March 22, 2021

Mr. Jim Snowden
Knox County Engineering & Public Works
205 West Baxter Avenue
Knoxville, TN 37917

Re: Traffic Letter for N Campbell Station Road Subdivision

Dear Mr. Snowden:

N Campbell Station Road Subdivision is located south of the intersection of Hardin Valley Road at N Campbell Station Road in Knox County, Tennessee. The development will include approximately 244 single family lots and FMA assumed a single driveway connection to N Campbell Station Road. Construction is proposed to take place this year and this analysis assumes full build out for the development will occur in 2024.

The purpose of this traffic analysis is to evaluate the driveway access to N Campbell Station Road and determine the need for exclusive turn lanes.

The standard practice for a residential subdivision with 150 or more lots is to require at least two access points to provide alternative access opportunities in the event that one access is blocked by a fallen tree, crash, or other. A preliminary site plan has not been provided for the N. Campbell Station Road Subdivision; therefore, FMA assumed a single driveway location with a boulevard entrance in order to evaluate the worst case scenario for an exclusive turn lane warrant.

N Campbell Station Road along the property line is a two-lane Road. The Knoxville-Knox County Planning Commission classifies N Campbell Station Road as a Minor Arterial with an 88 feet right-of-way per the Major Road Plan. The posted speed limit on N Campbell Station Road is 30 mph. N Campbell Station Road has no existing sidewalks or designated bike lanes in the vicinity of the proposed development. An aerial photo of the property is included in the attachments.

FMA conducted a peak hour turning movement count at the intersection of Pierceson Pointe Lane at N Campbell Station Road on Thursday February 25, 2021 from 7:00 a.m. to 9:00 a.m. and from 2:00 p.m. to 6:00 p.m. The AM peak hour at this intersection occurred between 7:15 a.m. and 8:15 a.m. and the PM peak hour occurred between 5:00 p.m. and 6:00 p.m.

Due to the altered traffic patterns from COVID-19 FMA increased the existing traffic count at the intersection of Pierceson Pointe Lane at N Campbell Station Road by 20% during both the AM and PM peak hours. Figure 1: 2021 Existing Peak Hour Traffic and the count data collected are included in the attachments.

The Tennessee Department of Transportation and the Knoxville Regional TPO maintain count stations in the vicinity of the proposed development. TPO count station ID: 093M354 is located on N Campbell Station Road south of Hardin Valley Road and TDOT count station ID: 000303 is located on N Campbell Station Road south of Yarnell Road. The annual growth rate for TPO station ID: 093M354 between 2010 and 2019 is approximately 4.23% and the 2019 ADT was 5,700 vehicles per day. The annual growth rate for TDOT station ID: 000303 between 2008 and 2018 is approximately 3.10% and the 2018 ADT was 5,593 vehicles per day. For the purpose of this study, an annual growth rate of 4% was assumed for traffic at the intersection of Pierceson Pointe Lane at N Campbell Station Road until full occupancy is reached in 2024. Figure 2: 2024 Background Peak Hour Traffic and the ADT trend line growth charts are included in the attachments.

The trip generation was calculated using the fitted curve equations where provided from *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers. Single-Family Detached Housing or Land Use 210 was used to calculate the daily trips, AM and PM peak hour trips. The land use worksheets are included in the attachments. A trip generation summary is shown in Table 1 – Trip Generation Summary.

Table 1 - Trip Generation Summary
N Campbell Station Road Subdivision

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Single-Family Detached Housing (LUC 210)	244 Lots	2,362	44	134	151	88

The total number of new trips generated by the N Campbell Station Road Subdivision will be 2,362 new daily trips, 178 trips during the AM peak hour and 239 trips during the PM peak hour.

N Campbell Station Road at the intersection with the proposed driveway connection has an existing trip distribution of 50% northbound and 50% southbound during the AM peak hour and 60% northbound and 40% southbound during the PM peak hour. The existing entering trip distribution at the intersection of N Campbell Station Road at Pierceson Point Lane is 25% northbound and 75% southbound during the AM peak hour and 60% northbound and 40% southbound during the PM peak hour and the existing exiting trip distribution is 45% northbound and 55% southbound during both the AM and PM peak hours. FMA used the existing trip generation to estimate the peak hour site traffic for the proposed N Campbell Station Road Subdivision. Figure 3: Peak Hour Site Traffic and Figure 4: Full Buildout Peak Hour Traffic are included in the attachments.

Unsignalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the AM and PM peak hours to evaluate the traffic conditions at the intersection of N Campbell Station Road at the proposed driveway connection. After the completion of the subdivision the full buildout traffic conditions for the westbound approach (driveway) operate at a LOS C during both the AM and PM peak hours and the southbound approach (N Campbell Station Road) operates at a LOS A during both the AM and PM peak hours. The HCS7 worksheets are included in the attachments.

The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to determine if a northbound right turn lane or a southbound left turn is warranted at the intersection of N Campbell Station Road at the proposed driveway connection. After review and assuming a single driveway connection there are no warranted turn lanes at the proposed intersection of N Campbell Station Road at the driveway connection during either the AM or PM peak hour conditions. The turn lane worksheets and analysis are included in the attachments.

N Campbell Station Road is classified as a Minor Arterial per the Major Road Plan. The minimum intersection spacing required on an arterial is 400 feet per the "Knoxville-Knox County Subdivision Regulations" as amended through February 13, 2020. In order to meet the minimum required intersection spacing the proposed driveway connection will need to be located greater than 400 feet north of Pierceson Pointe Lane and greater than 400 feet south of Hardin Valley Road.

The minimum required sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020. FMA recommends that the sight distance at the proposed intersection of N Campbell Station Road at the driveway connection be measured at 15 feet from the edge of pavement looking both northbound and southbound in order to ensure that the proposed driveway location meets the minimum required sight distance per the subdivision regulations.

FMA measured the sight distance along the property frontage on March 22, 2021 to verify that there are multiple locations where a single driveway connection can obtain a 300 foot minimum intersection sight distance.

FMA also verified that if two separate driveway connections along N Campbell Station Road were desired in order to comply with the Knox County standard practice for subdivisions with more than 150 lots, both a proposed driveway located at the northern end of the property line and a driveway located greater than 400 feet south would meet the 300 feet minimum intersection sight distance requirements.

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

Thank you,

Addie Kirkham, P.E.

Enclosure: Attachments

Attachments

N Campbell Station Rd

Printed: 2/22/2021 at 12:33:28 PM

0 200 400 800

ft

Knoxville - Knox County - KUB Geographic Information System

Project: N Campbell Station Road Subdivision
Intersection: Pierceson Pointe Lane at N Campbell Station Road
Date Conducted: 2/25/2021

	Pierceson Pointe Ln Eastbound			N Campbell Station Rd Northbound			N Campbell Station Rd Southbound			
Start	Left	Right	Total	Left	Thru	Total	Thru	Right	Total	Int. Total
7:00 AM	2	4	6	0	43	43	28	0	28	77
7:15 AM	3	9	12	0	67	67	41	1	42	121
7:30 AM	2	4	6	0	47	47	77	2	79	132
7:45 AM	3	3	6	0	68	68	77	1	78	152
Total	10	20	30	0	225	225	223	4	227	482
8:00 AM	6	2	8	2	68	70	61	2	63	141
8:15 AM	1	4	5	4	41	45	55	5	60	110
8:30 AM	0	3	3	2	28	30	30	0	30	63
8:45 AM	2	0	2	2	24	26	27	4	31	59
Total	9	9	18	10	161	171	173	11	184	373
2:00 PM	1	1	2	1	52	53	38	1	39	94
2:15 PM	2	0	2	0	30	30	35	0	35	67
2:30 PM	0	2	2	4	35	39	27	0	27	68
2:45 PM	3	1	4	4	51	55	43	4	47	106
Total	6	4	10	9	168	177	143	5	148	335
3:00 PM	2	2	4	0	34	34	49	3	52	90
3:15 PM	1	1	2	2	62	64	54	1	55	121
3:30 PM	3	2	5	0	62	62	110	3	113	180
3:45 PM	4	3	7	4	38	42	99	4	103	152
Total	10	8	18	6	196	202	312	11	323	543
4:00 PM	4	2	6	2	46	48	62	1	63	117
4:15 PM	1	1	2	5	44	49	51	2	53	104
4:30 PM	0	1	1	1	45	46	45	1	46	93
4:45 PM	1	3	4	3	40	43	53	3	56	103
Total	6	7	13	11	175	186	211	7	218	417
5:00 PM	2	3	5	3	50	53	32	6	38	96
5:15 PM	4	6	10	4	72	76	58	2	60	146
5:30 PM	4	1	5	5	65	70	47	2	49	124
5:45 PM	2	4	6	5	51	56	45	0	45	107
Total	12	14	26	17	238	255	182	10	192	473
Grand Total	53	62	115	53	1163	1216	1244	48	1292	2623
Approach %	46.1	53.9		4.4	95.6		96.3	3.7		
Total %	2.0	2.4	4.4	2.0	44.3	46.4	47.4	1.8	49.3	

Project: N Campbell Station Road Subdivision
Intersection: Pierceson Pointe Lane at N Campbell Station Road
Date Conducted: 2/25/2021

AM Peak Hour	7:15 AM - 8:15 AM	546
PM Peak Hour	5:00 PM - 6:00 PM	473

	Pierceson Pointe Ln Eastbound			N Campbell Station Rd Northbound			N Campbell Station Rd Southbound			
Start	Left	Right	Total	Left	Thru	Total	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:15 AM										
7:15 AM	3	**9**	12	0	67	67	41	1	42	121
7:30 AM	2	4	6	**0**	47	47	**77**	2	79	132
7:45 AM	3	3	6	0	68	68	77	1	78	**152**
8:00 AM	**6**	2	8	**2**	**68**	70	61	**2**	63	141
Total Volume	14	18	32	2	250	252	256	6	262	546
Existing (20% Increase)	17	22		2	300		307	7		655
Future (4% over 3 yrs)	19	24		3	337		346	8		737
PHF	0.58	0.50		0.25	0.92		0.83	0.75		0.90
Peak Hour Analysis from 4:00 PM to 6:00 PM										
PM Peak Hour begins at 3:15 PM										
5:00 PM	2	3	5	3	50	53	32	**6**	38	96
5:15 PM	**4**	**6**	10	4	**72**	76	**58**	2	60	**146**
5:30 PM	4	1	5	**5**	65	70	47	2	49	124
5:45 PM	2	4	6	5	51	56	45	0	45	107
Total Volume	12	14	26	17	238	255	182	10	192	473
Existing (20% Increase)	14	17		20	286		218	12		568
Future (4% over 3 yrs)	16	19		23	321		246	13		638
PHF	0.75	0.58		0.85	0.83		0.78	0.42		0.81

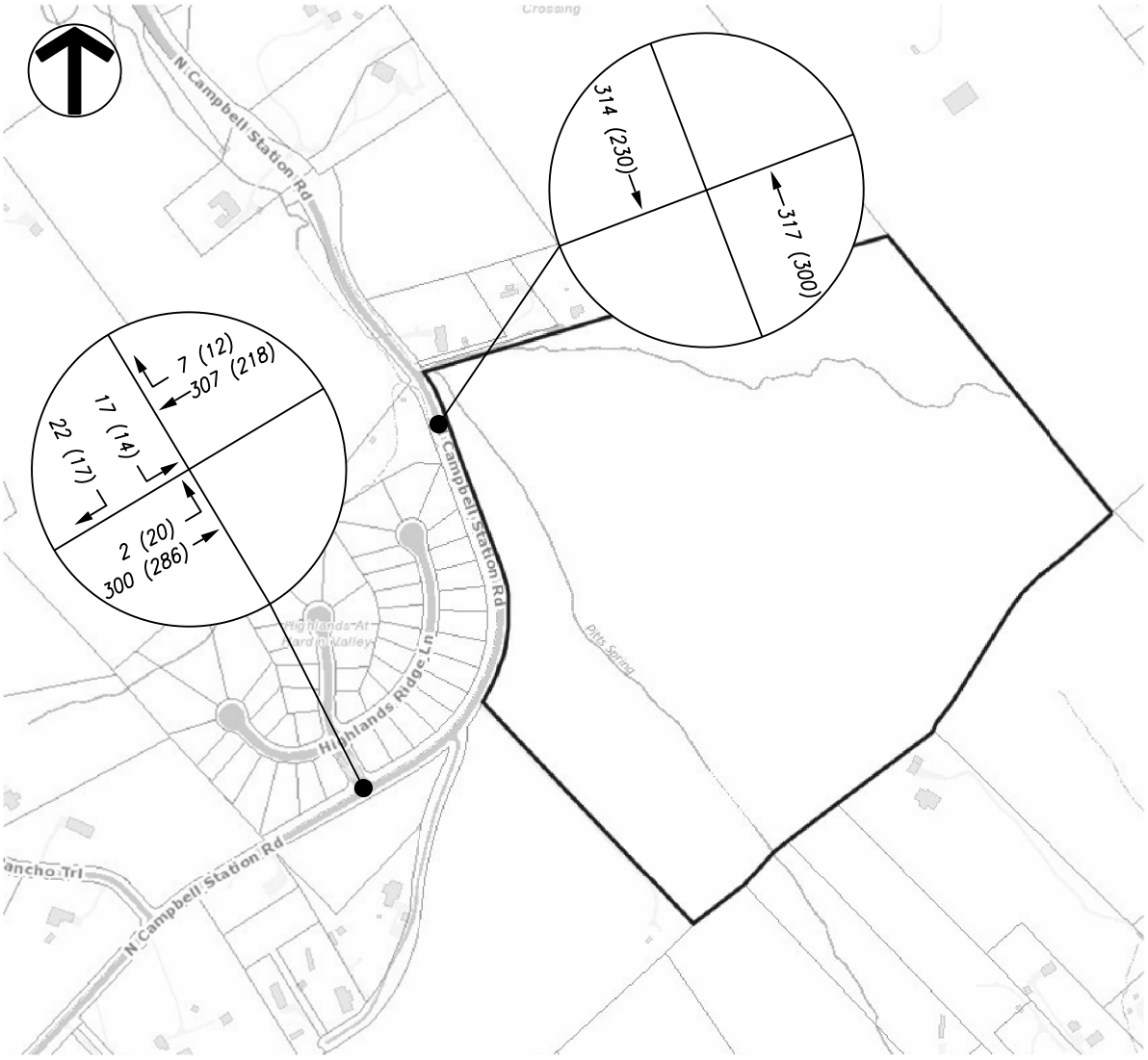
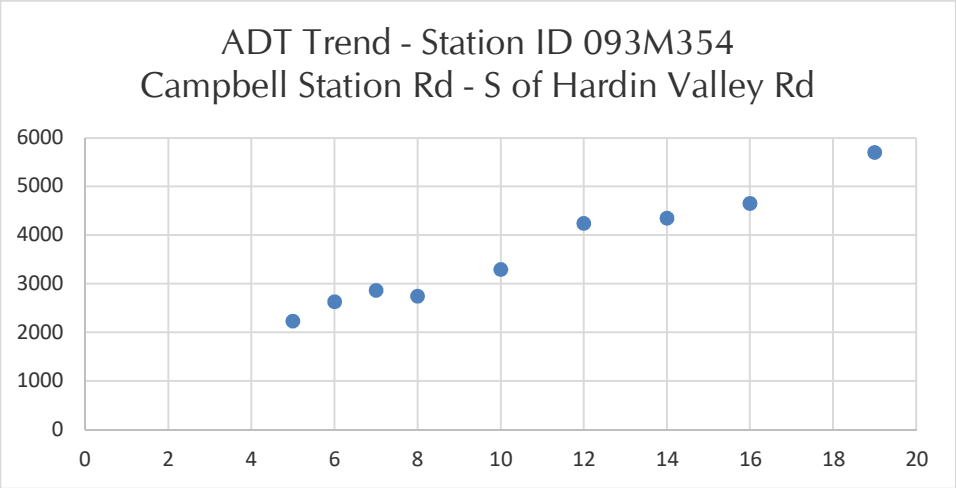


Figure 1: 2021 Existing Peak Hour Traffic

Year	Adjusted Average Daily Traffic
2001	
2002	
2003	
2004	
2005	2229
2006	2630
2007	2860
2008	2740
2009	
2010	3290
2011	
2012	4240
2013	
2014	4350
2015	
2016	4650
2017	
2018	
2019	5700

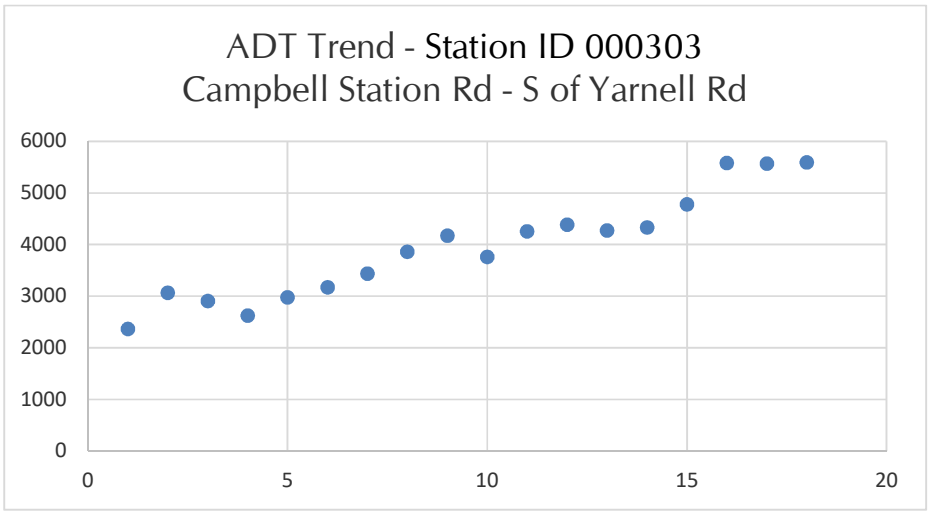


Most Recent Trend Line Growth

Year	ADT
2010	3290
2019	5700

Annual Percent Growth	**4.23%**

Year	Adjusted Average Daily Traffic
2001	2367
2002	3067
2003	2907
2004	2623
2005	2978
2006	3169
2007	3436
2008	3860
2009	4176
2010	3759
2011	4256
2012	4385
2013	4271
2014	4332
2015	4779
2016	5583
2017	5568
2018	5593



Most Recent Trend Line Growth

Year	ADT
2008	3860
2018	5593

Annual Percent Growth	**3.10%**

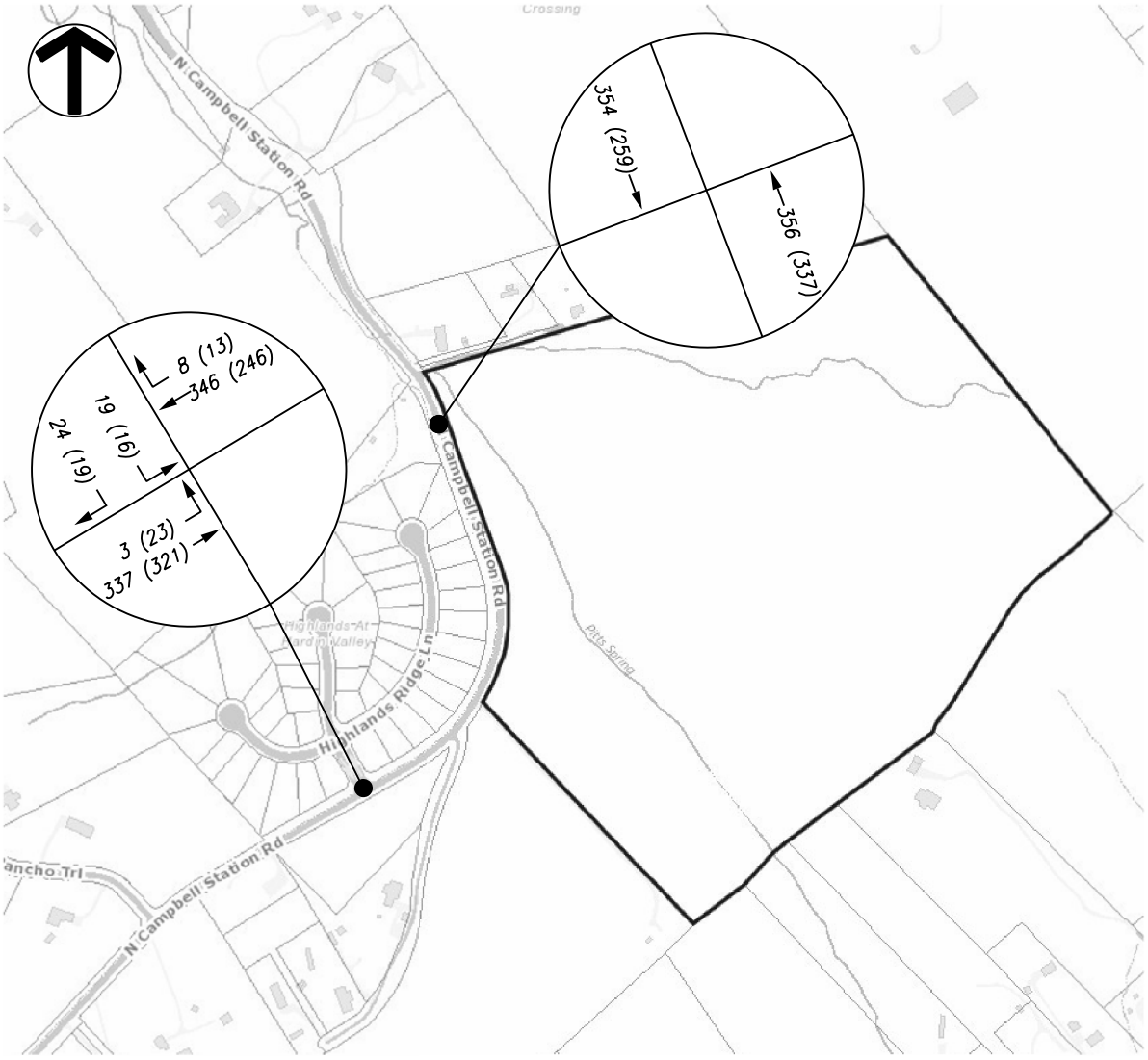


Figure 2: 2024 Background Peak Hour Traffic

Trip Generation

Project: N Campbell Station Subdivision
Date Conducted: 2/22/2021

Single-Family Detached Housing (LUC 210)
244 Single Family Lots

Average Daily Traffic
$Ln(T) = 0.92Ln(X) + 2.71$
$Ln(T) = 0.92Ln(244) + 2.71$
$T = 2362$

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
$T = 0.71(X) + 4.80$
$T = 0.71(244) + 4.80$
$T = 178$

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
$Ln(T) = 0.96Ln(X) + 0.20$
$Ln(T) = 0.96Ln(244) + 0.20$
$T = 239$

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	2362	50%	50%	1181	1181
AM Peak Hour	178	25%	75%	44	134
PM Peak Hour	239	63%	37%	151	88

Single-Family Detached Housing
(210)

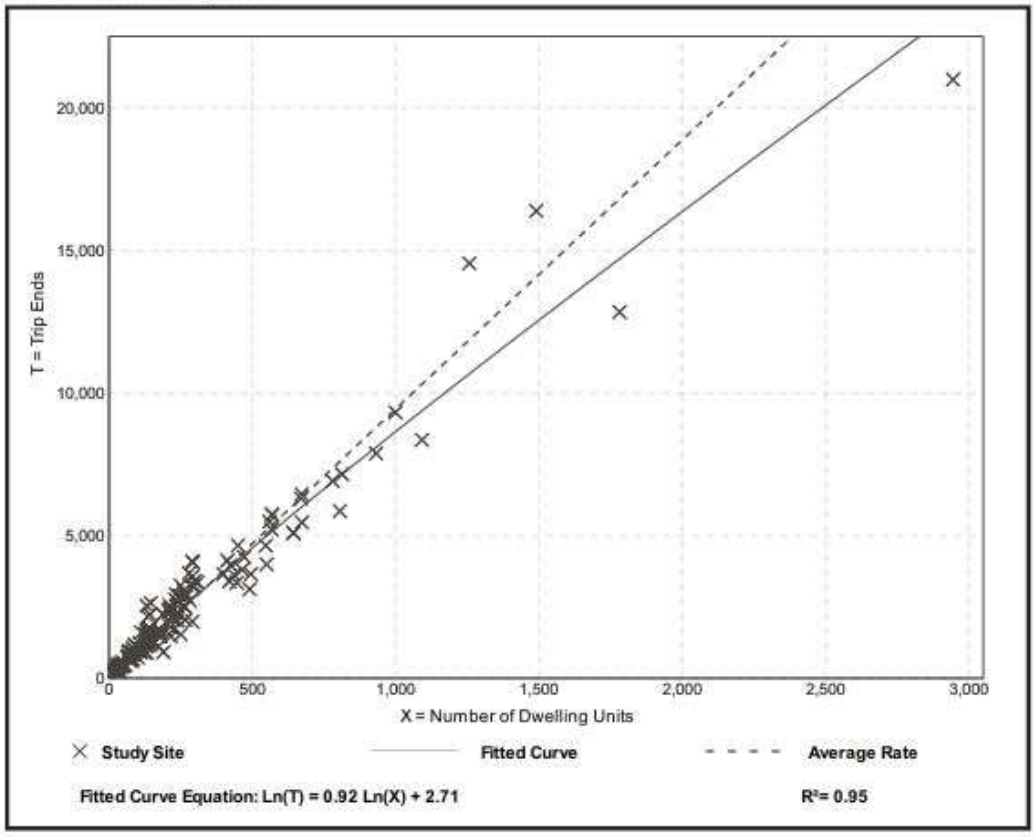
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 159
Avg. Num. of Dwelling Units: 264
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

Data Plot and Equation



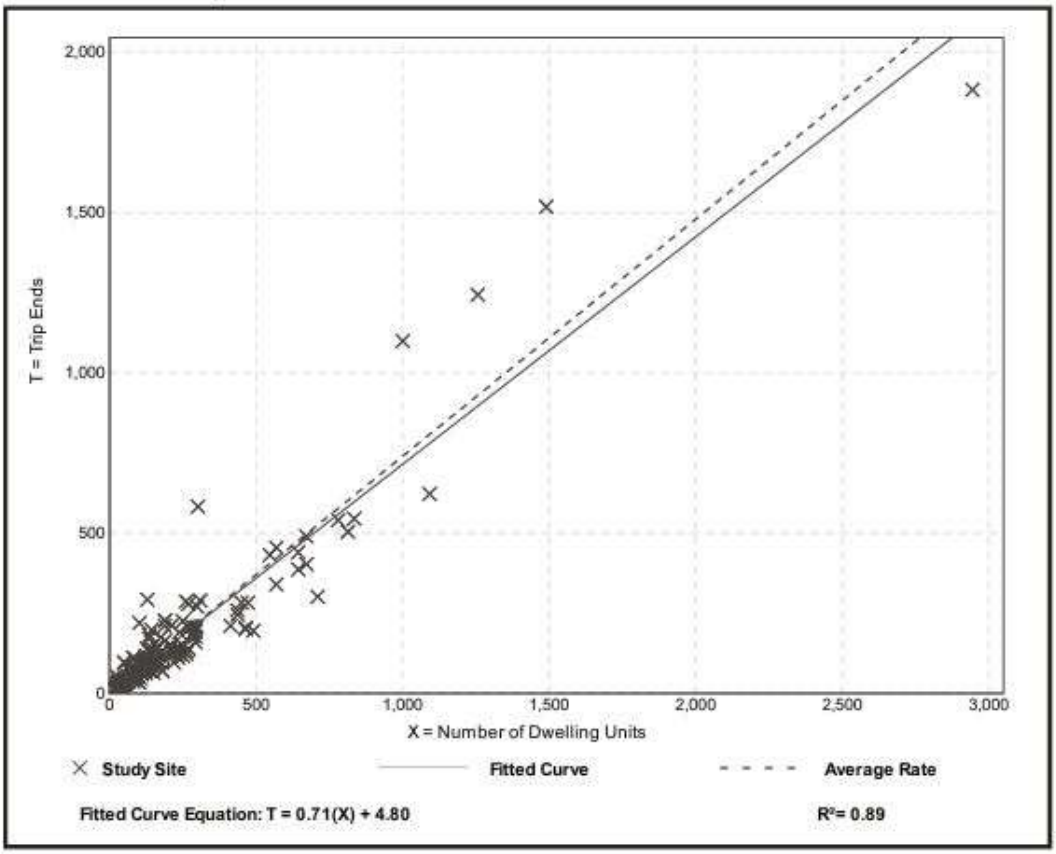
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	173
Avg. Num. of Dwelling Units:	219
Directional Distribution:	25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation



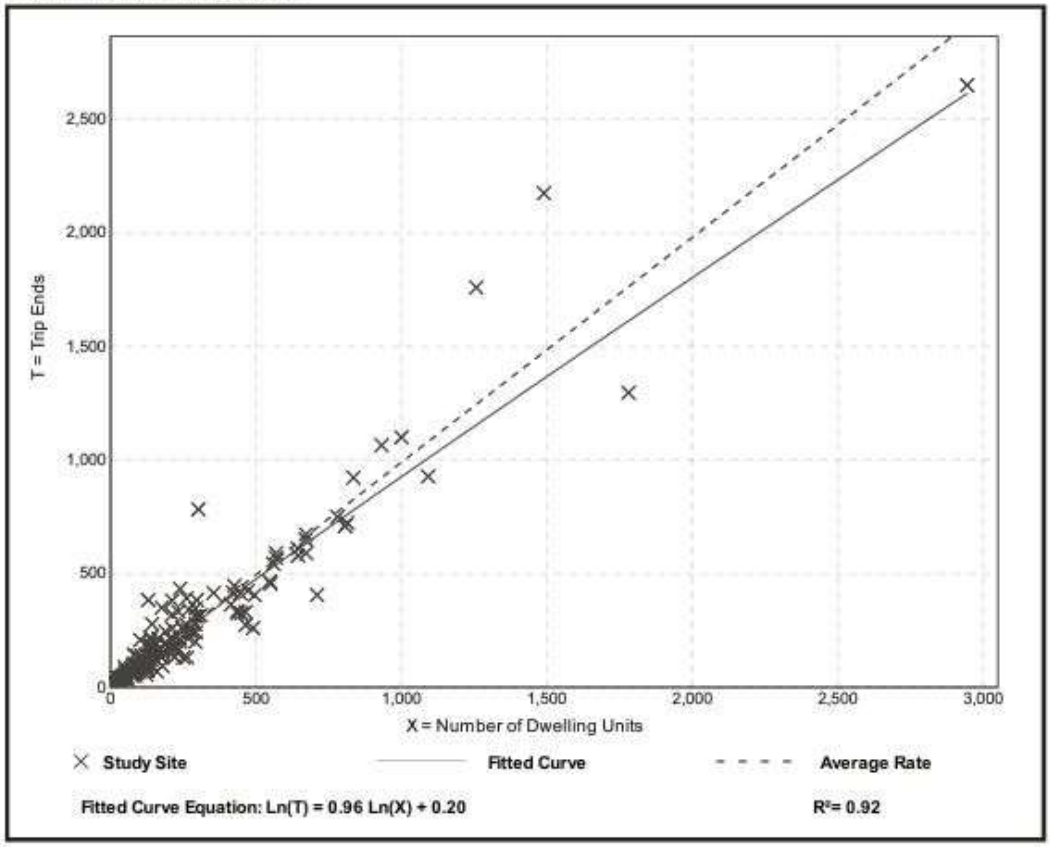
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
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. Num. of Dwelling Units:	242
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation



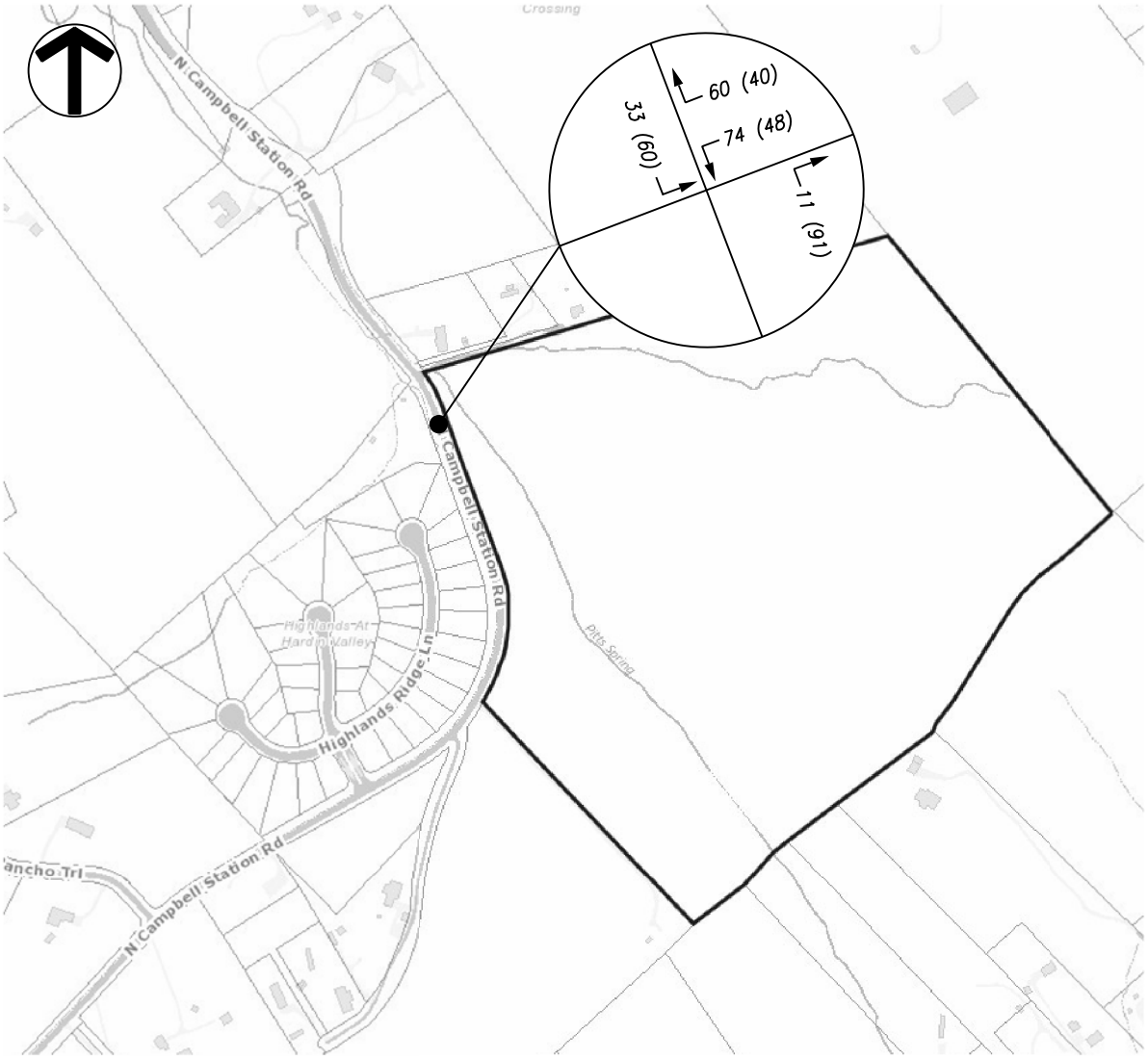


Figure 3: Peak Hour Site Traffic

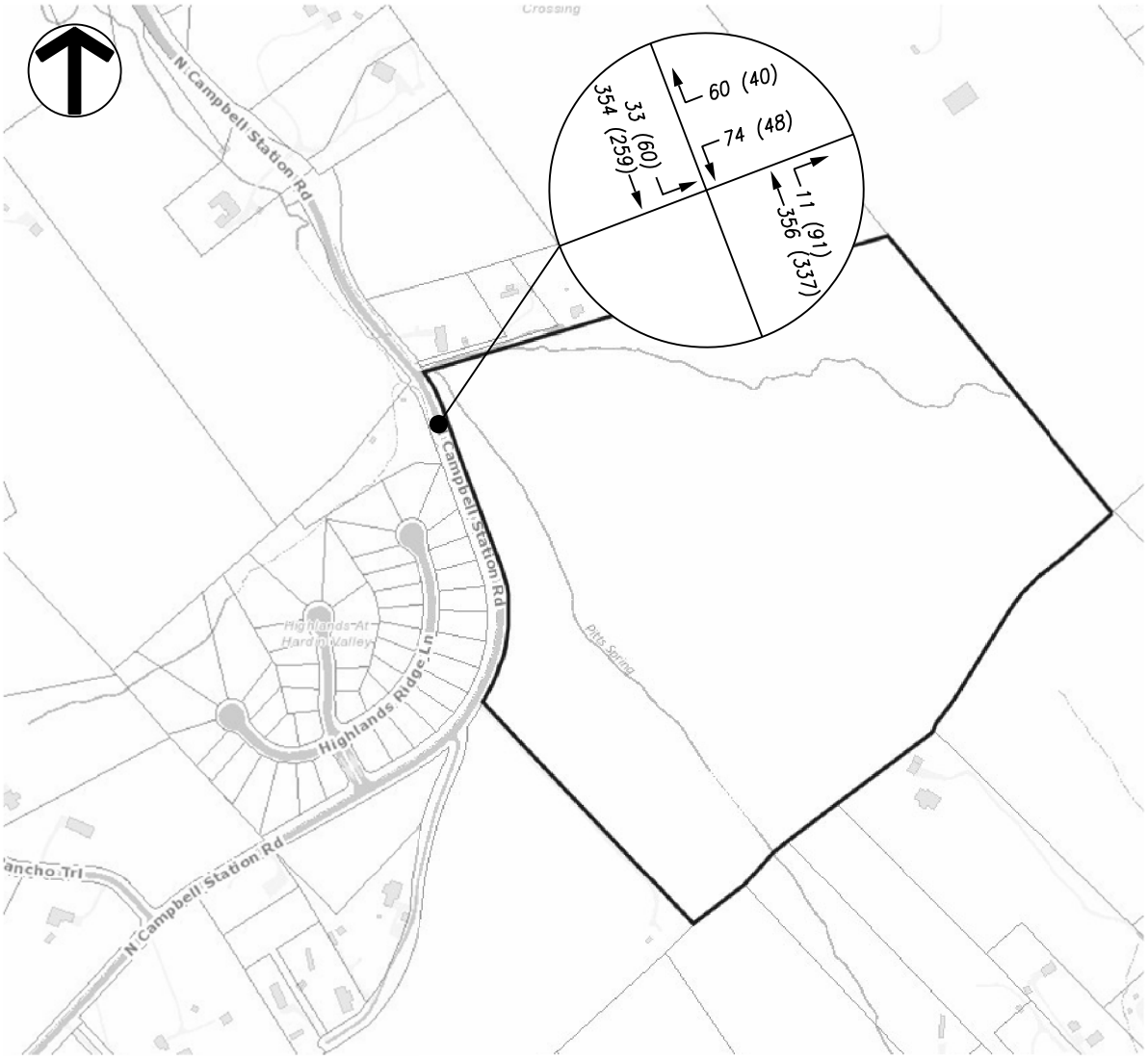


Figure 4: Full Buildout Peak Hour Traffic

HCS7 Two-Way Stop-Control Report

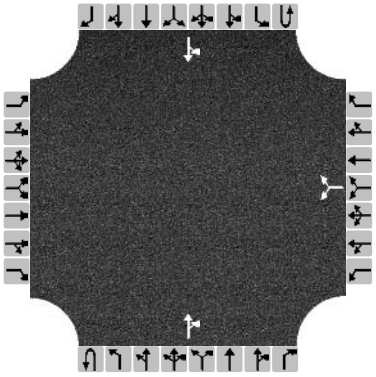
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/8/2021
Analysis Year	2024
Time Analyzed	Full Buildout AM Peak
Intersection Orientation	North-South
Project Description	592.012 - N Campbell Station Rd Subdivision

Site Information

Intersection	N Campbell at Driveway
Jurisdiction	Knox County
East/West Street	Driveway
North/South Street	N Campbell Station Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						74		60			356	11		33	354	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.42		6.22						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							145							36		
Capacity, c (veh/h)							416							1159		
v/c Ratio							0.35							0.03		
95% Queue Length, Q_{95} (veh)							1.5							0.1		
Control Delay (s/veh)							18.2							8.2		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						18.2								1.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

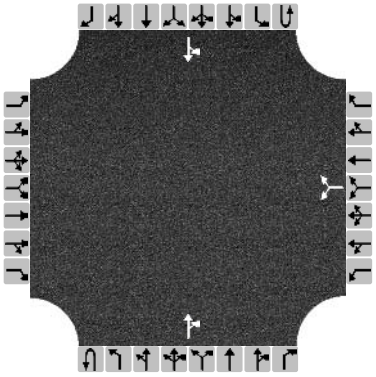
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/8/2021
Analysis Year	2024
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	North-South
Project Description	592.012 - N Campbell Station Rd Subdivision

Site Information

Intersection	N Campbell at Driveway
Jurisdiction	Knox County
East/West Street	Driveway
North/South Street	N Campbell Station Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						48		40			337	91		60	259	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)							0									
Right Turn Channelized			No				No				No				No	
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.42		6.22						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							95							65		
Capacity, c (veh/h)							414							1096		
v/c Ratio							0.23							0.06		
95% Queue Length, Q_{95} (veh)							0.9							0.2		
Control Delay (s/veh)							16.3							8.5		
Level of Service, LOS							C							A		
Approach Delay (s/veh)							16.3							2.1		
Approach LOS							C									

Project: N Campbell Station Road Subdivision

N Campbell Station Road at Driveway Connection

N Campbell Station Road VOLUMES
at Driveway Connection

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	367	354	33	60	NO
PM	428	259	60	75	NO

N Campbell Station Road VOLUMES
at Driveway Connection

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	356	11	249	NO
PM	337	91	299	NO

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170 150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 65	65 60	50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

AM Peak 33 LT

PM Peak 60 LT

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	460 55	55 50	50 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

* Or through volume only if a right-turn lane exists.

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99				AM Peak 11 RT PM Peak 91 RT		
100 - 149 150 - 199						
200 - 249 250 - 299						Yes
300 - 349 350 - 399				Yes	Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99					Yes	Yes Yes
100 - 149 150 - 199			Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

Date: March 22, 2021

Project Name: N Campbell Station Road Subdivision

To: Knoxville-Knox County Planning

Subject: Traffic Letter Review for N Campbell Station Road Subdivision

Dear Knoxville-Knox County Planning staff,

The following comment response document is submitted to address comments dated March 18, 2021:

1. **Reviewer Comment:** Address the standard policy that Knox County has of requiring multiple access points when the number of lots in a single development exceed 150 and mention whether two access points could be provided or alternatively if it must be only one access point that a boulevard section should be provided to the point where there are substantial alternate travel paths within the site.

   Response: Referenced the standard Knox County policy and added that FMA assumed a single boulevard entrance for the purpose of analyzing turn lanes.

2. **Reviewer Comment:** The TIL does not reference field measurement of sight distance, we recognize that perhaps a specific access point has not been determined at this point of the site plan development however the TIL should verify that sight distance meeting the minimum requirement is indeed available at some points along the property frontage given the horizontal and vertical alignments of N. Campbell Station Road.

   Response: FMA measured the sight distance along the property frontage on March 22, 2021 and verified that there are multiple locations where a 300 foot minimum intersection sight distance is attainable.

Sincerely,

Addie Kirkham, P.E.