

MEMORANDUM



1420 Spring Hill Road,
Suite 610,
Tysons, VA 22102
703-917-6620
WellsandAssociates.com

TO: Mark Mishler
Transportation Engineering Supervisor
Frederick County Division of Planning & Permitting

CC: Mike Kalinock, JPB Partners
Chad Tyler
Gerald Lee Miller, Terra Solutions Engineering, Inc.

FROM: Michael J. Workosky, PTP, TOPS, TSOS
John F. Cavan, P.E., PTOE

RE: Knowledge Farms
Frederick County, Maryland

SUBJECT: Traffic Analysis Addendum

Date: June 16, 2023

Introduction

This memorandum presents a traffic analysis addendum for Knowledge Farms located in Frederick County, Maryland. The site is located on the west side of Urbana Pike (MD 355) and south of Thornapple Drive, as shown on Figure 1.

The property was the subject of a previously prepared traffic study (dated December 8, 2021) that included residential and commercial uses with access provided via the existing driveway on Thornapple Drive. The purpose of this updated study is to reassess the MD 355/Thornapple Drive/Campus Drive intersection based on an updated development program and a secondary driveway proposed on MD 355 south of the Thornapple Drive intersection.

The assessment utilizes updated traffic count data collected in May 2023 and includes the AM and PM peak commuter hours and evaluates existing 2023 conditions and buildout conditions in 2026 with the construction and occupancy of uses proposed on the property. Based on discussions with Frederick County staff, this addendum focuses on the MD 355/Thornapple Drive intersection.

Background Information

The parameters of this study were discussed with Frederick County staff. It utilizes traffic information from recently prepared and approved studies in the area with updated traffic counts and background information for unbuilt and planned development. Sources of data for this study include JPB Partners, Terra Solutions Engineering, Frederick County, Maryland State Highway Administration (SHA), and the files of Wells + Associates, Inc.

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Development Program and Site Access

The Knowledge Farms property is currently occupied by an existing office/Research & Development (R&D) building of 36,000 S.F. It is currently approved for up to 140,000 S.F. of office/R&D uses.

The proposed program would consist of 297 various senior adult housing units (22 townhouses, 125 multi-family units and 150 assisted living units), and approximately 100,000 S.F. of commercial space (assumed as a self-storage facility). The updated site plan is shown in Figure 2.

Vehicular access would be provided from the existing driveway on Thornapple Drive and a proposed full-movement driveway on MD 355 approximately 720 feet south of the Thornapple Drive/Campus Drive intersection. The new driveway would require review and approval by SHA to allow for a break in access with regard to crossover spacing, operations, and turn lane requirements.

Existing Traffic Counts and Capacity Analyses

Updated existing traffic counts were collected at the MD 355/Thornapple Drive/Campus Drive intersection and the existing site driveway on Wednesday, May 17, 2023. The counts were collected on a typical weekday when Frederick County Public Schools were in session and under fair weather conditions. It is noted that while left turns from Campus Drive to southbound MD 355 are prohibited from 7:00 AM to 8:00 AM, Monday through Friday, lefts were recorded during this period and are included in this study. Based on the updated traffic counts, the AM peak hour generally occurred from 6:45 AM to 7:45 AM and the PM peak hour occurred from 4:45 PM to 5:45 PM.

A summary of the count data is contained in Appendix A. The existing lane use and peak hour volumes are shown in Figure 3.

Intersection capacity (Synchro) and queuing analyses were prepared at the study intersections for the AM and PM peak hours. Highway Capacity Manual (HCM) delay analyses and queues were calculated at unsignalized locations. The results are summarized on Tables 1 and 2 and contained in Appendix B.

The results indicate that the eastbound side-street movements on Thornapple Drive at the MD 355 intersection currently operate near or beyond capacity (at LOS “E” or “F”) during both the AM and PM peak hours. The westbound movements on Campus Drive currently operate at acceptable levels of service during both peak periods.

All of the turning movements at the existing site driveway currently operate at acceptable levels of service during both the AM and PM peak hours.

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Pipeline Development Trip Generation and Traffic Growth

A number of planned but unbuilt developments have been updated and included in this study. They include:

1. Villages of Urbana
2. Urbana Commons
3. Landsdale
4. Centerville Elementary School
5. Frederick Health at Urbana

The development densities for the pipeline developments were updated based on information provided by the land owners and data obtained by W+A. The number of AM and PM peak hour trips that expected to be generated by currently approved but unbuilt development were calculated consistent with previously prepared studies. Detailed information is contained in Appendix C.

In addition, consistent with previously prepared studies in the area, a one (1.0) percent growth rate was applied to the through traffic movements on MD 355 for a three-year period (2023 to 2026) to reflect buildout conditions. This growth rate accounts for anticipated development outside of the immediate study area.

A summary of the pipeline development traffic and traffic growth is shown in Figure 4.

Knowledge Farms Site Trip Generation and Comparison

The existing property is approved for 140,000 S.F. of office/R&D uses. Based on the approved traffic study from March 2001, the site has an existing vehicle trip capacity of 183 AM peak hour trips (152 in and 31 out) and 176 PM peak hour trips (26 in and 150 out), as shown on Table 3. (See Appendix D for additional information).

The number of AM and PM peak hour trips expected to be generated by the updated proposed development program were estimated based on the standard rates and equations contained in the Trip Generation, 11th Edition Manual, published by the Institute of Transportation Engineers (ITE).

The results indicate that the site is expected to generate 131 AM peak hour trips (81 in and 50 out) and 153 PM peak hour trips (57 in and 96 out) at full buildout. Thus, the proposed development program generates 52 fewer AM peak hour trips and 23 fewer PM peak hour trips than the currently approved program.

The proposed uses would add 74 AM peak hour trips (34 in and 40 out) and 97 PM peak hour trips (48 in and 49 out) to the road network when compared to the trips generated by the existing building (36,000 S.F.).

Future Traffic Forecasts and Capacity Analyses for 2026 (with Knowledge Farms)

Future traffic forecasts for 2026 with the development of the Knowledge Farms property were developed by using the updated existing traffic data from 2023, updated pipeline development densities for the surrounding area, a one (1.0) percent growth rate and the traffic expected to be generated by the proposed development program. The site generated trips and future traffic forecasts are shown on Figure 5.

The future lane use and traffic control are shown on Figure 6 and assume that a new traffic signal would be installed at the MD 355/Thornapple Drive/Campus Drive intersection, assuming traffic signal warrants are met and that the eastbound approach would be restriped or modified to provide a separate right turn lane. In addition, as part of the site development, a separate southbound right turn lane and northbound left turn lane would be provided at the proposed site driveway on MD 355 as required based on SHA criteria.

Capacity analyses were prepared for future conditions at the study intersections. The results are summarized on Tables 1 and 2 and summarized below. Detailed analyses are contained in Appendix E.

The MD 355/Thornapple Drive/Campus Drive intersection would operate at acceptable levels of service (with CLV's less than 1,600) during both the AM and PM peak hours assuming signalization as planned by others is installed and the eastbound approach is modified to provide a separate right turn lane.

All of the movements at the existing site driveway would operate at acceptable levels of service under future conditions assuming stop control.

The eastbound turning movements exiting the site onto MD 355 at the proposed site driveway would operate near capacity at LOS "E" during both the AM and PM peak hours. It is anticipated that this traffic would utilize gaps in through traffic on MD 355 created by the new traffic signal at Thornapple Drive. The balance of site generated traffic destined for northbound MD 355 would use Thornapple Drive to access the new traffic signal to turn left.

Thornapple Drive Traffic Operations

Traffic operations along Thornapple Drive between MD 355 and the existing site driveway were evaluated based on the updated traffic forecasts and queuing analysis. These operations are influenced by the new proposed site driveway to the south on MD 355 that reduces the critical movements from the north on MD 355. While the new site driveway provides some relief, the anticipated left turn queue along eastbound Thornapple Drive is expected to exceed approximately 80 feet of storage between MD 355 and the site driveway primarily during the PM peak hour. Thus, it is recommended that a second stop bar be provided on Thornapple Drive west of the site driveway to allow inbound traffic to enter the site without delay and eliminate queuing potential along MD 355.

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Conclusions

The results of this traffic analysis addendum are as follows:

1. Based on updated traffic data collected in May 2023, the MD 355/Thornapple Drive/Campus Drive intersection currently operates at levels of service with the exception of the side-street movements that operate at or beyond capacity (at LOS “E” or “F”) during the AM and/or PM peak hours.
2. The Knowledge Farms site is currently occupied by an office/R&D building of 36,000 S.F. and is approved for up to 140,000 S.F. The currently approved program has an existing vehicle trip threshold of 183 AM peak hour trips and 176 PM peak hour trips.
3. The proposed development program would retain the existing building and add approximately 297 senior adult housing units and 100,000 S.F. of commercial space (self-storage). This development program is expected to generate 131 AM peak hour trips and 153 PM peak hour trips at full buildout. The proposed development program would generate 52 fewer AM peak hour trips and 23 fewer PM peak hour trips when compared to the approved program. It would add 74 AM peak hour trips and 97 PM peak hour trips to the currently developed site.
4. Based on the future traffic forecasts the MD 355/Thornapple Drive/Campus Drive intersection would operate at acceptable levels of service assuming the planned traffic signal is installed and that the eastbound Thornapple Drive approach is modified to provide a separate right turn lane. All of the movements at the existing site driveway on Thornapple Drive would operate at acceptable levels of service in the future.
5. The proposed site driveway on MD 355 south of Thornapple Drive would require separate right and left turn lanes. Based on this configuration, the northbound exiting movements onto MD 355 would operate near capacity (at LOS “E”) during both the AM and PM peak hours. These movements are expected to use gaps in through traffic created by the new traffic signal at Thornapple Drive to exit the site. This driveway would reduce traffic demands at the Thornapple Drive intersection.
6. A review of the traffic operations along Thornapple Drive between MD 355 and the existing site driveway indicates that the queue for eastbound traffic would extend beyond the site driveway primarily during the PM peak hour. Thus, it is recommended that a second stop bar be provided west of the site driveway to eliminate queuing for inbound traffic.

Questions regarding this document should be directed to Wells + Associates.

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FIGURES

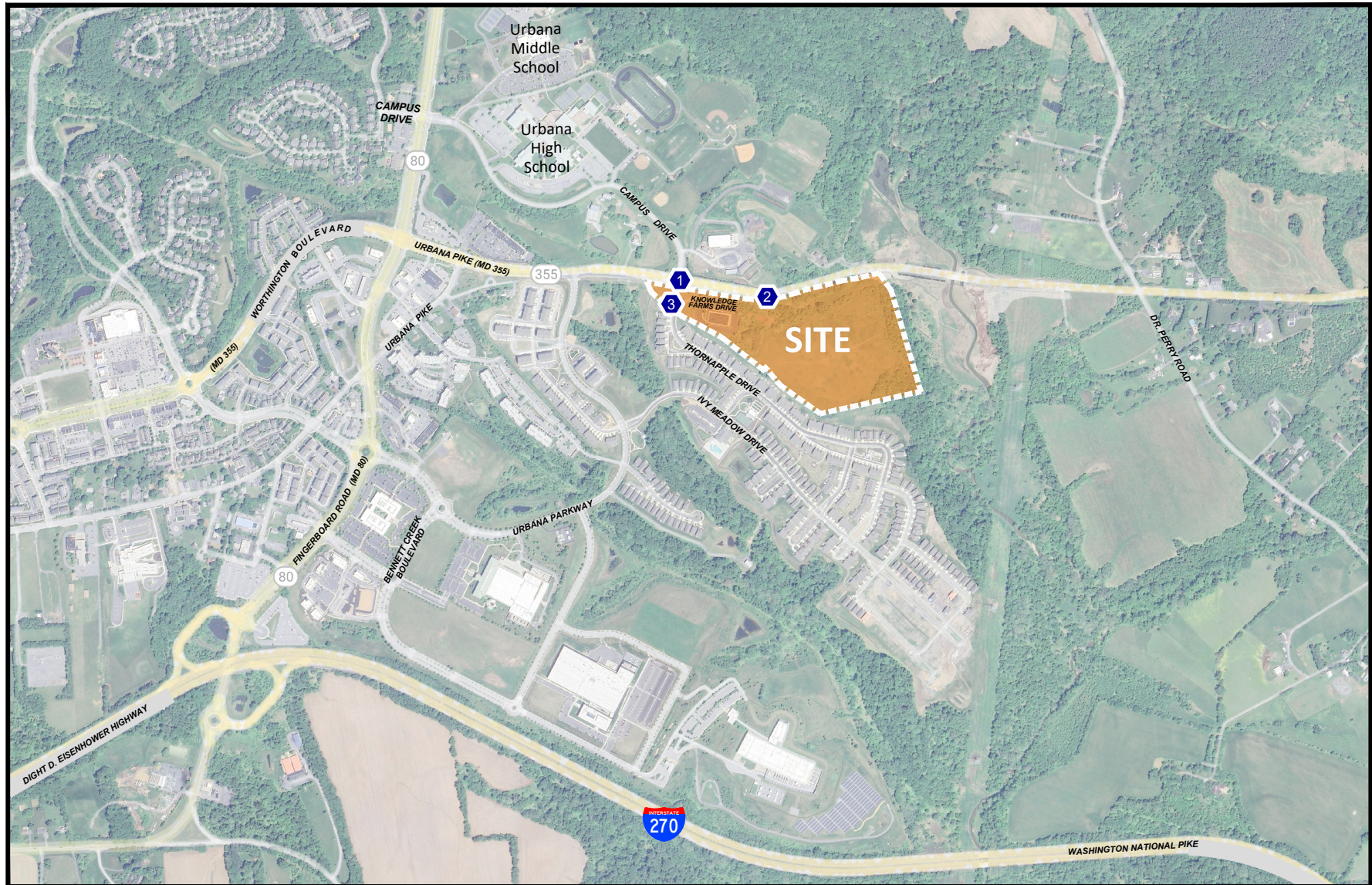


Figure 1
Site Location

 Study Intersection



Knowledge Farms
Frederick County, Maryland



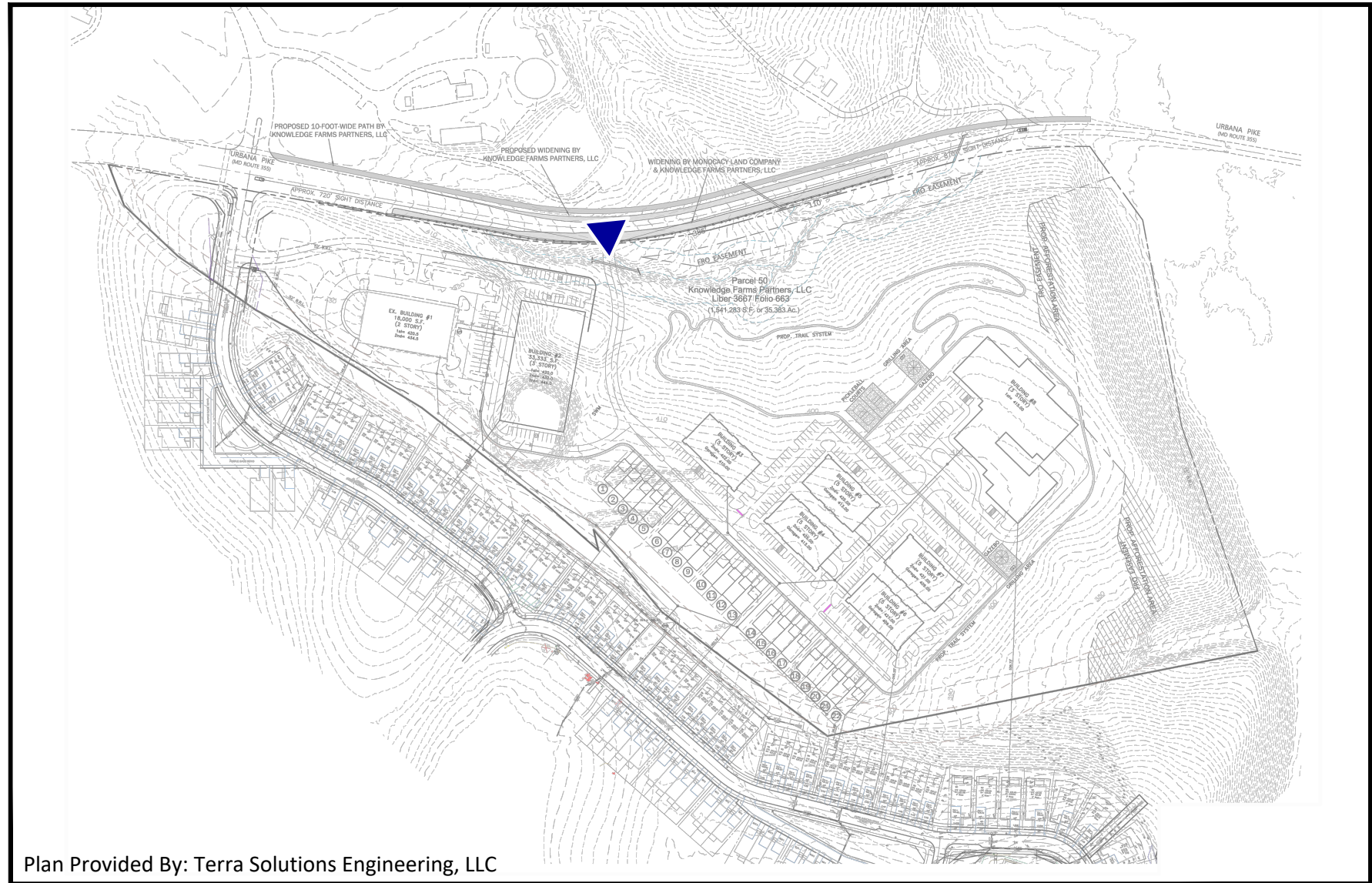


Figure 2
Concept Plan



Knowledge Farms
Frederick County, Maryland



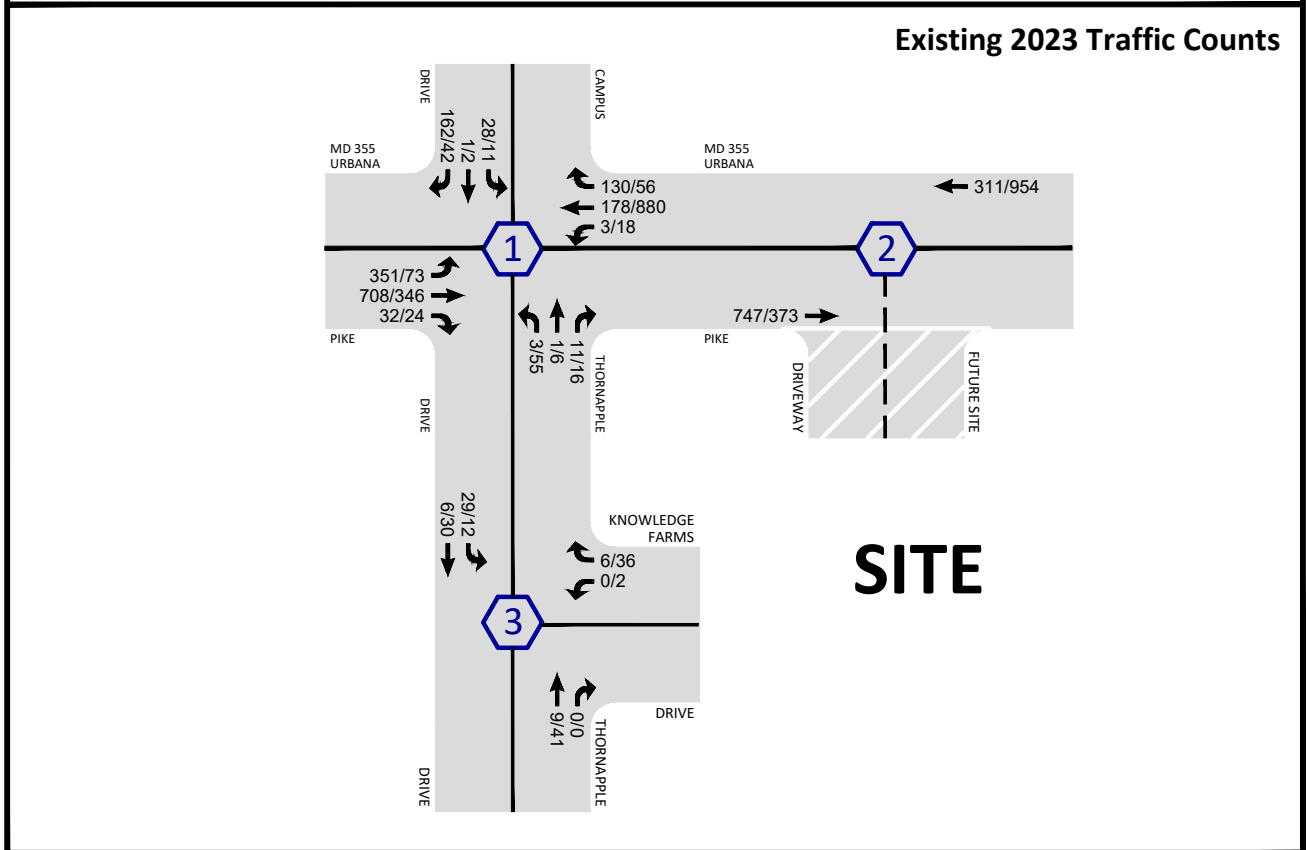
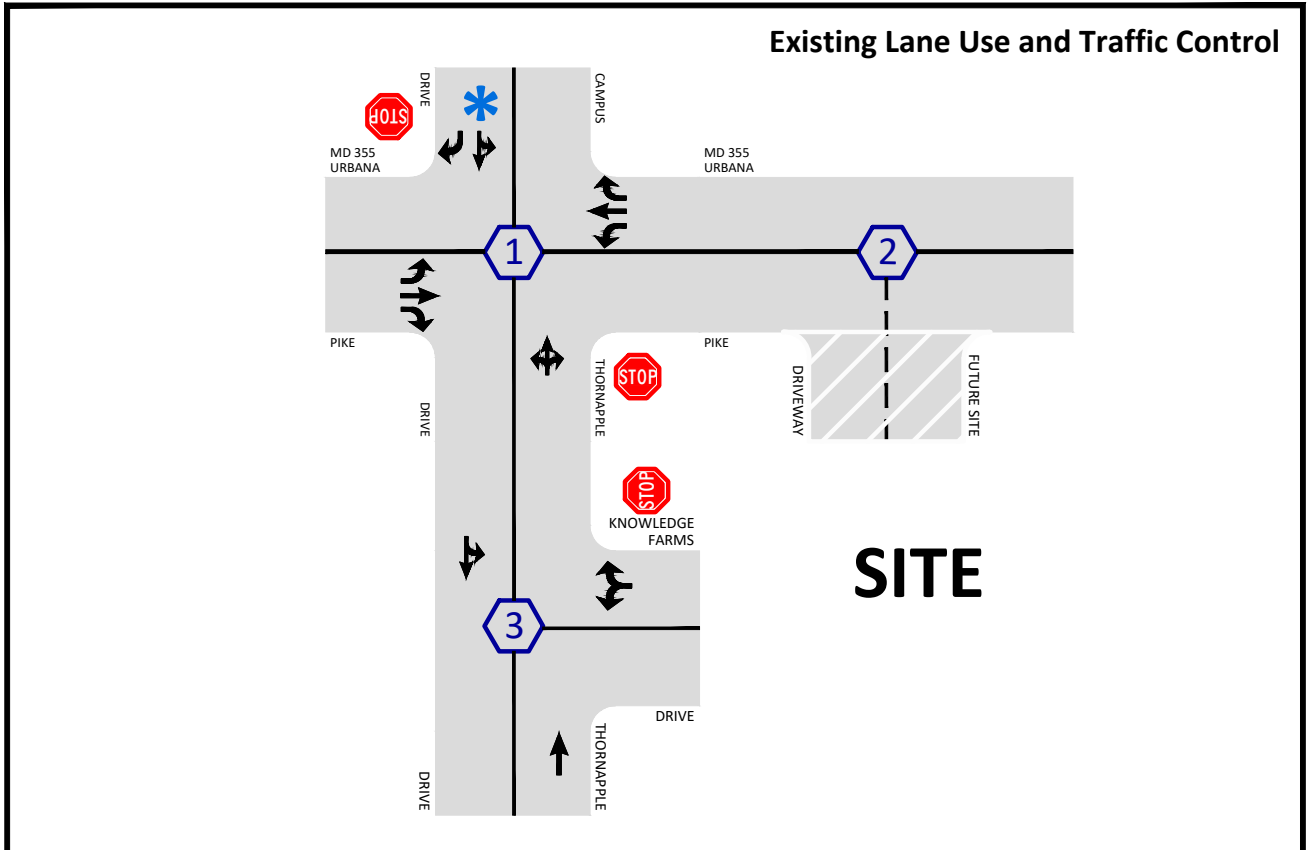


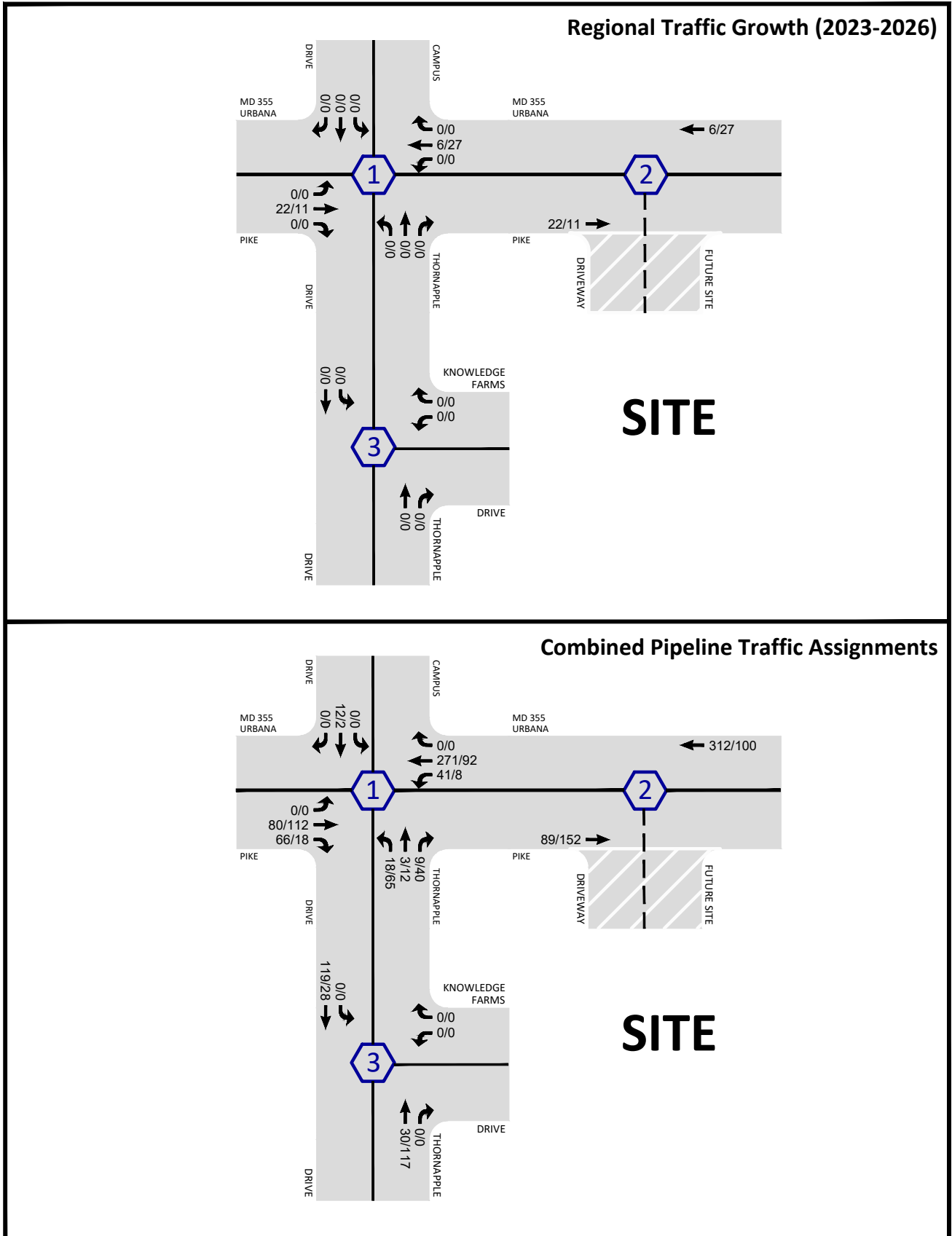
Figure 3
Existing 2023 Lane Use and
Traffic Counts

- ← Represents One Travel Lane
- STOP Stop Sign
- * Left Turns Prohibited
7AM - 8AM Monday-Friday
- AM PEAK HOUR
- PM PEAK HOUR
- 000 / 000



Knowledge Farms
Frederick County, Maryland





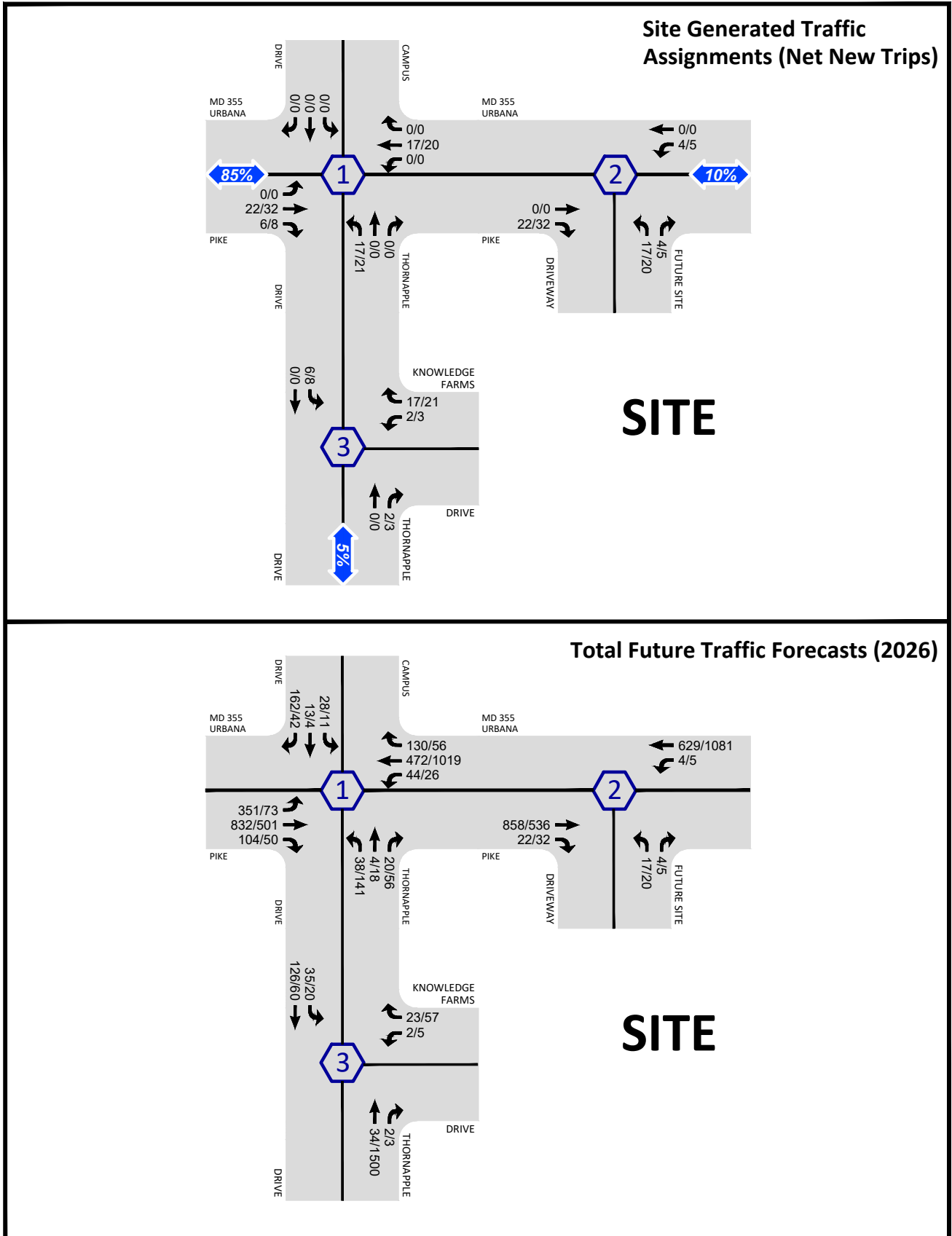


Figure 5
Site Generated and Total Future Traffic Forecasts



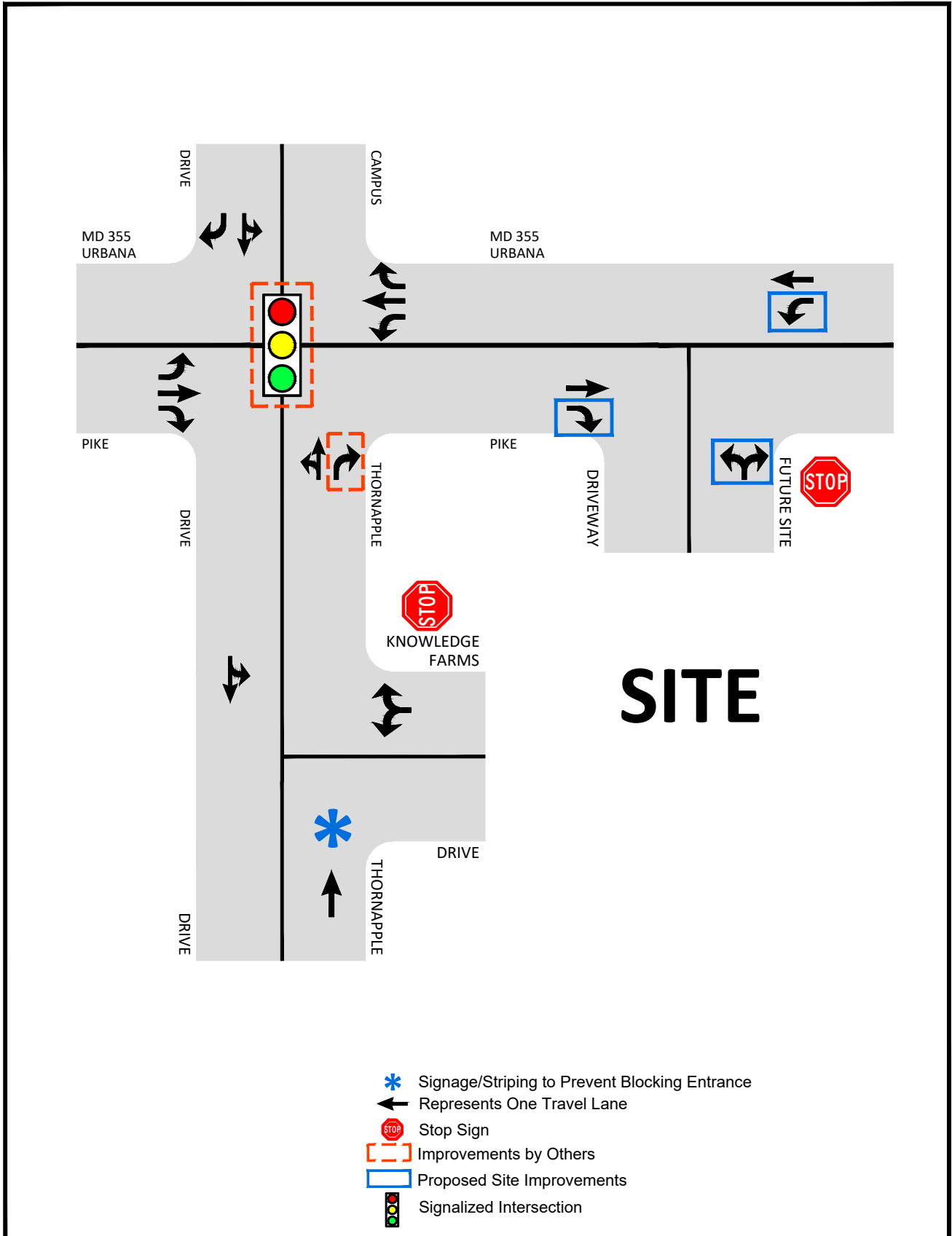


Figure 6
Total Future Lane Use and Traffic Control



Knowledge Farms
Frederick County, Maryland



TABLES

Table 1

Knowledge Farms

Intersection Level-of Service Summary (1) (2)

		2023 Existing Conditions		2026 Total Future Conditions	
	Lane Group	AM	PM	AM	PM
1. Urbana Pike (MD 355)/Campus Drive/Thornapple Drive					
<i>(Unsignalized Control)</i>	EBLTR	E (36.8)	F (97.5)	F (*)	F (*)
	WBT	D (33.0)	D (25.1)	F (*)	F (54.1)
	WBR	D (33.0)	D (25.1)	F (*)	F (54.1)
	NBL	A (9.4)	A (8.3)	B (10.7)	A (8.9)
	NBT	A (0.0)	A (0.0)	A (0.0)	A (0.0)
	NBR	A (0.0)	A (0.0)	A (0.0)	A (0.0)
	SBL	A (9.3)	B (10.5)	B (11.5)	B (11.6)
	SBT	A (0.0)	A (0.0)	A (0.0)	A (0.0)
	SBR	A (0.0)	A (0.0)	A (0.0)	A (0.0)
<i>Future Conditions</i>					
<i>- New traffic signal by others</i>					
<i>- Modify EB approach for separate right turn lane</i>					
	Overall	n/a	n/a	A (958)	C (1276)
2. Urbana Pike (MD 355)/Site Driveway					
<i>Future conditions assume new left and right turn lanes on Urbana Pike (MD 355)</i>	EBLR	FUTURE INTERSECTION		E (39.2)	E (49.2)
	NBL			B (10.0)	A (8.8)
	NBT			A (0.0)	A (0.0)
	SBT			A (0.0)	A (0.0)
	SBR			A (0.0)	A (0.0)
3. Thornapple Drive/Site Driveway					
	EBTR	A (0.0)	A (0.0)	A (0.0)	A (0.0)
	WBTL	A (6.0)	A (2.1)	A (1.8)	A (2.0)
	NBLR	A (8.4)	A (8.7)	A (8.7)	A (9.6)

Notes:

1. Unsignalized intersection results based on Highway Capacity Manual methodologies as reported by Synchro version 11. Numbers in parentheses represent seconds per vehicle of delay.
2. Signalized intersection results based on Critical Lane Volumes (CLV) methodologies.
3. * - Volume exceeds capacity, no result provided by Synchro reports.

Table 2

Knowledge Farms

Intersection Queuing Summary (1) (2)

		2023 Existing Conditions			2026 Total Future Conditions		
	Lane Group	Storage	AM	PM	Storage	AM	PM
1. Urbana Pike (MD 355)/Campus Drive/Thornapple Drive							
(Unsignalized Control)	EBLTR	-	10'	102'	-	*	*
	WBT	-	101'	13'	-	*	44'
	WBR	150'	101'	13'	150'	*	44'
	NBL	250'	0'	1'	250'	6'	2'
	NBT	-	0'	0'	-	0'	0'
	NBR	400'	0'	0'	400'	0'	0'
	SBL	425'	34'	3'	425'	51'	7'
	SBT	-	0'	0'	-	0'	0'
	SBR	-	0'	0'	-	0'	0'
Future Conditions							
- New traffic signal by others - Modify EB approach for separate right turn lane	EBLT	FUTURE IMPROVEMENT BY OTHERS			-	49'	186'
	EBR				-	0'	35'
	WBT				-	48'	18'
	WBR				150'	0'	0'
	NBL				250'	51'	30'
	NBT				-	551'	1189'
	NBR				400'	119'	53'
	SBL				425'	410'	85'
	SBT				-	971'	585'
SBR	-	77'	0'				
2. Urbana Pike (MD 355)/Site Driveway							
Future conditions assume new left and right turn lanes on Urbana Pike (MD 355)	EBLR	FUTURE INTERSECTION			-	15'	23'
	NBL				100'	0'	0'
	NBT				-	0'	0'
	SBT				-	0'	0'
	SBR				100'	0'	0'
3. Thornapple Drive/Site Driveway							
	EBTR	-	0'	0'	-	0'	0'
	WBTL	-	2'	1'	-	2'	1'
	NBLR	-	0'	3'	-	2'	6'

Notes:

1. Unsignalized intersection results based on Highway Capacity Manual methodologies as reported by Synchro version 11.
2. Signalized intersection results based on Maryland State Highways 95th percentile queue analyses methodology.
3. * - Volume exceeds capacity, no result provided by Synchro reports.

Table 3

Knowledge Farms

Trip Generation Analysis and Comparison

Development/Land Use	ITE Land Use			AM Peak Hour			PM Peak Hour		
	Code	Size	Units	In	Out	Total	In	Out	Total
<u>Existing/Approved Conditions</u>									
(The site is approved for up to 140,000 SF of Office uses, 36,000 SF of which is built)									
Research & Development Office ⁽¹⁾	ITE 760	140,000	SF	152	31	183	26	150	176
<u>Proposed Site Development Plan</u>									
Existing R&D/Office Building ⁽²⁾	ITE 760	36,000	SF	47	10	57	9	47	56
Proposed Townhouse Residential Use ⁽³⁾	ITE 251	22	DU	4	9	13	9	5	14
Proposed Residential Use ⁽⁴⁾	ITE 252	125	DU	9	16	25	18	14	32
Proposed Residential Use ⁽⁵⁾	ITE 254	150	Beds	16	11	27	14	22	36
Proposed Commercial Use ⁽⁶⁾	ITE 151	100,000	SF	5	4	9	7	8	15
Subtotal Existing with Proposed				81	50	131	57	96	153
Trip Generation Comparison: Proposed vs. Approved				(71)	19	(52)	31	(54)	(23)
Net Additional Trips: Proposed Uses				34	40	74	48	49	97

Notes:

(1) Based on rates and equations from ITE's Trip Generation, 6th Edition, from "Knowledge Farms Traffic Study, dated March 9, 2001.

(2) Based on rates and equations from ITE's Trip Generation, 11th Edition.

(3) ITE Land Use, Senior Adult Housing - Single-Family (251), was used to determine vehicle trips for residential use.

(4) ITE Land Use, Senior Adult Housing - Multifamily (252), was used to determine vehicle trips for residential use.

(5) ITE Land Use, Assisted Living (254), was used to determine vehicle trips for residential use.

(6) ITE Land Use, Mini-Warehouse (Self-Storage) (151), was used to determine vehicle trips for commercial use.

APPENDIX A TRAFFIC COUNT DATA

Wells + Associates, Inc

Tysons, Virginia

Turning Movement Count - Total Vehicles

PROJECT: Knowledge Farms		DATE: 5/17/2023		SOUTHBOUND ROAD: Urbana Pike - 355																							
W+A JOB NO: 8513		DAY: Wednesday		NORTHBOUND ROAD: Urbana Pike - 355																							
INTERSECTION: MD Route 355 & Campus Dr. & Thornapple Dr.		WEATHER: clear		WESTBOUND ROAD: Campus Drive																							
LOCATION: Frederick county,MD		COUNTED BY: Agan		EASTBOUND ROAD: Thornapple Drive																							
INPUTED BY: agan																											
Time Period	Southbound Urbana Pike - 355					Westbound Campus Drive					Northbound Urbana Pike - 355					Eastbound Thornapple Drive					North & South	East & West	Total				
	Right	Thru	Left	U-Turn	Total	PHF	Right	Thru	Left	J-Turn	Total	PHF	Right	Thru	Left	J-Turn	Total	PHF	Right	Thru				Left	J-Turn	Total	PHF
15 Minute Volumes																											
6:00 AM - 6:15 AM	2	181	4	0	187		0	0	0	0	0		3	13	0	0	16		3	0	1	0	4		203	4	207
6:15 AM - 6:30 AM	1	215	5	0	221		4	0	3	0	7		2	18	1	0	21		3	0	0	0	3		242	10	252
6:30 AM - 6:45 AM	0	170	8	0	178		4	0	1	0	5		1	16	0	0	17		1	0	1	0	2		195	7	202
6:45 AM - 7:00 AM	2	181	43	0	226		3	0	0	0	3		11	37	0	0	48		2	0	0	0	2		274	5	279
7:00 AM - 7:15 AM	3	207	137	0	347		48	0	2	0	50		38	52	0	0	90		4	0	0	0	4		437	54	491
7:15 AM - 7:30 AM	12	163	151	0	326		89	0	11	0	100		76	43	2	0	121		1	0	1	0	2		447	102	549
7:30 AM - 7:45 AM	15	157	20	0	192		22	1	15	0	38		5	46	1	0	52		4	1	2	0	7		244	45	289
7:45 AM - 8:00 AM	15	138	10	0	163		9	0	8	0	17		14	65	3	0	82		1	1	1	0	3		245	20	265
8:00 AM - 8:15 AM	16	192	8	0	216		4	1	3	0	8		2	53	0	0	55		4	0	4	0	8		271	16	287
8:15 AM - 8:30 AM	19	145	3	0	167		3	1	3	0	7		1	51	0	0	52		2	1	0	0	3		219	10	229
8:30 AM - 8:45 AM	12	110	8	0	130		5	3	1	0	9		1	41	2	0	44		3	2	7	0	12		174	21	195
8:45 AM - 9:00 AM	23	111	16	0	150		10	1	2	0	13		7	58	3	0	68		6	1	5	0	12		218	25	243
9:00 AM - 9:15 AM	16	76	11	0	103		7	0	4	0	11		5	49	2	0	56		5	5	6	0	16		159	27	186
9:15 AM - 9:30 AM	25	67	6	0	98		10	0	2	0	12		0	39	0	0	39		1	2	11	0	14		137	26	163
9:30 AM - 9:45 AM	16	47	3	0	66		6	1	1	0	8		3	50	3	0	56		3	1	8	0	12		122	20	142
9:45 AM - 10:00 AM	19	53	11	0	83		7	0	0	0	7		3	26	2	0	31		4	3	17	0	24		114	31	145
10:00 AM - 10:15 AM	10	46	7	0	63		5	1	1	0	7		3	50	4	0	57		3	4	14	0	21		120	28	148
10:15 AM - 10:30 AM	14	43	9	0	66		8	0	4	0	12		2	45	0	0	47		2	4	15	0	21		113	33	146
10:30 AM - 10:45 AM	12	38	18	0	68		16	1	2	0	19		0	41	0	0	41		3	0	14	0	17		109	36	145
10:45 AM - 11:00 AM	12	49	11	0	72		11	1	1	0	13		4	55	1	0	60		3	3	10	0	16		132	29	161
11:00 AM - 11:15 AM	15	44	10	0	69		10	1	4	0	15		3	62	2	0	67		3	3	11	0	17		136	32	168
11:15 AM - 11:30 AM	10	33	17	0	60		15	3	2	0	20		2	72	0	0	74		2	4	17	0	23		134	43	177
11:30 AM - 11:45 AM	11	39	8	0	58		6	1	2	0	9		1	44	1	0	46		7	1	7	0	15		104	24	128
11:45 AM - 12:00 PM	10	65	11	0	86		6	1	1	0	8		2	42	4	0	48		6	1	21	0	28		134	36	170
12:00 PM - 12:15 PM	8	69	7	0	84		18	1	1	0	20		0	73	4	0	77		5	2	10	0	17		161	37	198
12:15 PM - 12:30 PM	13	61	17	0	91		10	1	2	0	13		3	51	4	0	58		1	2	14	0	17		149	30	179
12:30 PM - 12:45 PM	13	61	17	0	91		8	3	3	0	14		2	46	6	0	54		1	0	13	0	14		145	28	173
12:45 PM - 1:00 PM	13	57	7	0	77		17	0	4	0	21		0	52	3	0	55		5	2	9	0	16		132	37	169
1:00 PM - 1:15 PM	8	68	5	0	81		6	0	4	0	10		2	52	1	0	55		2	0	15	0	17		136	27	163
1:15 PM - 1:30 PM	11	51	8	0	70		7	1	3	0	11		0	55	4	0	59		2	0	11	0	13		129	24	153
1:30 PM - 1:45 PM	12	57	13	0	82		2	1	2	0	5		6	52	1	0	59		2	0	8	0	10		141	15	156
1:45 PM - 2:00 PM	16	47	22	0	85		6	0	3	0	9		2	52	2	0	56		1	0	6	0	7		141	16	157
2:00 PM - 2:15 PM	17	49	42	0	108		9	2	5	0	16		7	54	3	0	64		5	0	8	0	13		172	29	201
2:15 PM - 2:30 PM	16	62	21	0	99		109	2	31	0	142		1	75	2	0	78		1	1	8	0	10		177	152	329
2:30 PM - 2:45 PM	16	57	17	0	90		33	1	6	0	40		2	91	2	0	95		4	2	8	0	14		185	54	239
2:45 PM - 3:00 PM	12	62	12	0	86		24	2	5	0	31		3	84	1	0	88		4	2	10	0	16		174	47	221
3:00 PM - 3:15 PM	10	66	4	0	80		16	0	5	0	21		7	156	2	0	165		3	3	17	0	23		245	44	289
3:15 PM - 3:30 PM	14	63	5	0	82		9	3	3	0	15		2	144	8	0	154		0	0	5	0	5		236	20	256
3:30 PM - 3:45 PM	12	61	6	0	79		10	0	2	0	12		7	172	5	0	184		2	3	7	0	12		263	24	287
3:45 PM - 4:00 PM	11	69	9	0	89		2	1	0	0	3		3	168	1	0	172		2	4	9	0	15		261	18	279
4:00 PM - 4:15 PM	3	86	5	0	94		10	1	2	0	13		3	168	4	0	175		3	2	17	0	22		269	35	304
4:15 PM - 4:30 PM	12	72	4	0	88		5	1	3	0	9		5	235	5	0	245		1	1	16	0	18		333	27	360
4:30 PM - 4:45 PM	16	63	4	0	83		2	0	0	0	2		9	229	6	0	244		8	4	20	0	32		327	34	361
4:45 PM - 5:00 PM	4	98	11	0	113		5	0	1	0	6		9	250	4	0	263		1	1	18	0	20		376	26	402
5:00 PM - 5:15 PM	5	92	23	0	120		13	0	5	0	18		16	186	5	0	207		5	3	12	0	20		327	38	365
5:15 PM - 5:30 PM	8	75	26	0	109		16	2	2	0	20		16	226	6	0	248		4	1	13	0	18		357	38	395
5:30 PM - 5:45 PM	7	81	13	0	101		8	0	3	0	11		15	218	3	0	236		6	1	12	0	19		337	30	367
5:45 PM - 6:00 PM	5	79	11	0	95		8	1	2	0	11		9	192	4	0	205		0	1	3	0	4		300	15	315
6:00 PM - 6:15 PM	4	62	8	0	74		5	0	3	0	8		10	120	2	0	132		1	0	6	0	7		206	15	221
6:15 PM - 6:30 PM	3	84	14	0	101		11	0	2	0	13		3	131	3	0	137		2	1	3	0	6		238	19	257
6:30 PM - 6:45 PM	5	51	14	0	70		14	0	0	0	14		1	97	3	0	101		0	1	9	0	10		171	24	195
6:45 PM - 7:00 PM	1	53	17	0	71		3	1	4	0	8		8	76	2	0	86		3	1	4	0	8		157	16	173
Total	565	4426	897	0	5888		694	41	179	0	914		340	4573	127	0	5040		150	75	464	0	689		10928	1603	12531
One Hour Volumes																											
6:00 AM - 7:00 AM	5	747	60	0	812																						

Wells + Associates, Inc

Tysons, Virginia

Turning Movement Count - Total Vehicles

PROJECT: Knowledge Farms						DATE: 5/17/2023						SOUTHBOUND ROAD: Urbana Pike - 355															
W+A JOB NO: 8513						DAY: Wednesday						NORTHBOUND ROAD: Urbana Pike - 355															
INTERSECTION: MD Route 355 & Campus Dr. & Thornapple Dr.						WEATHER: clear						WESTBOUND ROAD: Campus Drive															
LOCATION: Frederick county,MD						COUNTED BY: Agan						EASTBOUND ROAD: Thornapple Drive															
						INPUTED BY: agan																					
Time Period	Southbound Urbana Pike - 355					Westbound Campus Drive					Northbound Urbana Pike - 355					Eastbound Thornapple Drive					North & South	East & West	Total				
	Right	Thru	Left	U-Turn	Total	PHF	Right	Thru	Left	J-Turn	Total	PHF	Right	Thru	Left	J-Turn	Total	PHF	Right	Thru	Left	J-Turn		Total	PHF		
9:45 AM - 10:45 AM	55	180	45	0	280	0.84	36	2	7	0	45	0.59	8	162	6	0	176	0.77	12	11	60	0	83	0.86	456	128	584
10:00 AM - 11:00 AM	48	176	45	0	269	0.93	40	3	8	0	51	0.67	9	191	5	0	205	0.85	11	11	53	0	75	0.89	474	126	600
10:15 AM - 11:15 AM	53	174	48	0	275	0.95	45	3	11	0	59	0.78	9	203	3	0	215	0.8	11	10	50	0	71	0.85	490	130	620
10:30 AM - 11:30 AM	49	164	56	0	269	0.93	52	6	9	0	67	0.84	9	230	3	0	242	0.82	11	10	52	0	73	0.79	511	140	651
10:45 AM - 11:45 AM	48	165	46	0	259	0.9	42	6	9	0	57	0.71	10	233	4	0	247	0.83	15	11	45	0	71	0.77	506	128	634
11:00 AM - 12:00 PM	46	181	46	0	273	0.79	37	6	9	0	52	0.65	8	220	7	0	235	0.79	18	9	56	0	83	0.74	508	135	643
11:15 AM - 12:15 PM	39	206	43	0	288	0.84	45	6	6	0	57	0.71	5	231	9	0	245	0.8	20	8	55	0	83	0.74	533	140	673
11:30 AM - 12:30 PM	42	234	43	0	319	0.88	40	4	6	0	50	0.63	6	210	13	0	229	0.74	19	6	52	0	77	0.69	548	127	675
11:45 AM - 12:45 PM	44	256	52	0	352	0.97	42	6	7	0	55	0.69	7	212	18	0	237	0.77	13	5	58	0	76	0.68	589	131	720
12:00 PM - 1:00 PM	47	248	48	0	343	0.94	53	5	10	0	68	0.81	5	222	17	0	244	0.79	12	6	46	0	64	0.94	587	132	719
12:15 PM - 1:15 PM	47	247	46	0	340	0.93	41	4	13	0	58	0.69	7	201	14	0	222	0.96	9	4	51	0	64	0.94	562	122	684
12:30 PM - 1:30 PM	45	237	37	0	319	0.88	38	4	14	0	56	0.67	4	205	14	0	223	0.94	10	2	48	0	60	0.88	542	116	658
12:45 PM - 1:45 PM	44	233	33	0	310	0.95	32	2	13	0	47	0.56	8	211	9	0	228	0.97	11	2	43	0	56	0.82	538	103	641
1:00 PM - 2:00 PM	47	223	48	0	318	0.94	21	2	12	0	35	0.8	10	211	8	0	229	0.97	7	0	40	0	47	0.69	547	82	629
1:15 PM - 2:15 PM	56	204	85	0	345	0.8	24	4	13	0	41	0.64	15	213	10	0	238	0.93	10	0	33	0	43	0.83	583	84	667
1:30 PM - 2:30 PM	61	215	98	0	374	0.87	126	5	41	0	172	0.3	16	233	8	0	257	0.82	9	1	30	0	40	0.77	631	212	843
1:45 PM - 2:45 PM	65	215	102	0	382	0.88	157	5	45	0	207	0.36	12	272	9	0	293	0.77	11	3	30	0	44	0.79	675	251	926
2:00 PM - 3:00 PM	61	230	92	0	383	0.89	175	7	47	0	229	0.4	13	304	8	0	325	0.86	14	5	34	0	53	0.83	708	282	990
2:15 PM - 3:15 PM	54	247	54	0	355	0.9	182	5	47	0	234	0.41	13	406	7	0	426	0.65	12	8	43	0	63	0.68	781	297	1078
2:30 PM - 3:30 PM	52	248	38	0	338	0.94	82	6	19	0	107	0.67	14	475	13	0	502	0.76	11	7	40	0	58	0.63	840	165	1005
2:45 PM - 3:45 PM	48	252	27	0	327	0.95	59	5	15	0	79	0.64	19	556	16	0	591	0.8	9	8	39	0	56	0.61	918	135	1053
3:00 PM - 4:00 PM	47	259	24	0	330	0.93	37	4	10	0	51	0.61	19	640	16	0	675	0.92	7	10	38	0	55	0.6	1005	106	1111
3:15 PM - 4:15 PM	40	279	25	0	344	0.91	31	5	7	0	43	0.72	15	652	18	0	685	0.93	7	9	38	0	54	0.61	1029	97	1126
3:30 PM - 4:30 PM	38	288	24	0	350	0.93	27	3	7	0	37	0.71	18	743	15	0	776	0.79	8	10	49	0	67	0.76	1126	104	1230
3:45 PM - 4:45 PM	42	290	22	0	354	0.94	19	3	5	0	27	0.52	20	800	16	0	836	0.85	14	11	62	0	87	0.68	1190	114	1304
4:00 PM - 5:00 PM	35	319	24	0	378	0.84	22	2	6	0	30	0.58	26	882	19	0	927	0.88	13	8	71	0	92	0.72	1305	122	1427
4:15 PM - 5:15 PM	37	325	42	0	404	0.84	25	1	9	0	35	0.49	39	900	20	0	959	0.91	15	9	66	0	90	0.7	1363	125	1488
4:30 PM - 5:30 PM	33	328	64	0	425	0.89	36	2	8	0	46	0.58	50	891	21	0	962	0.91	18	9	63	0	90	0.7	1387	136	1523
4:45 PM - 5:45 PM	24	346	73	0	443	0.9	42	2	11	0	55	0.7	56	880	18	0	954	0.9	16	6	55	0	77	1	1397	132	1529
5:00 PM - 6:00 PM	25	327	73	0	425	0.89	45	3	12	0	60	0.75	56	822	18	0	896	0.9	15	6	40	0	61	0.76	1321	121	1442
5:15 PM - 6:15 PM	24	297	58	0	379	0.87	37	3	10	0	50	0.63	50	756	15	0	821	0.83	11	3	34	0	48	0.63	1200	98	1298
5:30 PM - 6:30 PM	19	306	46	0	371	0.92	32	1	10	0	43	0.83	37	661	12	0	710	0.75	9	3	24	0	36	0.47	1081	79	1160
5:45 PM - 6:45 PM	17	276	47	0	340	0.84	38	1	7	0	46	0.82	23	540	12	0	575	0.7	3	3	21	0	27	0.68	915	73	988
6:00 PM - 7:00 PM	13	250	53	0	316	0.78	33	1	9	0	43	0.77	22	424	10	0	456	0.83	6	3	22	0	31	0.78	772	74	846

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Tysons, Virginia

Turning Movement Count - Total Vehicles

PROJECT: Knowledge Farms										DATE: 5/17/2023										SOUTHBOUND ROAD: SB Street									
W+A JOB NO: 8513										DAY: Wednesday										NORTHBOUND ROAD: Driveway									
INTERSECTION: Thornapple Dr. & Driveway										WEATHER: clear										WESTBOUND ROAD: Thonapple Drive									
LOCATION: Frederick County,MD										COUNTED BY: Agan										EASTBOUND ROAD: Thonapple Drive									
										INPUTED BY: agan																			
Time Period	Southbound SB Street					PHF	Westbound Thonapple Drive					PHF	Northbound Driveway					PHF	Eastbound Thonapple Drive					PHF	North East & Total				
	Right	Thru	Left-Turn	Total	Right		Thru	Left-Turn	Total	Right	Thru		Left-Turn	Total	Right	Thru	Left-Turn		Total	South West									
15 Minute Volumes																													
6:00 AM - 6:15 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
6:15 AM - 6:30 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
6:30 AM - 6:45 AM	0	0	0	0	0		0	0	0	0	0		1	0	0	0	1		0	0	0	0		1	0	1			
6:45 AM - 7:00 AM	0	0	0	0	0		0	0	6	0	6		1	0	0	0	1		0	0	0	0		1	6	7			
7:00 AM - 7:15 AM	0	0	0	0	0		0	0	4	0	4		1	0	0	0	1		0	0	0	0		1	4	5			
7:15 AM - 7:30 AM	0	0	0	0	0		0	0	6	0	6		0	0	0	0	0		0	0	0	0		0	6	6			
7:30 AM - 7:45 AM	0	0	0	0	0		0	0	13	0	13		4	0	0	0	4		0	0	0	0		4	13	17			
7:45 AM - 8:00 AM	0	0	0	0	0		0	0	16	0	16		2	0	0	0	2		0	0	0	0		2	16	18			
8:00 AM - 8:15 AM	0	0	0	0	0		0	0	12	0	12		1	0	0	0	1		0	0	0	0		1	12	13			
8:15 AM - 8:30 AM	0	0	0	0	0		0	0	10	0	10		7	0	0	0	7		1	0	0	1		7	11	18			
8:30 AM - 8:45 AM	0	0	0	0	0		0	0	9	0	9		2	0	0	0	2		0	0	0	0		2	9	11			
8:45 AM - 9:00 AM	0	0	0	0	0		0	0	8	0	8		4	0	0	0	4		0	0	0	0		4	8	12			
4:00 PM - 4:15 PM	0	0	0	0	0		0	0	6	0	6		11	0	1	0	12		0	0	0	0		12	6	18			
4:15 PM - 4:30 PM	0	0	0	0	0		0	0	3	0	3		22	0	2	0	24		1	0	0	1		24	4	28			
4:30 PM - 4:45 PM	0	0	0	0	0		0	0	4	0	4		15	0	0	0	15		0	0	0	0		15	4	19			
4:45 PM - 5:00 PM	0	0	0	0	0		0	0	6	0	6		10	0	1	0	11		0	0	0	0		11	6	17			
5:00 PM - 5:15 PM	0	0	0	0	0		0	0	1	0	1		16	0	1	0	17		0	0	0	0		17	1	18			
5:15 PM - 5:30 PM	0	0	0	0	0		0	0	4	0	4		9	0	0	0	9		0	0	0	0		9	4	13			
5:30 PM - 5:45 PM	0	0	0	0	0		0	0	1	0	1		1	0	0	0	1		0	0	0	0		1	1	2			
5:45 PM - 6:00 PM	0	0	0	0	0		0	0	3	0	3		2	0	0	0	2		0	0	0	0		2	3	5			
6:00 PM - 6:15 PM	0	0	0	0	0		0	0	3	0	3		4	0	0	0	4		0	0	0	0		4	3	7			
6:15 PM - 6:30 PM	0	0	0	0	0		0	0	0	0	0		2	0	0	0	2		0	0	0	0		2	0	2			
6:30 PM - 6:45 PM	0	0	0	0	0		0	0	1	0	1		2	0	0	0	2		0	0	0	0		2	1	3			
6:45 PM - 7:00 PM	0	0	0	0	0		0	0	1	0	1		2	0	0	0	2		0	0	0	0		2	1	3			
4:00 AM - 4:15 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
4:15 AM - 4:30 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
4:30 AM - 4:45 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
4:45 AM - 5:00 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
5:00 AM - 5:15 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
5:15 AM - 5:30 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
5:30 AM - 5:45 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
5:45 AM - 6:00 AM	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0		0	0	0			
Total	0	0	0	0	0		0	0	117	0	117		119	0	5	0	124		2	0	0	2		124	119	243			
One Hour Volumes																													
6:00 AM - 7:00 AM	0	0	0	0	0		0	0	6	0	6	0.25	2	0	0	0	2	0.5	0	0	0	0		2	6	8			
6:15 AM - 7:15 AM	0	0	0	0	0		0	0	10	0	10	0.42	3	0	0	0	3	0.75	0	0	0	0		3	10	13			
6:30 AM - 7:30 AM	0	0	0	0	0		0	0	16	0	16	0.67	3	0	0	0	3	0.75	0	0	0	0		3	16	19			
6:45 AM - 7:45 AM	0	0	0	0	0		0	0	29	0	29	0.56	6	0	0	0	6	0.38	0	0	0	0		6	29	35			
7:00 AM - 8:00 AM	0	0	0	0	0		0	0	39	0	39	0.61	7	0	0	0	7	0.44	0	0	0	0		7	39	46			
7:15 AM - 8:15 AM	0	0	0	0	0		0	0	47	0	47	0.73	7	0	0	0	7	0.44	0	0	0	0		7	47	54			
7:30 AM - 8:30 AM	0	0	0	0	0		0	0	51	0	51	0.8	14	0	0	0	14	0.5	1	0	0	1	0.25	14	52	66			
7:45 AM - 8:45 AM	0	0	0	0	0		0	0	47	0	47	0.73	12	0	0	0	12	0.43	1	0	0	1	0.25	12	48	60			
8:00 AM - 9:00 AM	0	0	0	0	0		0	0	39	0	39	0.81	14	0	0	0	14	0.5	1	0	0	1	0.25	14	40	54			
4:00 PM - 5:00 PM	0	0	0	0	0		0	0	19	0	19	0.79	58	0	4	0	62	0.65	1	0	0	1	0.25	62	20	82			
4:15 PM - 5:15 PM	0	0	0	0	0		0	0	14	0	14	0.58	63	0	4	0	67	0.7	1	0	0	1	0.25	67	15	82			
4:30 PM - 5:30 PM	0	0	0	0	0		0	0	15	0	15	0.63	50	0	2	0	52	0.76	0	0	0	0		52	15	67			
4:45 PM - 5:45 PM	0	0	0	0	0		0	0	12	0	12	0.5	36	0	2	0	38	0.56	0	0	0	0		38	12	50			
5:00 PM - 6:00 PM	0	0	0	0	0		0	0	9	0	9	0.56	28	0	1	0	29	0.43	0	0	0	0		29	9	38			
5:15 PM - 6:15 PM	0	0	0	0	0		0	0	11	0	11	0.69	16	0	0	0	16	0.44	0	0	0	0		16	11	27			
5:30 PM - 6:30 PM	0	0	0	0	0		0	0	7	0	7	0.58	9	0	0	0	9	0.56	0	0	0	0		9	7	16			
5:45 PM - 6:45 PM	0	0	0	0	0		0	0	7	0	7	0.58	10	0	0	0	10	0.63	0	0	0	0		10	7	17			
6:00 PM - 7:00 PM	0	0	0	0	0		0	0	5	0	5	0.42	10	0	0	0	10	0.63	0	0	0	0		10	5	15			

APPENDIX B EXISTING CAPACITY ANALYSES

HCM Unsignalized Intersection Capacity Analysis

1: Urbana Pike/Worthington Boulevard & Thornapple Drive/Campus Drive

AM Existing
06/16/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	1	11	28	1	162	3	178	130	351	708	32
Future Volume (Veh/h)	3	1	11	28	1	162	3	178	130	351	708	32
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	3	1	12	30	1	176	3	193	141	382	770	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)	6											
Median type	None											
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1734	1874	770	1746	1768	193	805			334		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1734	1874	770	1746	1768	193	805			334		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	98	97	39	98	79	100			69		
cM capacity (veh/h)	41	49	401	49	57	849	819			1225		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	16	207	3	193	141	382	770	35				
Volume Left	3	30	3	0	0	382	0	0				
Volume Right	12	176	0	0	141	0	0	35				
cSH	129	328	819	1700	1700	1225	1700	1700				
Volume to Capacity	0.12	0.63	0.00	0.11	0.08	0.31	0.45	0.02				
Queue Length 95th (ft)	10	101	0	0	0	34	0	0				
Control Delay (s)	36.8	33.0	9.4	0.0	0.0	9.3	0.0	0.0				
Lane LOS	E	D	A			A						
Approach Delay (s)	36.8	33.0	0.1			3.0						
Approach LOS	E	D										
Intersection Summary												
Average Delay	6.3											
Intersection Capacity Utilization	56.4%											
ICU Level of Service	B											
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

3: Knowledge Farm & Thornapple Drive

AM Existing
06/16/2023

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	9	0	29	6	0	6
Future Volume (Veh/h)	9	0	29	6	0	6
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	0	32	7	0	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			10		81	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			10		81	10
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1610		903	1071
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	10	39	7			
Volume Left	0	32	0			
Volume Right	0	0	7			
cSH	1700	1610	1071			
Volume to Capacity	0.01	0.02	0.01			
Queue Length 95th (ft)	0	2	0			
Control Delay (s)	0.0	6.0	8.4			
Lane LOS		A	A			
Approach Delay (s)	0.0	6.0	8.4			
Approach LOS			A			
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization			18.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: Urbana Pike/Worthington Boulevard & Thornapple Drive/Campus Drive

PM Existing
06/16/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	6	16	11	2	42	18	880	56	24	346	73
Future Volume (Veh/h)	55	6	16	11	2	42	18	880	56	24	346	73
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	60	7	17	12	2	46	20	957	61	26	376	79
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)	6											
Median type	None											
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1426	1486	376	1446	1504	957	455			1018		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1426	1486	376	1446	1504	957	455			1018		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	34	94	97	88	98	85	98			96		
cM capacity (veh/h)	91	118	670	98	115	313	1106			682		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	84	60	20	957	61	26	376	79				
Volume Left	60	12	20	0	0	26	0	0				
Volume Right	17	46	0	0	61	0	0	79				
cSH	113	408	1106	1700	1700	682	1700	1700				
Volume to Capacity	0.74	0.15	0.02	0.56	0.04	0.04	0.22	0.05				
Queue Length 95th (ft)	102	13	1	0	0	3	0	0				
Control Delay (s)	97.5	25.1	8.3	0.0	0.0	10.5	0.0	0.0				
Lane LOS	F	D	A			B						
Approach Delay (s)	97.5	25.1	0.2			0.6						
Approach LOS	F	D										
Intersection Summary												
Average Delay			6.1									
Intersection Capacity Utilization			64.0%	ICU Level of Service					B			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Knowledge Farm & Thornapple Drive

PM Existing
06/16/2023

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	41	0	12	30	2	36
Future Volume (Veh/h)	41	0	12	30	2	36
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	45	0	13	33	2	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			45		104	45
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			45		104	45
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	96
cM capacity (veh/h)			1563		887	1025
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	45	46	41			
Volume Left	0	13	2			
Volume Right	0	0	39			
cSH	1700	1563	1017			
Volume to Capacity	0.03	0.01	0.04			
Queue Length 95th (ft)	0	1	3			
Control Delay (s)	0.0	2.1	8.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.1	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization			18.9%	ICU Level of Service		A
Analysis Period (min)			15			

APPENDIX C TRAFFIC FORECASTS

Table 1

Knowledge Farms

Pipeline Trip Generation Summary ¹

<u>Pipeline Developments</u>				<u>AM Peak Hour (Commuter Peak)</u>			<u>PM Peak Hour (Commuter Peak)</u>			<u>ADT</u>
	LUC	Amount	Units	In	Out	Total	In	Out	Total	Total
1. Monocacy Land Company (Urbana Properties) ⁽²⁾				1,621	414	2,035	539	1,535	2,074	18,003
2. Landsdale										
Active-Adult Detached Homes	251	800	D.U.	62	127	189	137	88	225	3,470
<u>Currently Occupied</u>	<u>251</u>	<u>675</u>	<u>D.U.</u>	<u>55</u>	<u>111</u>	<u>166</u>	<u>120</u>	<u>77</u>	<u>197</u>	<u>3,003</u>
Remaining to be Constructed		125	D.U.	7	16	23	17	11	28	467
Landsdale: Subtotal New Trips		125	D.U.	7	16	23	17	11	28	467
3. Urbana Commons										
High-Turnover Sit-Down Restaurant	932	6,000	S.F.	31	26	57	33	21	54	643
Passby Trips (AM:0% MID:43% PM:43%)				-	-	-	14	9	23	276
Urbana Commons: Subtotal New Trips		6,000	S.F.	31	26	57	19	12	31	367
4. Frederick Health at Urbana	720	40,000	S.F.	84	22	106	79	77	156	1,611
5. Urbana Village Center										
Total Retail Shopping Center	821	64,214	S.F.	141	86	227	278	302	580	6,068
<u>Currently Occupied</u>	<u>821</u>	<u>25,125</u>	<u>D.U.</u>	<u>55</u>	<u>34</u>	<u>89</u>	<u>109</u>	<u>118</u>	<u>227</u>	<u>2,374</u>
Passby Trips (AM:0% MID:40% PM:40%)				-	-	-	44	47	91	950
Urbana Village Center: Subtotal New Trips		39,089	D.U.	86	52	138	125	137	262	2,744
6. Woodlands at Urbana										
Active-Adult Detached Homes	251	232	D.U.	24	50	74	52	33	85	1,212
<u>Currently Occupied</u>	<u>251</u>	<u>99</u>	<u>D.U.</u>	<u>13</u>	<u>26</u>	<u>39</u>	<u>27</u>	<u>17</u>	<u>44</u>	<u>587</u>
Remaining to be Constructed		133	D.U.	11	24	35	25	16	41	625
Active-Adult Attached Homes	252	333	D.U.	22	42	64	46	37	83	987
<u>Currently Occupied</u>	<u>252</u>	<u>180</u>	<u>D.U.</u>	<u>12</u>	<u>23</u>	<u>35</u>	<u>25</u>	<u>20</u>	<u>45</u>	<u>545</u>
Remaining to be Constructed		153	D.U.	10	19	29	21	17	38	442
Woodlands: Subtotal New Trips		286	D.U.	21	43	64	46	33	79	1,067
7. Centerville Elementary School										
Students - Maximum Enrollment	520	635	Students	254	216	470	47	55	102	1,441
<u>Current Enrollment</u>	<u>520</u>	<u>444</u>	<u>Students</u>	<u>178</u>	<u>151</u>	<u>329</u>	<u>33</u>	<u>38</u>	<u>71</u>	<u>1,008</u>
Centerville Elementary: Subtotal New Trips		191	Students	76	65	141	14	17	31	433
Subtotal All Pipeline Developments				1,926	638	2,564	839	1,822	2,661	24,692

Notes:

(1) Trip generation based on ITE's Trip Generation Manual, 11th Edition.

(2) Trip generation based previously approved studies. Details are contained in the appendix.

6. Worthington Boulevard (MD 355) / Campus Drive / Thornapple Drive																
Component	Period	IN	OUT	Southbound			Westbound			Northbound			Eastbound			Total
				Urbana Pike (MD 355)			Campus Drive			Urbana Pike (MD 355)			Thornapple Drive			
				SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL	
<u>Pipeline Developments</u>																
Monocacy Land Company	AM & PM	X	X													
Landsdale	AM & PM	X	X													
Urbana Commons	AM & PM	X	X		35%						15%					
Knowledge Farms	AM & PM	X	X	55%			10%				35%					
Urbana Village Center	AM & PM	X	X										35%	10%	55%	
Woodlands at Urbana	AM & PM	X	X		2%	30%					15%					
Centerville Elem. School	AM & PM	X	X							3%			10%	5%	20%	
			X		15%					15%						
<u>Urbana YMCA Property</u>																
Inbound Site Traffic	AM & PM	X									10%				5%	
Outbound Site Traffic	AM & PM		X	5%	10%											

6. Worthington Boulevard (MD 355) / Campus Drive / Thornapple Drive																
Component	Period	IN	OUT	Southbound			Westbound			Northbound			Eastbound			Total
				Urbana Pike (MD 355)			Campus Drive			Urbana Pike (MD 355)			Thornapple Drive			
				SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL	
Raw Existing Peak Hour Traffic Counts (2021)	AM Com			34	682	322	212	3	28	136	157	4	12	4	2	1596
	PM Sch			42	305	47	195	3	61	17	353	7	9	1	32	1072
	PM Com			21	278	71	51	1	12	33	674	13	14	10	54	1232
Adjusted Existing Peak Hour Counts (with Construction)	AM Com			34	682	322	212	3	28	136	157	4	12	4	2	1596
	PM Sch			42	305	47	195	3	61	17	353	7	9	1	32	1072
	PM Com			21	278	71	51	1	12	33	674	13	14	10	54	1232
Adjusted Existing Peak Hour Counts (for Future)	AM Com			34	682	322	212	3	28	136	157	4	12	4	2	1596
	PM Sch			42	305	47	195	3	61	17	353	7	9	1	32	1072
	PM Com			21	278	71	51	1	12	33	674	13	14	10	54	1232
Regional Growth (2026)	AM Com			0	35	0	0	0	0	0	8	0	0	0	0	43
	PM Sch			0	16	0	0	0	0	0	18	0	0	0	0	34
	PM Com			0	14	0	0	0	0	0	34	0	0	0	0	48
1.0 % per year for 5 years	% Growth			5.1%						5.1%						
Existing Plus Regional Growth (2026)	AM Com			34	717	322	212	3	28	136	165	4	12	4	2	1639
	PM Sch			42	321	47	195	3	61	17	371	7	9	1	32	1106
	PM Com			21	292	71	51	1	12	33	708	13	14	10	54	1280
Monocacy Land Company (Urbana Properties)	AM Com	1621	414	59						247						306
	PM Sch	638	566	237						80						317
	PM Com	539	1535	94						82						176
Landsdale	AM Com	7	16	0												0
	PM Sch	19	16	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM Com	17	11	0	0	0	0	0	0	0	0	0	0	0	0	0
Urbana Commons	AM Com	31	26	0	9	0	0	0	0	0	5	0	0	0	0	14
	PM Sch	7	9	0	3	0	0	0	0	0	1	0	0	0	0	4
	PM Com	19	12	0	4	0	0	0	0	0	3	0	0	0	0	7
Knowledge Farms	AM Com	118	26	65	0	0	0	12	0	0	0	41	9	3	14	144
	PM Sch	67	52	37	0	0	0	7	0	0	0	23	18	5	29	119
	PM Com	22	115	12	0	0	0	2	0	0	0	8	40	12	63	137
Urbana Village Center	AM Com	86	52	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM Sch	107	118	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM Com	125	137	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodlands at Urbana	AM Com	21	43	0		6					1	3	4	2	9	25
	PM Sch	43	37	0	1	13	0	0	0	0	1	6	4	2	7	34
	PM Com	46	33	0	1	14					1	7	3	2	7	35
Centerville Elementary School	AM Com	76	65	0	10						11					21
	PM Sch	40	46	0	7	0	0	0	0	0	6	0	0	0	0	13
	PM Com	14	17	0	3						2					5
Subtotal All Pipeline	AM Com	1960	642	65	78	0	0	12	0	0	263	41	9	3	14	485
	PM Sch	921	844	37	247	0	0	7	0	0	87	23	18	5	29	453
	PM Com	782	1860	12	101	0	0	2	0	0	87	8	40	12	63	325
Site Trips: Medical Office Building	AM Com	84	22	1	2	0	0	0	0	0	8	0	0	0	4	15
	PM Sch	79	77	4	8	0	0	0	0	0	8	0	0	0	4	24
	PM Com	48	112	6	11	0	0	0	0	0	5	0	0	0	2	24
Rerouted Trips with RIRO Access	AM Com															
	PM Sch															
	PM Com															
Buildout Total Future with YMCA & Medical Office	AM Com			100	797	322	212	15	28	136	436	45	21	7	20	
	PM Sch			83	576	47	195	10	61	17	466	30	27	6	65	
	PM Com			39	404	71	51	3	12	33	800	21	54	22	119	

Table A
Frederick Health at Urbana
Monocacy Land Company - Northern MXD Trip Generation

Development/Use	Percent Reduction			ITE Land Use Code	Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Traffic
							In	Out	Total	In	Out	Total	In	Out	Total	
Proposed Program																
General Office	N/A	N/A	N/A	710	700,000	SF	783	107	890	245	206	451	147	716	863	5,969
Residential Internal	0%	2%	2%				-	1	1	1	3	4	-	5	5	44
Retail Internal	2%	2%	2%				0	0	1	1	1	2	2	1	3	42
TDM Reduction	10%	10%	10%				78	11	89	24	21	45	15	72	86	597
Total Office Trips							704	95	799	218	181	399	130	638	769	5,285
Single Family Detached-Approved	N/A	N/A	N/A	210	196	DU	37	110	147	74	58	132	122	71	193	1,931
Single Family Detached-Built	N/A	N/A	N/A	210	167	DU	32	95	127	64	50	114	105	62	167	1,667
			Difference		29		5	15	20	10	8	18	17	9	26	264
Single Family Attached	N/A	N/A	N/A	230	414	DU	27	134	161	64	64	128	129	64	193	2,214
Single Family Attached	N/A	N/A	N/A	230	318	DU	22	108	130	51	51	102	104	51	155	1,760
			Difference		96		5	26	31	13	13	26	25	13	38	454
Office Internal	0%	2%	2%		806		-	1	1	1	3	4	5	-	5	44
Retail Internal	12%	12%	12%				2	2	4	5	5	10	8	6	13	127
Total Residential Trips							8	38	46	17	13	30	29	16	46	547
Retail	N/A	N/A	N/A	820	8,935	SF	23	14	37	55	61	116	62	64	126	1,413
Office Internal	3%	3%	3%				0	0	1	1	1	2	1	2	3	42
Residential Internal	9%	9%	9%				2	2	4	5	5	10	6	8	13	127
Pass-by trips	25%	25%	25%				6	4	9	14	15	29	16	16	32	353
Total Retail Trips							15	8	23	35	39	74	40	38	78	890
Institutional (Day Care)	N/A	N/A	N/A	565	11,065	SF	65	57	122	12	11	23	58	65	123	527
Total Day Care Trips							65	57	122	12	11	23	58	65	123	527
Total Net New Trips - Northern MXD							792	198	990	282	244	526	257	758	1,015	7,249

Note: Trip calculations based on ITE [Trip Generation](#), 8th Edition, consistent with approved 4.24.15 TIA, Table 7, page 61.

Table B
Frederick Health at Urbana
Monocacy Land Company - Urbana PUD Trip Generation

Development/Land Use	ITE			AM Peak Hour			Midday Peak Hour			PM Peak Hour			ADT ⁽¹⁾
	Land Use Code	Amount	Unit	In	Out	Total	In	Out	Total	In	Out	Total	
Retail (Existing)	820	125,400	SF	107	69	176	307	338	645	363	377	740	7,867
Retail Passby Trips		40%		43	28	70	123	135	258	145	151	296	
Net Existing Retail				64	41	106	184	203	387	218	226	444	
Retail (Proposed)		186,000	SF	135	87	222	396	437	834	472	492	964	10,165
Retail Passby Trips		40%		54	35	89	159	175	333	189	197	386	
Total Retail (Proposed)				81	52	133	238	262	500	283	295	578	
Net Proposed New Retail Trips		60,600	SF	17	11	28	54	59	113	65	69	134	2,298
General Office (Existing)	710	69,548	SF	123	17	140	41	35	76	27	130	157	1,009
General Office (Proposed)		170,000	SF	253	34	287	82	69	152	46	223	269	2,007
Net Proposed New Office Trips		100,452	SF	130	17	147	41	34	75	19	93	112	998
Single Family Homes (Existing)	210	1,362	DU	241	722	963	442	345	787	694	408	1,102	11,492
Single Family Homes (Proposed)		1,362	DU	241	722	963	442	345	787	694	408	1,102	11,492
Net Proposed SFD Trips		0	DU	-	-	-	-	-	-	-	-	-	-
Townhomes (Existing)	230	1,362	DU	130	633	763	344	344	687	730	360	1,090	11,849
Townhomes (Proposed)		1,432	DU	136	666	802	361	361	723	768	378	1,146	12,458
Net Proposed Townhome Trips		70	DU	6	33	39	18	18	35	38	18	56	609
Multifamily (Existing)	220	228	DU	23	92	115	15	8	23	93	50	143	1,505
Multifamily (Proposed)		228	DU	23	92	115	15	8	23	93	50	143	1,505
Net Proposed Multifamily Trips		0	DU	-	-	-	-	-	-	-	-	-	-
Constructed													
Senior Adult Housing (Attached)	252	0	DU	-	-	-	-	-	-	-	-	-	-
Total Net New Trips - Urbana PUD				153	61	214	112	111	224	122	180	302	3,905

Notes: (1) Estimates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA.

Table C-1
Frederick Health at Urbana
Urbana Southern MXD Trip Generation for Existing Conditions (1)

Development/ Use	ITE Code	Type	Percent Reduction			Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Trips
								In	Out	Total	In	Out	Total	In	Out	Total	
Business Services (Retail)	820	Total	NA	NA	NA	3,888	S.F.	14	9	23	32	35	67	35	37	72	823
		Pass-by Trips	25%	25%	25%			4	2	6	8	9	17	9	9	18	206
Business Services (Retail)		New External	NA	NA	NA			10	7	17	24	27	51	22	23	45	519
Fast-Food with Drive Through	934	Total	NA	NA	NA	3,800	S.F.	96	92	188	55	54	108	67	62	129	1,885
		Pass-by Trips	49%	49%	49%			47	45	92	27	26	53	33	30	63	924
Fast-Food with Drive Through	932	New External	NA	NA	NA	3,800	S.F.	49	47	96	28	27	55	34	32	66	961
Fast-Food without Drive Through	934	Total	NA	NA	NA	3,452	S.F.	91	60	151	72	70	142	46	44	90	2,472
		Pass-by Trips	33%	43%	43%			30	20	50	31	30	61	20	19	39	1,063
Fast-Food with Drive Through	932	New External	NA	NA	NA	3,452	S.F.	61	40	101	41	40	81	26	25	51	1,409
Drive-in Bank (Sandy Spring Bank)	912	Total				2,898	SF	20	17	37	47	46	93	79	80	159	892
Internal trips to Office		Office Internal	5%	5%	5%			1	1	2	2	2	5	4	4	8	45
Passby Trips (2)		Pass-by Trips (2)	37%	37%	47%			7	6	14	17	17	34	37	37	75	419
Net External Trips		New External						12	10	21	27	26	54	38	38	76	428
Single Tenant Office Building (Fannie Mae)	715	Total				90,000	SF	152	19	171	46	39	85	26	145	171	1,125
Corporate Headquarters (Banner Life)	714	Total				140,000	SF	187	14	201	45	38	83	22	181	203	1,096
Data Center (existing Fannie Mae at 130,000 SF)	NA	Total				130,000	SF	22	7	29	7	7	14	7	22	29	NA
GSA Data Center	NA	Total				300,000	SF	51	15	66	16	16	33	15	51	66	NA
Total Employment Trips (unadjusted)		Total				660,000	SF	412	55	467	115	100	215	70	399	469	2,221
Bank/Rest/Retail Internal	0.4%	Internal				2%	2%	1	1	2	2	2	5	4	4	8	45
Net External Trips		New External						411	54	465	112	98	210	66	395	461	2,176
TOTAL EXISTING EXTERNAL TRIPS								543	157	700	232	218	451	185	513	699	5,493

Notes: (1) Estimates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA.

Table C-2
Frederick Health at Urbana
Monocacy Land Company - Southern MXD Trip Generation

Development/ Use	ITE Code	Type	Percent Reduction			Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Trips
								In	Out	Total	In	Out	Total	In	Out	Total	
Business Services (Retail)	820	Total	NA	NA	NA	11,350	S.F.	26	17	43	64	71	135	73	75	148	1,651
		Office Internal	2%	2%	2%			1	0	1	0	0	0	1	2	3	33
		Restaurant Internal	0%	10%	10%			0	0	0	0	0	0	7	8	15	165
		Pass-by Trips	25%	25%	25%			7	4	11	16	18	34	18	19	37	413
<i>Business Services (Retail)</i>		<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>			<i>19</i>	<i>12</i>	<i>31</i>	<i>48</i>	<i>53</i>	<i>102</i>	<i>46</i>	<i>47</i>	<i>93</i>	<i>1,040</i>
High Turnover (Sit-Down) Restaurant	932	Total	NA	NA	NA	3,000	S.F.	18	17	35	7	9	16	20	13	33	381
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	1	-	1	6
		Office Internal	9%	15%	15%			-	3	3	-	1	1	4	1	5	18
		Hotel Internal	0%	0%	0%			-	-	-	-	-	-	-	-	-	1
		Pass-by Trips	43%	43%	43%			8	7	15	3	4	7	9	6	14	164
<i>High Turnover (Sit-Down) Restaurant</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>3,000</i>	<i>S.F.</i>	<i>10</i>	<i>6</i>	<i>17</i>	<i>4</i>	<i>4</i>	<i>8</i>	<i>6</i>	<i>7</i>	<i>13</i>	<i>192</i>
Fast-Food with Drive Through	934	Total	NA	NA	NA	11,169	S.F.	281	270	551	161	158	319	197	181	378	5,541
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	5	5	10	94
		Office Internal	9%	13%	13%			5	45	48	9	11	21	43	9	51	269
		Hotel Internal	0%	1%	1%			1	1	2	1	1	2	1	1	2	7
		Pass-by Trips	49%	49%	49%			138	132	270	79	77	156	97	89	185	2,715
<i>Fast-Food with Drive Through</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>11,169</i>	<i>S.F.</i>	<i>137</i>	<i>92</i>	<i>229</i>	<i>72</i>	<i>69</i>	<i>140</i>	<i>51</i>	<i>77</i>	<i>129</i>	<i>2,456</i>
Fast-Food without Drive Through	934	Total	NA	NA	NA	5,309	S.F.	140	93	233	110	108	219	71	68	139	3,801
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	2	2	4	65
		Office Internal	9%	14%	14%			3	15	20	6	8	14	15	3	19	184
		Hotel Internal	1%	1%	1%			0	1	1	0	1	1	1	1	1	5
		Pass-by Trips	33%	43%	43%			46	31	77	47	47	94	31	29	60	1,634
<i>Fast-Food with Drive Through</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>5,309</i>	<i>S.F.</i>	<i>90</i>	<i>46</i>	<i>137</i>	<i>57</i>	<i>53</i>	<i>110</i>	<i>23</i>	<i>33</i>	<i>56</i>	<i>1,913</i>
Hotel (standard)	310	Total	NA	NA	NA	125	Rooms	39	29	68	11	7	18	34	36	70	256
		Restaurant Internal	5%	5%	5%			2	1	3	2	1	3	2	2	3	13
		Office Internal	10%	10%	10%			4	3	7	1	0	1	3	4	7	26
<i>Hotel (standard)</i>	<i>310</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>125</i>	<i>Rooms</i>	<i>33</i>	<i>24</i>	<i>58</i>	<i>8</i>	<i>6</i>	<i>14</i>	<i>29</i>	<i>30</i>	<i>59</i>	<i>218</i>
General Office	710	Total	NA	NA	NA	1,267,600	S.F.	1,259	172	1,431	387	325	712	255	1,244	1,499	9,429
		Retail Internal	2%	2%	2%			0	1	1	0	0	0	2	1	3	33
		Restaurant Internal	5%	5%	5%			63	9	72	19	16	36	13	62	75	471
		Hotel Internal	0.5%	0.5%	0.5%			3	4	7	0	1	1	4	3	7	44
		TDM Reduction	25%	25%	25%			315	43	358	97	81	178	64	311	375	2,357
<i>General Office</i>	<i>710</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>1,267,600</i>	<i>S.F.</i>	<i>878</i>	<i>116</i>	<i>994</i>	<i>270</i>	<i>227</i>	<i>497</i>	<i>173</i>	<i>866</i>	<i>1,039</i>	<i>6,524</i>
Data Center - Fully	NA	Total	NA	NA	NA	300,000	S.F.	51	15	66	17	17	33	15	51	66	NA
Land Bays F-8 through 12 - Woodlands at Urbana (Raystock Property) - ACCOUNTED FOR SEPARATELY																	
Senior Adult Housing (SFD) (3)	251	Total	NA	NA	NA	0	D.U.	-	-	-	-	-	-	-	-	-	-
Senior Adult Housing (SFA-TH) (3)	252	Total	NA	NA	NA	0	D.U.	-	-	-	-	-	-	-	-	-	-
TOTAL PROPOSED TRIPS								1,219	312	1,531	476	429	905	344	1,111	1,455	12,342
TOTAL EXISTING TRIPS								543	157	700	232	218	451	185	513	699	5,493
DIFFERENCE - NET NEW SOUTHERN MXD TRIPS								676	155	831	244	210	454	159	597	756	6,849

Notes: (1) Trip generation rates, internal trip rates, and passby rates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA except where noted.

(2) Estimates are based on ITE Trip Generation manual, 10th Edition rates, consistent with May 2018 study.

Table A
Frederick Health at Urbana
Monocacy Land Company - Northern MXD Trip Generation

Development/Use	Percent Reduction			ITE Land Use Code	Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Traffic
							In	Out	Total	In	Out	Total	In	Out	Total	
Proposed Program																
General Office	N/A	N/A	N/A	710	700,000	SF	783	107	890	245	206	451	147	716	863	5,969
Residential Internal	0%	2%	2%				-	1	1	1	3	4	-	5	5	44
Retail Internal	2%	2%	2%				0	0	1	1	1	2	2	1	3	42
TDM Reduction	10%	10%	10%				78	11	89	24	21	45	15	72	86	597
Total Office Trips							704	95	799	218	181	399	130	638	769	5,285
Single Family Detached-Approved	N/A	N/A	N/A	210	196	DU	37	110	147	74	58	132	122	71	193	1,931
Single Family Detached-Built	N/A	N/A	N/A	210	167	DU	32	95	127	64	50	114	105	62	167	1,667
			Difference		29		5	15	20	10	8	18	17	9	26	264
Single Family Attached	N/A	N/A	N/A	230	414	DU	27	134	161	64	64	128	129	64	193	2,214
Single Family Attached	N/A	N/A	N/A	230	318	DU	22	108	130	51	51	102	104	51	155	1,760
			Difference		96		5	26	31	13	13	26	25	13	38	454
Office Internal	0%	2%	2%		806		-	1	1	1	3	4	5	-	5	44
Retail Internal	12%	12%	12%				2	2	4	5	5	10	8	6	13	127
Total Residential Trips							8	38	46	17	13	30	29	16	46	547
Retail	N/A	N/A	N/A	820	8,935	SF	23	14	37	55	61	116	62	64	126	1,413
Office Internal	3%	3%	3%				0	0	1	1	1	2	1	2	3	42
Residential Internal	9%	9%	9%				2	2	4	5	5	10	6	8	13	127
Pass-by trips	25%	25%	25%				6	4	9	14	15	29	16	16	32	353
Total Retail Trips							15	8	23	35	39	74	40	38	78	890
Institutional (Day Care)	N/A	N/A	N/A	565	11,065	SF	65	57	122	12	11	23	58	65	123	527
Total Day Care Trips							65	57	122	12	11	23	58	65	123	527
Total Net New Trips - Northern MXD							792	198	990	282	244	526	257	758	1,015	7,249

Note: Trip calculations based on ITE Trip Generation, 8th Edition, consistent with approved 4.24.15 TIA, Table 7, page 61.

Table B
Frederick Health at Urbana
Monocacy Land Company - Urbana PUD Trip Generation

Development/Land Use	ITE			AM Peak Hour			Midday Peak Hour			PM Peak Hour			ADT ⁽¹⁾
	Land Use Code	Amount	Unit	In	Out	Total	In	Out	Total	In	Out	Total	
Retail (Existing)	820	125,400	SF	107	69	176	307	338	645	363	377	740	7,867
Retail Passby Trips		40%		43	28	70	123	135	258	145	151	296	
Net Existing Retail				64	41	106	184	203	387	218	226	444	
Retail (Proposed)		186,000	SF	135	87	222	396	437	834	472	492	964	10,165
Retail Passby Trips		40%		54	35	89	159	175	333	189	197	386	
Total Retail (Proposed)				81	52	133	238	262	500	283	295	578	
Net Proposed New Retail Trips		60,600	SF	17	11	28	54	59	113	65	69	134	2,298
General Office (Existing)	710	69,548	SF	123	17	140	41	35	76	27	130	157	1,009
General Office (Proposed)		170,000	SF	253	34	287	82	69	152	46	223	269	2,007
Net Proposed New Office Trips		100,452	SF	130	17	147	41	34	75	19	93	112	998
Single Family Homes (Existing)	210	1,362	DU	241	722	963	442	345	787	694	408	1,102	11,492
Single Family Homes (Proposed)		1,362	DU	241	722	963	442	345	787	694	408	1,102	11,492
Net Proposed SFD Trips		0	DU	-	-	-	-	-	-	-	-	-	-
Townhomes (Existing)	230	1,362	DU	130	633	763	344	344	687	730	360	1,090	11,849
Townhomes (Proposed)		1,432	DU	136	666	802	361	361	723	768	378	1,146	12,458
Net Proposed Townhome Trips		70	DU	6	33	39	18	18	35	38	18	56	609
Multifamily (Existing)	220	228	DU	23	92	115	15	8	23	93	50	143	1,505
Multifamily (Proposed)		228	DU	23	92	115	15	8	23	93	50	143	1,505
Net Proposed Multifamily Trips		0	DU	-	-	-	-	-	-	-	-	-	-
Constructed													
Senior Adult Housing (Attached)	252	0	DU	-	-	-	-	-	-	-	-	-	-
Total Net New Trips - Urbana PUD				153	61	214	112	111	224	122	180	302	3,905

Notes: (1) Estimates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA.

Table C-1
Frederick Health at Urbana
Urbana Southern MXD Trip Generation for Existing Conditions (1)

Development/ Use	ITE Code	Type	Percent Reduction			Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Trips
								In	Out	Total	In	Out	Total	In	Out	Total	
Business Services (Retail)	820	Total	NA	NA	NA	3,888	S.F.	14	9	23	32	35	67	35	37	72	823
		Pass-by Trips	25%	25%	25%			4	2	6	8	9	17	9	9	18	206
Business Services (Retail)		New External	NA	NA	NA			10	7	17	24	27	51	22	23	45	519
Fast-Food with Drive Through	934	Total	NA	NA	NA	3,800	S.F.	96	92	188	55	54	108	67	62	129	1,885
		Pass-by Trips	49%	49%	49%			47	45	92	27	26	53	33	30	63	924
Fast-Food with Drive Through	932	New External	NA	NA	NA	3,800	S.F.	49	47	96	28	27	55	34	32	66	961
Fast-Food without Drive Through	934	Total	NA	NA	NA	3,452	S.F.	91	60	151	72	70	142	46	44	90	2,472
		Pass-by Trips	33%	43%	43%			30	20	50	31	30	61	20	19	39	1,063
Fast-Food with Drive Through	932	New External	NA	NA	NA	3,452	S.F.	61	40	101	41	40	81	26	25	51	1,409
Drive-in Bank (Sandy Spring Bank)	912	Total				2,898	SF	20	17	37	47	46	93	79	80	159	892
Internal trips to Office		Office Internal	5%	5%	5%			1	1	2	2	2	5	4	4	8	45
Passby Trips (2)		Pass-by Trips (2)	37%	37%	47%			7	6	14	17	17	34	37	37	75	419
Net External Trips		New External						12	10	21	27	26	54	38	38	76	428
Single Tenant Office Building (Fannie Mae)	715	Total				90,000	SF	152	19	171	46	39	85	26	145	171	1,125
Corporate Headquarters (Banner Life)	714	Total				140,000	SF	187	14	201	45	38	83	22	181	203	1,096
Data Center (existing Fannie Mae at 130,000 SF)	NA	Total				130,000	SF	22	7	29	7	7	14	7	22	29	NA
GSA Data Center	NA	Total				300,000	SF	51	15	66	16	16	33	15	51	66	NA
Total Employment Trips (unadjusted)		Total				660,000	SF	412	55	467	115	100	215	70	399	469	2,221
Bank/Rest/Retail Internal	0.4%	Internal				2%	2%	1	1	2	2	2	5	4	4	8	45
Net External Trips		New External						411	54	465	112	98	210	66	395	461	2,176
TOTAL EXISTING EXTERNAL TRIPS								543	157	700	232	218	451	185	513	699	5,493

Notes: (1) Estimates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA.

Table C-2
Frederick Health at Urbana
Monocacy Land Company - Southern MXD Trip Generation

Development/ Use	ITE Code	Type	Percent Reduction			Amount	Units	AM Peak Hour			Midday Peak Hour			PM Peak Hour			Average Daily Trips
								In	Out	Total	In	Out	Total	In	Out	Total	
Business Services (Retail)	820	Total	NA	NA	NA	11,350	S.F.	26	17	43	64	71	135	73	75	148	1,651
		Office Internal	2%	2%	2%			1	0	1	0	0	0	1	2	3	33
		Restaurant Internal	0%	10%	10%			0	0	0	0	0	0	7	8	15	165
		Pass-by Trips	25%	25%	25%			7	4	11	16	18	34	18	19	37	413
<i>Business Services (Retail)</i>		<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>			<i>19</i>	<i>12</i>	<i>31</i>	<i>48</i>	<i>53</i>	<i>102</i>	<i>46</i>	<i>47</i>	<i>93</i>	<i>1,040</i>
High Turnover (Sit-Down) Restaurant	932	Total	NA	NA	NA	3,000	S.F.	18	17	35	7	9	16	20	13	33	381
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	1	-	1	6
		Office Internal	9%	15%	15%			-	3	3	-	1	1	4	1	5	18
		Hotel Internal	0%	0%	0%			-	-	-	-	-	-	-	-	-	1
		Pass-by Trips	43%	43%	43%			8	7	15	3	4	7	9	6	14	164
<i>High Turnover (Sit-Down) Restaurant</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>3,000</i>	<i>S.F.</i>	<i>10</i>	<i>6</i>	<i>17</i>	<i>4</i>	<i>4</i>	<i>8</i>	<i>6</i>	<i>7</i>	<i>13</i>	<i>192</i>
Fast-Food with Drive Through	934	Total	NA	NA	NA	11,169	S.F.	281	270	551	161	158	319	197	181	378	5,541
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	5	5	10	94
		Office Internal	9%	13%	13%			5	45	48	9	11	21	43	9	51	269
		Hotel Internal	0%	1%	1%			1	1	2	1	1	2	1	1	2	7
		Pass-by Trips	49%	49%	49%			138	132	270	79	77	156	97	89	185	2,715
<i>Fast-Food with Drive Through</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>11,169</i>	<i>S.F.</i>	<i>137</i>	<i>92</i>	<i>229</i>	<i>72</i>	<i>69</i>	<i>140</i>	<i>51</i>	<i>77</i>	<i>129</i>	<i>2,456</i>
Fast-Food without Drive Through	934	Total	NA	NA	NA	5,309	S.F.	140	93	233	110	108	219	71	68	139	3,801
		Retail Internal	0%	10%	10%			0	0	0	0	0	0	2	2	4	65
		Office Internal	9%	14%	14%			3	15	20	6	8	14	15	3	19	184
		Hotel Internal	1%	1%	1%			0	1	1	0	1	1	1	1	1	5
		Pass-by Trips	33%	43%	43%			46	31	77	47	47	94	31	29	60	1,634
<i>Fast-Food with Drive Through</i>	<i>932</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>5,309</i>	<i>S.F.</i>	<i>90</i>	<i>46</i>	<i>137</i>	<i>57</i>	<i>53</i>	<i>110</i>	<i>23</i>	<i>33</i>	<i>56</i>	<i>1,913</i>
Hotel (standard)	310	Total	NA	NA	NA	125	Rooms	39	29	68	11	7	18	34	36	70	256
		Restaurant Internal	5%	5%	5%			2	1	3	2	1	3	2	2	3	13
		Office Internal	10%	10%	10%			4	3	7	1	0	1	3	4	7	26
<i>Hotel (standard)</i>	<i>310</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>125</i>	<i>Rooms</i>	<i>33</i>	<i>24</i>	<i>58</i>	<i>8</i>	<i>6</i>	<i>14</i>	<i>29</i>	<i>30</i>	<i>59</i>	<i>218</i>
General Office	710	Total	NA	NA	NA	1,267,600	S.F.	1,259	172	1,431	387	325	712	255	1,244	1,499	9,429
		Retail Internal	2%	2%	2%			0	1	1	0	0	0	2	1	3	33
		Restaurant Internal	5%	5%	5%			63	9	72	19	16	36	13	62	75	471
		Hotel Internal	0.5%	0.5%	0.5%			3	4	7	0	1	1	4	3	7	44
		TDM Reduction	25%	25%	25%			315	43	358	97	81	178	64	311	375	2,357
<i>General Office</i>	<i>710</i>	<i>New External</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>1,267,600</i>	<i>S.F.</i>	<i>878</i>	<i>116</i>	<i>994</i>	<i>270</i>	<i>227</i>	<i>497</i>	<i>173</i>	<i>866</i>	<i>1,039</i>	<i>6,524</i>
Data Center - Fully	NA	Total	NA	NA	NA	300,000	S.F.	51	15	66	17	17	33	15	51	66	NA
Land Bays F-8 through 12 - Woodlands at Urbana (Raystock Property) - ACCOUNTED FOR SEPARATELY																	
Senior Adult Housing (SFD) (3)	251	Total	NA	NA	NA	0	D.U.	-	-	-	-	-	-	-	-	-	-
Senior Adult Housing (SFA-TH) (3)	252	Total	NA	NA	NA	0	D.U.	-	-	-	-	-	-	-	-	-	-
TOTAL PROPOSED TRIPS								1,219	312	1,531	476	429	905	344	1,111	1,455	12,342
TOTAL EXISTING TRIPS								543	157	700	232	218	451	185	513	699	5,493
DIFFERENCE - NET NEW SOUTHERN MXD TRIPS								676	155	831	244	210	454	159	597	756	6,849

Notes: (1) Trip generation rates, internal trip rates, and passby rates are based on ITE Trip Generation manual, 8th Edition, consistent with approved 4.24.15 TIA except where noted.

(2) Estimates are based on ITE Trip Generation manual, 10th Edition rates, consistent with May 2018 study.

APPENDIX D
DATA FROM APPROVED 2001 TRAFFIC STUDY



Street Traffic Studies, Ltd.

TRAFFIC IMPACT STUDY

Preliminary Plan Application, Knowledge Farms, Parcel 50

Urbana Election District No. 7

FREDERICK COUNTY, MARYLAND

**Prepared For:
Kirkegaard Technologies, I.I.C.**

March 9, 2001

**Prepared by: Stephen G. Petersen, P.E.
16626 S. Westland Drive • Gaithersburg, Maryland 20877**



Street Traffic Studies, Ltd.

TRAFFIC IMPACT STUDY

Preliminary Plan Application, Knowledge Farms, Parcel 50

Urbana Election District No. 7

FREDERICK COUNTY, MARYLAND

Prepared For:

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~~SP01-11~~ RJZ

SP01-11

SP516

3/28/01

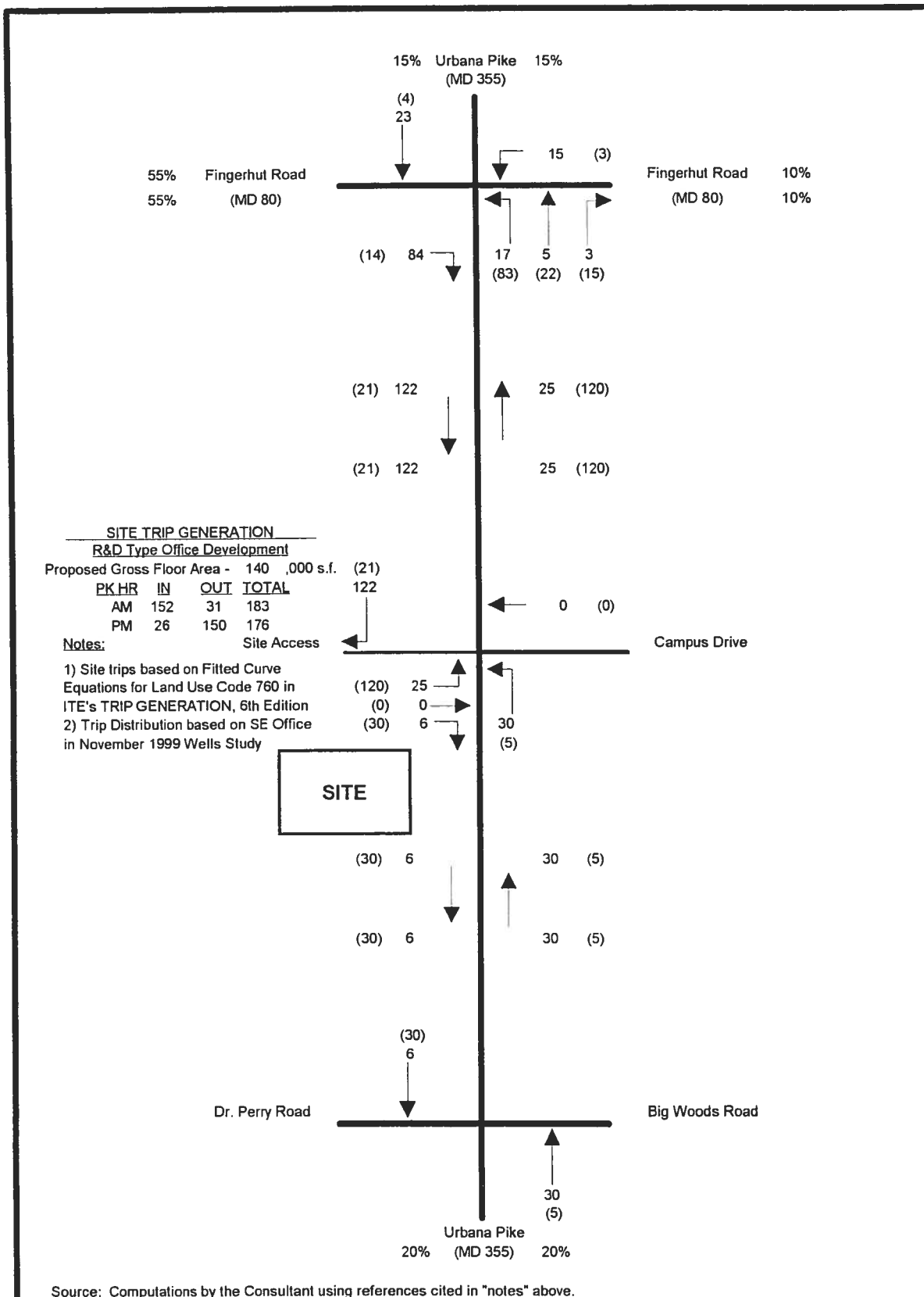
AF208

March 9, 2001

Prepared by: Stephen G. Petersen, P.E.

16626 S. Westland Drive • Gaithersburg, Maryland 20877

Telephone 301.948.1754 • FAX 301.258.0558



Source: Computations by the Consultant using references cited in "notes" above.



**STREET
TRAFFIC
STUDIES
LTD.**

LEGEND
 000 - Morning Peak Hour
 (000) - Evening Peak Hour
 0% - Trip Distribution

**EXHIBIT 7
TRIP GENERATION & ASSIGNMENT
SITE DEVELOPMENT**

APPENDIX E

TOTAL FUTURE CAPACITY ANALYSES

07. MD 355 / Campus Drive Critical Lane Volume Level of Service Calculations	Intersection: <u>07. MD 355 / Campus Drive</u> Jurisdiction: <u>Frederick County, Maryland</u> Scenario/Design Year: <u>Total Future Conditions 2026</u> Computed by: <u>Wells + Associates</u>	
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Lane Configuration

AM Peak

MD 355

(By Others)

R 1 T 1 L 1

Campus Drive

R 1 TL 1

Thornapple Drive

L 1 T 1 R 1

MD 355

PM Peak

Intersection Control: Signal: x (By Others) Stop: _____

Split: _____ Ways: _____

RTOR/Overlap (AM):	NB	28	SB	38	EB	44	WB	162
RTOR/Overlap (PM):	NB	11	SB	50	EB	26	WB	42
PCE (AM):	NB	1	SB	1	EB	1.1	WB	1.1
PCE (PM):	NB	1	SB	1	EB	1.1	WB	1.1

Opposing Volume		PCE	Number of Lanes		Lane Use Factor	Critical Lane Volume	
<199	1.10	1	1	1.00	A	≤	1,000
200-599	2.00	2	2	0.55	B	≤	1,150
600-799	3.00	3	3	0.40	C	≤	1,300
800-999	4.00	4	4	0.30	D	≤	1,450
>999	5.00	5	5	0.25	E	≤	1,600
		2 lefts	2	0.60	F	>	1,600

Phase	Movement	Volume	Lane Use Factor	Lane Volume	Opposing Lefts	Lane Use Factor	Opposing Volume	Critical Lane Volume	*
EB	TL	46	1.00	46	28	1.00	28	74	
WB	TL	44	1.00	44	38	1.00	38	82	*
NB	T	472	1.00	472	351	1.00	351	823	
SB	T	832	1.00	832	44	1.00	44	876	*
SUM								958	
A									

Note: Assumes a new traffic signal to be installed by others and the eastbound approach striped for a separate right turn lane.

Phase	Movement	Volume	Lane Use Factor	Lane Volume	Opposing Lefts	Lane Use Factor	Opposing Volume	Critical Lane Volume	*
EB	TL	173	1.00	173	11	1.00	11	184	*
WB	TL	16	1.00	16	141	1.00	141	157	
NB	T	1,019	1.00	1019	73	1.00	73	1092	*
SB	T	501	1.00	501	26	1.00	26	527	
SUM								1276	
C									

Note: Assumes a new traffic signal to be installed by others and the eastbound approach striped for a separate right turn lane.

HCM Unsignalized Intersection Capacity Analysis

AM Total Future

1: Urbana Pike/Worthington Boulevard & Thornapple Drive/Campus Drive

06/16/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	4	20	28	13	162	44	472	130	351	832	104
Future Volume (Veh/h)	38	4	20	28	13	162	44	472	130	351	832	104
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	41	4	22	30	14	176	48	513	141	382	904	113
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						6						
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2284	2418	904	2301	2390	513	1017			654		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2284	2418	904	2301	2390	513	1017			654		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	78	93	0	25	69	93			59		
cM capacity (veh/h)	5	18	335	14	19	561	682			933		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	67	220	48	513	141	382	904	113				
Volume Left	41	30	48	0	0	382	0	0				
Volume Right	22	176	0	0	141	0	0	113				
cSH	8	71	682	1700	1700	933	1700	1700				
Volume to Capacity	8.33	3.11	0.07	0.30	0.08	0.41	0.53	0.07				
Queue Length 95th (ft)	Err	Err	6	0	0	51	0	0				
Control Delay (s)	Err	Err	10.7	0.0	0.0	11.5	0.0	0.0				
Lane LOS	F	F	B			B						
Approach Delay (s)	Err	Err	0.7			3.1						
Approach LOS	F	F										
Intersection Summary												
Average Delay			1203.8									
Intersection Capacity Utilization			67.3%			ICU Level of Service				C		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 2: Urbana Pike & Site Driveway

AM Total Future
06/16/2023

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	4	4	629	858	22
Future Volume (Veh/h)	17	4	4	629	858	22
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	4	4	684	933	24
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1625	933	957			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1625	933	957			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	84	99	99			
cM capacity (veh/h)	112	323	719			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	22	4	684	933	24	
Volume Left	18	4	0	0	0	
Volume Right	4	0	0	0	24	
cSH	127	719	1700	1700	1700	
Volume to Capacity	0.17	0.01	0.40	0.55	0.01	
Queue Length 95th (ft)	15	0	0	0	0	
Control Delay (s)	39.2	10.0	0.0	0.0	0.0	
Lane LOS	E	B				
Approach Delay (s)	39.2	0.1		0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			55.2%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Knowledge Farm & Thornapple Drive

AM Total Future
06/16/2023

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	39	2	35	126	2	23
Future Volume (Veh/h)	39	2	35	126	2	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	42	2	38	137	2	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			44		256	43
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			44		256	43
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	98
cM capacity (veh/h)			1564		715	1027
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	44	175	27			
Volume Left	0	38	2			
Volume Right	2	0	25			
cSH	1700	1564	995			
Volume to Capacity	0.03	0.02	0.03			
Queue Length 95th (ft)	0	2	2			
Control Delay (s)	0.0	1.8	8.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.8	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay			2.2			
Intersection Capacity Utilization			25.2%		ICU Level of Service	
Analysis Period (min)			15		A	

HCM Unsignalized Intersection Capacity Analysis

PM Total Future

1: Urbana Pike/Worthington Boulevard & Thornapple Drive/Campus Drive

06/16/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	141	18	56	11	4	42	26	1019	56	50	501	73
Future Volume (Veh/h)	141	18	56	11	4	42	26	1019	56	50	501	73
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	153	20	61	12	4	46	28	1108	61	54	545	79
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						6						
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1819	1878	545	1888	1896	1108	624			1169		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1819	1878	545	1888	1896	1108	624			1169		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	68	89	63	93	82	97			91		
cM capacity (veh/h)	43	63	538	33	61	255	957			598		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	234	62	28	1108	61	54	545	79				
Volume Left	153	12	28	0	0	54	0	0				
Volume Right	61	46	0	0	61	0	0	79				
cSH	58	155	957	1700	1700	598	1700	1700				
Volume to Capacity	4.03	0.40	0.03	0.65	0.04	0.09	0.32	0.05				
Queue Length 95th (ft)	Err	44	2	0	0	7	0	0				
Control Delay (s)	Err	54.1	8.9	0.0	0.0	11.6	0.0	0.0				
Lane LOS	F	F	A			B						
Approach Delay (s)	Err	54.1	0.2			0.9						
Approach LOS	F	F										
Intersection Summary												
Average Delay			1079.7									
Intersection Capacity Utilization			79.1%		ICU Level of Service					D		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

2: Urbana Pike & Site Driveway

PM Total Future
06/16/2023

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	5	5	1081	536	32
Future Volume (Veh/h)	20	5	5	1081	536	32
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	5	5	1175	583	35
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1768	583	618			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1768	583	618			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	99	99			
cM capacity (veh/h)	91	512	962			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	27	5	1175	583	35	
Volume Left	22	5	0	0	0	
Volume Right	5	0	0	0	35	
cSH	108	962	1700	1700	1700	
Volume to Capacity	0.25	0.01	0.69	0.34	0.02	
Queue Length 95th (ft)	23	0	0	0	0	
Control Delay (s)	49.2	8.8	0.0	0.0	0.0	
Lane LOS	E	A				
Approach Delay (s)	49.2	0.0		0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			66.9%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Knowledge Farm & Thornapple Drive

PM Total Future
06/16/2023

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	158	3	20	60	5	57
Future Volume (Veh/h)	158	3	20	60	5	57
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	172	3	22	65	5	62
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			175		282	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			175		282	174
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		99	93
cM capacity (veh/h)			1401		696	870
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	175	87	67			
Volume Left	0	22	5			
Volume Right	3	0	62			
cSH	1700	1401	854			
Volume to Capacity	0.10	0.02	0.08			
Queue Length 95th (ft)	0	1	6			
Control Delay (s)	0.0	2.0	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.0	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			2.5			
Intersection Capacity Utilization			26.6%	ICU Level of Service	A	
Analysis Period (min)			15			