

MEMORANDUM

Kyles Station Road and SR 4 Kroger Marketplace And Multi-use Commercial Development Liberty Township, Butler County

To: Tom Makris, ODOT
From: Jamal Adhami
Subject: Traffic Impact Study Comments
Date: July 6, 2015
Cc: Matt Loeffler, Butler County
Cc: Kroger Project Team

Background

A Traffic Impact Study (TIS), dated June 24, 2015 was completed for the subject project and reviewed by Butler County and ODOT. There is a recent follow up suggestion by ODOT that an additional lane should be provided on the northbound approach of Kyles Station Road.

As requested by ODOT, supplemental information is provided in this Memorandum with regard to the ODOT recommendations at the intersection of State Route 4 and Kyles Station Road. The additional information is provided to assess the LOS and delay at the intersection using the proposed geometry as per Alternative 1 in the Traffic Impact Study and additional alternative referred to as Alternative 1A in the supplemental report.

Alternative 1 (recommended in the TIS) - Proposed geometry on the northbound approach of Kyles Station Road to include:

- An exclusive left turn lane;
- A lane shared for left turns and through traffic; and
- An exclusive right turn lane.

Alternative 1, in the TIS, is analyzed with split phasing on northbound and southbound approaches at the intersection.

Alternative 1A – As suggested by ODOT, this Alternate for the northbound approach is evaluated with the following geometry:

- Exclusive double left turn lanes,
- A lane for through movement; and
- An exclusive right turn lane.

The proposed geometry assumes the left turn lane will be aligned adequately so that split phasing for the northbound and southbound approaches can be eliminated.

HCS ANALYSIS

Tables 1A and 1B below summarizes the results with Alternative 1 as analyzed in the TIS for the proposed development and Alternative 1A being evaluated for comparison with Alternative 1.

The results provided in Table 1 are obtained using HCS software.

Table 1 – LOS Intersection of State Route 4 and Kyles Station Road

Table 1A – State Route 4 and Kyles Station Road - Level of Service/Delay (Seconds/Vehicle) - AM Peak Hour –Signalized Conditions																	
Alt 1 Lane Use	<i>Eastbound</i>				<i>Westbound</i>				<i>Northbound</i>				<i>Southbound</i>				<i>Intersection</i>
	L	2T	R	App.	L	T	TR	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1	D	C	C	C	E	D	D	D	C	C	C	C	-	D	-	D	C
	43.6	34.3	30.1	33.4	69.3	38.2	38.2	41.6	32.7	31.3	29.1	31.8	-	41.4	-	41.4	36.7
Alt 1A Lane Use	<i>Eastbound</i>				<i>Westbound</i>				<i>Northbound</i>				<i>Southbound</i>				<i>Intersection</i>
	L	2T	R	App.	L	T	TR	App.	2L	T	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1 A	D	C	C	C	D	D	D	D	D	B	B	C	-	D	-	D	C
	43.6	33.5	29.5	32.7	40.9	37.1	37.1	37.5	35.4	17.3	17.7	32.6	-	37.9	-	37.9	34.8

Table 1B – State Route 4 and Kyles Station Road - Level of Service/Delay (Seconds/Vehicle) - PM Peak Hour –Signalized Conditions																	
Alt 1 Lane Use	<i>Eastbound</i>				<i>Westbound</i>				<i>Northbound</i>				<i>Southbound</i>				<i>Intersection</i>
	L	2T	R	App.	L	T	TR	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1	D	F	B	D	E	C	C	C	E	D	C	D	-	D	-	D	D
	45.6	64.5	10.9	53.7	69.1	27.9	28.0	32.9	57.5	54.8	23.8	53.4	-	54.4	-	54.4	47.1
Alt 1A Lane Use	<i>Eastbound</i>				<i>Westbound</i>				<i>Northbound</i>				<i>Southbound</i>				<i>Intersection</i>
	L	2T	R	App.	L	T	TR	App.	2L	T	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1 A	D	F	B	E	E	C	C	C	E	C	B	E	-	D	-	D	D
	45.6	68.2	109	56.6	69.1	28.4	28.5	33.4	63.6	20.5	14.8	56.0	-	46.5	-	46.5	49.2

The summary of HCS analysis indicates that the capacity at the intersection will not be significantly improved or delay reduced when the intersection is analyzed with a comparison of Alternative 1 with Alternative 1A.

HCS ANALYSIS – QUEUE ESTIMATES

SYNCHRO analysis was completed for the two alternative and estimated queue lengths were compared. Table 2 below summarizes the results observed for the two alternatives. Specifically, the queues for the northbound left turns are compared for the two alternatives. The 95th percentile queue is observed for 2035 AM peak hour volumes is marginally lower for the Alternative 1A. The analysis completed with 2035 PM peak hour volumes indicate that the 95th percentile queue values will be impacted as the demand volume exceeds the capacity; thus indicating that the actual queue lengths may be higher.

Table 2 – Storage Length – Kyles Station Road and State Route 4						
Signalized (120 seconds cycle length)						
ODOT Criteria					Storage Length SYNCHRO (95 th percentile) Alt 1	Storage Length SYNCHRO (95 th percentile) Alt 1A
MOVEMENTS	Time Period	Hourly Volume 2035	Required Storage Length (FT) 2035	Blocked		
NB Left Turn Lane	AM	355	250	NO	215/212	173
	PM	605	350	NO	#485/#500	#348
EB Right Turn Lane	AM	264	514	YES	58	58
	PM	328	564	YES	127	127
NB Right Turn Lane	AM	46	264	YES	2	3
	PM	63	304	YES	5	19

SYNCHRO ANALYSIS – DELAY AND LOS

The results from SYNCHRO analysis are also used to observe the delay and LOS at the intersection for the Alternative 1 and Alternative 1A. The results are shown in Tables 3A and 3B. Note the HCS results are obtained by balancing the v/c ratio (average delay) for the critical movements. However, the SYNCHRO results are based on the optimum splits for efficient traffic flow at the intersection.

The results for the AM Peak Hour for the two alternative do not show a significant difference in the average delay at the intersection. The analysis completed for the PM Peak Hour volumes show a LOS D for the two alternatives with an average delay of 54.4 seconds/vehicles for the Alternative 1 and 48.6 seconds/vehicles for the Alternative 1A.

Table 3A – State Route 4 and Kyles Station Road - Level of Service/Delay (Seconds/Vehicle) - AM Peak Hour –Signalized Conditions – SYNCHRO Analysis																	
Alt 1 Lane Use	Eastbound				Westbound				Northbound				Southbound				Intersection
	L	2T	R	App.	L	2TR	-	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1	E	D	A	C	E	C	-	C	D	D	A	D	-	D	-	D	C
	58.3	42.5	4.8	34.0	66.5	367	-	31.0	39.7	39.5	1.2	35.4	-	44.8	-	44.8	33.3
Alt 1A Lane Use	Eastbound				Westbound				Northbound				Southbound				Intersection
	L	2T	R	App.	L	2TR	-	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1 A	E	D	A	C	E	C	-	C	D	C	A	C	-	D	-	D	C
	58.3	42.5	4.8	34.0	66.5	26.7	-	31.0	36.5	23.1	2.6	32.1	-	45.1	-	45.1	32.8

Table 3B – State Route 4 and Kyles Station Road - Level of Service/Delay (Seconds/Vehicle) - PM Peak Hour –Signalized Conditions – SYNCHRO Analysis																	
Alt 1 Lane Use	Eastbound				Westbound				Northbound				Southbound				Intersection
	L	2T	R	App.	L	2TR	-	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1	E	E	A	E	F	C	-	D	F	F	A	E	-	C	-	C	D
	65.8	67.9	9.4	56.4	115.7	28.1	-	38.7	83.5	87.3	1.8	78.2	-	28.8	-	28.8	54.4
Alt 1A Lane Use	Eastbound				Westbound				Northbound				Southbound				Intersection
	L	2T	R	App.	L	T	-	App.	L	LT	R	App.	-	LTR	-	App.	Overall
2035 – Build – Alt1 A	E	E	A	E	F	C	-	D	E	C	A	D	-	C	-	D	D
	65.8	67.9	9.4	56.4	115.7	28.1	-	38.7	55.5	23.7	4.1	48.6	-	29.0	-	29.0	48.6

FINDINGS

The comparison of the two Alternatives does not show a major improvement in flow of traffic at the intersection when considering the increase in construction cost.

In general it is not desirable to use split phasing on the major or minors streets at the intersection. However, in rare cases existing constraints lead to using such signal phasing. At the intersection of SR 4 and Kyles Station Road, northbound left turn volumes for the Build conditions are high. The northbound through and the total volume on the southbound approach are significantly lower. Using 2035 Build traffic volumes average number of vehicles for each cycle is about 2.4 for the AM Peak Hour; whereas it is estimated as 2.7 during the PM Peak Hour. *It is expected during several cycles at the intersection the southbound phase will be skipped as it may not have any vehicle on the approach.*

Since alternative 1A will require the northbound and southbound lanes to be aligned so that split phasing can be eliminated, it will require extensive widening of the existing right-of-way. To align the lanes adequately and eliminate split phase all the widening will have to be accomplished along west side of Kyles Station Road. In order to maintain existing northbound shared left turn and through shared lane to be used for the through movement only about 24 feet of widening will be required along west side of Kyles Station Road. Also, since the approach is posted at 55 mph the length of the improvements on SR 4 will extend 1320 ft. beyond the end of storage for the SR 4 left turn lane. This will result in overwhelming

cost for improvements and will be difficult to justify with the marginal benefits achieved for the motoring public. Also, such widening will impact the southbound through lane to be realigned. That will require widening on the north leg of the intersection.

Schematic plans showing the Alternatives 1 and 1A are attached. Alternative 1A clearly show the significant impact on pavement widening if the lanes along northbound and southbound approaches are to be aligned.