

February 20, 2020

Mr. Michael Zuraf, AICP  
Stafford County  
1300 Courthouse Road  
Stafford, Virginia 22554  
Phone: (540) 658-8668

Reference: 7-Eleven / Taco Bell – U.S. 1 at Hospital Center Boulevard  
Access Management Exception (AME) Request and Traffic Impact Analysis (TIA)

Dear Mr. Zuraf,

Ramey Kemp & Associates, Inc. (RKA) has performed a Traffic Impact Analysis (TIA) for the proposed convenience store with 16 fueling positions (f.p.) and fast-food restaurant located in the southwest quadrant of the U.S. 1 at Hospital Center Boulevard intersection. The proposed access plan includes one right-in / right-out driveway on U.S. 1, and one right-in / right-out driveway on Hospital Center Boulevard. If approved, the site is expected to be built in 2021. Figure 1 shows the site location and study intersections, and Figure 2 shows the conceptual site plan.

The purpose of this letter report is to provide the following:

- Trip generation calculations
- Evaluation of turn lane warrants for the proposed site driveways
- Capacity and queueing analysis of the study intersections

### **Existing Roadway Conditions**

U.S. 1 (Jefferson Davis Highway) is a four-lane Principal Arterial with an average daily traffic (ADT) volume of approximately 19,500 vehicles per day (vpd), and a posted speed limit of 35 miles per hour (mph).

Hospital Center Boulevard is a four-lane Major Collector west of U.S. 1 and a four-lane connector roadway east of U.S. 1 with an ADT volume of approximately 15,000 vpd west of U.S. 1 and 12,000 vpd east of U.S. 1. Hospital Center Boulevard has a posted speed limit of 35 mph west of U.S. 1.

Existing lane configurations are shown in Figure 3.

### **Existing Traffic Volumes**

Based on discussion with the County and VDOT, existing traffic volumes were based on the Burns Property TIA dated June 25, 2019. Figure 5 in the Burns Property TIA shows the projected 2022 AM and PM peak hour traffic volumes. The 2019 traffic volumes were estimated assuming a growth rate of 2.0% between 2019 and 2022, and are shown in Figure 4.

### **Approved Development**

Based on discussion with the County and VDOT, there are six approved developments in the vicinity of the site that will generate a significant amount of traffic. Figure 7a in the Burns Property TIA shows the trip potential of the six approved developments at the following level of build-out in 2026:

- Austin Ridge Commercial – 75% of trips
- Embrey Mill Commercial – 25% of trips
- South Campus – 25% of trips
- Stafford Commons – 100% of trips
- Stafford Hospital – 25% of trips
- Westgate Center – 50% of trips

Based on discussion with you, the build-out levels for three of the developments were adjusted:

- Austin Ridge Commercial – reduced to 50% of trips
- Embrey Mill Commercial – increased to 50% of trips
- Stafford Hospital – increased to 50% of trips

Figure 5 shows the total approved development trips.

### **Background Traffic Growth**

The existing 2019 peak hour traffic volumes were grown by an annual rate of 2.0% for two years to estimate the 2021 peak hour traffic volumes. Figure 6 shows the estimated 2021 no-build peak hour traffic volumes.

### Trip Generation

The trip generation potential of the site during a typical weekday, AM peak hour, and PM peak hour was estimated using the methodologies published by the Institute of Transportation Engineers (ITE) *Trip Generation Manual – 10<sup>th</sup> Edition*. Table 1 summarizes the trip generation calculations.

**Table 1: ITE Trip Generation – Weekday – 10<sup>th</sup> Edition**

Land Use (ITE Land Use Code)	Size	Weekday Daily Traffic (vpd)		AM Peak Hour (vph)		PM Peak Hour (vph)	
		Enter	Exit	Enter	Exit	Enter	Exit
Fast-Food Restaurant with Drive-Through Window (934)	2,700 s.f.	636	636	55	54	46	42
Super Convenience Market / Gas Station (960)	16 f.p. / 4,650 s.f.	1,865 <sup>2</sup>	1,865 <sup>2</sup>	201 <sup>1</sup>	201 <sup>1</sup>	172 <sup>1</sup>	172 <sup>1</sup>
Subtotal		2,501	2,501	256	255	218	214
Internal Capture – 5%		-125	-125	-12	-12	-10	-10
Driveway Volumes		2,376	2,376	244	243	208	204
ITE Pass-by Trips:							
Fast-Food – 49% AM / 50% PM		-299	-299	-25	-25	-20	-20
Super C-Store – 63% AM / 66% PM		-1,142	-1,142	-120	-120	-107	-107
<b>Net New Primary Trips</b>		<b>935</b>	<b>935</b>	<b>99</b>	<b>98</b>	<b>81</b>	<b>77</b>

Convenience stores and fast-food restaurants attract pass-by trips, which are made by drivers who are already driving by the site today and will visit the convenience store or fast-food restaurant in the future because they are convenient. The ITE pass-by rates are shown in Table 1.

### Site Traffic Distribution

The following primary site traffic distribution was applied based on a review of the existing traffic volumes, the adjacent roadway network, and engineering judgement:

- 45% to / from the west on Hospital Center Boulevard
- 30% to / from the north on U.S. 1
- 20% to / from the east on Hospital Center Boulevard
- 5% to / from the south on U.S. 1

Based on the historical ADT's, it was assumed that 60% of pass-by trips will originate from U.S. 1 and 40% of pass-by trips will originate from Hospital Center Boulevard.

Both proposed site driveways are right-in / right-out, and it was assumed that 80% of the pass-by trips on U.S. 1 will be in the southbound direction, and 80% of the pass-by trips on Hospital Center Boulevard will be in the eastbound direction. The following directional distributions were applied based on ease of site access for the pass-by trips:

- U.S. 1 – 48% southbound / 12% northbound
- Hospital Center Boulevard – 32% eastbound / 8% westbound

Figures 6 and 7 show the primary and pass-by site trip distributions. Figures 8 and 9 show the primary and pass-by site trip assignments. Figure 10 shows the total site trips, and Figure 11 shows the projected 2021 build-out peak hour traffic volumes.

### **VDOT Turn Lane Warrant Analysis**

The projected build-out AM and PM peak hour traffic volumes at the proposed site driveways were compared to the turn lane warrants in the Virginia Department of Transportation (VDOT) *Access Management Design Standards for Entrances and Intersections*.

#### Hospital Center Boulevard at Right-in / Right-out Driveway:

- An eastbound right-turn lane on Hospital Center Boulevard is warranted in the AM and PM peak hours. Based on discussion at the TIA scope meeting, the eastbound right-turn volume on Hospital Center Boulevard onto U.S. 1 southbound was treated as the major street through movement in evaluating this turn lane warrant.
- The steep topography of the western portion of the property makes it difficult to construct a full right-turn lane without a significant retaining wall. The applicant is willing to construct an eastbound right-turn taper to help minimize the impact to drivers on eastbound Hospital Center Boulevard.

#### U.S. 1 at Right-in / Right-out Driveway:

- A southbound right-turn lane on U.S. 1 is warranted in the AM and PM peak hours

Figure 12 shows the recommended roadway laneage at the proposed driveways.

### **Intersection Spacing Standards**

VDOT requires at least 305 feet of separation between traffic signals and partial access driveways on Principal Arterial roadways posted 35 mph. The proposed right-in / right-out driveway on U.S. 1 is approximately 425 feet south of Hospital Center Boulevard, which exceeds the VDOT minimum spacing standards.

VDOT requires at least 250 feet of separation between partial access driveways and other intersections on Collector roads posted 35 mph. The proposed right-in / right-out driveway on Hospital Center Boulevard is approximately 450 feet west of U.S. 1, which exceeds the VDOT minimum spacing standards. However, VDOT considers this proposed driveway to be within the functional area of the traffic signal because it is in the eastbound right-turn lane. VDOT is requiring an AME request to permit this driveway.

**Traffic Capacity Analysis**

Traffic capacity analysis for the study intersections was performed using Synchro 10, which is a comprehensive software package that allows the user to model signalized and unsignalized intersections to determine levels-of-service based on the thresholds specified in the Highway Capacity Manual (HCM) – 6<sup>th</sup> Edition. Synchro queues that contain a “#” symbol were reported used the maximum SimTraffic queues based on the average of ten microsimulation runs.

Table 2 summarizes the capacity analysis results for the signalized intersection of U.S. 1 at Hospital Center Boulevard, and the Synchro and SimTraffic outputs are enclosed for reference.

**Table 2: Level-of-Service Summary for U.S. 1 at Hospital Center Boulevard**

CONDITION	LANE GROUP	AM PEAK HOUR				PM PEAK HOUR			
		Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)	Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)
Existing (2019) Traffic Conditions <i>Prior to completion of Hospital Center Boulevard</i>	EBL	E	55.7	72	C (31.6 sec)	E	76.5	155	D (40.8 sec)
	EBT	E	57.1	139		E	72.1	268	
	EBR	A	4.0	43		C	31.3	297	
	WBL	D	44.4	100		F	84.8	160	
	WBT/R	D	52.2	261		E	63.1	211	
	NBL	D	44.8	185		E	57.7	96	
	NBT	C	30.6	263		B	18.4	172	
	NBR	A	5.2	77		A	0.6	7	
	SBL	E	60.9	103		F	104.6	57	
	SBT	B	12.3	63		C	24.2	326	
SBR	A	3.5	9	A	2.6	44			
No-Build (2021) Traffic Conditions <i>With Completion of Hospital Center Boulevard</i>	EBL	D	53.5	83	D (35.6 sec)	F	96.0	273	E (68.3 sec)
	EBT	E	60.0	195		F	99.8	804	
	EBR	A	5.0	75		E	60.4	1,228	
	WBL	D	45.5	133		F	116.2	250	
	WBT/R	D	54.4	309		F	92.5	490	
	NBL	D	48.3	268		E	55.6	290	
	NBT	D	36.8	297		C	22.4	218	
	NBR	B	11.0	166		A	1.2	15	
	SBL	E	60.4	170		F	88.1	88	
	SBT	C	24.8	118		E	74.8	640	
SBR	A	8.7	77	B	14.0	128			
Build (2021) Traffic Conditions <i>With Completion of Hospital Center Boulevard</i>	EBL	E	56.4	100	D (37.0 sec)	F	97.7	321	E (69.8 sec)
	EBT	E	63.4	238		F	94.0	401	
	EBR	A	6.9	100		E	60.4	440	
	WBL	D	49.4	183		F	137.3	250	
	WBT/R	D	50.6	315		E	74.9	584	
	NBL	E	58.2	274		E	59.8	298	
	NBT	D	38.1	277		C	25.0	223	
	NBR	B	15.2	192		A	2.2	26	
	SBL	D	50.9	321		F	96.0	87	
	SBT	B	16.3	166		F	81.2	769	
SBR	A	6.7	122	B	11.4	118			

Capacity analysis indicates that the intersection currently operates at LOS C during the AM peak hour and at LOS D during the PM peak hour. Under no-build conditions, the intersection is expected to operate at LOS D during the AM peak hour and at LOS E during the PM peak hour. Under build conditions, the intersection is expected to continue to operate at LOS D during the AM peak hour and at LOS E during the PM peak hour.

Note that the proposed primary trips are projected to increase the total approach volume at this intersection by approximately 6% in the AM peak hour and 4% in the PM peak hour. No improvements are recommended at this intersection.

Table 3 summarizes the capacity analysis results for the unsignalized intersection of Hospital Center Boulevard at Right-in / Right-out Driveway, and the Synchro outputs are enclosed for reference.

**Table 3: Level-of-Service Summary for Hospital Center Boulevard at Right-in / Right-out Driveway**

CONDITION	LANE GROUP	AM PEAK HOUR				PM PEAK HOUR			
		Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)	Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)
Build (2021) Traffic Conditions	EBT	-	-	-	N/A <sup>2</sup>	-	-	-	N/A <sup>2</sup>
	EBR	-	-	-		-	-	-	
	WBT	-	-	-		-	-	-	
	NBR <sup>1</sup>	C	16.7	40		D	30.6	65	

1. Level of service for minor approach
2. HCM methodology does not provide lane group or overall LOS, delay, and queue lengths for major street through movements or right turns at unsignalized intersections.

Under build conditions, capacity analysis indicates that the minor street right-turn movement is expected to operate with short delays (less than 25 seconds) during the AM peak hour and with moderate delays (between 25 and 50 seconds) during the PM peak hour with the following improvement:

- Construct a 200 foot eastbound right-turn taper on Hospital Center Boulevard

Table 4 summarizes the capacity analysis results for the unsignalized intersection of U.S. 1 at Right-in / Right-out Driveway, and the Synchro outputs are enclosed for reference.

**Table 4: Level-of-Service Summary for U.S. 1 at Right-in / Right-out Driveway**

CONDITION	LANE GROUP	AM PEAK HOUR				PM PEAK HOUR			
		Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)	Lane LOS	Lane Delay (sec)	Queue (ft)	Overall LOS (Delay)
Build (2021) Traffic Conditions	EBR <sup>1</sup>	B	12.4	15	N/A <sup>2</sup>	D	26.1	35	N/A <sup>2</sup>
	NBT	-	-	-		-	-	-	
	SBT	-	-	-		-	-	-	
	SBR	-	-	-		-	-	-	

1. Level of service for minor approach
2. HCM methodology does not provide lane group or overall LOS, delay, and queue lengths for major street through movements or right turns at unsignalized intersections.

Under build conditions, capacity analysis indicates that the minor street right-turn movement is expected to operate with short delays (less than 25 seconds) during the AM peak hour and with moderate delays (between 25 and 50 seconds) during the PM peak hour with the following improvement:

- Construct one southbound right-turn lane on U.S. 1 with 100 feet of storage and 100 feet of taper due to the limited property frontage

**Recommendations**

Based on the trip generation potential of the site, the following improvements are recommended:

Hospital Center Boulevard at Right-in / Right-out Driveway:

- Construct site driveway with one ingress lane and one egress lane
- Construct a 200 foot eastbound right-turn taper on Hospital Center Boulevard

U.S. 1 at Right-in / Right-out Driveway:

- Construct site driveway with one ingress lane and one egress lane
- Construct one southbound right-turn lane on U.S. 1 with 100 feet of storage and 100 feet of taper due to the limited property frontage

We appreciate your attention to this matter. Please contact me at (804) 217-8560 if you have any questions about this report.

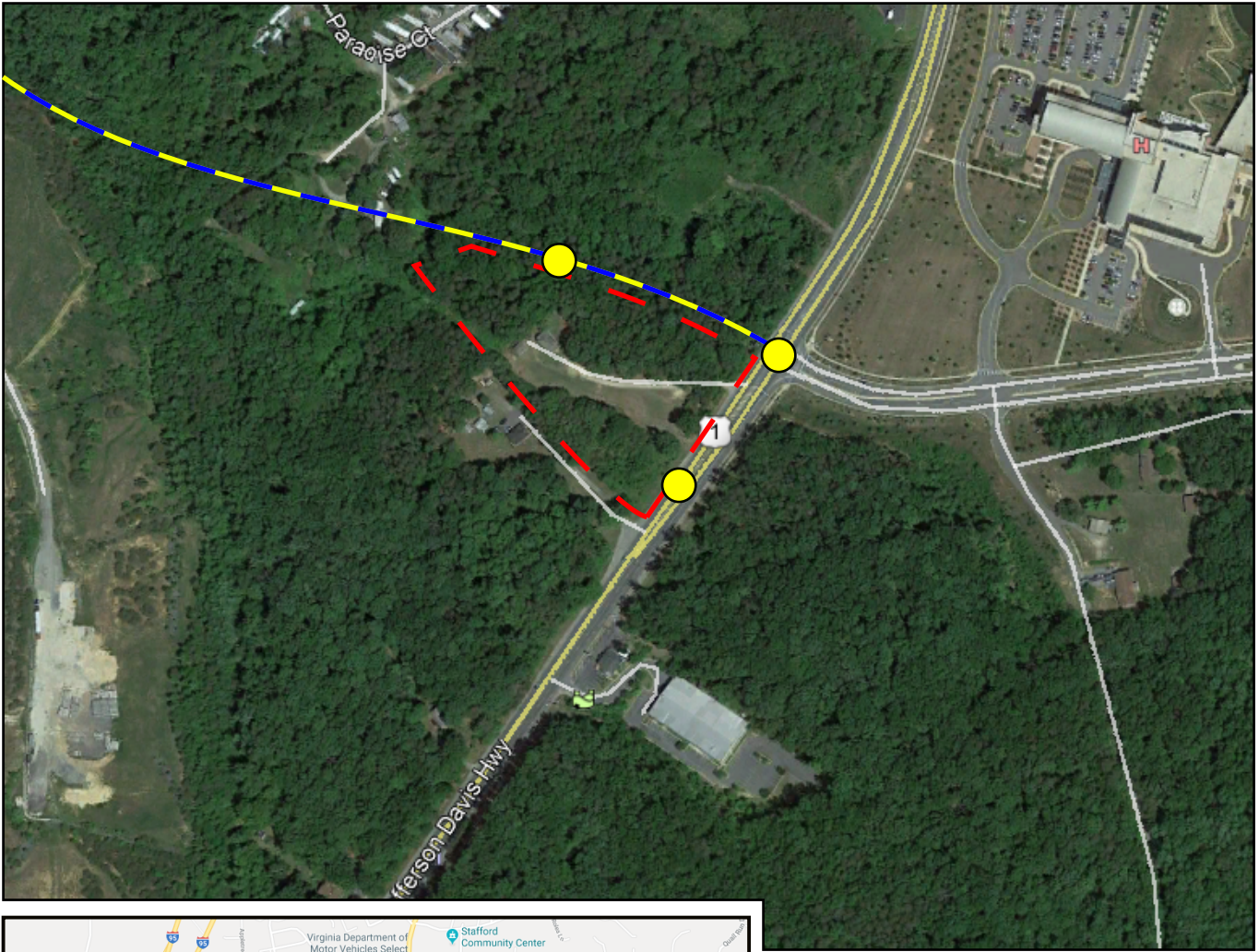
Sincerely yours,  
*Ramey Kemp & Associates, Inc.*



Carl Hultgren, P.E., PTOE  
Regional Manager

Enclosures: Figures, Baseline traffic volumes, Synchro output, VDOT turn lane warrant diagrams

Copy to: Ms. Margaret Niemann, VDOT  
Mr. David Beale, P.E., VDOT  
Mr. Peter Hedrich, P.E., PTOE, VDOT  
Mr. Steve Jones, Silver Companies  
Mr. Brett Skinner, Verdad Real Estate  
Mr. Jonathan Fairbanks, P.E., Fairbanks & Franklin



Inset



Overview



**LEGEND**



Study Intersection



Site Boundary



Future Hospital Center Blvd



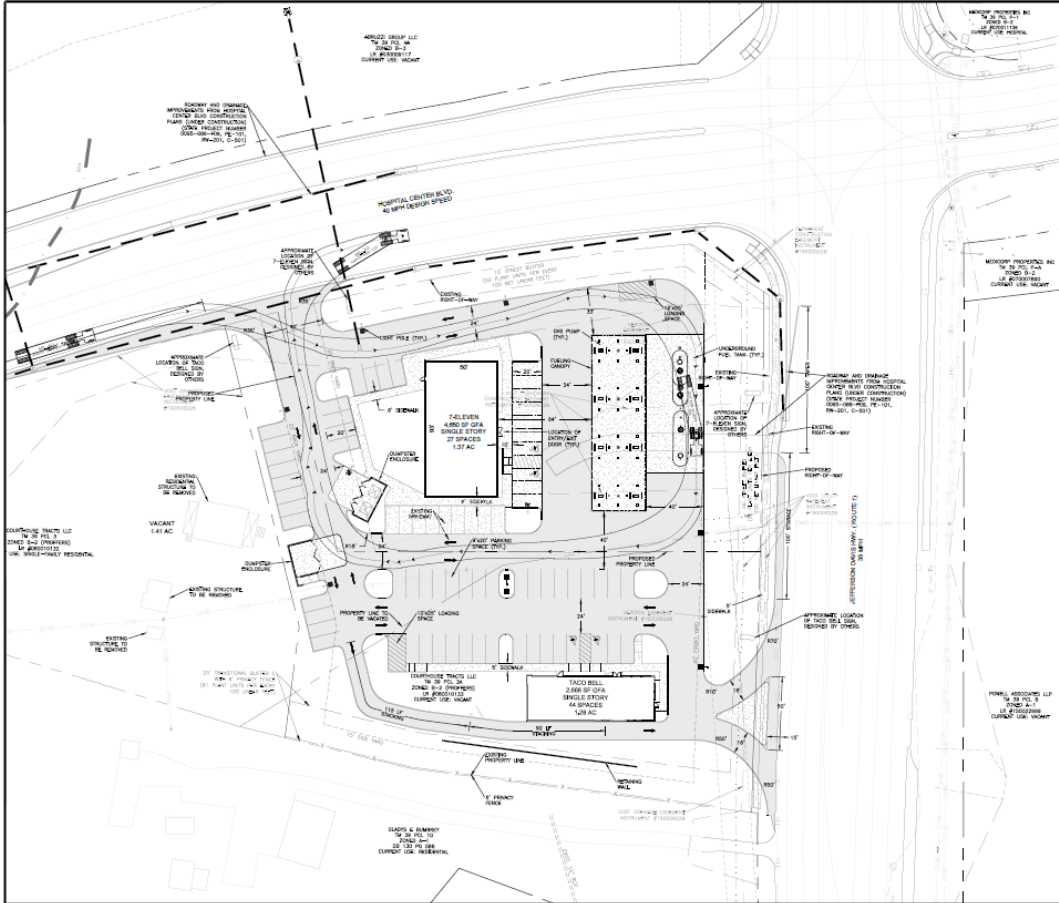
7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Site Location and  
Study Intersections

Scale: Not to Scale

Figure 1





**GENERAL NOTES**

1. THE SITE PLAN IS A CONCEPTUAL PLAN AND IS NOT TO BE USED FOR CONSTRUCTION.
2. ALL UTILITIES SHOWN ARE BASED ON RECORD DRAWINGS AND FIELD SURVEY.
3. ALL UTILITIES SHOWN ARE BASED ON RECORD DRAWINGS AND FIELD SURVEY.
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5. THE SITE PLAN IS A CONCEPTUAL PLAN AND IS NOT TO BE USED FOR CONSTRUCTION.

SITE SUMMARY	
PROJECT NO.	100-000000
DATE	10/1/2010
PROJECT NAME	7-ELEVEN / TACO BELL
CLIENT	JEFFERSON DAVIS HWY
PROJECT LOCATION	U.S. 1 AT HOSPITAL CENTER BLVD



PROJECT NO.	100-000000
DATE	10/1/2010
PROJECT NAME	7-ELEVEN / TACO BELL
CLIENT	JEFFERSON DAVIS HWY
PROJECT LOCATION	U.S. 1 AT HOSPITAL CENTER BLVD
PROJECT TYPE	CONCEPT PLAN
PROJECT NUMBER	2

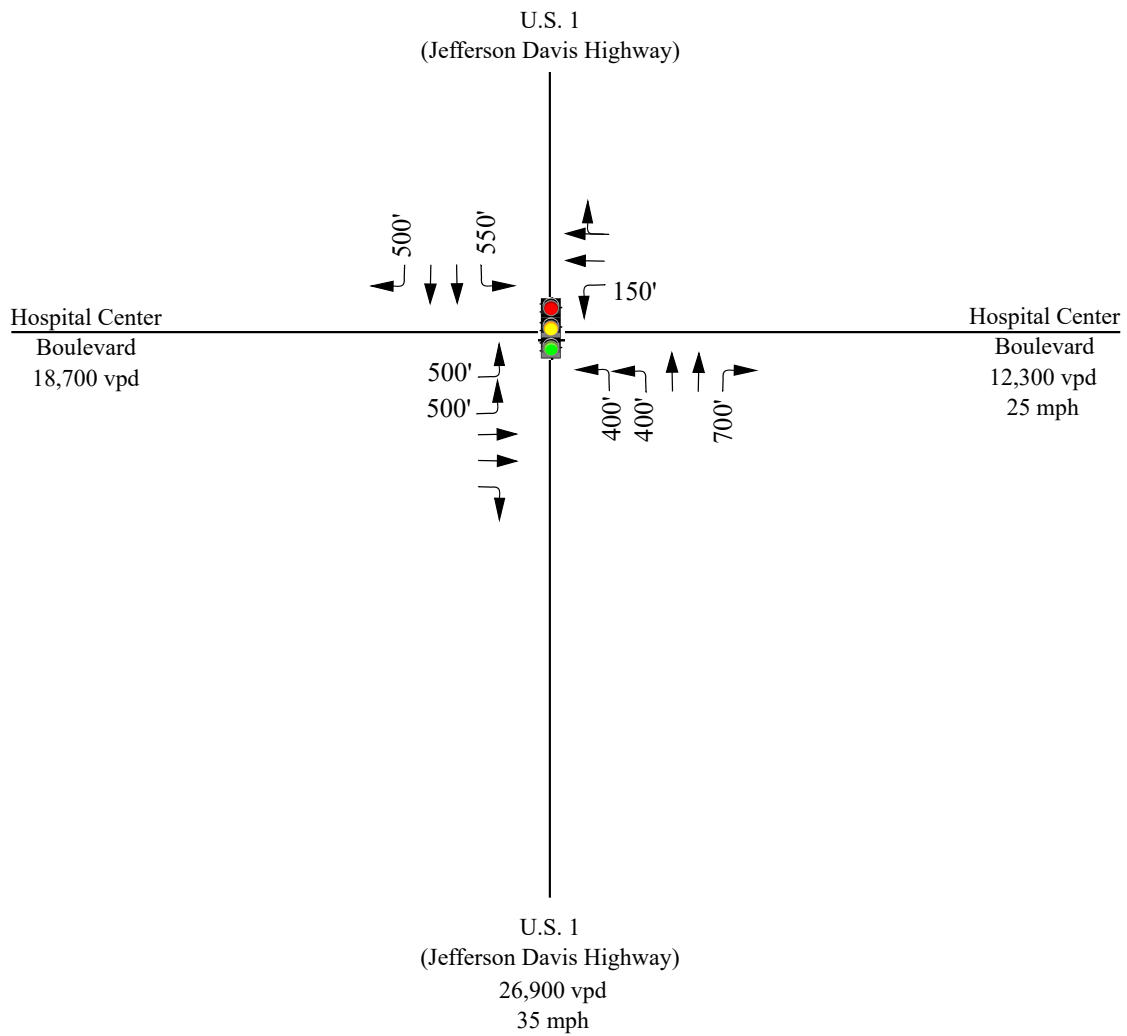


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Conceptual Site Plan

Scale: Not to Scale

Figure 2



**LEGEND**



Existing Traffic Signal



Existing Lane



Storage (In Feet)

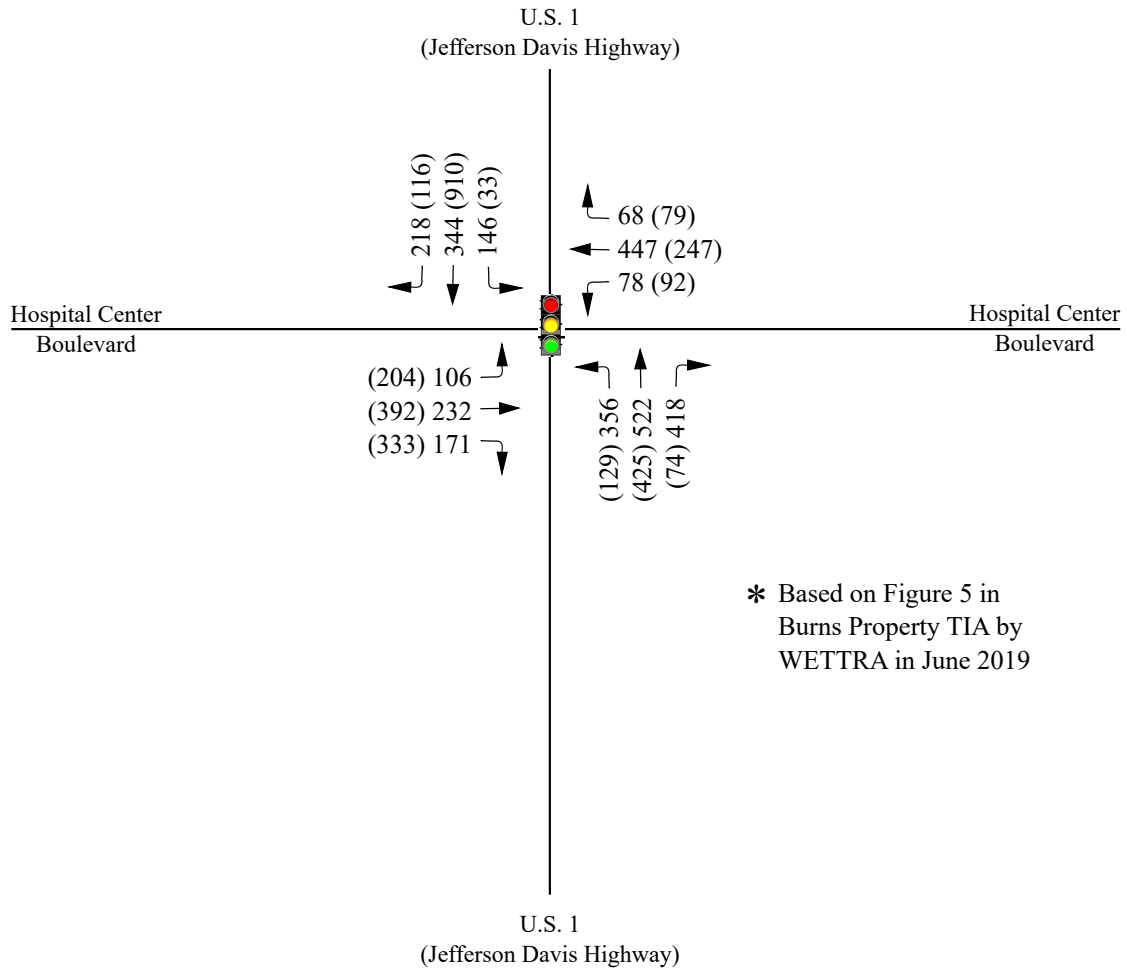


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Existing Laneage  
Configuration

Scale: Not to Scale

Figure 3



**LEGEND**

X (Y) AM (PM) Peak Hour

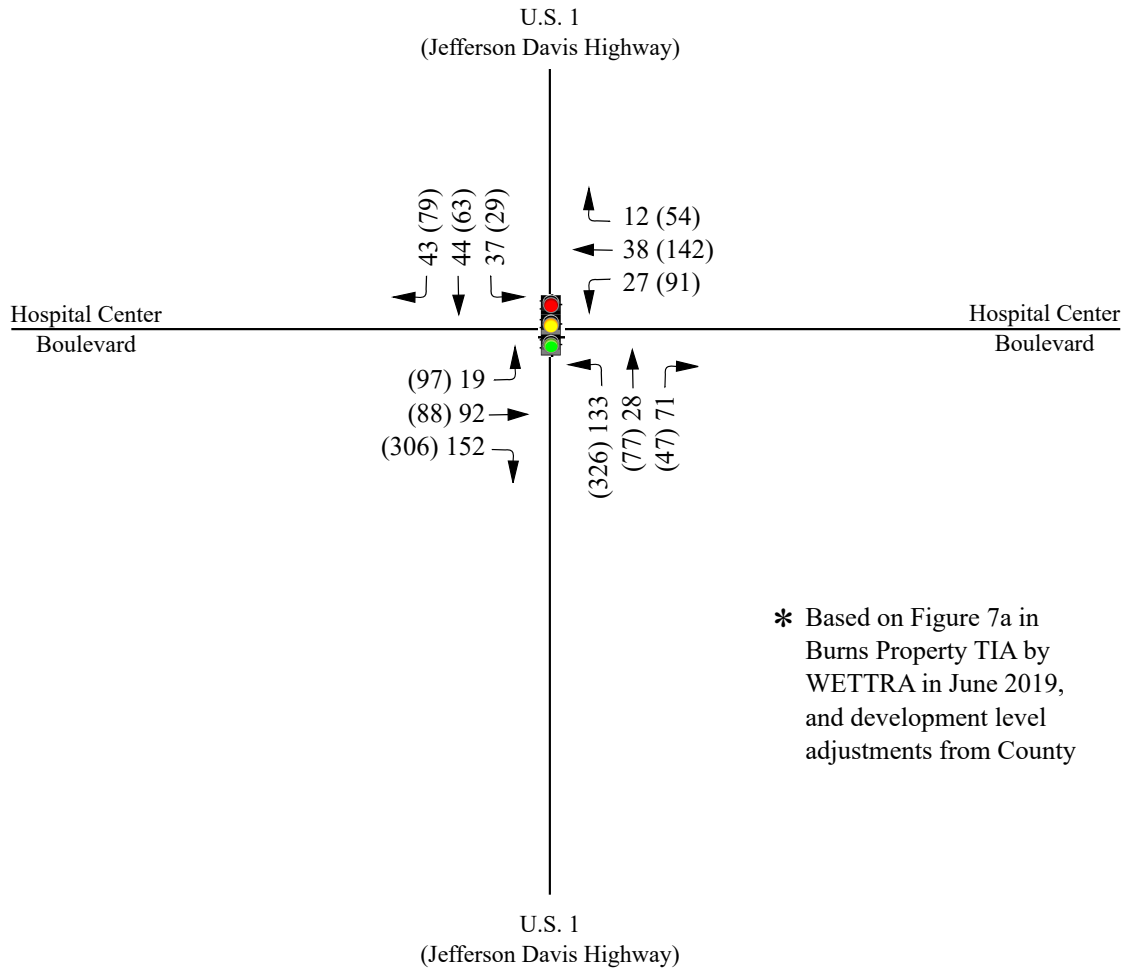


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Existing (2019) Peak  
Hour Traffic Volumes

Scale: Not to Scale

Figure 4



\* Based on Figure 7a in Burns Property TIA by WETTRA in June 2019, and development level adjustments from County

**LEGEND**

X (Y) AM (PM) Peak Hour

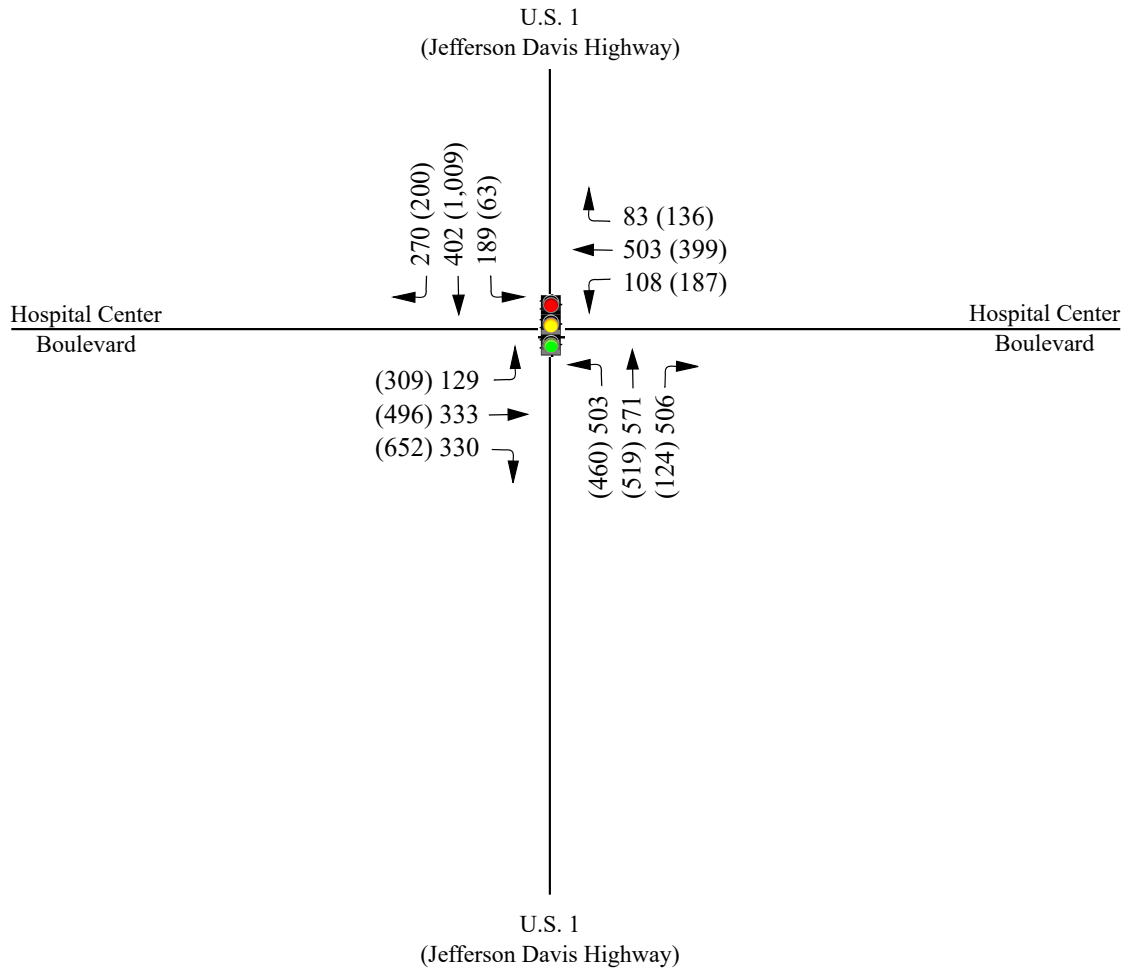


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Approved Development  
Trips

Scale: Not to Scale

Figure 5



**LEGEND**

X (Y) AM (PM) Peak Hour

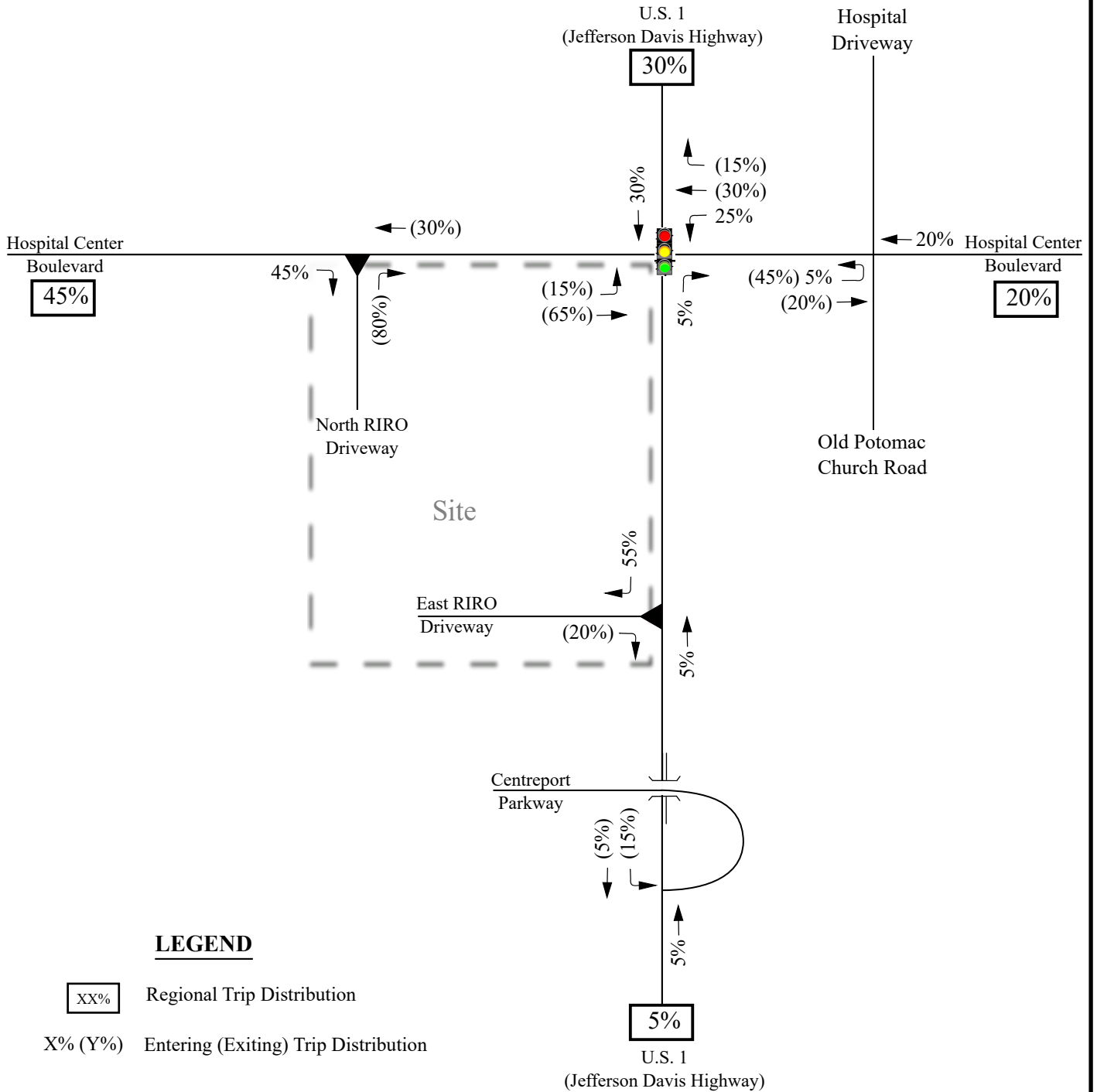


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

No-Build (2021) Peak  
Hour Traffic Volumes

Scale: Not to Scale

Figure 6

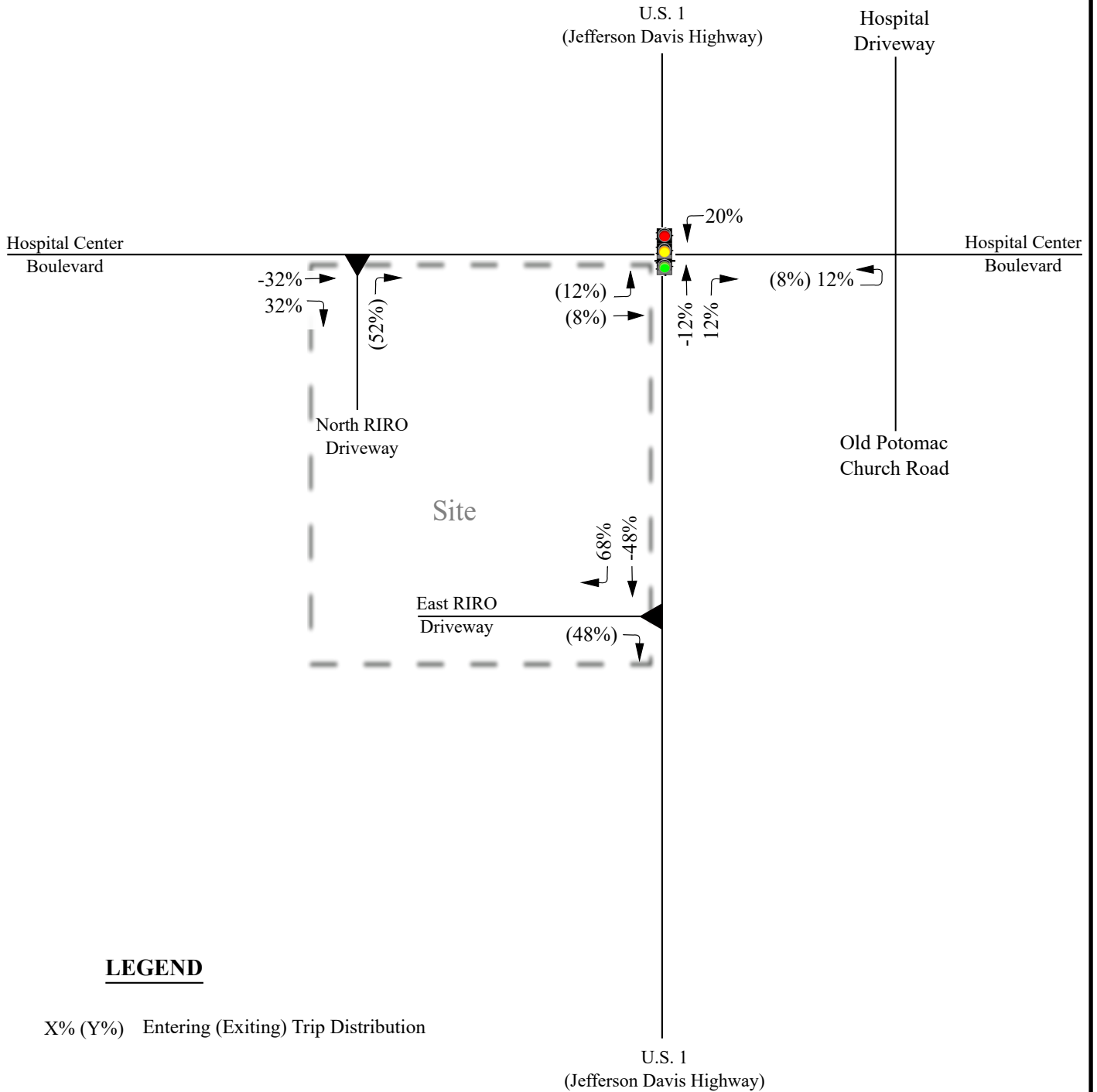


**7-Eleven / Taco Bell**  
 U.S. 1 at Hospital Center Boulevard  
 Stafford County, Virginia

Primary  
 Site Trip Distribution

Scale: Not to Scale

Figure 7

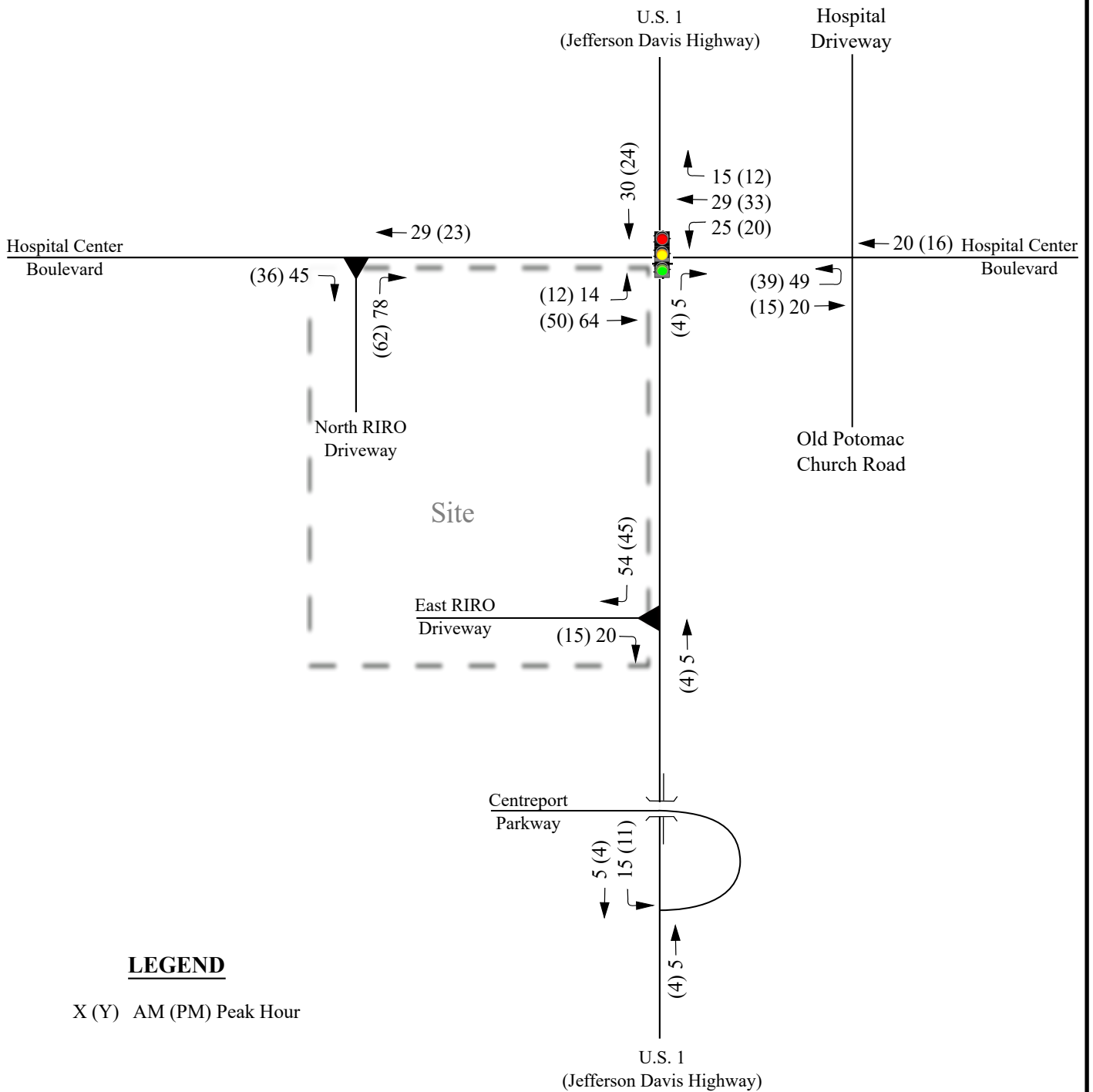


7-Eleven / Taco Bell  
 U.S. 1 at Hospital Center Boulevard  
 Stafford County, Virginia

Pass-By Trip Distribution

Scale: Not to Scale

Figure 8



**LEGEND**

X (Y) AM (PM) Peak Hour



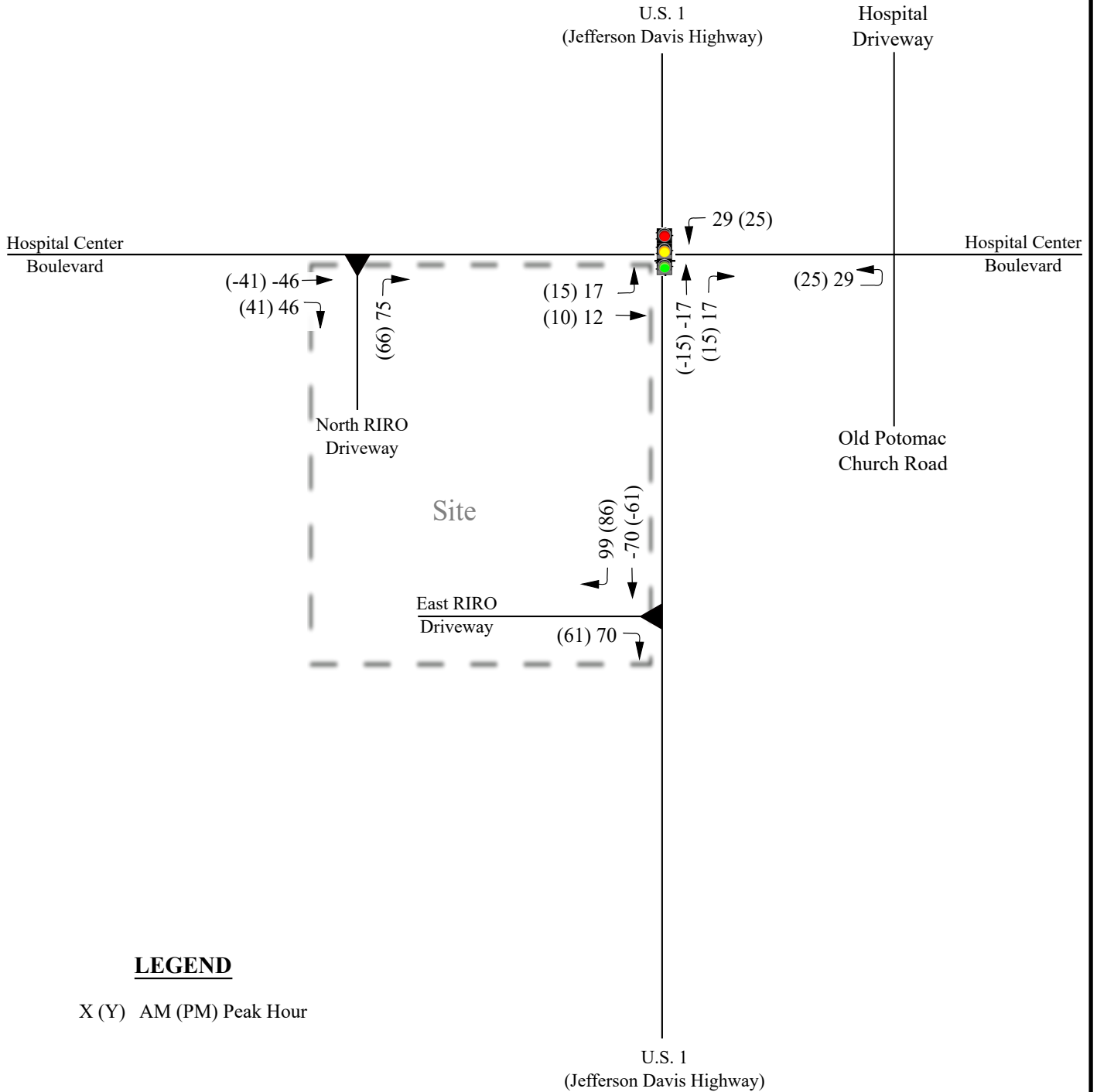
**7-Eleven / Taco Bell**  
 U.S. 1 at Hospital Center Boulevard  
 Stafford County, Virginia

**Primary Site Trip  
 Assignment**

Scale: Not to Scale

Figure 9





**LEGEND**

X (Y) AM (PM) Peak Hour

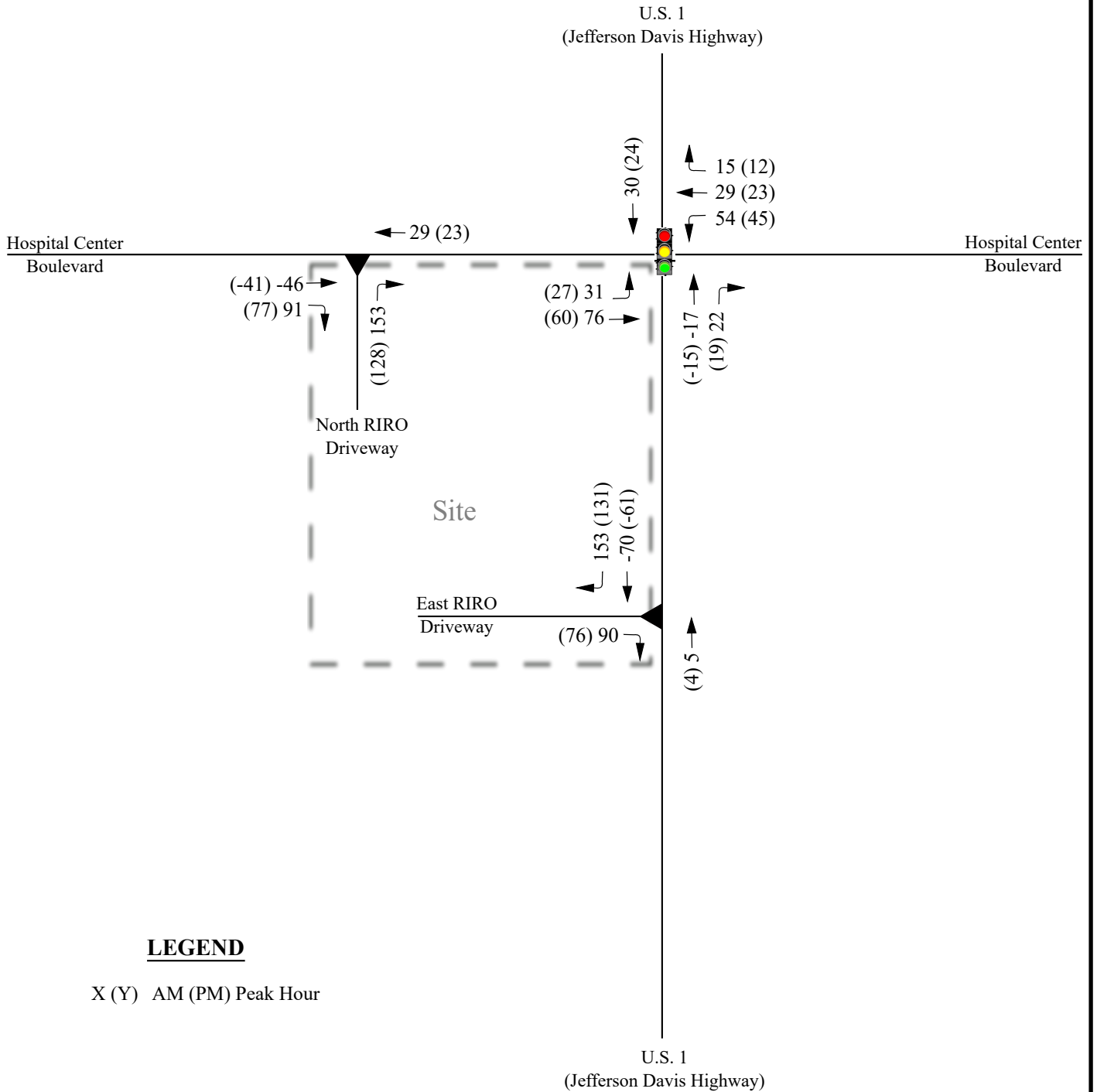


**7-Eleven / Taco Bell**  
 U.S. 1 at Hospital Center Boulevard  
 Stafford County, Virginia

**Pass-By Site Trip  
 Assignment**

Scale: Not to Scale

Figure 10

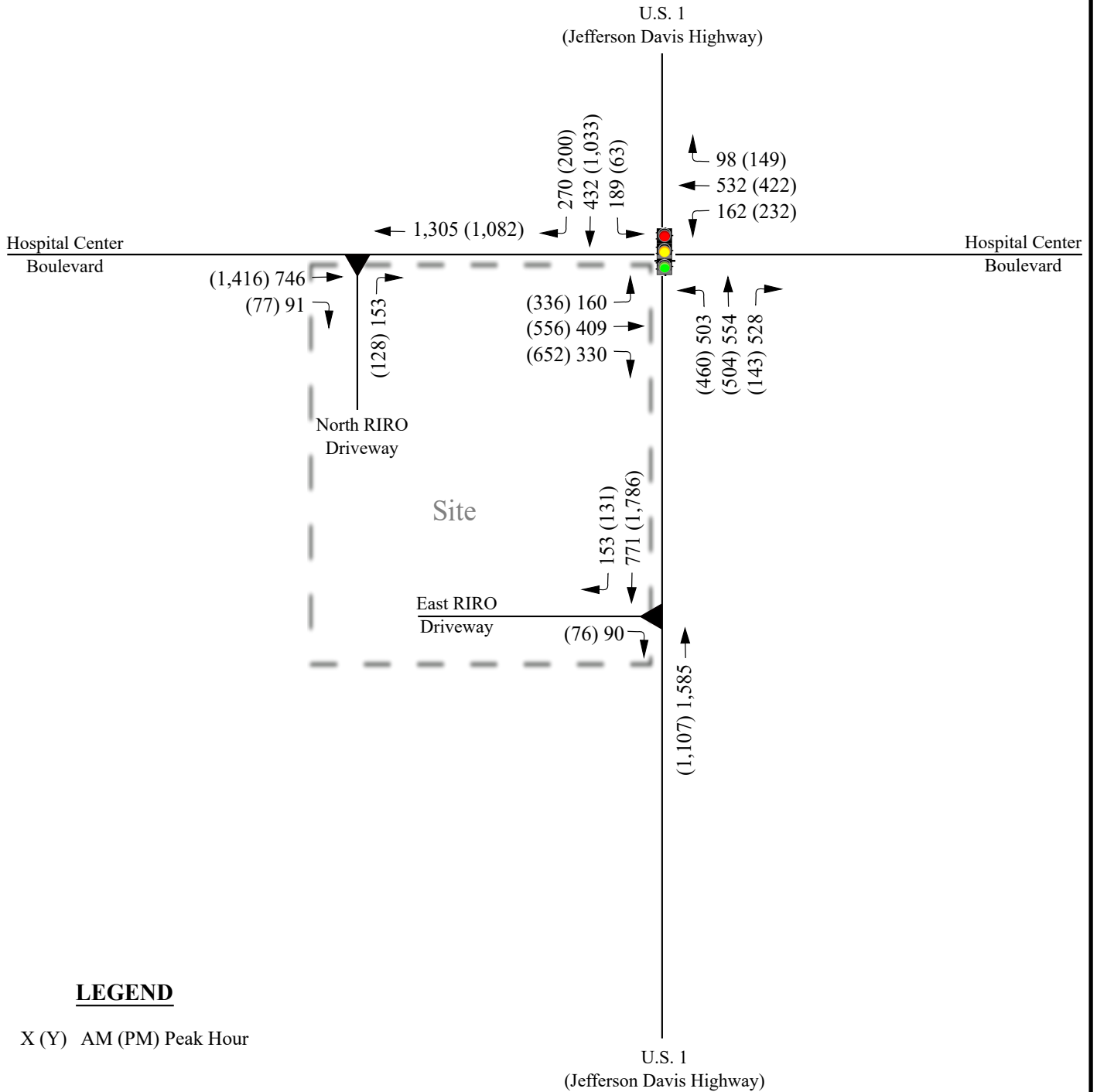


**7-Eleven / Taco Bell**  
 U.S. 1 at Hospital Center Boulevard  
 Stafford County, Virginia

Total Site Trips

Scale: Not to Scale

Figure 11



**LEGEND**

X (Y) AM (PM) Peak Hour

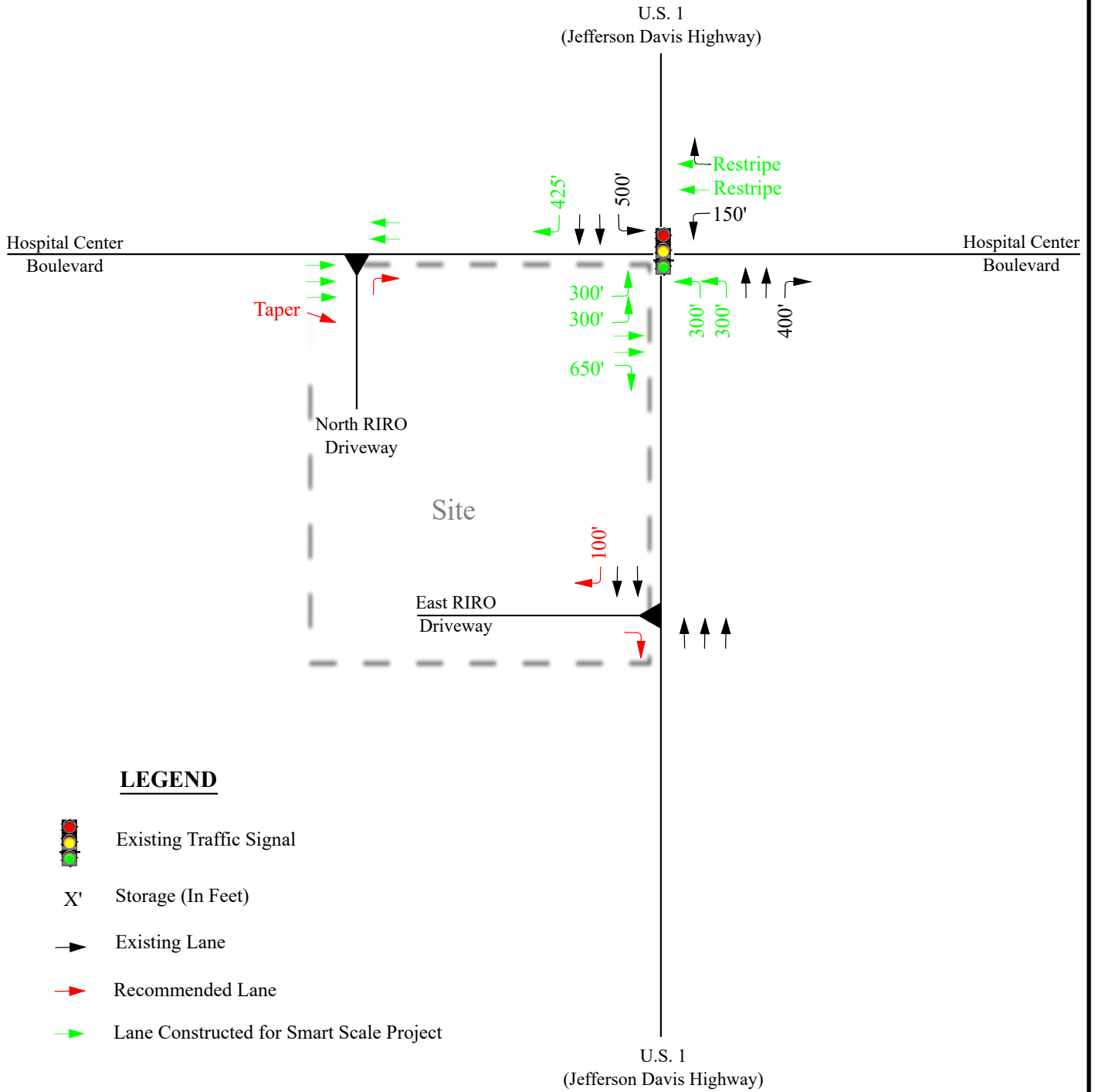


7-Eleven / Taco Bell  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Build (2021) Peak Hour  
Traffic Volumes

Scale: Not to Scale

Figure 12



**LEGEND**



Existing Traffic Signal

X'

Storage (In Feet)



Existing Lane



Recommended Lane



Lane Constructed for Smart Scale Project



**RAMEY KEMP  
&  
ASSOCIATES**  
TRANSPORTATION ENGINEERS

**7-Eleven / Taco Bell**  
U.S. 1 at Hospital Center Boulevard  
Stafford County, Virginia

Recommended Lane  
Configuration

Scale: Not to Scale

Figure 13

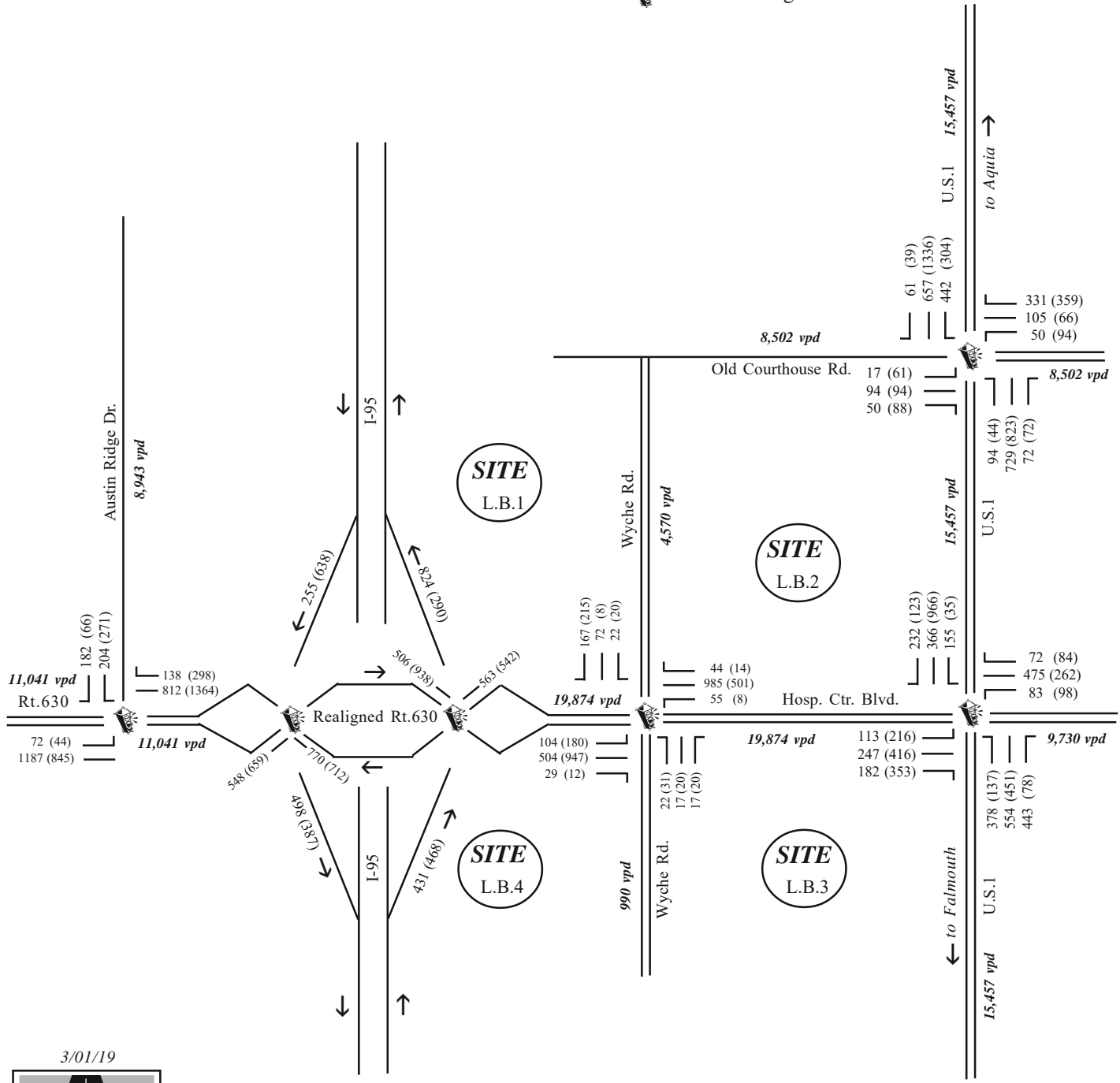
# LEGEND

123 (123) = AM (PM) Peak Hour Traffic Volumes

1,224 vpd = Daily Traffic Volume (veh. per day)

# = Unsignalized Intersection

🚦 = Traffic Signal



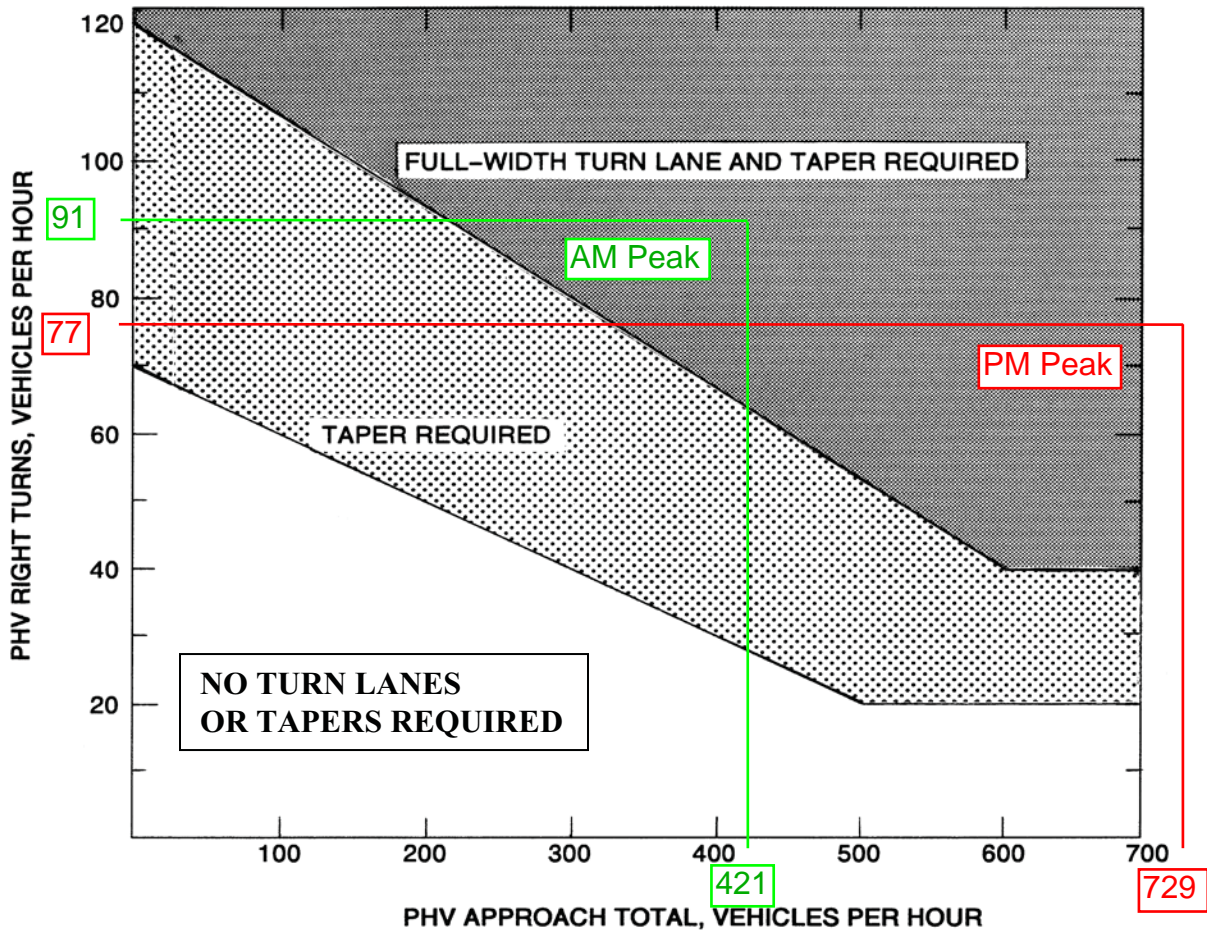
3/01/19



**Projected Yr. 2022 Roadway Network and Daily & AM/PM Peak Hour Traffic Volumes**

**FIGURE**

**5**



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

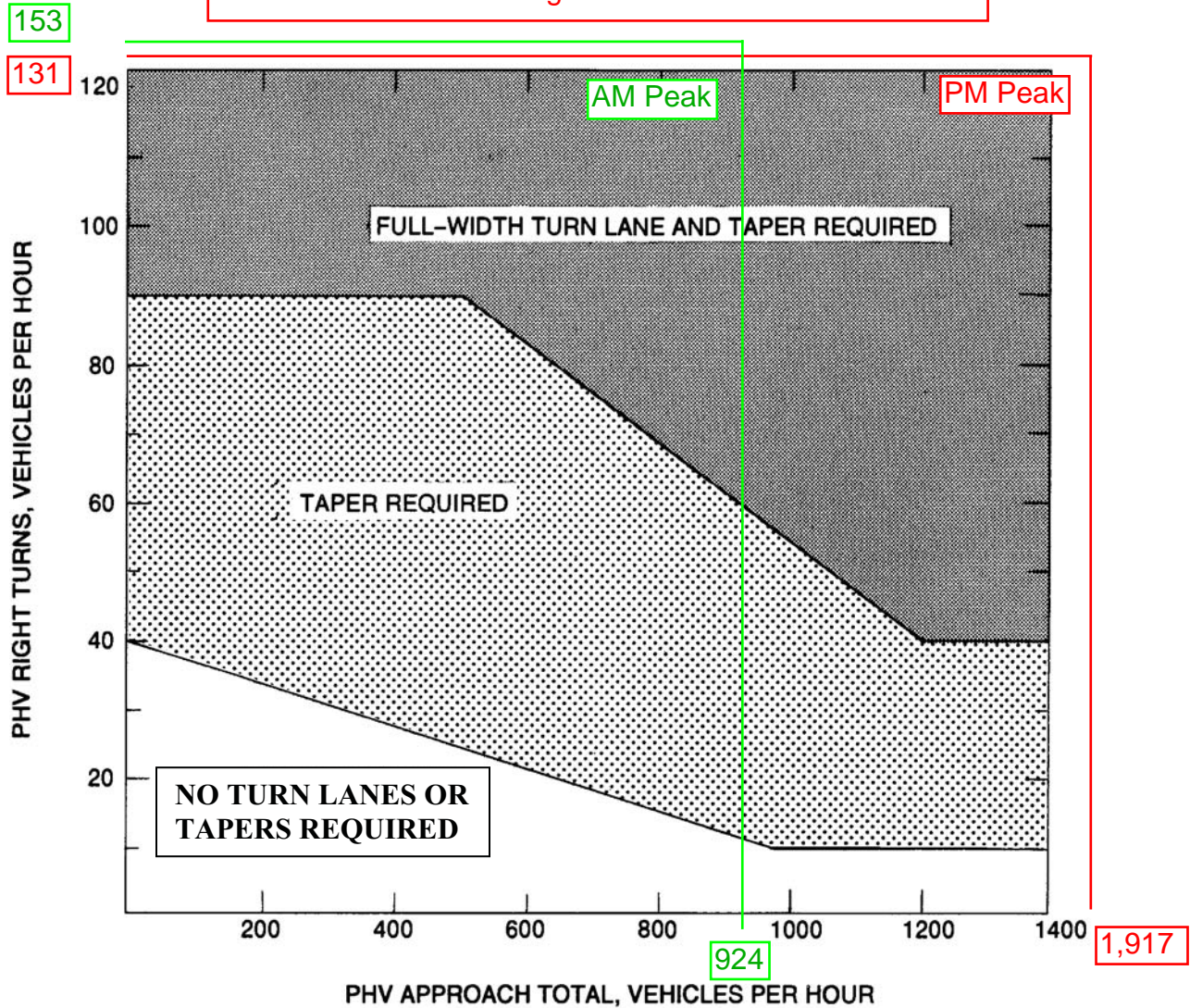
Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.\*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

\* Rev. 1/15

U.S. 1 at RIRO Driveway  
Build (2021) Volumes  
Southbound Right-Turn Lane Warrant



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV-** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.\*

**FIGURE 3-27 WARRANTS FOR RIGHT TURN TREATMENT (4-LANE HIGHWAY)**

\* Rev. 1/15

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Existing (2019) Conditions  
 Timing Plan: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	232	171	78	447	68	356	522	418	146	344	218
Future Volume (vph)	106	232	171	78	447	68	356	522	418	146	344	218
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3468	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3468	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			186		13				256			82
Link Speed (mph)		40			25			35			35	
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	115	252	186	85	560	0	387	567	454	159	374	237
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	28.0	27.0	28.0	34.0		27.0	38.0	28.0	26.0	37.0	22.0
Total Split (%)	18.3%	23.3%	22.5%	23.3%	28.3%		22.5%	31.7%	23.3%	21.7%	30.8%	18.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	10.0	13.8	45.2	20.5	24.4		25.4	46.0	66.5	15.6	36.2	46.2
Actuated g/C Ratio	0.08	0.12	0.38	0.17	0.20		0.21	0.38	0.55	0.13	0.30	0.38
v/c Ratio	0.40	0.62	0.26	0.28	0.78		0.53	0.42	0.46	0.69	0.35	0.36
Control Delay	55.7	57.1	4.0	44.4	52.2		44.8	30.6	5.2	60.9	12.3	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.7	57.1	4.0	44.4	52.2		44.8	30.6	5.2	60.9	12.3	3.5
LOS	E	E	A	D	D		D	C	A	E	B	A
Approach Delay		39.0			51.2			26.3			19.6	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	44	99	0	58	214		137	167	35	97	32	4
Queue Length 95th (ft)	72	139	43	100	261		185	263	77	103	63	9
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	457	648	712	341	832		726	1356	1020	295	1107	735
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0



7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Existing (2019) Conditions  
 Timing Plan: AM Peak Hour

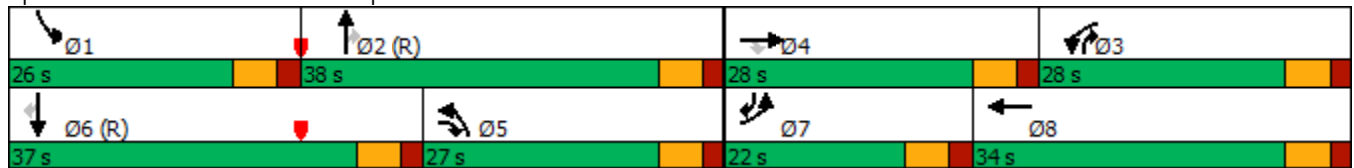
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.39	0.26	0.25	0.67		0.53	0.42	0.45	0.54	0.34	0.32

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.78  
 Intersection Signal Delay: 31.6  
 Intersection Capacity Utilization 60.4%  
 Analysis Period (min) 15

Intersection LOS: C  
 ICU Level of Service B

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Existing (2019) Conditions  
 Timing Plan: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	392	333	92	247	79	129	425	74	33	910	116
Future Volume (vph)	204	392	333	92	247	79	129	425	74	33	910	116
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3412	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3412	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109		25				109			126
Link Speed (mph)		40			25			35				35
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	222	426	362	100	354	0	140	462	80	36	989	126
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	33.0	30.0	22.0	33.0		30.0	81.0	22.0	14.0	65.0	22.0
Total Split (%)	14.7%	22.0%	20.0%	14.7%	22.0%		20.0%	54.0%	14.7%	9.3%	43.3%	14.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	14.2	22.9	51.0	13.2	21.8		22.1	84.5	98.9	7.8	67.9	82.1
Actuated g/C Ratio	0.09	0.15	0.34	0.09	0.15		0.15	0.56	0.66	0.05	0.45	0.55
v/c Ratio	0.68	0.79	0.59	0.65	0.68		0.28	0.23	0.07	0.40	0.62	0.14
Control Delay	76.5	72.1	31.3	84.8	63.1		57.7	18.4	0.6	104.6	24.2	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.5	72.1	31.3	84.8	63.1		57.7	18.4	0.6	104.6	24.2	2.6
LOS	E	E	C	F	E		E	B	A	F	C	A
Approach Delay		58.5			67.9			24.4			24.4	
Approach LOS		E			E			C			C	
Queue Length 50th (ft)	109	213	198	96	163		62	123	0	37	157	0
Queue Length 95th (ft)	155	268	297	160	211		96	172	7	m57	326	44
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	366	637	603	188	634		554	1993	1093	99	1601	940
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Existing (2019) Conditions  
 Timing Plan: PM Peak Hour

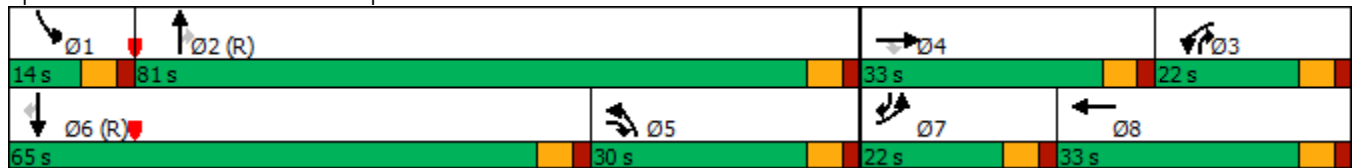
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.67	0.60	0.53	0.56		0.25	0.23	0.07	0.36	0.62	0.13

Intersection Summary

Area Type: Other  
 Cycle Length: 150  
 Actuated Cycle Length: 150  
 Offset: 15 (10%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 40.8  
 Intersection Capacity Utilization 65.9%  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Intersection LOS: D  
 ICU Level of Service C

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

No-Build (2021) Conditions  
 Timing Plan: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	129	333	330	108	503	83	503	571	506	189	402	270
Future Volume (vph)	129	333	330	108	503	83	503	571	506	189	402	270
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3465	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3465	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			329		14				165			82
Link Speed (mph)		40			25			35				35
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	362	359	117	637	0	547	621	550	205	437	293
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	24.0	32.0	32.0	34.0		32.0	36.0	32.0	28.0	32.0	22.0
Total Split (%)	18.3%	20.0%	26.7%	26.7%	28.3%		26.7%	30.0%	26.7%	23.3%	26.7%	18.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	12.0	16.4	49.6	21.6	26.0		27.2	39.7	61.3	18.3	30.8	42.8
Actuated g/C Ratio	0.10	0.14	0.41	0.18	0.22		0.23	0.33	0.51	0.15	0.26	0.36
v/c Ratio	0.41	0.75	0.42	0.37	0.84		0.70	0.53	0.62	0.76	0.48	0.47
Control Delay	53.5	60.0	5.0	45.5	54.4		48.3	36.8	11.0	60.4	24.8	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.5	60.0	5.0	45.5	54.4		48.3	36.8	11.0	60.4	24.8	8.7
LOS	D	E	A	D	D		D	D	B	E	C	A
Approach Delay		36.0			53.0			32.2			27.6	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	53	142	13	80	241		199	210	93	101	64	45
Queue Length 95th (ft)	83	195	75	133	309		268	297	166	m170	118	77
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	457	530	847	383	829		778	1169	941	324	919	667
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

No-Build (2021) Conditions  
 Timing Plan: AM Peak Hour

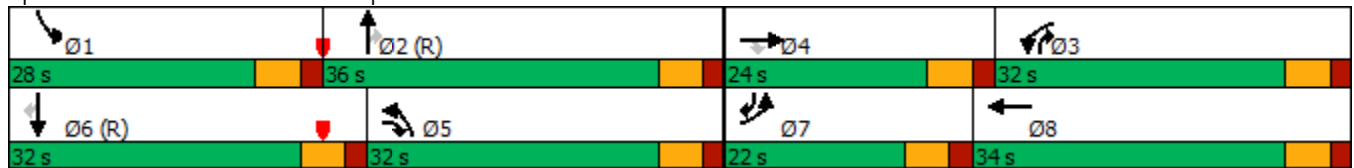
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.68	0.42	0.31	0.77		0.70	0.53	0.58	0.63	0.48	0.44

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 35.6  
 Intersection Capacity Utilization 66.5%  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Intersection LOS: D  
 ICU Level of Service C

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

No-Build (2021) Conditions  
 Timing Plan: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	309	496	652	187	399	136	460	519	124	63	1009	200
Future Volume (vph)	309	496	652	187	399	136	460	519	124	63	1009	200
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3405	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3405	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109		27				135			109
Link Speed (mph)		40			25			35				35
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	336	539	709	203	582	0	500	564	135	68	1097	217
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	29.0	41.0	24.0	31.0		41.0	79.0	24.0	18.0	56.0	22.0
Total Split (%)	14.7%	19.3%	27.3%	16.0%	20.7%		27.3%	52.7%	16.0%	12.0%	37.3%	14.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	16.0	23.0	64.0	18.0	25.0		35.0	77.3	96.5	10.3	50.0	66.0
Actuated g/C Ratio	0.11	0.15	0.43	0.12	0.17		0.23	0.52	0.64	0.07	0.33	0.44
v/c Ratio	0.92	0.99	0.96	0.96	0.99		0.62	0.31	0.13	0.57	0.93	0.29
Control Delay	96.0	99.8	60.4	116.2	92.5		55.6	22.4	1.2	88.1	74.8	14.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	96.0	99.8	60.4	116.2	92.5		55.6	22.4	1.2	88.1	74.8	14.0
LOS	F	F	E	F	F		E	C	A	F	E	B
Approach Delay		81.4			98.7			33.9			65.9	
Approach LOS		F			F			C			E	
Queue Length 50th (ft)	170	281	596	201	290		228	172	0	70	545	114
Queue Length 95th (ft)	#264	#407	#877	#365	#419		290	218	15	m88	#672	m128
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	366	542	737	212	590		801	1823	1066	141	1179	757
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

No-Build (2021) Conditions  
 Timing Plan: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.99	0.96	0.96	0.99		0.62	0.31	0.13	0.48	0.93	0.29

Intersection Summary

Area Type: Other  
 Cycle Length: 150  
 Actuated Cycle Length: 150  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.99  
 Intersection Signal Delay: 68.3  
 Intersection Capacity Utilization 93.6%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	EB	EB	EB	EB	EB	B2	B2	B2	WB	WB	WB	NB
Directions Served	L	L	T	T	R	T	T	T	L	T	TR	L
Maximum Queue (ft)	273	270	374	362	488	215	442	740	250	507	490	320
Average Queue (ft)	160	161	219	221	367	15	107	184	197	295	287	185
95th Queue (ft)	261	260	340	335	550	227	677	834	303	512	475	275
Link Distance (ft)	410	410	410	410	410	2327	2327	2327		1235	1235	314
Upstream Blk Time (%)			0	0	13							0
Queuing Penalty (veh)			0	0	0							0
Storage Bay Dist (ft)									150			
Storage Blk Time (%)									37	39		
Queuing Penalty (veh)									73	73		






























Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	NB	NB	NB	NB	B3	B3	SB	SB	SB	SB
Directions Served	L	T	T	R	T	T	L	T	T	R
Maximum Queue (ft)	302	216	202	68	10	9	139	626	640	400
Average Queue (ft)	169	124	107	20	0	0	63	421	433	98
95th Queue (ft)	260	191	177	50	11	8	120	609	619	300
Link Distance (ft)	314	314	314	314	108	108		2874	2874	
Upstream Blk Time (%)	0				0					
Queuing Penalty (veh)	0				0					
Storage Bay Dist (ft)							550			500
Storage Blk Time (%)								3	8	
Queuing Penalty (veh)								2	16	



7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Build (2021) Conditions  
 Timing Plan: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	160	409	330	162	532	98	503	554	528	189	432	270
Future Volume (vph)	160	409	330	162	532	98	503	554	528	189	432	270
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3458	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3458	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			295		17				82			82
Link Speed (mph)		40			25			35				35
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	174	445	359	176	685	0	547	602	574	205	470	293
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	25.0	30.0	36.0	39.0		30.0	39.0	36.0	20.0	29.0	22.0
Total Split (%)	18.3%	20.8%	25.0%	30.0%	32.5%		25.0%	32.5%	30.0%	16.7%	24.2%	18.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	11.8	18.2	47.3	22.2	28.6		23.1	36.9	59.0	18.8	32.6	44.4
Actuated g/C Ratio	0.10	0.15	0.39	0.18	0.24		0.19	0.31	0.49	0.16	0.27	0.37
v/c Ratio	0.52	0.83	0.45	0.54	0.82		0.83	0.55	0.70	0.74	0.49	0.46
Control Delay	56.4	63.4	6.9	49.4	50.6		58.2	38.1	15.2	50.9	16.3	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.4	63.4	6.9	49.4	50.6		58.2	38.1	15.2	50.9	16.3	6.7
LOS	E	E	A	D	D		E	D	B	D	B	A
Approach Delay		41.4			50.4			36.8			20.7	
Approach LOS		D			D			D			C	
Queue Length 50th (ft)	67	176	29	125	258		205	214	145	60	35	5
Queue Length 95th (ft)	100	#247	100	183	315		274	277	192	m#307	166	122
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	457	560	790	442	963		695	1087	918	276	960	689
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

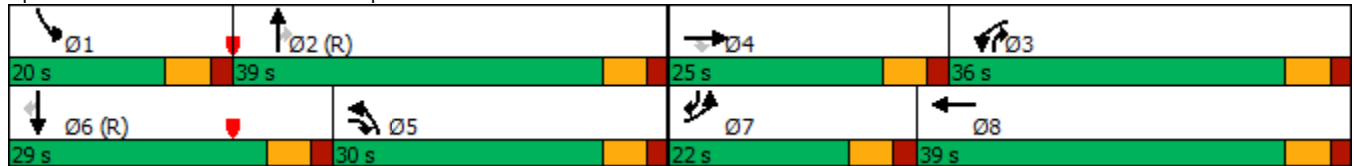
Build (2021) Conditions  
 Timing Plan: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.79	0.45	0.40	0.71		0.79	0.55	0.63	0.74	0.49	0.43

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.83  
 Intersection Signal Delay: 37.0  
 Intersection Capacity Utilization 69.5%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	EB	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	TR	L	L	T	T
Maximum Queue (ft)	121	125	238	237	180	242	317	297	290	275	272	255
Average Queue (ft)	61	61	138	141	84	114	182	183	182	159	173	151
95th Queue (ft)	102	107	207	210	145	214	277	276	266	247	247	225
Link Distance (ft)	421	421	421	421	421		1235	1235	316	316	316	316
Upstream Blk Time (%)									0	0	0	0
Queuing Penalty (veh)									1	0	0	0
Storage Bay Dist (ft)						150						
Storage Blk Time (%)						3	15					
Queuing Penalty (veh)						7	25					

Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	233	321	258	273	225
Average Queue (ft)	111	141	101	115	84
95th Queue (ft)	190	255	203	224	174
Link Distance (ft)	316		2874	2874	
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (ft)		550			500
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection

Int Delay, s/veh 1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑		↑
Traffic Vol, veh/h	746	91	0	1305	0	153
Future Vol, veh/h	746	91	0	1305	0	153
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	811	99	0	1418	0	166

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	-
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	-
Pot Cap-1 Maneuver	-	-	0
Stage 1	-	-	0
Stage 2	-	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	472	-	-	-
HCM Lane V/C Ratio	0.352	-	-	-
HCM Control Delay (s)	16.7	-	-	-
HCM Lane LOS	C	-	-	-
HCM 95th %tile Q(veh)	1.6	-	-	-

Intersection

Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑↑	↑↑	↘
Traffic Vol, veh/h	0	90	0	1585	771	153
Future Vol, veh/h	0	90	0	1585	771	153
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	98	0	1723	838	166

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	419	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	583	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	583	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT EBLn1	SBT	SBR
Capacity (veh/h)	- 583	-	-
HCM Lane V/C Ratio	- 0.168	-	-
HCM Control Delay (s)	- 12.4	-	-
HCM Lane LOS	- B	-	-
HCM 95th %tile Q(veh)	- 0.6	-	-

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Build (2021) Conditions  
 Timing Plan: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	336	556	652	232	422	148	460	504	143	63	1033	200
Future Volume (vph)	336	556	652	232	422	148	460	504	143	63	1033	200
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		0	0		0	550		500
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	3433	3539	1583	1770	3401	0	3433	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	1770	3401	0	3433	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109		29				121			109
Link Speed (mph)		40			25			35				35
Link Distance (ft)		499			1300			413			2976	
Travel Time (s)		8.5			35.5			8.0			58.0	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	365	604	709	252	620	0	500	548	155	68	1123	217
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4						2			6
Detector Phase	7	4	5	3	8		5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	10.0	22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	23.0	32.0	38.0	26.0	35.0		38.0	75.0	26.0	17.0	54.0	23.0
Total Split (%)	15.3%	21.3%	25.3%	17.3%	23.3%		25.3%	50.0%	17.3%	11.3%	36.0%	15.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		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	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag		Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	C-Min	None	None	C-Min	None
Act Effect Green (s)	17.0	26.0	64.0	20.0	29.0		32.0	72.7	93.9	9.8	48.0	65.0
Actuated g/C Ratio	0.11	0.17	0.43	0.13	0.19		0.21	0.48	0.63	0.07	0.32	0.43
v/c Ratio	0.94	0.99	0.96	1.07	0.91		0.68	0.32	0.15	0.59	0.99	0.29
Control Delay	97.7	94.0	60.4	137.3	74.9		59.8	25.0	2.2	96.0	81.2	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	97.7	94.0	60.4	137.3	74.9		59.8	25.0	2.2	96.0	81.2	11.4
LOS	F	F	E	F	E		E	C	A	F	F	B
Approach Delay		80.6			92.9			36.5			71.2	
Approach LOS		F			F			D			E	
Queue Length 50th (ft)	185	314	596	~272	303		234	177	8	69	512	104
Queue Length 95th (ft)	#285	#443	#877	#454	#413		298	223	26	m87	#725	m118
Internal Link Dist (ft)		419			1220			333			2896	
Turn Bay Length (ft)				150						550		500
Base Capacity (vph)	389	613	737	236	680		732	1715	1036	129	1132	747
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0

7-Eleven / Taco Bell - Stafford County, VA  
 1: U.S. 1 & Hospital Center Boulevard

Build (2021) Conditions  
 Timing Plan: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.99	0.96	1.07	0.91		0.68	0.32	0.15	0.53	0.99	0.29

Intersection Summary

Area Type: Other  
 Cycle Length: 150  
 Actuated Cycle Length: 150  
 Offset: 7 (5%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 110  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.07  
 Intersection Signal Delay: 69.8  
 Intersection Capacity Utilization 96.8%  
 Analysis Period (min) 15

Intersection LOS: E  
 ICU Level of Service F

- ~ 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.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: U.S. 1 & Hospital Center Boulevard



Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	EB	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	TR	L	L	T	T
Maximum Queue (ft)	300	321	394	401	440	250	616	584	299	287	239	225
Average Queue (ft)	187	191	256	264	378	225	380	355	193	173	135	109
95th Queue (ft)	304	307	390	395	505	298	620	573	276	253	214	192
Link Distance (ft)	421	421	421	421	421		1235	1235	316	316	316	316
Upstream Blk Time (%)	0	0	1	1	10				0	0		
Queuing Penalty (veh)	0	0	2	2	31				0	0		
Storage Bay Dist (ft)						150						
Storage Blk Time (%)						57	37					
Queuing Penalty (veh)						122	85					

Intersection: 1: U.S. 1 & Hospital Center Boulevard

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	92	366	753	769	518
Average Queue (ft)	27	93	480	495	149
95th Queue (ft)	67	308	770	786	464
Link Distance (ft)	316		2874	2874	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		550			500
Storage Blk Time (%)			11	18	
Queuing Penalty (veh)			7	36	



7-Eleven / Taco Bell - Stafford County, VA  
 2: RIRO Driveway & Hospital Center Boulevard

Build (2021) Conditions  
 Timing Plan: PM Peak Hour

Intersection

Int Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑		↑
Traffic Vol, veh/h	1416	77	0	1082	0	128
Future Vol, veh/h	1416	77	0	1082	0	128
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1539	84	0	1176	0	139

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	-
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	-
Pot Cap-1 Maneuver	-	-	0
Stage 1	-	-	0
Stage 2	-	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	30.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	276	-	-	-
HCM Lane V/C Ratio	0.504	-	-	-
HCM Control Delay (s)	30.6	-	-	-
HCM Lane LOS	D	-	-	-
HCM 95th %tile Q(veh)	2.6	-	-	-

Intersection

Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑↑	↑↑	↗
Traffic Vol, veh/h	0	76	0	1107	1786	131
Future Vol, veh/h	0	76	0	1107	1786	131
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	83	0	1203	1941	142

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	- 971	- 0	- 0
Stage 1	- -	- -	- -
Stage 2	- -	- -	- -
Critical Hdwy	- 6.94	- -	- -
Critical Hdwy Stg 1	- -	- -	- -
Critical Hdwy Stg 2	- -	- -	- -
Follow-up Hdwy	- 3.32	- -	- -
Pot Cap-1 Maneuver	0 252	0 -	- -
Stage 1	0 -	0 -	- -
Stage 2	0 -	0 -	- -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	- 252	- -	- -
Mov Cap-2 Maneuver	- -	- -	- -
Stage 1	- -	- -	- -
Stage 2	- -	- -	- -

Approach	EB	NB	SB
HCM Control Delay, s	26.1	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT EBLn1	SBT	SBR
Capacity (veh/h)	- 252	- -	- -
HCM Lane V/C Ratio	- 0.328	- -	- -
HCM Control Delay (s)	- 26.1	- -	- -
HCM Lane LOS	- D	- -	- -
HCM 95th %tile Q(veh)	- 1.4	- -	- -