SW 6th St & SW Lee Blvd Protected Left Turn STUDY

for

City of Lawton

Lawton, OK

December 6, 2024

wsb

SW 6th St & SW Lee Blvd Projected Left Turn Study

for

City of Lawton

Lawton, Oklahoma

WSB Project No. 027125-000

WSB
3522 Sam Rayburn Highway
Melissa, TX 75454
TBPE Firm Registration #16849

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Introduction

The services of WSB LLC (WSB) were retained by the City of Lawton (the Client) to conduct a study for the modification of the signal indications for NB left turn and SB left turn movements, from protected mode to permitted mode, at the intersection of SW 6th St and SW Lee Bvld, , in Lawton, Oklahoma, based on the request received.

In order to perform the study, 24-hour traffic counts were collected for the study location on Wednesday, October 16th, 2024. Accident data for the location were also obtained via the state's database, and Synchro modeling software was used to simulate the signal operations before and after the proposed modification

Study Approach

WSB used the TRAFFIC SIGNAL OPERTATIONS HANBOOK, 2ND EDITION, Chapter 2, Figure A-6, as guidance for determining the left turn operational mode. According to Figure A-6, several factors are considered, including crash data, sight distance, the number of left turn lanes and opposing thru lanes, speed of the opposing approach, and volumes of the left turn and opposing lanes.

The following criteria, according to Figure A-6, need to be met, in order to determine protected left turn operation mode:

1. Crashes – 1 crash of left turn movement in 1 year.
2. Speed – approach speed of opposing lane is equal or greater than 45 mph
3. Number of lanes – the opposing thru lanes are 4 or more
4. Sight distance – minimum of 280 ft for 35 mph posted speed limit
5. Left turn delay – more than 35s/veh during peak hour.
6. Volume – left turn volume vs. opposing volumes. The product of left turn volume and opposing volumes (thru & right turn volume) must be greater than 50,000 during peak hour.

In addition to the above criteria, WSB also analyze the intersection operations using Synchro modeling software, using both the current operation (protected left turn) and the proposed condition (permissive left turn) for the NB and SB left turn movements, to determine the before and after affects of the proposed change.

Summary

Using traffic volume and crash data collected, the results following the above criteria are as follow:

1. Crashes – there were no crashes reported related to left turn movements at the intersection.
2. Speed – the posted speed limit on SW 6th St is 35 mph
3. Number of lanes – the number of opposing thru lane on 6th St is 1
4. Sight distance – the approximate sight distance exceed 280 ft minimum required
5. Left turn delay – reviews of traffic video obtain during peak hour does not show significant delay
6. Volume – the product of left turn volume and opposing lane volume is 143 for SB, and 58 for NB approaches, far below the 50,000 thresholds

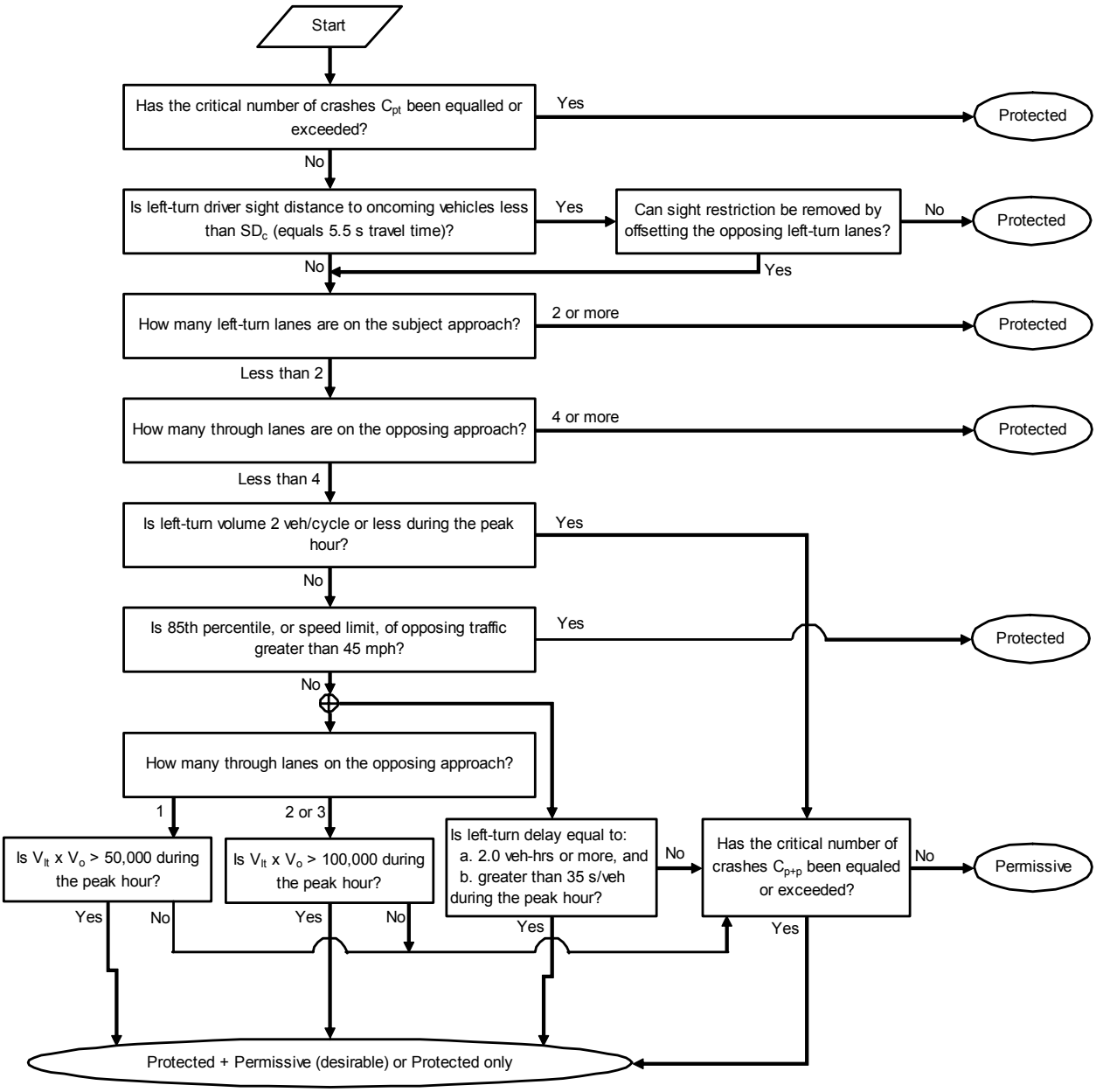
Using Synchro modeling, it shows that switching the NB and SB left turn movements to permitted mode will reduce the overall intersection delay by 2 seconds. Figure 1 shows the “before” and “after” results

In summary, the NB and SB left turn movements from SW 6th St does not meet the guidelines for protected left turn; and changing to permissive left turn phasing will improve the intersection performance by reducing overall delay.

Table 1 – Synchro Results Comparison

	Protect Left Turn	Permissive Left Turn
Intersection Level of Service	B	B
Intersection Delay (s)	14.4	12.9

APPENDIX A – FIGURE A-6 (SIGNAL OPERATIONS HANDBOOK)



Number of Left-Turn Movements on Subject Road	Period during which Crashes are Considered (years)	Critical Left-Turn-Related Crash Count When Considering Protected-only, C_{pt} (crashes/period)	When Considering Prot.+Perm, C_{p+p} (crashes/period)
One	1	6	4
One	2	11	6
One	3	14	7
Both	1	11	6
Both	2	18	9
Both	3	26	13

Oncoming Traffic Speed Limit (mph)	Minimum Sight Distance to Oncoming Vehicles, SD_c (ft)
25	200
30	240
35	280
40	320
45	360
50	400
55	440
60	480

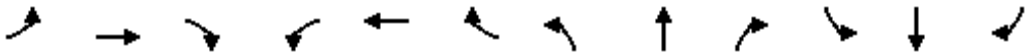
Variables

V_{lt} = left-turn volume on the subject approach, veh/h

V_o = through plus right-turn volume on the approach opposing the subject left-turn movement, veh/h

Figure A-6. Guidelines for Determining Left-Turn Operational Mode.

APPENDIX B – SYNCHRO RESULT PRINTOUT

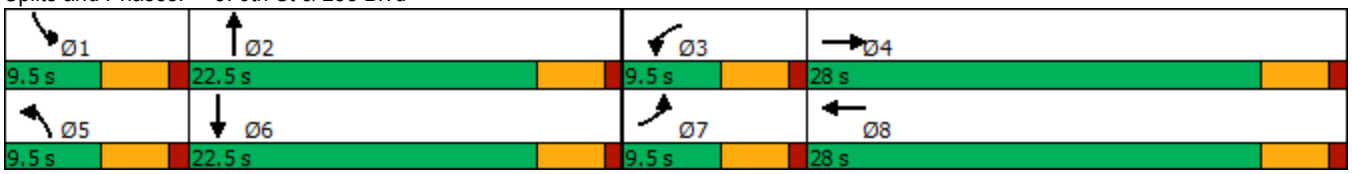


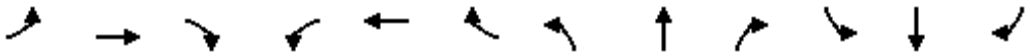
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	1031	2	0	472	8	1	143	23	20	60	0
Future Volume (vph)	2	1031	2	0	472	8	1	143	23	20	60	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	170		0	160		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1770	3539	0	1863	3529	0	1770	1824	0	1770	1863	0
Flt Permitted	0.950						0.950			0.950		
Satd. Flow (perm)	1770	3539	0	1863	3529	0	1770	1824	0	1770	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					3			11				
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		434			429			339			298	
Travel Time (s)		7.4			7.3			6.6			5.8	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	1123	0	0	522	0	1	180	0	22	65	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	9.5	28.0		9.5	28.0		9.5	22.5		9.5	22.5	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	5.1	23.7			22.2		5.1	18.3		5.1	18.3	
Actuated g/C Ratio	0.10	0.45			0.42		0.10	0.35		0.10	0.35	
v/c Ratio	0.01	0.70			0.35		0.01	0.28		0.13	0.10	
Control Delay	25.5	14.9			12.5		25.0	15.0		26.6	14.6	
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay	25.5	14.9			12.5		25.0	15.0		26.6	14.6	
LOS	C	B			B		C	B		C	B	
Approach Delay		14.9			12.5			15.1			17.6	
Approach LOS		B			B			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 69.5			
Actuated Cycle Length: 52.6			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 14.4		Intersection LOS: B	

Intersection Capacity Utilization 52.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: 6th St & Lee Blvd





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Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	170		0	160		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1770	3539	0	1863	3529	0	1770	1824	0	1770	1863	0
Flt Permitted	0.950						0.715			0.644		
Satd. Flow (perm)	1770	3539	0	1863	3529	0	1332	1824	0	1200	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					3			14				
Link Speed (mph)		40			40			35			35	
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Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
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Parking (#/hr)												
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Shared Lane Traffic (%)												
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Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
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Act Effct Green (s)	5.0	22.0			20.3		18.1	18.1		18.1	18.1	
Actuated g/C Ratio	0.10	0.45			0.41		0.37	0.37		0.37	0.37	
v/c Ratio	0.01	0.71			0.36		0.00	0.26		0.05	0.09	
Control Delay	22.0	13.7			11.3		12.0	12.5		12.1	12.1	
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay	22.0	13.7			11.3		12.0	12.5		12.1	12.1	
LOS	C	B			B		B	B		B	B	
Approach Delay		13.7			11.3			12.5			12.1	
Approach LOS		B			B			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 49.2			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 12.9		Intersection LOS: B	

Intersection Capacity Utilization 52.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: 6th St & Lee Blvd