

6-B-23-SU TIL Version 2 4/28/2023

April 28, 2023

Mr. Mike Conger Knoxville-Knox County Planning 400 Main Street, Suite 403 Knoxville, TN 37902

Re: Traffic Letter for Cook Out Broadway

Dear Mr. Conger:

Cook Out Restaurants is proposing a fast-food restaurant development at 2900 North Broadway in Knoxville, Tennessee. The total area of development is approximately 1 acre and the property is currently zoned C-G-2 (General Commercial). Construction is proposed to take place this year and this analysis assumes full build out for the development will occur in 2025.

2900 North Broadway is located approximately 160 feet north of the intersection North Broadway at Edgewood Avenue and approximately 200 feet south of the intersection of North Broadway at Claiborne Place. The site currently contains an abandoned bank facility. The proposed site plan includes a single driveway connection located on Edgewood Avenue approximately 15 feet east of the existing bank facility driveway connection. A copy of the proposed site plan is included in the attachments.

The purpose of this traffic analysis is to conduct a traffic capacity analysis, to determine the need for signal timing modification, and to evaluate the alley system shown on the site plan.

## **Existing Site Conditions**

North Broadway is a two-way road with two lanes northbound and two lanes southbound, along with a center two-way left-turn lane. The road width is approximately 53 feet in the site vicinity. The Knoxville-Knox County Planning Commission classifies North Broadway between W. Summit Hill Drive and Walker Boulevard as a Major Arterial with an 88 feet right-of-way per the Major Road Plan. The posted speed limit on North Broadway is 40 mph. North Broadway has existing sidewalks on either side of the road in the vicinity of the proposed development and there are no existing designated bike lanes in the vicinity of the proposed development.

Edgewood Avenue is a two-way road with one lane eastbound and one lane westbound that provides access to residential properties. The road width is approximately 26 feet in the site vicinity. The Knoxville-Knox County Planning Commission classifies Edgewood Avenue between Broadway and Whittle Springs Road as a Minor Collector with a 50-foot right-of-way per the Major Road Plan. The posted speed limit on Edgewood Avenue is 25 mph. An

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aerial photo of the existing intersection of North Broadway and Edgewood Avenue is included in the attachments.

The existing alley behind the proposed development has a ROW width of approximately 10 feet with access to residential lots, KFC parking lot and Claiborne Place. The old alley with access to Edgewood Avenue is closed and a hammerhead cross-access remains.

## Transit Network

The Knoxville Area Transit (KAT) operates in the vicinity of the proposed development. Route 22 (Broadway) travels from Knoxville Station to the Fountain City Superstop; Route 21 travels from Knoxville Station to the intersection of Chickamauga at Broadway.

The nearest KAT stops are currently located on North Broadway at Claiborne Place on Route 22, where the KAT Bus services northbound travel, and Broadway Street at Oglewood Avenue on Route 22, where the KAT Bus services southbound travel. A copy of the KAT Bus transit route is included in the attachments.

## **Pedestrian / Bicycle Network**

North Broadway has existing sidewalks both northbound and southbound at the signalized intersection at Edgewood Avenue as well as crosswalks across North Broadway and Edgewood Avenue.

The "Knoxville Bicycle Map 2017" classifies Edgewood Avenue as a comfortable bike route. The Nadine Street, Barton Street and Fairmont Boulevard east of the development are signed bike routes. North Broadway is classified as an arterial street and not recommended for biking. The First Creek Greenway is located in the vicinity of the proposed development. Bicycle parking is expected to be provided in the vicinity of the proposed Cook Out Restaurant.

A copy of the Knoxville Bicycle Map 2017 is included in the attachments.

## **Traffic Volumes**

The Cook Out Restaurant is not intended to be open during the AM peak hour; therefore, FMA only conducted a PM peak hour turning movement count at the intersection of North Broadway at Edgewood Avenue on Tuesday, May 17, 2022. The PM peak hour occurred between 3:30 p.m. and 4:30 p.m. with a peak hour factor (PHF) of 0.94. The traffic data collected is included in the attachments.

## **Background Growth**

TDOT count station #47000143 is located on North Broadway south of the intersection with Washington Pike and south of Edgewood Road. The annual growth rate for this station over the last five years is approximately -3.08% not including the low traffic count conducted in January 2021. The 2020 ADT was 23,884 vehicles per day.

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In order to calculate traffic for the background year 2025, FMA assumed an annual growth rate of 1%. Figure 1: 2022 Existing Peak Hour Traffic, Figure 2: 2025 Background Peak Hour Traffic, and the ADT trend line growth charts are included in the attachments.

## **TDOT Roadway Projects**

The Tennessee Department of Transportation (TDOT) is planning a resurfacing project along N Broadway between Central Street and Mineral Springs Avenue. The total length of the proposed project is 2.81 miles and the project has no proposed letting date.

The City of Knoxville in coordination with the Knoxville Area Transit is also actively implementing a federally funded Transit Signal Priority and Passenger Information System installation in the vicinity of the proposed development. The scope of work includes the implementation of Transit Signal Priority at 33 signalized intersections, installation of 27 new Accelerated Bus Corridor (ABC) stations, improvements to the Fountain City Superstop, and improved sidewalk and pedestrian connectivity between signalized intersections and Accelerated Bus Corridor (ABC) bus stops. This project has no proposed letting date.

## Trip Generation

FMA evaluated the trip generation for the proposed 3,130 SF Cook Out Restaurant. The trip generation was calculated using the average rates provided from the *Trip Generation*, 11<sup>th</sup> *Edition*, published by the Institute of Transportation Engineers. Fast-Food Restaurant with Drive-Through Window or Land Use 934 was used to calculate the daily trips and PM peak hour trips.

A pass-by trip occurs when a proposed development diverts traffic that is already traveling on a street adjacent to the site. The Knoxville-Knox County Planning issued a memo on March 10, 1997 outlining recommended pass-by rates for certain land uses including fastfood restaurants. A pass-by rate reduction of 40% was used for Fast Food Restaurant or Land Use 934 as referenced in the Knoxville-Knox County Planning Memo.

The land use worksheets are included in the attachments. A trip generation summary is shown below in Table 1 – Trip Generation Summary.

Land Use	G.F.A.	Daily Trips	AM Peak Hour Enter Exit	PM Peak Hour Enter Exit
Fast-Food Restaurant w/ Drive-Through Window (LUC 934)	3,130 S.F.	1,463		54 49
Pass-By Trips 40% New Trips 60%		585 878		22 20 32 29

# Table 1 - Trip Generation Summary2900 N Broadway

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The total number of new trips generated by the proposed commercial development at 2900 North Broadway is estimated to be 878 new daily trips and 61 new trips during the PM peak hour.

## **Trip Distribution**

The existing trip distribution on North Broadway at Edgewood Avenue is approximately 55% northbound and 45% southbound during the PM peak hour. The existing trip distribution on Edgewood Avenue at North Broadway is approximately 60% eastbound and 40% westbound during the PM peak hour.

The directional distribution of the new trips generated by the Cook Out Broadway was determined using the existing traffic volumes at the intersection of North Broadway at Edgewood Avenue in combination with the concept plan layout. Traffic entering from the alley is assumed to be negligible. FMA assumed a PM peak hour trip distribution that is approximately 45% North Broadway northbound, 40% North Broadway southbound and 15% Edgewood Avenue during the PM peak hour.

Figure 3: Peak Hour New Trip Distribution, Figure 4: Peak Hour Pass-By Trip Distribution, Figure 5: Peak Hour Site Traffic and Figure 6: 2025 Full Buildout Site Traffic are included in the attachments.

## Capacity Analysis and Level of Service

Signalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the PM peak hour to evaluate the traffic conditions at the intersection of North Broadway at Edgewood Avenue. The existing signal timing was provided by the City of Knoxville and is included in the attachments.

The results from the analyses are expressed with a term "level of service" (LOS), which is based on the amount of delay experienced at the intersection. The LOS index ranges from LOS A, indicating excellent traffic conditions with minimal delay, to LOS F indicating very congested conditions with excessive delay. LOS D generally is considered the minimum acceptable condition in urban areas. The HCS7 worksheets are included in the attachments and the results of the capacity analysis are shown in Table 2 – Intersection Capacity Analysis Level of Service (LOS) Summary.

Intersection	Time Period	Year 2022 Existing (Delay/LOS)	Year 2025 Background (Delay/LOS)	Year 2025 Full Buildout (Delay/LOS)
North Broadway @ Edgewood Avenue	PM Peak	11.5 / B	11.7 / B	14.1 / B

## Table 2 - Intersection Capacity Analysis Level of Service (LOS) Summary

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## **Queue Analysis**

The 50% or average queue length reflects the capacity of the traffic signal and the 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage.

The existing southbound left turn lane at the signalized intersection of North Broadway at Edgewood Avenue has an available storage length of 100 feet. The signalized intersection capacity analysis shows the full buildout 95% queue length for the southbound left turn lane (North Broadway) of 29 feet (1.1 vehicles) during the PM peak hour.

The existing westbound approach at the signalized intersection of North Broadway at Edgewood Avenue has an available storage length of 150 feet before the queue would block the driveway connection. The signalized intersection capacity analysis shows the full buildout 50% or average queue for the westbound approach (Edgewood Avenue) of 137.2 feet (5.4 vehicles) during the PM peak hour. The signalized intersection capacity analysis shows the background 95% queue for the westbound approach (Edgewood Avenue) of 187.8 feet (7.4 vehicles) during the PM peak hour and the full buildout 95% queue length of 234 feet (9.2 vehicles) during the PM peak hour.

The 95% queue length for the westbound approach (Edgewood Avenue) at the signalized intersection is expected to block the proposed Cook Out driveway connection; however, the queue length estimations may have inaccuracies due to the queue extending past the proposed driveway connection.

## **Conclusion and Recommendations**

After the completion of the Cook Out Restaurant located at 2900 North Broadway the signalized intersection of North Broadway at Edgewood Avenue will continue to operate at an acceptable LOS B during the PM peak hour. There are no recommended modifications to the existing signal timing provided by the City of Knoxville.

The result of the queue analysis for the southbound left turn lane (North Broadway) is that the existing storage length of 100 feet is adequate and there are no recommended improvements to the southbound left turn lane on North Broadway.

The result of the queue analysis for the westbound approach (Edgewood Avenue) is that the queue from the signalized intersection will block the proposed Cook Out driveway less than 50% of the time during the PM peak hour. Under average conditions the queue should not impact the driveway connection but if it becomes an issue FMA recommends considering the installation of a "Do Not Block Driveway" sign on Edgewood Avenue prior to the driveway connection. All signs and pavement markings should be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).

The alley between Claiborne Place and the residential parcels does not have any directional signs or striping indicating which is the preferred direction of traffic. FMA recommends adding a "Do Not Enter" sign to the alley to eliminate potential wrong way trips from the

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Cook Out Restaurant to the existing KFC parking lot. In addition to the "Do Not Enter" sign, a "One-Way" sign or pavement striping may need to be installed to ensure that the direction of traffic is clearly marked. All signs and pavement markings should be installed in accordance with the standards provided in the Manual on Uniform Traffic Control Devices (MUTCD).

Consideration should also be made to re-opening the alley access to Edgewood Avenue and closing the ROW where the existing hammerhead cross-access protrudes into the existing parking lot. The preliminary site plan would need to be re-worked to show a dedicated access between the existing alley and Edgewood Avenue. FMA recommends any improvements to the alley between Claiborne Place and Edgewood Avenue including realignment, increased signage, striping, etc. be coordinated with the City of Knoxville Department of Engineering.

I hope that this is helpful. Please contact me if you have any questions.

Thank you,



**Enclosure:** Attachments







KAT Route 22 (Broadway)



## **Map Features**

	Bike lanes
***	Climbing bike lane – one-way uphill
00000	Signed bike routes
	Comfortable routes
	Connections - use caution
	Local/neighborhood streets – generally comfortable for biking
	Collector streets — expect higher traffic speeds and volumes
	Arterial streets - not recommended
-	One-way street
*****	Steep slopes - greater than 10% grade
	Paved greenways
~	Multi-use unpaved trails
	Public restrooms
0	Parking for trailheads and bike routes
	Transit station & superstops - all KAT buses & trolleys have bike racks
5	Skateparks with BMX biking allowed
1	School
Ø	Bike Repair Stand

## Project: Cookout at N Broadway Intersection: N. Broadway at Edgewood Ave Date Conducted: Tuesday, May 17, 2022

	n e	Broadw	ay	Edgewood Ave			N Broadway			Driveway			
	Sou	uthbou	nd	W	estbou	nd	No	rthbou	nd	Ea	stbour	nd	
Start	Left	Thru	Total	Left	Right	Total	Thru	Right	Total	Left	Right	Total	Int. Total
2.00 PM	12	170	102	21	21	42	196	21	217	0	0	0	451
3:00 F/M	13	1/9	192	21 17	21	42	100	21	217	0	0	0	431
3.13 TM 3.30 PM	15	102	211	23	12	35	236	20	275	0	0	0	521
3.30 PM	13	202	215	25	12	38	219	37	275	1	0	1	510
Total	52	759	811	86	51	137	839	135	974	1	0	1	1923
- otal	01	100	01	00	5.	107	000		<u>.</u> .1	·	U		
4:00 PM	17	154	171	21	13	34	224	35	259	0	1	1	465
4:15 PM	16	182	198	20	9	29	209	38	247	1	0	1	475
4:30 PM	11	161	172	21	16	37	215	31	246	0	0	0	455
4:45 PM	22	173	195	21	19	40	218	29	247	0	0	0	482
Total	66	670	736	83	57	140	866	133	999	1	1	2	1877
5:00 PM	19	154	173	22	19	41	215	35	250	0	0	0	464
5:15 PM	20	178	198	10	14	24	256	20	276	0	0	0	498
5:30 PM	13	194	207	21	16	37	207	25	232	0	0	0	476
5:45 PM	17	177	194	21	10	31	208	15	223	0	0	0	448
Total	69	703	772	74	59	133	886	95	981	0	0	0	1886
Grand Total	187	2132	2319	243	167	410	2591	363	2954	2	1	3	5686
Approach %	8.1	91.9	-	59.3	40.7	-	87.7	12.3		66.7	33.3	-	
Total %	3.3	37.5	40.8	4.3	2.9	7.2	45.6	6.4	52.0	0.0	0.0	0.1	

## Project: Cookout at N Broadway Intersection: N. Broadway at Edgewood Ave Date Conducted: Tuesday, May 17, 2022

## PM Peak Hour 3:30 PM - 4:30 PM 1968

	N	Broadw	/ay	Edge	ewood	Ave	NI	Broadw	/ay	D	rivewa	ıy	
	Sou	uthbou	nd	W	estboui	nd	No	rthbou	nd	Ea	astbour	nd	
Start	Left	Thru	Total	Left	Right	Total	Thru	Right	Total	Left	Right	Total	Int. Total
Peak Hour Analysis from 3:00 PM to 6:00 PM													
PM Peak Hour begins at 3	3:30 PM	١											
3:30 PM	15	196	211	23	12	35	236	39	275	0	0	0	521
3:45 PM	13	202	215	25	13	38	219	37	256	1	0	1	510
4:00 PM	17	154	171	21	13	34	224	35	259	0	1	1	465
4:15 PM	16	182	198	20	9	29	209	38	247	1	0	1	475
Total Volume	61	734	795	89	47	136	888	149	1037	2	1	3	1971
Future (1% over 3 yrs)	63	756	-	92	48		915	154	-	2	1		2031
PHF	0.90	0.91		0.89	0.90		0.94	0.96		0.50	0.25		0.95

	Adjusted		
	Average Daily		
Year	Traffic		
2001	41295		
2002	37583		
2003	37847		
2004	31524		
2005	30887		
2006	29000	45000	
2007	30465	40000	
2008	30799	30000	
2009	28135	25000	
2010	26302	20000	
2011	26354	15000	-
2012	26788	10000	-
2013	27720	5000	
2014	25438	0	0
2015	27559		
2016	28690		
2017	32174		
2018	26592		
2019	29599		
2020	23884		
2021	16786		Мо



Most Recent	Trend	Line Growth
	Year	ADT
	2015	27559
	2020	23884

Annual Percent Growth	-3.08%
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Figure 1: 2022 Existing PM Peak Hour Traffic



Figure 2: 2025 Background PM Peak Hour Traffic

Project: Cook Out Broadway Date Conducted: Monday April 24, 2023

Fast- Food Restaurant with Drive Through Window (LUC 934) 3,130 SF

Average Daily Traffic T = 467.48(X) T = 467.48(3.13)T = 1463

## Peak Hour of Adjacent Street Traffic One Hour Between 4 and 6 p.m.

T = 33.03(X)T = 33.03(3.13)T = 103

		Per	cent	Number		
Time Period	Total Trips	Enter	Exit	Enter	Exit	
Weekday (24 hours)	1463	50%	50%	732	732	
PM Peak Hour	103	52%	48%	54	49	

# Fast-Food Restaurant with Drive-Through Window (934)

## Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: Weekday

## Setting/Location: General Urban/Suburban

Number of Studies: 71

Avg. 1000 Sq. Ft. GFA: 3

Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
467.48	98.89 - 1137.66	238.62

## Data Plot and Equation



# Fast-Food Restaurant with Drive-Through Window (934)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA On a: Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. Setting/Location: General Urban/Suburban Number of Studies: 190 Avg. 1000 Sq. Ft. GFA: 3 Directional Distribution: 52% entering, 48% exiting

## Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
33.03	8.77 - 117.22	17.59

## Data Plot and Equation





— 50% (50%) TRIP DISTRIBUTION ENTER (EXIT)

Figure 3: Peak Hour New Trip Distribution



— 50% (50%) TRIP DISTRIBUTION ENTER (EXIT)

Figure 4: Peak Hour Pass-By Trip Distribution



Figure 5: Peak Hour Site Traffic



Figure 6: 2025 Full Buildout Site Traffic

## ID: 94 Name: Broadway & Edgewood Configuration: Permanent

Param	Phs 1	Phs 2	Phs 3	Phs 4	Phs 5	Phs 6	Phs 7	Phs 8
Walk	0	0	0	6	0	0	0	0
Ped Clearance	0	0	0	16	0	0	0	0
Min Green	6	18	0	8	6	10	0	0
Gap Ext	2	3	2	3	2	3	1	1
Max1	25	60	25	30	20	45	25	25
Max2	50	75	30	35	25	65	50	50
Yellow Clr	4	4.5	4	4	4	4.5	3.5	3.5
Red Clr	2.5	1	2.5	1	2.5	2	1.5	1.5
Red Revert	0	0	0	0	0	0	0	0
Added Initial	0	0	0	0	0	0	0	0
Max Initial	0	0	0	0	0	0	0	0
Time Before Reduce	0	0	0	0	0	0	0	0
Cars Before Reduce	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0
Reduce By	0	0	0	0	0	0	0	0
Min Gap	0	0	0	0	0	0	0	0
Dynamic Max Limit	0	0	0	0	0	0	0	0
Dynamic Max Step	0	0	0	0	0	0	0	0
Startup	RED	GREEN	RED	RED	RED	GREEN	RED	RED
Enable	On	On	Off	On	Off	Off	Off	Off
Auto Flash Entry	Off							
Auto Flash Exit	Off							
Non-Actuated 1	Off	On	Off	Off	Off	Off	Off	Off
Non-Actuated 2	Off							
Lock Call	Off							
Min Recall	On	Off						
Max Recall	Off	On	Off	Off	Off	Off	Off	Off
Ped Recall	Off							
Soft Recall	Off							
Dual Entry	Off	On	Off	On	Off	On	Off	On
Sim Gap Enable	On							
Guar Passage	Off							
Rest In Walk	Off							
Cond Service	Off							
Add Init Calc	Off							
Concurrent Ps	1	1	1	1	2	2	2	2
Concur 1	5	5	7	7	1	1	3	3
Concur 2	6	6	8	8	2	2	4	4
Concur 3	0	0	0	0	0	0	0	0
Concur 4	0	0	0	0	0	0	0	0
Concur 5	0	0	0	0	0	0	0	0
Concur 6	0	0	0	0	0	0	0	0
Concur 7	0	0	0	0	0	0	0	0
Concur 8	0	0	0	0	0	0	0	0

## HCS7 Signalized Intersection Results Summary

General Information								Inter	sect	ion Inf	al at at at a								
Agency Ardurra Group							Dura	tion,	h	0.25	0.25		4+5						
Analyst Addie Kirkham		Analys	is Date	e Jun 2	n 20, 2022			Area Type			Other			1 A 8					
Jurisdiction City of Knoxville			Time Period		Existi	Existing PM Peak			PHF			0.95		w‡e					
Urban Street North Broadway			Analysis Year		r 2022	2022			Analysis Period			1> 7:00							
Intersection North Broadway at Edge			File Name		Existi	Existing PM Peak		Broadwav at E		at Edg	Edaewood.xus			514	×				
Project Description 243.226 - Cook Out Broadw				vay TL	<u> </u>										<u> </u>    ጎ ∢ ↑ ቀንዮ? ነ /				
Demand Information				EB			N N		NB		NB				SB				
Approach Movement				L	Т	R	L	٦		R	L	Т	R	L	Т	R			
Demand(v), veh/h				2	0	1	89	(	)	47	0	888	149	61	734	0			
				1															
Signal Information				215	- NAR	a é	<u> </u>								$\rightarrow$				
Cycle, s	110.0	Reference Phase	2			51	∙Ř ″						1	2	3	4			
Offset, s	0	Reference Point	End	Green	5.2	72.5	11.1	0.7	7 (	0.0	0.0								
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.5	4.0	3.5	5 (	0.0	0.0	_	<b>N</b>	$\nabla$					
Force Mode	Fixed	xed Simult. Gap N/S On		Red	1.0	1.0	1.0	1.5	5 (	0.0	0.0		5	6	7	<b>Y</b> 8			
			_				1	_		_			_						
Timer Results				EBL	-	EBT	WB		WB <sup>-</sup>	Т	NBI	-	NBT	SBI		SBT			
Assigned Phase						8		_	4				6	5		2			
Case Number					12.0		$\rightarrow$	12.0	)			6.3	1.0		4.0				
Phase Duration, s					5.7		$\rightarrow$	16.1	1			78.0	10.2	2 3	38.2				
Change Period, (Y+R c), s					5.0			5.0	0			6.5			6.5				
Max Allow Headway ( <i>MAH</i> ), s					3.2			3.2				0.0			0.0				
Queue Clearance Time ( $g_s$ ), s					2.2			11.0				3.2							
Green Extension Time ( g e ), s					0.0			0.2				0.0	0.1	0.0					
Phase Call Probability					0.09		$\rightarrow$	0.99	J				0.86	,					
Max Out Probability					0.00			0.00	)				0.00						
Movement Group Results				EB			WE	3			NB			SB					
Approach Movement			L	Т	R	L	Т	F	R	L	Т	R	L	Т	R				
Assigned Move	Assigned Movement		3	8	18	7	4	1	4	1	6	16	5	2	12				
Adjusted Flow Rate ( v ), veh/h				3			143	3		0	560	532	64	773	0				
Adjusted Saturation Flow Rate ( s ), veh/h/ln				1711			170	8		697	1870	1776	1781	1870	0				
Queue Service Time ( g s ), s				0.2			9.0			0.0	16.4	16.5	1.2	7.4	0.0				
Cycle Queue Clearance Time ( $g_c$ ), s				0.2			9.0			0.0	16.4	16.5	1.2	7.4	0.0				
Green Ratio ( g/C )				0.01			0.10	2		0.65	0.65	0.65	0.72	0.74					
Capacity ( c ), veh/h					11			172	2		65	1216	1154	407	2777				
Volume-to-Capacity Ratio ( X )					0.275			0.83	0		0.000	0.460	0.461	0.158	0.278	0.000			
Back of Queue (Q), ft/In (95 th percentile)					4.6			182.	5		0	271.4	257.1	17.3	110.4	0			
Back of Queue (Q), veh/In (95 th percentile)					0.2			7.2			0.0	10.7	10.3	0.7	4.3	0.0			
Queue Storage Ratio (RQ) (95 th percentile)					0.00			0.00	)		0.00	0.00	0.00	0.17	0.00	0.00			
Uniform Delay ( d 1 ), s/veh					54.4			48.	5		0.0	9.6	9.6	6.4	4.6				
Incremental Delay ( d 2 ), s/veh				4.7			3.9			0.0	1.3	1.3	0.1	0.2	0.0				
Initial Queue Delay ( d 3 ), s/veh				0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0				
Control Delay ( d ), s/veh				59.1			52.4	4		0.0	10.9	10.9	6.5	4.9					
Level of Service (LOS)					Е			D				В	В	А	А				
Approach Delay, s/veh / LOS				59.1		Е	52.4	ł	D		10.9	)	В	5.0		А			
Intersection Delay, s/veh / LOS						11	.5	5						В					
Multimodal Results			EB				WE		VВ		NB		SB						
Pedestrian LOS Score / LOS				2.9		С	2.9	2.9			2.1		B 2.0			В			
Bicycle LOS Score / LOS			0.5		А	0.7		Α		1.4		A	1.2		A				

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## HCS7 Signalized Intersection Results Summary

			-								_						
General Information								Interse	ectio	on Info		4444	× L				
Agency Ardu		Ardurra Group	Ardurra Group							Duration, h			0.25		445		
Analyst Addie Kirkham			Analysis Date		Jun 20	Jun 20. 2022			vpe		Other				₹_4		
Jurisdiction City of Knoxville			Time Period		Backg Peak	Background PM			PHF			0.95		w <sup>N</sup> 8 E			
Urban Street North Broadway				Analysis Year		2025	2025			is Pe	eriod	1> 7:00			ጜቀቱ	÷. ج	
Intersection North Broadway at Edge				File Name Background PM I					eak_Bro	adw	ay at l	- <b>]]]</b> ז≼ז≎יזיר					
Project Description 243.226 - Cook Out Broadw				way TL	ay TL												
					50		l	1.4	(D			ND			0.0		
Demand Information					EB	D	<u> </u>	- 1		,	1	NB			SB	D	
Approach Movement					0		L 02			` `		015	154	62	756		
Demand ( V ), ven/h				Z	U		92		J 40	5	0	915	154	03	750	0	
Signal Information						JL.	5	9			T					<u> </u>	
Cycle, s	110.0	Reference Phase	2	1		Re	,₿ĕ	7								Y	
Offset, s	0	Reference Point	End	Green	52	72 2	11 4	0.	7 0	n	0.0	_	1	2	3	4	
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.5	4.0	3.	5 0.0	0	0.0	-		512		~	
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	1.	5 0.0	0	0.0		5	6	7		
			_					_		_		_					
Timer Results				EBL E		EBT	WBL		WBT		NBL		NBT	SBL	-	SBT	
Assigned Phase	e					8			4	+			6	5		2	
Case Number						12.0			12.0	12.0		6.3		1.0		4.0	
Phase Duration, s						5.7	<u> </u>		16.4		77.7		10.2		87.9		
Change Period, (Y+R c), s						5.0			5.0			6.5		5.0		6.5	
Max Allow Headway ( <i>MAH</i> ), s						3.2			3.2				0.0	3.1	0.0		
Queue Clearance Time ( $g_s$ ), s				_	2.2			11.3	+		_	0.0	3.2		0.0		
Green Extension Time ( g e ), s				-	0.0			0.2	╈		-	0.0	0.1	-	0.0		
Max Out Proba	bility			<u> </u>	-	0.00			0.00	÷				0.07		_	
Max Out Frobability					0.00			0.00					0.00				
Movement Group Results				EB			W	3	Т		NB			SB			
Approach Movement		L	Т	R	L	Т	R		L	Т	R	L	Т	R			
Assigned Movement		3	8	18	7	4	14		1	6	16	5	2	12			
Adjusted Flow Rate (v), veh/h				3			147	7		0	577	548	66	796	0		
Adjusted Saturation Flow Rate (s), veh/h/ln				1711			170	9		682	1870	1776	1781	1870	0		
Queue Service Time ( <i>g</i> s), s				0.2			9.3	3	_	0.0	17.3	17.4	1.2	7.7	0.0		
Cycle Queue Clearance Time ( $g c$ ), s					0.2			9.3	3	+	0.0	17.3	17.4	1.2	7.7	0.0	
Green Ratio (g/C)					0.01			0.1	0	-	0.65	0.65	0.65	0.71	0.74		
Capacity ( c ), veh/h					11			17	/		65	1210	1149	395	2767	0.000	
Volume-to-Capacity Ratio ( $X$ )					0.275			107	0		0.000	0.477	0.477	10.100	0.288	0.000	
Back of Queue (Q), Tt/in (95 th percentile)					4.0			7/	.0	÷	0	203.4	200.0	0.7	110.0	0.0	
Queue Storage Ratio (RQ) (95 th percentile)					0.00			0.0	0		0.0	0.00	0.00	0.1	0.00	0.0	
Uniform Delay ( $d_1$ ). s/veh					54.4			48.	4	T	0.0	9.9	9.9	6.7	4.7	0.00	
Incremental Delay ( $d_2$ ), s/veh					4.7			3.9	)	+	0.0	1.3	1.4	0.1	0.3	0.0	
Initial Queue Delay ( <i>d</i> <sub>3</sub> ), s/veh				0.0			0.0	)	T	0.0	0.0	0.0	0.0	0.0	0.0		
Control Delay ( <i>d</i> ), s/veh				59.1			52.	2	╈	0.0	11.3	11.3	6.8	5.0			
Level of Service (LOS)					E			D		Т		В	В	Α	А		
Approach Delay, s/veh / LOS			59.1		E	52.2	2	D	T	11.3		В	5.1		A		
Intersection Delay, s/veh / LOS				11			.7								B		
Multimodal Results			EB			WE		В		NB		_		SB			
Pedestrian LOS	Score	/ LOS		2.9		C	2.9		C		2.1		В	2.0		В	
Bicycle LOS Score / LOS			0.5		A	0.7		A		1.4		A	1.2		A		

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## HCS7 Signalized Intersection Results Summary

General Information     Intersection Information       Agency     Ardurra Group       Duration, h     0.25				
Agency Ardurra Group Duration, h 0.25	↓ <b>L</b>			
Analysis				
I Anaivsi, 🔰 🔰 I Anaivsis Date IApr 26, 2023 🛛 Area Ivde 👘 IUther 🖉 🖆 🔤 👘	ے بل			
Jurisdiction City of Knoxville Time Period Full Buildout PM PHF 0.95				
Urban Street     North Broadway     Analysis Year     2025     Analysis Period     1> 7:00	₹ • t+			
Intersection North Broadway at Edge File Name Full Buildout PM Peak_Broadway at Edgewood.xus	ት የሻ ት ሸ			
Project Description 243.226 - Cook Out Broadway TL				
Demand Information EB WB NB S	B			
Approach Movement	T R			
Demand ( v) yeh/h 2 0 1 116 0 69 0 903 180 86 7	46 0			
Signal Information	<u> </u>			
Cycle, s 110.0 Reference Phase 2				
Offset, s 0 Reference Point End Green 5.6 68.6 14.6 0.7 0.0 0.0	3 4			
Uncoordinated No Simult. Gap E/W On Yellow 4.0 4.5 4.0 3.5 0.0 0.0 V				
Force Mode         Fixed         Simult. Gap N/S         On         Red         1.0         1.0         1.5         0.0         0.0         5         6	7 8			
Timer Results     EBL     EBT     WBL     WBT     NBL     NBT     SBL	SBT			
Assigned Phase         8         4         6         5	2			
Case Number         12.0         12.0         6.3         1.0	4.0			
Phase Duration, s         5.7         19.6         74.1         10.6	84.7			
Change Period, (Y+R c), s       5.0       5.0       6.5       5.0	6.5			
Max Allow Headway ( <i>MAH</i> ), s 3.2 3.2 0.0 3.1	0.0			
Queue Clearance Time (g s), s         2.2         14.3         3.9				
Green Extension Time ( g e ), s         0.0         0.3         0.0         0.2	0.0			
Phase Call Probability     0.09     1.00     0.94				
Max Out Probability 0.00 0.00 0.00				
Movement Group Results FB WB NB S	B			
Approach Movement L T R L T R L T R L T R L T R L T	- R			
Assigned Movement         3         8         18         7         4         14         1         6         16         5         2	12			
Adjusted Flow Rate (v), veh/h 3 195 0 587 553 91 78	5 0			
Adjusted Saturation Flow Rate (s), veh/h/ln 1711 1703 689 1870 1762 1781 18	70 0			
Queue Service Time (g s), s         0.2         12.3         0.0         19.4         19.4         1.9         8	4 0.0			
Cycle Queue Clearance Time (g c), s         0.2         12.3         0.0         19.4         19.4         1.9         8	4 0.0			
Green Ratio (g/C) 0.01 0.01 0.13 0.61 0.61 0.61 0.68 0.	71			
Capacity ( c ), veh/h 11 1225 65 1149 1082 372 26	60			
Volume-to-Capacity Ratio (X)         0.275         0.864         0.000         0.510         0.243         0.243	95 0.000			
Back of Queue (Q), ft/ln (95 th percentile)         4.6         234         0         319.3         300.7         29         13	1.4 0			
Back of Queue (Q), veh/ln (95 th percentile)         0.2         9.2         0.0         12.0         1.1         5	3 0.0			
Queue Storage Ratio ( RQ ) ( 95 th percentile)         0.00         0.00         0.00         0.00         0.00         0.29         0.29	00.00			
Uniform Delay ( d 1 ), s/veh       54.4       46.8       0.0       11.9       11.9       8.4       5	8			
Incremental Delay ( d 2 ), s/veh         4.7         4.1         0.0         1.6         1.7         0.1         0	3 0.0			
Initial Queue Delay ( d 3 ), s/veh         0.0         <	0 0.0			
Control Delay ( d ), s/veh         59.1         50.9         0.0         13.5         13.6         8.5         6	1			
Level of Service (LOS) E D B A A				
Approach Delay, s/veh / LOS         59.1         E         50.9         D         13.6         B         6.3	6.3 A			
Intersection Delay, s/veh / LOS 14.1 B	<u></u>			
Multimodal Results EB WB NB S	SB			
Pedestrian LOS Score / LOS 2.9 C 2.9 C 2.1 B 2.0	В			
Bicycle LOS Score / LOS 0.5 A 0.8 A 1.4 A 1.2	Α			

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April 28, 2023

Curtis Williams Civil Engineering Division 400 Main Street, Suite 475 Knoxville, TN 37901

Re: 2900 North Broadway Cook Out TIL Review

Dear Mr. Williams:

The following comment response letter is submitted to address comments dated April 19, 2023:

**1. Reviewer Comment:** Please provide a comment, response document when resubmitted. Please indicate where/how the comments are addressed (i.e. page number, table number, etc...). It is preferred that the comment response document be bound and included at the end of the appendix section of the study.

<u>Response:</u> A stamped comment response letter was included as an attachment at the back of the updated Traffic Letter.

## 2. Reviewer Comment: Page 1

- a. Introduction
  - i. The last sentence of the 2<sup>nd</sup> paragraph (Starting with "For the purpose...") seems to imply other possible driveway arrangements are being considered. Please note that any modifications to this assumption would require the site to be re-evaluated.

<u>Response</u>: Updated the statement to reflect what is shown on the site plan submitted for review on April 2023.

- b. Existing Site Conditions
  - i. The posted speed limit on North Broadway in this section should be 40 mph not 35 mph.

Response: Updated the speed limit to state 40 mph.

## 3. Reviewer Comment: Page 2

- a. Pedestrian / Bicycle Network
  - i. Please note that bicycle parking will be provided.

<u>Response</u>: Added the following statement to Page 2. "Bicycle parking is expected to be provided in the vicinity of the proposed Cook Out Restaurant.

- b. Traffic Volumes
  - i. Please mention that the restaurant is not intended to be open during the AM peak period (assuming this is true).

<u>Response:</u> Added the following statement "The Cook Out Restaurant is not intended to be open during the AM peak hour; therefore, FMA only conducted a PM peak hour turning movement count..."

## 4. Reviewer Comment: Page 3

- a. TDOT Roadway Projects
  - i. Please clarify that the TDOT resurfacing project between Central St and Mineral Springs Ave is on N Broadway.

<u>Response:</u> Added "along N Broadway" to page 3.

ii. Consider writing out the ABC (Accelerated Bus Corridor) Acronym out once for clarity.

Response: Added "Accelerated Bus Corridor" to page 3.

- b. Trip Generation
  - i. The letter states that the fitted curve equations are used, but no fitted curve equations exist on the attached trip generation sheets. Please revise paragraph.

<u>Response:</u> Revised paragraph to state "average rates" were used to calculate trip generation.

ii. Is the restaurant open during the AM peak? If not please remove AM trips from the report and state that restaurant is not open during the AM peak. If so, count data may be needed for the AM period.

<u>Response:</u> The restaurant is not open during the AM peak period. AM Peak Hour was removed from the trip generation table the report.

iii. The 53 trips number listed for the PM peak hour does not match the sum of the values shown from Table 1. Please revise.

Response: Updated Table 1 to reflect the revised building size of 3,130 SF.

Mr. Williams April 28, 2023 Page 3 of 3

## 5. Reviewer Comment: Page 4

- a. Trip Distribution
  - i. Please mention that alley entering traffic is assumed to be negligible.

<u>Response:</u> Added the following statement to page 4. "Traffic entering from the alley is assumed to be negligible.

## 6. Reviewer Comment: Page 5

- a. Capacity Analysis and LOS
  - i. Please note that the full build out queue length estimations for the WB approach to the intersection during the PM peak may have inaccuracies due to the queue extending past the Cook Out driveway. (The actual queue may be shorter than expected because of cars waiting on Cook Out's lot).

<u>Response:</u> Added the following statement to Page 5. "The 95% queue length for the westbound approach (Edgewood Avenue) at the signalized intersection is expected to block the proposed Cook Out driveway connection; however, the queue length estimations may have inaccuracies due to the queue extending past the proposed driveway connection."

- b. Conclusion and Recommendations
  - i. The "Do Not Block Driveway" sign recommendation could be revised to state that under normal conditions, this sign may not be needed, but if needed, the City can put up later if it becomes a particular issue with the queues during peak hours.

<u>Response:</u> Updated the recommendation to state "Under average conditions the queue should not impact the driveway connection but if it becomes an issue FMA recommends considering the installation of a "Do Not Block Driveway" sign on Edgewood Avenue prior to the driveway connection."

ii. In addition to the "DO NOT ENTER" sign recommendation, there is also a need for a double-sided ONE-WAY sign. END ONE WAY and BEGIN ONE WAY, may be useful as well. Please evaluate these signs and add to the recommendation as appropriate.

<u>Response</u>: Added the following statement to Page 5. "In addition to the "Do Not Enter" sign, a "One-Way" sign or pavement striping may need to be installed to ensure that the direction of traffic is clearly marked.

I hope that this is helpful. Please contact me if you have any questions.

Thank you,

Addie Kirkham, P.E.

