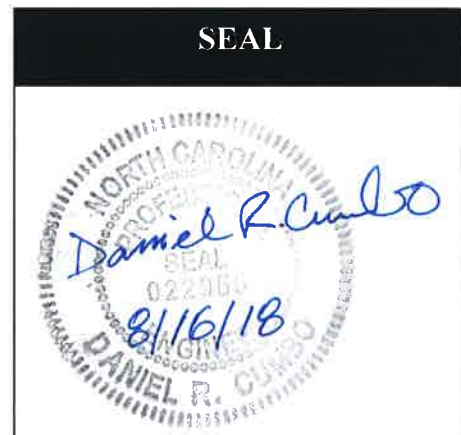
Scott's Hill Apartments New Hanover County, NC

Prepared for Evolve Acquisition, LLC
August 16, 2018

Analysis by: Cory Steiss, EI

Drafting/Graphics by: Cory Steiss, EI

Reviewed by: Dan Cumbo, P.E.



Sealed by:



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Wilmington Office:
3722 Shipyard Blvd, Suite E
Wilmington, NC 28403
Main: 910.251.8912; Fax: 336.458.9377

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TECHNICAL MEMORANDUM

To: Fredric Royal
 From: Daniel R. Cumbo, PE
 Date: August 16th, 2018
 RE: Scott's Hill Apartments, New Hanover County, NC

Introduction

The purpose of this report is to summarize the results of US 17 at the U-turn south of Creekwood Road. Incidentally, this U-turn movement for the signal was kept as permitted/protected in future scenarios when it should have been changed to protected only for the U-turn movement. As part of WMPO's review process, it is requested to provide the results with this movement changed to protected only.

LOS Results

Below in Table 1 is the updated LOS table for the intersection with the necessary edits made. The AM/PM existing scenarios have remained the same, and all future scenarios have been updated.

Table 1 - US 17 at U-turn south of Creekwood Road							
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)					
		Northbound			Southbound		
AM Peak Hour							
2018 Existing	A (2.8)	L	T	R	U	T	R
		A (2.9)			A (0.0)	A (0.0)	
		A (2.9)			N/A*		
2020 Future No Build	A (3.8)	L	T	R	U	T	R
		A (3.2)			C (24.1)	A (0.0)	
		A (3.2)			N/A*		
2020 Future Build	A (3.9)	L	T	R	U	T	R
		A (3.3)			C (24.2)	A (0.0)	
		A (3.3)			N/A*		
PM Peak Hour							
2018 Existing	A (4.8)	L	T	R	U	T	R
		A (4.9)			A (0.0)	A (0.0)	
		A (4.9)			N/A*		
2020 Future No Build	A (6.2)	L	T	R	U	T	R
		A (6.0)			C (34.1)	A (0.0)	
		A (6.0)			N/A*		
2020 Future Build	A (7.1)	L	T	R	U	T	R
		A (6.7)			C (34.5)	A (0.0)	
		A (6.7)			N/A*		

*Due to Synchro modeling practices for superstreets, which requires 2 separate nodes, the approach LOS can not be provided

Queue Results

Below in Table 2 are the updated queue results for the intersection with the necessary edits made. The AM/PM existing scenarios have remained the same, and all future scenarios have been updated.

Table 2 - Queue Results	
AM Peak Hour Queues	
Scenario	US 17 at U-turn south of Creekwood Road
2018 Existing	SBU
SimTraffic Max Queue (ft)	29
Synchro 95th Percentile Queue (ft)	0
Storage Bay (ft)	375
2020 Future No Build	SBU
SimTraffic Max Queue (ft)	49
Synchro 95th Percentile Queue (ft)	36
Storage Bay (ft)	375
2020 Full Build	SBU
SimTraffic Max Queue (ft)	50
Synchro 95th Percentile Queue (ft)	37
Storage Bay (ft)	375
PM Peak Hour Queues	
Scenario	US 17 at U-turn south of Creekwood Drive
2018 Existing	SBU
SimTraffic Max Queue (ft)	46
Synchro 95th Percentile Queue (ft)	0
Storage Bay (ft)	375
2020 Future No Build	SBU
SimTraffic Max Queue (ft)	70
Synchro 95th Percentile Queue (ft)	31
Storage Bay (ft)	375
2020 Full Build	SBU
SimTraffic Max Queue (ft)	68
Synchro 95th Percentile Queue (ft)	38
Storage Bay (ft)	375



Conclusion

Based on the updated results, the original conclusion to not provide any recommendations at this intersection remains. The LOS does not have a significant change from future no build to future build scenarios, nor do the queue results show any queueing issues.

Appendix

Level of Service

Lanes, Volumes, Timings
400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↶			↷		
Traffic Volume (vph)	36	0	0	1284	0	0
Future Volume (vph)	36	0	0	1284	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	3539	0	0
Right Turn on Red	No	No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			55	55	
Link Distance (ft)	91			1084	506	
Travel Time (s)	2.1			13.4	6.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	40	0	0	1427	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	40	0	0	1427	0	0
Turn Type	Prot			NA		
Protected Phases	3			2		
Permitted Phases						
Detector Phase	3			2		
Switch Phase						
Minimum Initial (s)	7.0			14.0		
Minimum Split (s)	13.4			20.6		
Total Split (s)	21.0			39.0		
Total Split (%)	35.0%			65.0%		
Maximum Green (s)	14.6			32.4		
Yellow Time (s)	3.0			5.2		
All-Red Time (s)	3.4			1.4		
Lost Time Adjust (s)	-1.4			-1.6		
Total Lost Time (s)	5.0			5.0		
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			6.0		
Minimum Gap (s)	3.0			3.4		
Time Before Reduce (s)	0.0			15.0		
Time To Reduce (s)	0.0			30.0		
Recall Mode	None			C-Max		
Act Effct Green (s)	8.6			52.5		
Actuated g/C Ratio	0.14			0.88		
v/c Ratio	0.16			0.46		
Control Delay	24.1			3.2		
Queue Delay	0.0			0.0		
Total Delay	24.1			3.2		
LOS	C			A		
Approach Delay	24.1			3.2		
Approach LOS	C			A		

Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Queue Length 50th (ft)	13			0		
Queue Length 95th (ft)	36			162		
Internal Link Dist (ft)	11			1004	426	
Turn Bay Length (ft)						
Base Capacity (vph)	472			3094		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.08			0.46		

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	12 (20%), Referenced to phase 2:NBT, Start of Green
Natural Cycle:	40
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.46
Intersection Signal Delay:	3.8
Intersection LOS:	A
Intersection Capacity Utilization	104.9%
ICU Level of Service	G
Analysis Period (min)	15

Splits and Phases: 400: US 17 & U-Turn south of Creekwood Road



Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↶			↷		
Traffic Volume (vph)	38	0	0	1296	0	0
Future Volume (vph)	38	0	0	1296	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	3539	0	0
Right Turn on Red	No	No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			55	55	
Link Distance (ft)	91			1084	506	
Travel Time (s)	2.1			13.4	6.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	42	0	0	1440	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	42	0	0	1440	0	0
Turn Type	Prot			NA		
Protected Phases	3			2		
Permitted Phases						
Detector Phase	3			2		
Switch Phase						
Minimum Initial (s)	7.0			14.0		
Minimum Split (s)	13.4			20.6		
Total Split (s)	21.0			39.0		
Total Split (%)	35.0%			65.0%		
Maximum Green (s)	14.6			32.4		
Yellow Time (s)	3.0			5.2		
All-Red Time (s)	3.4			1.4		
Lost Time Adjust (s)	-1.4			-1.6		
Total Lost Time (s)	5.0			5.0		
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			6.0		
Minimum Gap (s)	3.0			3.4		
Time Before Reduce (s)	0.0			15.0		
Time To Reduce (s)	0.0			30.0		
Recall Mode	None			C-Max		
Act Effct Green (s)	8.6			52.4		
Actuated g/C Ratio	0.14			0.87		
v/c Ratio	0.17			0.47		
Control Delay	24.2			3.3		
Queue Delay	0.0			0.0		
Total Delay	24.2			3.3		
LOS	C			A		
Approach Delay	24.2			3.3		
Approach LOS	C			A		

Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Queue Length 50th (ft)	14			0		
Queue Length 95th (ft)	37			166		
Internal Link Dist (ft)	11			1004	426	
Turn Bay Length (ft)						
Base Capacity (vph)	472			3093		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.09			0.47		

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	12 (20%), Referenced to phase 2:NBT, Start of Green
Natural Cycle:	40
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.47
Intersection Signal Delay:	3.9
Intersection LOS:	A
Intersection Capacity Utilization	106.6%
ICU Level of Service	G
Analysis Period (min)	15

Splits and Phases: 400: US 17 & U-Turn south of Creekwood Road



Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖			↗↗		
Traffic Volume (vph)	19	0	0	2172	0	0
Future Volume (vph)	19	0	0	2172	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	3539	0	0
Right Turn on Red	No	No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			55	55	
Link Distance (ft)	91			1084	506	
Travel Time (s)	2.1			13.4	6.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	21	0	0	2413	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	21	0	0	2413	0	0
Turn Type	Prot			NA		
Protected Phases	3			2		
Permitted Phases						
Detector Phase	3			2		
Switch Phase						
Minimum Initial (s)	7.0			14.0		
Minimum Split (s)	13.4			20.6		
Total Split (s)	20.0			60.0		
Total Split (%)	25.0%			75.0%		
Maximum Green (s)	13.6			53.4		
Yellow Time (s)	3.0			5.2		
All-Red Time (s)	3.4			1.4		
Lost Time Adjust (s)	-1.4			-1.6		
Total Lost Time (s)	5.0			5.0		
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			6.0		
Minimum Gap (s)	3.0			3.4		
Time Before Reduce (s)	0.0			15.0		
Time To Reduce (s)	0.0			30.0		
Recall Mode	None			C-Max		
Act Effct Green (s)	8.4			72.6		
Actuated g/C Ratio	0.10			0.91		
v/c Ratio	0.11			0.75		
Control Delay	34.1			6.0		
Queue Delay	0.0			0.0		
Total Delay	34.1			6.0		
LOS	C			A		
Approach Delay	34.1			6.0		
Approach LOS	C			A		

Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Queue Length 50th (ft)	10			0		
Queue Length 95th (ft)	31			490		
Internal Link Dist (ft)	11			1004	426	
Turn Bay Length (ft)						
Base Capacity (vph)	331			3212		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.06			0.75		

Intersection Summary

Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	2 (3%), Referenced to phase 2:NBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	6.2
Intersection LOS:	A
Intersection Capacity Utilization	116.3%
ICU Level of Service	H
Analysis Period (min)	15

Splits and Phases: 400: US 17 & U-Turn south of Creekwood Road



Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	27	0	0	2220	0	0
Future Volume (vph)	27	0	0	2220	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	3539	0	0
Right Turn on Red	No	No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			55	55	
Link Distance (ft)	91			1084	506	
Travel Time (s)	2.1			13.4	6.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	30	0	0	2467	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	30	0	0	2467	0	0
Turn Type	Prot			NA		
Protected Phases	3			2		
Permitted Phases						
Detector Phase	3			2		
Switch Phase						
Minimum Initial (s)	7.0			14.0		
Minimum Split (s)	13.4			20.6		
Total Split (s)	20.0			60.0		
Total Split (%)	25.0%			75.0%		
Maximum Green (s)	13.6			53.4		
Yellow Time (s)	3.0			5.2		
All-Red Time (s)	3.4			1.4		
Lost Time Adjust (s)	-1.4			-1.6		
Total Lost Time (s)	5.0			5.0		
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			6.0		
Minimum Gap (s)	3.0			3.4		
Time Before Reduce (s)	0.0			15.0		
Time To Reduce (s)	0.0			30.0		
Recall Mode	None			C-Max		
Act Effct Green (s)	8.6			72.5		
Actuated g/C Ratio	0.11			0.91		
v/c Ratio	0.16			0.77		
Control Delay	34.5			6.7		
Queue Delay	0.0			0.0		
Total Delay	34.5			6.7		
LOS	C			A		
Approach Delay	34.5			6.7		
Approach LOS	C			A		

Lanes, Volumes, Timings
 400: US 17 & U-Turn south of Creekwood Road

08/15/2018



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Queue Length 50th (ft)	14			0		
Queue Length 95th (ft)	38			#595		
Internal Link Dist (ft)	11			1004	426	
Turn Bay Length (ft)						
Base Capacity (vph)	331			3205		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.09			0.77		

Intersection Summary

Area Type: Other
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 2 (3%), Referenced to phase 2:NBT, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 7.1
 Intersection LOS: A
 Intersection Capacity Utilization 118.4%
 ICU Level of Service H
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 400: US 17 & U-Turn south of Creekwood Road



Queueing and Blocking Reports

Intersection: 400: US 17 & U-Turn south of Creekwood Road

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	49	109	96
Average Queue (ft)	19	30	21
95th Queue (ft)	47	83	68
Link Distance (ft)	40	1062	1062
Upstream Blk Time (%)	2		
Queuing Penalty (veh)	1		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 400: US 17 & U-Turn south of Creekwood Road

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	50	94	113
Average Queue (ft)	22	31	32
95th Queue (ft)	52	78	86
Link Distance (ft)	40	1062	1062
Upstream Blk Time (%)	4		
Queuing Penalty (veh)	1		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 400: US 17 & U-Turn south of Creekwood Road

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	70	134	99
Average Queue (ft)	17	28	29
95th Queue (ft)	47	92	95
Link Distance (ft)	40	1062	1062
Upstream Blk Time (%)	2		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 400: US 17 & U-Turn south of Creekwood Road

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	68	206	220
Average Queue (ft)	22	64	61
95th Queue (ft)	53	178	177
Link Distance (ft)	40	1062	1062
Upstream Blk Time (%)	6		
Queuing Penalty (veh)	2		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			