Kimley»Horn

MEMORANDUM

To: Andrew Bryant, AICP
Director
Lincoln County Planning and Inspections

From: Jonathan Guy, PE, AICP, PTOE
Dillon Turner, PE, PTOE
Kimley-Horn

Date: September 12, 2019

Subject: ***West Lake Charter School – NC 73 and Club Drive Operations Analysis***

At the request of the Lincoln County Planning Commission, Kimley-Horn has prepared this memorandum to summarize the operational characteristics of the intersection of NC 73 and Club Drive under the current intersection configurations prior to the implementation of the North Carolina Department of Transportation (NCDOT) NC 73 widening project R-5721A. In coordination with NCDOT and Lincoln County, this memorandum has been developed according to NCDOT Congestion Management and NCDOT's Municipal and School Transportation Assistance (MSTA) group guidelines for traffic analysis of schools and intersections. In addition, the analysis contained with in the memorandum has been developed using nationally accepted guidance from the Institute of Transportation Engineers (ITE) regarding data collection and analysis. The findings of the memorandum are discussed below.

BACKGROUND

The proposed Lincoln Charter School site is planned to be located in the northeast quadrant of the Club Drive at NC 73 intersection in Denver, North Carolina. As currently envisioned, the proposed charter school will ultimately consist of 765 students for grades K-8 with a 12,000 square foot early learning center outparcel. The owner of the site desires to stagger the start times for grades K-5 and 6-8 for the school. For the purposes of this TIA, a student population of 510 students was analyzed for grades K-5, because that would be the heaviest loading of students in the hour. The teachers for grades K-8 were included in the K-5 analysis as well as the 12,000 square foot early learning center.

As directed be the NCDOT during the scoping of the traffic impact analysis (TIA), the intersections within the study area along NC 73 were to be evaluated under the proposed conditions associated with TIP project R-5721A for both the 2020 background and 2020 build conditions. According to the

most recently adopted STIP, R-5721A is projected to start construction in 2023. Under R-5721, NC 73 will be widened to a multilane reduced conflict configuration. Under this concept left turning movements are minimized to key locations and supplemented with U-turn movements are strategic locations.

OPERATIONAL ANALYSIS

With the opening of the West Lake Charter School projected for 2020 and the widening of NC 73 not occurring until 2023, the existing intersection configuration of NC 73 and Club Drive will operate for several years until the widening is completed. As such, Lincoln County has requested the operations of the existing intersection be examined to determine the operational performance with and without the proposed school and to determine if any mitigation is required to offset the proposed school traffic.

Capacity analyses were performed for the 2019 existing traffic conditions, 2020 no-build traffic conditions, and 2020 build-out traffic conditions. Mitigation for traffic impacts caused by the proposed development were noted and recommended based on guidance provided in the *NCDOT Congestion Management Guidelines*. When determining the proposed development's traffic impact to the study area intersections, the 2020 no-build, and 2020 build-out conditions were compared.

Synchro LOS results and 95th percentile queues are reported in the following subsections. SimTraffic max queues are also summarized in the following subsections. Capacity analysis and SimTraffic queuing/blocking reports are attached for reference.

Signal splits were optimized for each condition analyzed.

Per NCDOT Congestion Management guidelines, the following considerations were made in this analysis:

- Right-turn on red (RTOR) operations were not allowed in this analysis.
- Permitted-protected left-turn movements were modeled as protected-only in future years.
- Lost time adjust was added to the yellow and red times provided in the signal plans to maintain a total lost time of 5 seconds for each movement for future year analysis.

The operations of the intersection of NC 73 and Club Drive are shown in Table 1 on the following page. The operations shown depict the LOS under the current laneage configuration (without R-5721 in place).

Table 1 - NC 73 at Club Drive								
Condition	Measure	EB		WBT		SB		Intersection
		EBL	EBT	WBT	WBR	SBL	SBR	
AM Peak Hour								
2020 Background	LOS (Delay)	B (18.3)		A (5.8)		D (43.1)		B (16.7)
	Synchro 95th Q	6'	#769'	176'	0'	#140	44'	
	SimTraffic Max Q	75'	252'	167'	28'	180'	152'	
2020 Build	LOS (Delay)	D (47.9)		A (9.7)		E (66.0)		D (39.0)
	Synchro 95th Q	94	#858	260'	0'	175'	130'	
	SimTraffic Max Q	325'	2936'	303'	53'	374'	501'	
2020 Build (RTOR Allowed)	LOS (Delay)	D (44.8)		A (9.1)		D (48.0)		D (36.1)
	Synchro 95th Q	101'	#936'	282'	0'	194'	0'	
	SimTraffic Max Q	324'	2062'	202'	53'	374'	434'	
2020 Build Improved (EB Left-Turn Phase)	LOS (Delay)	D (42.9)		C (26.6)		D (48.9)		D (39.9)
	Synchro 95th Q	69'	#936'	#528	4'	194'	39'	
	SimTraffic Max Q	325'	406'	425'	54'	367'	349'	
PM Peak Hour								
2020 Background	LOS (Delay)	A (6.4)		B (10.3)		C (29.4)		B (10.0)
	Synchro 95th Q	12'	213'	415'	0'	64'	33'	
	SimTraffic Max Q	53'	163'	236'	31'	75'	39'	
2020 Build	LOS (Delay)	D (35.1)		B (13.8)		F (104.0)		D (40.1)
	Synchro 95th Q	#135	259'	488'	0'	151'	144'	
	SimTraffic Max Q	325'	2934'	385'	53'	375'	473'	
2020 Build (RTOR Allowed)	LOS (Delay)	C (24.2)		B (11.2)		D (46.0)		C (23.1)
	Synchro 95th Q	79'	210'	395'	0'	#178	41'	
	SimTraffic Max Q	325'	1802'	342'	50'	372'	458'	
2020 Build Improved (EB Left-Turn Phase)	LOS (Delay)	B (14.9)		C (26.6)		D (36.4)		C (24.4)
	Synchro 95th Q	49'	182'	#662'	4'	#171'	54'	
	SimTraffic Max Q	280'	324'	748'	400'	375'	516'	
	Existing Storage	175'	-	-	100'	200'	-	-

As shown above the existing intersection, under 2020 No Build (without the school + early learning center) conditions the intersection is projected to operate at LOS B in both the AM and PM peak hours. With the introduction of the proposed site (with the school + early learning center) the intersection is projected to operate at LOS D in both the AM and PM peak hours. It is important to note that the LOS for the SB approach is projected to drop from LOS D in the AM to LOS E and from LOS C in the PM to LOS F. However, it is important to note that NCDOT congestion management guidelines for modeling do not allow right-turn on red to be considered. It is currently allowed at the intersection of NC 73 and Club Drive. With the allowance for right turn on red, the overall intersection PM peak hour LOS is projected to increase from LOS D to LOS C. Furthermore, the SB approach (Club Drive) is projected to improve from LOS E in the AM peak hour to LOS D and from LOS F to LOS D. With the implementation of an EB left-turn phase and SB right overlap phase, the intersection is projected to improve operations for the EB approach.

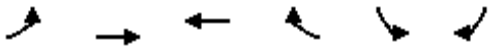
To accommodate the proposed school prior to the implementation of NCDOT TIP project R-5721 the proposed modifications are recommended at the intersection of NC 73 and Club Drive

- Implementation of an EB left-turn phase upon approval by NCDOT
- Implementation of a SB right-turn overlap phase upon approval by NCDOT
- Remarking of the center turn lane along Club Drive from a dedicated left-turn lane with defined storage to a bi-directional two-way left-turn to accommodate fluctuations in queues between the AM and PM peak hours
- Extension of the existing EB left-turn lane from 175 feet of storage to 300 feet of dedicated storage.
- Extension of the existing WB right-turn lane from 100 feet of storage to 400 feet of dedicated storage

CONCLUSION

Based on the operational analysis the impacts of the proposed West Lake Charter School can be mitigated with the recommended operational improvements until such time that NCDOT TIP project R-5721 is constructed.

Should you have any questions or comments please do not hesitate to contact Jonathan Guy or Dillon Turner at 704.333.5131.



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	33	668	888	83	57	28
Future Volume (vph)	33	668	888	83	57	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1779	1872	1817	1560	1718	1567
Flt Permitted	0.167				0.950	
Satd. Flow (perm)	313	1872	1817	1560	1718	1567
Right Turn on Red				No		No
Satd. Flow (RTOR)						
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.56	0.93	0.87	0.77	0.76	0.48
Heavy Vehicles (%)	3%	3%	3%	2%	4%	2%
Adj. Flow (vph)	59	718	1021	108	75	58
Shared Lane Traffic (%)						
Lane Group Flow (vph)	59	718	1021	108	75	58
Turn Type	Perm	NA	NA	pm+ov	Prot	Perm
Protected Phases		2	6	4	4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	14.0	14.0	14.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0	14.1	14.1	14.1
Total Split (s)	68.0	68.0	68.0	22.0	22.0	22.0
Total Split (%)	75.6%	75.6%	75.6%	24.4%	24.4%	24.4%
Maximum Green (s)	61.0	61.0	61.0	15.0	15.0	15.0
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)	6.0	6.0	6.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0
Time Before Reduce (s)	30.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	45.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	Min	Min	Min	None	None	None
Act Effct Green (s)	45.5	45.5	45.5	60.8	10.9	10.9
Actuated g/C Ratio	0.75	0.75	0.75	1.00	0.18	0.18
v/c Ratio	0.25	0.51	0.75	0.07	0.25	0.21
Control Delay	7.2	6.3	11.3	0.1	29.5	29.3

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	6.3	11.3	0.1	29.5	29.3
LOS	A	A	B	A	C	C
Approach Delay		6.4	10.3		29.4	
Approach LOS		A	B		C	
Queue Length 50th (ft)	7	107	215	0	24	18
Queue Length 95th (ft)	13	213	415	0	64	33
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	289	1732	1681	1554	523	477
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	0.20	0.41	0.61	0.07	0.14	0.12

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 60.8			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 10.0		Intersection LOS: B	
Intersection Capacity Utilization 60.9%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 5: NC-73 & Club Dr

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	6.3	11.3	0.1	29.5	29.3
LOS	A	A	B	A	C	C
Approach Delay		6.4	10.3		29.4	
Approach LOS		A	B		C	
Queue Length 50th (ft)	7	107	215	0	24	18
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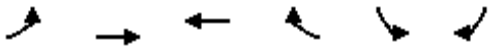


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	191	1075	626	77	232	165
Future Volume (vph)	191	1075	626	77	232	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1796	1872	1817	1501	1752	1523
Flt Permitted	0.311				0.950	
Satd. Flow (perm)	588	1872	1817	1501	1752	1523
Right Turn on Red				No		No
Satd. Flow (RTOR)						
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.50	0.89	0.92	0.58	0.58	0.60
Heavy Vehicles (%)	2%	3%	3%	6%	2%	5%
Adj. Flow (vph)	382	1208	680	133	400	275
Shared Lane Traffic (%)						
Lane Group Flow (vph)	382	1208	680	133	400	275
Turn Type	Perm	NA	NA	pm+ov	Prot	Perm
Protected Phases		2	6	4	4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	14.0	14.0	14.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0	14.1	14.1	14.1
Total Split (s)	56.7	56.7	56.7	23.3	23.3	23.3
Total Split (%)	70.9%	70.9%	70.9%	29.1%	29.1%	29.1%
Maximum Green (s)	49.7	49.7	49.7	16.3	16.3	16.3
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)	6.0	6.0	6.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0
Time Before Reduce (s)	30.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	45.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	Min	Min	Min	None	None	None
Act Effct Green (s)	51.7	51.7	51.7	80.0	18.3	18.3
Actuated g/C Ratio	0.65	0.65	0.65	1.00	0.23	0.23
v/c Ratio	1.01	1.00	0.58	0.09	1.00	0.79
Control Delay	66.8	41.9	10.5	0.1	78.7	47.5

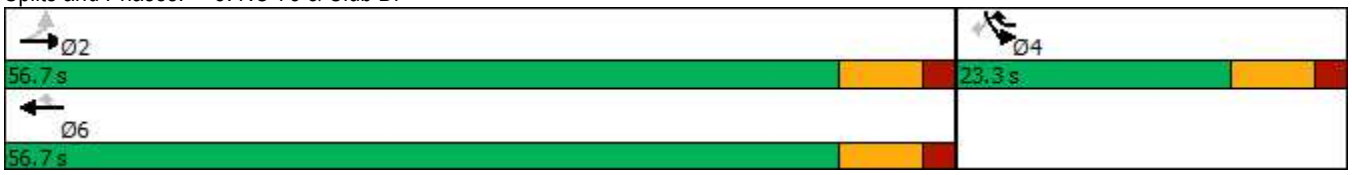
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.8	41.9	10.5	0.1	78.7	47.5
LOS	E	D	B	A	E	D
Approach Delay		47.9	8.8		66.0	
Approach LOS		D	A		E	
Queue Length 50th (ft)	~172	528	169	0	200	130
Queue Length 95th (ft)	94	#858	260	0	175	130
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	379	1209	1174	1501	400	348
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	1.01	1.00	0.58	0.09	1.00	0.79

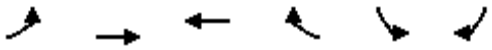
Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.01			
Intersection Signal Delay: 41.5		Intersection LOS: D	
Intersection Capacity Utilization 77.8%		ICU Level of Service D	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr





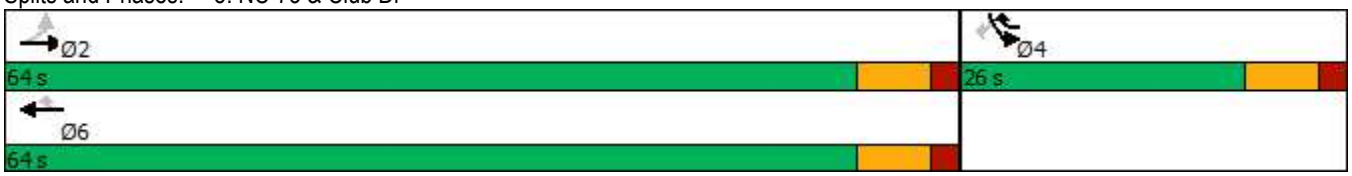
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	191	1075	626	77	232	165
Future Volume (vph)	191	1075	626	77	232	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1796	1872	1817	1501	1752	1523
Flt Permitted	0.311				0.950	
Satd. Flow (perm)	588	1872	1817	1501	1752	1523
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						275
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.50	0.89	0.92	0.58	0.58	0.60
Heavy Vehicles (%)	2%	3%	3%	6%	2%	5%
Adj. Flow (vph)	382	1208	680	133	400	275
Shared Lane Traffic (%)						
Lane Group Flow (vph)	382	1208	680	133	400	275
Turn Type	Perm	NA	NA	pm+ov	Prot	Perm
Protected Phases		2	6	4	4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	14.0	14.0	14.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0	14.1	14.1	14.1
Total Split (s)	64.0	64.0	64.0	26.0	26.0	26.0
Total Split (%)	71.1%	71.1%	71.1%	28.9%	28.9%	28.9%
Maximum Green (s)	57.0	57.0	57.0	19.0	19.0	19.0
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)	6.0	6.0	6.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0
Time Before Reduce (s)	30.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	45.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	Min	Min	Min	None	None	None
Act Effct Green (s)	59.0	59.0	59.0	90.0	21.0	21.0
Actuated g/C Ratio	0.66	0.66	0.66	1.00	0.23	0.23
v/c Ratio	0.99	0.98	0.57	0.09	0.98	0.49
Control Delay	63.0	39.0	10.9	0.1	76.3	7.0

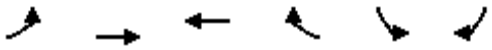
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.0	39.0	10.9	0.1	76.3	7.0
LOS	E	D	B	A	E	A
Approach Delay		44.8	9.1		48.0	
Approach LOS		D	A		D	
Queue Length 50th (ft)	190	592	189	0	227	0
Queue Length 95th (ft)	101	#936	282	0	194	0
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	385	1227	1191	1501	408	566
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	0.99	0.98	0.57	0.09	0.98	0.49

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.99			
Intersection Signal Delay: 36.1		Intersection LOS: D	
Intersection Capacity Utilization 77.8%		ICU Level of Service D	
Analysis Period (min) 15			

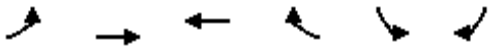
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr





Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	191	1075	626	77	232	165
Future Volume (vph)	191	1075	626	77	232	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1796	1872	1817	1501	1752	1523
Flt Permitted	0.144				0.950	
Satd. Flow (perm)	272	1872	1817	1501	1752	1523
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				111		153
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.50	0.89	0.92	0.58	0.58	0.60
Heavy Vehicles (%)	2%	3%	3%	6%	2%	5%
Adj. Flow (vph)	382	1208	680	133	400	275
Shared Lane Traffic (%)						
Lane Group Flow (vph)	382	1208	680	133	400	275
Turn Type	pm+pt	NA	NA	pm+ov	Prot	pm+ov
Protected Phases	5	2	6	4	4	5
Permitted Phases	2			6		4
Detector Phase	5	2	6	4	4	5
Switch Phase						
Minimum Initial (s)	4.0	14.0	14.0	7.0	7.0	4.0
Minimum Split (s)	11.0	21.0	21.0	14.1	14.1	11.0
Total Split (s)	18.0	64.0	46.0	26.0	26.0	18.0
Total Split (%)	20.0%	71.1%	51.1%	28.9%	28.9%	20.0%
Maximum Green (s)	11.0	57.0	39.0	19.0	19.0	11.0
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			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	3.0	6.0	6.0	2.0	2.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	3.0
Time Before Reduce (s)	0.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	None	Min	Min	None	None	None
Act Effct Green (s)	59.0	59.0	41.0	67.0	21.0	39.0
Actuated g/C Ratio	0.66	0.66	0.46	0.74	0.23	0.43
v/c Ratio	0.96	0.98	0.82	0.12	0.98	0.37
Control Delay	55.1	39.0	31.5	1.1	76.3	9.0

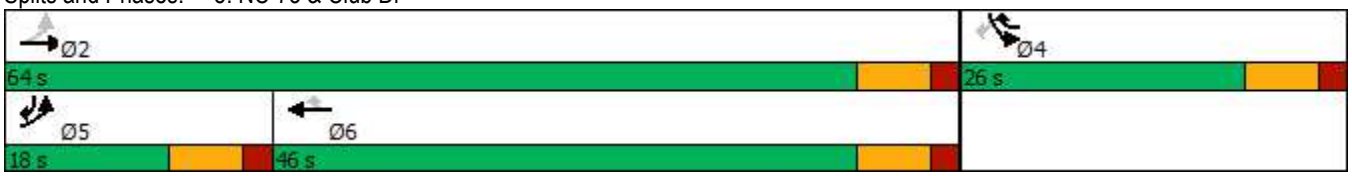


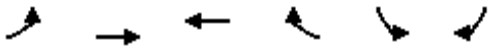
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.1	39.0	31.5	1.1	76.3	9.0
LOS	E	D	C	A	E	A
Approach Delay		42.9	26.6		48.9	
Approach LOS		D	C		D	
Queue Length 50th (ft)	129	592	325	3	227	42
Queue Length 95th (ft)	69	#936	#528	4	194	39
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	398	1227	827	1145	408	746
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	0.96	0.98	0.82	0.12	0.98	0.37

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 39.9		Intersection LOS: D	
Intersection Capacity Utilization 77.8%		ICU Level of Service D	
Analysis Period (min) 15			

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr





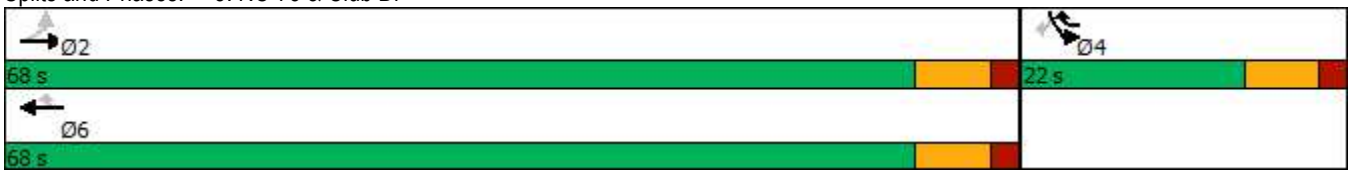
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	126	681	888	106	159	165
Future Volume (vph)	126	681	888	106	159	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1779	1872	1817	1560	1718	1567
Flt Permitted	0.153				0.950	
Satd. Flow (perm)	286	1872	1817	1560	1718	1567
Right Turn on Red				No		No
Satd. Flow (RTOR)						
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.56	0.93	0.87	0.77	0.76	0.48
Heavy Vehicles (%)	3%	3%	3%	2%	4%	2%
Adj. Flow (vph)	225	732	1021	138	209	344
Shared Lane Traffic (%)						
Lane Group Flow (vph)	225	732	1021	138	209	344
Turn Type	Perm	NA	NA	pm+ov	Prot	Perm
Protected Phases		2	6	4	4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	14.0	14.0	14.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0	14.1	14.1	14.1
Total Split (s)	68.0	68.0	68.0	22.0	22.0	22.0
Total Split (%)	75.6%	75.6%	75.6%	24.4%	24.4%	24.4%
Maximum Green (s)	61.0	61.0	61.0	15.0	15.0	15.0
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)	6.0	6.0	6.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0
Time Before Reduce (s)	30.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	45.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	Min	Min	Min	None	None	None
Act Effct Green (s)	63.0	63.0	63.0	90.0	17.0	17.0
Actuated g/C Ratio	0.70	0.70	0.70	1.00	0.19	0.19
v/c Ratio	1.12	0.56	0.80	0.09	0.65	1.17
Control Delay	121.3	8.7	15.6	0.1	44.0	140.4

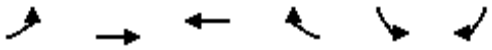
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	121.3	8.7	15.6	0.1	44.0	140.4
LOS	F	A	B	A	D	F
Approach Delay		35.1	13.8		104.0	
Approach LOS		D	B		F	
Queue Length 50th (ft)	~149	176	341	0	111	~234
Queue Length 95th (ft)	#135	259	488	0	151	144
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	200	1310	1271	1560	324	295
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	1.13	0.56	0.80	0.09	0.65	1.17

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Natural Cycle: 120
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.17
Intersection Signal Delay: 40.1 Intersection LOS: D
Intersection Capacity Utilization 79.7% ICU Level of Service D
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr





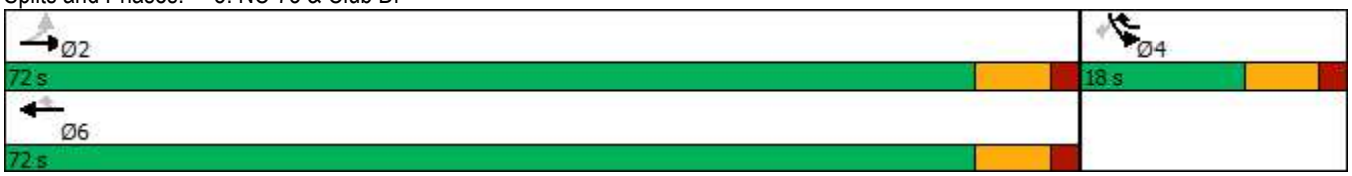
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	126	681	888	106	159	165
Future Volume (vph)	126	681	888	106	159	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1779	1872	1817	1560	1718	1567
Flt Permitted	0.167				0.950	
Satd. Flow (perm)	313	1872	1817	1560	1718	1567
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						180
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.56	0.93	0.87	0.77	0.76	0.48
Heavy Vehicles (%)	3%	3%	3%	2%	4%	2%
Adj. Flow (vph)	225	732	1021	138	209	344
Shared Lane Traffic (%)						
Lane Group Flow (vph)	225	732	1021	138	209	344
Turn Type	Perm	NA	NA	pm+ov	Prot	Perm
Protected Phases		2	6	4	4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	14.0	14.0	14.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0	14.1	14.1	14.1
Total Split (s)	72.0	72.0	72.0	18.0	18.0	18.0
Total Split (%)	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%
Maximum Green (s)	65.0	65.0	65.0	11.0	11.0	11.0
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)	6.0	6.0	6.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0
Time Before Reduce (s)	30.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	45.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	Min	Min	Min	None	None	None
Act Effct Green (s)	57.3	57.3	57.3	80.5	12.9	12.9
Actuated g/C Ratio	0.71	0.71	0.71	1.00	0.16	0.16
v/c Ratio	1.01	0.55	0.79	0.09	0.76	0.86
Control Delay	80.4	7.0	12.7	0.1	55.6	40.1

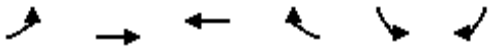
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.4	7.0	12.7	0.1	55.6	40.1
LOS	F	A	B	A	E	D
Approach Delay		24.2	11.2		46.0	
Approach LOS		C	B		D	
Queue Length 50th (ft)	95	142	276	0	117	94
Queue Length 95th (ft)	79	210	395	0	#178	41
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	256	1533	1487	1544	288	412
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	0.88	0.48	0.69	0.09	0.73	0.83

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 80.5			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.01			
Intersection Signal Delay: 23.1		Intersection LOS: C	
Intersection Capacity Utilization 79.7%		ICU Level of Service D	
Analysis Period (min) 15			

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr





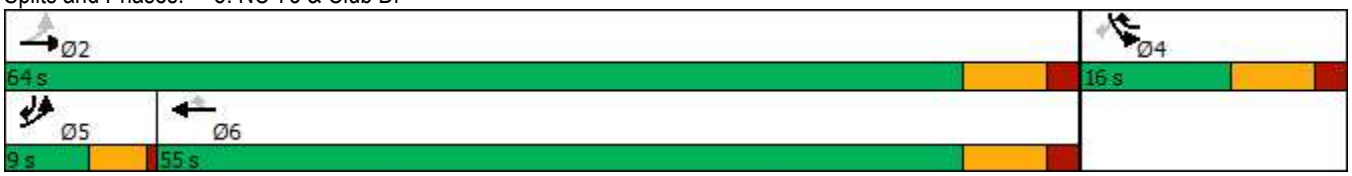
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	126	681	888	106	159	165
Future Volume (vph)	126	681	888	106	159	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-3%	3%		2%	
Storage Length (ft)	175			100	200	0
Storage Lanes	1			1	1	1
Taper Length (ft)	150				175	
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)	1779	1872	1817	1560	1718	1567
Flt Permitted	0.084				0.950	
Satd. Flow (perm)	157	1872	1817	1560	1718	1567
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				138		126
Link Speed (mph)		45	45		45	
Link Distance (ft)		6052	1989		1004	
Travel Time (s)		91.7	30.1		15.2	
Peak Hour Factor	0.56	0.93	0.87	0.77	0.76	0.48
Heavy Vehicles (%)	3%	3%	3%	2%	4%	2%
Adj. Flow (vph)	225	732	1021	138	209	344
Shared Lane Traffic (%)						
Lane Group Flow (vph)	225	732	1021	138	209	344
Turn Type	pm+pt	NA	NA	pm+ov	Prot	pm+ov
Protected Phases	5	2	6	4	4	5
Permitted Phases	2			6		4
Detector Phase	5	2	6	4	4	5
Switch Phase						
Minimum Initial (s)	4.0	14.0	14.0	7.0	7.0	4.0
Minimum Split (s)	8.0	21.0	21.0	14.1	14.1	8.0
Total Split (s)	9.0	64.0	55.0	16.0	16.0	9.0
Total Split (%)	11.3%	80.0%	68.8%	20.0%	20.0%	11.3%
Maximum Green (s)	5.0	57.0	48.0	9.0	9.0	5.0
Yellow Time (s)	3.5	5.0	5.0	5.0	5.0	3.5
All-Red Time (s)	0.5	2.0	2.0	2.0	2.0	0.5
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	2.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	3.0	6.0	6.0	2.0	2.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	3.0
Time Before Reduce (s)	0.0	30.0	30.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	45.0	45.0	0.0	0.0	0.0
Recall Mode	None	Min	Min	None	None	None
Act Effct Green (s)	57.9	54.9	45.8	61.9	11.1	23.1
Actuated g/C Ratio	0.76	0.72	0.60	0.81	0.15	0.30
v/c Ratio	0.84	0.54	0.93	0.11	0.84	0.61
Control Delay	42.2	6.5	30.1	0.4	62.9	20.3

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.2	6.5	30.1	0.4	62.9	20.3
LOS	D	A	C	A	E	C
Approach Delay		14.9	26.6		36.4	
Approach LOS		B	C		D	
Queue Length 50th (ft)	51	125	389	0	104	92
Queue Length 95th (ft)	48	192	#662	4	#171	54
Internal Link Dist (ft)		5972	1909		924	
Turn Bay Length (ft)	175			100	200	
Base Capacity (vph)	269	1462	1203	1296	250	564
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	0.84	0.50	0.85	0.11	0.84	0.61

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 76			
Natural Cycle: 75			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.93			
Intersection Signal Delay: 24.4		Intersection LOS: C	
Intersection Capacity Utilization 74.2%		ICU Level of Service D	
Analysis Period (min) 15			

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: NC-73 & Club Dr



Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	75	252	167	28	180	152
Average Queue (ft)	26	159	94	5	93	26
95th Queue (ft)	66	271	153	23	160	98
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)		4	3		0	
Queuing Penalty (veh)		2	2		0	

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	53	163	236	31	75	39
Average Queue (ft)	18	81	82	4	19	1
95th Queue (ft)	45	160	174	20	55	13
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)		0	3			
Queuing Penalty (veh)		0	3			

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	325	2936	303	53	374	501
Average Queue (ft)	162	790	136	23	168	144
95th Queue (ft)	374	2344	241	54	328	366
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	30	13	10		17	3
Queuing Penalty (veh)	363	38	10		48	13

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	325	2934	385	53	375	473
Average Queue (ft)	184	735	177	12	96	124
95th Queue (ft)	381	2226	310	40	241	350
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	41	5	13		1	16
Queuing Penalty (veh)	283	5	14		2	30

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	324	2062	202	53	374	434
Average Queue (ft)	164	584	100	6	121	37
95th Queue (ft)	355	1614	184	28	262	161
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	19	14	6		7	
Queuing Penalty (veh)	221	25	6		15	

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	325	2934	385	53	375	473
Average Queue (ft)	184	735	177	12	96	124
95th Queue (ft)	381	2226	310	40	241	350
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	41	5	13		1	16
Queuing Penalty (veh)	283	5	14		2	30

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	325	406	425	54	367	349
Average Queue (ft)	85	221	182	17	119	26
95th Queue (ft)	188	373	350	44	254	70
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	0	12	24		7	
Queuing Penalty (veh)	4	28	21		14	

Intersection: 5: NC-73 & Club Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	280	324	748	400	375	516
Average Queue (ft)	92	123	263	57	158	138
95th Queue (ft)	208	247	598	254	387	432
Link Distance (ft)		5980	1913			869
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	175			100	200	
Storage Blk Time (%)	12	1	22		30	0
Queuing Penalty (veh)	85	2	25		45	0