U-5949 NC 210 Corridor Improvements
Onslow County, NC

Traffic Capacity Analysis
Technical Memorandum

Prepared for:
NCDOT Division 3
5501 Barbados Blvd
Castle Haynes, NC 28249

Prepared by:
Accelerate Engineering, PLLC
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DocuSigned by:
Zhaolong Teng
6B6BA0DE5257455...

Accelerate Engineering, PLLC
License No. P-1442

875 Walnut Street, Suite 316, Cary, NC 27511
(919) 263-5678 | (704) 666-5811 www.AccelerateEng.com

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INTRODUCTION

The NC Department of Transportation (NCDOT) proposes to widen North Carolina Highway 210 (NC 210) to a multi-lane facility from US 17 to south of SR 1518 (Old Folkstone Road) in Onslow County. This project is approximately 5.8 miles long. The proposed project is included in the current 2018-2027 State Transportation Improvement Program (STIP) as project U-5949 with construction scheduled to start in 2025. This project is also included in the Jacksonville Urban Area Metropolitan Planning Organization (JUMPO)'s 2040 Long Range Transportation Plan (LRTP) adopted in January 2018. The project area is included in **Figure 1**.

The project level traffic forecast for the subject project was completed by Accelerate Engineering, PLLC in January 2018, and is included in **Appendix A**. This traffic capacity analysis technical memorandum documents the NC 210 traffic analysis results for the following four scenarios.

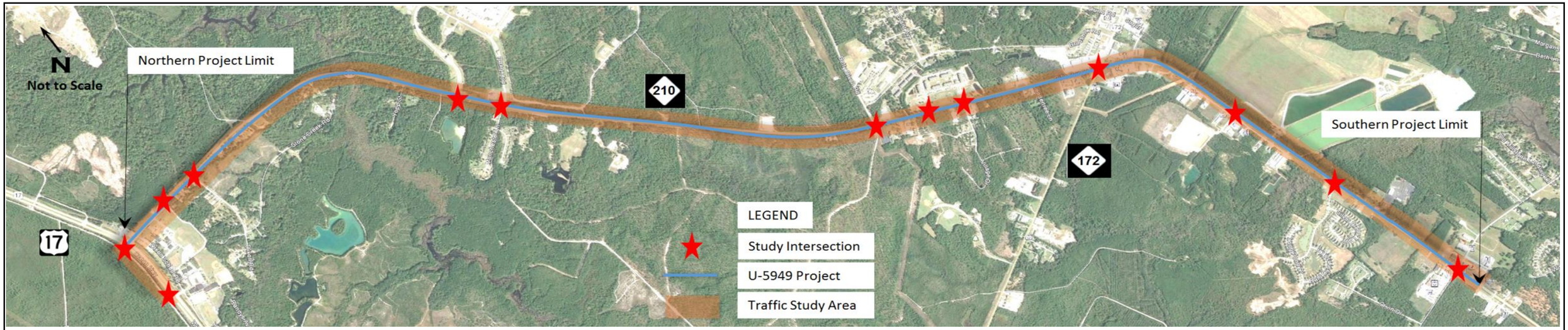
- 2017 Base Year No-Build
- 2040 No-Build
- 2040 Build

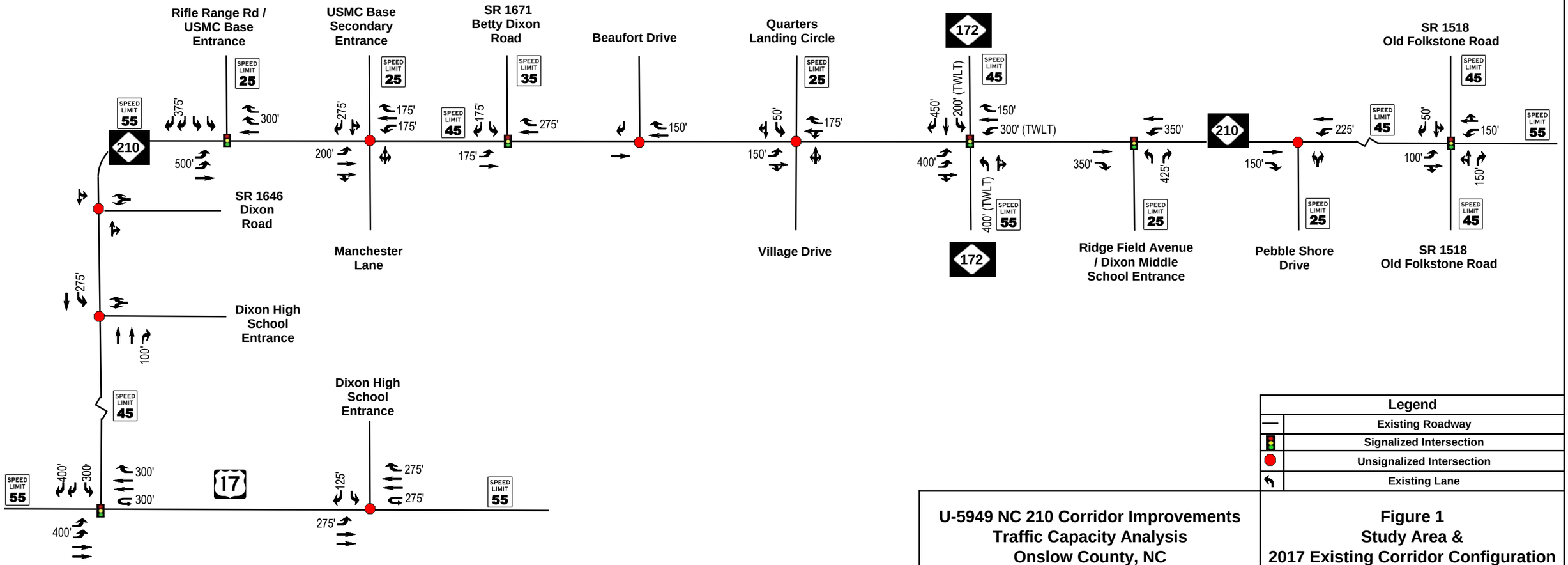
The project study area includes the following intersections where traffic forecast data is available.

1. NC 210 at US 17
2. NC 210 at Dixon High School Entrance
3. NC 210 at SR 1646 (Dixon Rd)
4. NC 210 at Rifle Range Road (USMC Base Main Entrance)
5. NC 210 at USMC Base Secondary Entrance/ Manchester Lane
6. NC 210 at SR 1671 (Betty Dixon Road)
7. NC 210 at Beaufort Drive
8. NC 210 at Village Drive / Quarters Landing Circle
9. NC 210 at NC 172
10. NC 210 at Dixon Middle School Entrance / Ridge Field Avenue
11. NC 210 at Pebble Shore Drive
12. NC 210 at SR 1518 (Old Folkstone Road)
13. US 17 at Dixon High School Entrance

The existing intersection lane configuration is included in **Figure 1**. Below is a detailed description of the existing study area roadway network.

NC 210 is a two to five-lane undivided facility, and is classified as a Minor Arterial in the state highway system. Within the study area, it runs mostly in the north-south direction connecting US 17 to North Topsail Beach. The US Marine Corps Special Operations Command (MARSOC) facilities are located on the east side of NC 210 between US 17 and Betty Dixon Road (SR 1671). Commercial land uses along the NC 210 corridor are currently concentrated near the NC 210 and NC 172 intersection and the NC 210 and Old Folkstone Road (SR 1518) intersection. There are three schools located along the project corridor, including Dixon Elementary School, Dixon Middle School, and Dixon High School. The 2016 historical AADT on NC 210 varied from 13,000 vpd near US 17 to 19,000 vpd near NC 127. The posted speed limit varied from 45 mph to 55 mph.





Legend	
—	Existing Roadway
	Signalized Intersection
	Unsignalized Intersection
	Existing Lane

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Figure 1
Study Area &
2017 Existing Corridor Configuration

US 17 is a north-south four-lane divided facility and is classified as a Principal Arterial in the state highway system. US 17 connects Jacksonville, NC to Wilmington, NC. Dixon High School is located in the southeastern quadrant of the US 17/NC 210 intersection. The 2016 historical AADT on US 17 varied from 14,000 vpd north of the NC 172 to 24,000 vpd north of NC 210. The posted speed limit is 55 mph.

Dixon Road (SR 1646) is a two-lane local roadway in a residential area. There is no posted speed limit sign identified; however, Dixon Road is classified as 55 mph in the NCDOT speed limit system. No historical AADT data is available.

Rifle Range Road (USMC Base Main Entrance) is a four-lane local roadway that provides access to the USMC Base. The speed limit is 25 mph. No historical AADT data is available.

Manchester Lane is a two-lane local roadway in a residential area. No posted speed limit signs were identified; therefore, a speed limit of 25 mph was assumed. No historical AADT data is available.

Betty Dixon Road (SR 1671) is a two-lane local roadway that provides access for Dixon Elementary School. The land use is mainly residential. The posted speed limit is 35 mph. No historical AADT data is available.

Beaufort Drive is a two-lane local roadway that provides access for the Quarters at Stone Bay Apartments. No posted speed limit signs were identified; therefore, a speed limit of 25 mph was assumed. No historical AADT data is available.

Quarter Landing Circle is a two-lane local roadway that provides access for the Quarters at Stone Bay Apartments. The speed limit is 25 mph. No historical AADT data is available.

Village Drive is a two-lane load roadway in a mostly residential area. A Taco Bell restaurant is located in the southwestern quadrant of the NC 210 / Village Drive intersection. No posted speed limit signs were identified; therefore, a speed limit of 25 mph was assumed. No historical AADT data is available.

NC 172 is a two to three lane roadway running east-west and is classified as a Minor Arterial in the state highway system. NC 172 connects US 17 to US 24 and provide access to Camp Lejeune. Commercial land uses are concentrated near the NC 210 / NC 172 intersection. The 2016 historical AADT was 6,700 vpd west of NC 210 and 20,000 vpd east of NC 210. The posted speed limit is 55 mph west of NC 210 and 45 mph east of NC 210.

Ridge Field Avenue is a two-lane local roadway that provides access to Dixon Middle School. It connects an access road that runs parallel to NC 210 and provides access to several commercial businesses. The posted speed limit is 25 mph. No historical AADT data is available.

Pebble Shore Drive is a two-lane local roadway that provides access for the Landing at Mill Creek Subdivision. The speed limit is 25 mph. No historical AADT data is available.

Old Folkstone Road (SR 1518) is a two-lane roadway running east-west and is classified as a Major Collector in the state highway system. Old Folkstone Road connects US 17 to Ennett Ln (SR 1519). Commercial land uses are concentrated near the NC 210 / Old Folkstone Road intersection. The 2016 historical AADT was 5,700 vpd west of NC 210 and 6,000 vpd east of NC 210. The posted speed limit is 45 mph.

METHODOLOGY

This traffic study evaluated the intersection traffic operational performance through the intersection capacity / Level of Service (LOS) analysis, traffic simulations, and queue analysis, in accordance with the NCDOT Congestion Management's Capacity Analysis Guidelines dated July 1, 2015.

2017 Base Year and 2040 Future Year peak hour traffic volumes are based on the Project Level Traffic Forecasts prepared by Accelerate Engineering, PLLC in January, 2018. The traffic forecast volumes were converted into the AM and PM peak hour volumes using the NCDOT Intersection Analysis Utility (IAU). The traffic forecast and IAU output sheets are included in **Appendix A**. The traffic forecast considered the development activities as well as the fiscally constrained projects in the JUMPO's 2040 LRTP. For traffic analysis purposes, the following two projects are assumed to be constructed by 2040. Additional information on these nearby projects can be found in the **Appendix B**.

- W-5602: Widen NC 172 to 3 lanes from NC 210 to the New River Bride.
- H090788: Widen SR 1518 (Old Folkstone Road) to 3 lanes from US 17 to SR 1519 (Ennett Lane).

The LOS analysis for signalized and unsignalized intersections was completed using Synchro version 9, which categorizes the LOS based on Transportation Research Board's Highway Capacity Manual (HCM) methodology and criteria. Ten one-hour microscopic traffic simulations were conducted in SimTraffic, a simulation program, for each analysis scenario. The simulation runs not only account for the stochastic nature of traffic flow but also provide finer details in traffic operations. In addition, the Capacity Analysis for Planning of Junctions (CAP-X), an analysis tool developed by the FHWA, was used to evaluate alternative intersection configurations.

This study evaluated the following analysis scenarios:

1. The "**2017 Base Year No-Build"** Analysis evaluates the current intersection operational performance.
2. The "**2040 No-Build"** Analysis examines the future traffic conditions where the proposed roadway improvements are not constructed. This analysis takes into account the future traffic growth and the planned transportation improvement TIP project W-5602 and project H090788
3. The "**2040 Build"** Analysis evaluates the widening scenario where NC 210 will be widened to a four-lane facility.

The existing traffic signal plans are included in **Appendix C.** Optimized signal timings were used in each scenario. In accordance with the NCDOT Capacity Analysis Guidelines, no "Right Turn on Red" (RTOR) was allowed in this study. This study assumed a Peak Hour Factor (PHF) of 0.9 for all study locations and analysis periods, except for the US 17 / Dixon High School Entrance, NC 210 / Dixon High School Entrance, NC 210 / Betty Dixon Road, and NC 210 / Ridge Field Avenue intersections where an AM PHF of 0.5 was used for the school trips.

2017 NO-BUILD ANALYSIS

The 2017 No-Build Analysis evaluates the current intersection conditions. The capacity analysis shows that all the signalized study intersections currently operate at an overall acceptable level of service (LOS) and delay in both AM and PM peak hour. Each approach at the signalized intersections currently operates at a LOS D or better in both peak hours. The queue analysis shows that the signalized intersections of NC 210 / NC 172 and NC 210 / Old Folkstone Road have turn-lane storage deficiencies during at least one peak hour.

All of the unsignalized study intersection movements operate at a LOS D or better in both AM and PM peak hours with the exception of the side-street movements at the NC 210 and Quarters Landing Circle / Village Drive intersection. During both AM and PM peak hours, the eastbound Village Drive approach and the westbound Quarters Landing Circle approach operate at a LOS E and F, respectively. The westbound left-turn queue exceeds the existing 50 ft. storage in both AM and PM peak hour.

The unsignalized intersection of US 17 / Dixon High School was evaluated to determine if signalization might be warranted in the current condition. The signal warrant analysis, which is included in **Appendix D,** suggests that this intersection does not currently satisfy any of the nine MUTCD signal warrants. Signalization of this intersection is not recommended at this time.

Figure 2 shows the 2017 No-Build peak hour volumes. The 2017 No-Build LOS and delay results are summarized in **Table 1**. The 2017 No-Build queue length analysis is summarized in **Table 2**. **Table 3** shows the network performance measures based on ten one-hour simulation runs. Detailed output reports can be found in **Appendix E**.

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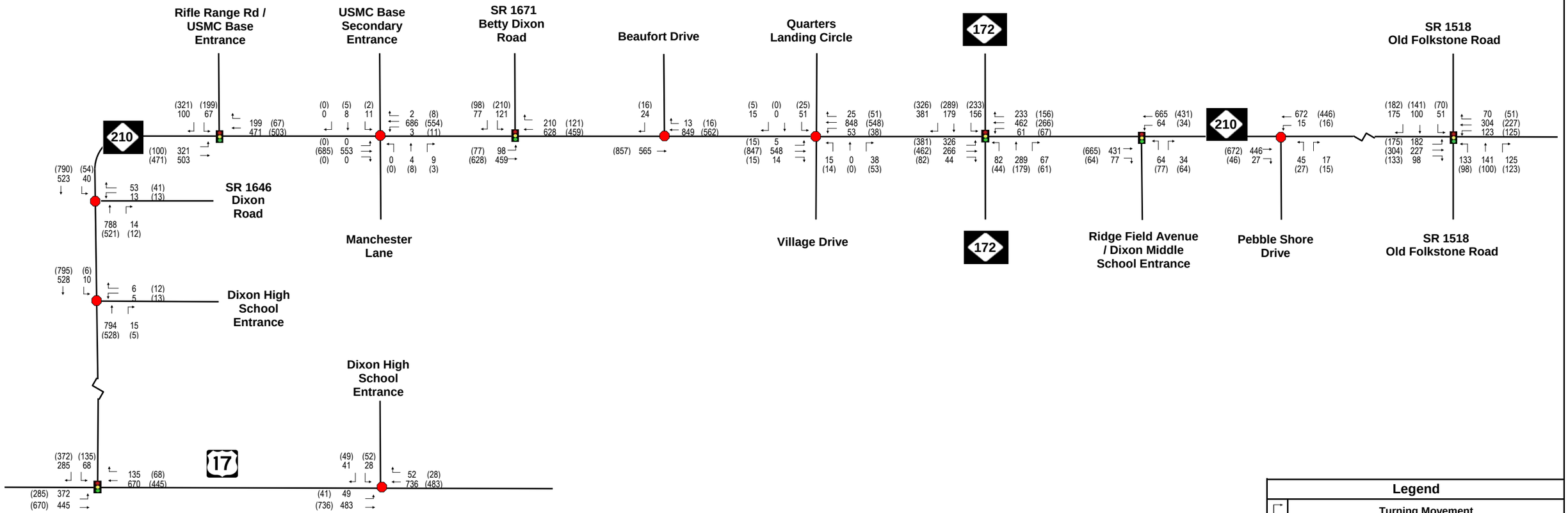
Not to Scale



Legend	
⌜	Turning Movement
—	Existing Roadway
	Signalized Intersection
	Unsignalized Intersection
XX	AM Peak Hour Traffic Volume
(XX)	PM Peak Hour Traffic Volume

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Figure 2
2017 No Build Peak Hour Traffic Volumes

Table 1: Level of Service Analysis – 2017 No-Build

Intersection	Approach		No Build (2017)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**14.2**	**B**	**13.1**	**B**
		WB - NC 210	12.9	B	12.0	B
		NB - US 17	18.3	B	19.4	B
		SB - US 17	10.8	B	10.2	B
NC 210 @ Dixon High School Entrance	unsignalized	WB - NC 210	0.3	A	0.1	A
		NB - Dixon High School Entrance	25.1	D	26.0	D
NC 210 @ Dixon Rd	unsignalized	WB - NC 210	0.7	A	0.6	A
		NB - Dixon Rd	26.6	D	23.3	C
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**14.5**	**B**	**17.1**	**B**
		WB - Rifle Range Rd/USMC Entr.	17.4	B	17.6	B
		NB - NC 210	17.9	B	23.4	C
		SB - NC 210	11.1	B	10.3	B
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB - Manchester Ln	24.3	C	33.7	D
		WB - USMC Secondary Entr.	28.6	D	24.3	C
		NB - NC 210	0.0	A	0.1	A
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**14.5**	**B**	**12.7**	**B**
		WB - Betty Dixon Rd	21.3	C	19.7	B
		NB - NC 210	9.0	A	8.0	A
		SB - NC 210	19.4	B	13.5	B
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	17.4	C	12.7	B
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB - Village Dr	46.9	E	45.3	E
		WB - Quarters Landing Cir	190.3	F	110.7	F
		NB - NC 210	0.5	A	0.6	A
		SB - NC 210	0.1	A	0.2	A
NC 210 @ NC 172	signalized	**Intersection Average**	**41.8**	**D**	**39.3**	**D**
		EB - NC 172	48.7	D	49.3	D
		WB - NC 172	30.9	C	31.0	C
		NB - NC 210	47.7	D	40.6	D
		SB - NC 210	42.2	D	43.1	D
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**12.0**	**B**	**12.4**	**B**
		EB - Ridge Field Ave / Dixon Middle School Entrance	19.5	B	25.4	C
		NB - NC 210	8.5	A	4.2	A
		SB - NC 210	14.6	B	15.2	B
NC 210 @ Pebble Shore Dr	unsignalized	NB - NC 210	0.2	A	0.3	A
NC 210 @ Old Folkstone Rd	signalized	**Intersection Average**	**15.0**	**B**	**14.3**	**B**
		EB - Old Folkstone Rd	17.2	B	16.3	B
		WB - Old Folkstone Rd	13.8	B	16.1	B
		NB - NC 210	13.8	B	11.8	B
		SB - NC 210	15.4	B	13.7	B
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	28.2	D	20.0	C
		SB - US 17	1.6	A	0.5	A

Unacceptable Delay/LOS

Table 2: Queue Analysis – 2017 No-Build

Intersection	Turn Lane		Storage Length (ft)	No Build (2017)			
				AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300	69	109	101	146
		WBR	400	68	97	67	110
		NBR	300	94	42	57	--
		NBU	300	8	30	8	32
		SBL	400	121	184	89	163
NC 210 @ Dixon High School Entrance	unsignalized	WBL	275	2	38	--	29
		NB	--	8	38	10	58
NC 210 @ Dixon Rd	unsignalized	WBTL	--	4	208	4	156
		NB	--	26	86	18	78
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	35	76	82	131
		WBR	375	33	81	102	145
		NBR	300	59	92	23	146
		SBL	500	116	132	47	57
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB	--	6	57	8	40
		WBR	275	10	21	4	21
		NBL	175	--	14	--	23
		SBL	200	--	17	--	15
NC 210 @ Betty Dixon Rd	signalized	WBL	--	72	130	134	162
		WBR	175	49	83	69	105
		NBR	275	--	65	--	56
		SBL	175	38	122	32	160
NC 210 @ Beaufort Dr	unsignalized	WBR	--	6	20	2	5
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB	--	38	94	46	100
		WBL	50	94	103	42	69
		WBTR	--	8	68	4	38
		NBL	--	4	--	2	--
		NBR	175	--	--	--	4
		SBL	150	--	25	2	29
NC 210 @ NC 172	signalized	EBL	400 (TWLT)	83	174	52	59
		WBL	200 (TWLT)	#150	183	#240	211
		WBR	450	356	247	274	190
		NBL	300 (TWLT)	100	400	#115	150
		NBR	150	234	250	165	249
		SBL	400	#210	200	214	599
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBL	--	49	88	85	88
		EBR	425	21	52	58	75
		NBL	350	20	73	10	58
		SBR	350	17	61	15	54
NC 210 @ Pebble Shore Dr	unsignalized	EB	--	26	67	16	66
		NBL	225	--	33	2	31
		SBR	150	--	--	--	--
NC 210 @ Old Folkstone Rd	signalized	EBLT	--	159	276	118	191
		EBL	250 (TWLT)	--	--	--	--
		EBR	150	69	206	72	149
		WBTL	--	84	158	122	260
		WBL	250 (TWLT)	--	--	--	--
		WBR	50	94	143	103	150
		NBL	150	64	125	69	152
		SBL	100	108	187	82	155
US 17 @ Dixon High School Entrance	unsignalized	WBL	--	38	67	22	74
		WBR	125	10	46	4	54
		NBR	275	--	6	--	2
		NBU	275	--	19	--	27
		SBL	275	8	54	2	62

Queue length greater than storage length

#: volume exceeds capacity

Table 3: Network Performance Measures – 2017 No-Build

Network Performance Measures	No Build (2017)	
	AM	PM
Travel Distance (mi)	11538	11508
Travel Time (hr)	357.7	357.0
Total Delay (hr)	94.1	92.6
Total Stops	6931	7128
Fuel Useage (gal)	371.1	372.6

2040 NO-BUILD ANALYSIS

The 2040 No-Build Analysis examines the future traffic conditions where the proposed roadway improvements are not constructed. This analysis takes into account the future traffic growth and the planned transportation improvements. The following assumptions were made for the 2040 No-Build Analysis:

- STIP project W-5602 will widen NC 172 to 3 lanes from NC 210 to the New River Bridge.
- Project H090788 will widen SR 1518 (Old Folkstone Road) to 3 lanes from US 17 to SR 1519 (Ennett Lane).

  NC 210 at SR 1518 (Old Folkstone Road)

  - Construct eastbound and westbound dedicated left turn lanes with 250 ft. storage and appropriate transition from the center TWLT lane.

The 2040 No-Build capacity analysis shows that four out of the six signalized intersections are expected to operate at an unacceptable LOS AM and/or PM peak hour. Despite the planned transportation improvements, the analysis shows that the intersections of NC 210 / NC 172 and NC 210 / Old Folkstone Road are expected to operate at an overall LOS F in both peak hours. All unsignalized study intersections have movements that are expected to operate at a LOS F in at least one peak hour.

The queue analysis shows the following turn-lane storage deficiencies during at least one peak hour:

- US 17 at NC 210 – NBR
- NC 210 at Rifle Road (USMC Base Entrance) – NBR
- NC 210 at Betty Dixon Road – WBR, NBR, SBL
- NC 210 at Quarters Landing Circle / Village Drive – WBL, NBR, SBL
- NC 210 at NC 172 – EBL, WBL, WBR, NBL, NBR, SBL
- NC 210 at Ridge Field Avenue – NBL, SBR
- NC 210 at Pebble Shore Drive – NBL
- NC 210 at Old Folkstone Road – EBL, EBR, WBL, WBR, NBL, SBL
- NC 210 at Dixon High School Entrance – WBR

The 2040 No-Build lane configuration is the same as 2017 No-Build lane configuration shown in **Figure 1,** with the exception of the 250 ft. eastbound and westbound dedicated left turn lanes at the NC 210 and Old Folkstone Road intersection. **Figure 3** shows the 2040 No-Build peak hour volumes. The 2040 No-Build LOS and delay results are summarized in **Table 4**. The 2040 No-Build queue length analysis are summarized in **Table 5**. **Table 6** shows the network performance measures based on ten one-hour simulation runs. Detailed output reports can be found in **Appendix E**.

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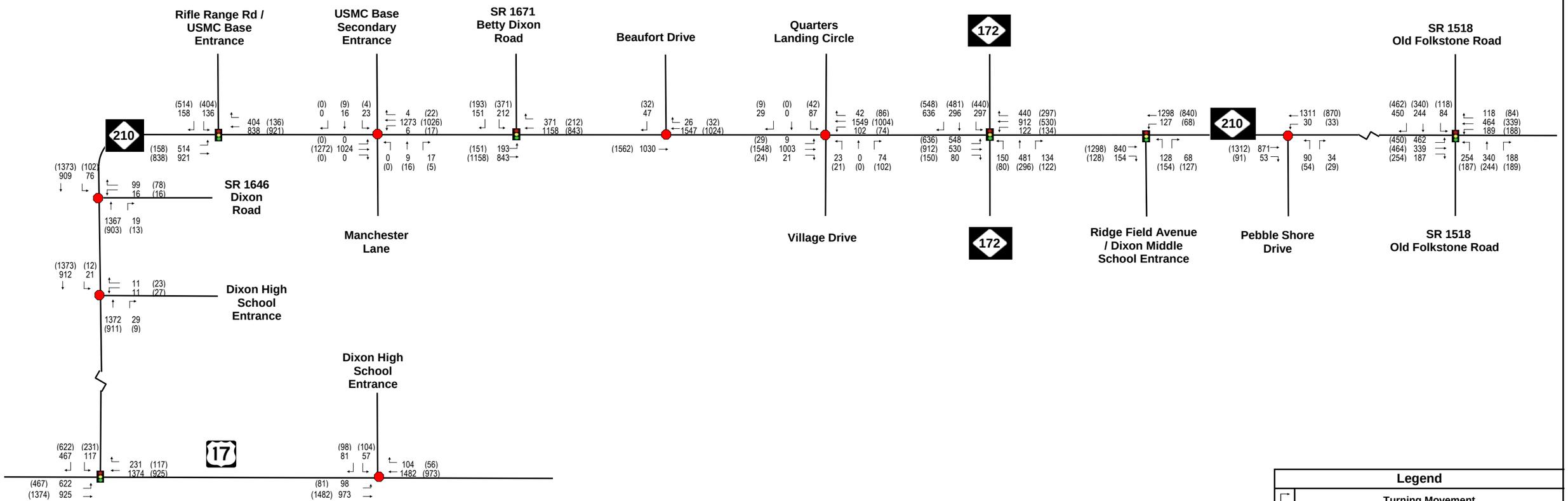

Legend	
⌐	Turning Movement
—	Existing Roadway
	Signalized Intersection
	Unsignalized Intersection
XX	AM Peak Hour Traffic Volume
(XX)	PM Peak Hour Traffic Volume

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Figure 3
2040 No-Build Peak Hour
Traffic Volumes

Table 4: Level of Service Analysis – 2040 No-Build

Intersection	Approach		No Build (2040)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**25.1**	**C**	**21.1**	**C**
		WB - NC 210	29.4	C	21.6	C
		NB - US 17	29.4	C	28.5	C
		SB - US 17	18.9	B	16.6	B
NC 210 @ Dixon High School Entrance	unsignalized	WB - NC 210	0.6	A	0.1	A
		NB - Dixon High School Entrance	**	F	**	F
NC 210 @ Dixon Rd	unsignalized	WB - NC 210	1.2	A	0.8	A
		NB - Dixon Rd	**	F	25.1	D
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**29.5**	**C**	**34.4**	**C**
		WB - Rifle Range Rd/USMC Entr.	29.4	C	41.3	D
		NB - NC 210	34.6	C	45.9	D
		SB - NC 210	25.1	C	15.9	B
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB - Manchester Ln	**	F	**	F
		WB - USMC Secondary Entr.	**	F	**	F
		NB - NC 210	0.1	A	0.2	A
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**105.8**	**F**	**53.4**	**D**
		WB - Betty Dixon Rd	175.2	F	84.9	F
		NB - NC 210	104.5	F	33.6	C
		SB - NC 210	69.8	E	55.7	E
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	64.3	F	22.3	C
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB - Village Dr	**	F	**	F
		WB - Quarters Landing Cir	**	F	**	F
		NB - NC 210	0.7	A	1.2	A
		SB - NC 210	0.1	A	0.2	A
NC 210 @ NC 172	signalized	**Intersection Average**	**174.5**	**F**	**160.6**	**F**
		EB - NC 172	261.5	F	245.0	F
		WB - NC 172	135.5	F	123.7	F
		NB - NC 210	185.9	F	103.7	F
		SB - NC 210	143.8	F	199.9	F
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**46.4**	**D**	**44.4**	**D**
		EB - Ridge Field Ave / Dixon Middle School Entrance	80.5	F	103.3	F
		NB - NC 210	53.9	D	14.6	B
		SB - NC 210	25.3	C	51.8	D
NC 210 @ Pebble Shore Dr	unsignalized	NB - NC 210	0.2	A	0.5	A
NC 210 @ Old Folkstone Rd	signalized	**Intersection Average**	**93.9**	**F**	**83.1**	**F**
		EB - Old Folkstone Rd	98.7	F	79.5	E
		WB - Old Folkstone Rd	91.9	F	68.0	E
		NB - NC 210	104.7	F	96.9	F
		SB - NC 210	83.2	F	89.7	F
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	**	F	**	F
		SB - US 17	3.7	A	0.6	A

Unacceptable Delay/LOS
** Delay exceeds 300 seconds

Table 5: Queue Analysis – 2040 No-Build

Intersection	Turn Lane		Storage Length (ft)	No Build (2040)			
				AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300	#163	147	217	193
		WBR	400	171	146	200	150
		NBR	300	141	400*	87	31
		NBU	300	7	73	8	32
		SBL	400	#281	280	198	203
NC 210 @ Dixon High School Entrance	unsignalized	WBL	275	6	61	2	32
		NB	--	92	107	126	195
NC 210 @ Dixon Rd	unsignalized	WBTL	--	14	1656	12	1332
		NB	--	254	1000	32	842
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	72	119	#231	315
		WBR	375	64	91	240	246
		NBR	300	123	500	46	500
		SBL	500	#272	189	90	172
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB	--	78	88	76	107
		WBR	275	2	21	2	25
		NBL	175	--	24	--	72
		SBL	200	--	24	--	75
NC 210 @ Betty Dixon Rd	signalized	WBL	--	336	757	#575	1985
		WBR	175	243	274	250	275
		NBR	275	164	375	50	375
		SBL	175	311	275	#288	275
NC 210 @ Beaufort Dr	unsignalized	WBR	--	42	56	10	39
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB	--	--	1100	--	1099
		WBL	50	26	150	54	148
		WBTR	--	--	1007	--	998
		NBL	--	14	--	18	--
		NBR	175	--	165	--	275
		SBL	150	2	227	4	249
NC 210 @ NC 172	signalized	EBL	400 (TWLT)	#314	500	#228	500
		WBL	200 (TWLT)	#709	300	#1031	300
		WBR	450	#1129	550	698	550
		NBL	300 (TWLT)	#300	400	#383	400
		NBR	150	657	250	459	250
		SBL	400	#589	600	#608	600
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBL	--	141	245	#345	733
		EBR	425	62	114	210	422
		NBL	350	140	450	#175	416
		SBR	350	39	117	22	409
NC 210 @ Pebble Shore Dr	unsignalized	EB	--	308	986	198	147
		NBL	225	2	324	6	131
		SBR	150	--	--	--	--
NC 210 @ Old Folkstone Rd	signalized	EBLT	--	#596	--	#360	--
		EBL	250 (TWLT)	#533	350	#360	349
		EBR	150	225	250	203	250
		WBTL	--	#516	--	#549	--
		WBL	250 (TWLT)	#220	350	#209	350
		WBR	50	592	150	434	150
		NBL	150	#358	250	#350	250
		SBL	100	#848	200	#670	200
US 17 @ Dixon High School Entrance	unsignalized	WBL	--	316	968	162	981
		WBR	125	58	225	18	225
		NBR	275	--	19	--	10
		NBU	275	--	27	2	25
		SBL	275	56	242	10	98

Queue length greater than storage length

#: volume exceeds capacity

Table 6: Network Performance Measures – 2040 No-Build

Network Performance Measures	No Build (2040)	
	AM	PM
Travel Distance (mi)	17165	17507
Travel Time (hr)	2018.1	1927.7
Total Delay (hr)	1629.6	1528.2
Total Stops	24462	24903
Fuel Useage (gal)	880.9	875.2

2040 BUILD ANALYSIS

The 2040 Build Analysis assumes that NC 210 will be widened to four lanes, and evaluates alternative intersection treatments along NC 210. Nearby transportation improvements (W-5602 and Project H090788) assumed in the 2040 No-Build Analysis are also included in this analysis.

CAP-X, an analysis tool developed by the FHWA, was used to perform the initial screening of alternative intersection configurations, including quadrant roadways, restricted crossing U-turn (also known as superstreet), median U-turn (also known as Michigan Left), roundabouts, etc. **Table 7** below summarizes the CAP-X analysis results.

Table 7: CAP-X Analysis Results -2040 Build Alternatives

Cap-X Analysis Intersection v/c Ratio	Conventional		Quadrant		Restricted Crossing U-Turn		Median U-Turn		Roundabout (2x1)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
US 17 @ NC 210	0.79	0.66	0.76 (N-E)	0.64 (N-E)	0.67 (N-S)	0.69 (N-S)	0.84 (N-S)	0.91 (N-S)	1.64	1.55
NC 210 @ Dixon High School Entrance	0.48	0.48	0.45 (S-E)	0.46 (S-E)	0.47 (E-W)	0.48 (E-W)	0.48 (E-W)	0.49 (E-W)	1.33	1.32
NC 210 @ Dixon Rd	0.53	0.47	0.45 (S-E)	0.46 (S-E)	0.54 (E-W)	0.50 (E-W)	0.54 (E-W)	0.56 (E-W)	1.37	1.39
NC 210 @ Rifle Range Rd / USMC Base Entrance	0.54	0.52	0.52 (N-E)	0.68 (N-E)	0.52 (N-S)	0.64 (N-S)	0.60 (N-S)	0.67 (N-S)	1.34	1.71
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	0.45	0.45	0.44 (N-E)	0.44 (N-E)	0.44 (N-S)	0.44 (N-S)	0.45 (N-S)	0.44 (N-S)	0.61	0.62
NC 210 @ Betty Dixon Rd	0.71	0.69	0.69 (N-E)	0.68 (N-E)	0.53 (N-S)	0.58 (N-S)	0.59 (N-S)	0.65 (N-S)	1.11	1.04
NC 210 @ Beaufort Dr	0.56	0.54	0.56 (N-E)	0.54 (N-E)	0.54 (N-S)	0.55 (N-S)	0.56 (N-S)	0.55 (N-S)	0.77	0.77
NC 210 @ Quarters Landing Circle / Village Dr	0.59	0.64	0.58 (S-W)	0.60 (N-E)	0.59 (N-S)	0.63 (N-S)	0.64 (N-S)	0.63 (N-S)	0.87	0.87
NC 210 @ NC 172	0.83	0.80	0.64 (N-E)	0.72 (N-E)	0.81 (N-S)	0.90 (N-S)	1.06 (N-S)	1.04 (N-S)	2.90	3.14
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	0.56	0.64	0.56 (N-W)	0.63 (N-W)	0.60 (N-S)	0.68 (N-S)	0.65 (N-S)	0.68 (N-S)	0.89	0.83
NC 210 @ Pebble Shore Dr	0.53	0.53	0.53 (N-W)	0.53 (N-W)	0.54 (N-S)	0.52 (N-S)	0.57 (N-S)	0.52 (N-S)	0.75	0.77
NC 210 @ Old Folkstone Rd	0.63	0.60	0.67 (S-E)	0.65 (S-E)	0.61 (N-S)	0.67 (N-S)	0.64 (N-S)	0.62 (N-S)	1.46	1.49
US 17 @ Dixon High School Entrance	0.60	0.56	0.59 (N-E)	0.56 (N-E)	0.55 (N-S)	0.58 (N-S)	0.59 (N-S)	0.66 (N-S)	0.86	0.84

Analyzed in 2040 Build Alternatives
v/c > 1

Based on the v/c ratio outputs from the CAP-X analysis and engineering judgement, the conventional widening, quadrants, restricted crossing (superstreet), and median U-turn (Michigan Lefts) could provide acceptable v/c ratios and were selected for further evaluations through capacity analysis and traffic simulations. **Table 8** below summarizes the intersection configurations for the Build alternatives, except for the conventional widening alternative. The lane configurations and preliminary LOS / delay analysis results for each of the Build alternatives can be found in the **Appendix F.**

Table 8: NC 210 Corridor Improvement Configurations -2040 Build Alternatives

Intersection Improvements Alternatives	Build Alt. A Improvements (2040)	Build Alt. B Improvements (2040)	Build Alt. C Improvements (2040)	Build Alt. D Improvements (2040)	Build Alt. E Improvements (2040)	Build Alt. F Improvements (2040)	Build Alt. G-1 Improvements (2040)	Build Alt. G-2 Improvements (2040)	Build Alt. H Improvements (2040)
US 17 @ NC 210									
NC 210 @ Dixon High School Entrance									
NC 210 @ Dixon Rd									
NC 210 @ Rifle Range Rd / USMC Base Entrance									
NC 210 @ USMC Base Secondary Entrance / Manchester Ln									
NC 210 @ Betty Dixon Rd									
NC 210 @ Beaufort Dr	RIRO	RIRO	RIRO	RIRO	RIRO	RIRO	RIRO	RIRO	RIRO
NC 210 @ Quarters Landing Circle / Village Dr									
NC 210 @ NC 172									
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance									
NC 210 @ Pebble Shore Dr									
NC 210 @ Old Folkstone Rd									
US 17 @ Dixon High School Entrance							RIRO	RIRO	RIRO

LEGEND
Conventional Widening Full Movement Intersection
Superstreet
Michigan Left
Northeast Quadrant
Michigan Left with Northwest Quadrant

Build Conventional Alternative (2040)

The Build Conventional Alternative evaluates the full-movement intersection configuration at each study intersection with the proposed four-lane widening and additional turn-lane improvements as necessary. The US 17 / Dixon High School Entrance, and NC 210 and Quarters Landing Circle / Village Drive intersection may require signalization. The projected travel demands in 2040 will require extensive widening at the NC 210 / NC 172 and NC 210 / Old Folkstone Road intersections for dual turn-lanes, which may have significant right-of-way impact.

Build Alternative A Improvements (2040)

The Build Alternative A evaluates both the superstreet intersections along NC 210 as well as the full-movement intersections of NC 210 / US 17, NC 210 / USMC Base Entrance, NC 210 / NC 172, and NC 210 / Old Folkstone Road. The US 17 / Dixon High School Entrance intersection was analyzed as a superstreet intersection. Based on the traffic simulation results, the network peak hour delays are expected to be among the highest when compared to other Build alternatives. It is typically not desirable to mix full-movement intersections / traffic signals in a superstreet corridor.

Build Alternative B Improvements (2040)

The Build Alternative B is similar to the Build Alternative A, but includes a Northeast Quadrant Roadway at the NC 210 / NC 172 intersection, and Michigan Left-Turns at the NC 210 / Old Folkstone Road intersection. At both intersections, this alternative attempts to mitigate congestion by redirecting the left-turn movements. Based on the traffic simulation results, the network peak hour delays are expected to rank second lowest when compared to other Build alternatives. Due to the construction of the Northeast Quadrant Roadway, however, this alternative likely will have significant right-of-way and property impact near the NC 210 / NC 172 intersection. The Michigan left-turn operations may require enforcement measures at the NC 210 / Old Folkstone Road intersection.

Build Alternative C Improvements (2040)

The Build Alternative C is similar to the Build Alternative B with the exception of the left-turn treatment at the NC 210 / Old Folkstone Road intersection. Instead of Michigan Left-Turns, a Superstreet intersection was analyzed for this location. Based on the traffic simulation results, the network peak hour delays are expected to rank third lowest among the Build alternatives. As discussed above, this alternative includes a Northeast Quadrant Roadway at the NC 210 / NC 172 intersection, which may displace businesses and residents near the NC 210 / NC 172 intersection.

Build Alternative D Improvements (2040)

The Build Alternative D is similar to the Build Alternative C with the exception that the NC 210 / NC 172 intersection was analyzed as a full-movement intersection. Two versions of this alternative were analyzed for different Dixon High School U-turn traffic treatments on US 17. Alternative D-1 includes a dedicated U-turn bulb out on US 17 north of the Dixon High School Entrance. Alternative D-2 re-routes the northbound U-turns to the US 17 / NC 210 intersection, and operates the northbound U-turn movements concurrently with the southbound left-turn movements. The traffic simulation results indicate that the network peak hour delays for Alternative D-2 are expected to be lower compared to Alternative D-1.

Build Alternative E Improvements (2040)

The Build Alternative E is similar to Build Alternative C, but includes a combination of Michigan Left-Turns and a Northwest Quadrant Roadway at the NC 210 / NC 172 intersection. All left-turn movements will be re-directed from the main intersection to the new quadrant connector intersection on NC 210, utilizing the new connector and a U-turn median break north of NC 172. The traffic simulation results indicate that the network peak hour delays are expected to be lower compared to Alternative D. The proposed NC 210 / NW Quadrant Roadway intersection configuration is unconventional in that the low-volume eastbound right-turn movement needs to yield to both southbound NC 210 through traffic and the northbound U-turn traffic. While property impacts on NC 172 will be reduced compared to the conventional widening alternative, additional right-of-way will be required for the new NW Quadrant Roadway. Enforcement measures and public information sessions may also be needed for the Michigan Left-Turn operations.

Build Alternative F Improvements (2040)

The Build Alternative F includes the same Michigan Left-Turns with NW Quadrant roadway at the NC 210 / NC 172 intersection as discussed in Alternative E, as well as a superstreet design for all other study intersections. Based on the traffic simulation results, the network peak hour delays are expected to rank the lowest when compared to other Build alternatives. It is noted that the superstreet design will restrict the left-turn movements from Rifle Rand Road/ USMC Base Entrance, which may not be acceptable to the MARSOC. The superstreet conversion will also alter the travel patterns at the heavily traveled NC 210/ NC 172 intersection with restricted access to the businesses in the vicinity of the intersection.

Build Alternative G Improvements (2040)

The Build Alternative G was developed based on inputs from the NCDOT Division 3 staff. This alternative is similar to Build Alternative D, but evaluates the US 17 / NC 210 intersection as a Green-T intersection instead of a full-movement intersection. This alternative will require widening US 17 to provide an inside southbound acceleration lane between NC 210 and the Dixon High School Entrance. Under this scenario, the Dixon High School Entrance on US 17 will be restricted to right in / right out only. The current southbound egressing school trips may be re-routed to the Dixon High School Entrance on NC 210, or a median break on US 17 north of NC 210. Both routes likely will require approximately one mile of additional travel distance. Two versions of this alternative were analyzed for different traffic control treatments at the NC 210 and Dixon High School Entrance intersection. Alternative G-1 analyzed the Dixon High School Entrance on NC 210 as a Superstreet intersection. Alternative G-2 analyzed it as a full movement intersection.

Build Alternative H Improvements (2040)

The Build Alternative H is identical to Build Alternative G-1, except that the US 17 / NC 210 intersection was analyzed as a superstreet intersection instead of a Green-T intersection. As the Dixon High School Entrance on US 17 will be limited to right-in/right-out access only, the current southbound egressing school trips as well as the left-turn traffic from NC 210 will make a U-turn on US 17 north of NC 210. A new traffic signal likely will be required at the proposed median break to accommodate the U-turn movements.

Traffic capacity analyses and traffic simulations were conducted for each of the Build alternatives discussed above. The lane configurations and preliminary LOS / delay analysis results are summarized in **Appendix F.** Based on the overall network performance, potential right-of-way impacts, inputs from key stakeholders as well as engineering judgement, Alternative G with the Green-T concept on US 17 was identified by the NCDOT Division 3 staff as the preferred alternative. Alternative G-1 and Alternative G-2 traffic analysis results and improvement recommendations are discussed in more details on the following pages.

The **2040 Build Alternative G-1** and **2040 Build Alternative G-2** are identical with the exception of the NC 210 / Dixon High School Entrance intersection configuration - a superstreet in Alternative G-1 and a full movement intersection in Alternative G-2. Both Alternatives G-1 and G-2 capacity analysis shows that all the signalized intersections are expected to operate at an overall LOS D or better in both AM and PM peak hour. At the US 17 and NC 210 intersection, the AM peak hour traffic analysis took into account the rerouted Dixon High School trips which have a lower PHF. A freeway merge analysis was also conducted for the new southbound "On Ramp" at the proposed US 17 and NC 210 Greet-T intersection. The freeway merge analysis shows that the new southbound "on-ramp" is expected to operate at LOS A in the AM peak hour and LOS B in the PM peak hour. At the NC 210 and NC 172 intersection, the eastbound NC 172 approach is expected to operate at LOS E during the AM peak hour.

All unsignalized study intersection movements are expected to operate at an acceptable LOS with the exception of the following intersections in the AM and / or PM peak hour:

- NC 210 at Dixon High School Entrance – WBL (only in Build Alternative G-1)
- NC 210 at Dixon Road – WBL
- NC 210 at Manchester Lane – NBL
- NC 210 at Quarter Landing Circle – SBL
- NC 210 at Village Drive – EBR, NBL
- NC 210 at Pebble Shore Drive – NBL

Traffic simulations, which take into account the gaps created by the adjacent traffic signals, show acceptable LOS for each intersection approaches discussed above. It is typical for minor street approaches to experience higher delays during peak hours at unsignalized intersections.

Based on the traffic capacity and queue analysis results, the following improvements are recommended for the 2040 Build Alternative G-1 and 2040 Build Alternative G-2 in addition to the planned transportation improvements in STIP project W-5602 and project H090788:

NC 210 (From US 17 to south of Old Folkstone Road)

- Construct road widening as needed to provide a raised median and two through lanes in each direction.

US 17 at NC 210

- Convert the full movement intersection into a Green-T intersection to allow free flow for the southbound through movement on US 17.
- Construct an inside southbound acceleration lane on US 17 between NC 210 and the Dixon High School Entrance with a minimum of 1200 ft. acceleration length.

- Construct a westbound left turn lane with a 400 ft. storage and appropriate taper and deceleration length.
- Signal upgrades to accommodate the propose Green-T intersection configuration.

US 17 at USMC Access Road

- Construct a northbound U-turn bulb-out on US 17 north of NC 210. The existing 250 ft. U-turn lane may be lengthened as needed.

Note: The US 17 / USMC Access Road intersection is not included in the traffic study. It is expected that this U-turn movement is needed to maintain access for the Shell gas station located in the northeast quadrant of the US 17 / NC 210 intersection.

US 17 at Dixon High School Entrance

- Install a raised median on US 17 and restrict the Dixon High School Entrance to right in / right out. Reroute the left-turn movements to / from the Dixon High School Entrance on US 17 to the Dixon High School Entrance on NC 210.

NC 210 at Dixon High School Entrance – Superstreet (Alternative G-1)

- Construct a westbound left turn lane with 275 ft. storage (existing) and appropriate taper and deceleration length.
- Construct an eastbound right turn lane with 100 ft. storage (existing) and appropriate taper and deceleration length.

NC 210 at Dixon High School Entrance – Full Movement Intersection (Alternative G-2)

- Construct a westbound left turn lane with 275 ft. storage (existing) and appropriate taper and deceleration length.
- Construct an eastbound right turn lane with 100 ft. storage (existing) and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

NC 210 at Dixon Road - Superstreet

- Construct a westbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct an eastbound U-turn bulb-out to accommodate the existing left-turn movements from Dixon High School Entrance (Alternative G-1). The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

Dixon Road U-Turn

- Construct an eastbound U-turn bulb-out on NC 210 approximately 750 ft. east of Dixon Road. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at USMC Access Road - Superstreet

- Provide an eastbound left turn lane with appropriate storage (200 ft. min), taper, and deceleration length.

- Construct a westbound U-turn bulb-out approximately 800 ft. west of the USMC Access Road to accommodate the left-turn movements from USMC Access Road. The proposed U-turn lane shall have a minimum of 200 ft. of storage, and appropriate taper and deceleration length.

Note: The NC 210 / USMC Access Road intersection is not included in the traffic study. It is expected that the proposed improvements are needed to maintained access to the USMC facilities.

NC 210 at USMC Base Entrance

- Construct a northbound U-turn lane with 300 ft. storage and appropriate taper and deceleration length.
- Construct northbound dual right turn lanes with 300 ft. storage (existing) and deceleration length.
- Construct southbound dual left turn lanes with 500 ft. storage (existing) and deceleration length.
- Signal upgrades to accommodate the proposed roadway widening.

NC 210 at USMC Secondary Base Entrance / Manchester Lane- Superstreet

- Install raised median on US 17 and restrict the left turn movements from the side streets. Reroute the left-turn movement from the USMC Secondary Base Entrance to make a U-turn at the adjacent intersection (NC 210 at USMC Base Entrance).
- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with a 100 ft. storage and appropriate taper and deceleration length.

Manchester Lane U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 1,000 ft. south of USMC Secondary Base Entrance / Manchester Lane. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at Betty Dixon Road (SR 1671) - Superstreet

- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 275 ft. storage (existing) and appropriate taper and deceleration length.
- Provide dual westbound right turn lanes with 175 ft. storage (existing, outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Betty Dixon Road (SR 1671) U-Turn

- Construct a northbound U-turn bulb-out on NC 210 approximately 1,100 ft. north of Betty Dixon Road. The proposed U-turn lane shall have a minimum of 350 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

NC 210 at Beaufort Drive

- Construct a northbound U-turn bulb-out to accommodate the existing left-turn movements from Quarters Landing Circle. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 150 ft. storage (existing) and appropriate taper and deceleration length.

NC 210 at Quarters Landing Circle / Village Drive - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 175 ft. storage (existing) and appropriate taper and deceleration length.
- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.

Note: This intersection should be monitored for potential signalization needs.

Village Drive U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 800 ft. south of Village Drive. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at NC 172

- Construct an eastbound left turn lane with approximately 400 ft. storage and appropriate taper and deceleration length.
- Construct a second eastbound through lane with a min. of 400 ft. storage and appropriate taper.
- Construct an eastbound right turn lane with approximately of 400 ft. storage and appropriate taper and deceleration length.
- Construct dual westbound left turn lanes with 400 ft. storage and appropriate taper and deceleration length.
- Construct dual westbound right turn lanes with 450 ft. storage and appropriate taper and deceleration length.
- Construct a northbound left turn lane with 450 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 450 ft. storage and appropriate taper and deceleration length.
- Construct dual southbound left turn lane with 700 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with 350 ft. storage and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed roadway widening.

NC 210 at Ridge Field Avenue - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. (350 ft. existing) storage and appropriate taper and deceleration length.

- Provide dual eastbound right turn lanes with 425 ft. storage (existing, outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Ridge Field Avenue U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 900 ft. south of Ridge Field Avenue. The proposed U-turn lane shall have a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

NC 210 at Pebble Shore Drive - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with 150 ft. storage (existing) and appropriate taper and deceleration length.

Pebble Shore Drive U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 1,100 ft. south of Pebble Shore Drive. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at Old Folkstone Road - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 400 ft. storage and appropriate taper and deceleration length.
- Construct dual southbound left turn lanes with 250 ft. storage and appropriate taper and deceleration length. Also construct a second eastbound receiving lane of sufficient length (2,000 ft. or otherwise determined by NCDOT) on Old Folkstone Road.
- Construct a southbound right turn lane with 400 ft. storage and appropriate taper and deceleration length.
- Provide dual eastbound right turn lanes with 350 ft. storage (outside lane only) and appropriate taper and deceleration length.
- Provide dual westbound right turn lanes with 350 ft. storage (outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Old Folkstone Road Northbound U-Turn

- Construct dual northbound U-turn lanes on NC 210 a minimum of 900 ft. north of Old Folkstone Road. The proposed U-turn lanes shall have a minimum of 350 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

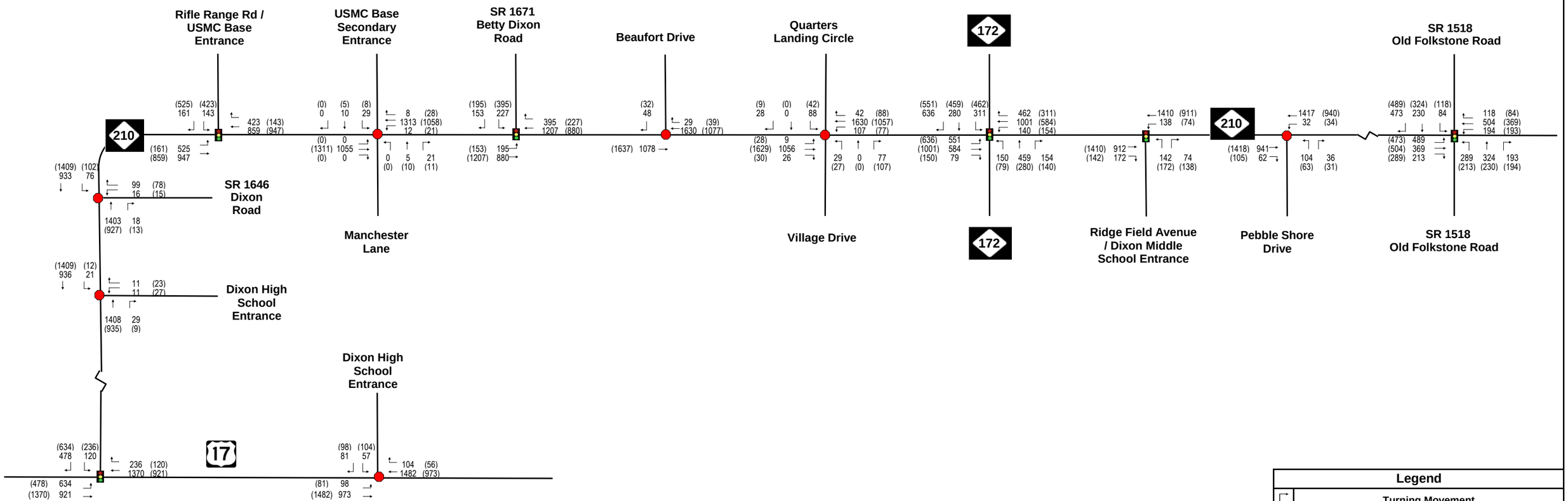
Old Folkstone Road Southbound U-Turn

- Construct dual southbound U-turn lanes on NC 210 a minimum of 900 ft. south of Old Folkstone Road. The proposed U-turn lane shall have a minimum of 300 ft. storage and appropriate taper and deceleration length.
- Drop the inside southbound through lane as a U-turn lane.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

Figure 4 shows the 2040 Build peak hour volumes. The 2040 Build Alternative G-1 and G-2 lane configurations are illustrated in **Figures 5 and 6.** The 2040 Build LOS and delay results for these two alternatives are summarized in **Table 9 and 10**. The 2040 Build queue length analysis results are summarized in **Table 10 and 11**. **Table 12 and 13** shows the network performance measures based on ten one-hour simulation runs. Detailed output reports can be found in **Appendix E**.

N

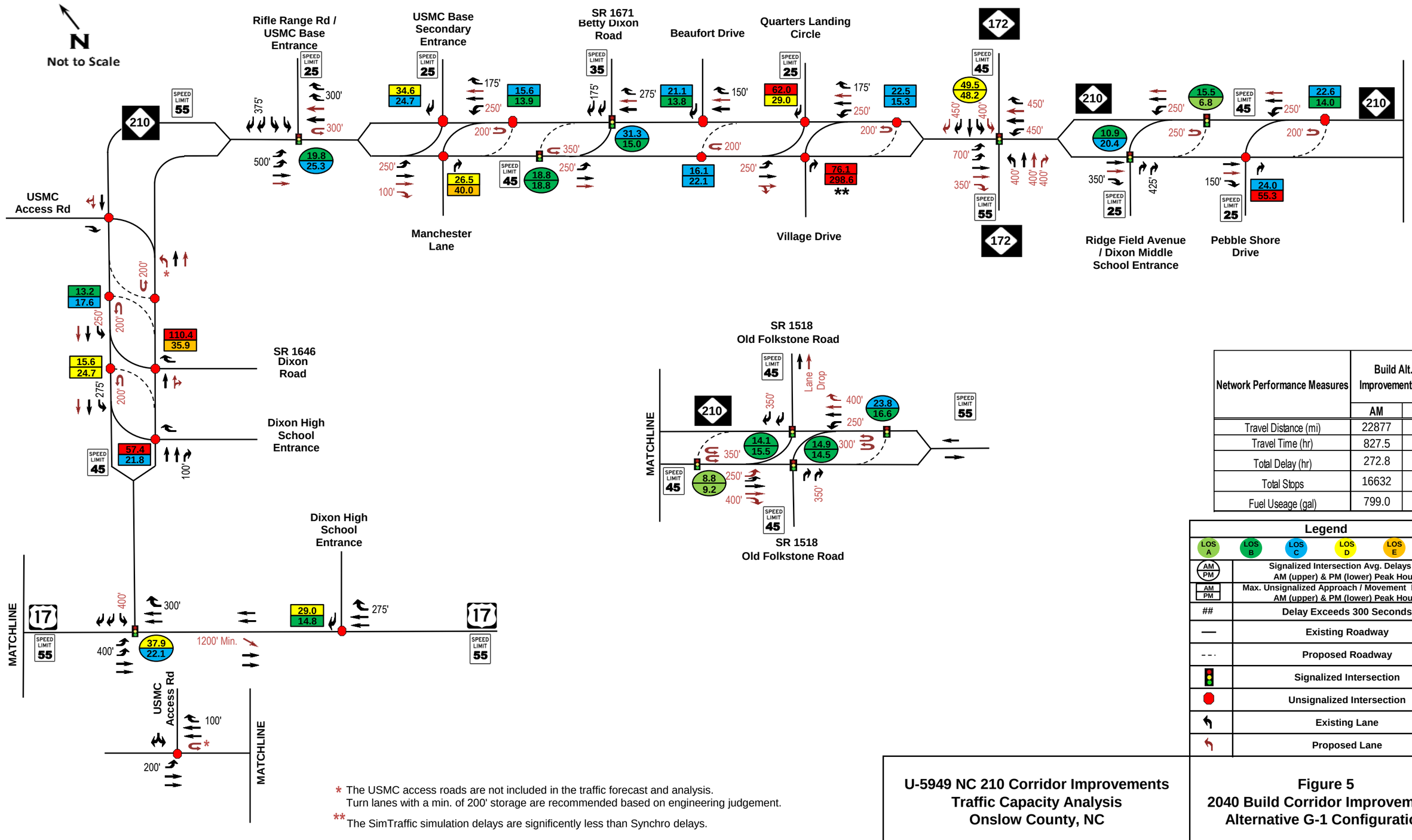
Not to Scale



Legend	
⌜	Turning Movement
—	Existing Roadway
	Signalized Intersection
	Unsignalized Intersection
XX	AM Peak Hour Traffic Volume
(XX)	PM Peak Hour Traffic Volume

U-5949 NC 210 Corridor Improvements
Traffic Capacity Analysis
Onslow County, NC

Figure 4
2040 Build Peak Hour
Traffic Volumes



Network Performance Measures	Build Alt. G-1 Improvements (2040)	
	AM	PM
Travel Distance (mi)	22877	23145
Travel Time (hr)	827.5	832.4
Total Delay (hr)	272.8	263.0
Total Stops	16632	16736
Fuel Useage (gal)	799.0	815.7

Legend

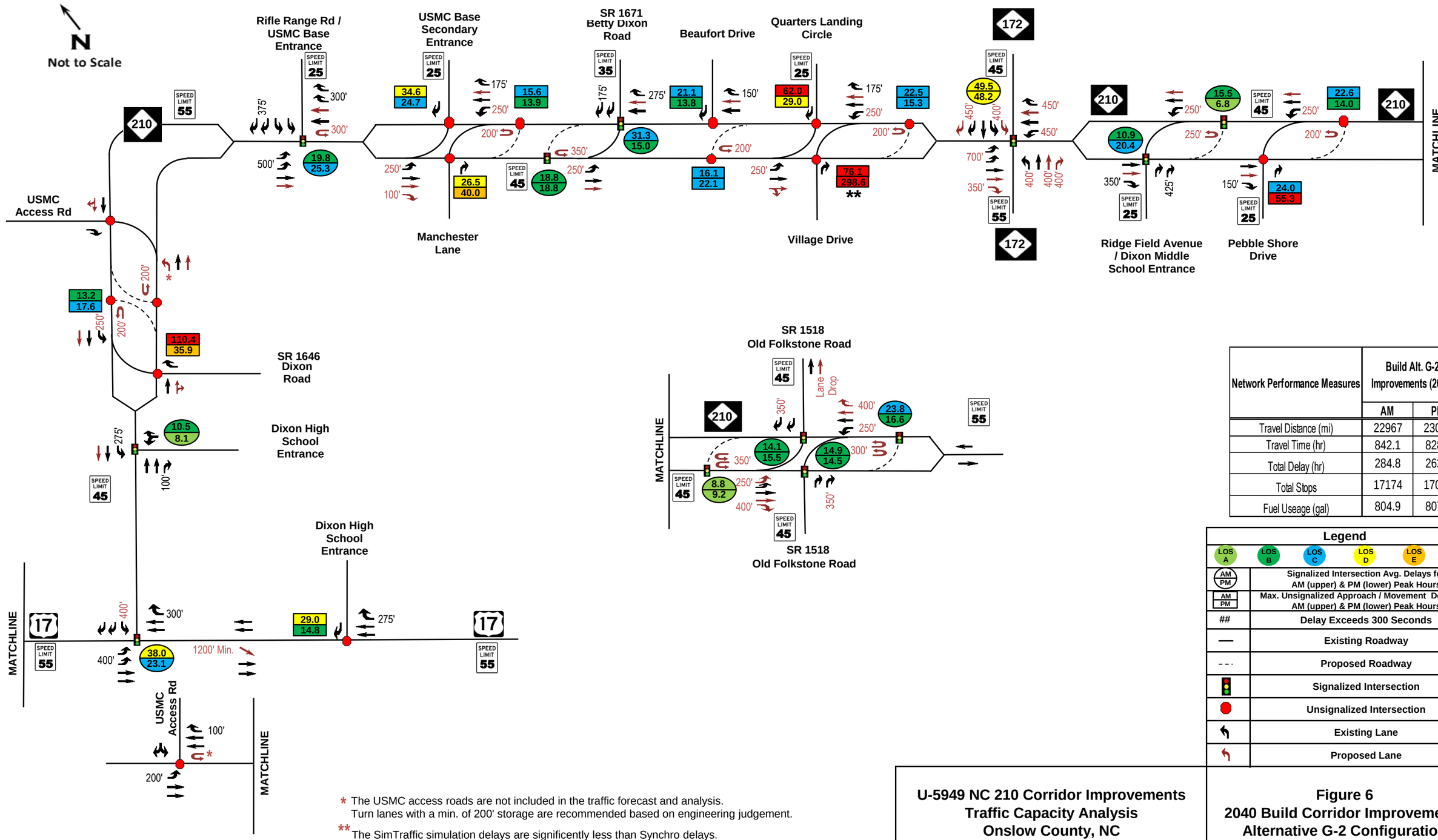
LOS A / LOS B / LOS C / LOS D / LOS E / LOS F	
AM / PM	Signalized Intersection Avg. Delays for AM (upper) & PM (lower) Peak Hours
AM / PM	Max. Unsignalized Approach / Movement Delays for AM (upper) & PM (lower) Peak Hours
##	Delay Exceeds 300 Seconds
—	Existing Roadway
- - -	Proposed Roadway
	Signalized Intersection
	Unsignalized Intersection
	Existing Lane
	Proposed Lane

* The USMC access roads are not included in the traffic forecast and analysis.
Turn lanes with a min. of 200' storage are recommended based on engineering judgement.

** The SimTraffic simulation delays are significantly less than Synchro delays.

U-5949 NC 210 Corridor Improvements
Traffic Capacity Analysis
Onslow County, NC

Figure 5
2040 Build Corridor Improvements
Alternative G-1 Configuration



Network Performance Measures	Build Alt. G-2 Improvements (2040)	
	AM	PM
Travel Distance (mi)	22967	23015
Travel Time (hr)	842.1	828.3
Total Delay (hr)	284.8	262.6
Total Stops	17174	17067
Fuel Useage (gal)	804.9	807.3

Legend

LOS A / LOS B / LOS C / LOS D / LOS E / LOS F	
AM / PM	Signalized Intersection Avg. Delays for AM (upper) & PM (lower) Peak Hours
AM / PM	Max. Unsignalized Approach / Movement Delays for AM (upper) & PM (lower) Peak Hours
##	Delay Exceeds 300 Seconds
—	Existing Roadway
- - -	Proposed Roadway
	Signalized Intersection
	Unsignalized Intersection
	Existing Lane
	Proposed Lane

* The USMC access roads are not included in the traffic forecast and analysis.
Turn lanes with a min. of 200' storage are recommended based on engineering judgement.

** The SimTraffic simulation delays are significently less than Synchro delays.

U-5949 NC 210 Corridor Improvements
Traffic Capacity Analysis
Onslow County, NC

Figure 6
2040 Build Corridor Improvements
Alternative G-2 Configuration

Table 9: Level of Service Analysis - 2040 Build Alternative G-1

Intersection	Approach		Build Alternative G-1 (2040)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**37.9**	**D**	**22.1**	**C**
		WB - NC 210	42.4	D	26.2	C
		NB - US 17	41.9	D	34.6	C
		SB - US 17	32.0	C	12.8	B
US 17 SB "On Ramp"	free flow	SB - US 17	*11.4	A	*17.7	B
NC 210 @ Dixon High School Entrance	unsignalized	WBL - NC 210	57.4 (20.1)	F (C)	21.8 (12.3)	C (B)
		NB - Dixon High School Entrance	26.0	D	16.3	B
Dixon High School (EB U-Turn)	unsignalized	EB - U-Turn	15.6	C	24.7	C
NC 210 @ Dixon Rd	unsignalized	WBL - NC 210	110.4 (20.2)	F(C)	35.9 (13.5)	E (C)
		NB - Dixon Rd	23.6	C	14.5	B
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	13.2	B	17.6	C
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**19.8**	**B**	**25.3**	**C**
		WB - Rifle Range Rd/USMC Entr.	37.3	D	40.6	D
		NB - NC 210	12.6	B	19.2	B
		SB - NC 210	22.7	C	17.7	B
NC 210 @ USMC Base Secondary Entrance	unsignalized	WB - USMC Secondary Entrance	16.5	C	13.4	B
		SBL - NC 210	34.6 (18.6)	D (C)	24.7 (12.1)	C (B)
NC 210 @ Manchester Ln	unsignalized	EB - Manchester Ln	14.0	B	16.0	C
		NBL - NC 210	26.5 (13.6)	D (B)	40.0 (15.8)	E (C)
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	15.6	C	13.9	B
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**31.3**	**C**	**15.0**	**B**
		WB - Betty Dixon Rd	44.9	D	15.8	B
		NB - NC 210	25.3	C	14.9	B
		SBL - NC 210	38.1	D	12.1	B
Betty Dixon Rd (NB U-Turn)	signalized	**Intersection Average**	**18.8**	**B**	**18.8**	**B**
		NB - U-Turn	21.5	C	33.6	C
		SB - NC 210	17.7	B	14.6	B
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	21.1	C	13.8	B
NC 210 @ Quarters Landing Circle	unsignalized	WB - Quarters Landing Cir	30.7	D	14.5	B
		SBL - NC 210	62.0 (35.0)	F (D)	29 (15.5)	D (D)
NC 210 @ Village Dr	unsignalized	EB - Village Dr	17.6	C	37.0	E
		NBL - NC 210	76.1 (15.1)	F (C)	298.6 (33.0)	F (D)
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	16.1	C	22.1	C
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.5	C	15.3	C
NC 210 @ NC 172	signalized	**Intersection Average**	**49.5**	**D**	**48.2**	**D**
		EB - NC 172	75.8	E	51.6	D
		WB - NC 172	51.5	D	43.5	D
		NB - NC 210	42.4	D	49.3	D
		SB - NC 210	40.2	D	50.4	D
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**10.9**	**B**	**20.4**	**C**
		EB - Ridge Field Ave / Dixon Middle School Entrance	21.2	C	25.6	C
		NBL - NC 210	10.3	B	19.2	B
		SB - NC 210	7.7	A	19.4	B
Ridge Field Ave (SB U-Turn)	signalized	**Intersection Average**	**15.5**	**B**	**6.8**	**A**
		NB - NC 210	12.1	B	6.2	A
		SB - U-Turn	36.0	D	10.3	B
NC 210 @ Pebble Shore Dr	unsignalized	EB - Pebble Shore Dr	15.5	C	20.7	C
		NBL - NC 210	24 (14.0)	C (B)	55.3 (22.6)	F (C)
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.6	C	14.0	B
SB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.1**	**B**	**15.5**	**B**
		EB - Old Folkstone Rd	8.8	A	9.3	A
		NBL - NC 210	25.4	C	26.1	C
		SB - NC 210	16.3	B	17.0	B
NB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.9**	**B**	**14.5**	**B**
		WB - Old Folkstone Rd	20.0	C	16.8	B
		NB - NC 210	12.7	B	15.5	B
		SBL - NC 210	12.2	B	8.2	A
Old Folkstone Rd (NB U-Turn)	signalized	**Intersection Average**	**8.8**	**A**	**9.2**	**A**
		NB - U-Turn	20.4	C	21.0	B
		SB - NC 210	5.4	A	5.1	A
Old Folkstone Rd (SB U-Turn)	signalized	**Intersection Average**	**23.8**	**C**	**16.6**	**B**
		NB - NC 210	20.3	C	12.0	B
		SB - U-Turn	28.4	C	23.3	C
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	29.0 (11.5)	D (B)	14.8 (5.7)	B (A)

Unacceptable Delay/LOS

(XX): Simulation Delay and LOS Results

* Average Density (D), pc/mi/ln

Table 10: Level of Service Analysis - 2040 Build Alternative G-2

Intersection	Approach		Build Alternative G-2 (2040)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**38.0**	**D**	**23.1**	**C**
		WB - NC 210	35.5	D	19.0	B
		NB - US 17	46.1	D	43.6	D
		SB - US 17	30.9	C	13.8	B
US 17 SB "On Ramp"	free flow	SB - US 17	*11.4	A	*17.7	B
NC 210 @ Dixon High School Entrance	signalized	**Intersection Average**	**10.5**	**B**	**8.1**	**A**
		EB - NC 210	8.8	A	4.7	A
		WB - NC 210	7.0	A	6.5	A
		NB - Dixon High School Entrance	53.6	D	39.9	D
NC 210 @ Dixon Rd	unsignalized	WBL - NC 210	110.4 (23.7)	F(C)	35.9 (13.5)	E (B)
		NB - Dixon Rd	23.6	C	14.5	B
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	13.2	B	17.6	C
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**19.8**	**B**	**25.3**	**C**
		WB - Rifle Range Rd/USMC Entr.	37.3	D	40.6	D
		NB - NC 210	12.6	B	19.2	B
		SB - NC 210	22.7	C	17.7	B
NC 210 @ USMC Base Secondary Entrance	unsignalized	WB - USMC Secondary Entrance	16.5	C	13.4	B
		SBL - NC 210	34.6 (28.6)	D (D)	24.7 (12.7)	C (B)
NC 210 @ Manchester Ln	unsignalized	EB - Manchester Ln	14.0	B	16.0	C
		NBL - NC 210	26.5 (14.6)	D (C)	40.0 (15.9)	E (C)
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	15.6	C	13.9	B
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**31.3**	**C**	**15.0**	**B**
		WB - Betty Dixon Rd	44.9	D	15.8	B
		NB - NC 210	25.3	C	14.9	B
		SBL - NC 210	38.1	D	12.1	B
Betty Dixon Rd (NB U-Turn)	signalized	**Intersection Average**	**18.8**	**B**	**18.8**	**B**
		NB - U-Turn	21.5	C	33.6	C
		SB - NC 210	17.7	B	14.6	B
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	21.1	C	13.8	B
NC 210 @ Quarters Landing Circle	unsignalized	WB - Quarters Landing Cir	30.7	D	14.5	B
		SBL - NC 210	62.0 (39.8)	F (E)	29.0 (15.0)	D (B)
NC 210 @ Village Dr	unsignalized	EB - Village Dr	17.6	C	37.0	E
		NBL - NC 210	76.1 (16.4)	F (C)	298.6 (26.2)	F (C)
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	16.1	C	22.1	C
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.5	C	15.3	C
NC 210 @ NC 172	signalized	**Intersection Average**	**49.5**	**D**	**48.2**	**D**
		EB - NC 172	75.8	E	51.6	D
		WB - NC 172	51.5	D	43.5	D
		NB - NC 210	42.4	D	49.3	D
		SB - NC 210	40.2	D	50.4	D
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**10.9**	**B**	**20.4**	**C**
		EB - Ridge Field Ave / Dixon Middle School Entrance	21.2	C	25.6	C
		NBL - NC 210	10.3	B	19.2	B
		SB - NC 210	7.7	A	19.4	B
Ridge Field Ave (SB U-Turn)	signalized	**Intersection Average**	**15.5**	**B**	**6.8**	**A**
		NB - NC 210	12.1	B	6.2	A
		SB - U-Turn	36.0	D	10.3	B
NC 210 @ Pebble Shore Dr	unsignalized	EB - Pebble Shore Dr	15.5	C	20.7	C
		NBL - NC 210	24 (12.9)	C (B)	55.3 (21.7)	F (C)
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.6	C	14.0	B
SB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.1**	**B**	**15.5**	**B**
		EB - Old Folkstone Rd	8.8	A	9.3	A
		NBL - NC 210	25.4	C	26.1	C
		SB - NC 210	16.3	B	17.0	B
NB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.9**	**B**	**14.5**	**B**
		WB - Old Folkstone Rd	20.0	C	16.8	B
		NB - NC 210	12.7	B	15.5	B
		SBL - NC 210	12.2	B	8.2	A
Old Folkstone Rd (NB U-Turn)	signalized	**Intersection Average**	**8.8**	**A**	**9.2**	**A**
		NB - U-Turn	20.4	C	21.0	B
		SB - NC 210	5.4	A	5.1	A
Old Folkstone Rd (SB U-Turn)	signalized	**Intersection Average**	**23.8**	**C**	**16.6**	**B**
		NB - NC 210	20.3	C	12.0	B
		SB - U-Turn	28.4	C	23.3	C
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	29.0 (11.0)	D (B)	14.8 (5.4)	B (A)

Unacceptable Delay/LOS

(XX): Simulation Delay and LOS Results

* Average Density (D), pc/mi/ln

Table 11: Queue Analysis - 2040 Build Alternative G-1

Intersection	Turn Lane		Storage Length {Future Storage} (ft)	Build Alternative G-1 (2040)			
				AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300 {400}	#218	259	#356	306
		WBR	Lane Drop	160	183	184	184
		NBR	300	157	*400	97	263
		SBL	400	#345	318	#257	229
NC 210 @ Dixon High School Entrance	unsignalized	WBL	275	32	54	4	36
		NBR	--	50	95	32	115
Dixon High School (EB U-Turn)	unsignalized	EB - U-Turn	{200}	24	57	44	92
NC 210 @ Dixon Rd	unsignalized	WBL	-- {250}	88	102	52	99
		NBR	--	38	115	16	98
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	{200}	2	31	4	38
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	93	104	219	241
		WBR	375	68	86	230	264
		NBU	-- {300}	m52	92	32	52
		NBR	300	m93	186	61	98
		SBL	500	262	259	101	128
NC 210 @ USMC Base Secondary Entrance	unsignalized	WBR	--	10	67	2	48
		SBL	{250}	2	27	2	31
NC 210 @ Manchester Ln	unsignalized	EBR	--	4	50	6	49
		NBL	175 {250}	4	37	12	53
		SBR	-- {100}	--	--	--	2
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	{200}	2	--	2	--
NC 210 @ Betty Dixon Rd	signalized	WBR	Dual 175	175	253	160	203
		NBR	275	253	*321	105	163
		SBL	175 {250}	168	237	78	130
Betty Dixon Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	99	135	#278	274
NC 210 @ Beaufort Dr	unsignalized	WBR	--	--	47	--	29
		NBR	250	14	--	6	--
NC 210 @ Quarters Landing Circle	unsignalized	WBR	--	50	210	10	71
		NBR	175	--	2	--	24
		SBL	150 {250}	10	37	12	49
NC 210 @ Village Dr	unsignalized	EBR	--	24	97	68	186
		NBL	{250}	94	96	138	101
		SBTR	--	--	11	--	20
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	{200}	18	93	14	72
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	10	61	6	52
NC 210 @ NC 172	signalized	EBL	{Dual 400} (TWLT)	#258	309	#146	122
		EBR	450 {Dual}	158	190	161	119
		WBL	200 {400}	186	263	239	298
		WBR	{400}	311	272	183	109
		NBL	300 {450}	m148	430	#236	445
		NBR	150 {450}	m412	*530	221	450
		SBL	400 {700}	#320	494	337	473
		SBR	-- {350}	64	78	131	339
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBR	Dual 425	52	151	104	176
		NBL	350 {250}	m30	141	m33	96
		SBR	350	65	117	m57	128
Ridge Field Ave (SB U-Turn)	signalized	SB - U-Turn	{250}	100	157	0	184
NC 210 @ Pebble Shore Dr	unsignalized	EBR	--	26	90	26	96
		NBL	225 {250}	12	58	28	71
		SBR	150	--	13	--	19
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	32	117	10	64
SB NC 210 @ Old Folkstone Rd	signalized	EBR	Dual {350}	139	176	112	162
		NBL	{250}	125	163	#146	182
		SBR	{400}	156	216	226	313
NB NC 210 @ Old Folkstone Rd	signalized	WBR	Dual {350}	#223	218	235	230
		NBR	{400}	m129	336	120	239
		SBL	{250}	60	119	82	144
Old Folkstone Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	m78	172	m101	242
Old Folkstone Rd (SB U-Turn)	signalized	SB - U-Turn	{300}	#194	205	125	171
US 17 @ Dixon High School Entrance	unsignalized	WBR	--	136	100	230	90
		NBR	275	--	--	33	--

Queue length greater than storage length

#: volume exceeds capacity

m: queue is metered by upstream signal

*: no/little storage blockage time/spillback

Table 12: Queue Analysis - 2040 Build Alternative G-2

Intersection	Turn Lane		Storage Length {Future Storage} (ft)	Build Alternative G-2 (2040)			
				AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300 {400}	#225	296	#324	338
		WBR	Lane Drop	143	190	115	156
		NBR	300	187	*400	102	*400
		SBL	400	#396	374	#257	302
NC 210 @ Dixon High School Entrance	signalized	EBR	100	9	188	m7	41
		WBL	275	35	70	24	54
		NBLR	--	88	148	144	186
NC 210 @ Dixon Rd	unsignalized	WBL	-- {250}	88	112	52	90
		NBR	--	38	123	16	79
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	{200}	2	42	4	39
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	93	112	219	246
		WBR	375	68	81	230	238
		NBU	-- {300}	m52	99	32	64
		NBR	300	m93	175	61	88
		SBL	500	258	270	98	140
NC 210 @ USMC Base Secondary Entrance	unsignalized	WBR	--	10	72	2	43
		SBL	{250}	2	31	2	28
NC 210 @ Manchester Ln	unsignalized	EBR	--	4	52	6	51
		NBL	175 {250}	4	34	12	48
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	{200}	2	--	2	--
NC 210 @ Betty Dixon Rd	signalized	WBR	Dual 175	175	*270	160	*201
		NBR	275	253	*310	105	151
		SBL	175 {250}	168	246	78	119
Betty Dixon Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	99	174	#278	292
NC 210 @ Beaufort Dr	unsignalized	WBR	--	--	41	--	26
		NBR	250	14	--	6	--
NC 210 @ Quarters Landing Circle	unsignalized	WBR	--	50	241	10	77
		NBR	175	--	7	--	23
		SBL	150 {250}	10	42	12	56
NC 210 @ Village Dr	unsignalized	EBR	--	24	92	68	161
		NBL	{250}	94	102	138	118
		SBTR	--	--	13	--	6
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	{200}	18	80	14	63
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	10	58	6	48
NC 210 @ NC 172	signalized	EBL	{Dual 400} (TWLT)	#258	253	#146	131
		EBR	450 {Dual}	158	172	161	116
		WBL	200 {400}	186	174	239	337
		WBR	{400}	311	184	183	266
		NBL	300 {450}	m148	*515	#236	352
		NBR	150 {450}	m412	*631	221	320
		SBL	400 {700}	#320	458	337	383
		SBR	-- {350}	64	103	131	387
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBR	Dual 425	52	157	104	187
		NBL	350 {250}	m30	144	m33	99
		SBR	350	65	114	m57	111
Ridge Field Ave (SB U-Turn)	signalized	SB - U-Turn	{250}	100	181	0	192
NC 210 @ Pebble Shore Dr	unsignalized	EBR	--	26	107	26	90
		NBL	225 {250}	12	190	28	65
		SBR	150	--	16	--	21
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	32	108	10	74
SB NC 210 @ Old Folkstone Rd	signalized	EBR	Dual {350}	139	175	112	162
		NBL	{250}	125	160	#146	165
		SBR	{400}	156	225	226	302
NB NC 210 @ Old Folkstone Rd	signalized	WBR	Dual {350}	#223	227	235	236
		NBR	{400}	m129	326	120	240
		SBL	{250}	60	119	82	151
Old Folkstone Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	m78	178	m101	214
Old Folkstone Rd (SB U-Turn)	signalized	SB - U-Turn	{300}	#194	215	125	186
US 17 @ Dixon High School Entrance	unsignalized	WBR	--	58	87	230	75
		NBR	275	--	--	33	--

Queue length greater than storage length

#: volume exceeds capacity

m: queue is metered by upstream signal

*: no/little storage blockage time/spillback

Table 13: Network Performance Measures – 2040 Build Alternative G-1

Network Performance Measures	Build Alt. G-1 Improvements (2040)	
	AM	PM
Travel Distance (mi)	22877	23145
Travel Time (hr)	827.5	832.4
Total Delay (hr)	272.8	263.0
Total Stops	16632	16736
Fuel Useage (gal)	799.0	815.7

Table 14: Network Performance Measures – 2040 Build Alternative G-2

Network Performance Measures	Build Alt. G-2 Improvements (2040)	
	AM	PM
Travel Distance (mi)	22967	23015
Travel Time (hr)	842.1	828.3
Total Delay (hr)	284.8	262.6
Total Stops	17174	17067
Fuel Useage (gal)	804.9	807.3

CONCLUSIONS AND RECOMMENDATIONS

The NC 210 project corridor is a two to five-lane undivided facility, and is classified as a Minor Arterial in the state highway system. It connects to US 17 and North Topsail Beach, serves as a commuter corridor for the area US Marine Corps facilities, and provides access to three public schools. Based on the latest traffic forecast, the AADT along the 5.8-mile project corridor may increase by 10,000 to 16,000 vpd between 2017 (No Build) and 2040 (Build).

Through traffic capacity analyses and simulations, over ten 2040 Build corridor improvement alternatives were evaluated to identify the most promising options to widen NC 210 to a four-lane facility from US 17 to south of Old Folkstone Road in Onslow County. These alternatives include different combinations of a variety of intersection configurations, including conventional full-movement intersections, quadrant intersections, restricted crossing (superstreet), and median U-turn (Michigan Lefts), and the Green-T intersection.

Based on the traffic analysis results, potential right-of-way impacts, inputs from key stakeholders as well as engineering judgement, Alternative G was identified by the NCDOT Division 3 staff as the preferred alternative. This alternative includes a four-lane superstreet corridor along NC 210, but retains the full movement intersections at the USMC (MARSOC) Entrance, the NC 172 intersection, and converts the US 17 / NC 210 intersection to a Green-T Intersection. This alternative will require widening along US 17 to provide an inside southbound acceleration lane between NC 210 and the Dixon High School Entrance, and restricting the Dixon High School Entrance on US 17 to right in / right out only. Two versions of this alternative were further analyzed for different traffic control treatments at the NC 210 and Dixon High School Entrance intersection. Alternative G-1 analyzed the Dixon High School Entrance on NC 210 as a Superstreet intersection. Alternative G-2 analyzed it as a full movement intersection. Based on the network traffic simulation results, Alternative G-1 is expected to have overall less network delays during peak hours than Alternative G-2, and is therefore recommended for future project development consideration.

Roadway improvements for the preferred alternative are summarized below. Notes on the intersection lane configurations / signalization needs for the project opening year are also included here based on the preliminary 2017 Build traffic analysis results.

NC 210 (From US 17 to south of Old Folkstone Road)

- Construct road widening as needed to provide a raised median and two through lanes in each direction.

US 17 at NC 210

- Convert the full movement intersection into a Green-T intersection to allow free flow for the southbound through movement on US 17.
- Construct an inside southbound acceleration lane on US 17 between NC 210 and the Dixon High School Entrance with a minimum of 1200 ft. acceleration length.
- Construct a westbound left turn lane with a 400 ft. storage and appropriate taper and deceleration length.
- Signal upgrades to accommodate the propose Green-T intersection configuration.

US 17 at USMC Access Road

- Construct a northbound U-turn bulb-out on US 17 north of NC 210. The existing 250 ft. U-turn lane may be lengthened as needed.

Note: The US 17 / USMC Access Road intersection is not included in the traffic study. It is expected that this U-turn movement is needed to maintain access for the Shell gas station located in the northeast quadrant of the US 17 / NC 210 intersection.

US 17 at Dixon High School Entrance

- Install a raised median on US 17 and restrict the Dixon High School Entrance to right in / right out. Reroute the left-turn movements to / from the Dixon High School Entrance on US 17 to the Dixon High School Entrance on NC 210.

NC 210 at Dixon High School Entrance – Superstreet

- Construct a westbound left turn lane with 275 ft. storage (existing) and appropriate taper and deceleration length.
- Construct an eastbound right turn lane with 100 ft. storage (existing) and appropriate taper and deceleration length.

NC 210 at Dixon Road - Superstreet

- Construct a westbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct an eastbound U-turn bulb-out to accommodate the existing left-turn movements from Dixon High School Entrance. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

Dixon Road U-Turn

- Construct an eastbound U-turn bulb-out on NC 210 approximately 750 ft. east of Dixon Road. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at USMC Access Road - Superstreet

- Provide an eastbound left turn lane with appropriate storage (200 ft. min), taper, and deceleration length.
- Construct a westbound U-turn bulb-out approximately 800 ft. west of the USMC Access Road to accommodate the left-turn movements from USMC Access Road. The proposed U-turn lane shall have a minimum of 200 ft. of storage, and appropriate taper and deceleration length.

Note: The NC 210 / USMC Access Road intersection is not included in the traffic study. It is expected that the proposed improvements are needed to maintained access to the USMC facilities.

NC 210 at USMC Base Entrance

- Construct a northbound U-turn lane with 300 ft. storage and appropriate taper and deceleration length.
- Construct northbound dual right turn lanes with 300 ft. storage (existing) and deceleration length.
- Construct southbound dual left turn lanes with 500 ft. storage (existing) and deceleration length.
- Signal upgrades to accommodate the proposed roadway widening.

NC 210 at USMC Secondary Base Entrance / Manchester Lane- Superstreet

- Install raised median on US 17 and restrict the left turn movements from the side streets. Reroute the left-turn movement from the USMC Secondary Base Entrance to make a U-turn at the adjacent intersection (NC 210 at USMC Base Entrance).
- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with a 100 ft. storage and appropriate taper and deceleration length.

Manchester Lane U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 1,000 ft. south of USMC Secondary Base Entrance / Manchester Lane. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at Betty Dixon Road (SR 1671) - Superstreet

- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 275 ft. storage (existing) and appropriate taper and deceleration length.
- Provide dual westbound right turn lanes with 175 ft. storage (existing, outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Betty Dixon Road (SR 1671) U-Turn

- Construct a northbound U-turn bulb-out on NC 210 approximately 1,100 ft. north of Betty Dixon Road. The proposed U-turn lane shall have a minimum of 350 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

Note: This U-turn intersection may not require signal control in the project opening year, based on preliminary 2017 Build traffic analysis.

NC 210 at Beaufort Drive

- Construct a northbound U-turn bulb-out to accommodate the existing left-turn movements from Quarters Landing Circle. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 150 ft. storage (existing) and appropriate taper and deceleration length.

NC 210 at Quarters Landing Circle / Village Drive - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.

- Construct a northbound right turn lane with 175 ft. storage (existing) and appropriate taper and deceleration length.
- Construct a southbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.

Note: This intersection should be monitored for potential signalization needs.

Village Drive U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 800 ft. south of Village Drive. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at NC 172

- Construct an eastbound left turn lane with approximately 400 ft. storage and appropriate taper and deceleration length.
- Construct a second eastbound through lane with a min. of 400 ft. storage and appropriate taper.
- Construct an eastbound right turn lane with approximately of 400 ft. storage and appropriate taper and deceleration length.
- Construct dual westbound left turn lanes with 400 ft. storage and appropriate taper and deceleration length.
- Construct dual westbound right turn lanes with 450 ft. storage and appropriate taper and deceleration length.
- Construct a northbound left turn lane with 450 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 450 ft. storage and appropriate taper and deceleration length.
- Construct dual southbound left turn lane with 700 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with 350 ft. storage and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed roadway widening.

NC 210 at Ridge Field Avenue - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. (350 ft. existing) storage and appropriate taper and deceleration length.
- Provide dual eastbound right turn lanes with 425 ft. storage (existing, outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Ridge Field Avenue U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 900 ft. south of Ridge Field Avenue. The proposed U-turn lane shall have a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

- *Note: This U-turn intersection may not require signal control in the project opening year, based on preliminary 2017 Build traffic analysis.*

NC 210 at Pebble Shore Drive - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a southbound right turn lane with 150 ft. storage (existing) and appropriate taper and deceleration length.

Pebble Shore Drive U-Turn

- Construct a southbound U-turn bulb-out on NC 210 approximately 1,100 ft. south of Pebble Shore Drive. The proposed U-turn lane shall have a minimum of 200 ft. storage and appropriate taper and deceleration length.

NC 210 at Old Folkstone Road - Superstreet

- Construct a northbound left turn lane with a minimum of 250 ft. storage and appropriate taper and deceleration length.
- Construct a northbound right turn lane with 400 ft. storage and appropriate taper and deceleration length.
- Construct dual southbound left turn lanes with 250 ft. storage and appropriate taper and deceleration length. Also construct a second eastbound receiving lane of sufficient length (2,000 ft. or otherwise determined by NCDOT) on Old Folkstone Road.
- Construct a southbound right turn lane with 400 ft. storage and appropriate taper and deceleration length.
- Provide dual eastbound right turn lanes with 350 ft. storage (outside lane only) and appropriate taper and deceleration length.
- Provide dual westbound right turn lanes with 350 ft. storage (outside lane only) and appropriate taper and deceleration length.
- Signal upgrades to accommodate the proposed superstreet intersection configuration.

Old Folkstone Road Northbound U-Turn

- Construct dual northbound U-turn lanes on NC 210 a minimum of 900 ft. north of Old Folkstone Road. The proposed U-turn lanes shall have a minimum of 350 ft. storage and appropriate taper and deceleration length.
- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

Note: This U-turn intersection may only require a single U-turn lane with stop sign control in the project opening year, based on preliminary 2017 Build traffic analysis.

Old Folkstone Road Southbound U-Turn

- Construct dual southbound U-turn lanes on NC 210 a minimum of 900 ft. south of Old Folkstone Road. The proposed U-turn lane shall have a minimum of 300 ft. storage and appropriate taper and deceleration length.
- Drop the inside southbound through lane as a U-turn lane.

- Install a new actuated traffic signal, if approved by NCDOT. Signal warrant analysis shall be prepared prior to the signal installation.

Note: This U-turn intersection may only require a single U-turn lane with stop sign control in the project opening year, based on preliminary 2017 Build traffic analysis.

The proposed improvements are expected to provide adequate capacity and acceptable LOS for the future design year 2040. The traffic capacity analysis results, and queue analysis results for each of the analysis scenarios are summarized in **Tables 15, and 16** on the following pages**,** respectively**.** The lane configurations and preliminary LOS / delay analysis results for the other 2040 Build improvement alternatives can be found in **Appendix F**.

Table 15: LOS Analysis Summary

Intersection	Approach		No Build (2017)				No Build (2040)			
			AM		PM		AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**14.2**	**B**	**13.1**	**B**	**25.1**	**C**	**21.1**	**C**
		WB - NC 210	12.9	B	12.0	B	29.4	C	21.6	C
		NB - US 17	18.3	B	19.4	B	29.4	C	28.5	C
		SB - US 17	10.8	B	10.2	B	18.9	B	16.6	B
NC 210 @ Dixon High School Entrance	unsignalized	WB - NC 210	0.3	A	0.1	A	0.6	A	0.1	A
		NB - Dixon High School Entrance	25.1	D	26.0	D	**	F	**	F
NC 210 @ Dixon Rd	unsignalized	WB - NC 210	0.7	A	0.6	A	1.2	A	0.8	A
		NB - Dixon Rd	26.6	D	23.3	C	**	F	25.1	D
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**14.5**	**B**	**17.1**	**B**	**29.5**	**C**	**34.4**	**C**
		WB - Rifle Range Rd/USMC Entr.	17.4	B	17.6	B	29.4	C	41.3	D
		NB - NC 210	17.9	B	23.4	C	34.6	C	45.9	D
		SB - NC 210	11.1	B	10.3	B	25.1	C	15.9	B
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB - Manchester Ln	24.3	C	33.7	D	**	F	**	F
		WB - USMC Secondary Entr.	28.6	D	24.3	C	**	F	**	F
		NB - NC 210	0.0	A	0.1	A	0.1	A	0.2	A
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**14.5**	**B**	**12.7**	**B**	**105.8**	**F**	**53.4**	**D**
		WB - Betty Dixon Rd	21.3	C	19.7	B	175.2	F	84.9	F
		NB - NC 210	9.0	A	8.0	A	104.5	F	33.6	C
		SB - NC 210	19.4	B	13.5	B	69.8	E	55.7	E
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	17.4	C	12.7	B	64.3	F	22.3	C
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB - Village Dr	46.9	E	45.3	E	**	F	**	F
		WB - Quarters Landing Cir	190.3	F	110.7	F	**	F	**	F
		NB - NC 210	0.5	A	0.6	A	0.7	A	1.2	A
		SB - NC 210	0.1	A	0.2	A	0.1	A	0.2	A
NC 210 @ NC 172	signalized	**Intersection Average**	**41.8**	**D**	**39.3**	**D**	**174.5**	**F**	**160.6**	**F**
		EB - NC 172	48.7	D	49.3	D	261.5	F	245.0	F
		WB - NC 172	30.9	C	31.0	C	135.5	F	123.7	F
		NB - NC 210	47.7	D	40.6	D	185.9	F	103.7	F
		SB - NC 210	42.2	D	43.1	D	143.8	F	199.9	F
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**12.0**	**B**	**12.4**	**B**	**46.4**	**D**	**44.4**	**D**
		EB - Ridge Field Ave / Dixon Middle School Entrance	19.5	B	25.4	C	80.5	F	103.3	F
		NB - NC 210	8.5	A	4.2	A	53.9	D	14.6	B
		SB - NC 210	14.6	B	15.2	B	25.3	C	51.8	D
NC 210 @ Pebble Shore Dr	unsignalized	NB - NC 210	0.2	A	0.3	A	0.2	A	0.5	A
NC 210 @ Old Folkstone Rd	signalized	**Intersection Average**	**15.0**	**B**	**14.3**	**B**	**93.9**	**F**	**83.1**	**F**
		EB - Old Folkstone Rd	17.2	B	16.3	B	98.7	F	79.5	E
		WB - Old Folkstone Rd	13.8	B	16.1	B	91.9	F	68.0	E
		NB - NC 210	13.8	B	11.8	B	104.7	F	96.9	F
		SB - NC 210	15.4	B	13.7	B	83.2	F	89.7	F
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	28.2	D	20.0	C	**	F	**	F
		SB - US 17	1.6	A	0.5	A	3.7	A	0.6	A

Unacceptable Delay/LOS
** Delay exceeds 300 seconds

Table 15: LOS Analysis Summary (Continued)

Intersection	Approach		Build Alternative G-1 (2040)				Build Alternative G-2 (2040)			
			AM		PM		AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
US 17 @ NC 210	signalized	**Intersection Average**	**37.9**	**D**	**22.1**	**C**	**38.0**	**D**	**23.1**	**C**
		WB - NC 210	42.4	D	26.2	C	35.5	D	19.0	B
		NB - US 17	41.9	D	34.6	C	46.1	D	43.6	D
		SB - US 17	32.0	C	12.8	B	30.9	C	13.8	B
US 17 SB "On Ramp"	free flow	SB - US 17	*11.4	A	*17.7	B	*11.4	A	*17.7	B
NC 210 @ Dixon High School Entrance	G-1 unsignalized / G-2 signalized	**Intersection Average**	**--**	**--**	**--**	**--**	**10.5**	**B**	**8.1**	**A**
		EB - NC 210	--	--	--	--	8.8	A	4.7	A
		WB - NC 210	--	--	--	--	7.0	A	6.5	A
		WBL - NC 210	57.4 (20.1)	F (C)	21.8 (12.3)	C (B)	--	--	--	--
		NB - Dixon High School Entrance	26.0	D	16.3	B	53.6	D	39.9	D
Dixon High School (EB U-Turn)	unsignalized	EB - U-Turn	15.6	C	24.7	C	--	--	--	--
NC 210 @ Dixon Rd	unsignalized	WBL - NC 210	110.4 (20.2)	F(C)	35.9 (13.5)	E (C)	110.4 (23.7)	F(C)	35.9 (13.5)	E (B)
		NB - Dixon Rd	23.6	C	14.5	B	23.6	C	14.5	B
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	13.2	B	17.6	C	13.2	B	17.6	C
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	**Intersection Average**	**19.8**	**B**	**25.3**	**C**	**19.8**	**B**	**25.3**	**C**
		WB - Rifle Range Rd/USMC Entr.	37.3	D	40.6	D	37.3	D	40.6	D
		NB - NC 210	12.6	B	19.2	B	12.6	B	19.2	B
		SB - NC 210	22.7	C	17.7	B	22.7	C	17.7	B
NC 210 @ USMC Base Secondary Entrance	unsignalized	WB - USMC Secondary Entrance	16.5	C	13.4	B	16.5	C	13.4	B
		SBL - NC 210	34.6 (18.6)	D (C)	24.7 (12.1)	C (B)	34.6 (28.6)	D (D)	24.7 (12.7)	C (B)
NC 210 @ Manchester Ln	unsignalized	EB - Manchester Ln	14.0	B	16.0	C	14.0	B	16.0	C
		NBL - NC 210	26.5 (13.6)	D (B)	40.0 (15.8)	E (C)	26.5 (14.6)	D (C)	40.0 (15.9)	E (C)
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	15.6	C	13.9	B	15.6	C	13.9	B
NC 210 @ Betty Dixon Rd	signalized	**Intersection Average**	**31.3**	**C**	**15.0**	**B**	**31.3**	**C**	**15.0**	**B**
		WB - Betty Dixon Rd	44.9	D	15.8	B	44.9	D	15.8	B
		NB - NC 210	25.3	C	14.9	B	25.3	C	14.9	B
		SBL - NC 210	38.1	D	12.1	B	38.1	D	12.1	B
Betty Dixon Rd (NB U-Turn)	signalized	**Intersection Average**	**18.8**	**B**	**18.8**	**B**	**18.8**	**B**	**18.8**	**B**
		NB - U-Turn	21.5	C	33.6	C	21.5	C	33.6	C
		SB - NC 210	17.7	B	14.6	B	17.7	B	14.6	B
NC 210 @ Beaufort Dr	unsignalized	WB - Beaufort Dr	21.1	C	13.8	B	21.1	C	13.8	B
NC 210 @ Quarters Landing Circle	unsignalized	WB - Quarters Landing Cir	30.7	D	14.5	B	30.7	D	14.5	B
		SBL - NC 210	62.0 (35.0)	F (D)	29 (15.5)	D (D)	62.0 (39.8)	F (E)	29.0 (15.0)	D (B)
NC 210 @ Village Dr	unsignalized	EB - Village Dr	17.6	C	37.0	E	17.6	C	37.0	E
		NBL - NC 210	76.1 (15.1)	F (C)	298.6 (33.0)	F (D)	76.1 (16.4)	F (C)	298.6 (26.2)	F (C)
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	16.1	C	22.1	C	16.1	C	22.1	C
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.5	C	15.3	C	22.5	C	15.3	C
NC 210 @ NC 172	signalized	**Intersection Average**	**49.5**	**D**	**48.2**	**D**	**49.5**	**D**	**48.2**	**D**
		EB - NC 172	75.8	E	51.6	D	75.8	E	51.6	D
		WB - NC 172	51.5	D	43.5	D	51.5	D	43.5	D
		NB - NC 210	42.4	D	49.3	D	42.4	D	49.3	D
		SB - NC 210	40.2	D	50.4	D	40.2	D	50.4	D
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	**Intersection Average**	**10.9**	**B**	**20.4**	**C**	**10.9**	**B**	**20.4**	**C**
		EB - Ridge Field Ave / Dixon Middle School Entrance	21.2	C	25.6	C	21.2	C	25.6	C
		NBL - NC 210	10.3	B	19.2	B	10.3	B	19.2	B
		SB - NC 210	7.7	A	19.4	B	7.7	A	19.4	B
Ridge Field Ave (SB U-Turn)	signalized	**Intersection Average**	**15.5**	**B**	**6.8**	**A**	**15.5**	**B**	**6.8**	**A**
		NB - NC 210	12.1	B	6.2	A	12.1	B	6.2	A
		SB - U-Turn	36.0	D	10.3	B	36.0	D	10.3	B
NC 210 @ Pebble Shore Dr	unsignalized	EB - Pebble Shore Dr	15.5	C	20.7	C	15.5	C	20.7	C
		NBL - NC 210	24 (14.0)	C (B)	55.3 (22.6)	F (C)	24 (12.9)	C (B)	55.3 (21.7)	F (C)
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	22.6	C	14.0	B	22.6	C	14.0	B
SB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.1**	**B**	**15.5**	**B**	**14.1**	**B**	**15.5**	**B**
		EB - Old Folkstone Rd	8.8	A	9.3	A	8.8	A	9.3	A
		NBL - NC 210	25.4	C	26.1	C	25.4	C	26.1	C
		SB - NC 210	16.3	B	17.0	B	16.3	B	17.0	B
NB NC 210 @ Old Folkstone Rd	signalized (superstreet)	**Intersection Average**	**14.9**	**B**	**14.5**	**B**	**14.9**	**B**	**14.5**	**B**
		WB - Old Folkstone Rd	20.0	C	16.8	B	20.0	C	16.8	B
		NB - NC 210	12.7	B	15.5	B	12.7	B	15.5	B
		SBL - NC 210	12.2	B	8.2	A	12.2	B	8.2	A
Old Folkstone Rd (NB U-Turn)	signalized	**Intersection Average**	**8.8**	**A**	**9.2**	**A**	**8.8**	**A**	**9.2**	**A**
		NB - U-Turn	20.4	C	21.0	B	20.4	C	21.0	B
		SB - NC 210	5.4	A	5.1	A	5.4	A	5.1	A
Old Folkstone Rd (SB U-Turn)	signalized	**Intersection Average**	**23.8**	**C**	**16.6**	**B**	**23.8**	**C**	**16.6**	**B**
		NB - NC 210	20.3	C	12.0	B	20.3	C	12.0	B
		SB - U-Turn	28.4	C	23.3	C	28.4	C	23.3	C
US 17 @ Dixon High School Entrance	unsignalized	WB - Dixon High School Entr.	29.0 (11.5)	D (B)	14.8 (5.7)	B (A)	29.0 (11.0)	D (B)	14.8 (5.4)	B (A)

Unacceptable Delay/LOS

(XX): Simulation Delay and LOS Results

* Average Density (D), pc/mi/ln

Table 16: Queue Analysis Summary

Intersection	Turn Lane		Storage Length (ft)	No Build (2017)				No Build (2040)			
				AM		PM		AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300	69	109	101	146	#163	147	217	193
		WBR	400	68	97	67	110	171	146	200	150
		NBR	300	94	42	57	--	141	400*	87	31
		NBU	300	8	30	8	32	7	73	8	32
		SBL	400	121	184	89	163	#281	280	198	203
NC 210 @ Dixon High School Entrance	unsignalized	WBL	275	2	38	--	29	6	61	2	32
		NB	--	8	38	10	58	92	107	126	195
NC 210 @ Dixon Rd	unsignalized	WBTL	--	4	208	4	156	14	1656	12	1332
		NB	--	26	86	18	78	254	1000	32	842
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	35	76	82	131	72	119	#231	315
		WBR	375	33	81	102	145	64	91	240	246
		NBR	300	59	92	23	146	123	500	46	500
		SBL	500	116	132	47	57	#272	189	90	172
NC 210 @ USMC Base Secondary Entrance / Manchester Ln	unsignalized	EB	--	6	57	8	40	78	88	76	107
		WBR	275	10	21	4	21	2	21	2	25
		NBL	175	--	14	--	23	--	24	--	72
		SBL	200	--	17	--	15	--	24	--	75
NC 210 @ Betty Dixon Rd	signalized	WBL	--	72	130	134	162	336	757	#575	1985
		WBR	175	49	83	69	105	243	274	250	275
		NBR	275	--	65	--	56	164	375	50	375
		SBL	175	38	122	32	160	311	275	#288	275
NC 210 @ Beaufort Dr	unsignalized	WBR	--	6	20	2	5	42	56	10	39
NC 210 @ Quarters Landing Circle / Village Dr	unsignalized	EB	--	38	94	46	100	--	1100	--	1099
		WBL	50	94	103	42	69	26	150	54	148
		WBTR	--	8	68	4	38	--	1007	--	998
		NBL	--	4	--	2	--	14	--	18	--
		NBR	175	--	--	--	4	--	165	--	275
		SBL	150	--	25	2	29	2	227	4	249
NC 210 @ NC 172	signalized	EBL	400 (TWLT)	83	174	52	59	#314	500	#228	500
		WBL	200 (TWLT)	#150	183	#240	211	#709	300	#1031	300
		WBR	450	356	247	274	190	#1129	550	698	550
		NBL	300 (TWLT)	100	400	#115	150	#300	400	#383	400
		NBR	150	234	250	165	249	657	250	459	250
		SBL	400	#210	200	214	599	#589	600	#608	600
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBL	--	49	88	85	88	141	245	#345	733
		EBR	425	21	52	58	75	62	114	210	422
		NBL	350	20	73	10	58	140	450	#175	416
		SBR	350	17	61	15	54	39	117	22	409
NC 210 @ Pebble Shore Dr	unsignalized	EB	--	26	67	16	66	308	986	198	147
		NBL	225	--	33	2	31	2	324	6	131
		SBR	150	--	--	--	--	--	--	--	--
NC 210 @ Old Folkstone Rd	signalized	EBLT	--	159	276	118	191	#596	--	#360	--
		EBL	250 (TWLT)	--	--	--	--	#533	350	#360	349
		EBR	150	69	206	72	149	225	250	203	250
		WBTL	--	84	158	122	260	#516	--	#549	--
		WBL	250 (TWLT)	--	--	--	--	#220	350	#209	350
		WBR	50	94	143	103	150	592	150	434	150
		NBL	150	64	125	69	152	#358	250	#350	250
		SBL	100	108	187	82	155	#848	200	#670	200
US 17 @ Dixon High School Entrance	unsignalized	WBL	--	38	67	22	74	316	968	162	981
		WBR	125	10	46	4	54	58	225	18	225
		NBR	275	--	6	--	2	--	19	--	10
		NBU	275	--	19	--	27	--	27	2	25
		SBL	275	8	54	2	62	56	242	10	98

Queue length greater than storage length

#: volume exceeds capacity

Table 16: Queue Analysis Summary (Continued)

Intersection	Turn Lane		Storage Length {Future Storage} (ft)	Build Alternative G-1 (2040)				Build Alternative G-2 (2040)			
				AM		PM		AM		PM	
				95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)	95th% Queue (ft)	Max Queue (ft)
US 17 @ NC 210	signalized	WBL	300 {400}	#218	259	#356	306	#225	296	#324	338
		WBR	Lane Drop	160	183	184	184	143	190	115	156
		NBR	300	157	*400	97	263	187	*400	102	*400
		SBL	400	#345	318	#257	229	#396	374	#257	302
NC 210 @ Dixon High School Entrance	G-1 unsignalized / G-2 signalized	EBR	100	--	--	--	--	9	188	m7	41
		WBL	275	32	54	4	36	35	70	24	54
		NBR	--	50	95	32	115	--	--	--	--
		NBLR	--	--	--	--	--	88	148	144	186
Dixon High School (EB U-Turn)	unsignalized	EB - U-Turn	{200}	24	57	44	92	--	--	--	--
NC 210 @ Dixon Rd	unsignalized	WBL	-- {250}	88	102	52	99	88	112	52	90
		NBR	--	38	115	16	98	38	123	16	79
Dixon Rd (EB U-Turn)	unsignalized	EB - U-Turn	{200}	2	31	4	38	2	42	4	39
NC 210 @ Rifle Rd / USMC Base Entrance	signalized	WBL	--	93	104	219	241	93	112	219	246
		WBR	375	68	86	230	264	68	81	230	238
		NBU	-- {300}	m52	92	32	52	m52	99	32	64
		NBR	300	m93	186	61	98	m93	175	61	88
		SBL	500	262	259	101	128	258	270	98	140
NC 210 @ USMC Base Secondary Entrance	unsignalized	WBR	--	10	67	2	48	10	72	2	43
		SBL	{250}	2	27	2	31	2	31	2	28
NC 210 @ Manchester Ln	unsignalized	EBR	--	4	50	6	49	4	52	6	51
		NBL	175 {250}	4	37	12	53	4	34	12	48
		SBR	-- {100}	--	--	--	2	--	--	--	--
Manchester Ln (SB U-Turn)	unsignalized	SB - U-Turn	{200}	2	--	2	--	2	--	2	--
NC 210 @ Betty Dixon Rd	signalized	WBR	Dual 175	175	253	160	203	175	*270	160	*201
		NBR	275	253	*321	105	163	253	*310	105	151
		SBL	175 {250}	168	237	78	130	168	246	78	119
Betty Dixon Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	99	135	#278	274	99	174	#278	292
NC 210 @ Beaufort Dr	unsignalized	WBR	--	--	47	--	29	--	41	--	26
		NBR	250	14	--	6	--	14	--	6	--
NC 210 @ Quarters Landing Circle	unsignalized	WBR	--	50	210	10	71	50	241	10	77
		NBR	175	--	2	--	24	--	7	--	23
		SBL	150 {250}	10	37	12	49	10	42	12	56
NC 210 @ Village Dr	unsignalized	EBR	--	24	97	68	186	24	92	68	161
		NBL	{250}	94	96	138	101	94	102	138	118
		SBTR	--	--	11	--	20	--	13	--	6
Quarters Landing (NB U-Turn)	unsignlized	NB - U-Turn	{200}	18	93	14	72	18	80	14	63
Village Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	10	61	6	52	10	58	6	48
NC 210 @ NC 172	signalized	EBL	{Dual 400} (TWLT)	#258	309	#146	122	#258	253	#146	131
		EBR	450 {Dual}	158	190	161	119	158	172	161	116
		WBL	200 {400}	186	263	239	298	186	174	239	337
		WBR	{400}	311	272	183	109	311	184	183	266
		NBL	300 {450}	m148	430	#236	445	m148	*515	#236	352
		NBR	150 {450}	m412	*530	221	450	m412	*631	221	320
		SBL	400 {700}	#320	494	337	473	#320	458	337	383
		SBR	-- {350}	64	78	131	339	64	103	131	387
NC 210 @ Ridge Field Ave / Dixon Middle School Entrance	signalized	EBR	Dual 425	52	151	104	176	52	157	104	187
		NBL	350 {250}	m30	141	m33	96	m30	144	m33	99
		SBR	350	65	117	m57	128	65	114	m57	111
Ridge Field Ave (SB U-Turn)	signalized	SB - U-Turn	{250}	100	157	0	184	100	181	0	192
NC 210 @ Pebble Shore Dr	unsignalized	EBR	--	26	90	26	96	26	107	26	90
		NBL	225 {250}	12	58	28	71	12	190	28	65
		SBR	150	--	13	--	19	--	16	--	21
Pebble Shore Dr (SB U-Turn)	unsignalized	SB - U-Turn	{200}	32	117	10	64	32	108	10	74
SB NC 210 @ Old Folkstone Rd	signalized	EBR	Dual {350}	139	176	112	162	139	175	112	162
		NBL	{250}	125	163	#146	182	125	160	#146	165
		SBR	{400}	156	216	226	313	156	225	226	302
NB NC 210 @ Old Folkstone Rd	signalized	WBR	Dual {350}	#223	218	235	230	#223	227	235	236
		NBR	{400}	m129	336	120	239	m129	326	120	240
		SBL	{250}	60	119	82	144	60	119	82	151
Old Folkstone Rd (NB U-Turn)	signalized	NB - U-Turn	{350}	m78	172	m101	242	m78	178	m101	214
Old Folkstone Rd (SB U-Turn)	signalized	SB - U-Turn	{300}	#194	205	125	171	#194	215	125	186
US 17 @ Dixon High School Entrance	unsignalized	WBR	--	136	100	230	90	58	87	230	75
		NBR	275	--	--	33	--	--	--	33	--

Queue length greater than storage length

#: volume exceeds capacity

m: queue is metered by upstream signal

*: no/little storage blockage time/spillback