

Ref: 9416

December 16, 2022

Ms. Maren Toohill, AICP
Town Planner
Town of Littleton Planning Board
37 Shattuck Street, Room 303
Littleton, MA 01460

Re: Proposed Mix-Used Development – 265-289 Great Road
Littleton, Massachusetts

Dear Ms. Toohill:

Vanasse & Associates, Inc. (VAI) has reviewed the Green International Affiliates, Inc. (GIA) letter dated December 1, 2022, and has provided this letter to respond to GIA Comment 1. The remaining comments were responded to in the spreadsheet table addressing other disciplines of review provided by GIA. For ease of review, the GIA comment is presented below in bold followed by VAI's response.

GIA – December 1, 2022

Traffic Study

Comment 1: The Traffic Impact Study states that the proposed buildings will consist of:

3,100 sf bank , a 7,600 sf grocery store, a 14,800 sf building with 7,400 sf of retail space on the first floor and 7,400 sf of office space on the second floor, a 6,000 sf building with 3,000 sf of retail space on the first floor and 3,000 sf of office space on the second floor, and a 3,100 coffee shop without a drive-through window

However, the Site Plan shows that the proposed buildings include:

3,300 sf of bank, a 6,600 sf of grocery store, a 14,800 sf building with 7,400 sf of retail space on the first floor and 7,400 sf of office space on the second floor, a 6,000 sf building with 3,000 sf of retail space on the first floor and 3,000 sf of office space on the second floor, and a 3,500 coffee shop.

The proposed gross area on the application, site plan and traffic study report shall be consistent.

Response: The analysis was updated to match the latest site plan which shows Building A as a 4,006 sf bank; Building B with a 6,574 sf grocery store on the first floor and a 3,000 sf office space on the second floor; Building C with 7,400 sf of retail space on the first floor and 7,400 sf of office space on the second floor; Building D with 3,000 sf of retail space on the first floor and 3,000 sf of office space on the second floor; and Building E as a 3,500 sf coffee shop. Table 6R and Table 7R show the updated trip generation for the Project. Table

9R shows the updated traffic-volume increases due to the Project, and Table 14R and Table 15R show the updated analysis for signalized and unsignalized intersections, respectively. Figure 8R and Figure 9R show the updated net new site-generated traffic volumes for the weekday evening and Saturday midday peak hours, respectively. Figure 10R and Figure 11R show the updated 2029 Build traffic volumes for the weekday evening and Saturday midday peak hours, respectively

As can be seen in Table 6R, the Project is expected to generate 2,162 new vehicle trips on an average weekday (two-way, 24-hour volume), with 175 new vehicle trips (81 new entering and 94 exiting) expected during the weekday evening peak hour. On Saturday, the Project is expected to generate 2,044 new vehicle trips, with 221 new vehicle trips (110 entering and 111 exiting) expected during the Saturday midday peak hour

Table 6R
PROPOSED SITE TRIP-GENERATION SUMMARY

Time Period/ Directional Distribution	Coffee/Donut Shop ^a			Retail ^b			Office ^c	Total		
	ITE Trips	Pass-by Trips ^d	New Trips	ITE Trips	Pass-by Trips ^e	New Trips	ITE Trips	ITE Trips	Pass-by Trips	New Trips
Weekday Daily	1,546	386	1,160	1,142	286	856	146	2,834	672	2,162
<i>Weekday Evening Peak Hour:</i>										
Entering	57	25	32	69	23	46	3	129	48	81
Exiting	<u>57</u>	<u>25</u>	<u>32</u>	<u>69</u>	<u>23</u>	<u>46</u>	<u>16</u>	<u>142</u>	<u>48</u>	<u>94</u>
Total	114	20	64	138	46	92	19	271	96	175
Saturday Daily	1,546	386	1,160	1,138	284	854	30	2,714	670	2,044
<i>Saturday Midday Peak Hour:</i>										
Entering	97	43	54	70	18	52	4	171	61	110
Exiting	<u>101</u>	<u>43</u>	<u>58</u>	<u>68</u>	<u>18</u>	<u>50</u>	<u>3</u>	<u>172</u>	<u>61</u>	<u>111</u>
Total	198	86	112	138	36	102	7	343	122	221

^aBased on ITE LUC 936, *Coffee/Donut Shop without Drive-Through Window*; 3,500 sf.

^bBased on ITE LUC 822, *Strip Retail Plaza (<40K)*; 20,980 sf.

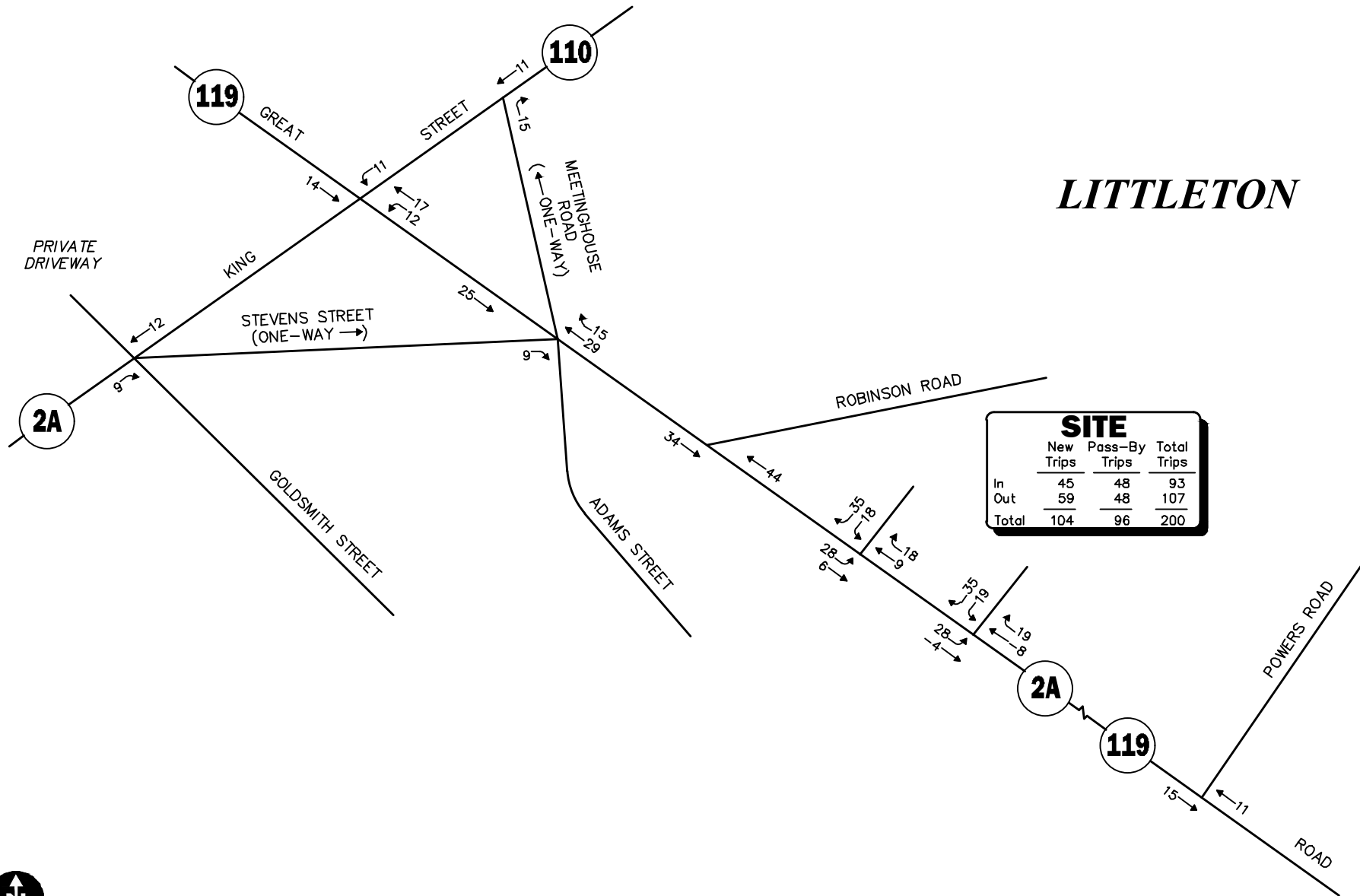
^cBased on ITE LUC 710, *General Office Building*; 13,400 sf.

^dBased on pass-by rate of 25 percent for daily and 43 percent for the peak hours.

^eBased on pass-by rate of 25 percent for daily, 34 percent for the weekday evening peak hour, and 26 percent for the Saturday midday peak hour.

As can be seen in Table 6R, the Project is expected to generate 2,162 new vehicle trips on an average weekday (two-way, 24-hour volume), with 175 new vehicle trips (81 entering and 94 exiting) expected during the weekday evening peak hour. On Saturday, the Project is expected to generate 2,044 new vehicle trips, with 221 new vehicle trips (110 entering and 111 exiting) expected during the Saturday midday peak hour.





VAI Vanasse & Associates inc

Figure 8R

**Net New Site-Generated
Weekday Evening
Peak-Hour Traffic Volumes**

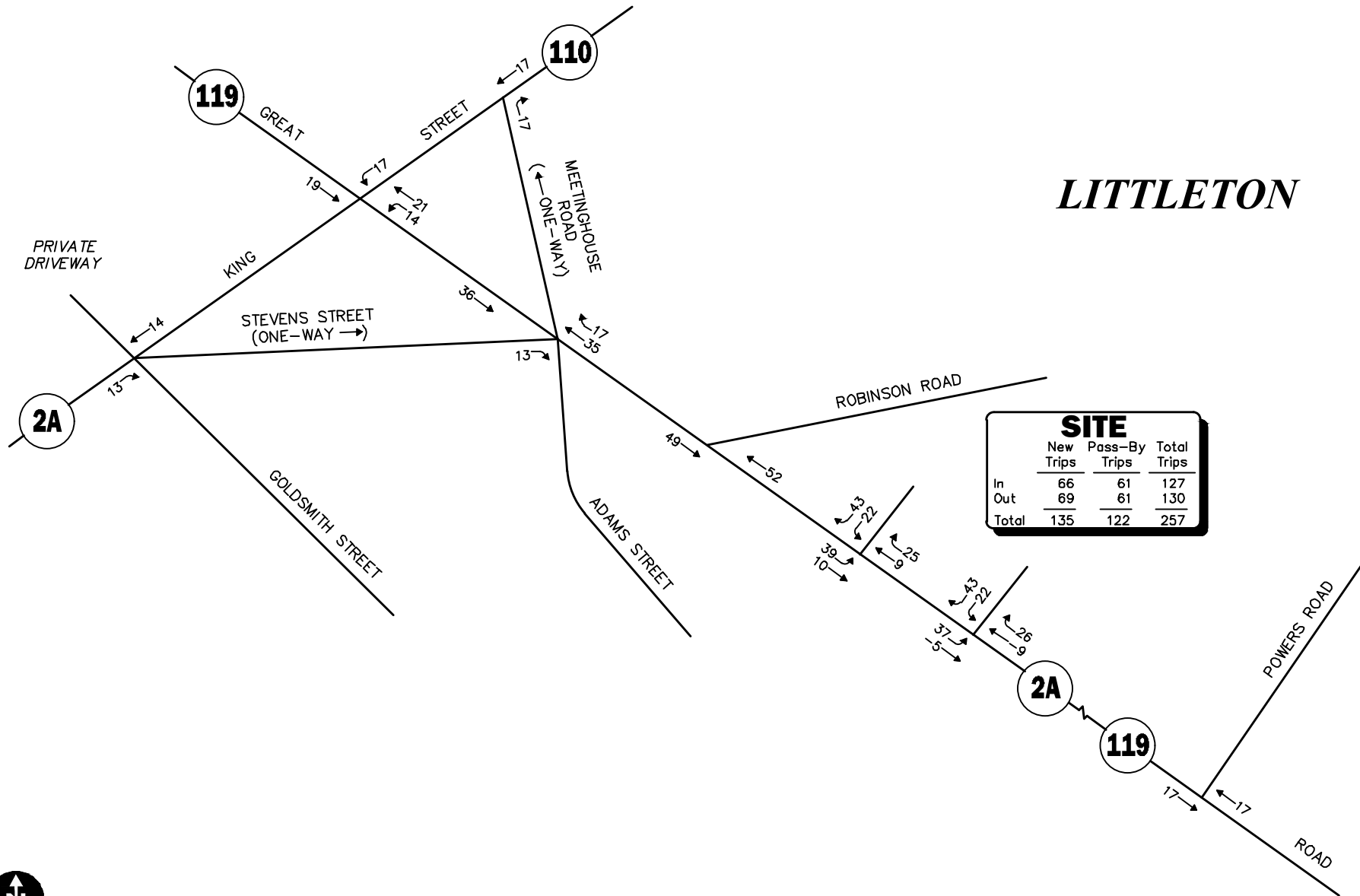
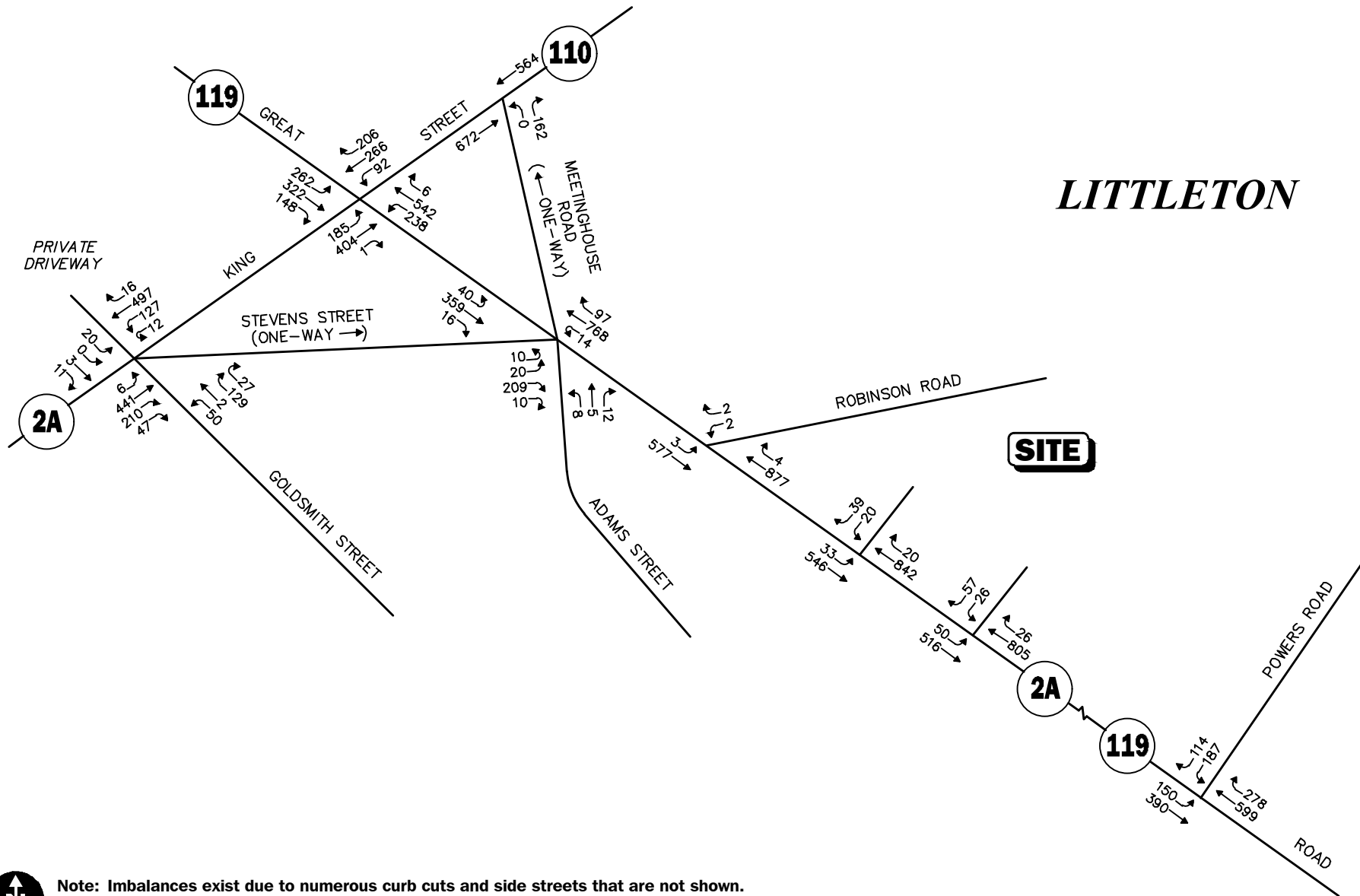


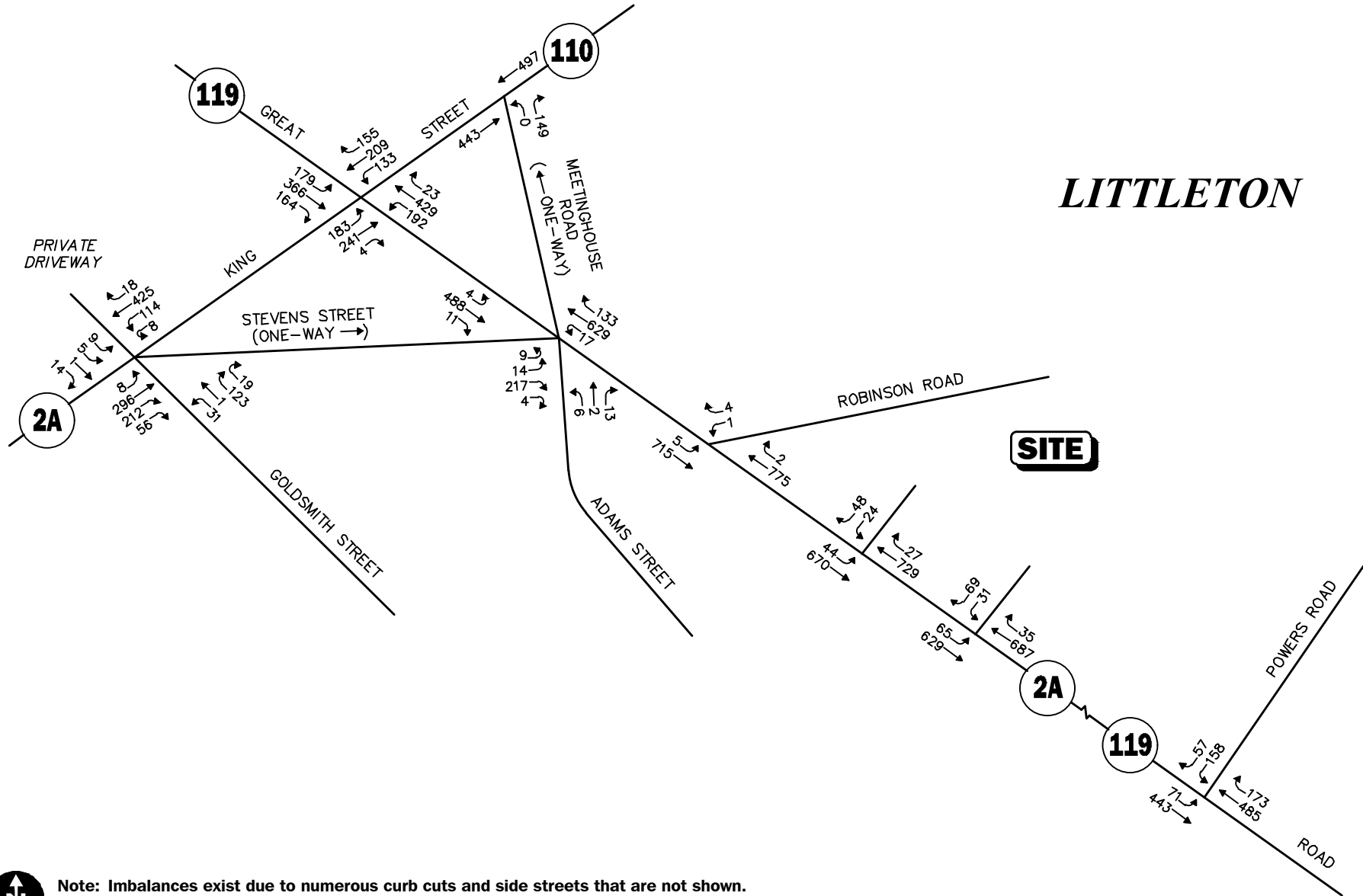
Figure 9R

Net New Site-Generated
Saturday Midday
Peak-Hour Traffic Volumes



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.
Not To Scale





Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale



Table 7R
NET NEW PROJECT TRIP-GENERATION SUMMARY

Time Period/ Directional Distribution	Proposed Site ITE Trips ^a	Existing Site ITE Trips ^b	Net ITE Trips	Pass-by Trips ^b	Net New Trips
Weekday Daily	2,834	402	2,432	672	1,760
<i>Weekday Evening Peak Hour:</i>					
Entering	129	36	93	48	45
Exiting	<u>142</u>	<u>35</u>	<u>107</u>	<u>48</u>	<u>59</u>
Total	271	71	200	96	104
Saturday Daily	2,714	376	2,338	670	1,668
<i>Saturday Midday Peak Hour:</i>					
Entering	171	44	127	61	66
Exiting	<u>172</u>	<u>42</u>	<u>130</u>	<u>61</u>	<u>69</u>
Total	343	86	257	122	135

^aFrom Table 6R.

^bFrom Table 5.

As can be seen in Table 7R, the Project is expected to generate 1,760 net new vehicle trips on an average weekday (two-way, 24-hour volume), with 104 net new vehicle trips (45 entering and 59 exiting) expected during the weekday evening peak hour. On Saturday, the Project is expected to generate 1,668 net new vehicle trips, with 135 net new vehicle trips (66 entering and 69 exiting) expected during the Saturday midday peak hour.



Table 9R
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2029 No-Build	2029 Build	Traffic-Volume Increase Over No-Build	Percent Increase Over No-Build
<i>Great Road, east of Powers Road:</i>				
Weekday Evening	1,428	1,454	26	1.8
Saturday Midday	1,225	1,259	34	2.8
<i>Great Road, west of King Street:</i>				
Weekday Evening	1,634	1,665	31	1.9
Saturday Midday	1,436	1,476	40	2.8
<i>King Street, north of Meetinghouse Road:</i>				
Weekday Evening	1,372	1,398	26	1.9
Saturday Midday	1,055	1,089	34	3.2
<i>King Street, south of Goldsmith Street:</i>				
Weekday Evening	1,241	1,262	21	1.7
Saturday Midday	1,015	1,042	27	2.7

As can be seen in Table 9R, Project-related traffic-volume increases external to the study area relative to 2029 No-Build conditions are anticipated to range from 21 to 40 vehicles or 1.7 to 3.2 percent during the peak periods.



Table 14R
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Signalized Intersection/ Peak Hour/Movement	2022 Baseline				2029 No-Build				2029 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Great Road at King Street												
<i>Weekday Evening:</i>												
Great Road EB LT	0.88	50.4	D	109/325	1.07	>80.0	F	164/423	1.12	>80.0	F	186/445
Great Road EB TH/RT	0.73	40.5	D	282/525	0.81	45.3	D	325/618	0.83	47.2	D	340/648
Great Road WB LT	0.66	29.2	C	86/190	0.80	40.2	D	96/261	0.87	50.5	D	102/312
Great Road WB TH/RT	0.77	43.7	D	335/626	0.84	48.8	D	382/724	0.87	51.3	D	399/759
King Street NB LT	>1.20	>80.0	F	152/338	>1.20	>80.0	F	166/358	1.39	>80.0	F	166/358
King Street NB TH/RT	0.90	65.9	E	332/595	1.05	>80.0	F	384/653	1.05	>80.0	F	384/653
King Street SB LT	0.42	34.2	C	36/86	0.51	37.6	D	43/98	0.57	41.0	D	49/116
King Street SB TH/RT	1.08	>80.0	F	380/722	1.15	>80.0	F	432/787	1.15	>80.0	F	432/787
Overall	--	70.3	E	--	--	>80.0	F	--	--	>80.0	F	--
<i>Saturday Midday:</i>												
Great Road EB LT	0.47	23.2	C	62/163	0.57	28.1	C	72/177	0.61	29.7	C	72/193
Great Road EB TH/RT	0.72	39.0	D	280/633	0.82	45.6	D	340/740	0.85	48.1	D	360/782
Great Road WB LT	0.56	27.8	C	63/171	0.75	41.3	D	77/233	0.86	54.6	D	83/288
Great Road WB TH/RT	0.59	35.4	D	238/492	0.68	39.4	D	285/585	0.71	40.6	D	304/632
King Street NB LT	1.03	>80.0	F	90/278	1.12	>80.0	F	110/318	1.12	>80.0	F	110/318
King Street NB TH/RT	0.52	41.9	D	146/267	0.52	41.3	D	158/284	0.52	41.3	D	158/284
King Street SB LT	0.36	29.5	C	54/113	0.41	30.4	C	64/129	0.47	32.2	C	75/147
King Street SB TH/RT	0.86	58.9	E	251/418	0.87	58.7	E	276/457	0.87	58.7	E	276/457
Overall	--	45.4	D	--	--	51.1	D	--	--	52.9	D	--

See notes at end of table.



Table 14R (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Signalized Intersection/ Peak Hour/Movement	2022 Baseline				2029 No-Build				2029 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Great Road at Powers Road												
<i>Weekday Evening:</i>												
Great Road EB LT	0.31	7.3	A	19/44	0.43	8.2	A	24/44	0.44	8.4	A	24/44
Great Road EB TH	0.40	7.9	A	52/107	0.36	6.4	A	69/111	0.37	6.5	A	73/116
Great Road WB TH	0.60	19.7	B	88/170	0.79	23.8	C	204/321	0.80	24.0	C	209/329
Great Road WB RT	0.23	1.0	A	0/15	0.25	0.8	A	0/13	0.25	0.8	A	0/13
Powers Road SB LT	0.50	22.4	C	53/112	0.66	36.8	D	79/178	0.66	37.6	D	80/182
Power Road SB RT	0.26	5.9	A	0/29	0.32	8.0	A	0/38	0.32	8.1	A	0/38
Overall	--	11.2	B	--	--	15.3	B	--	--	15.4	B	--
<i>Saturday Midday:</i>												
Great Road EB LT	0.16	5.7	A	8/23	0.18	5.9	A	9/25	0.19	6.0	A	9/25
Great Road EB TH	0.47	8.1	A	58/123	0.50	8.5	A	69/139	0.51	8.7	A	74/146
Great Road WB TH	0.68	19.2	B	119/235	0.71	19.9	B	140/266	0.72	20.6	C	149/283
Great Road WB RT	0.14	0.8	A	0/12	0.15	0.8	A	0/12	0.15	0.8	A	0/12
Powers Road SB LT	0.44	22.8	C	48/102	0.48	24.1	C	55/109	0.48	24.4	C	57/109
Power Road SB RT	0.15	7.3	A	0/23	0.16	7.3	A	0/24	0.16	7.3	A	0/24
Overall	--	12.6	B	--	--	13.1	B	--	--	13.5	B	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel of service.

^dQueue length in feet.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.



Table 15R
UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Unsignalized Intersection/ Critical Movement/Peak Hour	2022 Baseline				2029 No-Build				2029 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d	Demand	Delay	LOS	Queue	Demand	Delay	LOS	Queue
Great Road at Robinson Road												
<i>Weekday Evening:</i>												
Robinson Road SB LT/RT	4	20.8	C	3	4	24.1	C	3	4	26.4	D	3
<i>Saturday MIDDAY:</i>												
Robinson Road SB LT/RT	5	16.1	C	3	5	18.0	C	3	5	19.6	C	3
King Street at Meetinghouse Road												
<i>Weekday Evening:</i>												
Meetinghouse Road NB LT/RT	129	17.9	C	38	147	20.6	C	50	162	21.8	C	58
<i>Saturday MIDDAY:</i>												
Meetinghouse Road NB LT/RT	113	12.1	B	18	132	12.8	B	23	149	13.1	B	28
Great Road at Adams Street/ Stevens Street/Meetinghouse Drive^e												
<i>Weekday Evening:</i>												
Adams Street NB LT/TH/RT	23	21.6	C	12	25	26.2	D	15	25	28.9	D	16
Stevens Street NEB LT/TH/RT	217	20.1	C	120	240	26.8	D	176	249	31.9	D	209
<i>Saturday MIDDAY:</i>												
Adams Street NB LT/TH/RT	20	21.6	C	12	21	25.5	D	14	21	29.1	D	16
Stevens Street NEB LT/TH/RT	207	20.8	C	97	231	28.4	D	142	244	36.1	E	180
King Street at Goldsmith Street/ Stevens Street/Private Driveway^e												
<i>Weekday Evening:</i>												
Goldsmith Street EB LT/TH/RT	194	>50.0	F	191	208	>50.0	F	350	208	>50.0	F	378
Private Driveway WB LT/TH/RT	34	33.1	D	27	34	39.9	E	32	34	41.0	E	33
<i>Saturday MIDDAY:</i>												
Goldsmith Street EB LT/TH/RT	163	23.0	C	95	174	29.3	D	123	174	31.2	D	129
Private Driveway WB LT/TH/RT	29	19.7	C	12	29	22.0	C	13	29	22.7	C	14

See notes at end of table.



Table 15R (Continued)
UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Unsignalized Intersection/ Critical Movement/Peak Hour	2022 Baseline				2029 No-Build				2029 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d	Demand	Delay	LOS	Queue	Demand	Delay	LOS	Queue
Great Road at West Site Driveway												
Weekday Evening: West Site Driveway SB LT/RT	Site Traffic Neglected Under 2022 Baseline Conditions				6	21.2	C	3	59	30.9	D	33
Saturday Midday: West Site Driveway SB LT/RT					7	19.6	C	3	72	33.9	D	43
Great Road at East Site Driveway												
Weekday Evening: East Site Driveway SB LT/RT	Site Traffic Neglected Under 2022 Baseline Conditions				29	21.3	C	10	83	33.8	D	50
Saturday Midday: East Site Driveway SB LT/RT					35	21.2	C	13	100	38.9	E	65

^aDemand in vehicles per hour.

^bDelay in seconds per vehicle.

^cLevel of service.

^d95th percentile queue length in feet.

^eAnalysis conducted using SIDRA methodology.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; NEB = northeastbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.



As shown in Table 14R and Table 15R, the intersection level of service did not change with the update to the sizes of the proposed uses to the Project. All recommendations and conclusions from the TIA remain valid. Therefore, VAI continues to conclude that Project-related traffic increases will not result in significant increases on overall traffic volumes or traffic delays within the study area. The site driveways will provide efficient access to and from the development. In general, Project-related traffic can be adequately accommodated within the existing infrastructure with minimal impact on the traffic operations within the study area.

We trust that the above satisfactorily addresses the comments and if you should have any questions or require additional information, please feel free to contact either of us.

Sincerely,

VANASSE & ASSOCIATES, INC.



Scott W. Thornton, P.E.
Principal



Derek Roach, P.E.
Senior Transportation Engineer

cc: File



APPENDIX

TRIP GENERATION DATA
CAPACITY ANALYSIS

TRIP GENERATION DATA

Institute of Transportation Engineers (ITE)
Trip Generation, 11 th Edition
Land Use Code (LUC) 710 - General Office Building

Average Vehicle Trips Ends vs: 1,000 Square Feet Gross Floor Area
Independent Variable (X): 13.400

AVERAGE WEEKDAY DAILY

$$T = 10.84 * (X)$$

$$T = 10.84 * 13.400$$

$$T = 145.26$$

$$T = 146 \text{ vehicle trips}$$

with 50% (73 vpd) entering and 50% (73 vpd) exiting.

WEEKDAY MORNING PEAK HOUR

$$T = 1.52 * (X)$$

$$T = 1.52 * 13.400$$

$$T = 20.37$$

$$T = 20 \text{ vehicle trips}$$

with 88% (18 vph) entering and 12% (2 vph) exiting.

WEEKDAY EVENING PEAK HOUR

$$T = 1.44 * (X)$$

$$T = 1.44 * 13.4$$

$$T = 19.30$$

$$T = 19 \text{ vehicle trips}$$

with 17% (3 vph) entering and 83% (16 vph) exiting.

SATURDAY DAILY

$$T = 2.21 * (X)$$

$$T = 2.21 * 13.400$$

$$T = 29.61$$

$$T = 30 \text{ vehicle trips}$$

with 50% (15 vpd) entering and 50% (15 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 0.53 * (X)$$

$$T = 0.53 * 13.400$$

$$T = 7.10$$

$$T = 7 \text{ vehicle trips}$$

with 54% (4 vpd) entering and 46% (3 vpd) exiting.

Institute of Transportation Engineers (ITE)
Trip Generation, 11th Edition
Land Use Code (LUC) 822 - Strip Retail Plaza (<40K)

Average Vehicle Trips Ends vs: 1,000 Square Feet Gross Leasable Area
Independent Variable (X): 20.980

2.125

AVERAGE WEEKDAY DAILY

$$T = 54.45 * X$$

$$T = 54.45 * 20.980$$

$$T = 1,142.36$$

T = 1,142 vehicle trips
with 50% (571 vpd) entering and 50% (571 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 2.36 * (X)$$

$$T = 2.36 * 20.980$$

$$T = 49.51$$

T = 50 vehicle trips
with 60% (30 vph) entering and 40% (20 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 6.59 * X$$

$$T = 6.59 * 20.980$$

$$T = 138.26$$

T = 138 vehicle trips
with 50% (69 vph) entering and 50% (69 vph) exiting.

SATURDAY DAILY

LUC 822 Daily	54.45	LUC 822 Daily	X	X=	54.28
---------------	-------	---------------	---	----	-------

LUC 822 PM	6.59	LUC 822 PM	6.57		
------------	------	------------	------	--	--

$$T = 54.28 * X$$

$$T = 54.28 * 20.980$$

$$T = 1,138.79$$

T = 1,138 vehicle trips
with 50% (569 vph) entering and 50% (569 vph) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 6.57 * X$$

$$T = 6.57 * 20.980$$

$$T = 137.84$$

T = 138 vehicle trips
with 51% (70 vph) entering and 49% (68 vph) exiting.

Institute of Transportation Engineers (ITE)
Trip Generation, 11 th Edition
Land Use Code (LUC) 912 - Drive-In Bank

Average Vehicle Trips Ends vs: 1,000 Square Feet Gross Floor Area
Independent Variable (X): 2.742

AVERAGE WEEKDAY DAILY

$$T = 100.35 * (X)$$

$$T = 100.35 * 2.742$$

$$T = 275.16$$

$$T = 276 \text{ vehicle trips}$$

with 50% (138 vpd) entering and 50% (138 vpd) exiting.

O

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 9.95 * (X)$$

$$T = 9.95 * 2.742$$

$$T = 27.28$$

$$T = 27 \text{ vehicle trips}$$

with 58% (16 vph) entering and 42% (11 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 21.01 * (X)$$

$$T = 21.01 * 2.742$$

$$T = 57.61$$

$$T = 58 \text{ vehicle trips}$$

with 50% (29 vph) entering and 50% (29 vph) exiting.

SATURDAY DAILY

$$T = 86.48 * (X)$$

$$T = 86.48 * 2.742$$

$$T = 237.13$$

$$T = 238 \text{ vehicle trips}$$

with 50% (119 vpd) entering and 50% (119 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 26.35 * (X)$$

$$T = 26.35 * 2.742$$

$$T = 72.25$$

$$T = 72 \text{ vehicle trips}$$

with 51% (37 vph) entering and 49% (35 vph) exiting.

Institute of Transportation Engineers (ITE)

Trip Generation , 11th Edition

Land Use Code (LUC) 932 - High-Turnover (Sit-Down) Restaurant

Average Vehicle Trips Ends vs: 1000 Square Feet Gross Floor Area

Independent Variable (X): 0.840

AVERAGE WEEKDAY DAILY

$$T = 107.20 * (X)$$

$$T = 107.20 * 0.840$$

$$T = 90.05$$

$$T = 90 \text{ vehicle trips}$$

with 50% (45 vpd) entering and 50% (45 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 9.57 * (X)$$

$$T = 9.57 * 0.840$$

$$T = 8.04$$

$$T = 8 \text{ vehicle trips}$$

with 55% (4 vph) entering and 45% (4 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 9.05 * (X)$$

$$T = 9.05 * 0.840$$

$$T = 7.60$$

$$T = 8 \text{ vehicle trips}$$

with 61% (5 vph) entering and 39% (3 vph) exiting.

SATURDAY DAILY

$$T = 122.40 * (X)$$

$$T = 122.40 * 0.840$$

$$T = 102.82$$

$$T = 102 \text{ vehicle trips}$$

with 50% (51 vpd) entering and 50% (51 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 11.19 * (X)$$

$$T = 11.19 * 0.840$$

$$T = 9.40$$

$$T = 9 \text{ vehicle trips}$$

with 51% (5 vph) entering and 49% (4 vph) exiting.

Institute of Transportation Engineers (ITE)

Trip Generation , 11th Edition

Land Use Code (LUC) 936 - Coffee/Donut Shop without Drive-Through Window

Average Vehicle Trips Ends vs: 1000 Square Feet Gross Floor Area

Independent Variable (X): 3.500

WEEKDAY DAILY

LUC 937 Daily 533.57 LUC 936 Daily X x= 441.88

LUC 937 PM 38.99 LUC 936 PM 32.29

T = 441.88 * (X)

T = 441.88 * 3.500

T = 1546.58

T = 1,546 vehicle trips

with 50% (773 vph) entering and 50% (773 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 93.08 * (X)

T = 93.08 * 3.500

T = 325.78

T = 326 vehicle trips

with 51% (166 vph) entering and 49% (160 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 32.29 * (X)

T = 32.29 * 3.500

T = 113.02

T = 114 vehicle trips

with 50% (57 vph) entering and 50% (57 vph) exiting.

SATURDAY DAILY

Assume same as Weekday Daily

T = 441.88 * (X)

T = 441.88 * 3.500

T = 1546.58

T = 1,546 vehicle trips

with 50% (773 vph) entering and 50% (773 vph) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 56.50 * (X)

T = 56.50 * 3.500

T = 197.75

T = 198 vehicle trips

with 49% (97 vph) entering and 51% (101 vph) exiting.

Institute of Transportation Engineers (ITE)

Trip Generation , 11th Edition

Land Use Code (LUC) 943 - Automobile Parts and Service Center

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area

Independent Variable (X): 2.214

AVERAGE WEEKDAY DAILY

$$T = 16.60 * (X)$$

$$T = 16.60 * 2.214$$

$$T = 36.75$$

$$T = 36 \text{ vehicle trips}$$

with 50% (18 vpd) entering and 50% (18 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 1.91 * (X)$$

$$T = 1.91 * 2.214$$

$$T = 4.23$$

$$T = 4 \text{ vehicle trips}$$

with 72% (3 vph) entering and 28% (1 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 2.06 * (X)$$

$$T = 2.06 * 2.214$$

$$T = 4.56$$

$$T = 5 \text{ vehicle trips}$$

with 39% (2 vph) entering and 61% (3 vph) exiting.

NO SATURDAY DATA PROVIDED. ASSUME SAME AS WEEKDAY DAILY AND WEEKDAY EVENING PEAK HOUR

SATURDAY DAILY

$$T = 16.60 * (X)$$

$$T = 16.60 * 2.214$$

$$T = 36.75$$

$$T = 36 \text{ vehicle trips}$$

with 50% (18 vpd) entering and 50% (18 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 2.06 * (X)$$

$$T = 2.06 * 2.214$$

$$T = 4.56$$

$$T = 5 \text{ vehicle trips}$$

with 39% (2 vph) entering and 61% (3 vph) exiting.

		Proposed										Existing	LUC 943					
	3,500 sf	LUC 936 Pass By	New Trips	20,980 sf	LUC 822 Pass By	New Trips	LUC 710 13,400 sf	Total Trips	Pass-By Trips	New Trips		LUC 912 2,742 sf	LUC 932 840 sf	2,214 sf	Total Existing Trips	Net Total	Net Total Pass-By	Net Total New
Weekday Daily	1,546	386	1,160	1,142	286	856	146	2,834	672	2,162		276	90	36	402	2,432	672	1,760
PM Peak																		
In	57	25	32	69	23	46	3	129	48	81		29	5	2	36	93	48	45
Out	57	25	32	69	23	46	16	142	48	94		29	3	3	35	107	48	59
Total	114	50	64	138	46	92	19	271	96	175		58	8	5	71	200	96	104
Saturday Daily	1,546	386	1,160	1,138	284	854	30	2,714	670	2,044		238	102	36	376	2,338	670	1,668
SAT Peak																		
In	97	43	54	70	18	52	4	171	61	110		37	5	2	44	127	61	66
Out	101	43	58	68	18	50	3	172	61	111		35	4	3	42	130	61	69
Total	198	86	112	138	36	102	7	343	122	221		72	9	5	86	257	122	135

Pass-By Percents				
	Weekday Daily	PM Peak	SAT Daily	SAT Peak
LUC 820	25	34	25	26
LUC 932	25	43	25	43

CAPACITY ANALYSIS

2029 Build Weekday Evening Peak Hour

2029 Build Saturday Midday Peak Hour

2029 Build Weekday Evening Peak Hour

Lanes, Volumes, Timings
11: King Street & Great Road

2029 Build Weekday Evening Peak Hour
12/15/2022

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	262	322	148	238	542	6	185	404	1	92	266	206
Future Volume (vph)	262	322	148	238	542	6	185	404	1	92	266	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	11	12	12	10	11	12	11	11	12
Storage Length (ft)	0		0	260		0	150		0	260		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr't		0.953			0.998						0.935	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1728	1733	0	1745	1878	0	1685	1819	0	1745	1708	0
Flt Permitted	0.111			0.178			0.132			0.133		
Satd. Flow (perm)	202	1733	0	327	1878	0	234	1819	0	244	1708	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18									27	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		234			401			318			358	
Travel Time (s)		5.3			9.1			7.2			8.1	
Peak Hour Factor	0.89	0.89	0.89	0.93	0.93	0.93	0.84	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	0%	1%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	294	362	166	256	583	6	220	481	1	101	292	226
Shared Lane Traffic (%)												
Lane Group Flow (vph)	294	528	0	256	589	0	220	482	0	101	518	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		11			11			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.00	1.04	1.00	1.00	1.09	1.04	1.00	1.04	1.04	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	

Lanes, Volumes, Timings
11: King Street & Great Road

2029 Build Weekday Evening Peak Hour
12/15/2022

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Detector Phase	1	6		5	2		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	24.0		11.0	24.0		11.0	24.0		10.0	24.0	
Total Split (s)	18.0	49.0		18.0	49.0		13.0	36.0		13.0	36.0	
Total Split (%)	13.3%	36.3%		13.3%	36.3%		9.6%	26.7%		9.6%	26.7%	
Maximum Green (s)	13.0	43.0		12.0	43.0		7.0	30.0		8.0	30.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	6.0		6.0	6.0		6.0	6.0		5.0	6.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	57.2	43.2		55.2	43.2		37.3	30.3		39.0	30.1	
Actuated g/C Ratio	0.48	0.36		0.46	0.36		0.31	0.25		0.33	0.25	
v/c Ratio	1.12	0.83		0.87	0.87		1.39	1.05		0.57	1.15	
Control Delay	121.0	47.2		50.5	51.3		239.2	99.0		41.0	130.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	121.0	47.2		50.5	51.3		239.2	99.0		41.0	130.6	
LOS	F	D		D	D		F	F		D	F	
Approach Delay		73.6			51.1			143.0			116.0	
Approach LOS		E			D			F			F	

Intersection Summary

Area Type: Other

Cycle Length: 135

Actuated Cycle Length: 119.8

Natural Cycle: 150

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.39

Intersection Signal Delay: 92.3

Intersection LOS: F

Intersection Capacity Utilization 99.4%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 11: King Street & Great Road

 Ø1	 Ø2	 Ø3	 Ø4	 Ø9
18 s	49 s	13 s	36 s	19 s
 Ø5	 Ø6	 Ø7	 Ø8	
18 s	49 s	13 s	36 s	

Lane Group	Ø9
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	19.0
Total Split (s)	19.0
Total Split (%)	14%
Maximum Green (s)	16.0
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	6
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
11: King Street & Great Road

2029 Build Weekday Evening Peak Hour
12/15/2022



Lane Group	SEL	SET	NWL	NWT	NEL	NET	SWL	SWT
Lane Group Flow (vph)	294	528	256	589	220	482	101	518
v/c Ratio	1.12	0.83	0.87	0.87	1.39	1.05	0.57	1.15
Control Delay	121.0	47.2	50.5	51.3	239.2	99.0	41.0	130.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	121.0	47.2	50.5	51.3	239.2	99.0	41.0	130.6
Queue Length 50th (ft)	~186	340	102	399	~166	~384	49	~432
Queue Length 95th (ft)	#445	#648	#312	#759	#358	#653	#116	#787
Internal Link Dist (ft)		154		321		238		278
Turn Bay Length (ft)			260		150		260	
Base Capacity (vph)	262	635	293	676	158	460	180	449
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.12	0.83	0.87	0.87	1.39	1.05	0.56	1.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

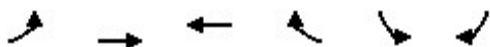
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
18: Great Road & Powers Road

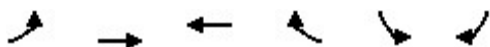
2029 Build Weekday Evening Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	150	390	599	278	187	114
Future Volume (vph)	150	390	599	278	187	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	10	11
Storage Length (ft)	220			220	0	100
Storage Lanes	1			1	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1745	1837	1818	1546	1685	1561
Flt Permitted	0.177				0.950	
Satd. Flow (perm)	325	1837	1818	1546	1685	1561
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				293		136
Link Speed (mph)		30	30		30	
Link Distance (ft)		297	344		294	
Travel Time (s)		6.8	7.8		6.7	
Peak Hour Factor	0.89	0.89	0.95	0.95	0.84	0.84
Heavy Vehicles (%)	0%	0%	1%	1%	0%	0%
Adj. Flow (vph)	169	438	631	293	223	136
Shared Lane Traffic (%)						
Lane Group Flow (vph)	169	438	631	293	223	136
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		11	11		10	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.04	1.04	1.04	1.04	1.09	1.04
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA	pm+ov	Prot	Prot

Lanes, Volumes, Timings
18: Great Road & Powers Road

2029 Build Weekday Evening Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Protected Phases	5	2	6	4	4	4
Permitted Phases	2			6		
Detector Phase	5	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	23.0	23.0	15.0	15.0	15.0
Total Split (s)	13.0	63.0	50.0	20.0	20.0	20.0
Total Split (%)	15.7%	75.9%	60.2%	24.1%	24.1%	24.1%
Maximum Green (s)	8.0	58.0	45.0	15.0	15.0	15.0
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	Min	Min	Min
Act Effect Green (s)	41.2	41.2	28.1	46.1	12.9	12.9
Actuated g/C Ratio	0.64	0.64	0.44	0.71	0.20	0.20
v/c Ratio	0.44	0.37	0.80	0.25	0.66	0.32
Control Delay	8.4	6.5	24.0	0.8	37.6	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.4	6.5	24.0	0.8	37.6	8.1
LOS	A	A	C	A	D	A
Approach Delay	7.0		16.6	26.4		
Approach LOS	A		B	C		

Intersection Summary

Area Type: Other

Cycle Length: 83

Actuated Cycle Length: 64.5

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.80

Intersection Signal Delay: 15.4

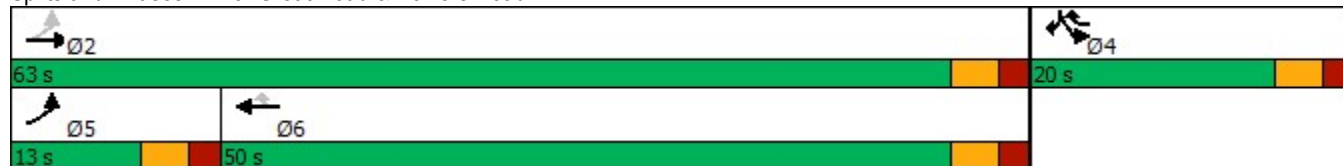
Intersection LOS: B

Intersection Capacity Utilization 62.7%

ICU Level of Service B

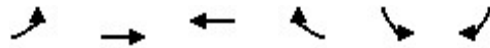
Analysis Period (min) 15

Splits and Phases: 18: Great Road & Powers Road



Queues
18: Great Road & Powers Road

2029 Build Weekday Evening Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	169	438	631	293	223	136
v/c Ratio	0.44	0.37	0.80	0.25	0.66	0.32
Control Delay	8.4	6.5	24.0	0.8	37.6	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.4	6.5	24.0	0.8	37.6	8.1
Queue Length 50th (ft)	24	73	209	0	80	0
Queue Length 95th (ft)	44	116	329	13	#182	38
Internal Link Dist (ft)		217	264		214	
Turn Bay Length (ft)	220			220		100
Base Capacity (vph)	390	1619	1317	1241	407	480
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.27	0.48	0.24	0.55	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	3	577	877	4	2	2
Future Vol, veh/h	3	577	877	4	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	94	94	50	50
Heavy Vehicles, %	0	0	1	0	0	0
Mvmt Flow	3	634	933	4	4	4

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	937	0	0 1575 935
Stage 1	-	-	- 935 -
Stage 2	-	-	- 640 -
Critical Hdwy	4.1	-	- 6.4 6.2
Critical Hdwy Stg 1	-	-	- 5.4 -
Critical Hdwy Stg 2	-	-	- 5.4 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	739	-	- 122 325
Stage 1	-	-	- 385 -
Stage 2	-	-	- 529 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	739	-	- 121 325
Mov Cap-2 Maneuver	-	-	- 121 -
Stage 1	-	-	- 383 -
Stage 2	-	-	- 529 -

Approach	EB	WB	SW
HCM Control Delay, s	0.1	0	26.4
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBRSWLn1
Capacity (veh/h)	739	-	-	- 176
HCM Lane V/C Ratio	0.004	-	-	- 0.045
HCM Control Delay (s)	9.9	0	-	- 26.4
HCM Lane LOS	A	A	-	- D
HCM 95th %tile Q(veh)	0	-	-	- 0.1

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	33	546	842	20	20	39
Future Vol, veh/h	33	546	842	20	20	39
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	94	94	92	92
Heavy Vehicles, %	0	0	1	0	0	0
Mvmt Flow	36	600	896	21	22	42
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	917	0	-	0	1579	907
Stage 1	-	-	-	-	907	-
Stage 2	-	-	-	-	672	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	752	-	-	-	122	337
Stage 1	-	-	-	-	397	-
Stage 2	-	-	-	-	511	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	752	-	-	-	113	337
Mov Cap-2 Maneuver	-	-	-	-	113	-
Stage 1	-	-	-	-	368	-
Stage 2	-	-	-	-	511	-
Approach	EB	WB		SW		
HCM Control Delay, s	0.6	0		30.9		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBRSWLn1		
Capacity (veh/h)	752	-	-	-	-	202
HCM Lane V/C Ratio	0.048	-	-	-	-	0.317
HCM Control Delay (s)	10	0	-	-	-	30.9
HCM Lane LOS	B	A	-	-	-	D
HCM 95th %tile Q(veh)	0.2	-	-	-	-	1.3

Intersection						
Int Delay, s/veh	2.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	516	805	26	26	57
Future Vol, veh/h	50	516	805	26	26	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	94	94	92	92
Heavy Vehicles, %	0	0	1	0	0	0
Mvmt Flow	55	567	856	28	28	62
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	884	0	-	0	1547	870
Stage 1	-	-	-	-	870	-
Stage 2	-	-	-	-	677	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	774	-	-	-	127	354
Stage 1	-	-	-	-	413	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	774	-	-	-	114	354
Mov Cap-2 Maneuver	-	-	-	-	114	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	509	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.9	0		33.8		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	774	-	-	-	213	
HCM Lane V/C Ratio	0.071	-	-	-	0.424	
HCM Control Delay (s)	10	0	-	-	33.8	
HCM Lane LOS	B	A	-	-	D	
HCM 95th %tile Q(veh)	0.2	-	-	-	2	

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↕	
Traffic Vol, veh/h	672	0	0	564	0	162
Future Vol, veh/h	672	0	0	564	0	162
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	91	91	92	92
Heavy Vehicles, %	1	0	0	1	0	0
Mvmt Flow	800	0	0	620	0	176
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	-	-	1420	800
Stage 1	-	-	-	-	800	-
Stage 2	-	-	-	-	620	-
Critical Hdwy	-	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	-	0	0	-	152	388
Stage 1	-	0	0	-	446	-
Stage 2	-	0	0	-	540	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	-	-	152	388
Mov Cap-2 Maneuver	-	-	-	-	152	-
Stage 1	-	-	-	-	446	-
Stage 2	-	-	-	-	540	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0		21.8	
HCM LOS					C	
Minor Lane/Major Mvmt	NBLn1		EBT	WBT		
Capacity (veh/h)	388		-	-		
HCM Lane V/C Ratio	0.454		-	-		
HCM Control Delay (s)	21.8		-	-		
HCM Lane LOS	C		-	-		
HCM 95th %tile Q(veh)	2.3		-	-		

MOVEMENT SUMMARY

 **Site: 101 [King Street at Goldsmith Street-Stevens Street-Private Driveway (Site Folder: General)]**

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
SouthEast: Goldsmith Street														
3x	L2	50	0.0	53	0.0	1.036	143.6	LOS F	15.1	377.1	1.00	1.91	4.19	12.1
8x	T1	2	0.0	2	0.0	1.036	133.0	LOS F	15.1	377.1	1.00	1.91	4.19	12.1
18x	R2	129	0.0	137	0.0	1.036	111.7	LOS F	15.1	377.1	1.00	1.91	4.19	12.1
18bx	R3	27	0.0	29	0.0	1.036	106.7	LOS F	15.1	377.1	1.00	1.91	4.19	12.2
Approach		208	0.0	221	0.0	1.036	118.9	LOS F	15.1	377.1	1.00	1.91	4.19	12.1
NorthEast: King Street														
1bx	L3	12	0.0	13	0.0	0.505	9.3	LOS A	5.2	129.9	0.51	0.14	0.98	33.0
1x	L2	127	0.0	143	0.0	0.505	9.5	LOS A	5.2	129.9	0.51	0.14	0.98	33.1
6x	T1	497	1.0	558	1.0	0.505	6.9	LOS A	5.2	129.9	0.51	0.14	0.98	34.4
16x	R2	16	0.0	18	0.0	0.505	9.3	LOS A	5.2	129.9	0.51	0.14	0.98	33.3
Approach		652	0.8	733	0.8	0.505	7.5	NA	5.2	129.9	0.51	0.14	0.98	34.1
NorthWest: Private Driveway														
7x	L2	20	0.0	28	0.0	0.327	49.5	LOS E	1.3	32.2	0.87	0.92	1.06	21.0
4x	T1	3	0.0	4	0.0	0.327	48.3	LOS E	1.3	32.2	0.87	0.92	1.06	21.1
14x	R2	11	9.0	15	9.0	0.327	23.8	LOS C	1.3	32.2	0.87	0.92	1.06	21.0
Approach		34	2.9	48	2.9	0.327	41.0	LOS E	1.3	32.2	0.87	0.92	1.06	21.0
SouthWest: King Street														
5x	L2	6	17.0	7	17.0	0.291	6.3	LOS A	0.1	3.3	0.02	0.00	0.03	35.8
2x	T1	441	1.0	531	1.0	0.291	2.4	LOS A	0.1	3.3	0.02	0.00	0.03	38.3
12ax	R1	210	0.0	253	0.0	0.175	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.2
12x	R2	47	0.0	57	0.0	0.175	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.3
Approach		704	0.8	848	0.8	0.291	1.5	NA	0.1	3.3	0.02	0.00	0.02	37.1
All Vehicles		1598	0.7	1850	0.7	1.036	19.0	NA	15.1	377.1	0.35	0.31	0.92	28.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
 Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
 Delay Model: HCM Delay Formula (Geometric Delay is not included).
 Queue Model: HCM Queue Formula.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 101 [Great Road at Adams Street/Stevens Street/ Meetinghouse Road (Site Folder: General)]**

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Adams Street														
3a	L1	8	0.0	11	0.0	0.188	46.1	LOS E	0.6	16.0	0.77	0.73	0.77	23.7
8	T1	5	0.0	7	0.0	0.188	33.8	LOS D	0.6	16.0	0.77	0.73	0.77	23.7
18b	R3	12	9.0	17	9.0	0.188	15.4	LOS C	0.6	16.0	0.77	0.73	0.77	23.7
Approach		25	4.3	35	4.3	0.188	28.9	LOS D	0.6	16.0	0.77	0.73	0.77	23.7
SouthEast: Great Road														
3bx	L3	14	0.0	14	0.0	0.490	7.5	LOS A	0.6	16.3	0.04	0.00	0.08	35.0
8x	T1	768	1.0	792	1.0	0.490	4.4	LOS A	0.6	16.3	0.04	0.00	0.08	36.6
18ax	R1	97	0.0	100	0.0	0.490	4.8	LOS A	0.6	16.3	0.04	0.00	0.08	35.2
Approach		879	0.9	906	0.9	0.490	4.5	NA	0.6	16.3	0.04	0.00	0.08	36.4
NorthWest: Great Road														
7bx	L3	40	3.0	45	3.0	0.291	7.2	LOS A	1.1	28.2	0.23	0.02	0.29	35.1
4x	T1	359	0.0	408	0.0	0.291	3.3	LOS A	1.1	28.2	0.23	0.02	0.29	36.9
14ax	R1	16	0.0	18	0.0	0.291	6.6	LOS A	1.1	28.2	0.23	0.02	0.29	35.2
Approach		415	0.3	472	0.3	0.291	3.8	NA	1.1	28.2	0.23	0.02	0.29	36.6
West: Stevens Street														
5b	L3	10	0.0	12	0.0	0.711	48.2	LOS E	8.4	209.0	0.67	1.06	1.87	22.9
5	L2	20	0.0	24	0.0	0.711	52.8	LOS F	8.4	209.0	0.67	1.06	1.87	22.9
12a	R1	209	0.0	252	0.0	0.711	29.3	LOS D	8.4	209.0	0.67	1.06	1.87	23.1
12	R2	10	0.0	12	0.0	0.711	26.8	LOS D	8.4	209.0	0.67	1.06	1.87	23.1
Approach		249	0.0	300	0.0	0.711	31.9	LOS D	8.4	209.0	0.67	1.06	1.87	23.0
All Vehicles		1568	0.6	1712	0.6	0.711	9.6	NA	8.4	209.0	0.22	0.21	0.47	32.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
 Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
 Delay Model: HCM Delay Formula (Geometric Delay is not included).
 Queue Model: HCM Queue Formula.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2029 Build Saturday Midday Peak Hour

Lanes, Volumes, Timings
11: King Street & Great Road

2029 Build Saturday Midday Peak Hour
12/15/2022

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	179	366	164	192	429	23	183	241	4	133	209	155
Future Volume (vph)	179	366	164	192	429	23	183	241	4	133	209	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	11	12	12	10	11	12	11	11	12
Storage Length (ft)	0		0	260		0	150		0	260		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr't		0.953			0.992			0.998			0.936	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1745	1738	0	1745	1867	0	1685	1833	0	1745	1719	0
Flt Permitted	0.231			0.164			0.177			0.437		
Satd. Flow (perm)	424	1738	0	301	1867	0	314	1833	0	803	1719	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			2			1			26	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		234			401			318			358	
Travel Time (s)		5.3			9.1			7.2			8.1	
Peak Hour Factor	0.95	0.95	0.95	0.91	0.91	0.91	0.96	0.96	0.96	0.87	0.87	0.87
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	188	385	173	211	471	25	191	251	4	153	240	178
Shared Lane Traffic (%)												
Lane Group Flow (vph)	188	558	0	211	496	0	191	255	0	153	418	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		11			11			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.00	1.04	1.00	1.00	1.09	1.04	1.00	1.04	1.04	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	

Lanes, Volumes, Timings
11: King Street & Great Road

2029 Build Saturday Midday Peak Hour
12/15/2022

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Detector Phase	1	6		5	2		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	24.0		11.0	24.0		11.0	24.0		10.0	24.0	
Total Split (s)	15.0	50.0		15.0	50.0		12.0	48.0		12.0	48.0	
Total Split (%)	10.4%	34.7%		10.4%	34.7%		8.3%	33.3%		8.3%	33.3%	
Maximum Green (s)	10.0	44.0		9.0	44.0		6.0	42.0		7.0	42.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	6.0		6.0	6.0		6.0	6.0		5.0	6.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	55.7	44.5		53.6	44.5		38.0	31.9		40.0	31.9	
Actuated g/C Ratio	0.47	0.37		0.45	0.37		0.32	0.27		0.34	0.27	
v/c Ratio	0.61	0.85		0.86	0.71		1.12	0.52		0.47	0.87	
Control Delay	29.7	48.1		54.6	40.6		138.8	41.3		32.2	58.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.7	48.1		54.6	40.6		138.8	41.3		32.2	58.7	
LOS	C	D		D	D		F	D		C	E	
Approach Delay		43.5			44.8			83.1			51.6	
Approach LOS		D			D			F			D	

Intersection Summary

Area Type: Other

Cycle Length: 144

Actuated Cycle Length: 119.1

Natural Cycle: 150

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.12

Intersection Signal Delay: 52.9

Intersection LOS: D

Intersection Capacity Utilization 90.5%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 11: King Street & Great Road

 Ø1	 Ø2	 Ø3	 Ø4	 Ø9
15 s	50 s	12 s	48 s	19 s
 Ø5	 Ø6	 Ø7	 Ø8	
15 s	50 s	12 s	48 s	

Lane Group	Ø9
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	19.0
Total Split (s)	19.0
Total Split (%)	13%
Maximum Green (s)	16.0
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	1
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
11: King Street & Great Road

2029 Build Saturday Midday Peak Hour
12/15/2022



Lane Group	SEL	SET	NWL	NWT	NEL	NET	SWL	SWT
Lane Group Flow (vph)	188	558	211	496	191	255	153	418
v/c Ratio	0.61	0.85	0.86	0.71	1.12	0.52	0.47	0.87
Control Delay	29.7	48.1	54.6	40.6	138.8	41.3	32.2	58.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.7	48.1	54.6	40.6	138.8	41.3	32.2	58.7
Queue Length 50th (ft)	72	360	83	304	~110	158	75	276
Queue Length 95th (ft)	#193	#782	#288	#632	#318	284	147	457
Internal Link Dist (ft)		154		321		238		278
Turn Bay Length (ft)			260		150		260	
Base Capacity (vph)	310	659	246	699	170	655	326	630
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.85	0.86	0.71	1.12	0.39	0.47	0.66

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

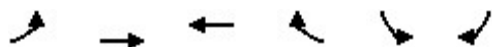
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
18: Great Road & Powers Road

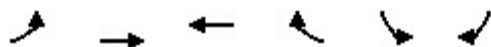
2029 Build Saturday Midday Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	71	443	485	173	158	57
Future Volume (vph)	71	443	485	173	158	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	10	11
Storage Length (ft)	220			220	0	100
Storage Lanes	1			1	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1745	1818	1818	1561	1685	1561
Flt Permitted	0.225				0.950	
Satd. Flow (perm)	413	1818	1818	1561	1685	1561
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				192		68
Link Speed (mph)		30	30		30	
Link Distance (ft)		297	344		294	
Travel Time (s)		6.8	7.8		6.7	
Peak Hour Factor	0.89	0.89	0.90	0.90	0.84	0.84
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Adj. Flow (vph)	80	498	539	192	188	68
Shared Lane Traffic (%)						
Lane Group Flow (vph)	80	498	539	192	188	68
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		11	11		10	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.04	1.04	1.04	1.04	1.09	1.04
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA	pm+ov	Prot	Prot

Lanes, Volumes, Timings
18: Great Road & Powers Road

2029 Build Saturday Midday Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Protected Phases	5	2	6	4	4	4
Permitted Phases	2			6		
Detector Phase	5	2	6	4	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	23.0	23.0	15.0	15.0	15.0
Total Split (s)	13.0	44.0	31.0	20.0	20.0	20.0
Total Split (%)	20.3%	68.8%	48.4%	31.3%	31.3%	31.3%
Maximum Green (s)	8.0	39.0	26.0	15.0	15.0	15.0
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	Min	Min	Min
Act Effect Green (s)	26.3	26.3	20.1	40.4	11.4	11.4
Actuated g/C Ratio	0.54	0.54	0.41	0.82	0.23	0.23
v/c Ratio	0.19	0.51	0.72	0.15	0.48	0.16
Control Delay	6.0	8.7	20.6	0.8	24.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	8.7	20.6	0.8	24.4	7.3
LOS	A	A	C	A	C	A
Approach Delay	8.3		15.4	19.8		
Approach LOS	A		B	B		

Intersection Summary

Area Type: Other

Cycle Length: 64

Actuated Cycle Length: 49

Natural Cycle: 55

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay: 13.5

Intersection LOS: B

Intersection Capacity Utilization 50.9%

ICU Level of Service A

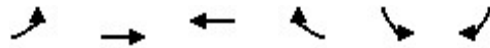
Analysis Period (min) 15

Splits and Phases: 18: Great Road & Powers Road



Queues
18: Great Road & Powers Road

2029 Build Saturday Midday Peak Hour
12/15/2022



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	80	498	539	192	188	68
v/c Ratio	0.19	0.51	0.72	0.15	0.48	0.16
Control Delay	6.0	8.7	20.6	0.8	24.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	8.7	20.6	0.8	24.4	7.3
Queue Length 50th (ft)	9	74	149	0	57	0
Queue Length 95th (ft)	25	146	#283	12	109	24
Internal Link Dist (ft)		217	264		214	
Turn Bay Length (ft)	220			220		100
Base Capacity (vph)	467	1427	1090	1341	583	584
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.35	0.49	0.14	0.32	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	5	715	775	2	1	4
Future Vol, veh/h	5	715	775	2	1	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	93	93	63	63
Heavy Vehicles, %	0	0	1	0	0	0
Mvmt Flow	5	786	833	2	2	6

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	835	0	0 1630 834
Stage 1	-	-	- 834 -
Stage 2	-	-	- 796 -
Critical Hdwy	4.1	-	- 6.4 6.2
Critical Hdwy Stg 1	-	-	- 5.4 -
Critical Hdwy Stg 2	-	-	- 5.4 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	807	-	- 113 371
Stage 1	-	-	- 430 -
Stage 2	-	-	- 448 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	807	-	- 112 371
Mov Cap-2 Maneuver	-	-	- 112 -
Stage 1	-	-	- 425 -
Stage 2	-	-	- 448 -

Approach	EB	WB	SW
HCM Control Delay, s	0.1	0	19.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBRSWLn1
Capacity (veh/h)	807	-	-	- 254
HCM Lane V/C Ratio	0.007	-	-	- 0.031
HCM Control Delay (s)	9.5	0	-	- 19.6
HCM Lane LOS	A	A	-	- C
HCM 95th %tile Q(veh)	0	-	-	- 0.1

Intersection						
Int Delay, s/veh	1.9					
Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	44	670	729	27	24	48
Future Vol, veh/h	44	670	729	27	24	48
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	93	93	92	92
Heavy Vehicles, %	0	0	1	0	0	0
Mvmt Flow	48	736	784	29	26	52
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	813	0	-	0	1631	799
Stage 1	-	-	-	-	799	-
Stage 2	-	-	-	-	832	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	823	-	-	-	113	389
Stage 1	-	-	-	-	446	-
Stage 2	-	-	-	-	431	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	823	-	-	-	102	389
Mov Cap-2 Maneuver	-	-	-	-	102	-
Stage 1	-	-	-	-	402	-
Stage 2	-	-	-	-	431	-
Approach	EB	WB		SW		
HCM Control Delay, s	0.6	0		33.9		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBRSWLn1		
Capacity (veh/h)	823	-	-	-	201	
HCM Lane V/C Ratio	0.059	-	-	-	0.389	
HCM Control Delay (s)	9.6	0	-	-	33.9	
HCM Lane LOS	A	A	-	-	D	
HCM 95th %tile Q(veh)	0.2	-	-	-	1.7	

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	65	629	687	35	31	69
Future Vol, veh/h	65	629	687	35	31	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	93	93	92	92
Heavy Vehicles, %	0	0	1	0	2	2
Mvmt Flow	71	691	739	38	34	75
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	777	0	-	0	1591	758
Stage 1	-	-	-	-	758	-
Stage 2	-	-	-	-	833	-
Critical Hdwy	4.1	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	848	-	-	-	118	407
Stage 1	-	-	-	-	463	-
Stage 2	-	-	-	-	427	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	848	-	-	-	102	407
Mov Cap-2 Maneuver	-	-	-	-	102	-
Stage 1	-	-	-	-	400	-
Stage 2	-	-	-	-	427	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.9	0		38.9		
HCM LOS	E					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	848	-	-	-	211	
HCM Lane V/C Ratio	0.084	-	-	-	0.515	
HCM Control Delay (s)	9.6	0	-	-	38.9	
HCM Lane LOS	A	A	-	-	E	
HCM 95th %tile Q(veh)	0.3	-	-	-	2.6	

Intersection						
Int Delay, s/veh	1.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Vol, veh/h	443	0	0	497	0	149
Future Vol, veh/h	443	0	0	497	0	149
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	87	87	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	461	0	0	571	0	162

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	-	-	1032	461
Stage 1	-	-	-	461	-
Stage 2	-	-	-	571	-
Critical Hdwy	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	5.4	-
Follow-up Hdwy	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	-	0	0	260	605
Stage 1	-	0	0	639	-
Stage 2	-	0	0	569	-
Platoon blocked, %	-		-		
Mov Cap-1 Maneuver	-	-	-	260	605
Mov Cap-2 Maneuver	-	-	-	260	-
Stage 1	-	-	-	639	-
Stage 2	-	-	-	569	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	13.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBT
Capacity (veh/h)	605	-	-
HCM Lane V/C Ratio	0.268	-	-
HCM Control Delay (s)	13.1	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	1.1	-	-

MOVEMENT SUMMARY

 **Site: 101 [King Street at Goldsmith Street-Stevens Street-Private Driveway (Site Folder: General)]**

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
SouthEast: Goldsmith Street														
3x	L2	31	0.0	40	0.0	0.632	45.3	LOS E	5.1	128.2	0.78	1.07	1.75	23.2
8x	T1	1	0.0	1	0.0	0.632	40.8	LOS E	5.1	128.2	0.78	1.07	1.75	23.2
18x	R2	123	0.0	158	0.0	0.632	28.4	LOS D	5.1	128.2	0.78	1.07	1.75	23.2
18bx	R3	19	0.0	24	0.0	0.632	25.6	LOS D	5.1	128.2	0.78	1.07	1.75	23.3
Approach		174	0.0	223	0.0	0.632	31.2	LOS D	5.1	128.2	0.78	1.07	1.75	23.2
NorthEast: King Street														
1bx	L3	8	0.0	8	0.0	0.386	7.0	LOS A	2.8	70.5	0.40	0.10	0.61	34.0
1x	L2	114	0.0	120	0.0	0.386	7.2	LOS A	2.8	70.5	0.40	0.10	0.61	34.1
6x	T1	425	0.0	447	0.0	0.386	4.9	LOS A	2.8	70.5	0.40	0.10	0.61	35.5
16x	R2	18	0.0	19	0.0	0.386	7.0	LOS A	2.8	70.5	0.40	0.10	0.61	34.4
Approach		565	0.0	595	0.0	0.386	5.5	NA	2.8	70.5	0.40	0.10	0.61	35.2
NorthWest: Private Driveway														
7x	L2	9	0.0	11	0.0	0.150	27.6	LOS D	0.5	13.5	0.74	0.70	0.74	25.4
7ax	L1	5	0.0	6	0.0	0.150	38.7	LOS E	0.5	13.5	0.74	0.70	0.74	25.8
4x	T1	1	0.0	1	0.0	0.150	28.1	LOS D	0.5	13.5	0.74	0.70	0.74	25.5
14x	R2	14	0.0	17	0.0	0.150	13.5	LOS B	0.5	13.5	0.74	0.70	0.74	25.5
Approach		29	0.0	36	0.0	0.150	22.7	LOS C	0.5	13.5	0.74	0.70	0.74	25.5
SouthWest: King Street														
5x	L2	8	0.0	9	0.0	0.190	4.7	LOS A	0.1	2.6	0.04	0.00	0.04	37.1
2x	T1	296	0.0	344	0.0	0.190	1.5	LOS A	0.1	2.6	0.04	0.00	0.04	38.8
12ax	R1	212	1.0	247	1.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.2
12x	R2	56	0.0	65	0.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.3
Approach		572	0.4	665	0.4	0.190	0.9	NA	0.1	2.6	0.02	0.00	0.02	37.0
All Vehicles		1340	0.2	1519	0.2	0.632	7.6	NA	5.1	128.2	0.30	0.21	0.52	33.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
 Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
 Delay Model: HCM Delay Formula (Geometric Delay is not included).
 Queue Model: HCM Queue Formula.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 101 [Great Road at Adams Street/Stevens Street/ Meetinghouse Road (Site Folder: General)]**

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h HV %]		DEMAND FLOWS [Total veh/h HV %]		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh Dist ft]		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Adams Street														
3a	L1	6	17.0	10	17.0	0.183	54.6	LOS F	0.6	15.3	0.79	0.78	0.79	23.3
8	T1	2	0.0	3	0.0	0.183	35.2	LOS E	0.6	15.3	0.79	0.78	0.79	23.7
18b	R3	13	0.0	21	0.0	0.183	16.3	LOS C	0.6	15.3	0.79	0.78	0.79	23.8
Approach		21	4.9	33	4.9	0.183	29.1	LOS D	0.6	15.3	0.79	0.78	0.79	23.7
SouthEast: Great Road														
3bx	L3	17	0.0	18	0.0	0.449	7.5	LOS A	0.8	19.1	0.07	0.00	0.12	35.0
8x	T1	629	1.0	662	1.0	0.449	4.0	LOS A	0.8	19.1	0.07	0.00	0.12	36.6
18ax	R1	133	0.0	140	0.0	0.449	4.4	LOS A	0.8	19.1	0.07	0.00	0.12	35.2
Approach		779	0.8	820	0.8	0.449	4.1	NA	0.8	19.1	0.07	0.00	0.12	36.3
NorthWest: Great Road														
7bx	L3	4	0.0	5	0.0	0.322	6.9	LOS A	0.2	3.9	0.02	0.00	0.03	36.3
4x	T1	488	1.0	581	1.0	0.322	2.6	LOS A	0.2	3.9	0.02	0.00	0.03	38.0
14ax	R1	11	0.0	13	0.0	0.322	4.1	LOS A	0.2	3.9	0.02	0.00	0.03	36.2
Approach		503	1.0	599	1.0	0.322	2.7	NA	0.2	3.9	0.02	0.00	0.03	38.0
West: Stevens Street														
5b	L3	9	0.0	10	0.0	0.724	51.3	LOS F	7.2	180.0	0.76	1.16	2.06	22.0
5	L2	14	8.0	16	8.0	0.724	60.9	LOS F	7.2	180.0	0.76	1.16	2.06	21.9
12a	R1	217	0.0	241	0.0	0.724	34.0	LOS D	7.2	180.0	0.76	1.16	2.06	22.1
12	R2	4	0.0	4	0.0	0.724	29.9	LOS D	7.2	180.0	0.76	1.16	2.06	22.2
Approach		244	0.5	271	0.5	0.724	36.1	LOS E	7.2	180.0	0.76	1.16	2.06	22.1
All Vehicles		1547	0.9	1723	0.9	0.724	9.1	NA	7.2	180.0	0.18	0.20	0.41	33.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if $v/c > 1$ irrespective of movement delay value (does not apply for approaches and intersection).
 Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
 Delay Model: HCM Delay Formula (Geometric Delay is not included).
 Queue Model: HCM Queue Formula.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.