Stantec Consulting Services Inc.
801 Jones Franklin Road, Suite 300
Raleigh, North Carolina 27606-3563

September 21, 2020

File: 171002240

Attention: Mr. Chuck Edwards, PE, District Engineer

NCDOT Division 7, District 1
115 East Crescent Square Drive
P. O. Box 766
Graham, NC 27253

Dear Mr. Edwards,

Reference: Research Triangle Logistics Park TIA Supplement

Stantec has produced this supplemental traffic analysis at the request of Orange County. This analysis corresponds to a change in access to the proposed Research Triangle Logistics Park (RTLP) development located off of Old NC 86 near Interstate 40 in Orange County, NC. This supplement builds upon the original traffic impact analysis (TIA) dated June 4, 2020 as well as the supplement dated August 5, 2020.

Revised Access

Stantec has been requested to evaluate access to the site being provided by one full-movement access point onto SR 1009 (Old NC 86) at the Service Road. The access onto SR 1129 (Davis Road) will be restricted to emergency vehicles only.

Traffic Volume Development

Trip percent assignment and build traffic volume calculations have been revised assuming all traffic enters and exits the development from the Service Road. Revised traffic volume calculations, trip distribution, trip assignment, and build traffic volumes figures can be found in the attachments.

Capacity Analysis

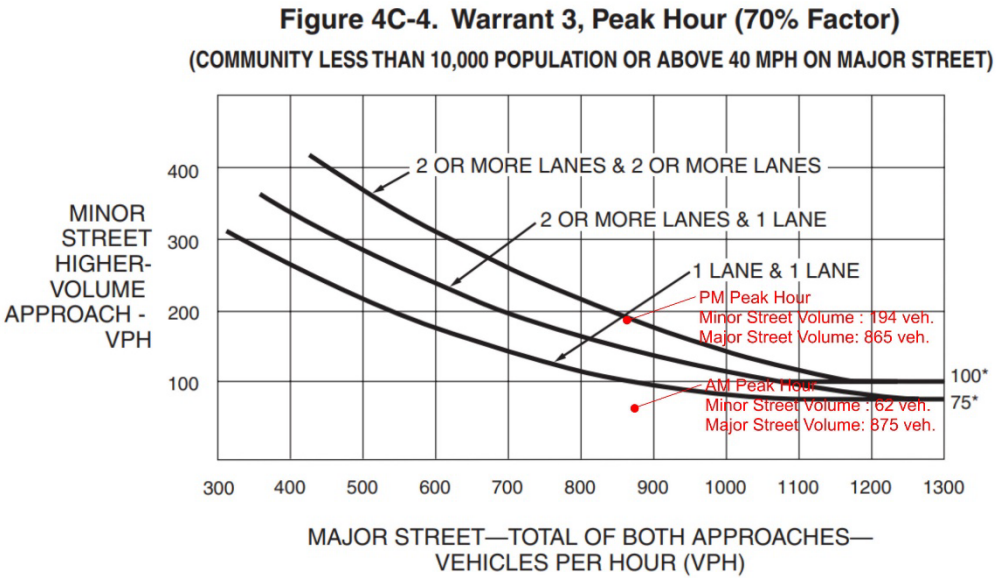
An updated traffic analysis has been performed and is included in the attachments. The results of the analysis show that with the recommended improvements in place, all study intersections operate with acceptable levels of service. These results are summarized in Table 1. SimTraffic simulations show that queues do not reach adjacent intersections between the signalized intersections of Old NC 86 at the I-40 eastbound ramps and Old NC 86 at the Service Road. Synchro printouts and SimTraffic queuing and blocking reports can be found in the attachments.

A review of the peak hour volumes at the intersection of Old NC 86 and the Service Road determined the PM peak hour volumes met the criteria for installation of a traffic signal as discussed in the Manual on Uniform Traffic Control Devices (MUTCD). This is shown in Figure 1.

Table 1: Level of Service Summary

Intersection	Approach	2023 Build-Improved	
		AM Peak LOS (Delay in sec./veh.)	PM Peak LOS (Delay in sec./veh.)
Old NC 86 at I-40 EB Ramps (signalized)	Overall	D (35.6)	C (26.4)
	EB Approach	E (56.8)	E (55.4)
	NB Approach	C (27.2)	C (20.9)
	SB Approach	C (33.6)	C (24.2)
Old NC 86 at Service Road (signalized)	Overall	A (6.5)	B (15.9)
	EB Approach	D (54.1)	D (49.9)
	NB Approach	A (3.8)	A (7.6)
	SB Approach	A (1.9)	A (6.5)
Old NC 86 at Davis Road (stop-controlled)	Overall	A (6.6)	A (2.7)
	EB Approach	D (30.9)	C (22.3)
	NB Left-Turn	A (8.2)	A (8.6)

Figure 1: Peak Hour Warrant



Recommended Improvements

Using this plan for access, the following improvements are recommended:

Old NC 86 at I-40 EB Ramps

- Install a traffic signal
- Construct a second northbound thru-lane
- Construct an exclusive northbound right-turn lane with 250 feet of full-width storage and appropriate taper. The right-turn movement will be channelized and operate under the control of a yield sign.

Old NC 86 at Service Road

- Install a traffic signal
- Construct an exclusive northbound left-turn lane with 100 feet of full-width storage and appropriate taper.
- Construct an exclusive southbound right-turn lane with 100 feet of full-width storage and appropriate taper.
- Construct an exclusive eastbound right-turn lane with 300 feet of full-width storage and appropriate taper.

Due to the revised access, improvements previously discussed at the intersection of Old NC 86 at Davis Road and Davis Road at Access D are no longer warranted. These improvements are illustrated in Figure 2. A conceptual design is provided in Figure 3.

Right of Way

The extensive widening along Old NC 86 between the I-40 EB ramps and the Service Road require right of way to be obtained. The potential areas to be acquired are shown in red on Figure 3. Property lines and aerial imagery were obtained from Orange County's web-based geographic information system (GIS). Additional right of way may be required due to NCDOT comment or differences between topography obtained through GIS versus surveyed field conditions.

Reference: **Research Triangle Logistics Park TIA Supplement**

Figure 2: Recommended Improvements

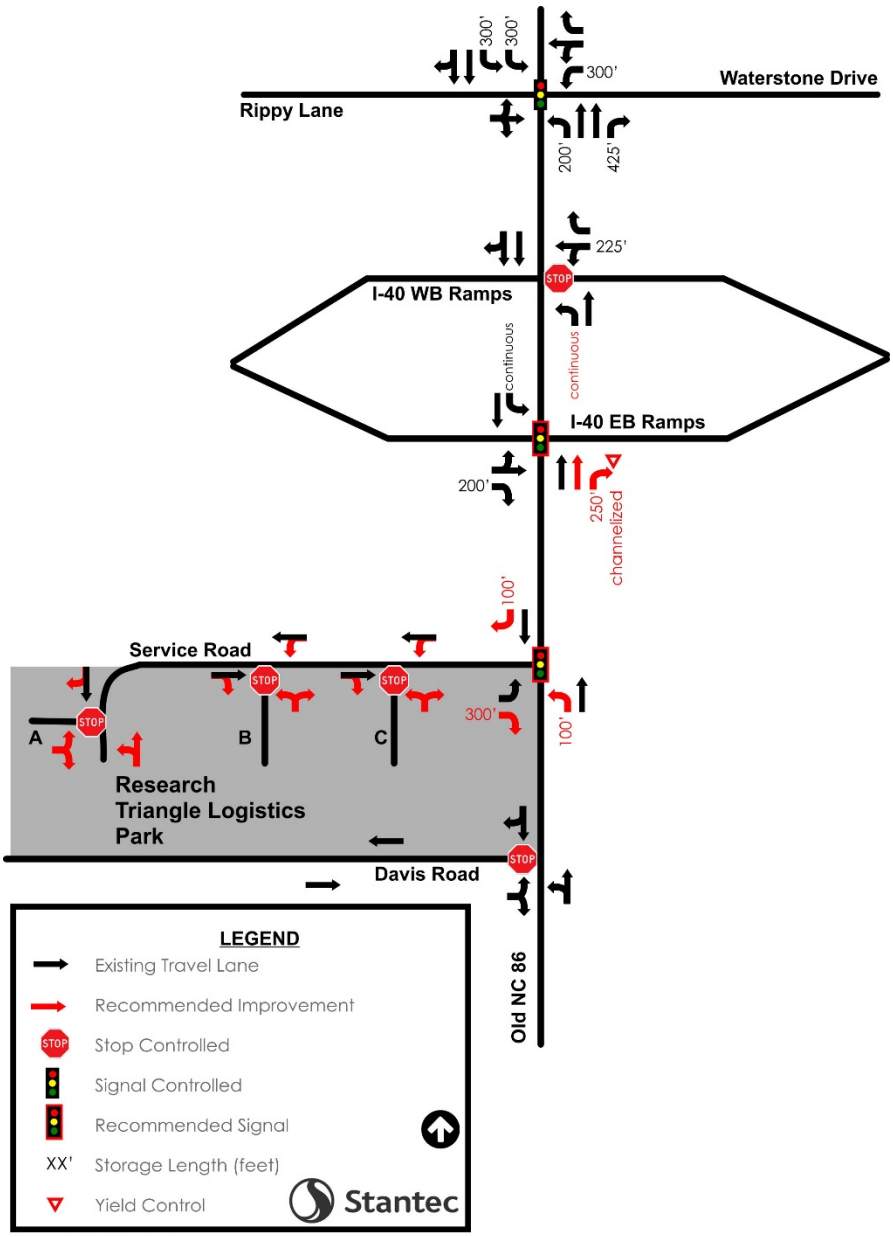
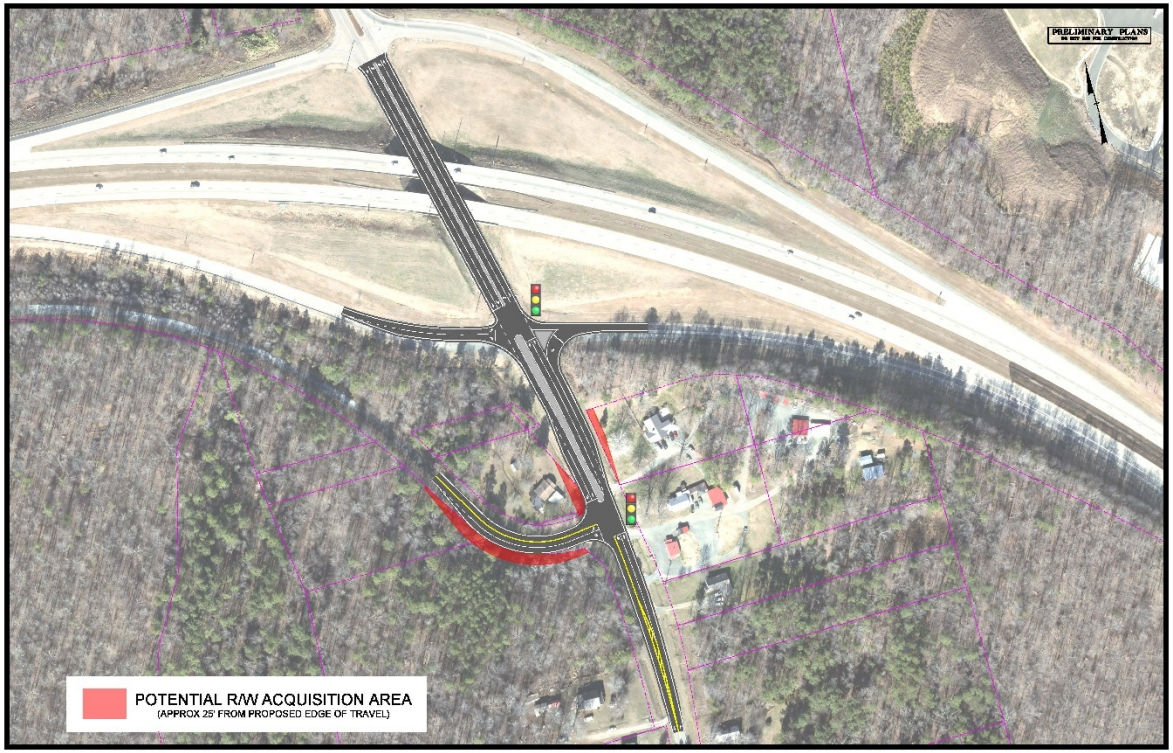


Figure is Not To Scale

Reference: **Research Triangle Logistics Park TIA Supplement**

Figure 3: Conceptual Design



Reference: **Research Triangle Logistics Park TIA Supplement**

Regards,

Stantec Consulting Services, Inc.

Matt Peach, PE, PTOE
Senior Transportation Engineer
Phone: 919-865-7375
Matt.Peach@Stantec.com

Attachement:
1. Traffic Volume Calculations
2. Trip Distribution
3. Site Trip Assignment
4. 2023 Build Traffic Volumes
5. Synchro Reports
6. SimTraffic Queuing and Blocking Reports

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Attachment 1: Traffic Volume Calculations

Research Triangle Logistics Park TIA: Traffic Volume Calculations with Service Road Only

Waterstone Trips

RTLP Site Trips

	Prev. Study Volumes (2016)		Existing (2020)		Historical Growth (2016-2020)		Background (2023)		Historical Growth (2020-2023)		Approved Development Trips		No-Build (2023)		Primary Trip Distribution		Primary Trip Assignment		Build (2023)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 1 - Old NC 86 at Waterstone Drive / Rippy Lane																				
EBL	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
EBT	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
EBR	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
WBL	107	168	111	175	4	7	114	180	3	5	138	208	252	388	5%		12	4	264	392
WBT	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
WBR	150	160	156	166	6	6	161	171	5	5	100	161	261	332			0	0	261	332
NBL	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
NBT	462	567	481	590	19	23	496	608	15	18	36	93	532	701		20%	15	48	547	749
NBR	196	130	204	135	8	5	210	139	6	4	223	175	433	314		5%	4	12	437	326
SBL	212	96	221	100	9	4	228	103	7	3	201	137	429	240			0	0	429	240
SBT	595	515	619	536	24	21	638	552	19	16	54	61	692	613	20%		49	18	741	631
SBR	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
Intersection 2 - Old NC 86 at I-40 WB On/Off Ramps																				
WBL	17	41	18	43	1	2	19	44	1	1	0	0	19	44	30%		74	26	93	70
WBT	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
WBR	294	391	306	407	12	16	315	419	9	12	155	161	470	580			0	0	470	580
NBL	70	79	73	82	3	3	75	84	2	2	0	0	75	84		25%	18	60	93	144
NBT	368	310	383	323	15	13	395	333	12	10	104	107	499	440		25%	18	60	517	500
SBT	671	614	698	639	27	25	719	658	21	19	134	188	853	846	25%		62	22	915	868
SBR	35	73	36	76	1	3	37	78	1	2	58	81	95	159			0	0	95	159
Intersection 3 - Old NC 86 at I-40 EB On/Off Ramps																				
EBL	74	38	77	40	3	2	79	41	2	1	78	80	157	121			0	0	157	121
EBT	4	4	4	4	0	0	4	4	0	0	0	0	4	4			0	0	4	4
EBR	85	41	88	43	3	2	91	44	3	1	0	0	91	44	25%		62	22	153	66
NBT	364	351	379	365	15	14	390	376	11	11	26	27	416	403		50%	37	119	453	522
NBR	72	19	75	20	3	1	77	21	2	1	0	0	77	21		30%	22	71	99	92
SBL	481	327	501	340	20	13	516	350	15	10	115	161	631	511			0	0	631	511
SBT	207	328	215	341	8	13	222	351	7	10	19	27	241	378	55%		136	48	377	426

Stantec Document Classification: Stantec Internal

Research Triangle Logistics Park TIA: Traffic Volume Calculations with Service Road Only

Waterstone Trips | **RTLP Site Trips**

	Prev. Study Volumes (2016)		Existing (2020)		Historical Growth (2016-2020)		Background (2023)		Historical Growth (2020-2023)		Approved Development Trips		No-Build (2023)		Primary Trip Distribution		Primary Trip Assignment		Build (2023)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 4 - Old NC 86 at Service Road																				
EBL	4	4	4	4	0	0	4	4	0	0	0	0	4	4		80%	58	190	62	194
EBR	4	4	4	4	0	0	4	4	0	0	0	0	4	4		20%	15	48	19	52
NBL	4	4	4	4	0	0	4	4	0	0	0	0	4	4	20%		49	18	53	22
NBT	432	366	450	381	18	15	464	393	14	12	26	27	490	420			0	0	494	424
SBT	288	365	300	380	12	15	309	392	9	12	19	27	328	419			0	0	328	419
SBR	4	4	4	4	0	0	4	4	0	0	0	0	4	4	80%		198	70	202	74
Intersection 5 - Old NC 86 at Davis Road																				
EBL	146	62	152	65	6	3	157	67	5	2	0	0	157	67	5%		12	4	173	75
EBR	17	25	18	26	1	1	19	27	1	1	0	0	19	27			0	0	19	27
NBL	26	38	27	40	1	2	28	41	1	1	0	0	28	41			0	0	28	41
NBT	290	308	302	321	12	13	311	331	9	10	26	27	337	358	15%		37	13	374	371
SBT	243	243	253	253	10	10	261	261	8	8	19	27	280	288		15%	11	36	291	324
SBR	49	126	51	131	2	5	53	135	2	4	0	0	53	135		5%	4	12	57	147

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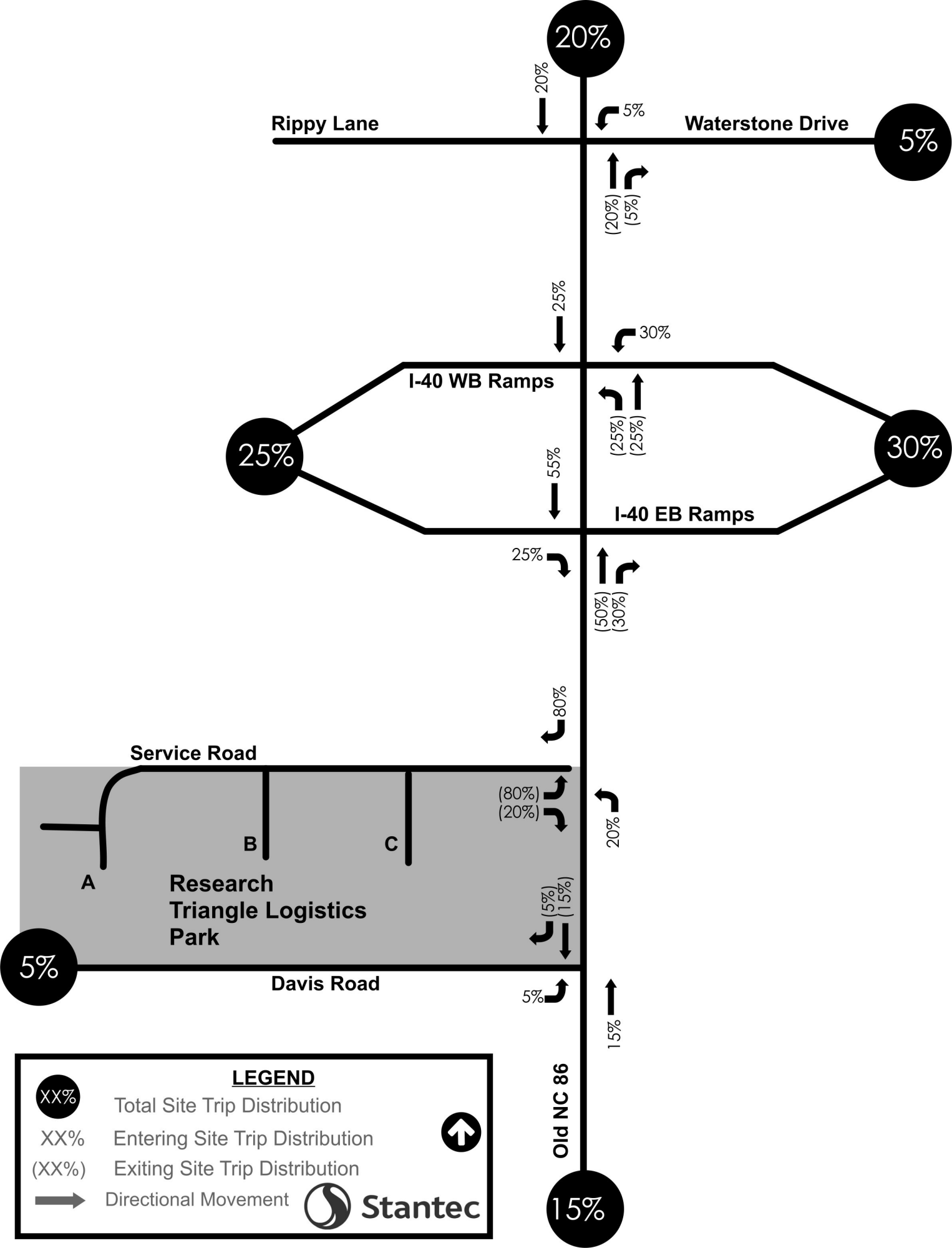
Attachment 2: Trip Distribution


20%
20%
5%
Rippy Lane
Waterstone Drive
5%
(20%)
(5%)
25%
30%
I-40 WB Ramps
(25%)
(25%)
25%
30%
55%
I-40 EB Ramps
25%
(50%)
(30%)
80%
Service Road
(80%)
(20%)
20%
B
C
A
Research
Triangle Logistics
Park
(5%)
(15%)
5%
Davis Road
5%
15%
Old NC 86
15%
LEGEND
XX%
Total Site Trip Distribution
XX%
Entering Site Trip Distribution
(XX%)
Exiting Site Trip Distribution
Directional Movement
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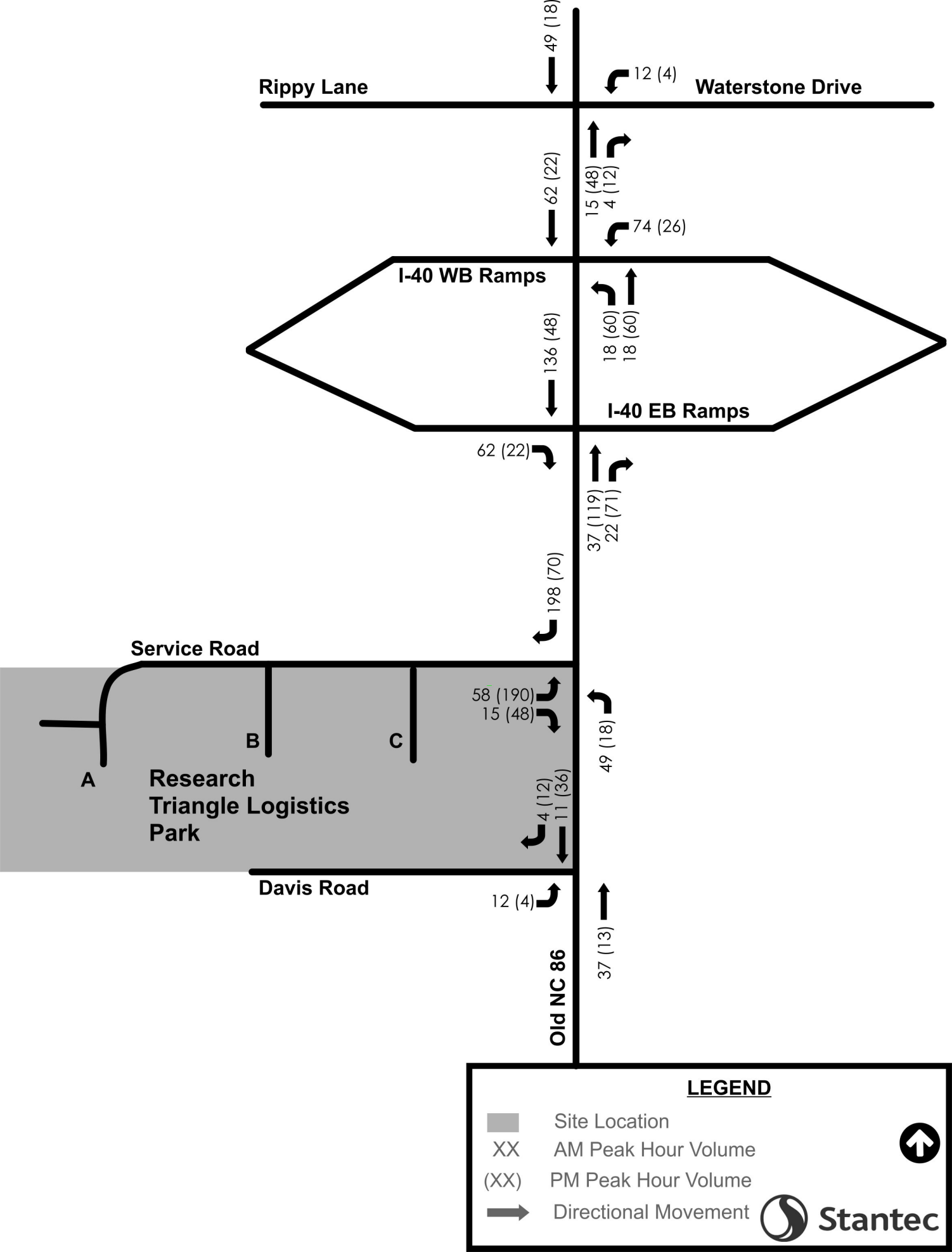
Attachment 3: Site Trip Assignment


Rippy Lane
Waterstone Drive
49 (18)
12 (4)
62 (22)
15 (48)
4 (12)
74 (26)
I-40 WB Ramps
136 (48)
18 (60)
18 (60)
I-40 EB Ramps
62 (22)
37 (119)
22 (71)
198 (70)
Service Road
58 (190)
15 (48)
49 (18)
A
B
C
Research
Triangle Logistics
Park
4 (12)
11 (36)
Davis Road
12 (4)
37 (13)
Old NC 86
LEGEND
Site Location
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume
Directional Movement
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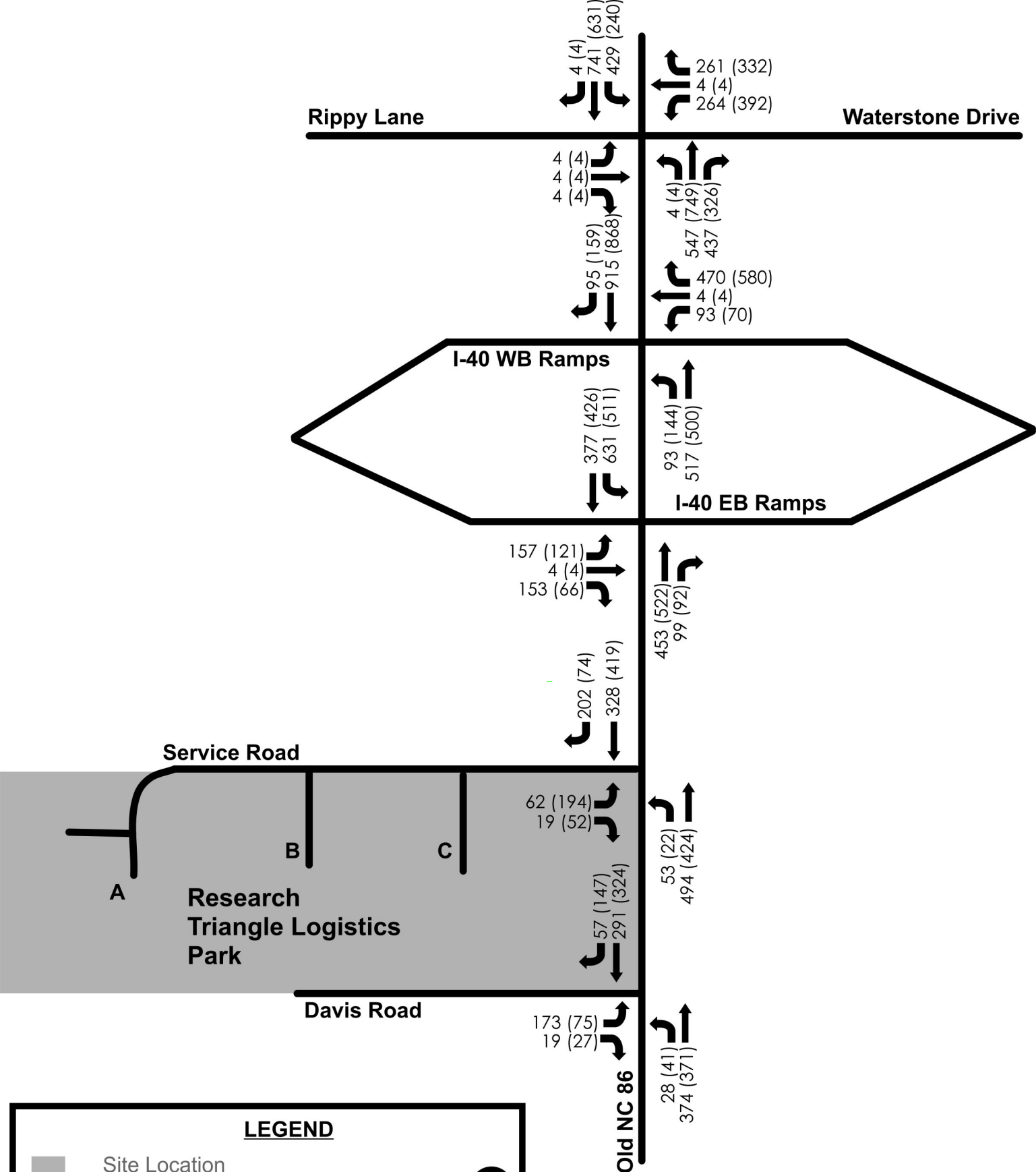
Attachment 4: 2023 Build Traffic Volumes



LEGEND

- Site Location
- XX AM Peak Hour Volume
- (XX) PM Peak Hour Volume
- Directional Movement

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Figure is Not To Scale

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Attachment 5: Synchro Reports

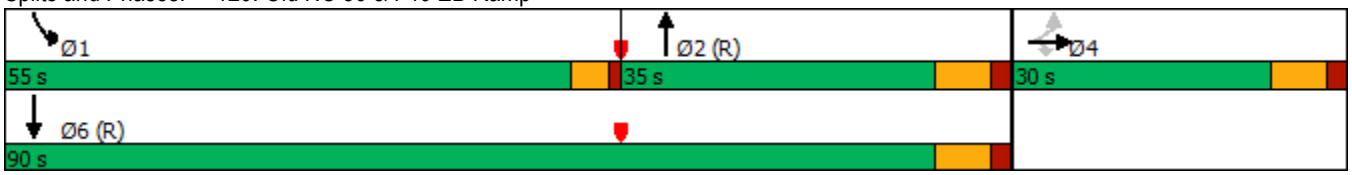
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	157	4	153	0	0	0	0	453	99	631	377	0
Future Volume (vph)	157	4	153	0	0	0	0	453	99	631	377	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		200	0		0	0		250	0		0
Storage Lanes	0		1	0		0	0		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected		0.953								0.950		
Satd. Flow (prot)	0	1775	1583	0	0	0	0	3539	1583	1770	1863	0
Flt Permitted		0.953								0.950		
Satd. Flow (perm)	0	1775	1583	0	0	0	0	3539	1583	1770	1863	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		55			55			45			45	
Link Distance (ft)		1173			557			452			723	
Travel Time (s)		14.5			6.9			6.8			11.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	174	4	170	0	0	0	0	503	110	701	419	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	178	170	0	0	0	0	503	110	701	419	0
Turn Type	Perm	NA	Perm					NA	Free	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						Free			
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					12.0		7.0	12.0	
Minimum Split (s)	25.0	25.0	25.0					25.0		11.5	25.0	
Total Split (s)	30.0	30.0	30.0					35.0		55.0	90.0	
Total Split (%)	25.0%	25.0%	25.0%					29.2%		45.8%	75.0%	
Maximum Green (s)	23.0	23.0	23.0					28.0		50.5	83.0	
Yellow Time (s)	5.0	5.0	5.0					5.0		3.5	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0		1.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0					-2.0		-2.0	-2.0	
Total Lost Time (s)		5.0	5.0					5.0		2.5	5.0	
Lead/Lag								Lag		Lead		
Lead-Lag Optimize?								Yes		Yes		
Vehicle Extension (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Recall Mode	None	None	None					C-Min		None	C-Min	
Walk Time (s)	7.0	7.0	7.0					7.0			7.0	
Flash Dont Walk (s)	11.0	11.0	11.0					11.0			11.0	
Pedestrian Calls (#/hr)	0	0	0					0			0	
Act Effct Green (s)		19.7	19.7					35.4	120.0	52.4	90.3	
Actuated g/C Ratio		0.16	0.16					0.30	1.00	0.44	0.75	
v/c Ratio		0.61	0.66					0.48	0.07	0.91	0.30	
Control Delay		55.2	58.6					33.2	0.1	50.8	4.8	
Queue Delay		0.0	0.0					0.0	0.0	0.0	0.0	
Total Delay		55.2	58.6					33.2	0.1	50.8	4.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS		E	E					C	A	D	A	
Approach Delay		56.8						27.2			33.6	
Approach LOS		E						C			C	
Queue Length 50th (ft)		129	124					160	0	542	65	
Queue Length 95th (ft)		195	191					180	0	#762	133	
Internal Link Dist (ft)		1093			477			372			643	
Turn Bay Length (ft)			200						250			
Base Capacity (vph)		369	329					1061	1583	795	1402	
Starvation Cap Reductn		0	0					0	0	0	0	
Spillback Cap Reductn		0	0					0	0	0	0	
Storage Cap Reductn		0	0					0	0	0	0	
Reduced v/c Ratio		0.48	0.52					0.47	0.07	0.88	0.30	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 35.6 Intersection LOS: D
Intersection Capacity Utilization 66.7% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 120: Old NC 86 & I-40 EB Ramp



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	62	19	53	494	328	202
Future Volume (vph)	62	19	53	494	328	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	100			100
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.541			
Satd. Flow (perm)	1770	1583	1008	1863	1863	1583
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	35			45	45	
Link Distance (ft)	1157			1553	452	
Travel Time (s)	22.5			23.5	6.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	69	21	59	549	364	224
Shared Lane Traffic (%)						
Lane Group Flow (vph)	69	21	59	549	364	224
Turn Type	Prot	Perm	Perm	NA	NA	pm+ov
Protected Phases	4			2	6	4
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	4
Switch Phase						
Minimum Initial (s)	7.0	7.0	12.0	12.0	12.0	7.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (s)	85.0	85.0	35.0	35.0	35.0	85.0
Total Split (%)	70.8%	70.8%	29.2%	29.2%	29.2%	70.8%
Maximum Green (s)	78.0	78.0	28.0	28.0	28.0	78.0
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Min	C-Min	C-Min	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	12.3	12.3	97.7	97.7	97.7	120.0
Actuated g/C Ratio	0.10	0.10	0.81	0.81	0.81	1.00
v/c Ratio	0.38	0.13	0.07	0.36	0.24	0.14
Control Delay	55.6	49.3	2.8	3.9	2.6	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.4	0.0
Total Delay	55.6	49.3	2.8	3.9	2.9	0.2

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	E	D	A	A	A	A
Approach Delay	54.1			3.8	1.9	
Approach LOS	D			A	A	
Queue Length 50th (ft)	51	15	7	87	39	0
Queue Length 95th (ft)	95	39	18	152	74	0
Internal Link Dist (ft)	1077			1473	372	
Turn Bay Length (ft)		300	100			100
Base Capacity (vph)	1180	1055	820	1516	1516	1583
Starvation Cap Reductn	0	0	0	0	686	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.02	0.07	0.36	0.44	0.14

Intersection Summary	
Area Type:	Other
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 70 (58%), Referenced to phase 2:NBTL and 6:SBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.38	
Intersection Signal Delay: 6.5	Intersection LOS: A
Intersection Capacity Utilization 45.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 130: Old NC 86 & Service Road

Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	173	19	28	374	291	57
Future Vol, veh/h	173	19	28	374	291	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	192	21	31	416	323	63

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	833	355	386	0	-	0
Stage 1	355	-	-	-	-	-
Stage 2	478	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	339	689	1172	-	-	-
Stage 1	710	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	327	689	1172	-	-	-
Mov Cap-2 Maneuver	327	-	-	-	-	-
Stage 1	686	-	-	-	-	-
Stage 2	624	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	30.9	0.6	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1172	-	345	-	-
HCM Lane V/C Ratio	0.027	-	0.618	-	-
HCM Control Delay (s)	8.2	0	30.9	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	3.9	-	-

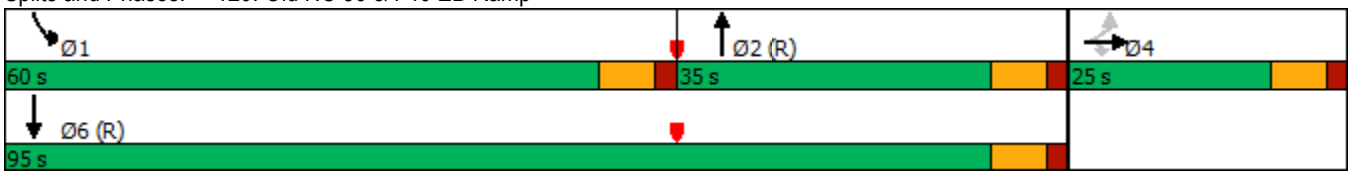
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	121	4	66	0	0	0	0	522	92	511	426	0
Future Volume (vph)	121	4	66	0	0	0	0	522	92	511	426	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		200	0		0	0		250	0		0
Storage Lanes	0		1	0		0	0		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected		0.954								0.950		
Satd. Flow (prot)	0	1777	1583	0	0	0	0	3539	1583	1770	1863	0
Flt Permitted		0.954								0.950		
Satd. Flow (perm)	0	1777	1583	0	0	0	0	3539	1583	1770	1863	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		55			55			45			45	
Link Distance (ft)		1173			557			452			723	
Travel Time (s)		14.5			6.9			6.8			11.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	134	4	73	0	0	0	0	580	102	568	473	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	138	73	0	0	0	0	580	102	568	473	0
Turn Type	Perm	NA	Perm					NA	Free	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						Free			
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					12.0		7.0	12.0	
Minimum Split (s)	25.0	25.0	25.0					25.0		14.0	25.0	
Total Split (s)	25.0	25.0	25.0					35.0		60.0	95.0	
Total Split (%)	20.8%	20.8%	20.8%					29.2%		50.0%	79.2%	
Maximum Green (s)	18.0	18.0	18.0					28.0		53.0	88.0	
Yellow Time (s)	5.0	5.0	5.0					5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0					-2.0		-2.0	-2.0	
Total Lost Time (s)		5.0	5.0					5.0		5.0	5.0	
Lead/Lag								Lag		Lead		
Lead-Lag Optimize?								Yes		Yes		
Vehicle Extension (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Recall Mode	None	None	None					C-Min		None	C-Min	
Walk Time (s)	7.0	7.0	7.0					7.0			7.0	
Flash Dont Walk (s)	11.0	11.0	11.0					11.0			11.0	
Pedestrian Calls (#/hr)	0	0	0					0			0	
Act Effct Green (s)		16.2	16.2					42.4	120.0	46.4	93.8	
Actuated g/C Ratio		0.14	0.14					0.35	1.00	0.39	0.78	
v/c Ratio		0.58	0.34					0.46	0.06	0.83	0.32	
Control Delay		58.0	50.5					24.6	0.1	37.7	7.9	
Queue Delay		0.0	0.0					0.0	0.0	0.0	0.0	
Total Delay		58.0	50.5					24.6	0.1	37.7	7.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS		E	D					C	A	D	A	
Approach Delay		55.4						20.9			24.2	
Approach LOS		E						C			C	
Queue Length 50th (ft)		101	52					170	0	426	150	
Queue Length 95th (ft)		164	96					208	0	356	204	
Internal Link Dist (ft)		1093			477			372			643	
Turn Bay Length (ft)			200						250			
Base Capacity (vph)		296	263					1251	1583	811	1456	
Starvation Cap Reductn		0	0					0	0	0	0	
Spillback Cap Reductn		0	0					0	0	0	0	
Storage Cap Reductn		0	0					0	0	0	0	
Reduced v/c Ratio		0.47	0.28					0.46	0.06	0.70	0.32	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 26.4 Intersection LOS: C
Intersection Capacity Utilization 62.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 120: Old NC 86 & I-40 EB Ramp



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	194	52	22	424	419	74
Future Volume (vph)	194	52	22	424	419	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	100			100
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.458			
Satd. Flow (perm)	1770	1583	853	1863	1863	1583
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	35			45	45	
Link Distance (ft)	1157			1553	452	
Travel Time (s)	22.5			23.5	6.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	216	58	24	471	466	82
Shared Lane Traffic (%)						
Lane Group Flow (vph)	216	58	24	471	466	82
Turn Type	Prot	Perm	Perm	NA	NA	pm+ov
Protected Phases	4			2	6	4
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	4
Switch Phase						
Minimum Initial (s)	7.0	7.0	12.0	12.0	12.0	7.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (s)	85.0	85.0	35.0	35.0	35.0	85.0
Total Split (%)	70.8%	70.8%	29.2%	29.2%	29.2%	70.8%
Maximum Green (s)	78.0	78.0	28.0	28.0	28.0	78.0
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Min	C-Min	C-Min	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	23.0	23.0	87.0	87.0	87.0	120.0
Actuated g/C Ratio	0.19	0.19	0.72	0.72	0.72	1.00
v/c Ratio	0.64	0.19	0.04	0.35	0.35	0.05
Control Delay	52.6	39.9	6.3	7.7	7.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.6	0.0
Total Delay	52.6	39.9	6.3	7.7	7.6	0.1

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	D	D	A	A	A	A
Approach Delay	49.9			7.6	6.5	
Approach LOS	D			A	A	
Queue Length 50th (ft)	156	38	5	118	57	0
Queue Length 95th (ft)	219	71	16	215	209	0
Internal Link Dist (ft)	1077			1473	372	
Turn Bay Length (ft)		300	100			100
Base Capacity (vph)	1180	1055	618	1350	1350	1583
Starvation Cap Reductn	0	0	0	0	518	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.05	0.04	0.35	0.56	0.05

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 15.9 Intersection LOS: B
Intersection Capacity Utilization 41.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 130: Old NC 86 & Service Road

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	75	27	41	371	324	147
Future Vol, veh/h	75	27	41	371	324	147
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	83	30	46	412	360	163

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	946	442	523	0	-	0
Stage 1	442	-	-	-	-	-
Stage 2	504	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	290	615	1043	-	-	-
Stage 1	648	-	-	-	-	-
Stage 2	607	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	273	615	1043	-	-	-
Mov Cap-2 Maneuver	273	-	-	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	607	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	22.3	0.9	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1043	-	320	-	-
HCM Lane V/C Ratio	0.044	-	0.354	-	-
HCM Control Delay (s)	8.6	0	22.3	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.1	-	1.6	-	-

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Attachment 6: SimTraffic Queuing and Blocking Reports

Intersection: 100: Old NC 86 & Rippy Lane/Waterstone Drive

Movement	EB	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	L	LT	R	L	T	T	R	L	L	T	TR
Maximum Queue (ft)	49	161	165	119	21	217	228	224	248	279	192	193
Average Queue (ft)	10	85	86	47	2	112	122	85	134	172	87	77
95th Queue (ft)	33	144	148	96	12	188	197	170	225	251	164	150
Link Distance (ft)	955		1363	1363		1008	1008				1266	1266
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)		300			200			425	300	300		
Storage Blk Time (%)						1			0	0		
Queuing Penalty (veh)						0			0	0		

Intersection: 110: Old NC 86 & I-40 WB Ramp

Movement	WB	WB	NB	NB	SB
Directions Served	LT	R	L	T	TR
Maximum Queue (ft)	158	35	108	141	26
Average Queue (ft)	61	3	40	5	2
95th Queue (ft)	124	45	84	103	13
Link Distance (ft)		1219	679	679	1008
Upstream Blk Time (%)				0	
Queuing Penalty (veh)				0	
Storage Bay Dist (ft)	225				
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	2	0			

Intersection: 120: Old NC 86 & I-40 EB Ramp

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	LT	R	T	T	R	L	T
Maximum Queue (ft)	253	223	249	266	52	575	185
Average Queue (ft)	119	105	115	158	3	384	66
95th Queue (ft)	204	183	212	237	36	537	153
Link Distance (ft)	1137		383	383		679	679
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			250		
Storage Blk Time (%)	1	1		0			
Queuing Penalty (veh)	2	1		0			

Intersection: 130: Old NC 86 & Service Road

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	108	58	59	142	95	52
Average Queue (ft)	46	15	22	55	28	10
95th Queue (ft)	89	44	50	117	72	37
Link Distance (ft)	1112			1488	383	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		300	100			100
Storage Blk Time (%)				1	0	
Queuing Penalty (veh)				1	0	

Intersection: 140: Old NC 86 & Davis Road

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	182	72
Average Queue (ft)	68	9
95th Queue (ft)	148	40
Link Distance (ft)	978	1365
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 7

Intersection: 100: Old NC 86 & Rippy Lane/Waterstone Drive

Movement	EB	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	L	LT	R	L	T	T	R	L	L	T	TR
Maximum Queue (ft)	49	213	222	216	19	269	279	106	167	198	172	190
Average Queue (ft)	11	126	131	86	2	135	149	43	62	117	72	81
95th Queue (ft)	34	195	203	170	10	237	252	83	145	180	144	158
Link Distance (ft)	955		1363	1363		1008	1008				1266	1266
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)		300			200			425	300	300		
Storage Blk Time (%)						2						
Queuing Penalty (veh)						0						

Intersection: 110: Old NC 86 & I-40 WB Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	TR
Maximum Queue (ft)	126	28	144	6	31
Average Queue (ft)	52	1	59	0	4
95th Queue (ft)	106	29	118	6	20
Link Distance (ft)		1219	679	1008	1008
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	225				
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	1	0			

Intersection: 120: Old NC 86 & I-40 EB Ramp

Movement	EB	EB	NB	NB	SB	SB
Directions Served	LT	R	T	T	L	T
Maximum Queue (ft)	178	122	239	265	515	233
Average Queue (ft)	89	52	98	135	285	51
95th Queue (ft)	155	101	198	232	459	151
Link Distance (ft)	1137		383	383	679	679
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200				
Storage Blk Time (%)	0	0		0		
Queuing Penalty (veh)	0	0		0		

Intersection: 130: Old NC 86 & Service Road

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	265	114	45	181	217	68
Average Queue (ft)	134	37	11	73	86	5
95th Queue (ft)	224	83	36	151	174	30
Link Distance (ft)	1112			1488	383	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		300	100			100
Storage Blk Time (%)	0		0	4	5	
Queuing Penalty (veh)	0		0	1	4	

Intersection: 140: Old NC 86 & Davis Road

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	95	102	4
Average Queue (ft)	36	19	0
95th Queue (ft)	73	63	3
Link Distance (ft)	978	1365	696
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 7