

**Traffic Impact Analysis**  
**Cannon Ridge Village**  
Stafford County, Virginia

**Prepared for:**  
Lennar  
November 22, 2017

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Prepared by:

Bowman Consulting Group, Ltd.  
3951 Westerre Parkway, Suite 150  
Richmond, Virginia 23233  
Phone: 804.616.3240  
Fax: 804.270.2008

Analysts: Silvia Barrantes, MS  
Project Manager: Carlos G. Garcia, PE

Bowman Job # 100088-01-002

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## Executive Summary

This report summarizes the findings of the traffic impact analysis (TIA) performed by Bowman Consulting Group (BCG) for the proposed Cannon Ridge Village development located in Stafford County, Virginia. The purpose of this study is to determine the potential impact (if any) to the existing traffic operations within the surrounding roadway network caused by the proposed development.

A Pre-Scoping meeting with VDOT, Stafford County and Lennar was held at the VDOT Fredericksburg Residency on October 4, 2017. The purpose for the meeting was to discuss the major components of this study and to agree on the methodology and approach for completion of the study. During this Pre-Scoping meeting it was agreed that the analysis within this study shall be extended to the build out year of 2027 and design year 2033.

The following intersections were evaluated in this Traffic Impact Analysis:

### Along Route US-17:

- Stafford Lakes Parkway and Warrenton Road (US 17)
- Banks Ford Parkway/ Berea Church Road and Warrenton Road (US 17)
- Celebrate Virginia Parkway/International Parkway and Warrenton Road (US 17)
- Banks Ford Parkway/Car Dealership and Warrenton Road (US 17)
- McWhirt Loop/Lichfield Boulevard and Warrenton Road (US 17)
- Commerce Parkway/Plantation Drive and Warrenton Road (US 17)
- Commuter lot/Falls Run Drive and Warrenton Road (US 17)
- Victor Neilsen Drive/Mclanes Drive and Warrenton Road (US 17)
- Sanford Drive/Stanstead Road and Warrenton Road (US 17)

### Others:

- Scott's Ford Road / Celebrate Virginia Parkway
- Banks Ford Parkway / Celebrate Virginia Parkway
- Greenbank / Banks Ford Parkway
- Banks Ford Parkway / McWhirt Loop
- Celebrate Virginia Parkway / Hyannis Place and Bolivar Point Lane

The access to the proposed development will be provided by a direct connection to Celebrate Virginia Parkway. The main site entrance will connect with Celebrate Virginia Parkway at the intersection of Celebrate Virginia Parkway and Scott's Ford Lane (creating the 4<sup>th</sup> leg of the intersection).

The proposed development will consist of 1,177 units of adult community (age restricted) living.

The proposed development is expected to generate 282 trips during the morning peak hour (IN: 94 and OUT: 189) and 388 trips during the evening peak hour (IN: 190 and OUT: 388).

Based on the capacity analyses, most of the turning movement for the signalized intersections evaluated in this study are not expected to experience significant changes in the levels of service due to the proposed development.

Currently VDOT is evaluating the traffic operations along the Route 17 Corridor and is looking to optimize and coordinate the traffic signal timing along the Corridor. In addition to the study, additional

improvements will be completed along the southbound direction and are incorporated in this study under build-out and design years. The improvements will consist of the following elements:

- On the Southbound direction along Route 17, the right turn only lane will be designated as a through-right lane starting south of the signal at the park n ride/falls run. This lane will continue to the signal at Sanford/Gateway and will be required to enter the southbound ramp to I-95. The next lane over will also be required to enter the SB ramp to I-95. The adjacent next two SB lanes will be through lanes.

VDOT's current Route 17 corridor study is expected to modify/adjust the existing traffic signal timings along the corridor. Since this study identified minimal changes in delay and/or levels of service due to the proposed development, it is anticipated that VDOT's traffic signal timing adjustments will also be able to accommodate the traffic anticipated for the Cannon Ridge Village Development.

The results of the capacity analyses for the un-signalized intersections indicate that the intersections evaluated in this report would continue to operate at acceptable levels of service C or better during the 2027 and 2033 scenarios.

The minimal impacts identified in this report do not require physical alteration improvements to the existing roadway network.

The installation of a traffic signal is not warranted at the intersection of Banks Ford Parkway / Celebrate Virginia Parkway.

It is recommended for the County to explore opportunities for extending the service of Route D2 to Del-Webb and the proposed Cannon Ridge Village development.

It is recommended to connect the pedestrian facilities from the proposed Cannon Ridge Village Development to the existing multi-purpose trail to maintain pedestrian connectivity along Celebrate VA Parkway.

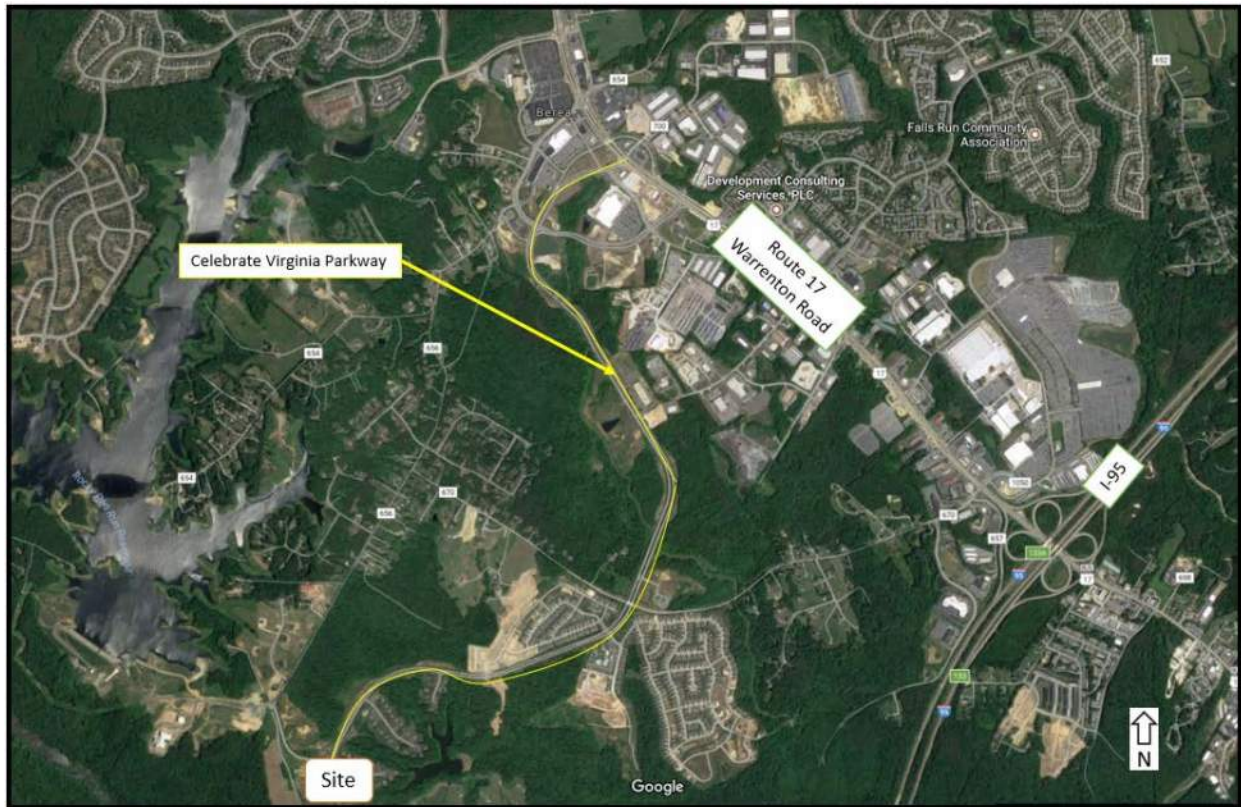
The results of this traffic impact study indicate that significant changes in levels of service were not observed as a result of the proposed Cannon Ridge Development. Therefore, the proposed Cannon Ridge Village Development is not expected to have significant or minimal impact on the existing roadway system.

## Introduction

This report summarizes the findings of the traffic impact analysis performed by Bowman Consulting Group (BCG) for the proposed Cannon Ridge Village Development located at 5316 Celebrate Virginia Parkway in Stafford County, Virginia. The purpose of this study is to determine the potential impact (if any) to the existing traffic operations within the surrounding roadway network caused by the proposed development.

## Background Information

The proposed development is generally located to the west of I-95 and south of Route 17 (Warrenton Road). **Figure 1**, depicts the site location.



**Figure 1.** Site location.

The access to the proposed development will be provided by a direct connection to Celebrate Virginia Parkway. The main site entrance will connect with Celebrate Virginia Parkway at the intersection of Celebrate Virginia Parkway and Scott's Ford Lane (creating the 4<sup>th</sup> leg of the intersection).

The Applicant, LENNAR, is proposing to develop the site with an age restricted community land use. The proposed development will consist of the following:

- 354 30 ft. senior SFA lots
- 588 50 ft. senior SFD lots
- 235 60 ft. senior SFD lots

## Scope of work

A Pre-Scoping meeting with VDOT, Stafford County and Lennar was held at the VDOT Fredericksburg Residency on October 4, 2017. The purpose for the meeting was to discuss the major components of this study and to agree on the methodology and approach for completion of the study.

During the meeting, the following items were discussed and agreed upon by all parties:

### Study Periods

- Existing Conditions (2017)
- Build-Out Year (2027)
- Design Year (2033)

### Intersections to be evaluated

Along Route US-17:

- Stafford Lakes Parkway and Warrenton Road (US 17)
- Banks Ford Parkway/ Berea Church Road and Warrenton Road (US 17)
- Celebrate Virginia Parkway/International Parkway and Warrenton Road (US 17)
- Banks Ford Parkway/Car Dealership and Warrenton Road (US 17)
- McWhirt Loop/Lichfield Boulevard and Warrenton Road (US 17)
- Commerce Parkway/Plantation Drive and Warrenton Road (US 17)
- Commuter lot/Falls Run Drive and Warrenton Road (US 17)
- Victor Neilsen Drive/Mclanes Drive and Warrenton Road (US 17)
- Sanford Drive/Stanstead Road and Warrenton Road (US 17)

Others

- Scott's Ford Road / Celebrate Virginia Parkway
- Banks Ford Parkway / Celebrate Virginia Parkway
- Greenbank / Banks Ford Parkway
- Banks Ford Parkway / McWhirt Loop
- Celebrate Virginia Parkway / Hyannis Place and Bolivar Point Lane

### Traffic Data

VDOT offered to provide the Synchro files for the corridor along Route 17 near the site. The Synchro files includes the existing traffic signal timing and the traffic counts for the morning and evening peak hours for the existing conditions (2017). The traffic signal timing from synchro will be used for our analysis.

### Internal Capture

A 15% trip adjustment factor was determined for internal allowance. This rate is based on the assumption that the shopping center located along the Banks Ford Parkway will attract/generate 15% of the total trips from and to the site.

### Traffic Signal Warrant Analysis

The preparation of a traffic signal warrant analysis at the intersection of Banks Ford Parkway and Celebrate Virginia Parkway was discussed and requested. Based on further coordination with VDOT, it was agreed to evaluate only the traffic signal warrants for the peak hour and four-hour periods.

### Route 17 Corridor Study and Future Improvements

Currently VDOT is evaluating the traffic operations along the Route 17 Corridor and is looking to optimize and coordinate the traffic signal timing along the Corridor. In addition to the study, additional improvements will be completed along the southbound direction and will be incorporated in this study under build-out and design years. The improvements will consist of the following elements:

On the southbound direction along Route 17, the right turn only lane will be designated as a through-right lane starting south of the signal at the park n ride/falls run. This lane will continue to the signal at Sanford/Gateway and will be required to enter the southbound ramp to I-95. The next lane over will also be required to enter the SB ramp to I-95. The adjacent next two SB lanes will be through lanes.

The approved Scope of work is included in **Appendix A** for further information.

### **Existing Roadway Network**

#### Scott's Ford Road and Celebrate Virginia Parkway



**Figure 2.** Scott's Ford Road and Celebrate Virginia Parkway.

This three-way stop controlled intersection will be the main access point to the proposed Cannon Ridge Village development. This side of the network is mostly a residential area. The northbound approach provides an exclusive left turn lane and a through-right turn lane, the southbound approach provides an exclusive left turn lane, one exclusive right turn lane and one through lane. The eastbound has one exclusive left turn lane a one exclusive right turn lane and the westbound approach has one lane for all turning movements. These approaches are controlled by a stop sign. Pedestrian activity is accommodated

by a pedestrian trail located on the east side of Celebrate Virginia Parkway; the pedestrian trail extends from Scott's Ford Road to approximately 200' south of Jewett Lane.

#### Warrenton Road and Berea Church Road



**Figure 3. Warrenton Road and Berea Church Road**

Warrenton Road (Route 17) is the main corridor of the roadway network to be analyzed and it is considered a north/south route. The intersection of Warrenton Road and Berea Church Road is signalized. The northbound approach (Warrenton Road) consists of dual exclusive left turn lanes, three through lanes and one exclusive right turn lane. The southbound approach (Warrenton Road) has an exclusive left turn lane, one exclusive right turn lane and three through lanes. The eastbound (Banks Ford Parkway) has one exclusive left turn lane, one exclusive right turn lane and one shared left-through turn lane. The westbound approach (Berea Church Road) consists of one exclusive left turn lane, one through lane and a channelized (yield) exclusive right turn lane. Pedestrian facilities are present at all quadrants of the intersection.

Warrenton Road and Celebrate VA Parkway**Figure 4.** Warrenton Road and Celebrate VA Parkway

This is a signalized intersection that provides for five lanes in the south and the northbound approaches. The northbound approach (Warrenton Road) consists of one exclusive left turn lane, one exclusive channelized right turn lane and three through lanes. The southbound approach has one exclusive right turn lane, one exclusive left turn lane and three through lanes, the eastbound consists of dual exclusive left turn lanes, one through lane and one channelized right turn lane. The westbound approach consists of a shared left-through turn lane and one exclusive right turn lane. Pedestrian facilities are present at all quadrants of the intersection.

Warrenton Road and Banks Ford Parkway**Figure 5.** Warrenton Road and Banks Ford Parkway

This is a signalized four-legged intersection. The westbound approach is for an auto store, the driveway consists of a one lane driveway for all turning movements. The eastbound approach consists of one channelized right turn lane, one exclusive left turn lane and one shared left-through lane. The southbound approach (Warrenton Road) consists in one exclusive left turn lane, one exclusive right turn lane and three through lanes. The northbound approach consists of dual exclusive left turn lanes, one exclusive right turn lane and three through lanes. Pedestrian facilities are present at all quadrants of the intersection.

#### Banks Ford Parkway and Celebrate VA Parkway



**Figure 6.** Banks Ford Parkway and Celebrate VA Parkway

This intersection is an un-signalized, median divided, four-legged intersection. The northbound approach (Celebrate Virginia Parkway) consists of one exclusive left turn lane, one channelized right turn lane and three through lanes. This approach also has a painted area for an additional left turn lane. The southbound approach consists of one exclusive left turn lane, one exclusive right turn lane and three through lanes. The eastbound and westbound approaches consist of one shared left-through turn lane and one exclusive right turn lane. These approaches also have paved painted areas for potential lane increase in the future. Pedestrian facilities are present at the northeast, northwest and southeast quadrants of the intersection.

Warrenton Road, McWhirt Loop and Lichfield Boulevard

**Figure 7.** Warrenton Road, McWhirt Loop and Lichfield Boulevard

This is a signalized four-legged intersection. Pedestrian facilities are present at all quadrants of the intersection. However, only the Lichfield Boulevard approach has a pedestrian phase. The northbound approach consists of one exclusive left turn lane, one exclusive right turn lane and three through lanes. The southbound consists of dual exclusive left turn lanes, one exclusive right turn lane and three through lanes. The eastbound approach (McWhirt Loop) consists of one shared left-through turn lane and one exclusive right turn lane. The westbound approach consists of one shared left-through turn lane, one exclusive left turn lane and one exclusive right turn lane.

Greenbank Road and Banks Ford Parkway**Figure 8. Greenbank Road and Banks Ford Parkway**

This four-legged intersection is un-signalized. The westbound approach provides access to a retail center with one shared left-through lane and an exclusive right turn lane. The eastbound approach (Greenbank Road) consists one shared through-right turn lane and one exclusive left turn lane. The north and southbound approach (Banks Ford Parkway) consists of one exclusive left turn lane, one exclusive right turn lane and two through lanes. Pedestrian facilities are present along the eastside of Banks Ford Parkway.

Banks Ford Parkway and McWhirt Loop**Figure 9. Banks Ford Parkway and McWhirt Loop**

This four-legged intersection is un-signalized. The eastbound and westbound approaches (McWhirt Loop) consists of one shared left-through turn lane and one exclusive right turn lane. The north and southbound approaches (Banks Ford Parkway) consists in one exclusive left turn lane, one exclusive right turn lane and two through lanes. Pedestrian facilities are present at all quadrants of the intersection.

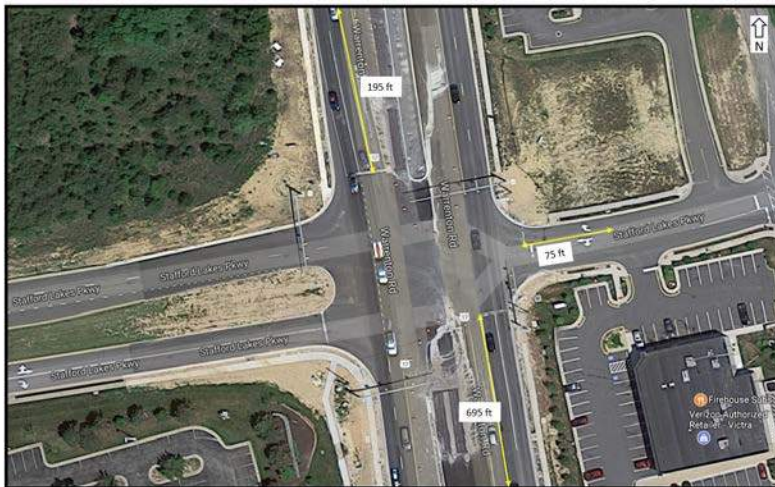
Celebrate VA Parkway, Hyannis Place and Bolivar Point Lane



**Figure 10.** Celebrate VA Parkway, Hyannis Place and Bolivar Point Lane

This is an un-signalized intersection, in a residential area. The northbound and southbound approaches consist of one exclusive left turn lane, one exclusive right turn lane and two through lanes. The eastbound and westbound approaches are connections to residential developments with driveways of one lane for all the turning movements. Pedestrian facilities are present at the southwest, southeast and northeast quadrants of the intersection.

Warrenton Road and Stafford Lakes Parkway



**Figure 11.** Warrenton Road and Stafford Lakes Parkway

The northbound approach consists of a dual exclusive left turn lane, one exclusive right turn and three through lanes. The southbound approach consists of one exclusive right turn lane, one exclusive left turn and three through lanes. The westbound and eastbound approaches (Stafford Lakes Parkway) consists of one shared left-through turn lane and one exclusive right turn lane. Pedestrian facilities are present at all quadrants of the intersection

#### Warrenton Road, Commerce Parkway and Plantation Drive



**Figure 12.** Warrenton Road, Commerce Parkway and Plantation Drive

This intersection is a signalized, four-legged intersection that connects the main corridor (north/south bounds) to commercial and industrial areas. The westbound (Plantation Drive) and eastbound approach (Commerce Parkway) consists of one exclusive left turn lane, one shared left-through turn lane and one exclusive right turn lane. The southbound approach consists of dual exclusive left turn lanes, one exclusive right turn lane and three through lanes. The northbound approach consists of one exclusive left turn lane, one exclusive right turn lanes and three through lanes.

### Warrenton road, Commuter lot and Falls Run Drive



**Figure 13.** Warrenton road, Commuter lot and Falls Run Drive

This is a signalized, four-legged intersection that connects the main corridor to the commuter lot (eastbound approach) and a retail area. The eastbound approach consists of one shared left-through turn lane and dual exclusive right turn lanes. The westbound consists of one exclusive right turn lane, one shared left-through turn lane and one exclusive left turn lane. The northbound approach consists of dual exclusive left turn lanes, one exclusive right turn lane and three through lanes. The southbound approach consists of one exclusive left turn lane, one exclusive right turn lanes and three through lanes.

Warrenton Road, Victor Neilsen Drive and McLanes Drive**Figure 14.** Warrenton Road, Victor Neilsen Drive and McLanes Drive

This intersection is signalized. It provides access to a fast food restaurant (eastbound approach, Victor Neilsen) and an industrial area (westbound, McLanes Drive) to the main corridor. The north and southbound approaches consist of one exclusive left turn lane, one exclusive right turn lanes and three through lanes. The eastbound and westbound consist of one driveway with one lane for all the turning movements.

Warrenton Road, Sanford Drive and Stanstead Road**Figure 15.** Warrenton Road, Sanford Drive and Stanstead Road

This intersection is the closest one to the I-95 of this study. The southbound approach consists of one exclusive left turn lane, one exclusive right turn lanes and three through lanes. The northbound approach consists of one exclusive left turn lane, one exclusive right turn lanes and four through lanes. The eastbound approach consists of dual exclusive right turn lanes and one shared left-through turn lane. The westbound consists of dual exclusive left turn lanes, one shared through-right turn lane and one exclusive right turn lane.

## Data collection

On May 30<sup>th</sup> and 31<sup>st</sup>, turning movement counts were conducted during the morning and evening peak periods to identify peak hours of the additional intersections that are not part of the main corridor. On October 5<sup>th</sup>, 2017, VDOT provided the Synchro model for the Route 17 Corridor (AM & PM Peak Hours). The traffic data from the model was used to evaluate the intersections along the corridor. Additionally, field inspections were conducted on October 19<sup>th</sup> to obtain an inventory of existing roadway geometry, traffic control and location of adjacent intersections.

## Manual Counts

Existing peak hour turning movement traffic counts were conducted by Technical Traffic Services at five of the study intersections referenced above (Scott's Ford Lane / Celebrate Virginia Pkwy, Banks ford Pkwy / Celebrate Virginia Pkwy, Greenbank Rd / Banks Ford Pkwy, Banks Ford Pkwy / McWhirt Loop and Celebrate Virginia Pkwy/ Hyannis Pl / Bolivar Point Ln). These counts were completed on May 30<sup>th</sup>, 31<sup>st</sup>, June 1<sup>st</sup> and June 7<sup>th</sup>, of 2017 while public schools were in session. The counts were conducted on a typical weekday from 6:00 AM to 9:00 AM and 4:00 PM to 7:00 PM.

A traffic impact analysis is based on a snap shot in time of the existing traffic characteristics. The morning and evening peak periods evaluated for all intersections on this study were determined to be from 7:30 AM to 8:30 AM and from 4:30 PM to 5:30 PM, respectively. The 2017 morning and evening traffic volumes are summarized and depicted on **Appendix B**.

## Crash Data Evaluation

Crash data was extracted directly from the VDOT's application within the Virginia Roads database for each of the primary nine study intersections for the past five years (2013-2017). **Table 1** shows the crash data extracted.

**Table 1.** Crash data for the intersection in study.

Intersection	Crashes	
	Property damage	Injury
Scott's Ford Road and Celebrate Virginia Parkway	0	0
Warrenton Road and Berea Church Road	10	2
Warrenton Road and Celebrate VA Parkway	8	1
Warrenton Road and Banks Ford Parkway	3	2
Banks Ford Parkway and Celebrate VA Parkway	4	2
Warrenton Road, McWhirt Loop and Lichfield Blvd	5	0
Greenbank Road and Banks Ford Parkway	0	0
Banks Ford Parkway and McWhirt Loop	2	1
Celebrate VA Parkway, Hyannis Place and Bolivar Point Lane	0	0

Please note that Warrenton Road has experienced construction work in the in the past years. This information is included in the data base as part of the crash details and this may have been an impact on the safety of the intersections along the road. **Table 2** depicts additional details of the crashes occurred in those intersections with more than five crashes during the past years.

**Table 2.** Description of the crashes in the intersections most affected.

Intersection	Collision Type	Crashes							
		Property damage					Injury		
		2013	2014	2015	2016	2017	2014	2015	2016
Warrenton Road and Berea Church Road	Rear end	4 <sup>(1)</sup>	1 <sup>(1)</sup>	1	1			1 <sup>(1)</sup>	
	Angle		2 <sup>(1)</sup>		1 <sup>(1)</sup>		1 <sup>(1)</sup>		
Warrenton Road and Celebrate VA Parkway	Rear end		1	2	4 <sup>(1)</sup>				
	Angle				1		1 <sup>(1)</sup>		1 <sup>(1)</sup>
Banks Ford Parkway and Celebrate VA Parkway	Angle			1	3		2		
Warrenton Road, McWhirt Loop and Lichfield Blvd	Rear end		1 <sup>(1)</sup>	2 <sup>(1)</sup>					
	Angle		1 <sup>(1)</sup>			1			

<sup>(1)</sup> At least one crash occurred in a work zone.

Based on the data obtained, there are no indications of hazardous patterns that could have caused the crashes documented above.

## Traffic Forecast and Background Traffic

Two steps were considered on the traffic forecast (background traffic) evaluation.

The first step was to determine a background growth rate applicable for the area. A growth rate of 2.0% was discussed and agreed with VDOT and the County during the pre-scoping meeting. This rate was found to be adequate and was used on this study.

The 2017 traffic volumes were projected to the 2027 and 2033 year using the 2.0% growth rate to create the no-build conditions.

The second step was to identify nearby developments that are projected to be completed within the near future. From the Scope of Work, nearby developments were not identified.

The background traffic at full build out of the proposed project (2027) was calculated by adding the volumes calculated in the above Traffic Forecast section and trips generated by the proposed Cannon Ridge Village development. In a similar way the design year (2033) traffic volumes were calculated. The traffic volumes for the existing conditions (2017) were forecasted to 2033 using the 2% growth rate for the No Build condition and the expected trip generation was added to those volumes for the Build conditions. The traffic forecast volumes are depicted in the figures included on **Appendix C**.

## Trip Generation

The Applicant, Lennar, is proposing to develop the site with residential use. The proposed development will consist of 1,177 units of Senior Adult Housing (age restricted). As requested by VDOT and The County, Bowman completed a trip generation analysis for the adjacent Del-Webb Development (Similar Land use) to identify the trip generation rates using actual traffic counts for a similar type development within the area.

Based on coordination with the County, it was determined to use the distribution rates from the adjacent development Del-Webb (See scoping form on **Appendix A** for more detail), trip generation rates were developed as follow:

**Table 3.** Trip Generation Ratio.

Del-Webb		
Total Units Completed	720	Per County's Assessment on 11/2/17
Traffic Volumes Collected by Bowman		
Morning Trips	172	Data collected at main entrance
Evening Trips	236	
Trip Generation Ratio		
Time		Ratio
Morning Peak	172/720	0.24
Evening Peak	236/720	0.33

The information described above was reviewed and compared against the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 9th edition* rates by the County and VDOT. Based on that comparison, it was determined that the rates from Del-Webb Development are higher than the ITE rates. **Table 4** displays the trip generation for the proposed development and includes the morning and evening peak hours as well as the average daily trips generated from the proposed development.

**Table 4.** ITE Site Trip Generation Analysis

Land Use	Size	Units	Land Use Code	Weekday					
				AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
<b>Residential</b>  Age Restricted Development	1,177	D.U.	251	Rate=		0.24	Rate=		0.33
				33%	67%		49%	51%	
				94	189	282	190	198	388
				<b>94</b>	<b>189</b>	<b>282</b>	<b>190</b>	<b>198</b>	<b>388</b>

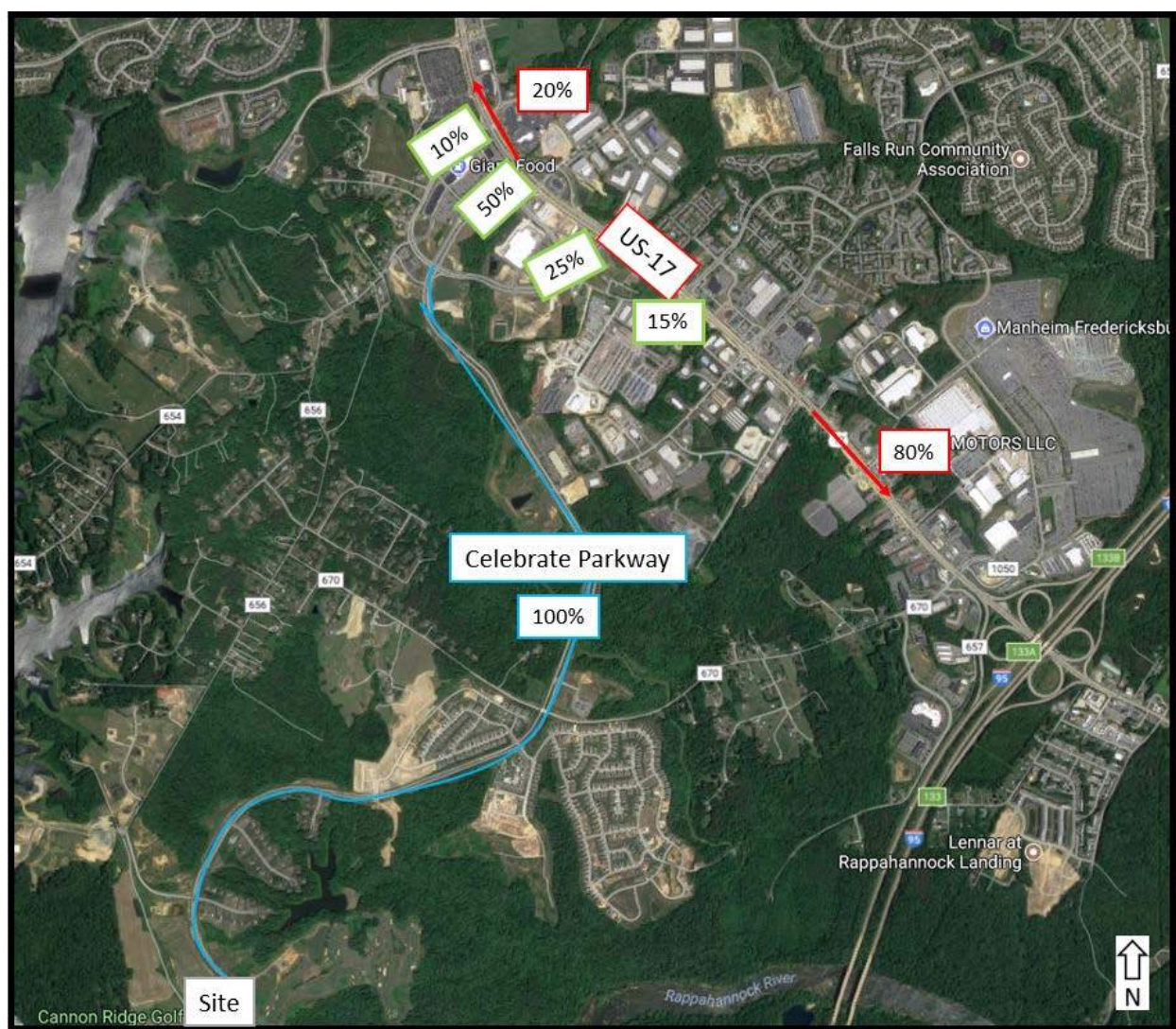
**Notes:** The trip generation data was generated from actual traffic data from Del-Webb which is a similar type development located nearby and along Celebrate Virginia Parkway.

These traffic volumes were then distributed to the roadway system in accordance with a site traffic distribution pattern developed based on a review of traffic patterns in the area. For purposes of this study, it was determined that 20% of the traffic generated by the development would travel to/from the North and 80% to/from the south. The site generated trip distribution is depicted on **Figure 16**.

This study assumes that 60% of the traffic coming from the south on Route 17 will use the direct connector to Celebrate Virginia Parkway. It was also assumed that approximately 20% of the traffic from the south of Route 17 will turn left at either one of the three roadways that provide access to Celebrate Virginia Parkway (Celebrate VA Parkway, Banks Ford Parkway and McWhirt loop). These assumptions were made as a conservative approach; it is most likely that the majority of the traffic will use the direct connector from Route 17 to Celebrate Virginia Parkway (Southbound direction) to access the proposed Cannon Ridge Village Development.

An internal capture of 15% was agreed during the scoping meeting with VDOT and the County. This internal capture would generate trips to/from the Cannon Ridge Village development to/from the shopping center at the Greenbank Road / Banks Ford Parkway intersection. The trip distribution assumes 100% of the trips moving to/from the site are going through Scott's Ford Lane / Celebrate Virginia Parkway and Celebrate Virginia Parkway / Hyannis Place / Bolivar Point Lane intersections. Then, the 85% of those trips were distributed as depicted in **Figure 16**. For the trips coming from the site, the 15% of the internal capture was counted as part of the left turning traffic in the northbound approach at the Banks Ford Parkway / Celebrate Virginia Parkway intersection and then as the left turning traffic at Greenbank Road / Banks Ford Parkway intersection. In a similar way, the trips going to the site, the 15% of the internal capture was counted as traffic turning left on the westbound approach at the Greenbank Road / Banks

Ford Parkway intersection and then as part of the right turning traffic in the westbound approach at the Banks Ford Parkway / Celebrate Virginia Parkway intersection.



**Figure 16.** Trip Generation Distribution.

The traffic distribution results for all the scenarios are depicted in the figures included on **Appendix C**.

The anticipated daily traffic volumes for the site can be calculated using a daily average rate of 4.0 per the ITE Trip Generation Manual. Therefore, the anticipated daily trips for the development would be approximately 4,708 units per day.

## Capacity Analysis

The study intersections were analyzed for each scenario using the 2010 Highway Capacity Manual (HCM) methodologies using the computer software package Synchro 10 with Sim Traffic. The analysis uses capacity, Level of Service, control delay, and queuing as the criteria for the performance of the intersections.

Capacity, as defined by the HCM, is a measure of the maximum number of vehicles in an hour that can travel through an intersection or section of roadway under typical conditions. Level of Service (LOS) is a marker of the driving conditions and perception of drivers while traveling during the given time period. LOS ranges from LOS “A” which represents free flow conditions, to LOS “F” which represents breakdown conditions. **Table 5** shows the LOS for intersections as defined by the HCM.

**Table 5.** Level of Service

Unsignalized Intersections		Signalized Intersections	
Level of Service	Average Control Delay (sec/veh)	Level of Service	Average Control Delay (sec/veh)
A	≤10	A	≤10
B	>10-15	B	>10-20
C	>15-25	C	>20-35
D	>25-35	D	>35-55
E	>35-50	E	>55-80
F	≥50	F	≥80

Typically, LOS “A” through “D” is considered acceptable, while LOS “E” and “F” are considered failing or unacceptable. Control delay is a measure of the total amount of delay experienced by an individual vehicle and includes delay related to deceleration, queue delay, stopped delay, and acceleration. **Table 5** shows the amount of control delay (in seconds per vehicle) that corresponds to the LOS for signalized and unsignalized intersections.

The reported queues, or linear distance of delayed vehicles, in this study are average 95<sup>th</sup> percentile queues as reported by SimTraffic after 10 runs of 60 minutes each with a 15-minute seeding time. They are reported to ensure that the storage lengths of lanes at intersections are of adequate length and that queued vehicles will not interfere with free flow vehicles or adjacent intersections.

Capacity analyses were completed for the above referenced study intersections during the existing conditions (2017), build out year (2027) for no-build (without Cannon Ridge Village development) conditions and build conditions (with Cannon Ridge Village development) and the design year (2033) for no-build and build conditions.

## Analysis of Existing Conditions 2017

### Capacity Analysis

The LOS for the intersections in this study are presented in the following tables ( **Table 6** to **Table 19**). This analysis was completed using the counts provided by VDOT for the intersections along Route 17 and the counts completed by Bowman Consulting for the other intersections. The counts are for the peak hour in an average weekday.

#### Geico / Stafford Lakes Parkway / Route 17

This four-legged signalized intersection is currently experiencing capacity constraints along the Route 17 approaches; during the morning peak the southbound approach would experience a LOS of E and during the evening peak the northbound approach would experience a LOS F and the southbound approach would remain at LOS E. The capacity analysis results are summarized in **Table 6**.

**Table 6.** Geico / Stafford Lakes Parkway / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Geico / Stafford Lakes Parkway / Route 17	Approach	Movement				
	EB	L	75.1	E	68.6	E
		T	26.6	C	27.0	C
		R	14.8	B	14.7	B
		Approach	28.0	C	28.4	C
	WB	L	97.2	F	73.7	E
		T	3.8	A	5.2	A
		R	10.8	B	11.1	B
		Approach	36.1	D	10.9	B
	NB	L				
		T	69.3	E	245.0	F
		R	43.3	D	40.4	D
		Approach	47.0	D	115.1	F
	SB	L				
		T	62.0	E	60.0	E
		R	57.3	E	57.0	E
		Approach	60.1	E	58.1	E

Banks Ford Parkway / Berea Church / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 7**.

**Table 7.** Banks Ford Parkway / Berea Church / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement				
	EB	L	39.6	D	43.0	D
		T	7.8	A	9.6	A
		R	0.0	A	0.0	A
		Approach	7.7	A	9.2	A
	WB	L	57.4	E	53.4	D
		T	3.9	A	6.3	A
		R	0.0	A	0.0	A
		Approach	13.1	B	7.4	A
	NB	L	65.1	E	87.2	F
		T	65.4	E	83.7	F
		R	43.3	D	58.1	E
		Approach	58.5	E	76.3	E
	SB	L	66.1	E	61.5	E
		T	62.3	E	60.1	E
		R	57.8	E	56.6	E
		Approach	62.9	E	60.0	E

Celebrate Virginia Parkway / International Parkway / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 8**.

**Table 8.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / International Parkway / Route 17	Approach	Movement				
	EB	L	35.4	D	32.9	C
		T	35.0	D	46.3	D
		R	10.7	B	14.7	B
		Approach	34.9	C	45.1	D
	WB	L	62.2	E	50.2	D
		T	13.0	B	23.2	C
		R	17.3	B	35.8	D
		Approach	14.1	B	25.0	C
	NB	L	61.7	E	61.0	E
		T	62.7	E	59.5	E
		R	60.3	E	58.7	E
		Approach	61.5	E	59.9	E
	SB	L				
		T	61.2	E	79.3	E
		R	52.0	D	48.0	D
		Approach	58.8	E	68.6	E

Banks Ford Parkway / Car Dealership / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 9**.

**Table 9.** Banks Ford Parkway / Car Dealership / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Car Dealership / Route 17	Approach	Movement				
	EB	L				
		T	2.7	A	3.2	A
		R	4.8	A	7.5	A
		Approach	2.8	A	3.3	A
	WB	L	61.0	E	56.8	E
		T	12.6	B	13.2	B
		R				
		Approach	13.9	B	14.3	B
	NB	L	59.8	E	60.0	E
		T	59.9	E	60.0	E
		R	59.7	E	59.7	E
		Approach	59.7	E	59.8	E
	SB	L				
		T			63.6	E
		R				
		Approach	0.0	A	63.6	E

McWhirt Loop / Lichfield Boulevard / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 10**.

**Table 10.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
McWhirt Loop / Lichfield Boulevard / Route 17	Approach	Movement				
	EB	L	78.7	E	98.1	F
		T	5.6	A	3.8	A
		R	14.4	B	14.1	B
		Approach	13.1	B	15.0	B
	WB	L	29.1	C	33.9	C
		T	10.8	B	8.7	A
		R	2.0	A	0.6	A
		Approach	11.3	B	9.3	A
	NB	L				
		T	64.8	E	67.8	E
		R	56.4	E	54.8	D
		Approach	59.8	E	59.4	E
	SB	L	68.6	E	62.4	E
		T	67.5	E	62.8	E
		R	55.8	E	56.9	E
		Approach	62.9	E	59.5	E

Commerce Parkway / Plantation Drive / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 11**.

**Table 11.** Commerce Parkway / Plantation Drive / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Commerce Parkway / Plantation Drive / Route 17	Approach	Movement				
	EB	L	42.3	D	68.6	D
		T	10.9	B	6.2	A
		R	10.9	B	3.7	A
		Approach	12.3	B	8.9	A
	WB	L	62.9	E	68.0	E
		T	21.8	C	10.3	B
		R	17.2	C	13.9	B
		Approach	23.2	C	12.2	B
	NB	L	59.4	E	57.1	E
		T	59.3	E	57.7	E
		R	57.6	E	56.1	E
		Approach	58.4	E	56.5	E
	SB	L	67.2	E	82.4	F
		T	66.4	E	82.4	F
		R	54.0	D	53.8	D
		Approach	63.0	D	72.6	E

Commuter Lot / Falls Run Drive / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 12**.

**Table 12.** Commuter Lot / Falls Run Drive / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Commuter Lot / Falls Run Drive / Route 17	Approach	Movement				
	EB	L	94.6	F	89.0	F
		T	3.7	A	12.8	B
		R	8.3	A	13.2	B
		Approach	5.4	A	15.3	B
	WB	L	46.8	D	28.8	C
		T	11.8	B	4.7	A
		R	38.0	D	11.5	B
		Approach	13.0	B	5.7	A
	NB	L				
		T	62.1	E	65.5	E
		R	61.9	E	56.2	E
		Approach	61.9	E	59.3	E
	SB	L	63.6	E	68.9	E
		T	63.9	E	69.4	E
		R	59.8	E	57.3	E
		Approach	62.2	E	65.0	E

Victor Nailsen / McLanes Drive / Route 17

The north/southbound approaches at this four-legged signalized intersection are expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 13**.

**Table 13.** Victor Nailsen / McLanes Drive / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Victor Nailsen / McLanes Drive / Route 17	Approach	Movement				
	EB	L	90.8	F		
		T	1.2	A	1.7	A
		R	4.2	A	3.8	A
		Approach	1.4	A	1.8	A
	WB	L	81.8	F	103.9	F
		T	9.2	A	3.3	A
		R	0.0	A	2.0	A
		Approach	9.8	A	3.8	A
	NB	L				
		T	62.1	E	56.4	E
		R				
		Approach	62.1	E	56.4	E
	SB	L				
		T	59.6	E	63.3	E
		R				
		Approach	59.6	E	63.3	E

Sanford Drive / Stanstead Road / Route 17

The southbound approach at this four-legged signalized intersection is expected to operate at capacity during the existing conditions as the approaches are expected to operate at levels of service E during the morning and evening conditions. The capacity analysis results are summarized in **Table 14**.

**Table 14.** Sanford Drive / Stanstead Road / Route 17 intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Sanford Drive / Stanstead Road / Route 17	Approach	Movement				
	EB	L	30.9	C	33.7	C
		T	7.8	A	21.6	C
		R	16.5	B	16.3	B
		Approach	8.7	A	22.1	C
	WB	L	66.4	E	62.6	E
		T	31.0	C	25.1	C
		R	12.2	B	13.2	B
		Approach	30.2	C	25.1	C
		T	61.2	E	59.7	E
		R	37.3	D	41.7	D
		Approach	44.7	D	43.9	D
	SB	L	98.7	F	269.2	F
		T	117.7	F	288.5	F
		R	54.7	D	55.1	E
		Approach	99.5	F	237.9	F

Banks Ford Parkway / Greenbank / Shopping Center

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the morning and evening existing conditions. The capacity analysis results are summarized in **Table 15**.

**Table 15.** Banks Ford Parkway / Greenbank / Shopping Center intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement				
	EB	L	9.6	A	10.9	B
		T	8.5	A	9.8	A
		R	10.0	B	12.5	B
		Approach	9.3	A	10.4	B
	WB	L	8.6	A	8.5	A
		T	7.3	A	8.3	A
		Approach	0.9		2.4	A
	NB	L	0.0		0.0	
		T	0.0		0.0	
		R	0.0		7.4	A

Celebrate Virginia Parkway / Bolivar Point / Hyannis Place

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the morning and evening existing conditions. The capacity analysis results are summarized in **Table 16**.

**Table 16.** Celebrate Virginia Parkway / Bolivar Point / Hyannis Place intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Bolivar Point / Hyannis Place	Approach	Movement				
	EB	L	10.4	B	11.6	B
		Approach	10.4	B	11.6	B
	WB	L	8.8	A	9.0	A
		Approach	8.8	A	9.0	A
	SB	L	7.2	A	7.4	A

Celebrate Virginia Parkway / Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the morning and evening existing conditions. The capacity analysis was completed using the HCS7 (Highway Capacity Software) results are summarized in **Table 17**.

**Table 17.** Celebrate Virginia Parkway / Banks Ford Parkway intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Banks Ford Parkway	Approach	Movement				
	EB	L	10.6	B	14.1	B
		R	9.4	A	9.5	A
		Approach	10.1	B	12.8	B
	WB	L	11.2	B	13.9	B
		R	9.0	A	9.0	A
		Approach	11.1	B	13.8	B
	NB	L	8.8	A	8.9	A
		Approach	1.5		3.2	
	SB	L	8.3	A	8.4	A
		Approach	0.3		2.2	

Celebrate Virginia Parkway / Scott's Ford Lane

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the morning and evening existing conditions. The capacity analysis results are summarized in **Table 18**.

**Table 18.** Celebrate Virginia Parkway / Scott's Ford Lane intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Scott's Ford Lane	Approach	Movement				
	EB	L	8.8	A	8.8	A
		T	8.4	A	8.7	A
		Approach	8.6	A	8.8	A
	WB	L	8.8	A	8.9	A
		Approach	8.8	A	8.9	A
	NB	L	7.3	A	7.3	A
		Approach	4.8			
	SB	L	7.2	A	7.2	A
		Approach	1.3			

McWhirt Loop Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the morning and evening existing conditions. The capacity analysis results are summarized in **Table 19**.

**Table 19.** McWhirt Loop Banks Ford Parkway intersection delays and LOS for 2017, existing conditions.

INTERSECTION			2017 AM PEAK		2017 PM PEAK	
			Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS
McWhirt Loop Banks Ford Parkway	Approach	Movement				
	EB	L	9.8	A	9.9	A
		T	8.4	A	8.5	A
		R	10.0	A	10.3	B
		Approach	9.5	A	9.8	A
	WB	L	8.5	A	8.4	A
		T	7.3	A	7.7	A
		R	0.0		0.0	
		Approach	0.1	A	1.6	A
		R	7.4	A	7.3	A
		Approach	2.0	A	0.2	A

The results of the capacity analysis indicate that the unsignalized intersections generally operate at acceptable levels of service C or better. The Route 17 is currently experiencing capacity constraints as some of the northbound and southbound approaches are experiencing LOS of E and/or F.

It is our understanding that VDOT is currently evaluating preparing a traffic signal timing adjustment for the Route 17 Corridor with the new signal timings expected to be in place in 2018.

## Queuing

Besides the capacity analyses, the queuing was also evaluated for the existing conditions to determine if the existing auxiliary lanes were adequate for the existing conditions and to compare the results with the forecasted conditions. The results of the queuing evaluation are summarized in the following tables (**Table 20** to **Table 25**).

Please note that the intersections evaluated in this section are intersections where the anticipated trips would use the existing auxiliary lanes.

### Banks Ford Parkway / Berea Church / Route 17

**Table 20.** Banks Ford Parkway / Berea Church / Route 17 intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK
				95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement			
	EB	L	185	43	46
		R	200	36	28
	WB	L	275	63	21
		R	300	91	20
	NB	L		83	126
		LT		66	122
		R	160	20	37
	SB	L		74	68
		R			36

### Celebrate Virginia Parkway / International Parkway / Route 17

**Table 21.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK	
				95th % Queue (ft)	95th % Queue (ft)	
Celebrate Virginia Parkway / International Parkway / Route 17	Approach	Movement				
	EB	L	160	95	172	
		WB	L	200	16	55
			R	175	32	269
	NB	L		22	38	
		L		35	75	
	SB	LT		192	225	

Banks Ford Parkway / Car Dealership / Route 17**Table 22.** Banks Ford Parkway / Car Dealership / Route 17 intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK
				95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Car Dealership / Route 17	Approach	Movement			
	EB	R			9
	WB	L	400	78	37
		L	400	55	63
	NB	L		36	16
		LT		12	12

McWhirt Loop / Lichfield Boulevard / Route 17**Table 23.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK
				95th % Queue (ft)	95th % Queue (ft)
McWhirt Loop / Lichfield Boulevard / Route 17	Approach	Movement			
	EB	L	350	174	391
	WB	L	290	45	30
		L	290	43	70
		R	400	19	20
	NB	LT		50	100
		R	70	57	93
	SB	L	120	125	164
		LT		139	258
		R	145	48	155

Banks Ford Parkway / Greenbank / Shopping Center**Table 24.** Banks Ford Parkway / Greenbank / Shopping Center intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK
				95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement			
	EB	L	185	38	29
		TR		33	36
	WB	LT		17	26
		R		16	5

McWhirt Loop Banks Ford Parkway**Table 25.** McWhirt Loop Banks Ford Parkway intersection queuing report for 2017, existing conditions.

INTERSECTION			Existing Storage (ft)	2017 AM PEAK	2017 PM PEAK
				95th % Queue (ft)	95th % Queue (ft)
McWhirt Loop Banks Ford Parkway	Approach	Movement			
	EB	LT		32	28
	WB	LT		38	38
		R	150	17	
	SB	L	200	19	
		R	205		17

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

## Analysis of Future Conditions 2027

### Capacity Analysis

The LOS for the intersections in study are presented in the **Table 26** to **Table 39**. This analysis was done using the counts provided by VDOT for the intersections along Route 17 and the counts done by Bowman Consulting for the other intersections. Those counts were used to forecast the traffic for year 2027 using a growth rate of 2%. In this case, the evaluation was done for the “No Build” condition (without the development) and “Build” condition (with the development). The counts are for the peak hour in a weekday.

#### Geico / Stafford Lakes Parkway / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and/or F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 26**.

**Table 26.** Geico / Stafford Lakes Parkway / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Geico / Stafford Lakes Parkway / Route 17	Approach	Movement								
	EB	L	118.4	F	118.4	F	73.2	E	73.2	E
		T	31.8	C	32.1	C	32.0	C	32.7	C
		R	15.2	B	15.2	B	15.1	B	15.1	B
		Approach	36.0	D	36.3	D	33.3	C	33.9	C
	WB	L	145.7	F	143.8	F	71.1	E	70.2	E
		T	2.5	A	3.2	A	5.6	A	6.2	A
		R	11.2	B	11.2	B	11.4	B	11.4	B
		Approach	52.0	D	50.9	D	11.0	A	11.4	B
	NB	L								
		T	82.1	F	82.1	F	350.2	F	350.2	F
		R	46.8	D	46.8	D	42.0	D	42.0	D
		Approach	51.8	D	51.8	D	154.3	F	154.3	F
	SB	L								
		T	62.4	E	62.4	E	59.8	E	59.8	E
		R	56.6	E	56.6	E	56.5	E	56.5	E
		Approach	60.0	E	60.0	E	57.6	E	57.6	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Banks Ford Parkway / Berea Church / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and some others of F during the evening conditions. The capacity analysis results are summarized in **Table 27**.

**Table 27.** Banks Ford Parkway / Berea Church / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement								
	EB	L	41.9	D	41.4	D	40.3	D	40.7	D
		T	11.2	B	11.5	B	13.3	B	13.6	B
		R	0.0	A	0.0	A	0.0	A	0.0	A
		Approach	10.9	B	11.1	B	12.5	B	12.7	B
	WB	L	65.7	E	67.8	E	59.7	E	60.0	E
		T	6.6	A	4.4	A	6.3	A	6.1	A
		R	0.0	A	0.0	A	0.0	A	0.0	A
		Approach	16.7	B	15.2	B	7.6	A	7.4	A
	NB	L	63.2	E	64.0	E	107.5	F	127.3	F
		T	63.3	E	64.4	E	107.2	F	128.5	F
		R	42.2	D	41.9	D	48.3	D	47.7	D
		Approach	56.7	E	58.1	E	87.7	F	102.7	F
	SB	L	64.4	E	64.4	E	64.4	E	64.4	E
		T	60.8	E	60.8	E	60.8	E	60.8	E
		R	56.4	E	56.4	E	56.4	E	56.4	E
		Approach	61.4	E	61.4	E	61.4	E	61.4	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Celebrate Virginia Parkway / International Parkway / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and some others of F during the evening conditions. The capacity analysis results are summarized in **Table 28**.

**Table 28.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / International Parkway / Route 17	Approach	Movement								
	EB	L	37.4	D	37.2	D	33.1	C	33.3	C
		T	40.1	D	43.9	D	51.7	D	52.4	D
		R	11.5	B	12.9	B	15.4	B	15.9	B
		Approach	39.8	D	43.3	D	50.2	D	50.6	D
	WB	L	59.8	E	56.5	E	54.7	D	61.8	E
		T	22.8	C	24.6	C	27.3	C	26.5	C
		R	14.1	B	15.2	B	22.7	C	21.4	C
		Approach	22.4	C	24.1	C	27.6	C	27.2	C
	NB	L	61.7	E	60.8	E	61.3	E	62.4	E
		T	63.1	E	60.9	E	59.4	E	59.1	E
		R	60.1	E	59.3	E	58.5	E	58.6	E
		Approach	61.5	E	60.0	E	60.0	E	60.1	E
	SB	T	63.4	E	63.4	E	111.7	F	111.7	F
		R	50.7	D	50.7	D	47.4	D	47.4	D
		Approach	60.1	E	60.1	E	89.8	F	89.8	F

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Banks Ford Parkway / Car Dealership / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and the evening conditions. The capacity analysis results are summarized in **Table 29**.

**Table 29.** Banks Ford Parkway / Car Dealership / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Car Dealership / Route 17	Approach	Movement								
	EB	L								
		T	4.2	A	4.0	A	4.3	A	5.5	A
		R	5.4	A	5.8	A	8.0	A	8.0	A
		Approach	4.2	A	4.0	A	4.4	A	6.0	A
	WB	L	59.9	E	60.0	E	62.0	E	62.3	E
		T	18.8	B	21.1	C	20.0	C	22.1	C
		R								
		Approach	19.9	B	22.3	C	21.1	C	23.4	C
	NB	L	59.9	E	58.5	E	58.7	E	60.4	E
		T	60.0	E	58.6	E	58.7	E	60.5	E
		R	59.7	E	58.5	E	58.4	E	58.6	E
		Approach	59.7	E	58.5	E	58.5	E	58.8	E
	SB	L								
		T					63.6	E	63.6	E
		R								
		Approach	0.0	A	0.0	A	63.6	E	63.6	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

McWhirt Loop / Lichfield Boulevard / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and/or F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 30**.

**Table 30.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
McWhirt Loop / Lichfield Boulevard / Route 17	Approach	Movement								
	EB	L	91.6	F	95.4	F	131.2	F	130.1	F
		T	8.1	A	7.0	A	8.7	A	11.4	B
		R	15.0	B	15.0	B	15.9	B	15.9	B
		Approach	16.7	B	15.6	B	23.1	C	24.6	C
	WB	L	28.8	C	28.7	C	30.1	C	29.7	C
		T	88.2	F	102.3	F	17.2	B	30.7	C
		R	1.3	A	1.3	A	0.7	A	1.0	A
		Approach	81.6	F	94.6	F	16.8	B	29.3	C
	NB	L								
		T	65.0	E	64.6	E	78.0	E	78.8	E
		R	56.0	E	56.2	E	56.1	E	61.3	E
		Approach	59.6	E	59.0	E	63.9	E	67.1	E
	SB	L	74.7	E	74.7	E	65.7	E	65.7	E
		T	73.5	E	73.5	E	66.2	E	66.2	E
		R	55.2	E	55.2	E	56.5	E	56.5	E
		Approach	66.1	E	66.1	E	60.7	E	60.7	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Commerce Parkway / Plantation Drive / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and/or F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 31**.

**Table 31.** Commerce Parkway / Plantation Drive / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Commerce Parkway / Plantation Drive / Route 17	Approach	Movement								
	EB	L	37.5	D	37.1	D	37.4	D	37.3	D
		T	15.7	B	17.9	B	8.7	A	10.4	A
		R	11.3	B	11.3	B	2.0	A	1.8	A
		Approach	16.6	B	18.6	B	10.9	B	12.3	B
	WB	L	62.3	E	61.7	E	64.8	E	63.9	E
		T	112.8	F	125.9	F	15.9	B	19.6	B
		R	18.9	B	18.4	B	28.1	C	29.9	C
		Approach	105.0	F	116.9	F	18.7	B	21.9	C
	NB	L	57.4	E	57.4	E	59.9	E	59.9	E
		T	57.4	E	57.4	E	59.7	E	59.7	E
		R	55.8	E	55.8	E	56.2	E	56.2	E
		Approach	56.5	E	56.5	E	57.7	E	57.7	E
	SB	L	78.5	E	78.5	E	111.7	F	111.7	F
		T	77.0	E	77.0	E	111.4	F	111.4	F
		R	53.7	D	53.7	D	53.5	D	53.5	D
		Approach	70.6	E	70.6	E	91.7	F	91.7	F

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Commuter Lot / Falls Run Drive / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and the evening conditions. The capacity analysis results are summarized in **Table 32**.

**Table 32.** Commuter Lot / Falls Run Drive / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Commuter Lot / Falls Run Drive / Route 17	Approach	Movement								
	EB	L	89.7	F	88.5	F	95.2	F	93.8	F
		T	4.1	A	4.7	A	26.3	C	41.3	D
		R	8.4	A	8.4	A	15.6	B	15.6	B
		Approach	5.7	A	6.2	A	28.4	C	42.7	D
	WB	L	51.5	D	51.6	D	32.9	C	36.2	D
		T	24.7	C	29.4	C	10.5	B	14.8	B
		R	7.1	A	6.7	A	11.9	B	11.9	B
		Approach	24.3	C	28.8	C	11.3	B	15.4	B
	NB	T	62.1	E	62.1	E	74.9	E	74.9	E
		R	61.9	E	61.9	E	56.2	E	56.2	E
		Approach	61.9	E	61.9	E	62.5	E	62.5	E
	SB	L	64.4	E	64.4	E	75.8	E	75.8	E
		T	64.3	E	64.3	E	77.6	E	77.6	E
		R	59.4	E	59.5	E	56.8	E	56.8	E
		Approach	62.5	E	62.5	E	69.8	E	69.8	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Victor Nailsen / McLanes Drive / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and the evening conditions. The capacity analysis results are summarized in **Table 33**.

**Table 33.** Victor Nailsen / McLanes Drive / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Victor Nailsen / McLanes Drive / Route 17	Approach	Movement								
	EB	L								
		T	1.4	A	1.4	A	1.1	A	1.2	A
		R								
		Approach	1.4	A	1.4	A	1.1	A	1.2	A
	WB	L	78.0	E	77.8	E	91.5	F	88.0	F
		T	13.3	B	14.5	B	5.1	A	5.8	A
		R	0.0	A	0.0	A	2.2	A	2.2	A
		Approach	13.8	B	14.9	B	5.5	A	6.1	A
	NB	L								
		T	61.8	E	61.8	E	55.4	E	55.4	E
		R								
		Approach	61.8	E	61.8	E	55.4	E	55.4	E
	SB	L								
		T	59.6	E	59.6	E	66.3	E	66.3	E
		R								
		Approach	59.6	E	59.6	E	66.3	E	66.3	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Sanford Drive / Stanstead Road / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2027 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and/or F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 34**.

**Table 34.** Sanford Drive / Stanstead Road / Route 17 intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Sanford Drive / Stanstead Road / Route 17	Approach	Movement								
	EB	L	34.7	D	36.2	D	38.3	D	2.8	A
		T	9.3	A	11.2	B	19.9	B	17.5	B
		R								B
		Approach	10.1	B	11.9	B	20.6	C	30.9	C
	WB	L	77.4	E	77.4	E	67.7	E	67.7	E
		T	73.2	E	82.7	F	29.2	C	31.3	C
		R	13.3	B	13.3	B	14.2	B	14.3	B
		Approach	65.7	E	73.7	E	28.8	C	30.5	C
	NB	L								
		T	63.1	E	63.1	E	61.1	E	61.1	E
		R	36.6	D	36.6	D	42.8	D	42.8	D
		Approach	44.8	D	44.8	D	45.0	D	45.0	D
	SB	L	160.8	F	160.8	F	402.5	F	402.5	F
		T	181.5	F	181.5	F	423.5	F	423.5	F
		R	54.8	D	54.8	D	55.2	E	55.2	E
		Approach	154.9	F	154.9	F	348.7	F	348.7	F

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions. However, the eastbound approach has a drop in the LOS from B to C (still acceptable) during the morning peak hour.

Banks Ford Parkway / Greenbank / Shopping Center

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2027 No Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 35**.

**Table 35.** Banks Ford Parkway / Greenbank / Shopping Center intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement								
	EB	L	9.9	A	10.0	B	11.7	B	12.0	B
		TR	8.6	A	8.6	A	10.3	B	10.6	B
		R								
	WB	Approach	9.5	A	9.7	A	11.1	B	11.4	B
		L	10.3	B	10.3	B	14.0	B	13.4	B
		T	8.6	A	8.7	A	8.5	A	8.6	A
		R								
		Approach	9.3	A	9.9	B	13.3	B	13.1	B
	NB	LTR	7.4	A	7.4	A	7.5	A	8.7	A
	SB	1							7.6	A

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Celebrate Virginia Parkway / Bolivar Point / Hyannis Place

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2027 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 36**.

**Table 36.** Celebrate Virginia Parkway / Bolivar Point / Hyannis Place intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Bolivar Point / Hyannis Place	Approach	Movement								
	EB	L	13.0	B	13.9	B	12.7	B	19.5	C
		Approach			13.9	B			19.5	C
	WB	L	9.1	A	9.8	A	9.2	A	10.7	B
		Approach			9.8	A			10.7	B
	NB	L	7.4	A			7.4	A	7.9	A
	SB	L	7.4	A	7.8	A	7.5	A	8.0	A

Celebrate Virginia Parkway / Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2027 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 37**.

**Table 37.** Celebrate Virginia Parkway / Banks Ford Parkway intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Banks Ford Parkway	Approach	Movement								
	EB	L	11.1	B	13.1	B	16.7	C	34.0	D
		R	9.5	A	9.7	A	9.9	A	10.5	B
		Approach	10.4	B	11.7	B	13.9	B	24.4	C
	WB	L	11.9	B	14.5	B	16.6	C	36.0	E
		R	9.1	A	9.4	A	9.1	A	9.3	A
		Approach	11.8	B	14.3	B	16.5	C	35.8	E
	NB	L	8.9	A	9.3	A	9.1	A	10.1	B
	SB	L	8.3	A	8.6	A	8.5	A	8.9	A
		Approach	0.3		0.2		2.2		1.5	

Celebrate Virginia Parkway / Scott's Ford Lane

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2027 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 38**.

**Table 38.** Celebrate Virginia Parkway / Scott's Ford Lane intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Celebrate Virginia Parkway / Scott's Ford Lane	Approach	Movement								
	EB	L	8.8	A	10.9	B	8.9	A	12.1	B
		T	8.4	A	8.8	A	8.7	A	10.2	A
		R								
	WB	Approach	8.7	A	10.2	B	8.9	A	11.9	B
		L	8.8	A	10.2	B	8.9	A	10.9	B
		R								
	NB	Approach	8.8	A	10.2	B	8.9	A	10.9	B
		L	7.3	A	7.5	A	7.3	A	7.7	A
		T	0.0							
	SB	R								
		Approach	4.8	A	7.5	A	2.1			
		L	7.2	A			7.2	A	7.5	A
	SB	Approach	1.3				1.2			

McWhirt Loop Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2027 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 39**.

**Table 39.** McWhirt Loop Banks Ford Parkway intersection delays and LOS for 2027, existing conditions.

INTERSECTION			2027 No Build AM PEAK		2027 Build AM PEAK		2027 No Build PM PEAK		2027 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement								
	EB	L	10.1	B	10.4	B	10.3	B	11.0	B
		T	8.4	A	8.4	A	8.5	A	8.4	A
		R								
		Approach	9.7	A	10.0	B	10.1	B	10.7	A
	WB	L	10.4	B	10.8	B	10.8	B	10.9	B
		T	8.5	A	8.6	A	8.4	A	8.6	A
		R								
		Approach	10.1	B	10.5	B	10.4	B	10.6	B
	NB	L	7.4	A	7.4	A	7.8	A	7.4	A
		Approach	0.1				1.7			
	SB	L	7.5	A	7.6	A	7.4	A	7.9	A
		T								
		R								
		Approach	2.0				0.2			

## Queuing

Besides the capacity analyses, the queuing was also evaluated for the future conditions in the build out year 2027, to determine if the auxiliary lanes that are already there were adequate for the existing conditions and then compare the results with the Forecasted conditions. The results of the queuing evaluation are summarized in **Table 40** to **Table 45**.

### Banks Ford Parkway / Berea Church / Route 17

**Table 40.** Banks Ford Parkway / Berea Church / Route 17 intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement					
	EB	L	185	26	23	33	22
		R	200	16	30	30	27
	WB	L	275	130	181	42	18
		L		133	193	74	
		R	300			11	
	NB	L		52	67	104	111
		LT		65	86	93	105
		R	160	39	38	49	91
	SB	L		105	70	127	63
R				124	75		

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

Celebrate Virginia Parkway / International Parkway / Route 17**Table 41.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
Celebrate Virginia Parkway / International Parkway / Route 17	Approach	Movement					
	EB	L	160	64	229	209	250
		R					
	WB	L	200	15	196	37	86
		R	175	235	270	276	235
	NB	L		51	61	53	50
		L		55	78	109	76
	SB	LT		167	220	337	170

Based on the queue evaluation, the existing auxiliary lane storage lengths for the eastbound left turn lane and westbound right turn lane would not be able to accommodate the anticipated traffic demand during the no-build and build traffic conditions.

Banks Ford Parkway / Car Dealership / Route 17**Table 42.** Banks Ford Parkway / Car Dealership / Route 17 intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Car Dealership / Route 17	Approach	Movement					
	EB	R				11	
	WB	L	400	65	97	43	39
		L	400	52	59	50	55
	NB	L		14	13	19	23
		LT					13
	SB	LTR					19

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

McWhirt Loop / Lichfield Boulevard / Route 17**Table 43.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
McWhirt Loop / Lichfield Boulevard / Route 17	Approach	Movement					
	EB	L	350	321	294	327	297
		R	290		26	16	35
	WB	L	290	46	42	33	34
		L	400	53	150	31	83
		R		21	18	51	43
	NB	LT	70	55	141	216	521
		R	120	52	100	99	115
	SB	L		130	177	158	109
		LT	145	177	170	186	152
R			162	176	157	141	

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

Banks Ford Parkway / Greenbank / Shopping Center**Table 44.** Banks Ford Parkway / Greenbank / Shopping Center intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
9Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement	185	30	30	36	47
	EB	TR			34	34	35
		WB	LT				25
	R			10	21	17	
	NB	L			19	32	27
	SB	R				6	9

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

## McWhirt Loop Banks Ford Parkway

**Table 45.** McWhirt Loop Banks Ford Parkway intersection queuing report for 2027, existing conditions.

INTERSECTION			Existing Storage (ft)	2027 No Build AM PEAK	2027 Build AM PEAK	2027 No Build PM PEAK	2027 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
McWhirt Loop Banks Ford Parkway	Approach	Movement					
	EB	LT		30	36	69	34
		R		22	26	13	14
	WB	LT		37	51	36	46
		R	150	17	25		24
	SB	L	200				19
	NB	L	205			9	

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

The capacity analysis results indicate that the intersections analyzed are not expected to experience a significant increase in delay and/or an overall intersection level of service change due to the proposed development. Furthermore, the traffic signal timing adjustments being prepared by VDOT for the Route 17 corridor would most likely accommodate the traffic anticipated for the Cannon Ridge Village Development.

## Analysis of Future Conditions Design Year (2033)

### Capacity Analysis

This scenario evaluates the 2033 design year for the “No build” and “Build” conditions. The purpose for this comparison is to determine if mitigation improvements are necessary to accommodate the proposed Cannon Ridge Village Development. The LOS for the intersections in study are presented in the following tables ( **Table 46** to **Table 59**)

#### Geico / Stafford Lakes Parkway / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches is expected to operate at levels of service F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 46**.

**Table 46.** Geico / Stafford Lakes Parkway / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Geico / Stafford Lakes Parkway / Route 17	Approach	Movement								
	EB	L	144.2	F	144.2	F	77.9	E	77.9	E
		T	38.0	D	38.8	D	38.7	D	40.3	D
		R	15.4	B	15.4	B	15.4	B	15.4	B
		Approach	43.1	D	43.7	D	39.9	D	41.4	D
	WB	L	196.6	F	195.1	F	69.0	E	68.4	E
		T	2.8	A	3.4	A	7.2	A	7.9	A
		R	11.4	B	11.4	B	11.7	B	11.7	B
		Approach	69.8	E	68.6	E	12.3	B	12.9	B
	NB	L								
		T	96.2	F	96.2	F	431.7	F	431.7	F
		R	52.3	D	52.3	D	43.3	D	43.3	D
		Approach	58.5	E	58.5	E	184.8	F	184.8	F
	SB	L								
		T	63.9	E	63.9	E	59.8	E	59.8	E
		R	56.4	E	56.4	E	56.0	E	56.0	E
		Approach	60.8	E	60.8	E	57.3	E	57.3	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Banks Ford Parkway / Berea Church / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 47**.

**Table 47.** Banks Ford Parkway / Berea Church / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Berea Church / Route 17	Approach	Movement								
	EB	L	44.9	D	45.0	D	42.6	D	43.3	D
		T	15.4	B	15.9	B	21.1	C	22.3	C
		R	0.0	A	0.0	A	0.0	A	0.0	A
		Approach	14.9	B	15.3	B	19.6	B	20.5	C
	WB	L	73.6	E	73.3	E	61.7	E	61.6	E
		T	7.0	A	4.8	A	7.4	A	7.3	A
		R	0.0	A	0.0	A	0.0	A	0.0	A
		Approach	18.4	B	16.5	B	8.7	A	8.6	A
	NB	L	63.7	E	66.0	E	141.7	F	162.2	F
		T	63.8	E	65.9	E	135.8	F	158.4	F
		R	42.0	D	41.7	D	46.2	D	45.2	D
		Approach	57.0	E	59.3	E	107.9	F	123.6	F
	SB	L	68.0	E	68.0	E	68.0	E	68.0	E
		T	61.6	E	61.6	E	61.6	E	61.6	E
		R	56.2	E	56.2	E	56.2	E	56.2	E
		Approach	63.1	E	63.1	E	63.1	E	63.1	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Celebrate Virginia Parkway / International Parkway / Route 17

This four-legged signalized intersection is expected to operate at capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 48**.

**Table 48.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
Celebrate Virginia Parkway / Internation al Parkway / Route 17	Approac h	Movemen t								
	EB	L	37.0	D	36.3	D	34.0	C	33.9	C
		T	44.1	D	48.2	D	57.3	E	57.9	E
		R	12.0	B	13.4	B	15.6	B	15.9	B
		Approach	43.7	D	47.4	D	55.5	E	55.8	E
	WB	L	56.8	E	53.7	D	56.6	E	66.0	E
		T	49.5	D	56.9	E	36.1	D	36.3	D
		R	13.5	B	14.1	B	18.3	B	17.1	B
		Approach	45.6	D	52.1	D	35.1	D	35.6	D
	NB	L	61.8	E	60.8	E	61.7	E	64.0	E
		T	63.2	E	60.8	E	59.3	E	59.1	E
		R	60.0	E	59.1	E	58.3	E	58.5	E
		Approach	61.5	E	59.9	E	60.1	E	60.8	E
	SB	L								
		T	65.3	E	65.3	E	150.6	F	150.6	F
		R	49.9	D	49.9	D	47.5	D	47.5	D
		Approach	61.3	E	61.3	E	115.5	F	115.5	F

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Banks Ford Parkway / Car Dealership / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and the evening conditions. The capacity analysis results are summarized in **Table 49**.

**Table 49.** Banks Ford Parkway / Car Dealership / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Car Dealership / Route 17	Approach	Movement								
	EB	L								
		T	4.6	A	4.6	A	5.7	A	7.7	A
		R	5.4	A	5.8	A	8.0	A	8.7	A
		Approach	4.6	A	4.6	A	5.8	A	7.7	A
	WB	L	60.4	E	60.6	E	63.0	E	60.8	E
		T	23.8	C	26.6	C	24.8	C	27.3	C
		R								
		Approach	24.8	C	27.6	C	25.8	C	28.3	C
	NB	L	60.0	E	58.6	E	61.0	E	60.3	E
		T	60.0	E	58.6	E	60.0	E	60.4	E
		R	59.7	E	58.5	E	58.5	E	151.9	F
		Approach	59.8	E	58.5	E	58.8	E	140.1	F
	SB	L								
		T					63.6	E	63.6	E
		R								
		Approach	0.0	A	0.0	A	63.6	E	63.6	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

McWhirt Loop / Lichfield Boulevard / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 50**.

**Table 50.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
McWhirt Loop / Lichfield Boulevard / Route 17	Approach	Movement								
	EB	L	104.1	F	106.8	F	170.9	F	168.4	F
		T	13.7	B	13.6	B	16.6	B	22.1	C
		R	15.6	B	15.5	B	16.3	B	16.3	B
		Approach	22.9	C	22.7	C	34.6	C	38.2	D
	WB	L	29.0	C	28.9	C	30.6	C	30.7	C
		T	171.9	F	186.7	F	57.3	E	85.7	F
		R	1.1	A	1.0	A	1.0	A	1.1	A
		Approach	157.8	F	171.6	F	53.4	D	79.5	E
	NB	L								
		T	64.9	E	64.4	E	89.5	F	89.8	F
		R	55.6	E	55.8	E	60.4	E	72.6	E
		Approach	59.4	E	58.7	E	70.7	E	78.3	E
	SB	L	80.1	F	80.1	F	69.7	E	69.7	E
		T	78.5	E	78.5	E	68.5	E	68.5	E
		R	54.8	D	54.8	D	56.3	E	56.3	E
		Approach	69.0	E	69.0	E	62.0	E	62.0	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions. However, some of the approaches are expected to drop the level of service during the evening peak hour.

Commerce Parkway / Plantation Drive / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 51**.

**Table 51.** Commerce Parkway / Plantation Drive / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Commerce Parkway / Plantation Drive / Route 17	Approach	Movement								
	EB	L	35.8	D	34.6	D	37.2	D	37.0	D
		T	19.0	B	23.6	C	11.3	B	13.3	B
		R	11.7	B	11.7	B	1.4	A	1.4	A
		Approach	19.6	B	23.9	C	13.2	B	14.9	B
	WB	L	56.9	E	57.1	E	63.0	E	62.1	E
		T	181.8	F	195.5	F	23.8	C	39.2	D
		R	16.5	B	15.8	B	19.9	B	19.8	B
		Approach	166.5	F	179.1	F	24.4	C	37.4	D
	NB	L	57.7	E	57.7	E	60.6	E	60.6	E
		T	57.7	E	57.7	E	60.6	E	60.6	E
		R	55.8	E	55.8	E	56.3	E	56.3	E
		Approach	56.6	E	56.6	E	58.1	E	58.1	E
	SB	L	90.3	F	90.3	F	147.1	F	147.1	F
		T	90.3	F	90.3	F	148.2	F	148.2	F
		R	53.5	D	53.5	D	53.6	D	53.6	D
		Approach	79.4	E	79.4	E	115.7	F	115.7	F

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Commuter Lot / Falls Run Drive / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 52**.

**Table 52.** Commuter Lot / Falls Run Drive / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Commuter Lot / Falls Run Drive / Route 17	Approach	Movement								
	EB	L	83.7	F	83.1	F	85.9	F	84.8	F
		T	5.7	A	6.3	A	58.3	E	83.3	F
		R	8.5	A	8.5	A	15.1	B	15.1	B
		Approach	7.2	A	7.6	A	58.9	E	82.9	F
	WB	L	51.4	D	51.4	D	40.3	D	42.6	D
		T	76.9	E	87.0	F	25.4	C	41.9	D
		R	6.0	A	5.9	A	12.8	B	12.8	B
		Approach	74.2	E	83.9	F	25.6	C	41.3	D
	NB	T	62.1	E	62.1	E	85.0	F	85.0	F
		R	61.9	E	61.9	E	56.0	E	56.0	E
		Approach	61.9	E	61.9	E	65.8	E	65.8	E
	SB	L	64.5	E	64.5	E	82.8	F	82.8	F
		T	64.3	E	64.3	E	84.1	F	84.1	F
		R	59.3	E	59.3	E	56.6	E	56.6	E
		Approach	62.4	E	62.4	E	74.0	E	74.0	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions. However, the eastbound approach is expected to drop the level of service from E to F.

Victor Nailsen / McLanes Drive / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches are expected to operate at levels of service E during the morning and the evening conditions. The capacity analysis results are summarized in **Table 53**.

**Table 53.** Victor Nailsen / McLanes Drive / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELA Y (S)	LOS	DELAY (S)	LOS	DELA Y (S)	LOS
Victor Nailsen / McLane s Drive / Route 17	Approach	Movement								
	EB	L								
		T	1.6	A	1.6	A	2.0	A	2.4	A
		R								
		Approach	1.6	A	1.6	A	2.0	A	2.4	A
	WB	L	78.5	E	78.5	E	87.3	F	86.6	F
		T	22.3	C	25.6	C	6.5	A	7.6	A
		R	0.0	A	0.0	A	2.4	A	2.4	A
		Approach	22.6	C	25.8	C	6.8	A	7.9	A
	NB	L								
		T	61.6	E	61.6	E	54.7	D	54.7	D
		R								
		Approach	61.6	E	61.6	E	54.7	D	54.7	D
	SB	L								
		T	59.3	E	59.3	E	68.2	E	68.2	E
		R								
		Approach	59.3	E	59.3	E	68.2	E	68.2	E

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Sanford Drive / Stanstead Road / Route 17

This four-legged signalized intersection is expected to operate at or near capacity during the 2033 No Build conditions as several of the turning movements in one of the approaches is expected to operate at levels of service E and F during the morning and the evening conditions. The capacity analysis results are summarized in **Table 54**.

**Table 54.** Sanford Drive / Stanstead Road / Route 17 intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
Sanford Drive / Stanstea d Road / Route 17	Approac h	Movemen t								
	EB	L	38.0	D	38.5	D	43.2	D	44.2	D
		T	13.7	B	16.1	E	60.5	E	83.9	F
		R								
		Approach	14.5	B	16.8	B	59.8	E	82.4	F
	WB	L	88.5	F	88.5	F	73.4	E	73.4	E
		T	132.8	F	143.2	F	34.4	C	39.3	D
		R	14.3	B	14.3	B	15.0	B	15.1	B
		Approach	115.5	F	124.3	F	33.3	C	37.3	D
	NB	L								
		T	66.0	E	66.0	E	63.1	E	63.1	E
		R	36.2	D	36.2	D	44.0	D	44.0	D
		Approach	45.5	D	45.5	D	46.3	D	46.3	D
	SB	L	217.4	F	217.4	F	501.2	F	501.3	F
		T	234.1	F	234.1	F	518.3	F	518.3	F
		R	54.8	D	54.8	D	55.3	E	55.3	E
		Approach	204.3	F	204.3	F	429.7	F	429.7	F

Based on the results of the capacity analysis, this intersection, in general, is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions. However, the eastbound approach is expected to experience a drop in the level of service from D to E during the morning peak hour.

Banks Ford Parkway / Greenbank / Shopping Center

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2033 No Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 55**.

**Table 55.** Banks Ford Parkway / Greenbank / Shopping Center intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement								
	EB	L	10.1	B	10.3	B	12.3	B	12.7	B
		TR	8.6	A	8.6	A	10.5	B	10.8	B
		R	10.5	B			15.0	C		
		Approach	9.7	A	9.8	A	14.3	B	11.8	B
	WB	L	8.7	A	10.6	B	8.6	A	14.5	B
		T	7.4	A	8.7	A	8.8	A	8.6	A
		R	0.0				0.0			
		Approach	0.9		10.1	B	2.6		14.1	B
	NB	LTR	0.0		7.4	A	7.5	A	8.9	A
		Approach	0.0							
	SB	L							7.6	A
		Approach								

Based on the results of the capacity analysis, this intersection is not expected to experience a significant change (LOS drop) when comparing the No-Build and Build conditions.

Celebrate Virginia Parkway / Bolivar Point / Hyannis Place

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2033 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 56**.

**Table 56.** Celebrate Virginia Parkway / Bolivar Point / Hyannis Place intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
Celebrate VA Pkwy / Hyannis Place	Approach	Movement								
	EB	Approach	14.1	B	14.7	B	13.6	B	21.6	C
	WB	Approach	9.2	A	9.9	A	9.4	A	11.0	B
	NB	Approach	7.4	A			7.4	A	7.9	A
	SB	Approach	7.4	A	7.9	A	7.5	A	8.0	A

Celebrate Virginia Parkway / Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2033 No Build during the morning and evening conditions. The capacity analysis results are summarized in **Table 57**.

**Table 57.** Celebrate Virginia Parkway / Banks Ford Parkway intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
Celebrate Virginia Parkway / Banks Ford Parkway	Approach	Movement								
	EB	L	11.5	B	15.0	C	19.4	C	48.1	E
		R	9.6	A	10.0	A	9.7	A	10.6	B
		Approach	10.7	B	12.3	B	16.8	C	33.3	D
	WB	L	12.5	B	17.6	C	18.7	C	56.9	F
		R	9.1	A	9.4	A	9.1	A	9.4	A
		Approach	12.4	B	17.4	C	18.6	C	56.5	F
	NB	L	9.1	A	9.7	A	9.2	A	10.3	B
	SB	L	8.3	A	8.6	A	8.5	A	8.9	A
		Approach	0.3		0.2		2.2		1.6	

During the build conditions, the westbound left turn movement is projected to operate at or near capacity during the evening peak period. However, this analysis is based on the assumption that 20% of the traffic at this location will come to/from the south on route 17. However, since this condition would be as a result of the anticipated site traffic, it is most likely that this traffic would then use the direct connector access from route 17 to go south on Celebrate Parkway.

#### Celebrate Virginia Parkway / Scott's Ford Lane

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2033 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 58**.

**Table 58.** Celebrate Virginia Parkway / Scott's Ford Lane intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
Celebrate Virginia Parkway / Scott's Ford Lane	Approach	Movement								
	EB	L	8.9	A	11.0	B	8.9	A	12.2	B
		T	8.4	A	8.8	A	8.6	A	10.0	B
		Approach	8.7	A	10.3	B	8.9	A	11.8	B
	WB	L					8.9	A	10.9	B
		T	8.9	A	10.3	B				
		Approach	8.9	A	10.3	B	8.9	A	10.9	B
		T	7.3	A	7.5	A	7.3	A	7.7	A
		Approach	5.5	A			1.9			
		T	7.2	A	7.6	A	7.2	A	7.7	A

McWhirt Loop Banks Ford Parkway

This four-legged un-signalized intersection is expected to operate at acceptable levels of service during the 2033 No Build and Build conditions during the morning and evening conditions. The capacity analysis results are summarized in **Table 59**.

**Table 59.** McWhirt Loop Banks Ford Parkway intersection delays and LOS for 2033, existing conditions.

INTERSECTION			2033 No Build AM PEAK		2033 Build AM PEAK		2033 No Build PM PEAK		2033 Build PM PEAK	
			Conditions		Conditions		Conditions		Conditions	
			DELAY (S)	LO S	DELA Y (S)	LO S	DELAY (S)	LO S	DELA Y (S)	LO S
McWhirt Loop Banks Ford Parkway	Approach	Movement								
	EB						10.7	B		
			10.3	B	10.7	B	8.4	A	11.4	B
			8.4	A	8.4	A			8.4	A
		Approach	9.9	A	10.2	B	10.4	B	11.0	B
	WB		10.7	B	11.1	B	10.3	B	11.2	B
			8.5	A	8.7	A	8.6	A	8.7	A
		Approach	10.3	B	10.7	B	9.7	A	10.9	B
	NB		7.4	A	7.4	A	7.4	A	7.4	A
	SB		7.5	A	7.7	A	7.8	A	8.0	A

## Queuing

Besides the capacity analyses, the queuing was also evaluated for the future conditions in the design year 2033 to determine if the auxiliary lanes are adequate. The results of the queuing evaluation are summarized in the following tables (**Table 60** to **Table 65**).

### Banks Ford Parkway / Berea Church / Route 17

**Table 60.** Banks Ford Parkway / Berea Church / Route 17 intersection queuing report for 2033, existing conditions.

INTERSECTION			Existin g Storag e (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK
	Approac h	Movemen t		95th % Queue (ft)	95th % Queu e (ft)	95th % Queue (ft)	95th % Queu e (ft)
Banks Ford Parkwa y / Berea Church / Route 17	EB	L	185	29	21	49	63
		R	200	187	186	196	270
	WB	L	275	139	144	39	31
		L		182	177	13	39
		R	300				5
	NB	L		67	75	363	142
		LT		66	52	527	148
		R	160	16	48	240	112
	SB	L		88	66	86	130

Based on the queue evaluation, the existing auxiliary lane storage lengths for the eastbound right turn lane accommodate the anticipated traffic demand during the build traffic conditions.

Celebrate Virginia Parkway / International Parkway / Route 17**Table 61.** Celebrate Virginia Parkway / International Parkway / Route 17 intersection queuing report for 2033, existing conditions.

INTERSECTION			Existing Storage (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK	
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	
Celebrate Virginia Parkway / International Parkway / Route 17	Approach	Movement						
	EB	L	160	230	189	112	204	
		WB	L	200	194	46	264	263
			R	175	80	232	290	277
	NB	L		36	30	71	119	
		L		83	40	96	119	
	SB	LT		209	206	408	473	
		R			79	247	216	

Based on the queue evaluation, the existing auxiliary lane storage lengths for the eastbound left turn lane and westbound right turn lane would not be able to accommodate the anticipated traffic demand during the no-build and build traffic conditions.

Banks Ford Parkway / Car Dealership / Route 17**Table 62.** Banks Ford Parkway / Car Dealership / Route 17 intersection queuing report for 2033, existing conditions.

INTERSECTION			Existin g Storag e (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK
				95th % Queue (ft)	95th % Queu e (ft)	95th % Queue (ft)	95th % Queu e (ft)
Banks Ford Parkway / Car Dealership / Route 17	Approac h	Movemen t					
	EB	R					11
	WB	L	400	73	57	125	55
		L	400	47	41	97	71
	NB	L			20	15	40
		LT			10	15	14
		R				48	93=
	SB	LTR				23	

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

McWhirt Loop / Lichfield Boulevard / Route 17

**Table 63.** McWhirt Loop / Lichfield Boulevard / Route 17 intersection queuing report for 2033, existing conditions.

INTERSECTION			Existin g Storag e (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK
				95th % Queue (ft)	95th % Queu e (ft)	95th % Queue (ft)	95th % Queu e (ft)
McWhirt Loop / Lichfield Boulevard / Route 17	Approac h	Movemen t					
	EB	L	350	201	329	285	429
		R				25	13
	WB	L	290	70	60	45	70
		L	290	56	77	52	60
		R	400	40	39	16	26
	NB	LT		90	161	275	283
		R	70	79	120	104	112
	SB	L	120	174	172	112	135
		LT		187	437	130	155
R		145	123	196	165	144	

Based on the queue evaluation, the existing auxiliary lane storage lengths for the eastbound left turn lane and southbound left turn lane would not be able to accommodate the anticipated traffic demand during the build traffic conditions.

Banks Ford Parkway / Greenbank / Shopping Center**Table 64.** Banks Ford Parkway / Greenbank / Shopping Center intersection queuing report for 2033, existing conditions.

INTERSECTION			Existing Storage (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
Banks Ford Parkway / Greenbank / Shopping Center	Approach	Movement	185	33	43	52	26
	EB	TR		34	64	32	32
		WB	LT		26	29	44
			R		17	12	
	NB	L				29	31
	SB	R					

Based on the queue evaluation, the existing auxiliary lane storage lengths are adequate for the existing traffic demand.

McWhirt Loop Banks Ford Parkway**Table 65.** McWhirt Loop Banks Ford Parkway intersection queuing report for 2033, existing conditions.

INTERSECTION			Existing Storage (ft)	2033 No Build AM PEAK	2033 Build AM PEAK	2033 No Build PM PEAK	2033 Build PM PEAK
				95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)	95th % Queue (ft)
McWhirt Loop Banks Ford Parkway	Approach	Movement					
	EB	LT		25	36	26	46
		R		15		25	16
	WB	LT		75	67	30	61
		R		150	17	21	28

The capacity analysis results indicate that the intersections analyzed are not expected to experience a significant increase in delay and/or an overall intersection level of service change due to the proposed development. Furthermore, the traffic signal timing adjustments being prepared by VDOT for the Route 17 corridor would most likely accommodate the traffic anticipated for the Cannon Ridge Village Development.

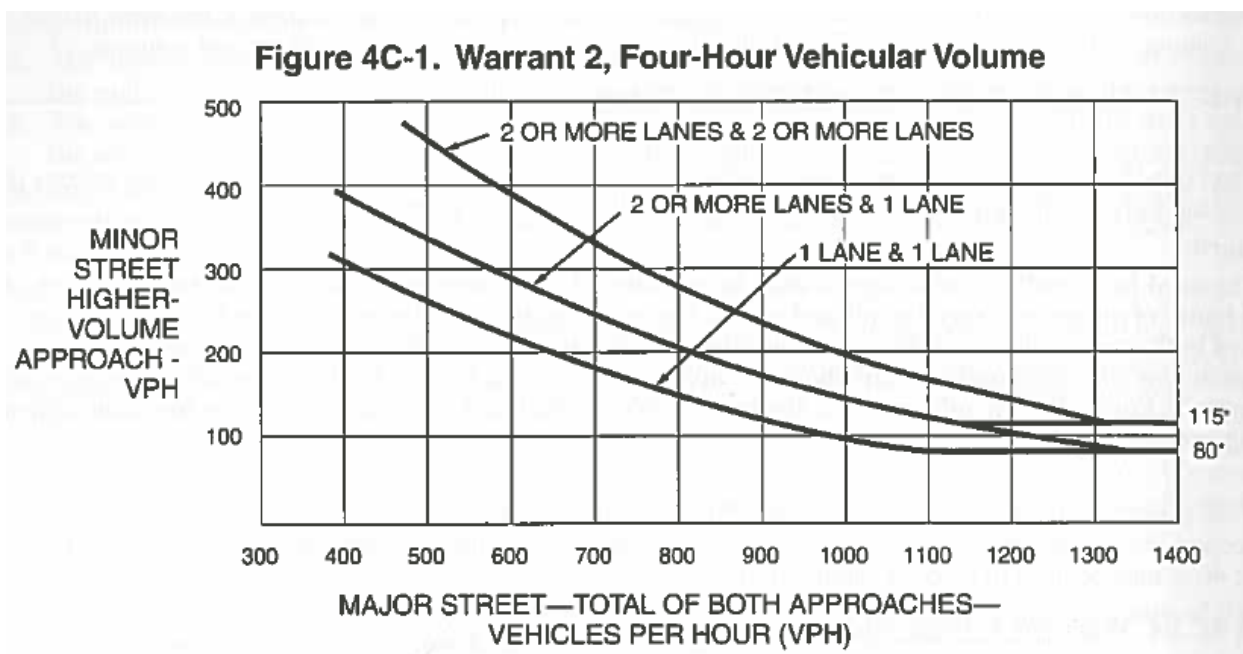
## Traffic Signal Warrant Evaluation

As documented in the Scope of work (**Appendix A**), a “limited” traffic signal warrant evaluation was completed for the Banks Ford Parkway / Celebrate Virginia Parkway intersection. Only the four-hour and the peak hour warrants were evaluated under this scenario as follow:

### Warrant 1: Four-hour Vehicular Volume

**Table 66.** Traffic volumes in four hours at the Banks Ford Parkway / Celebrate Virginia Parkway intersection.

	6:45-7:30	7:45-8:30	15:15-16:00	16:45 -17:30
<b>Major Street (Celebrate Virginia Parkway)</b>	188	267	309	318
<b>Minor Street (Banks Ford Parkway)</b>	70	128	159	220



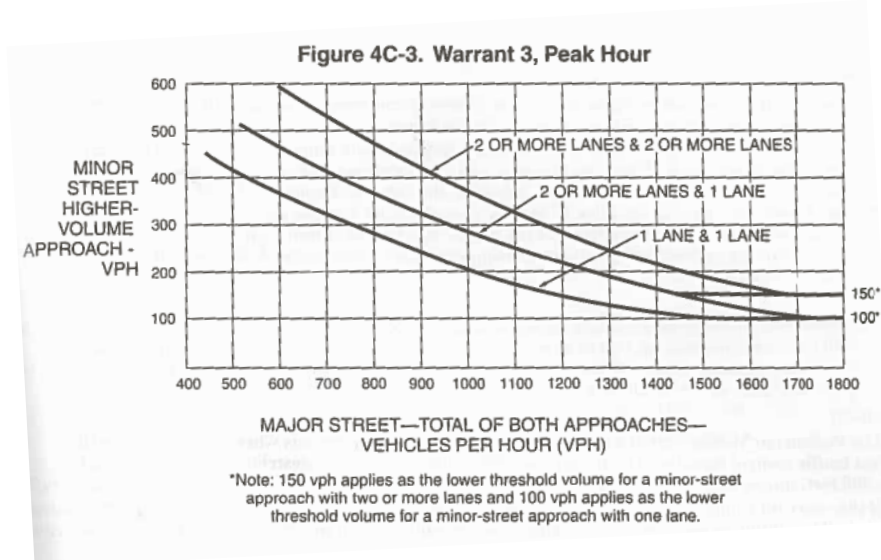
**Figure 17.** Four- hour warrant for traffic sign evaluation.

### Warrant 3: Peak Hour

**Table 67** depicts the volumes of the peak hours and based on **Figure 18**, indicates if it meets the warrant or not. As a result of the evaluation it is possible to conclude that a traffic signal is not required in that intersection.

**Table 67.** Traffic volumes in the peak hours at the Banks Ford Parkway / Celebrate Virginia Parkway intersection.

Scenario	Minor street higher volume approach (Banks Ford Parkway)		Major street Total volume of both approaches (Celebrate Virginia Parkway)		Warrant met?
	AM	PM	AM	PM	
Existing conditions 2017	70	158	267	318	NO
2027 No Build	85	193	325	388	NO
2027 Build	115	238	556	667	NO
2033 No Build	96	217	367	437	NO
2033 Build	126	262	598	716	NO

**Figure 18.** Peak hour warrant for traffic sign evaluation.

Based on the results of the traffic signal warrant analyses, the anticipated traffic volumes for the build out year and the design year are not expected to meet the warrants as a result of the proposed Cannon Ridge Village Development.

### Transit access

The potential transit access to the site and to Del-Webb development was evaluated. Although there are several means of transportation in the area such as cab companies and Uber, the only bus route identified in the vicinity of the project area is Route D2 which provides service to FRED Central, England Run, Olde Forge Shopping Center and Geico. This service route provides bus stops directly to Geico and the Shopping Center.

It is recommended for the County to explore opportunities for extending the service to Del-Webb and the proposed Cannon Ridge Village development.

### **Bike and Pedestrian accommodations**

As discussed in the Scope of work (**Appendix A**), the bike and pedestrian accommodations were evaluated in the area. It was found during the field visit, that there is a multipurpose trail along the eastside of Celebrate VA Parkway. This trail limits are from Scott's Ford Road to approximately 200 feet south of Jewett Lane where it changes to a regular sidewalk. This pedestrian facility includes lighting and curb ramps at major intersections.

It is recommended to connect the pedestrian facilities from the proposed Cannon Ridge Village Development to the existing multi-purpose trail to maintain pedestrian connectivity along Celebrate VA Parkway.

## **Summary of findings and Conclusions**

Based on the capacity analyses, most of the turning movement for the signalized intersections evaluated in this assessment did not experience significant changes in the levels of service due to the proposed site.

- The proposed development is expected to generate 282 trips during the morning peak hour (IN: 94 and OUT: 189) and 388 trips during the evening peak hour (IN: 190 and OUT: 388).
- Based on the capacity analyses, most of the turning movement for the signalized intersections evaluated in this study are not expected to experience significant changes in the levels of service due to the proposed development.
- VDOT's current Route 17 corridor study is expected to modify/adjust the existing traffic signal timings along the corridor. Since this study identified minimal changes in delay and/or levels of service due to the proposed development, it is anticipated that VDOT's traffic signal timing adjustments will also be able to accommodate the traffic anticipated for the Cannon Ridge Village Development.
- The results of the capacity analyses for the un-signalized intersections indicate that the intersections evaluated in this report would continue to operate at acceptable levels of service C or better during the 2027 and 2033 scenarios.
- The minimal impacts identified in this report do not require physical alteration improvements to the existing roadway network.
- The installation of a traffic signal is not warranted at the intersection of Banks Ford Parkway / Celebrate Virginia Parkway.
- It is recommended for the County to explore opportunities for extending the service of Route D2 to Del-Webb and the proposed Cannon Ridge Village development.

- It is recommended to connect the pedestrian facilities from the proposed Cannon Ridge Village Development to the existing multi-purpose trail to maintain pedestrian connectivity along Celebrate VA Parkway.
- The results of this traffic impact study indicate that significant changes in levels of service were not observed as a result of the proposed Cannon Ridge Development. Therefore, these results indicate that the proposed Cannon Ridge Village Development has no significant or minimal impact on the existing roadway system.

## **Appendix A: Scope of Work**

## PRE-SCOPE OF WORK MEETING FORM

### Information on the Project Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

#### Contact Information

Consultant Name:	Bowman Consulting Group - Carlos Garcia, PE
Tele:	804-616-3240
E-mail:	cgarciab@bowmanconsulting.com
Developer/Owner Name:	Colin Stiles
Tele:	703-263-2400
E-mail:	Colin.Stiles@lennar.com

#### Project Information

Project Name:	Cannon Ridge Village			
Project Location: (Attach regional and site specific location map)	Stafford County, Virginia (See Figure 1 and 2)			
Project Description: Including type of application (rezoning, subdivision, site plan), acreage, business square ft, number of dwelling units, access location, etc. Attach additional sheet if necessary)	The project consists of approximately 531.56 acres, which are zoned RBC district. The proposed development will consist of 1,220 age restricted residential units (980 units are detached and 240 are attached).			
Locality/County:	Stafford County			
Proposed Use: (Check all that apply; attach additional pages as necessary)	<b>Residential</b> <input checked="" type="checkbox"/>	<b>Commercial</b> <input type="checkbox"/>	<b>Mixed Use</b> <input type="checkbox"/>	<b>Other</b> <input type="checkbox"/>
<p><b>* The trip generation rates were determined based on actual data from Del-Webb (Age Restricted Development located near Cannon Ridge) and in coordination with VDOT and the County.</b></p>	<b>Residential</b> # of Units: <u>1,220</u>  <b>Commercial</b> Use Sq Ft: * _____  ITE LU Code(s): _____ _____ _____ _____		<b>Mixed Use:</b> # Res. Units: _____ ITE LU Code(s): _____ Commercial Use Sq Ft: _____ ITE LU Code(s): _____  <b>Other:</b> _____ ITE LU Code(s): _____ Sq Ft: _____	


It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Traffic Impact Analysis Assumptions					
Study Period	Existing Year: 2017	Build-out Year: 2027		Design Year: 2033	
Study Area Boundaries (Attach map)	North: Celebrate Parkway / Route 17		South:		
	East: I-95		West:		
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	VDOT's US-17 corridor study I-95 Southbound Collector-Distributor Lanes – Rappahannock River Crossing I-95 Express Lanes Fredericksburg Extension (Fred Ex)				
Consistency With Comprehensive Plan	Yes, The property is within the Suburban future land use designation in the Comprehensive Plan.				
Available Traffic Data (Historical, forecasts)	Traffic Data from Virginia Roads (ADT's) See attached (VDOT also provided traffic counts along the US-17 Corridor)				
Trip Distribution (Attach sketch)	Road Name: US 17	N <u>20</u> %	S <u>80</u> %	E <u>    </u> %	W <u>    </u> %
See attachments for additional information.	Road Name: Celebrate Virginia Pkwy	N <u>    </u> %	S <u>100</u> %	E <u>    </u> %	W <u>    </u> %
	Road Name:	N <u>    </u> %	S <u>    </u> %	E <u>    </u> %	W <u>    </u> %
	Road Name:	N <u>    </u> %	S <u>    </u> %	E <u>    </u> %	W <u>    </u> %
Annual Vehicle Trip Growth Rate:	2%	Peak Period for Study (check all that apply)		<input checked="" type="checkbox"/> AM	<input checked="" type="checkbox"/> PM <input type="checkbox"/> SAT
Study Intersections and/or Road Segments (Attach additional sheets as necessary)	1. Scott's Ford Road and Celebrate VA Parkway		6. McWhirt Loop/Warrenton Road/Lichfield Blvd		
	2. Warrenton Road (RT. 17) and Berea Church Road		7. Greenbank Road and Banks Ford Parkway		
	3. Warrenton Road and Celebrate VA Parkway		8. Banks Ford Parkway and McWhirt Loop		
	4. Banks Ford Parkway and Warrenton Road		9. Celebrate VA Pkwy & Hyannis Pl & Bolivar Point Ln		
	5. Banks Ford Parkway and Celebrate VA Parkway		10.		
Trip Adjustment Factors	Internal allowance: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Reduction: <u>15 (*)</u> % trips		Pass-by allowance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Reduction: <u>    </u> % trips		
Software Methodology	<input checked="" type="checkbox"/> Synchro <input type="checkbox"/> HCS (v.2000/+) <input type="checkbox"/> aaSIDRA <input type="checkbox"/> CORSIM <input type="checkbox"/> Other <u>    </u>				
Traffic Signal Proposed or Affected (Analysis software to be used, progression speed, cycle length)	Adjustments to the existing signals will be evaluated and included in the study.				

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Improvement(s) Assumed or to be Considered	Traffic signal timing adjustments to existing traffic lights from Celebrate Pkwy to Sanford Drive (if needed).
Background Traffic Studies Considered	The area boundaries does have any existing traffic studies that can be considered as part of this study.
Plan Submission	<input type="checkbox"/> Master Development Plan (MDP) <input checked="" type="checkbox"/> Generalized Development Plan (GDP) <input type="checkbox"/> Preliminary/Sketch Plan <input type="checkbox"/> Other Plan type (Final Site, Subd. Plan)
Additional Issues to be addressed	<input checked="" type="checkbox"/> Queuing analysis <input checked="" type="checkbox"/> Actuation/Coordination <input type="checkbox"/> Weaving analysis <input type="checkbox"/> Merge analysis <input checked="" type="checkbox"/> Bike/Ped Accommodations <input checked="" type="checkbox"/> Intersection(s) <input checked="" type="checkbox"/> TDM Measures <input type="checkbox"/> Other _____

NOTES on ASSUMPTIONS: \*See attached list of notes and assumptions\*

SIGNED:  DATE: 10/17/2017  
Applicant or Consultant

PRINT NAME: Carlos G. Garcia, PE  
Applicant or Consultant

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

## Cannon Ridge Village

## Administrative Guidelines

April 2013

## SCOPE OF WORK MEETING CONCLUSIONS

## ADDITIONS TO THE VDOT REQUIRED ELEMENTS, CHANGES TO THE METHODOLOGY OR STANDARD ASSUMPTIONS, AND SIGNATURE PAGE

**Any additions to the VDOT Required Elements or changes to the Methodology or Standard Assumptions due to special circumstances that are approved by VDOT:**

*[The page contains faint horizontal lines, suggesting ghosting or extremely faded text.]*

The applicant will contact VDOT and the locality prior to the preparation of the traffic impact analysis study in the event there are any substantial changes in the existing conditions that will affect the scope of the study.

**AGREED:**

Applicant or Consultant

DATE: 10/17/17

**PRINT NAME:**

Carlos G. Garcia, PE  
Applicant or Consultant

**SIGNED:**

**VDOT Representative**

DATE: 11/9/17

**PRINT NAME:**

DAVID L BEALE  
VDOT Representative

**SIGNED:**

**Local Government Representative**

DATE: 11/9/17

**PRINT NAME:**

Charles J. Hess  
Local Government Representative

## **NOTES AND ASSUMPTIONS**

### **VDOT requested to evaluate the following intersections along the US 17 Corridor:**

1. Stafford Lakes Parkway and Warrenton Road (US 17) (Not need to discuss in TIA but needs to be included in the Synchro model)
2. Banks Ford Parkway/ Berea Church Road and Warrenton Road (US 17) (Not need to discuss in TIA but needs to be included in the Synchro model)
3. Celebrate Virginia Parkway/International Parkway and Warrenton Road (US 17)
4. Banks Ford Parkway/Car Dealership and Warrenton Road (US 17)
5. McWhirt Loop/Lichfield Boulevard and Warrenton Road (US 17)
6. Commerce Parkway/Plantation Drive and Warrenton Road (US 17)
7. Commuter lot/Falls Run Drive and Warrenton Road (US 17)
8. Victor Neilsen Drive/Mclanes Drive and Warrenton Road (US 17)
9. Sanford Drive/Stanstead Road and Warrenton Road (US 17)

We will not need new traffic counts as VDOT will provide traffic data along the corridor including the Synchro files for the morning and evening peak periods. (VDOT provided the information on 10/5/17)

### **VDOT & County requested to:**

- Re-evaluate the proposed trip generation since information from the ITE trip generation manual appears to be low for age restricting housing. It was recommended to evaluate the trip generation for the existing age restricting community (Del-Webb along Celebrate Virginia Parkway). **(1)**
- Re-evaluate the trip distribution using the traffic data provided by VDOT along US 17 (Considering that the connection of Scott's Ford Lane and Greenbank Road will be eliminated). **(2)**
- Internal capture will be considered (15%) for site trips to the shopping center on Celebrate Virginia Parkway (\*).
- Complete and prepare a traffic signal warrant analysis at the intersection of Banks Ford Parkway and Celebrate Virginia Parkway. Based on discussions with VDOT on 10/16/17, the signal warrant analyses will be completed for the peak hour and four hour warrants.
- Discuss potential transit access to site and to Del-Webb.
- Discuss potential bike and Ped accommodations along Celebrate Virginia Parkway (one side).
- Discuss the future use of the site roadway network (Public vs Private)
- The property is within the Suburban future land use designation in the Comprehensive Plan. The property is within the Suburban future land use designation in the Comprehensive Plan, Within these areas the Plan recommends a maximum density of 3 units per acre for single-family detached units and a density of between 3.5 to 7 units per acre for townhomes and 7 to 15 units per acre for apartments/condos.

**Follow up-**

- 1) Based on coordination with the County, it was determined that the current Del-Webb Development has built approximately 720 units. Based on the traffic data collected for the Del-Webb development (turning movement counts at the site entrance for the AM and PM peak periods), trip generation rates were developed as follow:

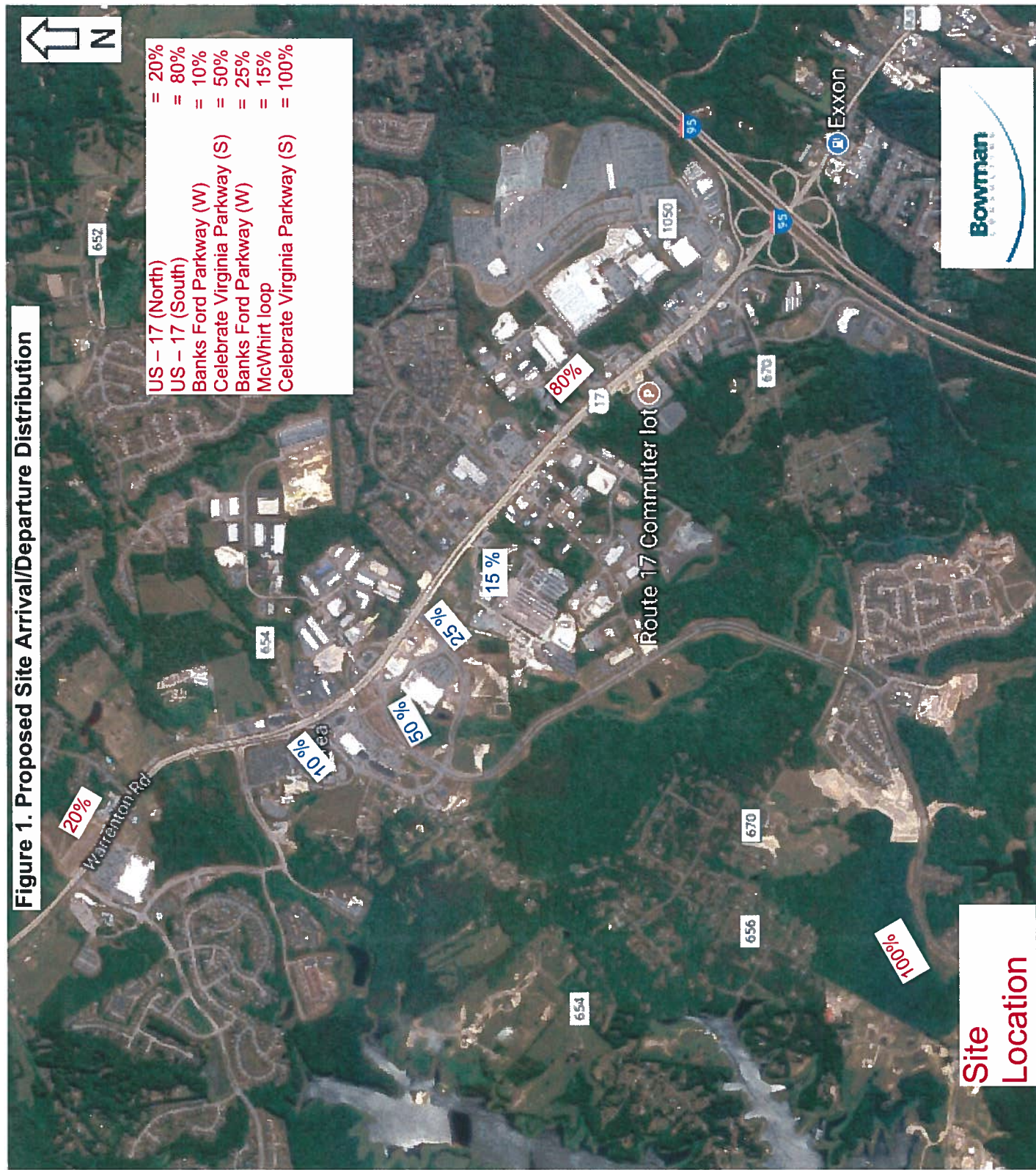
<u>Del- Webb</u>			
720	Units	Per County's assessment (See email dated 11/2/2017)	
<i>Traffic Volumes Collected Bowman</i>			
172	Morning Trips		
236	Evening Trips		
<u>Trip generation Ratio</u>			
Morning Peak	=	172/720 =	0.24
Evening Peak	=	236/720 =	0.33

The information described above was review and compared against the ITE rates by the County and VDOT. Based on the review, it was determined that the rates from the Del-Webb Development were higher than the ITE rates. Therefore, the traffic impact study will use the trip generation rates determined for the existing Del-Webb Development which is also an Age Restricted Development located nearby the Cannon Ridge Site and along Celebrate Virginia Parkway.

- 2) The arrival/departure trip distribution rates have been revised based on traffic data along US 17 obtained from VDOT. The rates were discussed with VDOT on 10/16/17 and are summarized below:

US – 17 (North)	=	20%
US – 17 (South)	=	80%
Banks Ford Parkway (W)	=	10%
Celebrate Virginia Parkway (S)	=	50%
Banks Ford Parkway (W)	=	25%
McWhirt loop	=	15%
Celebrate Virginia Parkway (S)	=	100%

Figure 1. Proposed Site Arrival/Departure Distribution



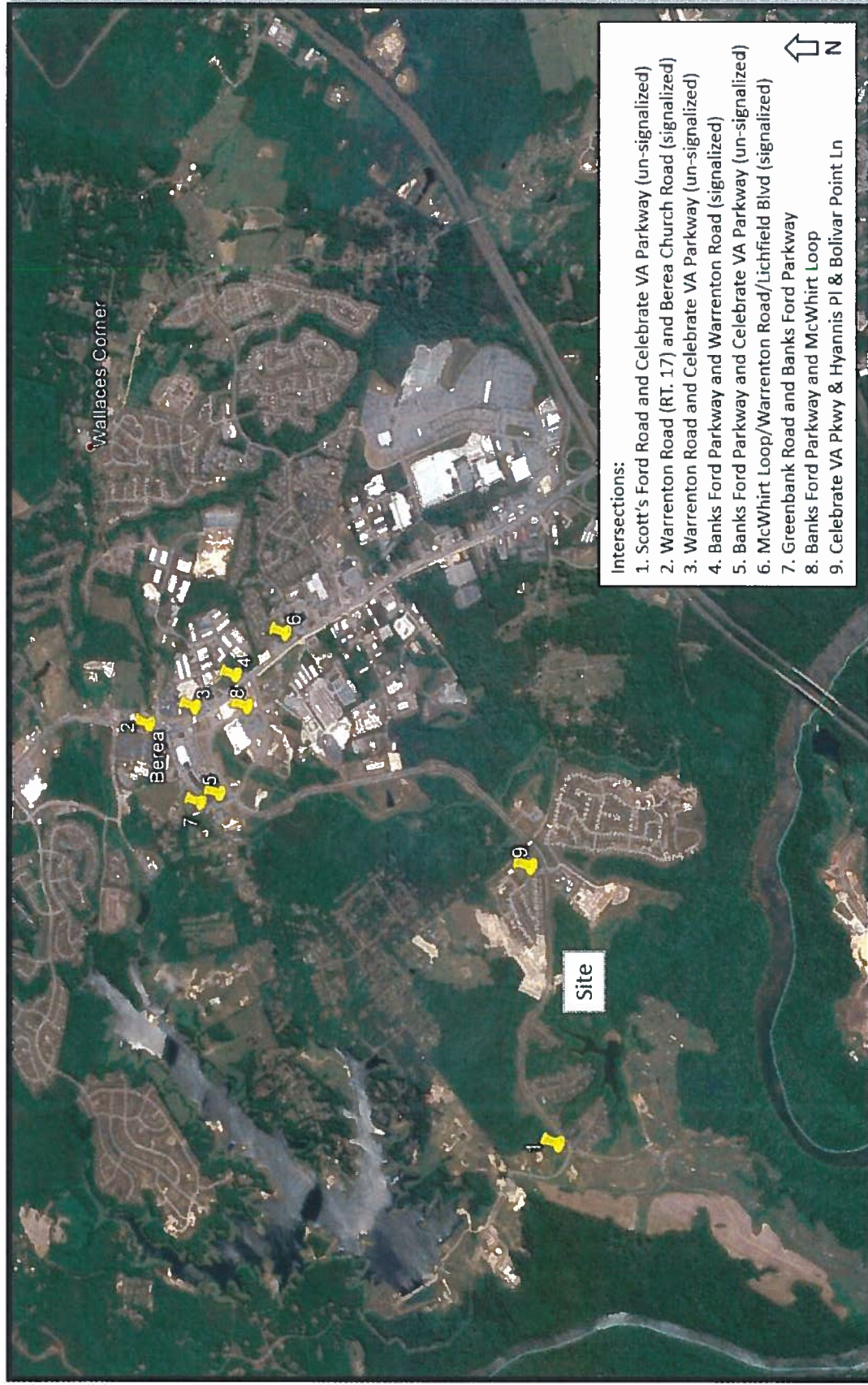


Figure 1. Location of the intersections proposed to be analyzed.

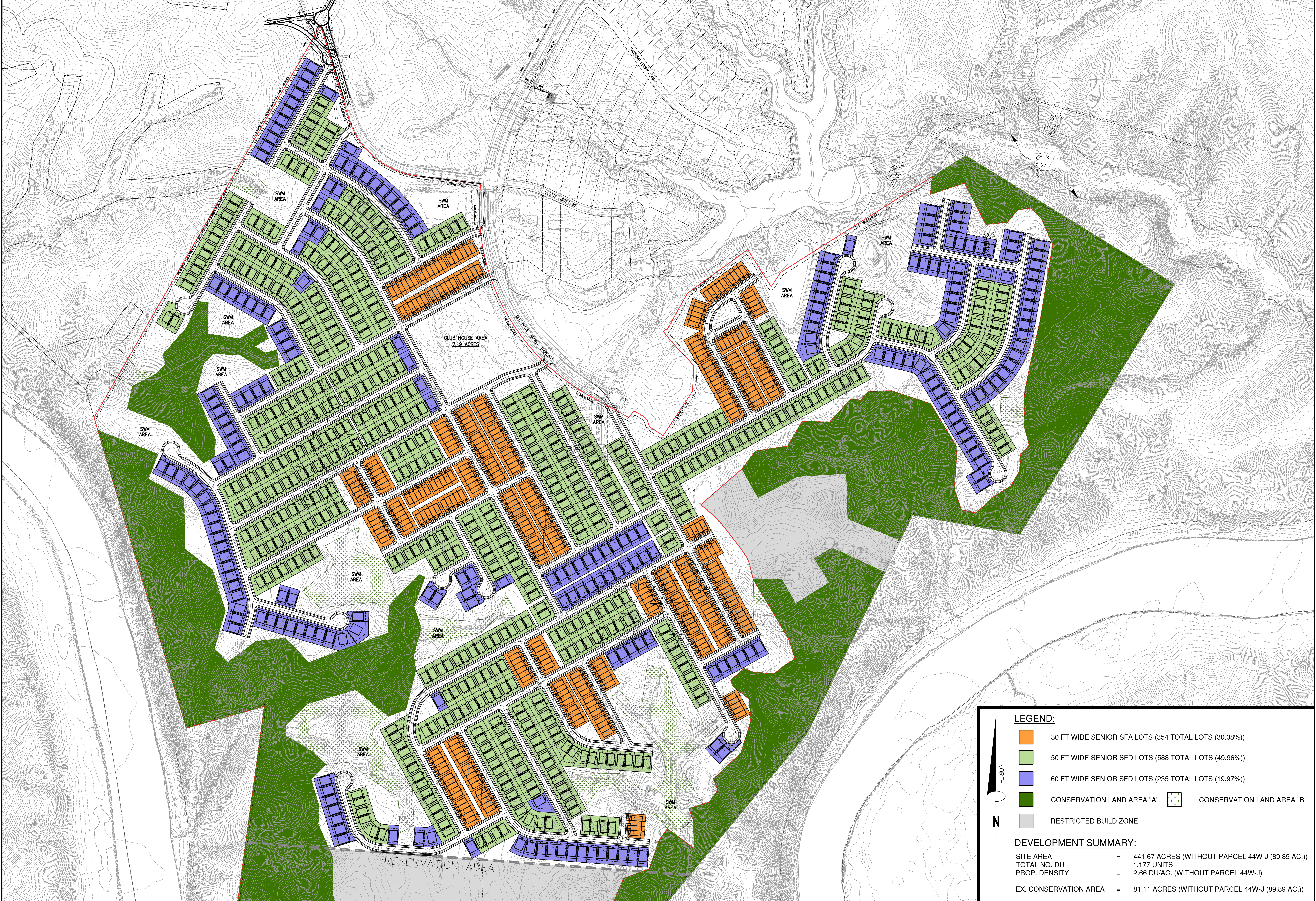
Table 1. Average Daily Traffic

Road	Average Daily Traffic (ADT)
VA-670 E	2,500
SC-654 E (Celebrate VA Parkway)	2,200
US-17 W	38,000
US-17 E	32,000
I-95 N	133,000
I-95 S	147,000

Table 2. Trip Generation Estimation

Land Use	Size	Units	Land Use Code	Weekday					
				AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
<b>Residential</b> Age Restricted Development	1,220 D.U.		251	Rate= 0.24			Rate= 0.33		
				98	196	293	197	205	403
				98	196	293	197	205	403

Notes The trip generation data was generated from actual traffic data from Del-Webb which is a similar type development located nearby and along Celebrate Virginia Parkway.

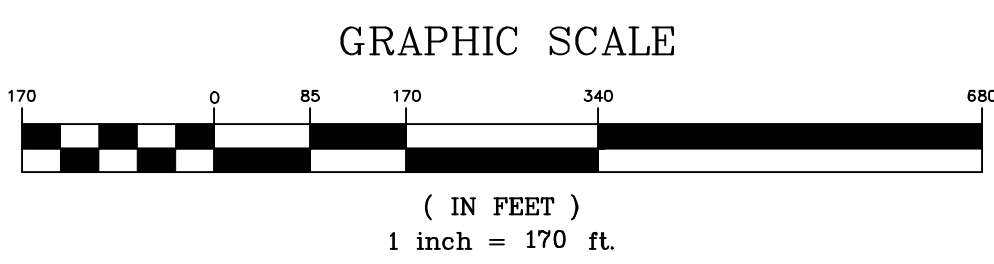


**LEGEND:**

- 30 FT WIDE SENIOR SFA LOTS (354 TOTAL LOTS (30.08%))
- 50 FT WIDE SENIOR SFD LOTS (588 TOTAL LOTS (49.96%))
- 60 FT WIDE SENIOR SFD LOTS (235 TOTAL LOTS (19.97%))
- CONSERVATION LAND AREA "A"
- CONSERVATION LAND AREA "B"
- RESTRICTED BUILD ZONE

**DEVELOPMENT SUMMARY:**

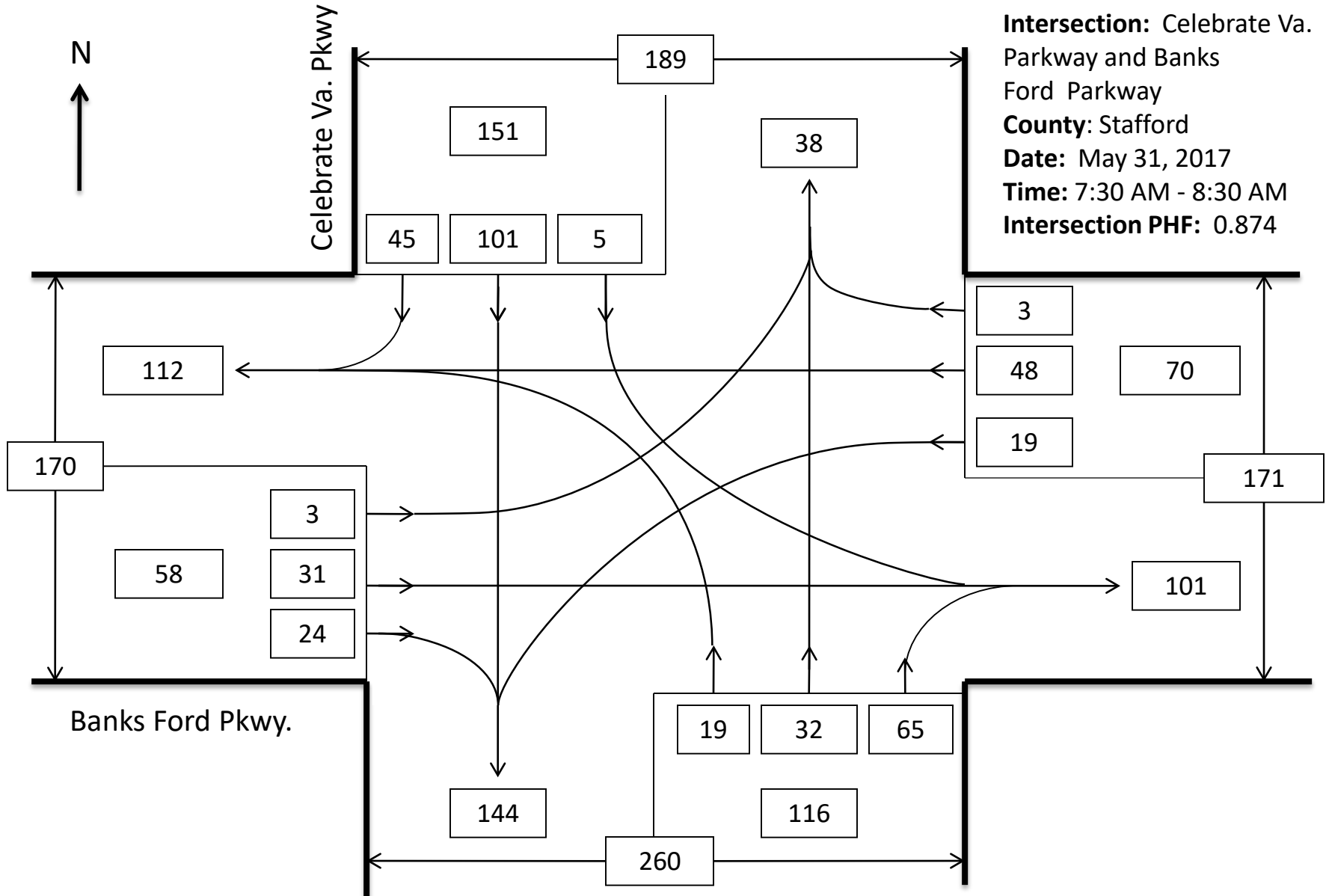
SITE AREA	=	441.67 ACRES (WITHOUT PARCEL 44W-J (89.89 AC.))
TOTAL NO. DU	=	1,177 UNITS
PROP. DENSITY	=	2.66 DU/AC. (WITHOUT PARCEL 44W-J)
EX. CONSERVATION AREA	=	81.11 ACRES (WITHOUT PARCEL 44W-J (89.89 AC.))



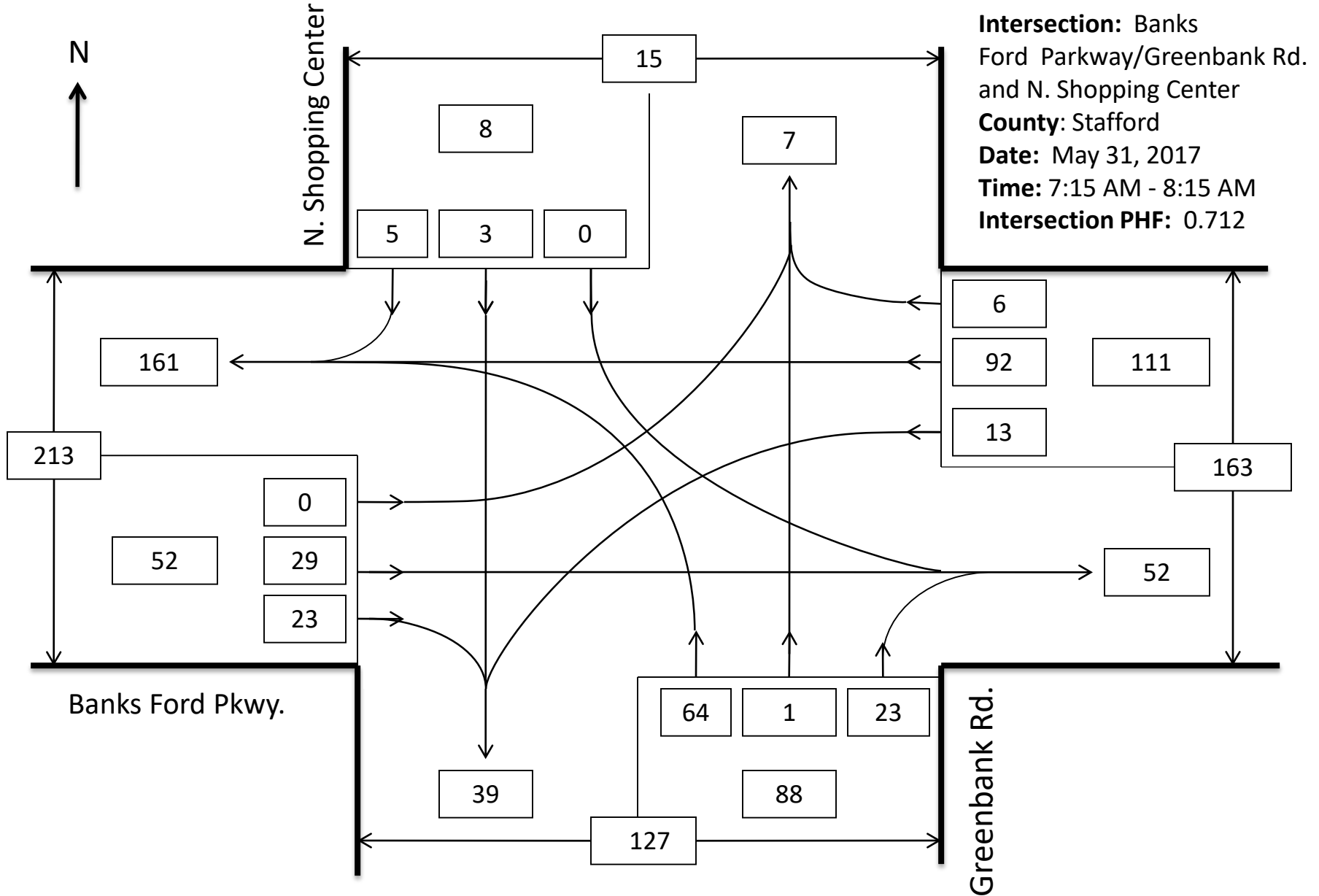
CANNON RIDGE  
 AGE RESTRICTED COMMUNITY  
 HARTWOOD MAGISTERIAL DISTRICT, STAFFORD COUNTY, VIRGINIA

## **Appendix B: Traffic Counts**

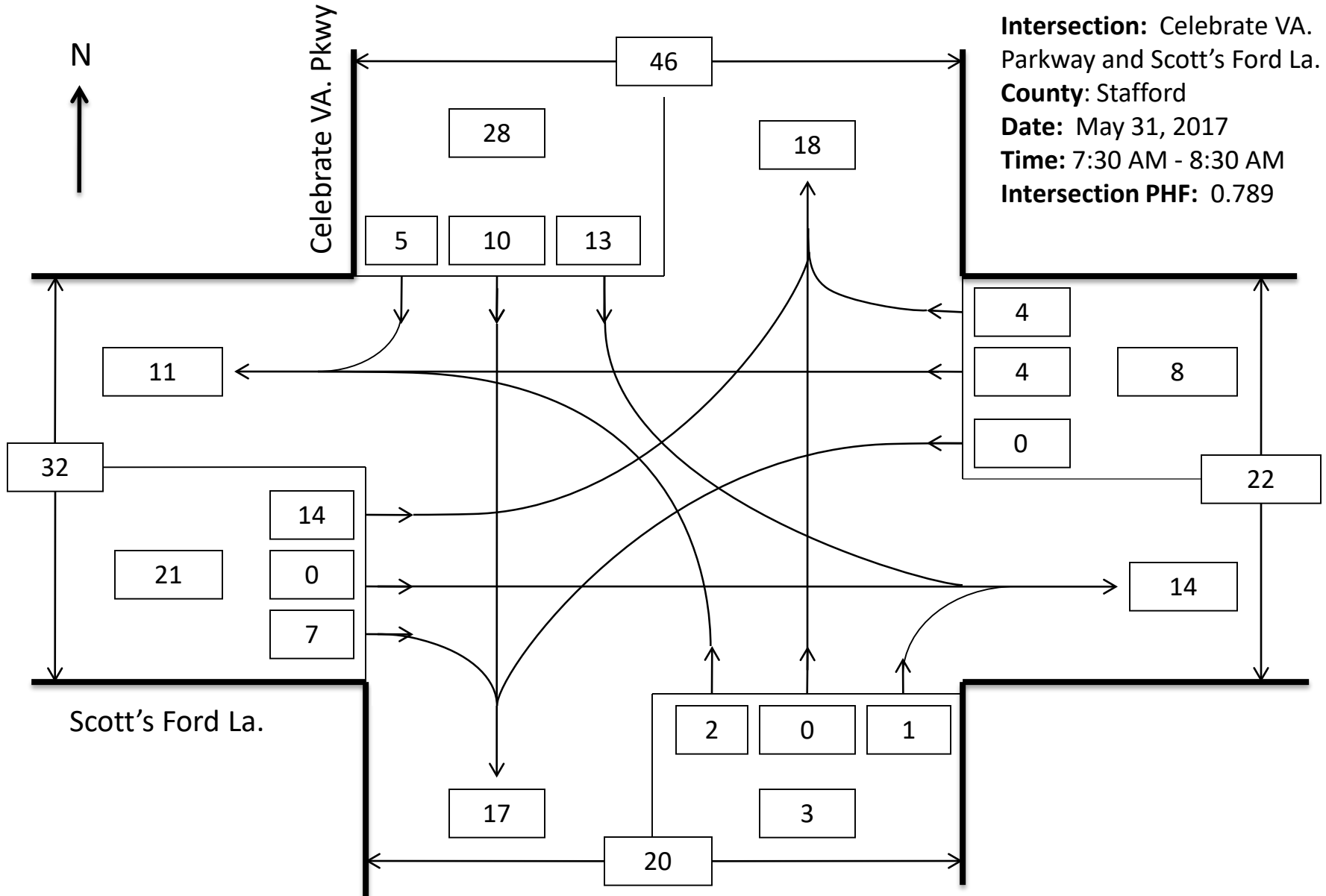
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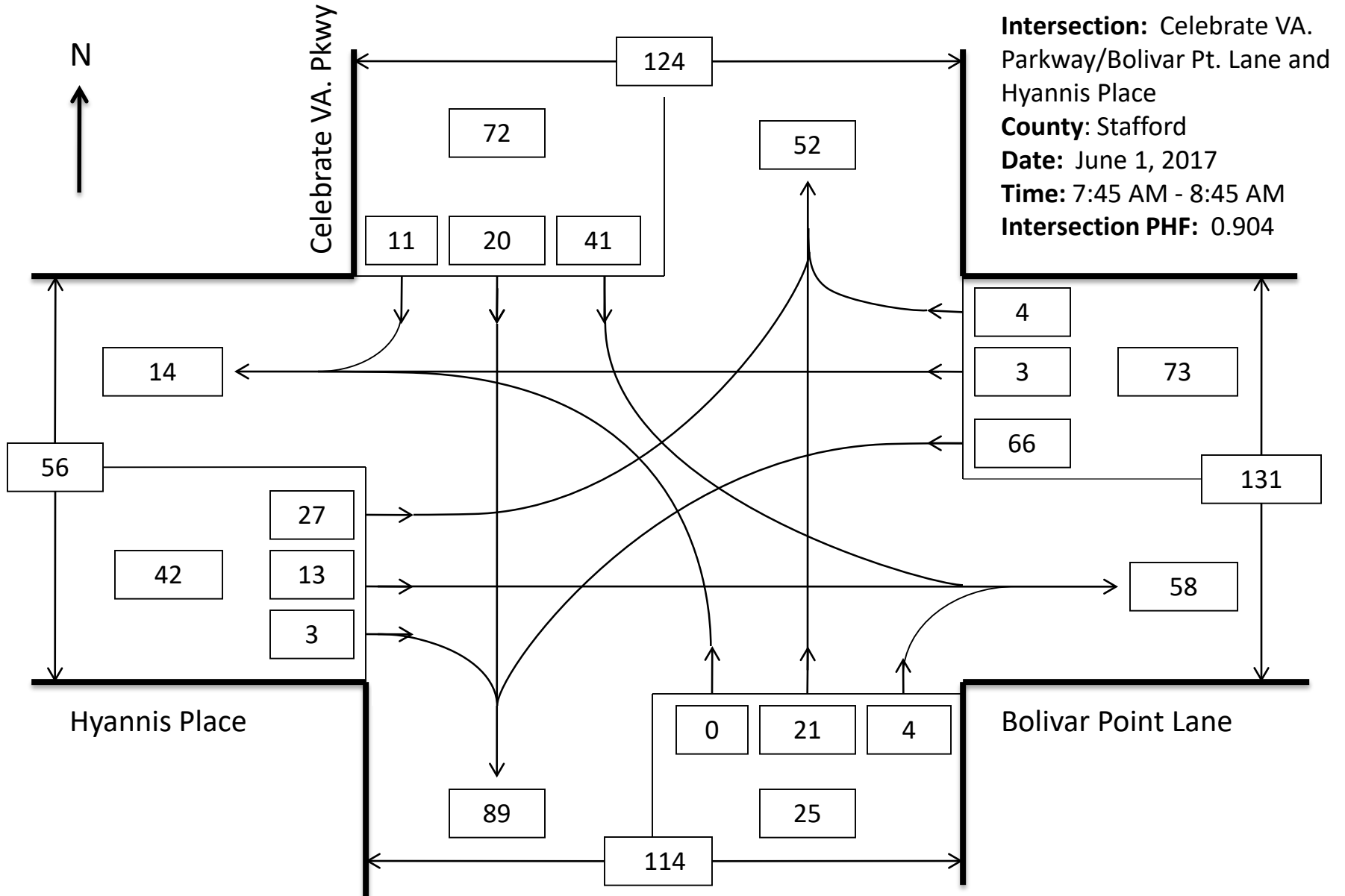
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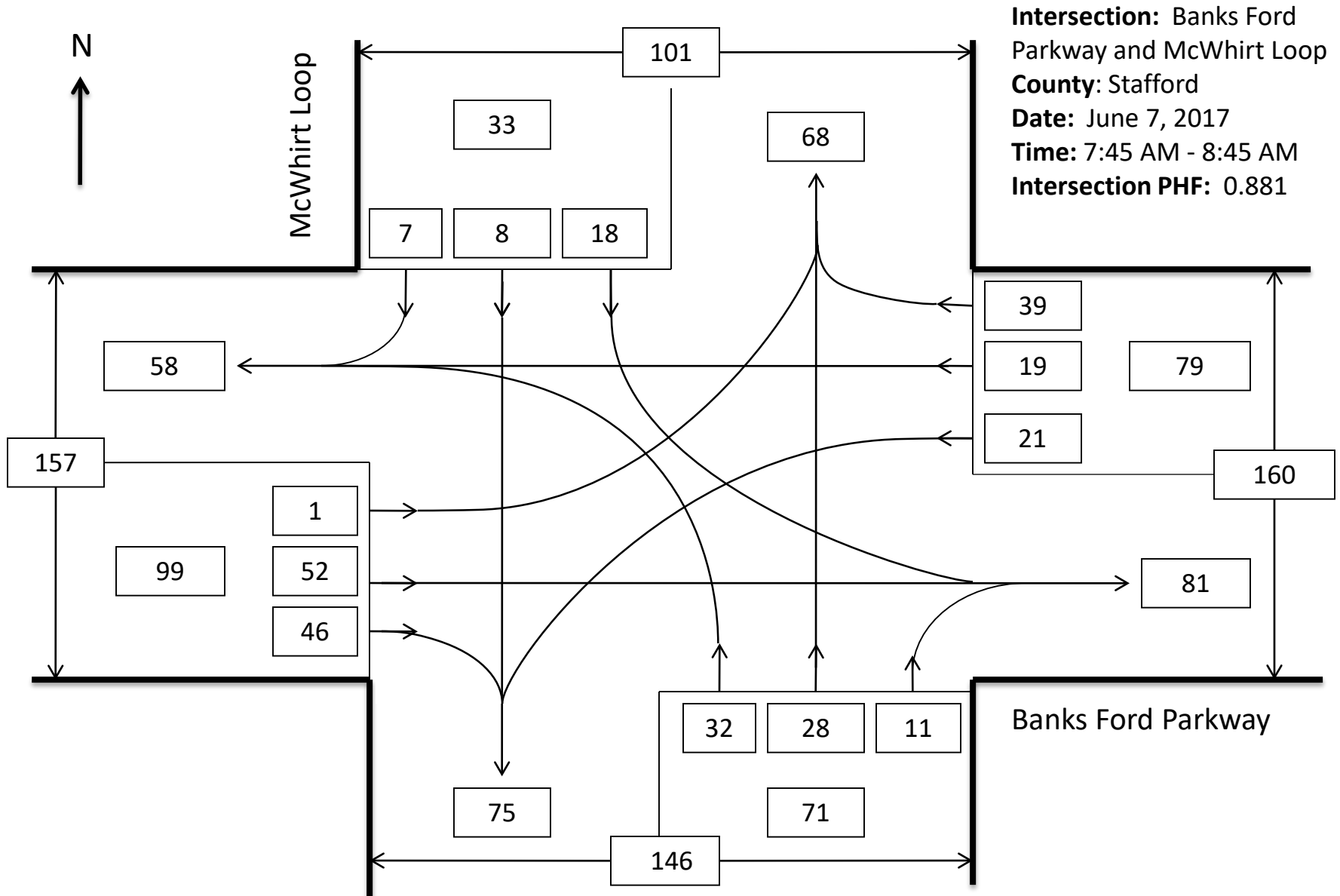
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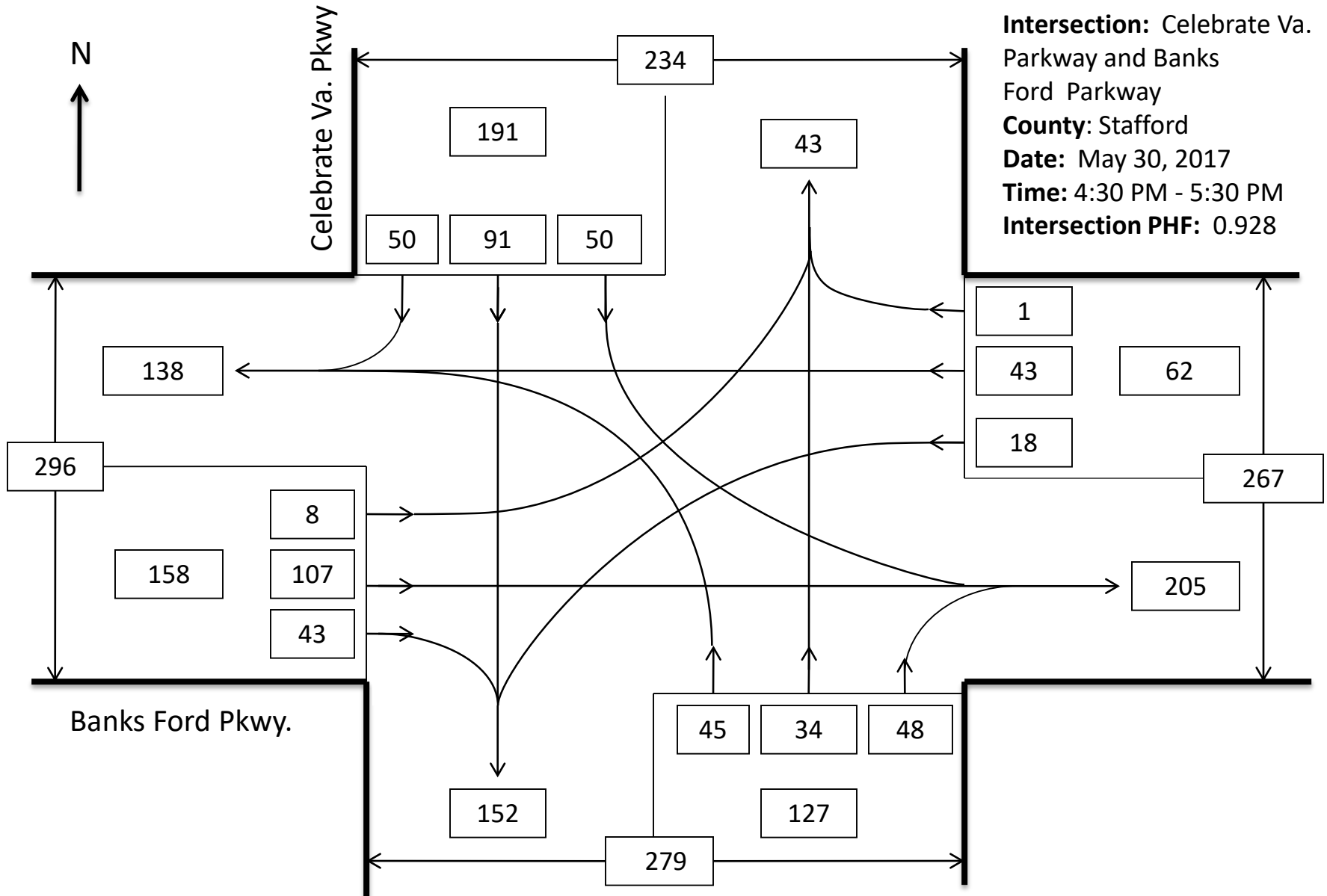
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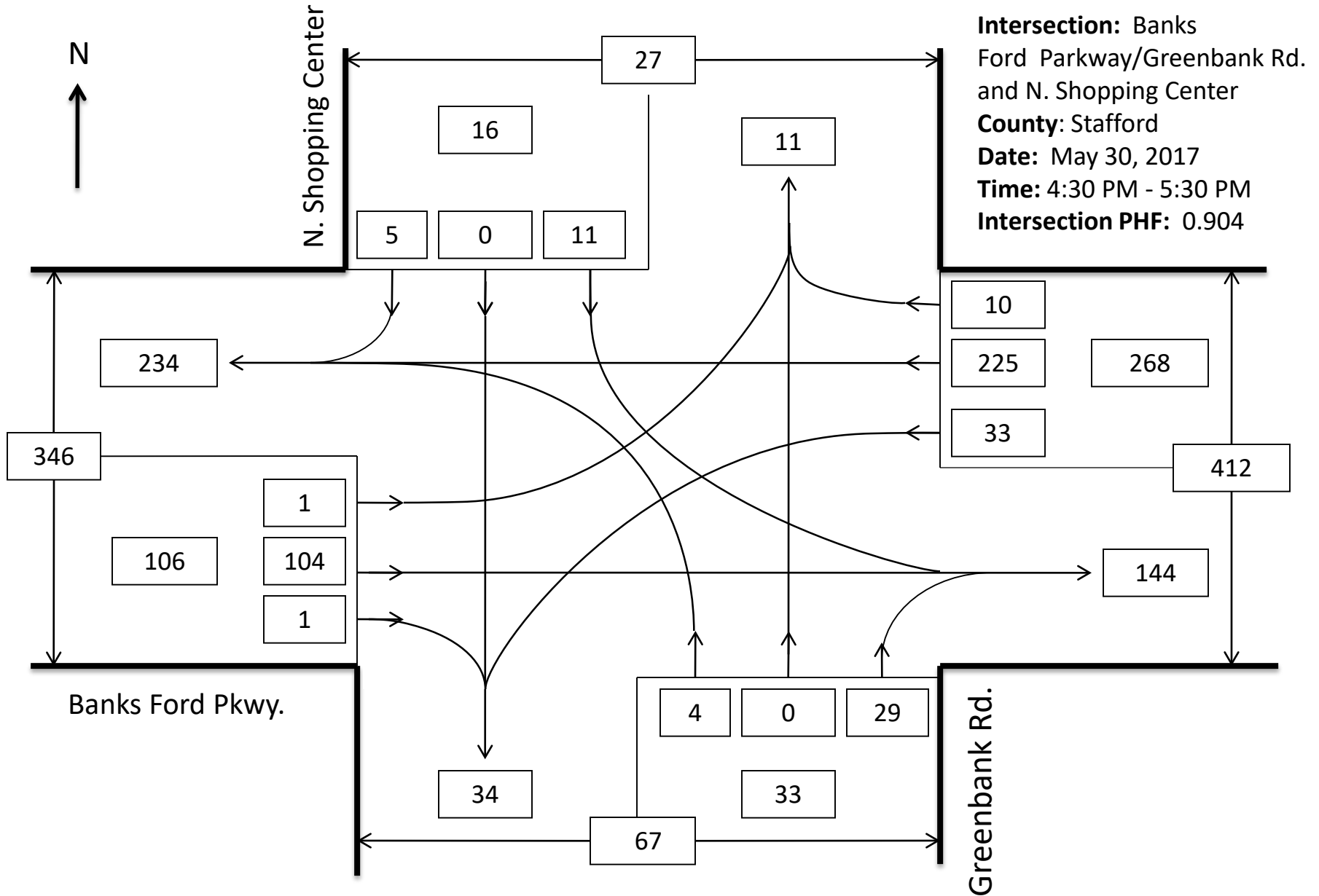
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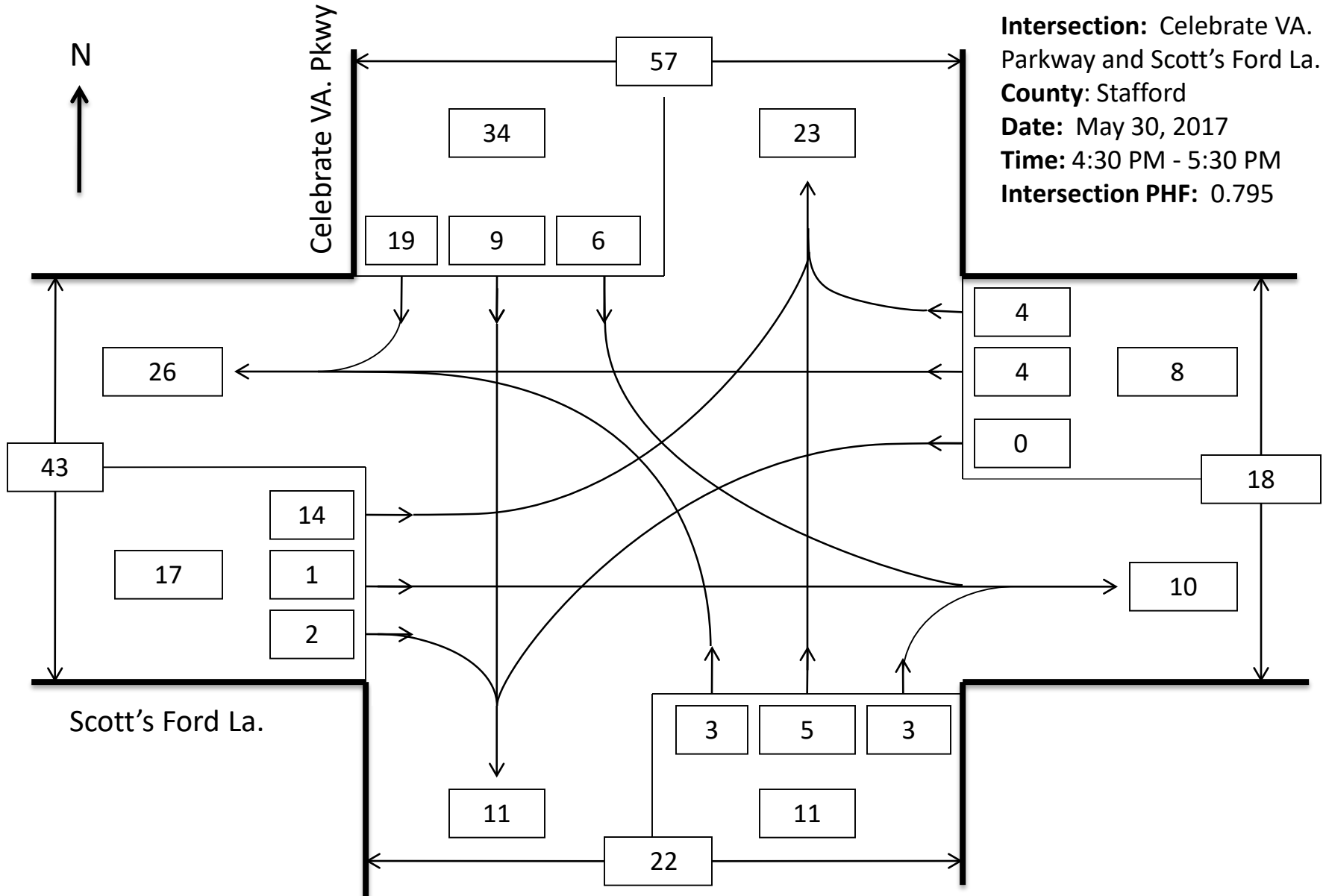
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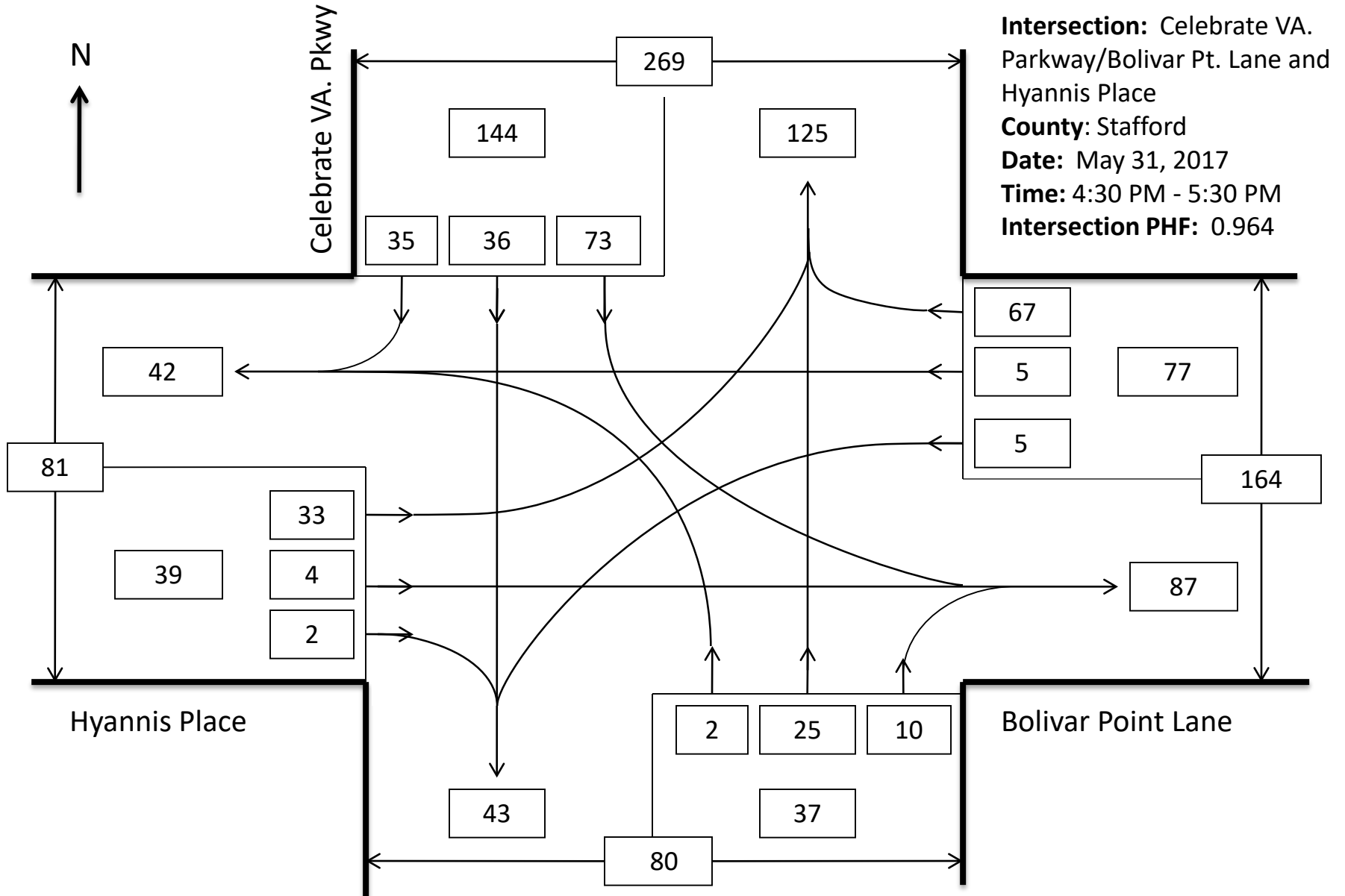
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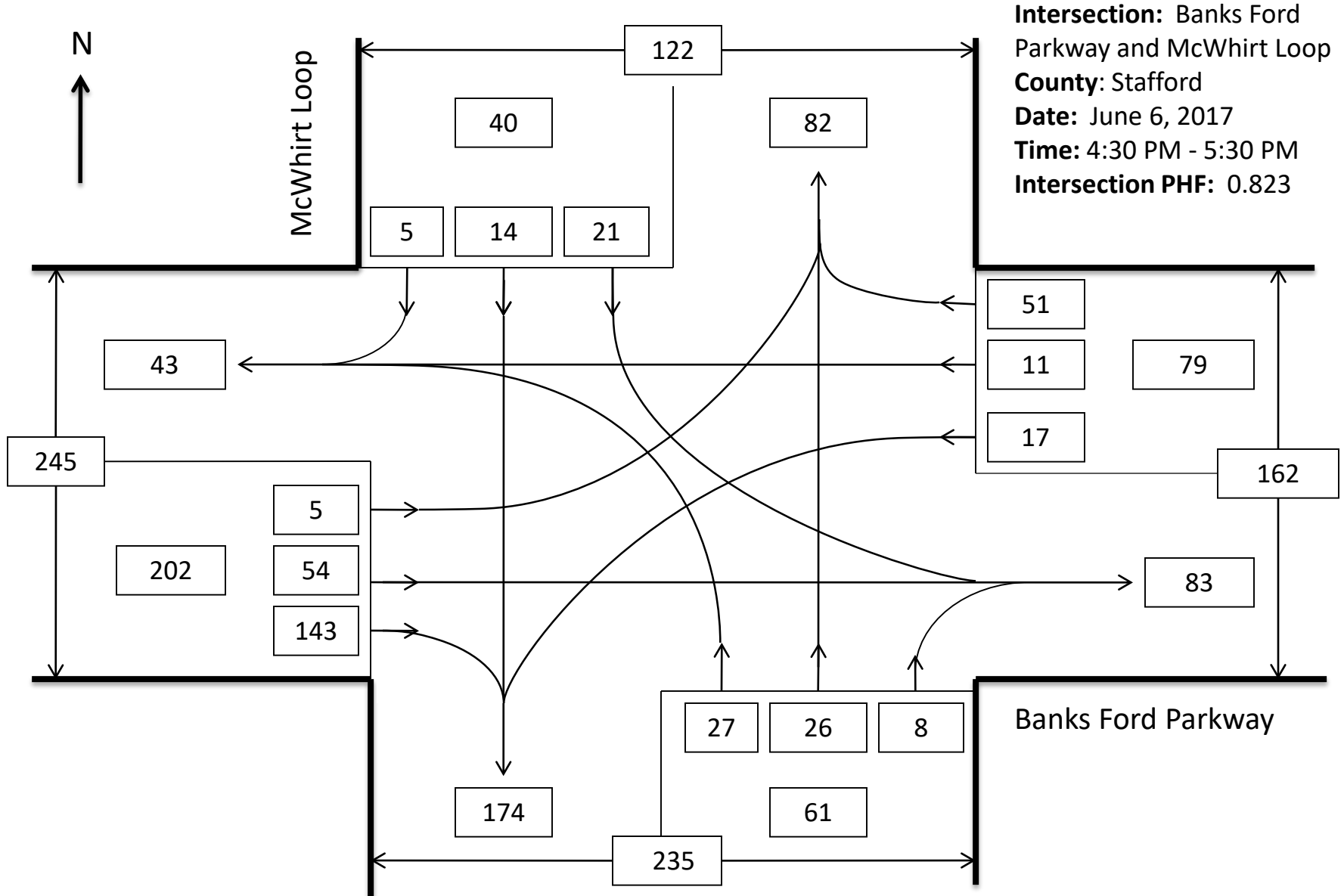
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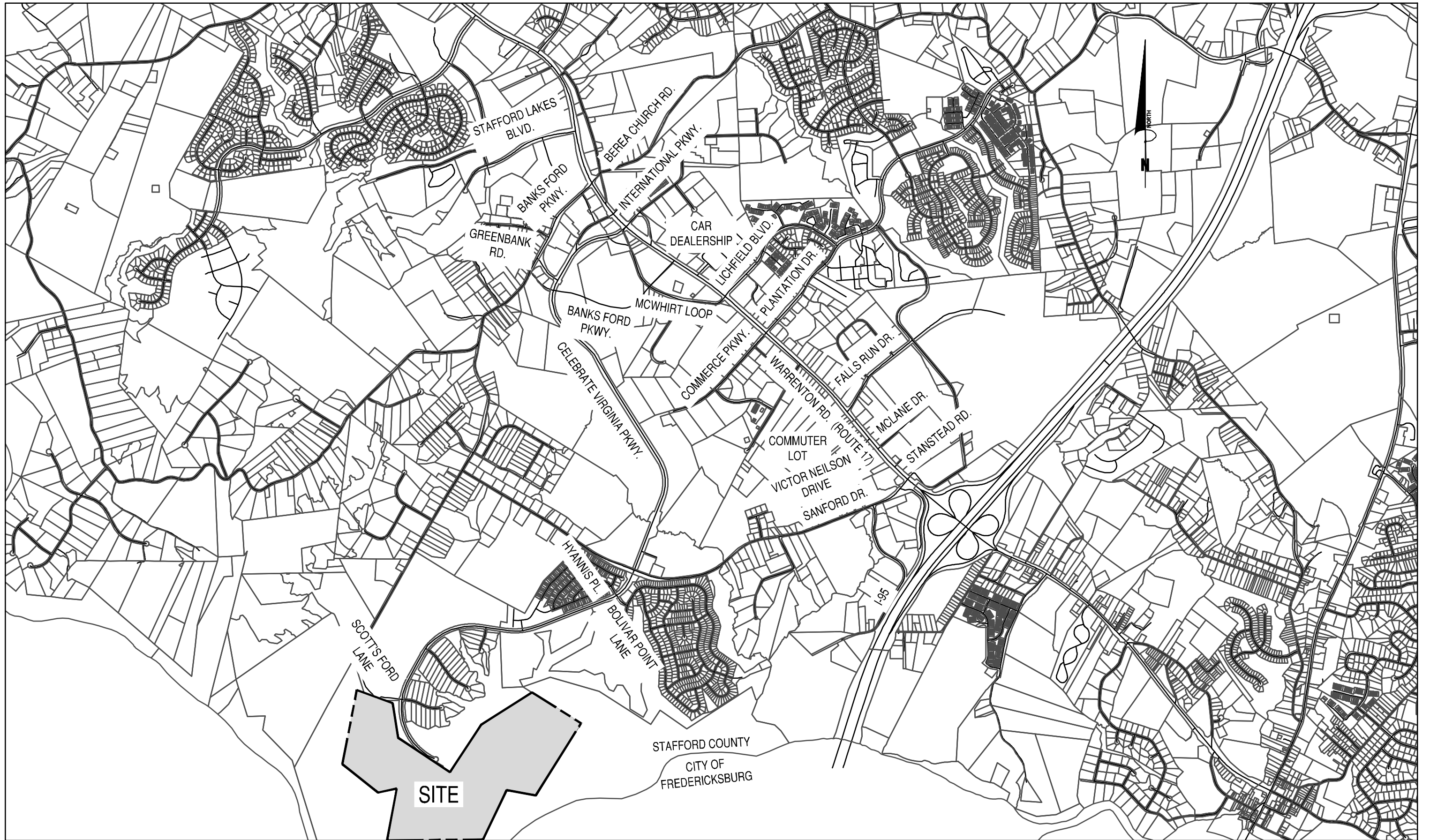
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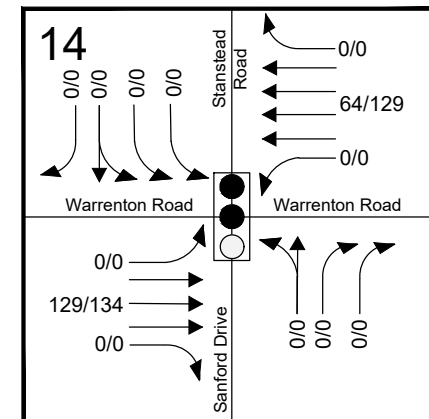
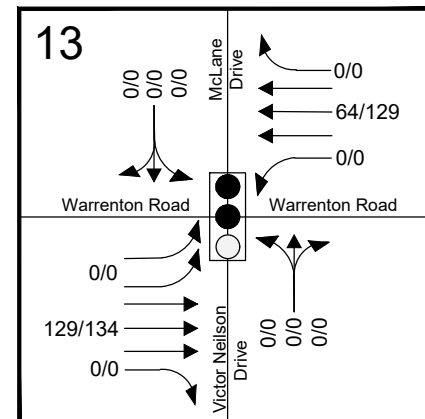
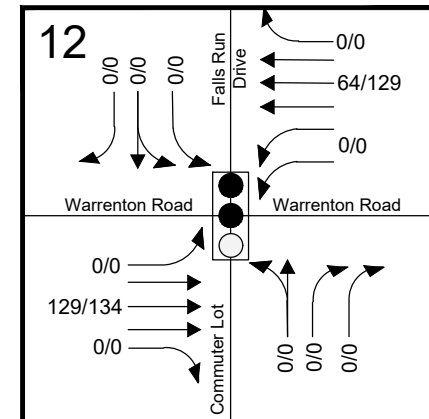
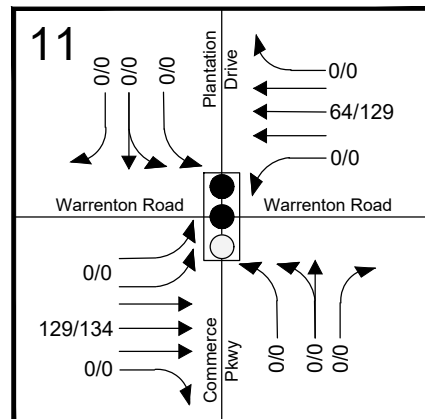
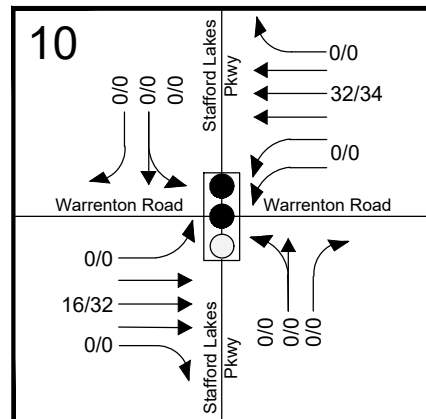
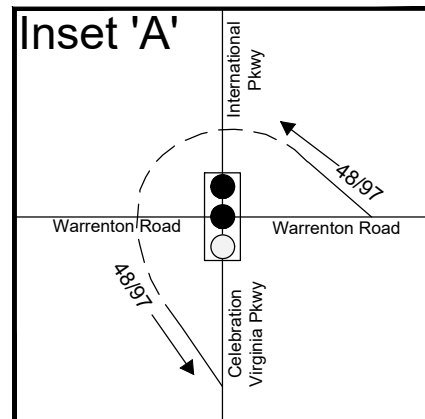
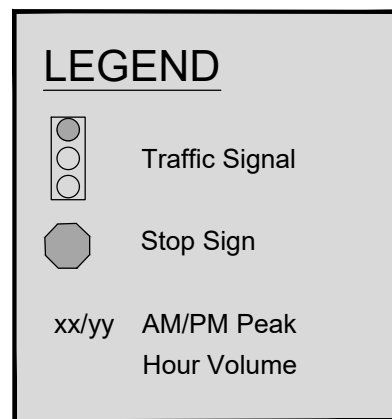
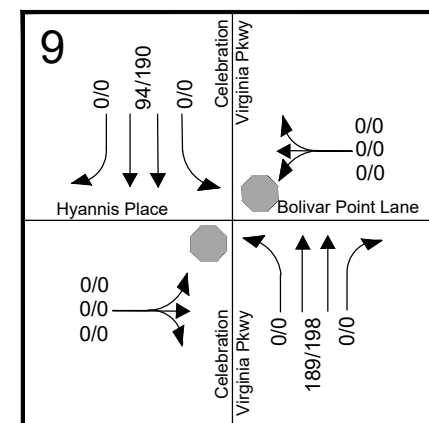
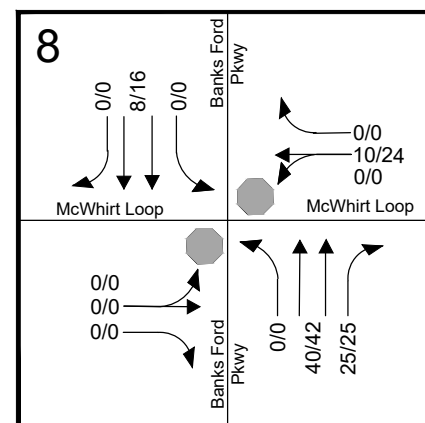
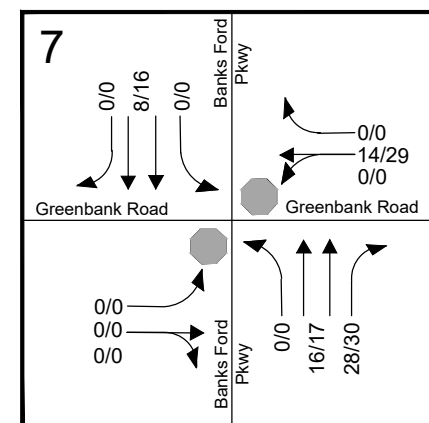
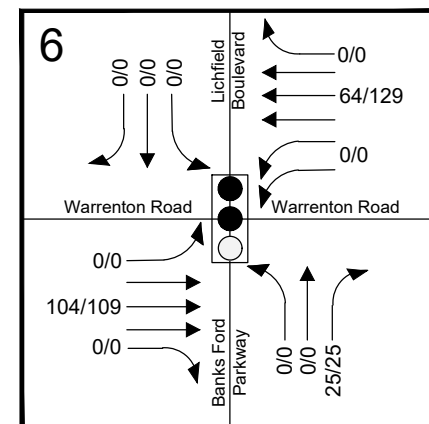
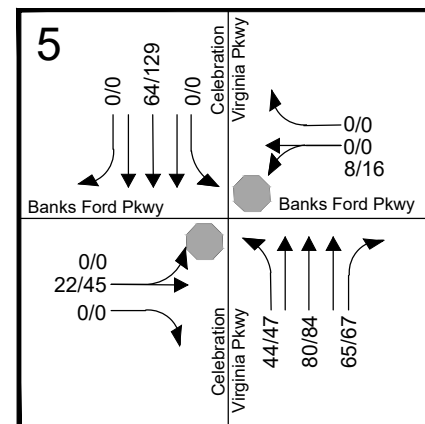
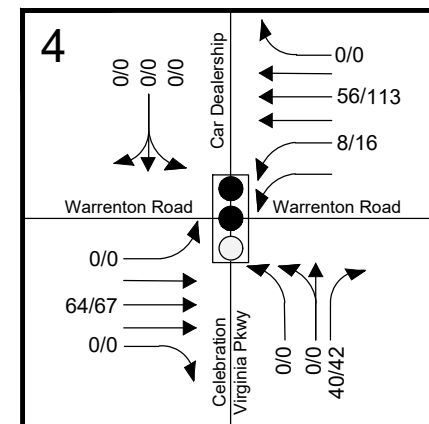
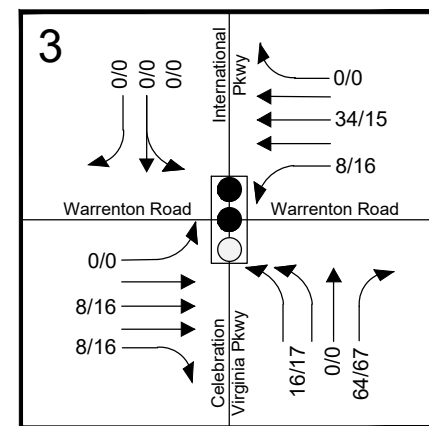
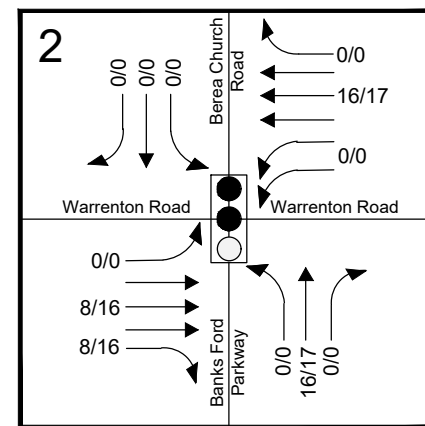
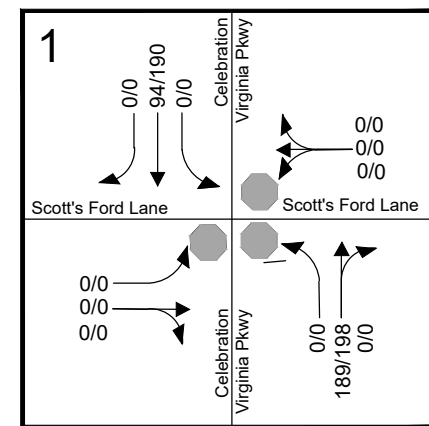
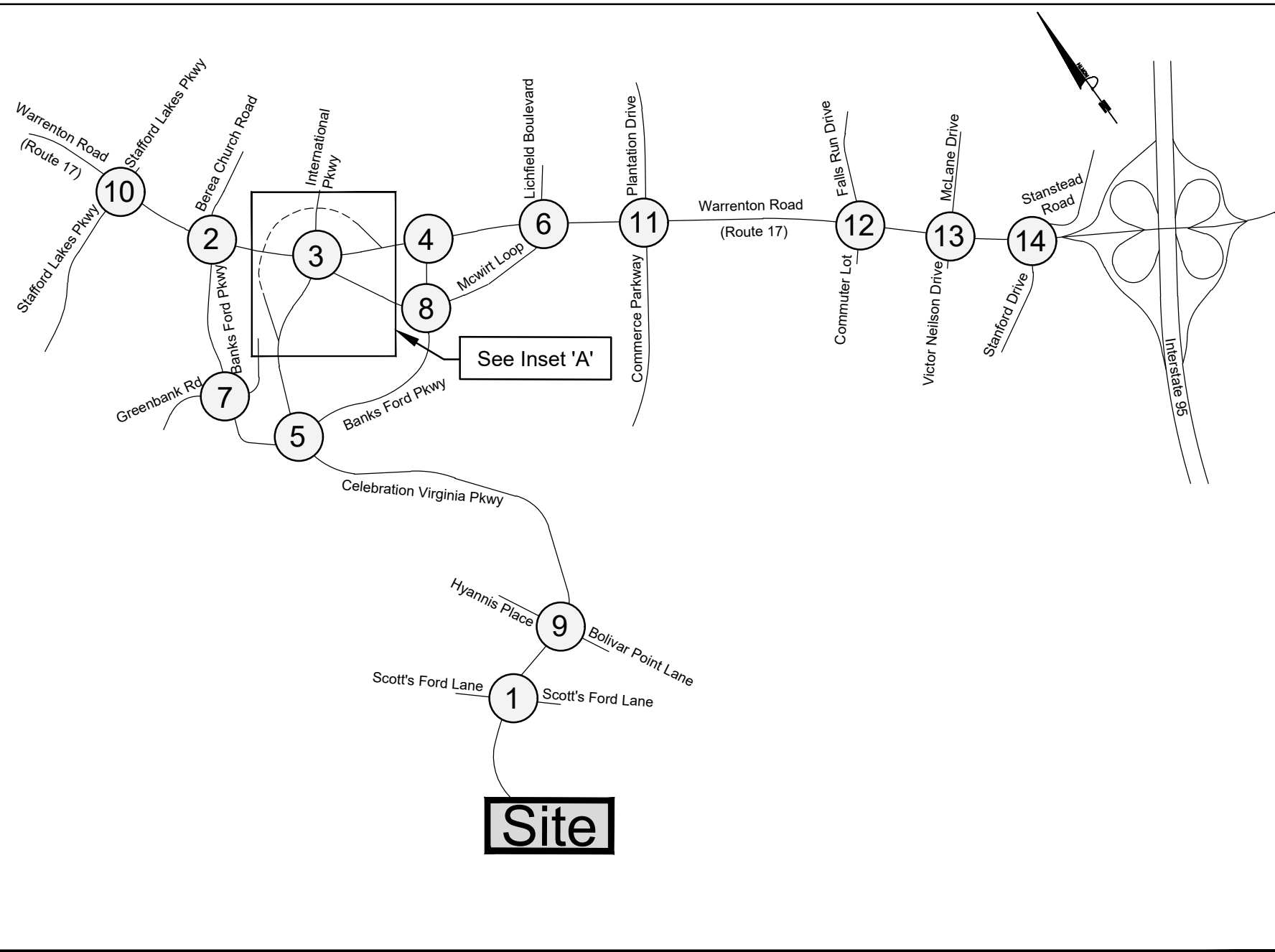


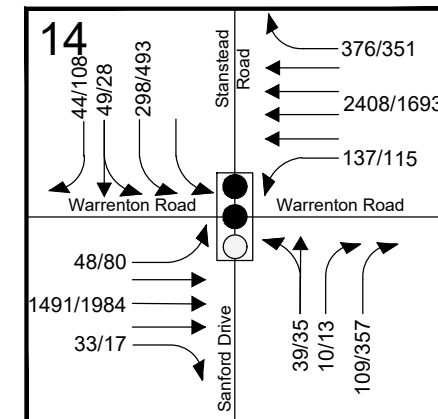
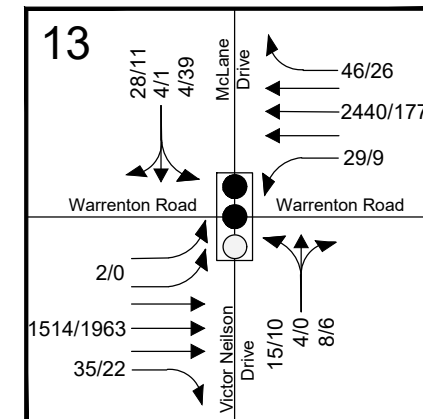
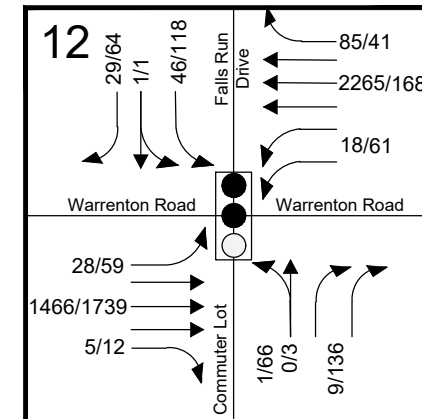
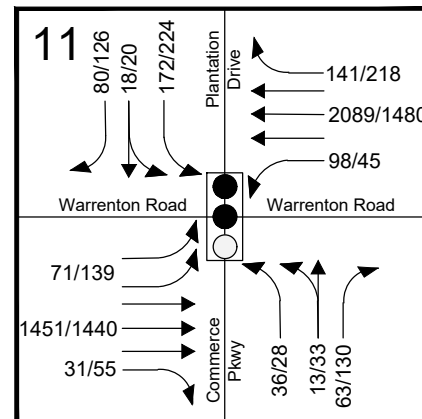
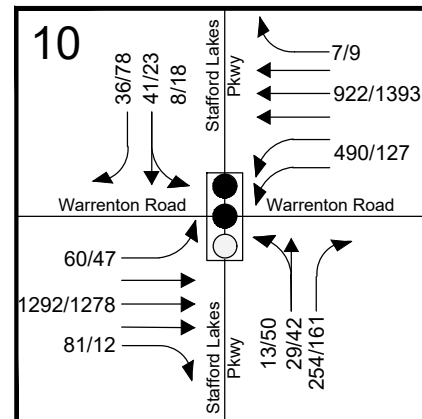
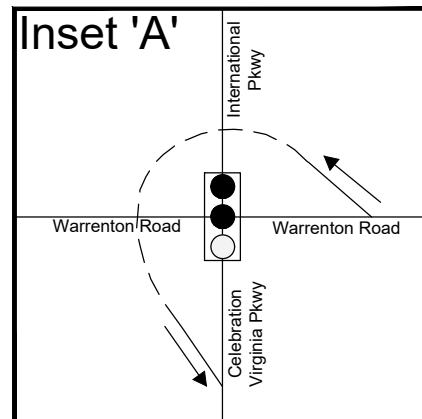
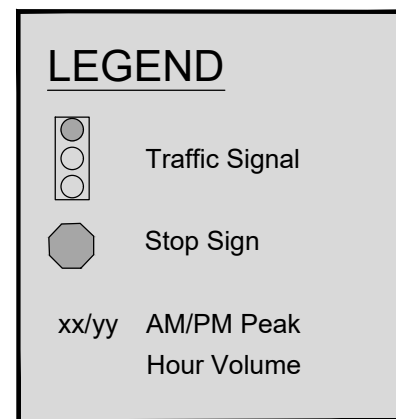
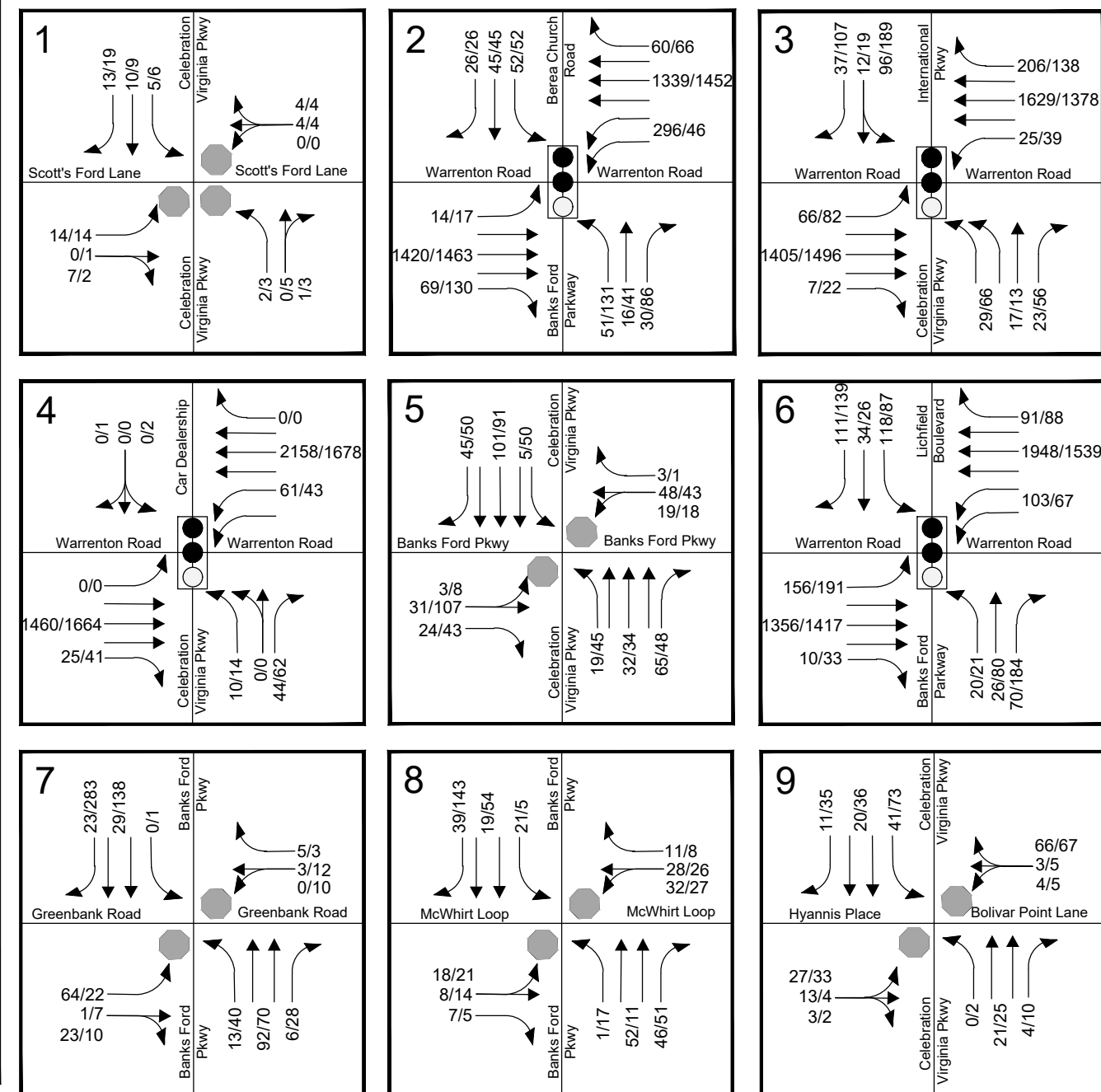
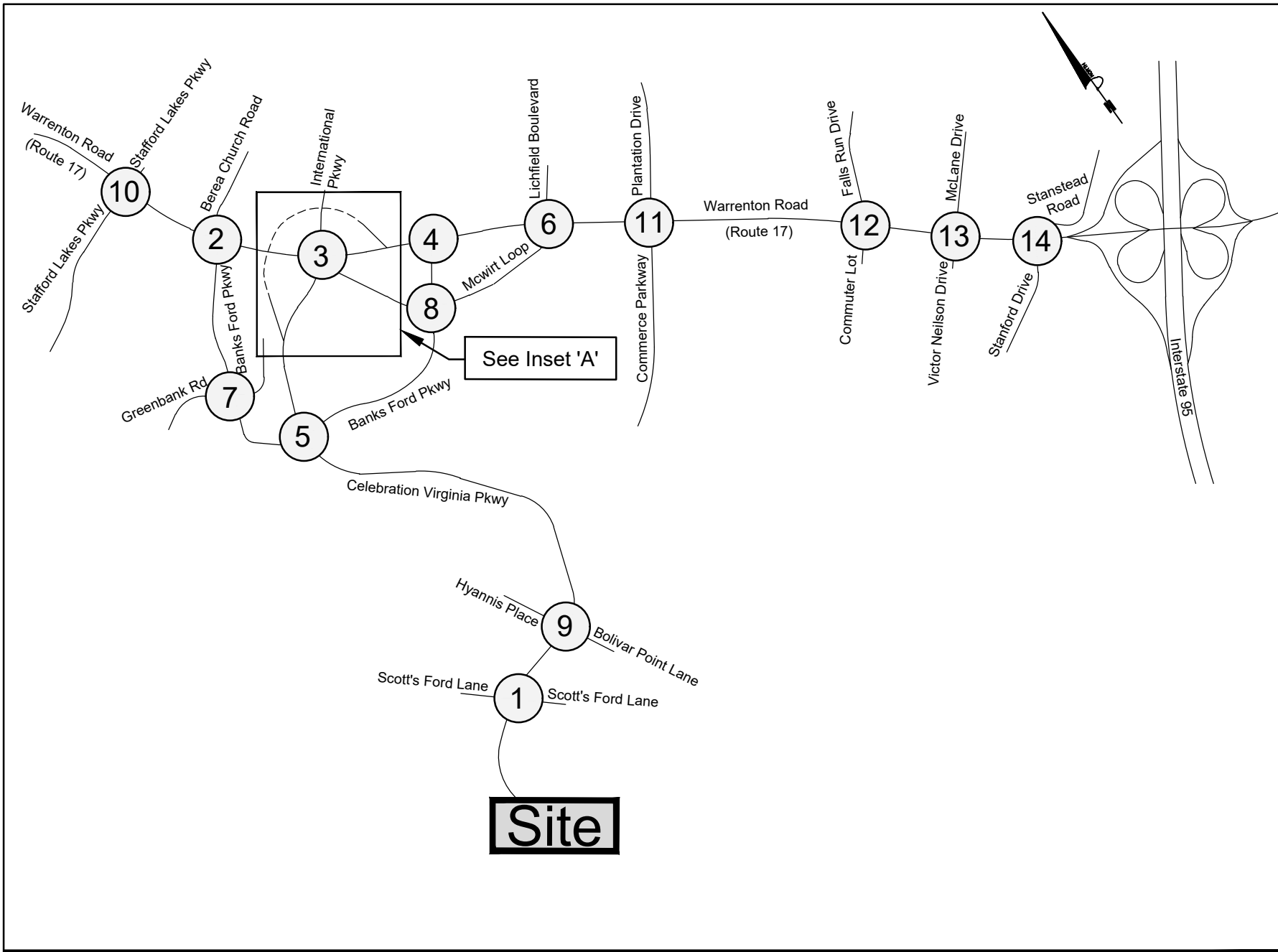
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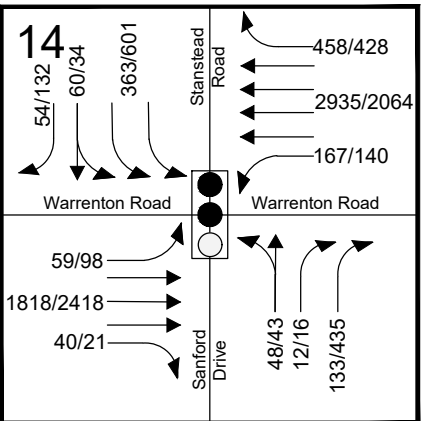
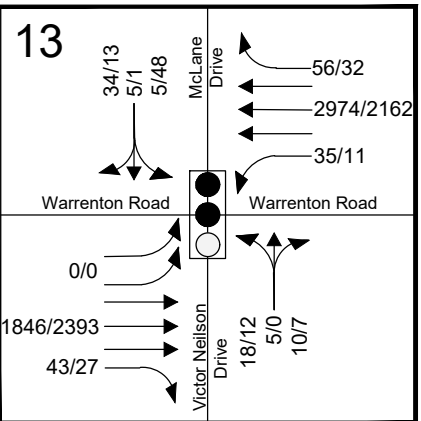
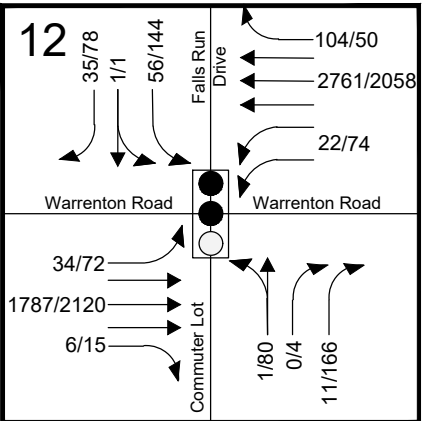
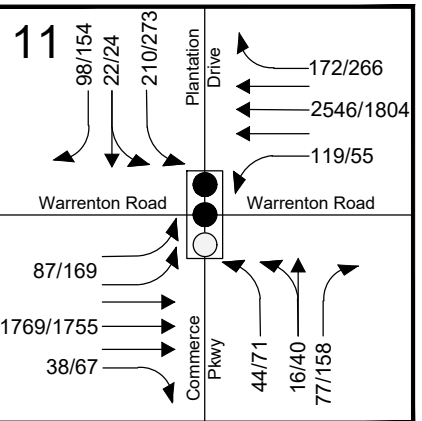
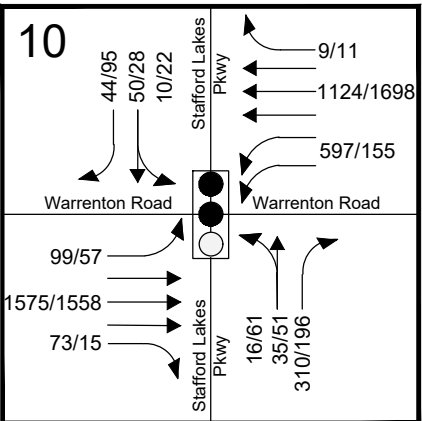
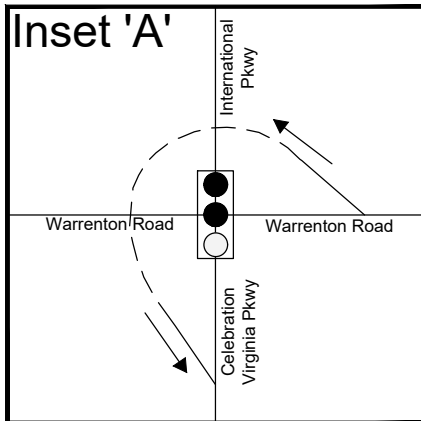
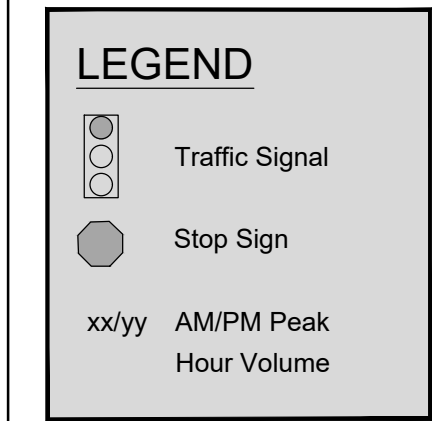
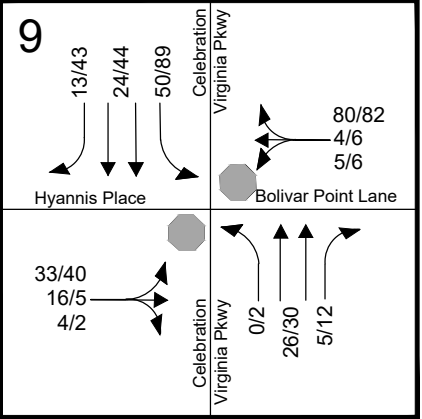
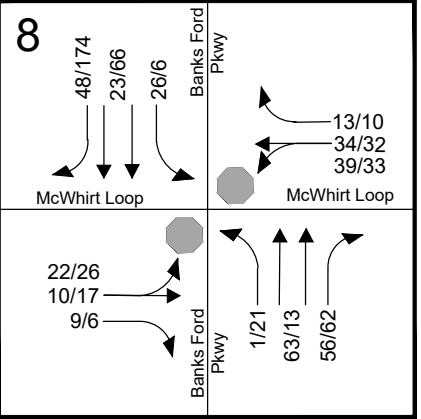
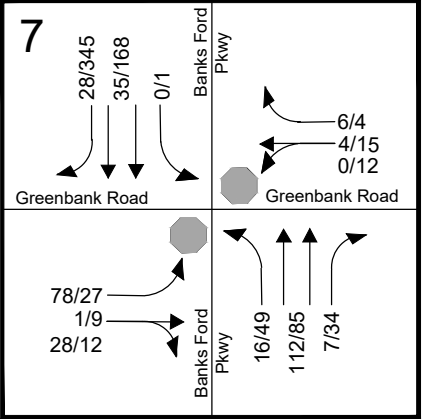
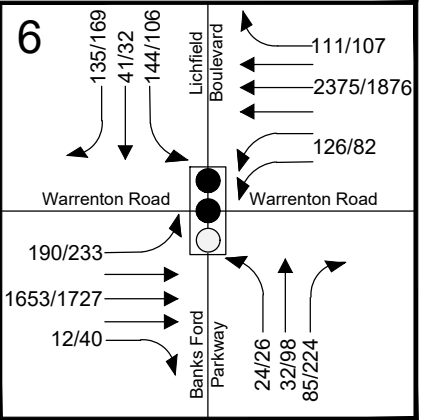
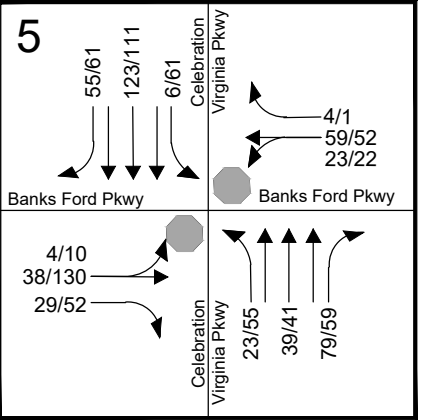
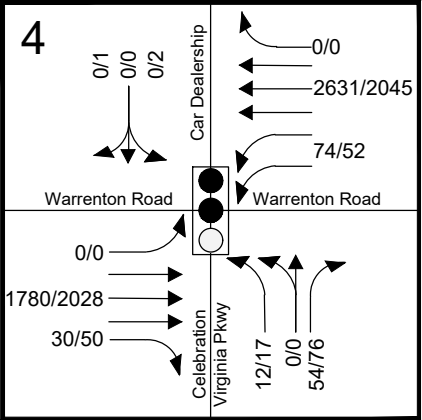
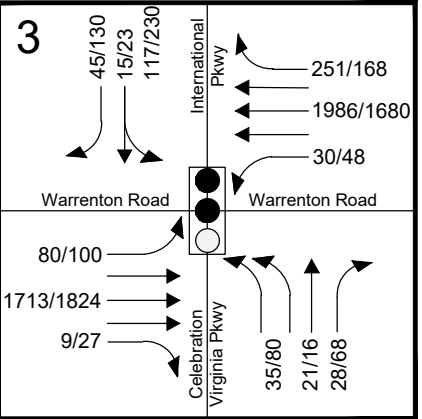
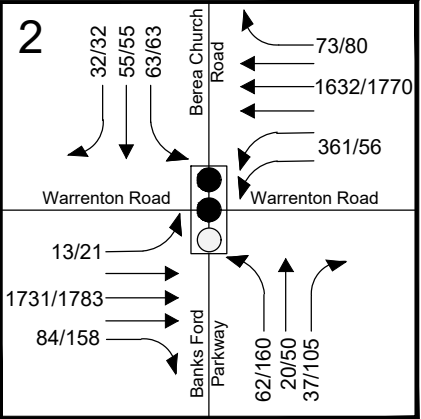
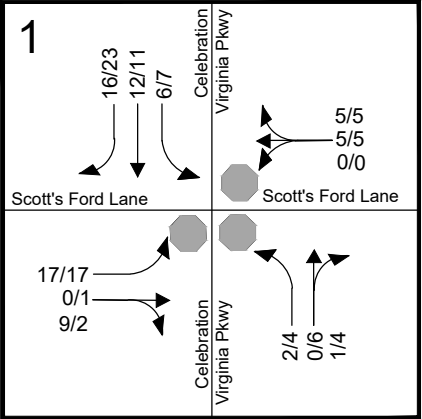
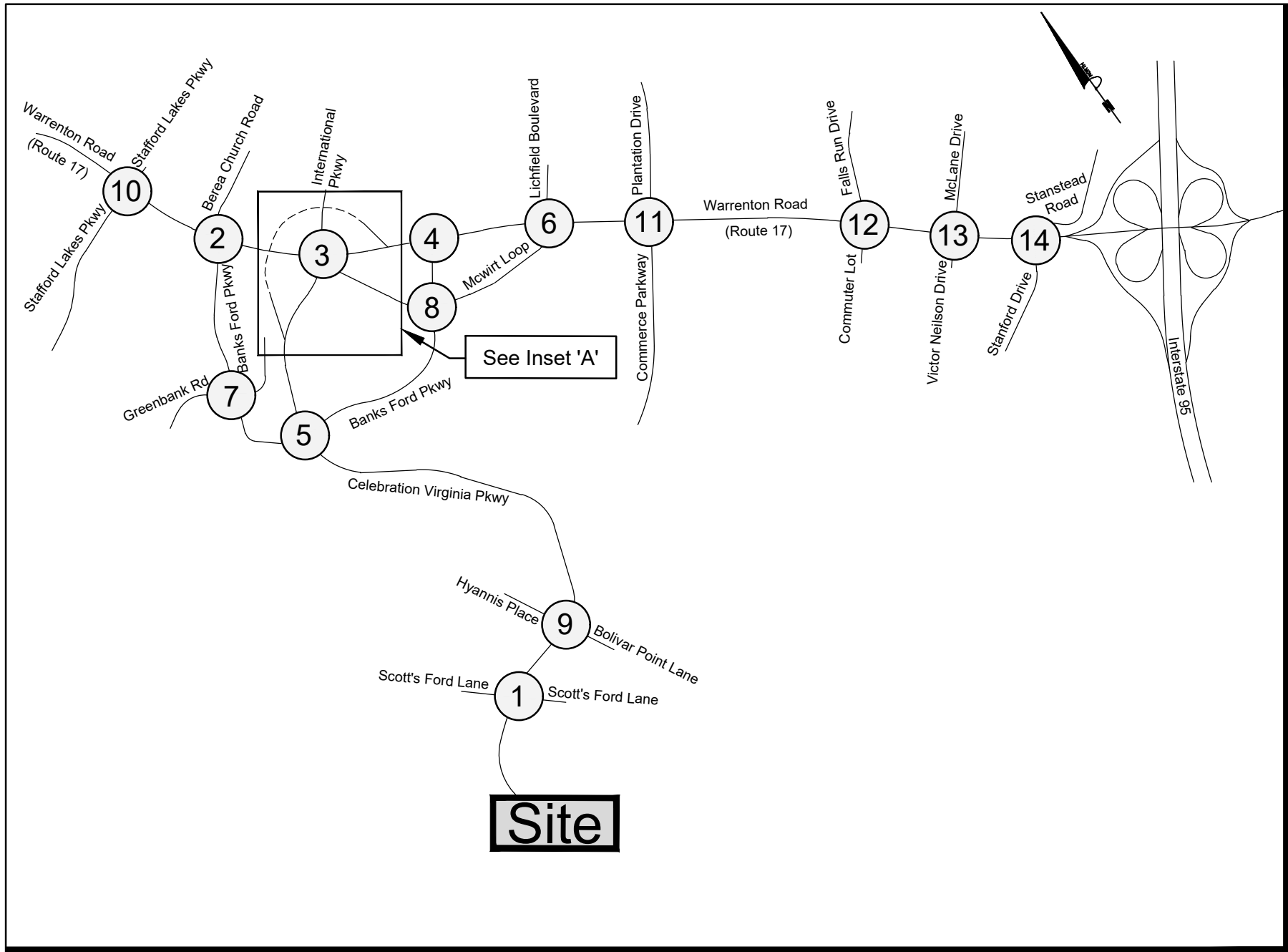


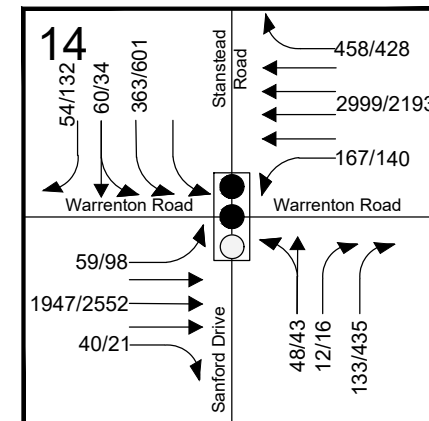
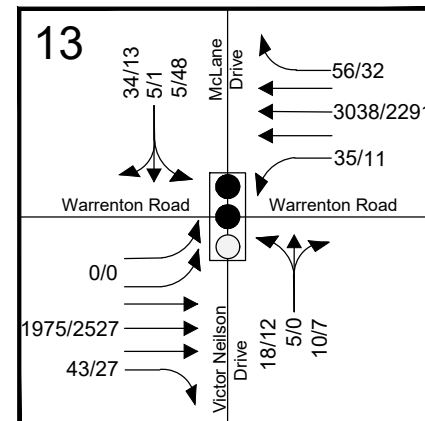
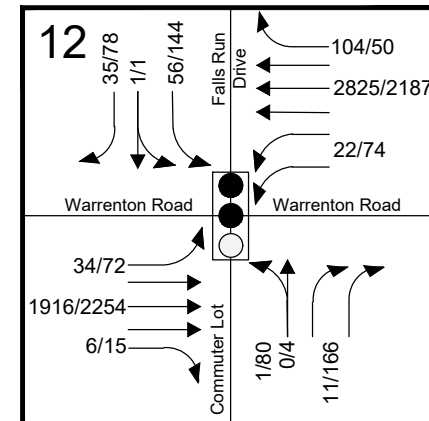
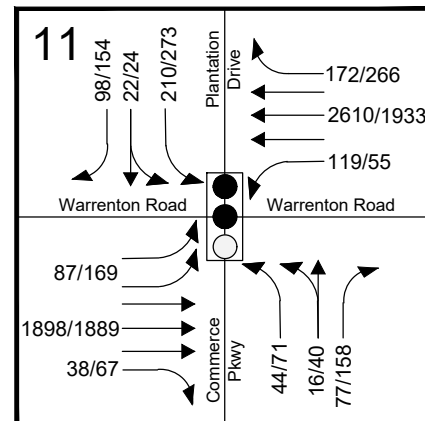
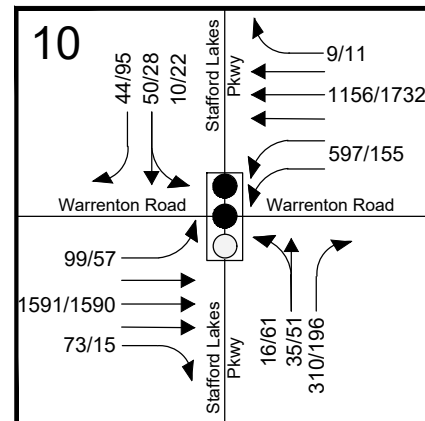
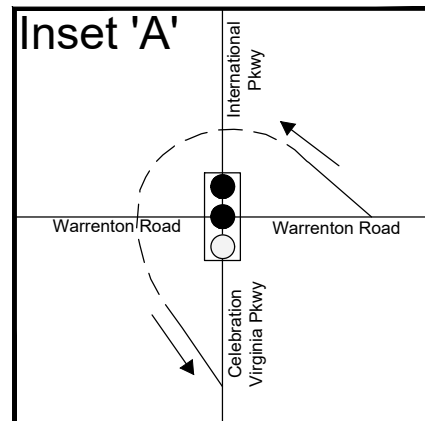
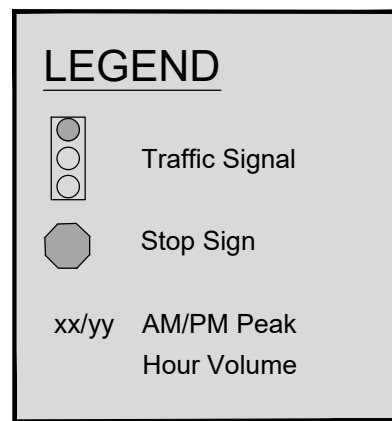
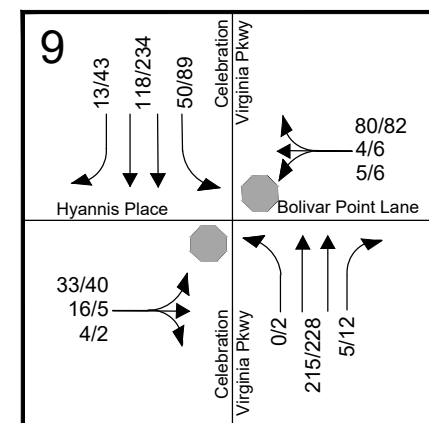
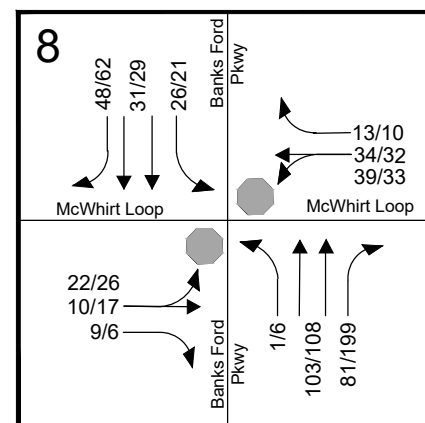
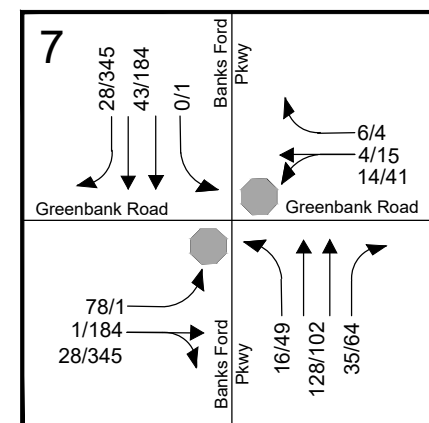
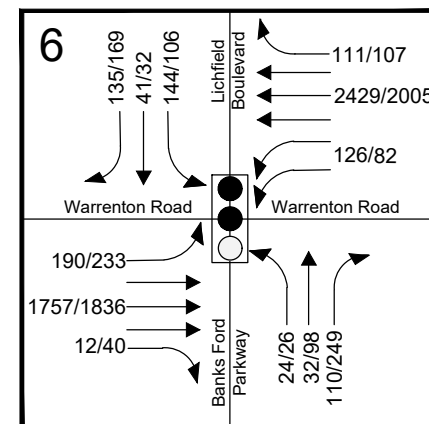
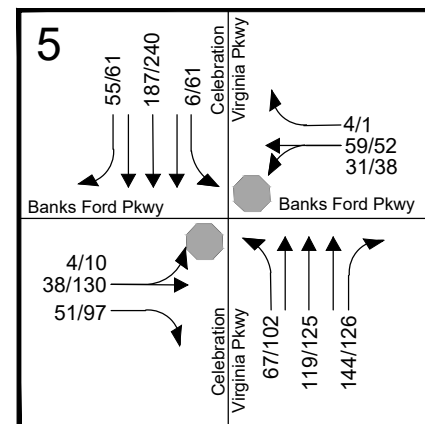
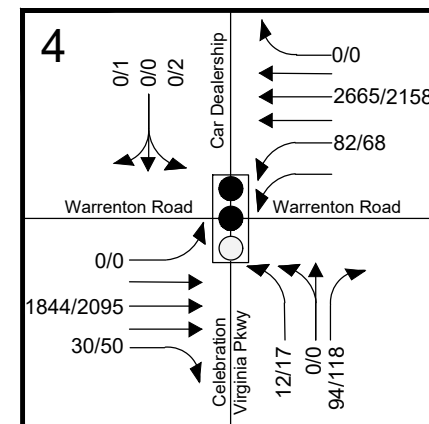
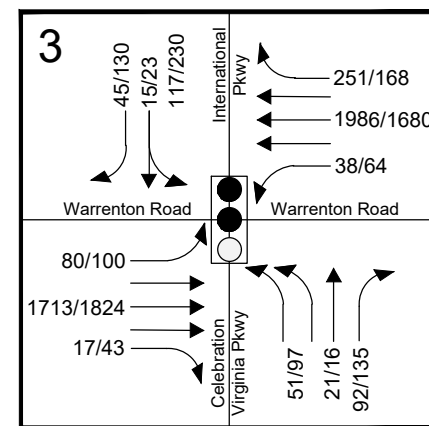
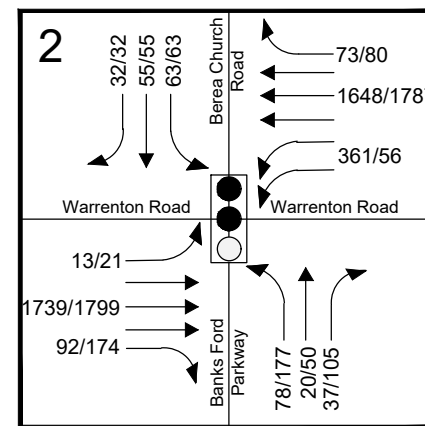
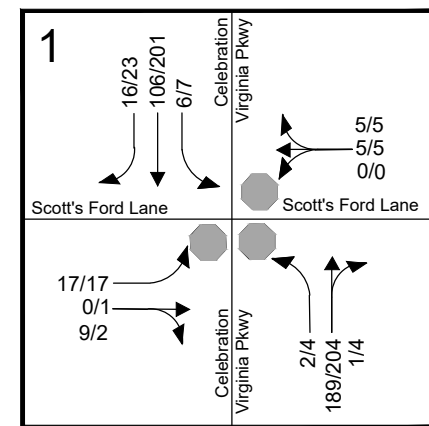
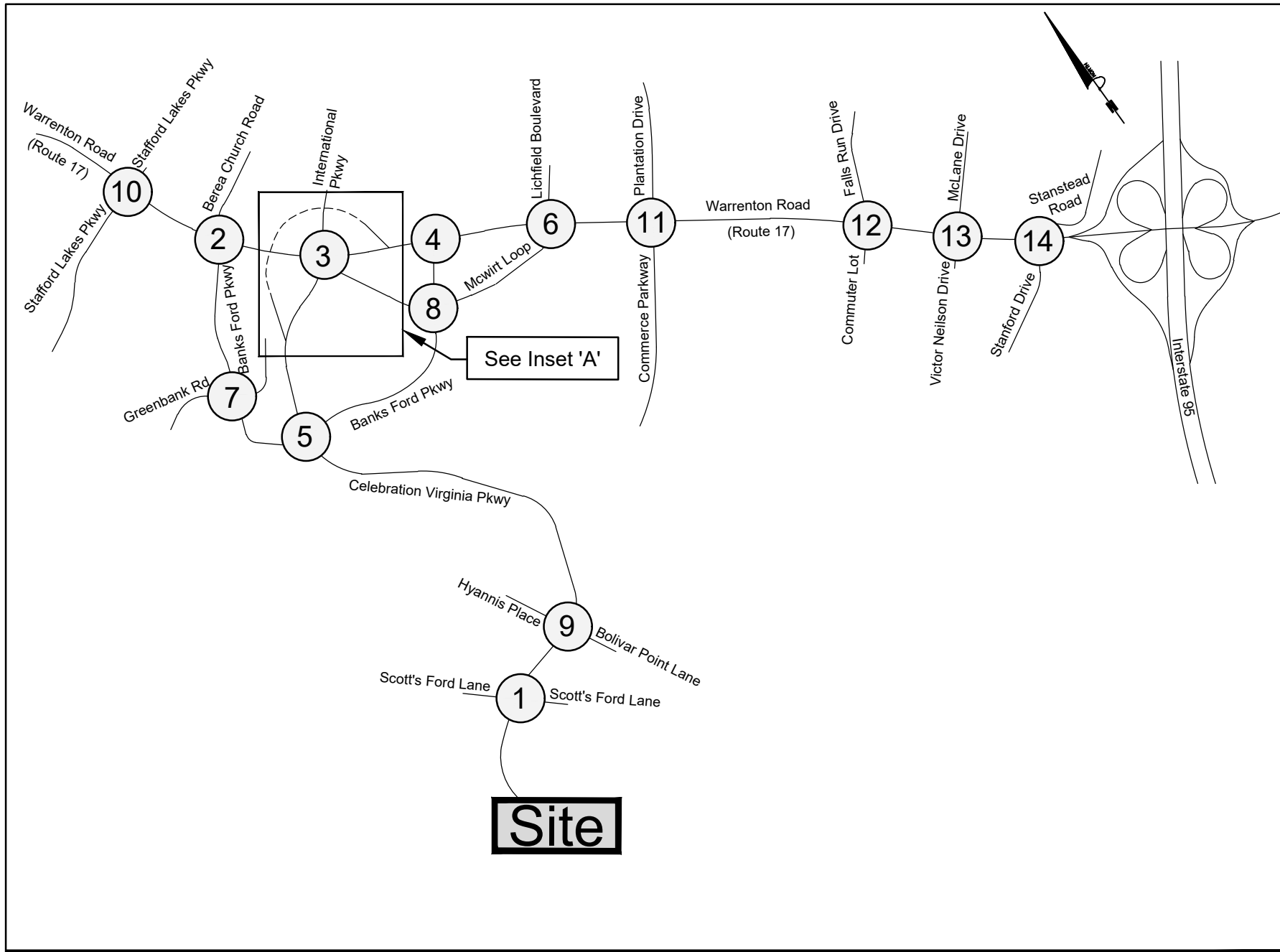
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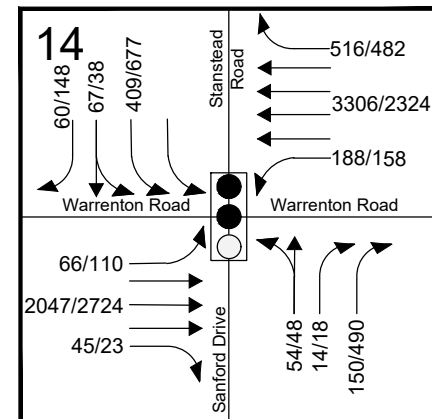
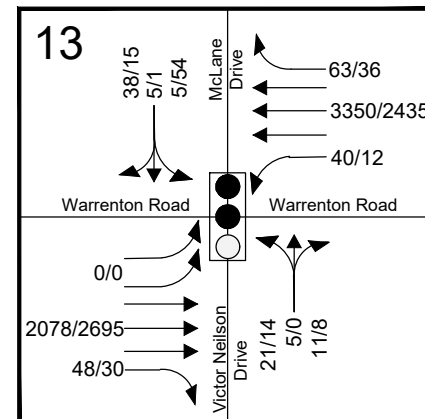
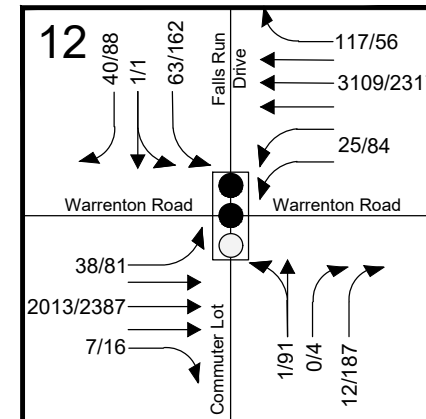
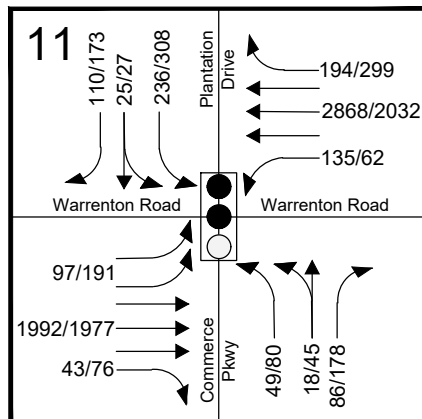
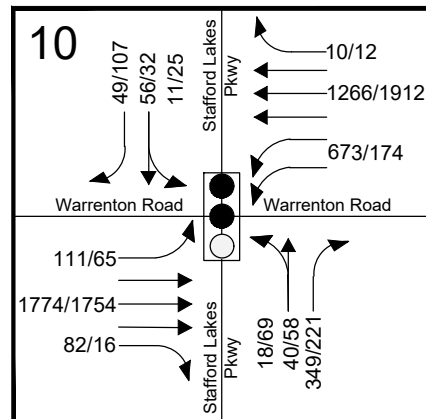
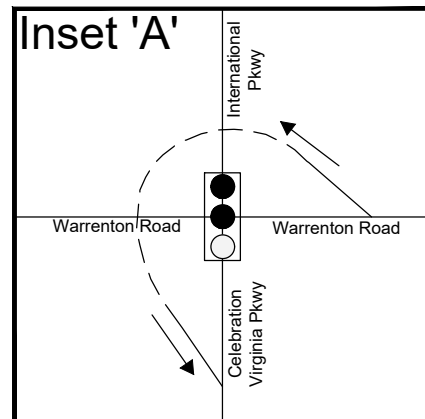
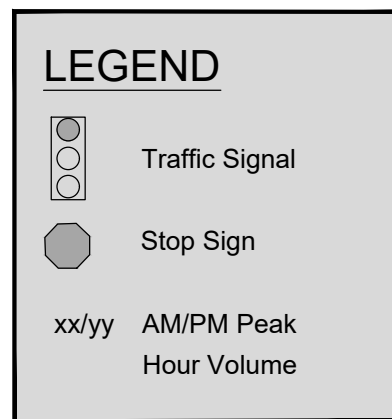
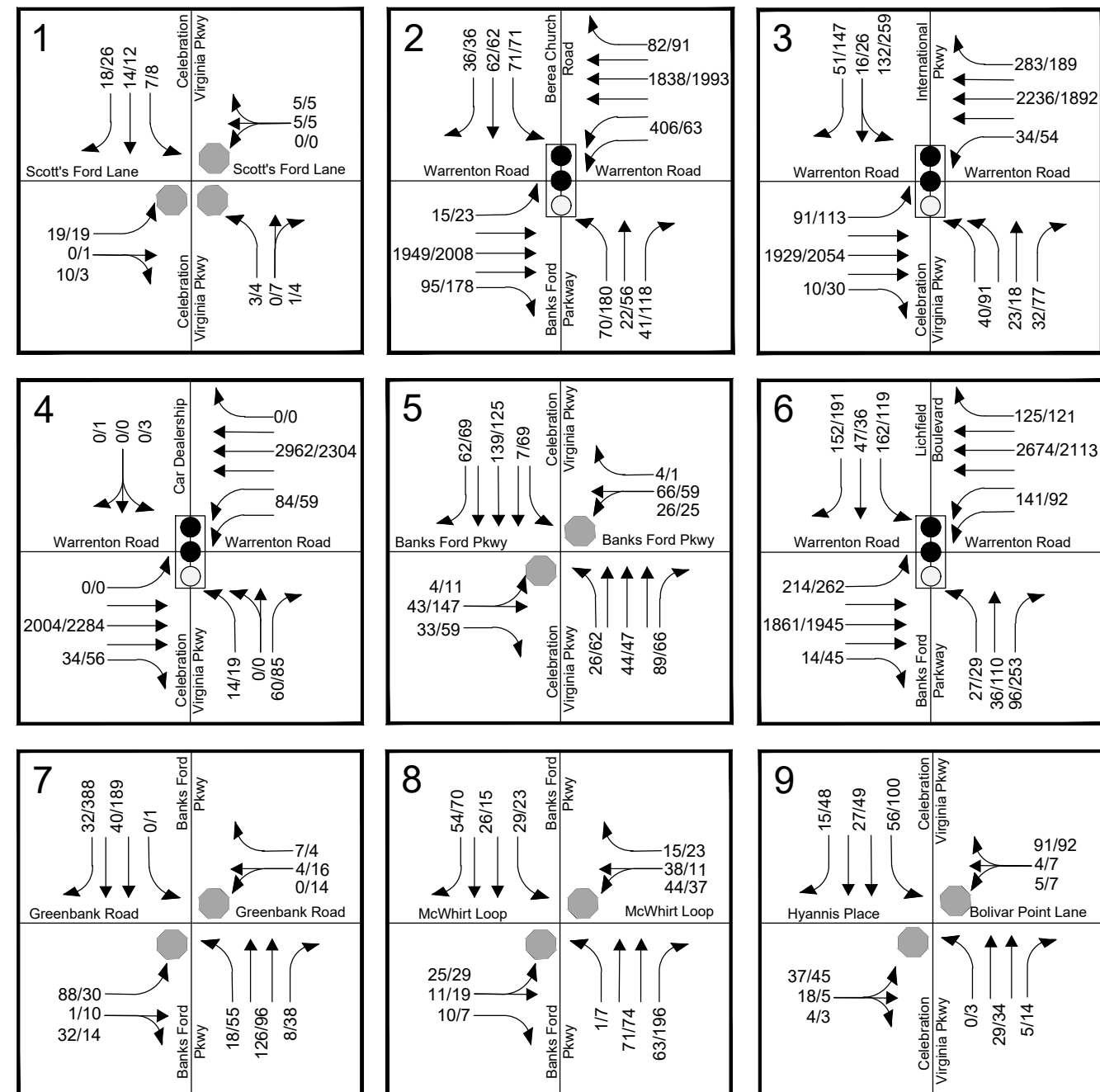
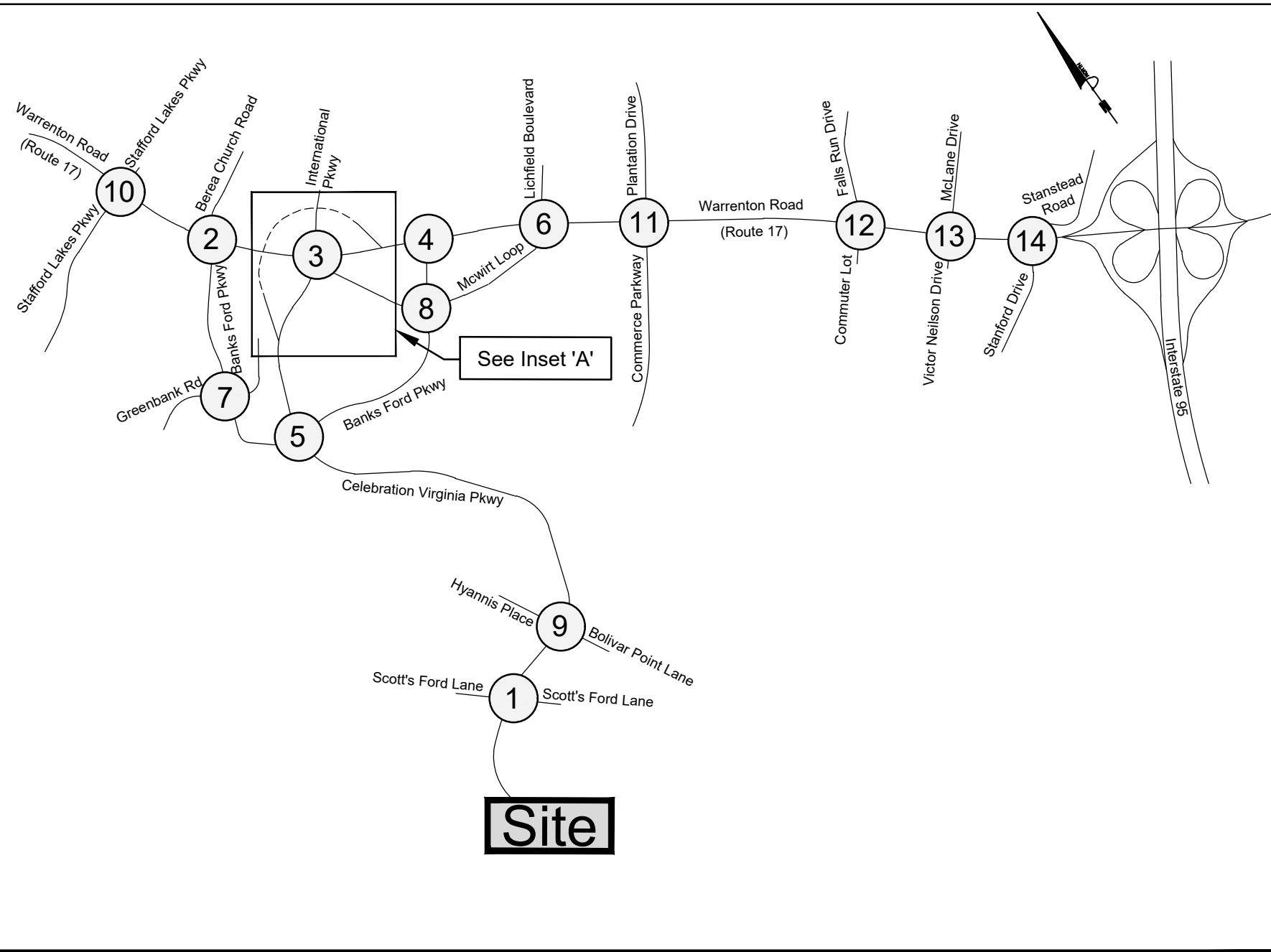


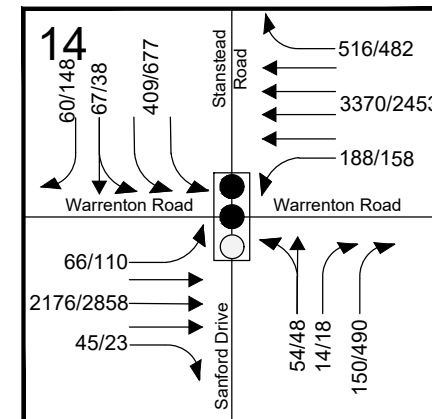
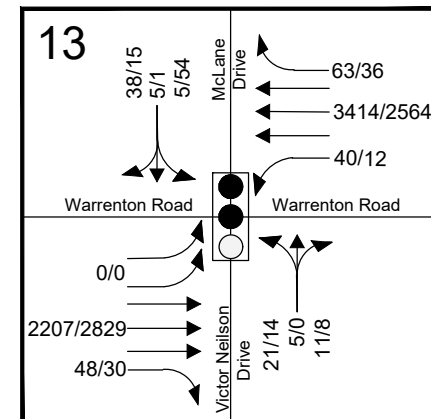
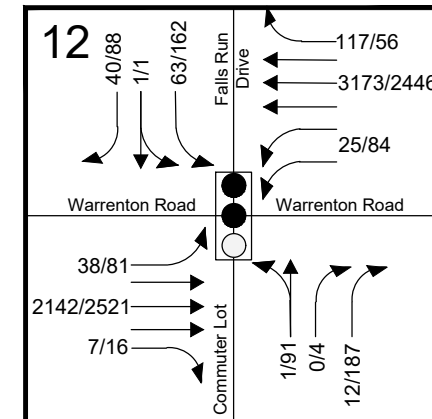
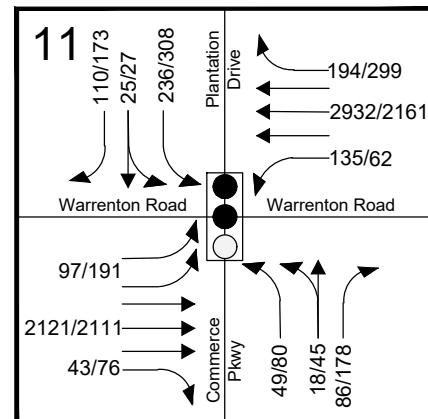
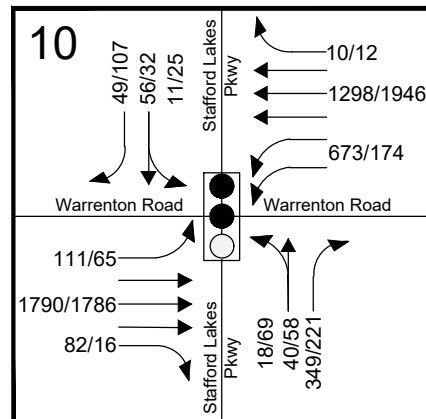
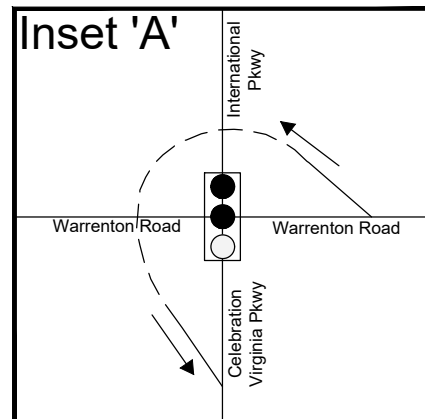
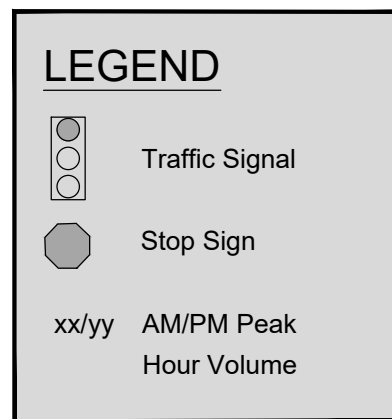
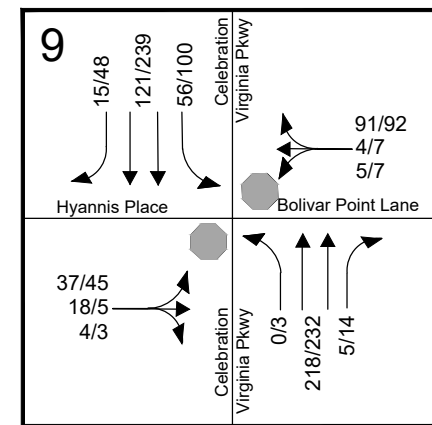
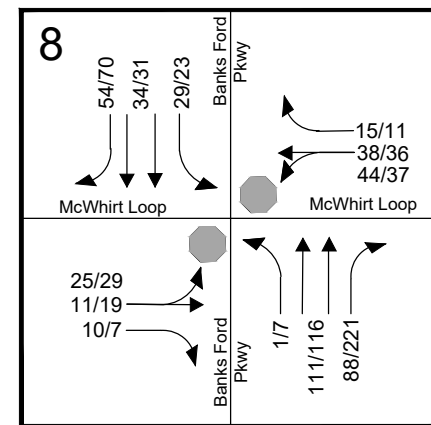
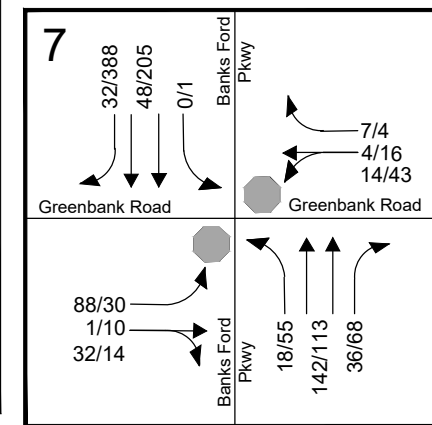
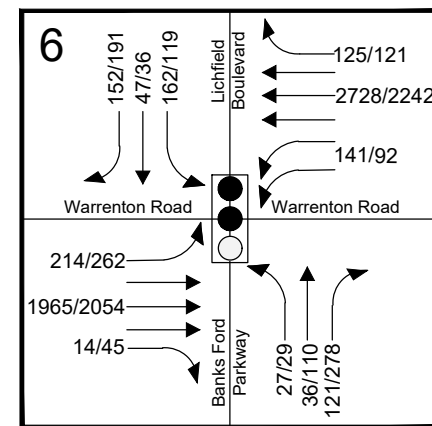
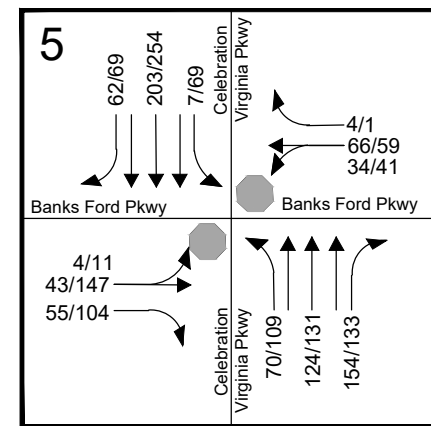
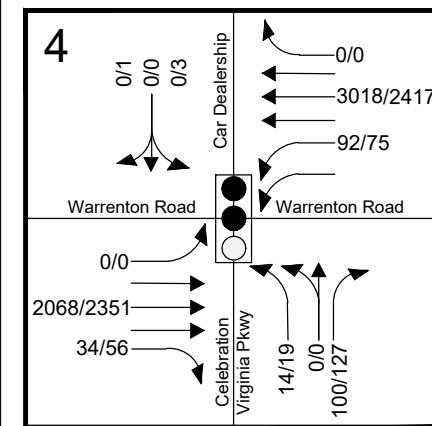
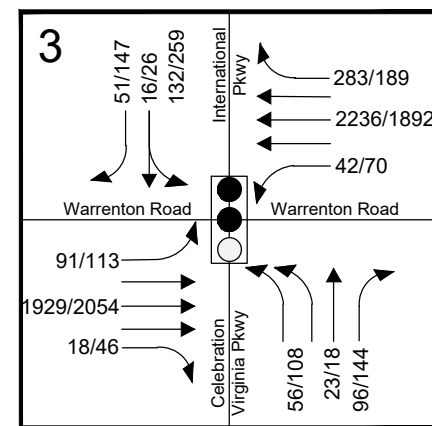
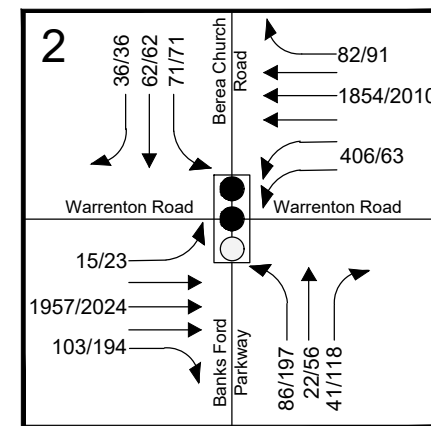
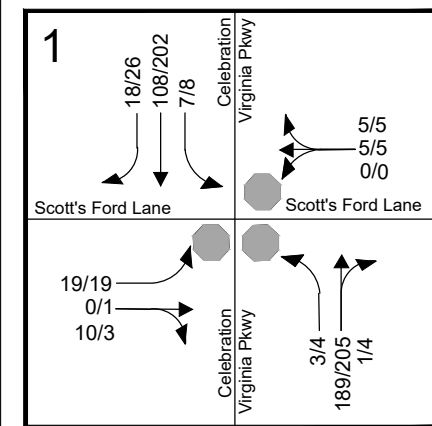
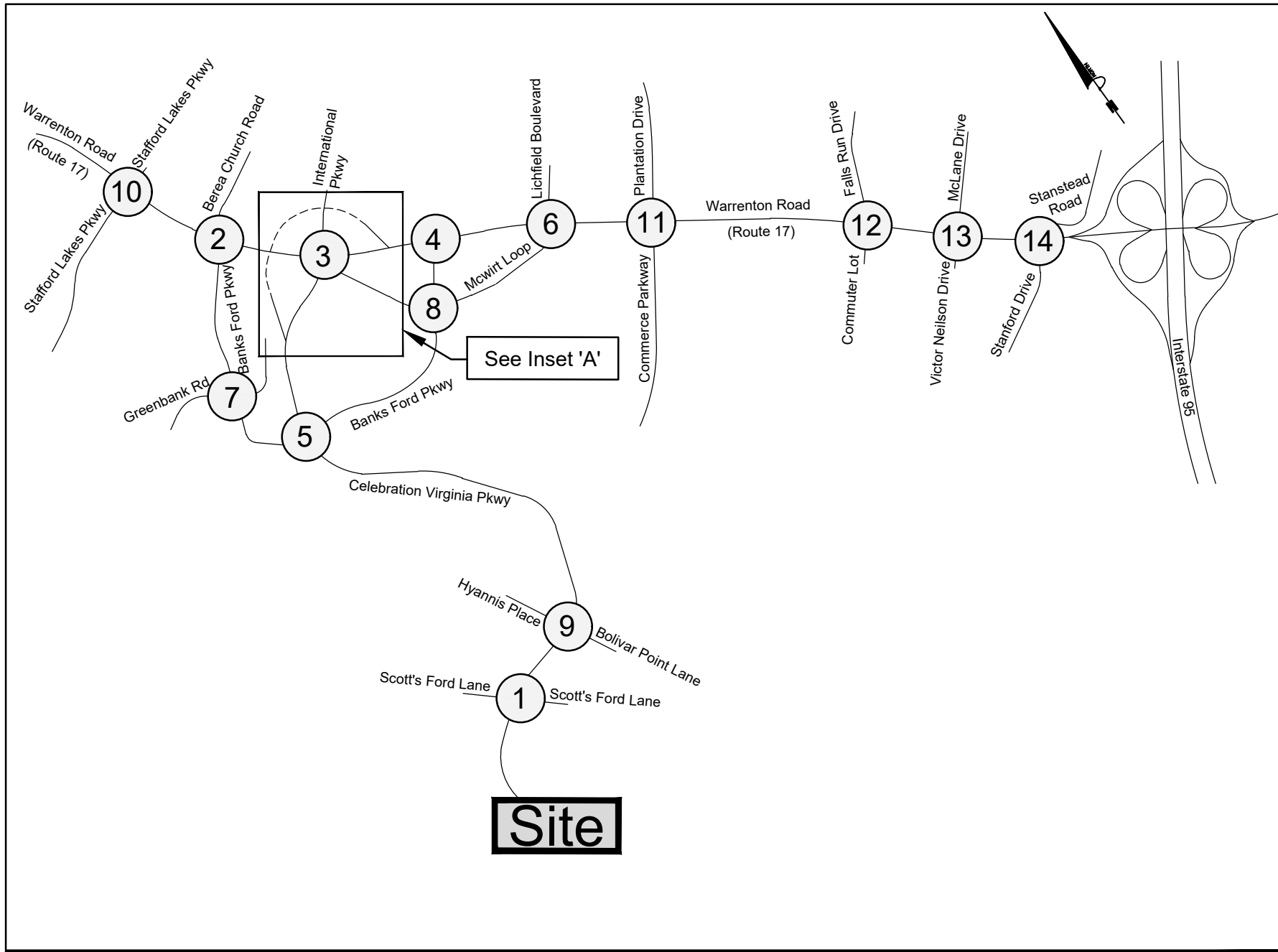


































## **Appendix D: Capacity Analysis Results**

## **Capacity Analysis Results**

*Existing Conditions 2017*

# HCM Signalized Intersection Capacity Analysis

## 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.17)

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	1292	81	490	922	7	13	29	254	8	41	36
Future Volume (vph)	60	1292	81	490	922	7	13	29	254	8	41	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00		0.99	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00		0.99	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	67	1436	90	544	1024	8	14	32	282	9	46	40
RTOR Reduction (vph)	0	0	42	0	0	3	0	0	158	0	0	38
Lane Group Flow (vph)	67	1436	48	544	1024	5	0	46	124	0	55	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	63.0	68.9	23.0	77.0	77.0		5.9	28.9		8.1	8.1
Effective Green, g (s)	9.0	63.0	68.9	23.0	77.0	77.0		5.9	28.9		8.1	8.1
Actuated g/C Ratio	0.07	0.48	0.53	0.18	0.59	0.59		0.05	0.22		0.06	0.06
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2224	838	607	2718	937		82	348		115	99
v/s Ratio Prot	0.04	c0.31	0.00	c0.16	0.22			c0.03	0.06		c0.03	
v/s Ratio Perm			0.03			0.00			0.02			0.00
v/c Ratio	0.55	0.65	0.06	0.90	0.38	0.01		0.56	0.36		0.48	0.03
Uniform Delay, d1	58.5	25.1	14.8	52.3	13.9	10.8		60.8	42.7		58.9	57.2
Progression Factor	1.00	1.00	1.00	1.53	0.24	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	16.6	1.5	0.0	17.2	0.4	0.0		8.5	0.6		3.1	0.1
Delay (s)	75.1	26.6	14.8	97.2	3.8	10.8		69.3	43.3		62.0	57.3
Level of Service	E	C	B	F	A	B		E	D		E	E
Approach Delay (s)		28.0			36.1			47.0			60.1	
Approach LOS		C			D			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		34.1					HCM 2000 Level of Service		C			
HCM 2000 Volume to Capacity ratio		0.68										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		30.0			
Intersection Capacity Utilization		67.1%					ICU Level of Service		C			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	1420	69	296	1339	60	51	16	30	52	45	26
Future Volume (vph)	14	1420	69	296	1339	60	51	16	30	52	45	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	15	1560	76	325	1471	66	56	18	33	57	49	29
RTOR Reduction (vph)	0	0	31	0	0	19	0	0	27	0	0	27
Lane Group Flow (vph)	15	1560	45	325	1471	47	36	38	6	57	49	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	70.2	76.4	18.0	84.2	91.8	6.2	6.2	24.2	7.6	7.6	7.6
Effective Green, g (s)	4.0	70.2	76.4	18.0	84.2	91.8	6.2	6.2	24.2	7.6	7.6	7.6
Actuated g/C Ratio	0.03	0.54	0.59	0.14	0.65	0.71	0.05	0.05	0.19	0.06	0.06	0.06
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2478	1015	475	2972	1203	79	81	293	102	107	91
v/s Ratio Prot	0.01	c0.34	0.00	c0.09	0.32	0.00	0.02	c0.02	0.00	c0.03	0.03	
v/s Ratio Perm			0.03			0.03			0.00			0.00
v/c Ratio	0.28	0.63	0.04	0.68	0.49	0.04	0.46	0.47	0.02	0.56	0.46	0.02
Uniform Delay, d1	61.6	20.8	11.3	53.3	11.9	5.8	60.3	60.3	43.2	59.6	59.2	57.7
Progression Factor	0.61	0.33	0.00	0.96	0.29	0.00	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	1.0	0.0	6.1	0.5	0.0	4.1	4.2	0.0	6.5	3.1	0.1
Delay (s)	39.6	7.8	0.0	57.4	3.9	0.0	65.1	65.4	43.3	66.1	62.3	57.8
Level of Service	D	A	A	E	A	A	E	E	D	E	E	E
Approach Delay (s)		7.7			13.1			58.5			62.9	
Approach LOS		A			B			E			E	
























## Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	1405	7	25	1629	206	29	17	23	96	12	37
Future Volume (vph)	66	1405	7	25	1629	206	29	17	23	96	12	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	71	1511	8	27	1752	222	31	18	25	103	13	40
RTOR Reduction (vph)	0	0	3	0	0	61	0	0	24	0	0	36
Lane Group Flow (vph)	71	1511	5	27	1752	161	31	18	1	0	116	4
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	9.3	77.4	77.4	5.2	72.8	86.8	4.9	4.9	4.9		14.0	14.0
Effective Green, g (s)	9.3	77.4	77.4	5.2	72.8	86.8	4.9	4.9	4.9		14.0	14.0
Actuated g/C Ratio	0.07	0.60	0.60	0.04	0.56	0.67	0.04	0.04	0.04		0.11	0.11
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	127	2746	947	70	2544	1046	130	70	59		189	168
v/s Ratio Prot	c0.04	c0.33		0.02	c0.39	0.02	0.01	c0.01			c0.07	
v/s Ratio Perm			0.00			0.09			0.00			0.00
v/c Ratio	0.56	0.55	0.01	0.39	0.69	0.15	0.24	0.26	0.02		0.61	0.03
Uniform Delay, d1	58.4	15.8	10.7	60.8	20.5	8.0	60.7	60.8	60.2		55.4	51.9
Progression Factor	0.53	2.17	1.00	0.98	0.57	2.16	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.3	0.6	0.0	2.8	1.2	0.1	1.0	1.9	0.1		5.8	0.1
Delay (s)	35.4	35.0	10.7	62.2	13.0	17.3	61.7	62.7	60.3		61.2	52.0
Level of Service	D	D	B	E	B	B	E	E	E		E	D
Approach Delay (s)		34.9			14.1			61.5			58.8	
Approach LOS		C			B			E			E	

## Intersection Summary






























HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

10/25/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	1460	25	61	2158	0	10	0	44	0	0	0
Future Volume (vph)	0	1460	25	61	2158	0	10	0	44	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00			
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599			
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1622	28	68	2398	0	11	0	49	0	0	0
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	47	0	0	0
Lane Group Flow (vph)	0	1622	20	68	2398	0	5	6	2	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm			
Protected Phases	5	2		1	6		4	4			3	
Permitted Phases			2			6			4	3		
Actuated Green, G (s)		94.9	94.9	8.0	109.9		5.6	5.6	5.6			
Effective Green, g (s)		94.9	94.9	8.0	109.9		5.6	5.6	5.6			
Actuated g/C Ratio		0.73	0.73	0.06	0.85		0.04	0.04	0.04			
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0			
Lane Grp Cap (vph)		3333	1149	210	3860		73	73	68			
v/s Ratio Prot		0.36		0.02	c0.53		0.00	c0.00				
v/s Ratio Perm			0.01						0.00			
v/c Ratio		0.49	0.02	0.32	0.62		0.07	0.08	0.03			
Uniform Delay, d1		7.3	4.8	58.4	3.3		59.7	59.7	59.6			
Progression Factor		0.31	1.00	1.04	3.71		1.00	1.00	1.00			
Incremental Delay, d2		0.4	0.0	0.2	0.4		0.1	0.2	0.1			
Delay (s)		2.7	4.8	61.0	12.6		59.8	59.9	59.7			
Level of Service		A	A	E	B		E	E	E			
Approach Delay (s)		2.8			13.9		59.7				0.0	
Approach LOS		A			B		E				A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		10.2				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.68										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		59.6%				ICU Level of Service		B				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)


10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	156	1356	10	103	1948	91	20	26	70	118	34	111
Future Volume (vph)	156	1356	10	103	1948	91	20	26	70	118	34	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	171	1490	11	113	2141	100	22	29	77	130	37	122
RTOR Reduction (vph)	0	0	5	0	0	49	0	0	71	0	0	112
Lane Group Flow (vph)	171	1490	6	113	2141	51	0	51	6	83	84	10
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	16.2	69.0	69.0	12.5	65.8	65.8		9.3	9.3	10.2	10.2	10.2
Effective Green, g (s)	16.2	69.0	69.0	12.5	65.8	65.8		9.3	9.3	10.2	10.2	10.2
Actuated g/C Ratio	0.12	0.53	0.53	0.10	0.51	0.51		0.07	0.07	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	221	2448	844	326	2299	793		128	111	129	133	122
v/s Ratio Prot	0.10	c0.32		0.03	c0.47			c0.03		c0.05	0.05	
v/s Ratio Perm			0.00			0.03			0.00			0.01
v/c Ratio	0.77	0.61	0.01	0.35	0.93	0.06		0.40	0.05	0.64	0.63	0.08
Uniform Delay, d1	55.1	21.1	14.4	54.9	30.0	16.4		57.7	56.2	58.1	58.1	55.5
Progression Factor	1.17	0.21	1.00	0.52	0.20	0.12		1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.1	1.0	0.0	0.5	4.8	0.1		2.0	0.2	10.5	9.4	0.3
Delay (s)	78.7	5.6	14.4	29.1	10.8	2.0		64.8	56.4	68.6	67.5	55.8
Level of Service	E	A	B	C	B	A		E	E	E	E	E
Approach Delay (s)		13.1			11.3			59.8			62.9	
Approach LOS		B			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		16.7										
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		130.0							29.0			
Intersection Capacity Utilization		75.0%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↗	↖	↑↑↑	↗	↖	↖	↗	↖	↖	↗
Traffic Volume (vph)	71	1451	31	98	2089	141	36	13	63	172	18	80
Future Volume (vph)	71	1451	31	98	2089	141	36	13	63	172	18	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1738	1591	1664	1684	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1738	1591	1664	1684	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	76	1544	33	104	2222	150	38	14	67	183	19	85
RTOR Reduction (vph)	0	0	13	0	0	55	0	0	63	0	0	77
Lane Group Flow (vph)	76	1544	20	104	2222	95	26	26	4	101	101	8
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	12.0	69.2	77.2	12.8	70.0	82.0	8.0	8.0	8.0	12.0	12.0	12.0
Effective Green, g (s)	12.0	69.2	77.2	12.8	70.0	82.0	8.0	8.0	8.0	12.0	12.0	12.0
Actuated g/C Ratio	0.09	0.53	0.59	0.10	0.54	0.63	0.06	0.06	0.06	0.09	0.09	0.09
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	316	2443	940	173	2459	993	104	106	97	153	155	144
v/s Ratio Prot	0.02	c0.34	0.00	0.06	c0.49	0.01	c0.02	0.01		c0.06	0.06	
v/s Ratio Perm			0.01			0.05			0.00			0.01
v/c Ratio	0.24	0.63	0.02	0.60	0.90	0.10	0.25	0.25	0.04	0.66	0.65	0.05
Uniform Delay, d1	54.8	21.4	10.9	56.2	27.0	9.4	58.1	58.1	57.4	57.0	57.0	53.8
Progression Factor	0.77	0.46	1.00	1.05	0.65	1.82	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.0	0.0	4.0	4.3	0.0	1.3	1.2	0.2	10.2	9.4	0.2
Delay (s)	42.3	10.9	10.9	62.9	21.8	17.2	59.4	59.3	57.6	67.2	66.4	54.0
Level of Service	D	B	B	E	C	B	E	E	E	E	E	D
Approach Delay (s)		12.3			23.2			58.4			63.0	
Approach LOS		B			C			E			E	
























## Intersection Summary

HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	1466	5	18	2265	85	1	0	9	46	1	29
Future Volume (vph)	28	1466	5	18	2265	85	1	0	9	46	1	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	1593	5	20	2462	92	1	0	10	50	1	32
RTOR Reduction (vph)	0	0	2	0	0	30	0	0	10	0	0	31
Lane Group Flow (vph)	30	1593	3	20	2462	62	0	1	0	25	26	1
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	5.3	83.6	83.6	8.7	87.5	87.5		3.2	3.2	5.5	5.5	5.5
Effective Green, g (s)	5.3	83.6	83.6	8.7	87.5	87.5		3.2	3.2	5.5	5.5	5.5
Actuated g/C Ratio	0.04	0.64	0.64	0.07	0.67	0.67		0.02	0.02	0.04	0.04	0.04
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	72	2966	1023	228	3073	1060		42	67	70	70	66
v/s Ratio Prot	0.02	c0.35		0.01	c0.54			c0.00		0.02	c0.02	
v/s Ratio Perm			0.00			0.04			0.00			0.00
v/c Ratio	0.42	0.54	0.00	0.09	0.80	0.06		0.02	0.00	0.36	0.37	0.02
Uniform Delay, d1	60.8	12.6	8.3	56.9	15.1	7.2		61.9	61.8	60.5	60.6	59.7
Progression Factor	1.50	0.25	1.00	0.82	0.67	5.25		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.6	0.0	0.1	1.6	0.1		0.2	0.0	3.1	3.3	0.1
Delay (s)	94.6	3.7	8.3	46.8	11.8	38.0		62.1	61.9	63.6	63.9	59.8
Level of Service	F	A	A	D	B	D		E	E	E	E	E
Approach Delay (s)		5.4			13.0			61.9			62.2	
Approach LOS		A			B			E			E	

## Intersection Summary






















HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	1514	35	29	2440	46	15	4	8	4	4	28
Future Volume (vph)	2	1514	35	29	2440	46	15	4	8	4	4	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.96			0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97			0.99	
Satd. Flow (prot)	1778	4613	1591	1761	4567	1575		1655			1599	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.80			0.96	
Satd. Flow (perm)	1778	4613	1591	1761	4567	1575		1366			1541	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	1682	39	32	2711	51	17	4	9	4	4	31
RTOR Reduction (vph)	0	0	10	0	0	11	0	9	0	0	29	0
Lane Group Flow (vph)	2	1682	29	32	2711	40	0	21	0	0	10	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases			6			2	3			3		
Actuated Green, G (s)	1.3	97.4	97.4	5.5	101.6	101.6		6.6			6.6	
Effective Green, g (s)	1.3	97.4	97.4	5.5	101.6	101.6		6.6			6.6	
Actuated g/C Ratio	0.01	0.75	0.75	0.04	0.78	0.78		0.05			0.05	
Clearance Time (s)	7.0	6.5	6.5	7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)	17	3456	1192	74	3569	1230		69			78	
v/s Ratio Prot	0.00	0.36		c0.02	c0.59							
v/s Ratio Perm			0.02			0.03		c0.02			0.01	
v/c Ratio	0.12	0.49	0.02	0.43	0.76	0.03		0.31			0.12	
Uniform Delay, d1	63.8	6.4	4.2	60.7	7.6	3.2		59.5			58.9	
Progression Factor	1.38	0.12	1.00	1.31	1.10	0.00		1.00			1.00	
Incremental Delay, d2	2.8	0.4	0.0	2.0	0.8	0.0		2.6			0.7	
Delay (s)	90.8	1.2	4.2	81.8	9.2	0.0		62.1			59.6	
Level of Service	F	A	A	F	A	A		E			E	
Approach Delay (s)		1.4			9.8			62.1			59.6	
Approach LOS		A			A			E			E	






























## Intersection Summary

HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)





















10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  				 	 		
Traffic Volume (vph)	48	1491	33	137	2408	376	39	10	109	298	49	44
Future Volume (vph)	48	1491	33	137	2408	376	39	10	109	298	49	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5	7.5	7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	1761	5755	1575		1782	2773	3237	1655	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	1761	5755	1575		1782	2773	3237	1655	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	54	1675	37	154	2706	422	44	11	122	335	55	49
RTOR Reduction (vph)	0	0	19	0	0	103	0	0	92	0	0	45
Lane Group Flow (vph)	54	1675	18	154	2706	319	0	55	30	258	132	4
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases			6			2						3
Actuated Green, G (s)	11.6	64.9	64.9	15.9	69.2	80.2		9.2	32.1	11.0	11.0	11.0
Effective Green, g (s)	11.6	64.9	64.9	15.9	69.2	80.2		9.2	32.1	11.0	11.0	11.0
Actuated g/C Ratio	0.09	0.50	0.50	0.12	0.53	0.62		0.07	0.25	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5	7.5	7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	2302	794	215	3063	971		126	684	273	140	134
v/s Ratio Prot	0.03	c0.36		0.09	c0.47	0.03		c0.03	0.01	0.08	c0.08	
v/s Ratio Perm			0.01			0.17						0.00
v/c Ratio	0.34	0.73	0.02	0.72	0.88	0.33		0.44	0.04	0.95	0.94	0.03
Uniform Delay, d1	55.6	25.6	16.5	54.9	26.8	12.0		57.9	37.3	59.2	59.2	54.6
Progression Factor	0.53	0.23	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	1.9	0.0	11.5	4.1	0.2		3.3	0.0	39.5	58.5	0.1
Delay (s)	30.9	7.8	16.5	66.4	31.0	12.2		61.2	37.3	98.7	117.7	54.7
Level of Service	C	A	B	E	C	B		E	D	F	F	D
Approach Delay (s)		8.7			30.2			44.7			99.5	
Approach LOS		A			C			D			F	
Intersection Summary												
HCM 2000 Control Delay	29.3			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.85											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			29.0					
Intersection Capacity Utilization	70.4%			ICU Level of Service			C					
Analysis Period (min)	15											

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane























10/26/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	0	7	0	4	4	2	0	1	5	10	13
Future Volume (Veh/h)	14	0	7	0	4	4	2	0	1	5	10	13
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	14	0	7	0	4	4	2	0	1	5	10	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None								None			
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	30	25	10	32	38	0	23			1		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	30	25	10	32	38	0	23			1		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	100	100	100	100			100		
cM capacity (veh/h)	968	865	1071	967	851	1084	1592			1622		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	14	7	8	2	1	5	10	13				
Volume Left	14	0	0	2	0	5	0	0				
Volume Right	0	7	4	0	1	0	0	13				
cSH	968	1071	954	1592	1700	1622	1700	1700				
Volume to Capacity	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01				
Queue Length 95th (ft)	1	0	1	0	0	0	0	0				
Control Delay (s)	8.8	8.4	8.8	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.6		8.8	4.8		1.3						
Approach LOS	A		A									
Intersection Summary												
Average Delay	5.0											
Intersection Capacity Utilization	20.0%			ICU Level of Service					A			
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis























## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	1	23	0	3	5	13	92	6	0	29	23
Future Volume (Veh/h)	64	1	23	0	3	5	13	92	6	0	29	23
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	64	1	23	0	3	5	13	92	6	0	29	23
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108	153	14	156	170	46	52				98	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108	153	14	156	170	46	52				98	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	100	98	100	100	100	99				100	
cM capacity (veh/h)	848	732	1062	772	716	1014	1552				1493	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	64	24	3	5	13	46	46	6	0	14	14	23
Volume Left	64	0	0	0	13	0	0	0	0	0	0	0
Volume Right	0	23	0	5	0	0	0	6	0	0	0	23
cSH	848	1042	716	1014	1552	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.08	0.02	0.00	0.00	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01
Queue Length 95th (ft)	6	2	0	0	1	0	0	0	0	0	0	0
Control Delay (s)	9.6	8.5	10.0	8.6	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A	B	A	A							
Approach Delay (s)	9.3	9.1		0.9					0.0			
Approach LOS	A	A										
Intersection Summary												
Average Delay	3.8											
Intersection Capacity Utilization	24.3%			ICU Level of Service					A			
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway





















10/25/2017

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	18	8	7	32	28	11	1	52	46	21	19	39	
Future Volume (Veh/h)	18	8	7	32	28	11	1	52	46	21	19	39	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour 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	
Hourly flow rate (vph)	18	8	7	32	28	11	1	52	46	21	19	39	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)											718		
pX, platoon unblocked													
vC, conflicting volume	114	161	10	116	154	26	58						98
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	114	161	10	116	154	26	58						98
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	98	99	99	96	96	99	100						99
cM capacity (veh/h)	808	720	1069	826	726	1044	1544						1493
Direction, Lane#	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4	
Volume Total	26	7	60	11	1	26	26	46	21	10	10	39	
Volume Left	18	0	32	0	1	0	0	0	21	0	0	0	
Volume Right	0	7	0	11	0	0	0	46	0	0	0	39	
cSH	779	1069	776	1044	1544	1700	1700	1700	1493	1700	1700	1700	
Volume to Capacity	0.03	0.01	0.08	0.01	0.00	0.02	0.02	0.03	0.01	0.01	0.01	0.02	
Queue Length 95th (ft)	3	0	6	1	0	0	0	0	1	0	0	0	
Control Delay (s)	9.8	8.4	10.0	8.5	7.3	0.0	0.0	0.0	7.4	0.0	0.0	0.0	
Lane LOS	A	A	B	A	A								
Approach Delay (s)	9.5			9.8			0.1						
Approach LOS	A			A				2.0					
Intersection Summary													
Average Delay			4.2										
Intersection Capacity Utilization			24.4%		ICU Level of Service				A				
Analysis Period (min)			15										

# HCM Unsignalized Intersection Capacity Analysis

## 3: Celebrate VA/Celbrate VA & Hyannis Place/Bolivar Point Lane

10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	13	3	4	3	66	0	21	4	41	20	11
Future Volume (Veh/h)	27	13	3	4	3	66	0	21	4	41	20	11
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	14	3	4	3	72	0	23	4	45	22	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	197	139	11	134	147	12	34			27		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	197	139	11	134	147	12	34			27		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	100	99	100	93	100			97		
cM capacity (veh/h)	677	730	1067	792	722	1066	1576			1585		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	46	79	0	12	12	4	45	11	11	12		
Volume Left	29	4	0	0	0	0	45	0	0	0		
Volume Right	3	72	0	0	0	4	0	0	0	12		
cSH	709	1030	1700	1700	1700	1700	1585	1700	1700	1700		
Volume to Capacity	0.06	0.08	0.00	0.01	0.01	0.00	0.03	0.01	0.01	0.01		
Queue Length 95th (ft)	5	6	0	0	0	0	2	0	0	0		
Control Delay (s)	10.4	8.8	0.0	0.0	0.0	0.0	7.3	0.0	0.0	0.0		
Lane LOS	B	A					A					
Approach Delay (s)	10.4	8.8	0.0				4.2					
Approach LOS	B	A										
Intersection Summary												
Average Delay			6.5									
Intersection Capacity Utilization			24.6%		ICU Level of Service					A		
Analysis Period (min)			15									

**Intersection: 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center**

Movement	EB	EB	WB	WB
Directions Served	L	TR	LT	R
Maximum Queue (ft)	30	24	20	15
Average Queue (ft)	21	14	4	5
95th Queue (ft)	38	33	17	16
Link Distance (ft)		1010	815	815
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185			
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Intersection: 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton**

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	R	L	L	T	T	LT	R	LT
Maximum Queue (ft)	80	325	284	306	49	198	212	35	29	98	89	79
Average Queue (ft)	24	232	207	207	26	151	158	10	13	46	40	36
95th Queue (ft)	77	332	298	309	51	219	238	32	34	95	99	88
Link Distance (ft)		2762	2762	2762				728	728	748	748	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				410	690	690					65
Storage Blk Time (%)												5
Queuing Penalty (veh)												2

**Intersection: 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton**

Movement	SB
Directions Served	R
Maximum Queue (ft)	36
Average Queue (ft)	11
95th Queue (ft)	35
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	L	LT
Maximum Queue (ft)	45	124	87	108	39	45	64	82	38	56	66	60
Average Queue (ft)	14	84	65	62	11	27	50	19	10	19	35	32
95th Queue (ft)	43	140	90	133	36	63	91	71	35	58	83	66
Link Distance (ft)		282	282	282				489	489	489	2137	2137
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	185				200	400	400					
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB
Directions Served	R	L	T
Maximum Queue (ft)	18	70	51
Average Queue (ft)	6	57	37
95th Queue (ft)	20	74	54
Link Distance (ft)		552	552
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	160		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report  
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10/25/2017

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	104	187	180	190	18	323	189	164	30	26	28	52
Average Queue (ft)	42	101	100	95	4	143	94	101	10	5	14	17
95th Queue (ft)	95	197	183	203	16	327	212	190	32	22	35	52
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		2				3		0				
Queuing Penalty (veh)		1				1		0				

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	199	65
Average Queue (ft)	106	17
95th Queue (ft)	192	59
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	4	
Queuing Penalty (veh)	2	

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	L	L	T	T	T	L	LT
Maximum Queue (ft)	182	238	111	69	49	184	207	189	39	14
Average Queue (ft)	46	53	28	45	37	37	41	38	12	3
95th Queue (ft)	163	207	99	78	55	158	178	163	36	12
Link Distance (ft)	571	571	571			734	734	734	604	604
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)				400	400					
Storage Blk Time (%)								2		
Queuing Penalty (veh)								0		

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	LT	R
Maximum Queue (ft)	174	87	88	68	46	44	163	210	225	17	51	51
Average Queue (ft)	112	46	57	48	14	25	106	127	143	6	30	41
95th Queue (ft)	174	96	96	90	45	43	204	246	252	19	50	57
Link Distance (ft)		585	585	585			490	490	490		799	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				290	290				400		70
Storage Blk Time (%)											0	0
Queuing Penalty (veh)											0	0

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	133	134	44
Average Queue (ft)	51	103	31
95th Queue (ft)	125	139	48
Link Distance (ft)		980	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	120		145
Storage Blk Time (%)	0	2	
Queuing Penalty (veh)	0	4	

# Queuing and Blocking Report

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10/25/2017

## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	31	75	125	204	197	26	114	304	351	410	56	88
Average Queue (ft)	18	50	94	110	110	5	51	248	263	297	34	38
95th Queue (ft)	43	83	139	208	194	22	116	318	359	441	66	99
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)										3		
Queuing Penalty (veh)										5		

## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	66	64	136	126	46
Average Queue (ft)	24	29	87	75	28
95th Queue (ft)	72	64	134	145	56
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90		130	
Storage Blk Time (%)				4	
Queuing Penalty (veh)				3	

## Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	SB	SB	SB
Directions Served	L	T	T	T	L	T	T	T	R	L	LT	R
Maximum Queue (ft)	32	282	242	293	32	90	123	188	20	55	27	51
Average Queue (ft)	11	56	48	59	8	57	74	102	4	25	5	37
95th Queue (ft)	31	243	208	252	28	107	151	202	17	63	23	54
Link Distance (ft)		2403	2403	2403		954	954	954		607		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300				250		150	150
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	T	T	T	L	T	T	T	LTR	LTR
Maximum Queue (ft)	47	44	42	48	90	132	114	48	20
Average Queue (ft)	18	13	12	22	18	26	23	24	12
95th Queue (ft)	55	42	39	53	77	114	98	58	28
Link Distance (ft)	954	954	954		849	849	849	484	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)				150					
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	T	T	T	T	R	LT
Maximum Queue (ft)	65	122	104	150	14	175	595	563	343	334	185	65
Average Queue (ft)	45	70	49	57	3	165	488	462	276	230	120	49
95th Queue (ft)	69	130	124	146	12	196	648	634	364	339	252	74
Link Distance (ft)		849	849	849			1165	1165	1165	1165		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330				330	150					160	
Storage Blk Time (%)						29	19			20	0	
Queuing Penalty (veh)						175	26			76	3	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	86	17	205	200	124	26
Average Queue (ft)	45	4	193	159	69	21
95th Queue (ft)	94	15	208	196	116	38
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					1	
Queuing Penalty (veh)					0	

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (ft)	19	29
Average Queue (ft)	15	21
95th Queue (ft)	27	39
Link Distance (ft)	1628	2167
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NW	SW	SW
Directions Served	LT	R	LT	R	T	T
Maximum Queue (ft)	31	4	29	26	36	30
Average Queue (ft)	15	2	23	5	14	13
95th Queue (ft)	28	4	41	22	36	34
Link Distance (ft)	865	865	2100	2100	1812	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					155	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	EB	WB	NB	SB	SB	SB
Directions Served	L	TR	LTR	TR	L	T	R
Maximum Queue (ft)	21	17	24	23	25	31	26
Average Queue (ft)	13	7	5	5	5	12	5
95th Queue (ft)	29	20	21	20	22	35	22
Link Distance (ft)		2563	3446	614		5758	5758
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	120				190		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 67: McWhirt Loop & Banks Ford Parkway












Movement	EB	WB	WB	SB
Directions Served	LT	LT	R	L
Maximum Queue (ft)	24	28	20	22
Average Queue (ft)	17	21	4	4
95th Queue (ft)	32	38	17	19
Link Distance (ft)	927	626	626	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			200	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 297

# HCM Signalized Intersection Capacity Analysis

## 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.17)































												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	1278	12	127	1393	9	50	42	161	18	23	78
Future Volume (vph)	47	1278	12	127	1393	9	50	42	161	18	23	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	52	1420	13	141	1548	10	56	47	179	20	26	87
RTOR Reduction (vph)	0	0	6	0	0	4	0	0	139	0	0	81
Lane Group Flow (vph)	52	1420	7	141	1548	6	0	103	40	0	46	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	62.3	68.3	23.0	76.3	76.3		6.0	29.0		8.7	8.7
Effective Green, g (s)	9.0	62.3	68.3	23.0	76.3	76.3		6.0	29.0		8.7	8.7
Actuated g/C Ratio	0.07	0.48	0.53	0.18	0.59	0.59		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2199	831	607	2693	929		82	349		122	106
v/s Ratio Prot	c0.03	c0.31	0.00	0.04	c0.34			c0.06	0.02		c0.03	
v/s Ratio Perm			0.00			0.00			0.01			0.00
v/c Ratio	0.43	0.65	0.01	0.23	0.57	0.01		1.26	0.11		0.38	0.05
Uniform Delay, d1	58.0	25.5	14.7	45.9	16.7	11.1		62.0	40.3		58.1	56.8
Progression Factor	1.00	1.00	1.00	1.59	0.26	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	10.5	1.5	0.0	0.8	0.8	0.0		183.0	0.1		2.0	0.2
Delay (s)	68.6	27.0	14.7	73.7	5.2	11.1		245.0	40.4		60.0	57.0
Level of Service	E	C	B	E	A	B		F	D		E	E
Approach Delay (s)		28.4			10.9			115.1			58.1	
Approach LOS		C			B			F			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		28.0										
HCM 2000 Volume to Capacity ratio		0.61										
Actuated Cycle Length (s)		130.0							30.0			
Intersection Capacity Utilization		67.7%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 			 	
Traffic Volume (vph)	17	1463	130	46	1452	66	131	41	86	52	45	26
Future Volume (vph)	17	1463	130	46	1452	66	131	41	86	52	45	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	19	1608	143	51	1596	73	144	45	95	57	49	29
RTOR Reduction (vph)	0	0	60	0	0	23	0	0	75	0	0	27
Lane Group Flow (vph)	19	1608	83	51	1596	50	94	95	20	57	49	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	65.8	75.2	18.0	79.8	88.6	9.4	9.4	27.4	8.8	8.8	8.8
Effective Green, g (s)	4.0	65.8	75.2	18.0	79.8	88.6	9.4	9.4	27.4	8.8	8.8	8.8
Actuated g/C Ratio	0.03	0.51	0.58	0.14	0.61	0.68	0.07	0.07	0.21	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2323	1000	475	2817	1164	120	124	331	118	124	106
v/s Ratio Prot	0.01	c0.35	0.01	0.01	c0.35	0.00	c0.06	0.06	0.01	c0.03	0.03	
v/s Ratio Perm			0.05			0.03			0.00			0.00
v/c Ratio	0.35	0.69	0.08	0.11	0.57	0.04	0.78	0.77	0.06	0.48	0.40	0.02
Uniform Delay, d1	61.7	24.4	12.1	49.0	14.9	6.8	59.3	59.2	41.0	58.4	58.1	56.6
Progression Factor	0.64	0.34	0.00	1.08	0.38	0.00	1.01	1.01	1.42	1.00	1.00	1.00
Incremental Delay, d2	3.3	1.5	0.0	0.4	0.7	0.0	27.6	24.1	0.1	3.1	2.1	0.1
Delay (s)	43.0	9.6	0.0	53.4	6.3	0.0	87.2	83.7	58.1	61.5	60.1	56.6
Level of Service	D	A	A	D	A	A	F	F	E	E	E	E
Approach Delay (s)		9.2			7.4			76.3			60.0	
Approach LOS		A			A			E			E	













### Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	1496	22	39	1378	138	66	13	56	189	19	107
Future Volume (vph)	82	1496	22	39	1378	138	66	13	56	189	19	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	88	1609	24	42	1482	148	71	14	60	203	20	115
RTOR Reduction (vph)	0	0	11	0	0	54	0	0	57	0	0	98
Lane Group Flow (vph)	88	1609	13	42	1482	94	71	14	3	0	223	17
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	11.8	68.4	68.4	7.2	63.3	82.4	6.8	6.8	6.8		19.1	19.1
Effective Green, g (s)	11.8	68.4	68.4	7.2	63.3	82.4	6.8	6.8	6.8		19.1	19.1
Actuated g/C Ratio	0.09	0.53	0.53	0.06	0.49	0.63	0.05	0.05	0.05		0.15	0.15
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	161	2427	837	97	2212	993	180	97	83		257	229
v/s Ratio Prot	c0.05	c0.35		0.02	0.33	0.01	c0.02	0.01			c0.13	
v/s Ratio Perm			0.01			0.05			0.00			0.01
v/c Ratio	0.55	0.66	0.02	0.43	0.67	0.09	0.39	0.14	0.04		0.87	0.07
Uniform Delay, d1	56.5	22.4	14.7	59.4	25.4	9.3	59.6	58.8	58.5		54.2	47.8
Progression Factor	0.53	2.02	1.00	0.80	0.86	3.86	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	1.1	0.0	2.8	1.5	0.0	1.4	0.7	0.2		25.1	0.1
Delay (s)	32.9	46.3	14.7	50.2	23.2	35.8	61.0	59.5	58.7		79.3	48.0
Level of Service	C	D	B	D	C	D	E	E	E		E	D
Approach Delay (s)		45.1			25.0			59.9			68.6	
Approach LOS		D			C			E			E	

## Intersection Summary






























HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	1664	41	43	1678	0	14	0	62	2	0	1
Future Volume (vph)	0	1664	41	43	1678	0	14	0	62	2	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.95	
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599		1722	
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599		1722	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1849	46	48	1864	0	16	0	69	2	0	1
RTOR Reduction (vph)	0	0	15	0	0	0	0	0	66	0	3	0
Lane Group Flow (vph)	0	1849	31	48	1864	0	8	8	3	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		86.5	86.5	8.0	101.5		5.6	5.6	5.6		1.4	
Effective Green, g (s)		86.5	86.5	8.0	101.5		5.6	5.6	5.6		1.4	
Actuated g/C Ratio		0.67	0.67	0.06	0.78		0.04	0.04	0.04		0.01	
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		3038	1047	210	3565		73	73	68		18	
v/s Ratio Prot		c0.40		0.01	c0.41		c0.00	0.00			c0.00	
v/s Ratio Perm			0.02						0.00			
v/c Ratio		0.61	0.03	0.23	0.52		0.11	0.11	0.04		0.00	
Uniform Delay, d1		12.2	7.4	58.1	5.3		59.8	59.8	59.6		63.6	
Progression Factor		0.20	1.00	0.98	2.43		1.00	1.00	1.00		1.00	
Incremental Delay, d2		0.7	0.0	0.1	0.4		0.2	0.2	0.1		0.0	
Delay (s)		3.2	7.5	56.8	13.2		60.0	60.0	59.7		63.6	
Level of Service		A	A	E	B		E	E	E		E	
Approach Delay (s)		3.3			14.3			59.8			63.6	
Approach LOS		A			B			E			E	

### Intersection Summary
























HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.5
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	1417	33	67	1539	88	21	80	184	87	26	139
Future Volume (vph)	191	1417	33	67	1539	88	21	80	184	87	26	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	210	1557	36	74	1691	97	23	88	202	96	29	153
RTOR Reduction (vph)	0	0	17	0	0	50	0	0	184	0	0	142
Lane Group Flow (vph)	210	1557	19	74	1691	47	0	111	18	61	64	11
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	17.4	70.0	70.0	10.0	63.1	63.1		11.8	11.8	9.2	9.2	9.2
Effective Green, g (s)	17.4	70.0	70.0	10.0	63.1	63.1		11.8	11.8	9.2	9.2	9.2
Actuated g/C Ratio	0.13	0.54	0.54	0.08	0.49	0.49		0.09	0.09	0.07	0.07	0.07
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	2483	856	261	2205	760		164	141	117	120	110
v/s Ratio Prot	c0.12	0.34		0.02	c0.37			c0.06		0.04	c0.04	
v/s Ratio Perm			0.01			0.03			0.01			0.01
v/c Ratio	0.89	0.63	0.02	0.28	0.77	0.06		0.68	0.13	0.52	0.53	0.10
Uniform Delay, d1	55.3	20.9	14.0	56.6	27.4	17.7		57.3	54.4	58.3	58.3	56.5
Progression Factor	1.29	0.13	1.00	0.59	0.24	0.02		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.8	1.0	0.0	0.6	2.1	0.1		10.5	0.4	4.1	4.5	0.4
Delay (s)	98.1	3.8	14.1	33.9	8.7	0.6		67.8	54.8	62.4	62.8	56.9
Level of Service	F	A	B	C	A	A		E	D	E	E	E
Approach Delay (s)		15.0			9.3			59.4			59.5	
Approach LOS		B			A			E			E	

## Intersection Summary

























HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	1440	55	45	1480	218	28	33	130	224	20	126
Future Volume (vph)	139	1440	55	45	1480	218	28	33	130	224	20	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1771	1591	1664	1681	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1771	1591	1664	1681	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	148	1532	59	48	1574	232	30	35	138	238	21	134
RTOR Reduction (vph)	0	0	22	0	0	97	0	0	127	0	0	121
Lane Group Flow (vph)	148	1532	37	48	1574	135	27	38	11	129	130	13
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	16.5	70.9	80.9	8.6	63.0	75.5	10.0	10.0	10.0	12.5	12.5	12.5
Effective Green, g (s)	16.5	70.9	80.9	8.6	63.0	75.5	10.0	10.0	10.0	12.5	12.5	12.5
Actuated g/C Ratio	0.13	0.55	0.62	0.07	0.48	0.58	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	435	2503	985	116	2213	914	130	136	122	160	161	150
v/s Ratio Prot	0.04	c0.33	0.00	0.03	c0.34	0.01	0.02	c0.02		c0.08	0.08	
v/s Ratio Perm			0.02			0.07			0.01			0.01
v/c Ratio	0.34	0.61	0.04	0.41	0.71	0.15	0.21	0.28	0.09	0.81	0.81	0.09
Uniform Delay, d1	51.8	20.2	9.5	58.3	26.3	12.5	56.3	56.6	55.8	57.6	57.6	53.5
Progression Factor	0.74	0.26	0.39	1.14	0.33	1.10	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.9	0.0	1.8	1.5	0.1	0.8	1.1	0.3	24.8	24.8	0.2
Delay (s)	38.6	6.2	3.7	68.0	10.3	13.9	57.1	57.7	56.1	82.4	82.4	53.8
Level of Service	D	A	A	E	B	B	E	E	E	F	F	D
Approach Delay (s)		8.9			12.2			56.5			72.6	
Approach LOS		A			B			E			E	

## Intersection Summary






























HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  				 			
Traffic Volume (vph)	59	1739	12	61	1688	41	66	3	136	118	1	64
Future Volume (vph)	59	1739	12	61	1688	41	66	3	136	118	1	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	1890	13	66	1835	45	72	3	148	128	1	70
RTOR Reduction (vph)	0	0	6	0	0	19	0	0	137	0	0	66
Lane Group Flow (vph)	64	1890	7	66	1835	26	0	75	11	64	65	4
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	7.7	71.6	71.6	11.6	76.0	76.0		9.5	9.5	8.3	8.3	8.3
Effective Green, g (s)	7.7	71.6	71.6	11.6	76.0	76.0		9.5	9.5	8.3	8.3	8.3
Actuated g/C Ratio	0.06	0.55	0.55	0.09	0.58	0.58		0.07	0.07	0.06	0.06	0.06
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	105	2540	876	304	2669	920		127	200	105	106	99
v/s Ratio Prot	0.04	c0.41		0.02	c0.40			c0.04		0.04	c0.04	
v/s Ratio Perm			0.00			0.02			0.00			0.00
v/c Ratio	0.61	0.74	0.01	0.22	0.69	0.03		0.59	0.05	0.61	0.61	0.05
Uniform Delay, d1	59.7	22.2	13.2	55.0	18.8	11.4		58.4	56.1	59.3	59.3	57.1
Progression Factor	1.36	0.50	1.00	0.52	0.18	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.9	1.6	0.0	0.3	1.3	0.1		7.2	0.1	9.6	10.1	0.2
Delay (s)	89.0	12.8	13.2	28.8	4.7	11.5		65.5	56.2	68.9	69.4	57.3
Level of Service	F	B	B	C	A	B		E	E	E	E	E
Approach Delay (s)		15.3			5.7			59.3			65.0	
Approach LOS		B			A			E			E	






















### Intersection Summary

HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1963	22	9	1774	26	10	0	6	39	1	11
Future Volume (vph)	0	1963	22	9	1774	26	10	0	6	39	1	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5	6.5	7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00		1.00			1.00	
Frt		1.00	0.85	1.00	1.00	0.85		0.95			0.97	
Flt Protected		1.00	1.00	0.95	1.00	1.00		0.97			0.96	
Satd. Flow (prot)		4613	1591	1761	4567	1575		1630			1684	
Flt Permitted		1.00	1.00	0.95	1.00	1.00		0.83			0.76	
Satd. Flow (perm)		4613	1591	1761	4567	1575		1397			1336	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2181	24	10	1971	29	11	0	7	43	1	12
RTOR Reduction (vph)	0	0	6	0	0	5	0	17	0	0	8	0
Lane Group Flow (vph)	0	2181	18	10	1971	24	0	1	0	0	48	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases			6			2	3			3		
Actuated Green, G (s)		98.9	98.9	1.6	107.5	107.5		9.0			9.0	
Effective Green, g (s)		98.9	98.9	1.6	107.5	107.5		9.0			9.0	
Actuated g/C Ratio		0.76	0.76	0.01	0.83	0.83		0.07			0.07	
Clearance Time (s)		6.5	6.5	7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		3509	1210	21	3776	1302		96			92	
v/s Ratio Prot		c0.47		0.01	c0.43							
v/s Ratio Perm			0.01			0.02		0.00			c0.04	
v/c Ratio		0.62	0.02	0.48	0.52	0.02		0.01			0.52	
Uniform Delay, d1		7.1	3.8	63.8	3.4	2.0		56.4			58.4	
Progression Factor		0.16	1.00	1.43	0.86	1.00		1.00			1.00	
Incremental Delay, d2		0.6	0.0	12.6	0.4	0.0		0.1			4.8	
Delay (s)		1.7	3.8	103.9	3.3	2.0		56.4			63.3	
Level of Service		A	A	F	A	A		E			E	
Approach Delay (s)		1.8			3.8			56.4			63.3	
Approach LOS		A			A			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		3.8										
HCM 2000 Volume to Capacity ratio		0.63										
Actuated Cycle Length (s)		130.0						20.5				
Intersection Capacity Utilization		53.3%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

10/25/2017



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↑	↱↱	↰↰	↑	↱
Traffic Volume (vph)	80	1984	17	115	1693	351	35	13	357	493	28	108
Future Volume (vph)	80	1984	17	115	1693	351	35	13	357	493	28	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5	7.5	7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1761	5755	1575		1789	2773	3237	1635	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1761	5755	1575		1789	2773	3237	1635	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	90	2229	19	129	1902	394	39	15	401	554	31	121
RTOR Reduction (vph)	0	0	9	0	0	147	0	0	120	0	0	111
Lane Group Flow (vph)	90	2229	10	129	1902	247	0	54	281	388	197	10
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases			6			2						3
Actuated Green, G (s)	14.5	65.1	65.1	14.9	65.5	76.5		10.0	31.9	11.0	11.0	11.0
Effective Green, g (s)	14.5	65.1	65.1	14.9	65.5	76.5		10.0	31.9	11.0	11.0	11.0
Actuated g/C Ratio	0.11	0.50	0.50	0.11	0.50	0.59		0.08	0.25	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5	7.5	7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	2310	796	201	2899	926		137	680	273	138	134
v/s Ratio Prot	0.05	c0.48		0.07	c0.33	0.02		0.03	c0.10	0.12	c0.12	
v/s Ratio Perm			0.01			0.13						0.01
v/c Ratio	0.45	0.96	0.01	0.64	0.66	0.27		0.39	0.41	1.42	1.43	0.08
Uniform Delay, d1	54.0	31.3	16.3	55.0	23.9	13.1		57.1	41.2	59.5	59.5	54.8
Progression Factor	0.60	0.35	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	10.8	0.0	7.6	1.2	0.2		2.5	0.6	209.7	229.0	0.2
Delay (s)	33.7	21.6	16.3	62.6	25.1	13.2		59.7	41.7	269.2	288.5	55.1
Level of Service	C	C	B	E	C	B		E	D	F	F	E
Approach Delay (s)		22.1			25.1			43.9			237.9	
Approach LOS		C			C			D			F	



















## Intersection Summary

HCM 2000 Control Delay	50.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane























10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	1	2	0	4	4	3	5	3	6	9	19
Future Volume (Veh/h)	14	1	2	0	4	4	3	5	3	6	9	19
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	14	1	2	0	4	4	3	5	3	6	9	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	38	35	9	36	52	6	28				8	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	38	35	9	36	52	6	28				8	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	99	100	100	100	100	100	100				100	
cM capacity (veh/h)	956	853	1073	963	834	1076	1585				1612	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	14	3	8	3	8	6	9	19				
Volume Left	14	0	0	3	0	6	0	0				
Volume Right	0	2	4	0	3	0	0	19				
cSH	956	988	940	1585	1700	1612	1700	1700				
Volume to Capacity	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01				
Queue Length 95th (ft)	1	0	1	0	0	0	0	0				
Control Delay (s)	8.8	8.7	8.9	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.8		8.9	2.0		1.3						
Approach LOS	A		A									
Intersection Summary												
Average Delay	4.1											
Intersection Capacity Utilization	20.0%			ICU Level of Service			A					
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis























## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	7	10	10	12	3	40	70	28	1	138	283
Future Volume (Veh/h)	22	7	10	10	12	3	40	70	28	1	138	283
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	22	7	10	10	12	3	40	70	28	1	138	283
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	264	318	69	234	573	35	421			98		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	264	318	69	234	573	35	421			98		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	99	99	99	97	100	96			100		
cM capacity (veh/h)	633	576	980	668	413	1030	1135			1493		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	22	17	22	3	40	35	35	28	1	69	69	283
Volume Left	22	0	10	0	40	0	0	0	1	0	0	0
Volume Right	0	10	0	3	0	0	0	28	0	0	0	283
cSH	633	760	499	1030	1135	1700	1700	1700	1493	1700	1700	1700
Volume to Capacity	0.03	0.02	0.04	0.00	0.04	0.02	0.02	0.02	0.00	0.04	0.04	0.17
Queue Length 95th (ft)	3	2	3	0	3	0	0	0	0	0	0	0
Control Delay (s)	10.9	9.8	12.5	8.5	8.3	0.0	0.0	0.0	7.4	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	10.4		12.1		2.4				0.0			
Approach LOS	B		B									
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			34.2%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway













10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	14	5	27	26	8	17	11	51	5	54	143
Future Volume (Veh/h)	21	14	5	27	26	8	17	11	51	5	54	143
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	21	14	5	27	26	8	17	11	51	5	54	143
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	124	160	27	94	252	6	197			62		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	124	160	27	94	252	6	197			62		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	100	97	96	99	99			100		
cM capacity (veh/h)	795	720	1042	852	640	1076	1373			1539		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	35	5	53	8	17	6	6	51	5	27	27	143
Volume Left	21	0	27	0	17	0	0	0	5	0	0	0
Volume Right	0	5	0	8	0	0	0	51	0	0	0	143
cSH	763	1042	733	1076	1373	1700	1700	1700	1539	1700	1700	1700
Volume to Capacity	0.05	0.00	0.07	0.01	0.01	0.00	0.00	0.03	0.00	0.02	0.02	0.08
Queue Length 95th (ft)	4	0	6	1	1	0	0	0	0	0	0	0
Control Delay (s)	9.9	8.5	10.3	8.4	7.7	0.0	0.0	0.0	7.3	0.0	0.0	0.0
Lane LOS	A	A	B	A	A				A			
Approach Delay (s)	9.8		10.0		1.6				0.2			
Approach LOS	A		B									
<b>Intersection Summary</b>												
Average Delay			3.1									
Intersection Capacity Utilization			25.5%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

3:

10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↑↑	↔	↔	↑↑	↔
Traffic Volume (veh/h)	33	4	2	5	5	67	2	25	10	73	36	35
Future Volume (Veh/h)	33	4	2	5	5	67	2	25	10	73	36	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	4	2	5	5	73	2	27	11	79	39	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	290	239	20	212	266	14	77			38		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	290	239	20	212	266	14	77			38		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	99	100	99	99	93	100			95		
cM capacity (veh/h)	569	627	1054	693	606	1063	1520			1571		
Direction, Lane#	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	42	83	2	14	14	11	79	20	20	38		
Volume Left	36	5	2	0	0	0	79	0	0	0		
Volume Right	2	73	0	0	0	11	0	0	0	38		
cSH	587	986	1520	1700	1700	1700	1571	1700	1700	1700		
Volume to Capacity	0.07	0.08	0.00	0.01	0.01	0.01	0.05	0.01	0.01	0.02		
Queue Length 95th (ft)	6	7	0	0	0	0	4	0	0	0		
Control Delay (s)	11.6	9.0	7.4	0.0	0.0	0.0	7.4	0.0	0.0	0.0		
Lane LOS	B	A	A				A					
Approach Delay (s)	11.6	9.0	0.4				3.8					
Approach LOS	B	A										
Intersection Summary												
Average Delay			5.7									
Intersection Capacity Utilization			26.2%			ICU Level of Service				A		
Analysis Period (min)			15									

Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	SB
Directions Served	L	TR	LT	R
Maximum Queue (ft)	24	30	22	5
Average Queue (ft)	10	15	9	2
95th Queue (ft)	29	36	26	5
Link Distance (ft)		1010	815	2137
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrenton

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	LT
Maximum Queue (ft)	83	218	298	243	87	82	57	74	69	138	45	70
Average Queue (ft)	54	146	197	185	37	38	18	44	28	79	18	32
95th Queue (ft)	97	246	327	264	90	88	57	85	66	154	45	68
Link Distance (ft)		2762	2762	2762			728	728	728	748	748	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				690	690						65
Storage Blk Time (%)												11
Queuing Penalty (veh)												9

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrenton

Movement	SB
Directions Served	R
Maximum Queue (ft)	59
Average Queue (ft)	32
95th Queue (ft)	59
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

# Queuing and Blocking Report

am

10/25/2017

## Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	L	LT
Maximum Queue (ft)	45	326	308	223	21	23	18	38	14	52	131	126
Average Queue (ft)	18	224	181	121	12	6	8	23	3	21	78	64
95th Queue (ft)	46	348	336	221	28	21	20	46	12	53	126	122
Link Distance (ft)		282	282	282				489	489	489	2137	2137
Upstream Blk Time (%)		3	1									
Queuing Penalty (veh)		16	6									
Storage Bay Dist (ft)	185				200	400	400					
Storage Blk Time (%)		7		1								
Queuing Penalty (veh)		1		1								

## Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	T	R
Maximum Queue (ft)	39	68	71	42
Average Queue (ft)	17	44	34	8
95th Queue (ft)	37	68	81	36
Link Distance (ft)		552	552	552
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	160			
Storage Blk Time (%)				
Queuing Penalty (veh)				

# Queuing and Blocking Report

am

10/25/2017

## Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	184	535	509	524	59	318	328	343	200	29	74	31
Average Queue (ft)	106	338	354	351	19	259	237	280	131	20	46	9
95th Queue (ft)	172	546	515	523	55	321	323	373	269	38	75	30
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		20				13		13				
Queuing Penalty (veh)		17				5		19				

## Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	215	194
Average Queue (ft)	190	105
95th Queue (ft)	225	229
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	15	0
Queuing Penalty (veh)	16	0

## Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	T	L	LT
Maximum Queue (ft)	43	44	20	11	37	73	93	71	108	18	12
Average Queue (ft)	13	13	8	2	22	15	29	24	43	4	4
95th Queue (ft)	41	42	23	9	37	63	91	74	130	16	12
Link Distance (ft)	571	571	571	571			734	734	734	602	602
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)					400	400					
Storage Blk Time (%)									0		
Queuing Penalty (veh)									0		

# Queuing and Blocking Report

am

10/25/2017

## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	LT	R
Maximum Queue (ft)	371	48	47	24	24	67	83	86	125	20	93	91
Average Queue (ft)	228	10	16	9	12	27	38	38	71	6	63	73
95th Queue (ft)	391	41	44	28	30	70	78	94	133	20	100	93
Link Distance (ft)		585	585	585			490	490	490		799	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				290	290				400		70
Storage Blk Time (%)	9										9	9
Queuing Penalty (veh)	41										16	9

## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	144	262	170
Average Queue (ft)	66	141	87
95th Queue (ft)	164	258	155
Link Distance (ft)		980	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	120		145
Storage Blk Time (%)	1	16	
Queuing Penalty (veh)	1	29	

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	55	53	134	113	135	52	51	201	350	252	53	26
Average Queue (ft)	38	40	52	67	78	22	28	144	196	180	27	12
95th Queue (ft)	73	59	127	122	127	55	48	233	331	282	55	30
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	115	114	136	134	88
Average Queue (ft)	54	47	101	99	56
95th Queue (ft)	117	105	138	132	93
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90		130	
Storage Blk Time (%)	0	1		0	
Queuing Penalty (veh)	0	0		1	

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	R
Maximum Queue (ft)	55	96	183	195	37	30	237	191	235	73	90	30
Average Queue (ft)	33	48	69	67	11	12	104	112	132	54	71	18
95th Queue (ft)	62	105	169	181	34	28	220	187	259	78	103	41
Link Distance (ft)		2403	2403	2403			954	954	954	683	683	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300						220
Storage Blk Time (%)									0			
Queuing Penalty (veh)									0			

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	188	175	52
Average Queue (ft)	135	96	45
95th Queue (ft)	199	193	60
Link Distance (ft)	607		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	150
Storage Blk Time (%)	5	0	
Queuing Penalty (veh)	6	0	

Intersection: 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	T	T	T	L	T	T	T	LTR	LTR
Maximum Queue (ft)	25	44	23	23	48	51	70	46	66
Average Queue (ft)	5	12	8	14	15	21	24	28	38
95th Queue (ft)	22	40	24	28	47	53	74	55	74
Link Distance (ft)	954	954	954		849	849	849	484	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)				150					
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	T	R	LT	R
Maximum Queue (ft)	89	118	136	100	127	296	293	282	115	52	67	174
Average Queue (ft)	50	79	94	78	60	180	178	149	39	22	49	124
95th Queue (ft)	102	127	151	113	128	282	325	280	105	51	86	182
Link Distance (ft)		849	849	849		1165	1165	1165	1165		451	451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330				150					160		
Storage Blk Time (%)						11						
Queuing Penalty (veh)						13						

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	LT	R
Maximum Queue (ft)	117	290	246	208	155
Average Queue (ft)	53	272	224	184	118
95th Queue (ft)	127	314	259	223	198
Link Distance (ft)	451	611	611	611	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				130	
Storage Blk Time (%)				23	1
Queuing Penalty (veh)				24	2

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (ft)	24	60
Average Queue (ft)	21	32
95th Queue (ft)	25	66
Link Distance (ft)	1628	2167
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NE	SW	SW
Directions Served	LT	R	LT	L	T	T
Maximum Queue (ft)	35	5	30	24	53	45
Average Queue (ft)	18	4	22	5	17	14
95th Queue (ft)	32	7	40	21	53	45
Link Distance (ft)	865	865	2100		1812	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)				325		155
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	WB	NB	NB	SB	SB
Directions Served	L	LTR	L	TR	T	R
Maximum Queue (ft)	26	25	25	27	29	26
Average Queue (ft)	21	5	10	5	6	10
95th Queue (ft)	25	21	29	23	25	30
Link Distance (ft)		3446	1464	1464	5758	5758
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	120					
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 67: McWhirt Loop & Banks Ford Parkway

Movement	EB	WB	WB
Directions Served	LT	LT	R
Maximum Queue (ft)	26	28	20
Average Queue (ft)	9	21	4
95th Queue (ft)	28	38	17
Link Distance (ft)	927	626	626
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary


Network wide Queuing Penalty: 233

## **Capacity Analysis Results**

*Build out year 2027*

# HCM Signalized Intersection Capacity Analysis

























5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↰	↱		↰	↱
Traffic Volume (vph)	99	1575	73	597	1124	9	16	35	310	10	50	44
Future Volume (vph)	99	1575	73	597	1124	9	16	35	310	10	50	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1815	1567		1857	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1815	1567		1857	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	110	1750	81	663	1249	10	18	39	344	11	56	49
RTOR Reduction (vph)	0	0	39	0	0	4	0	0	149	0	0	46
Lane Group Flow (vph)	110	1750	42	663	1249	6	0	57	195	0	67	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	62.1	68.1	23.0	76.1	76.1		6.0	29.0		8.9	8.9
Effective Green, g (s)	9.0	62.1	68.1	23.0	76.1	76.1		6.0	29.0		8.9	8.9
Actuated g/C Ratio	0.07	0.48	0.52	0.18	0.59	0.59		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2192	829	607	2686	926		83	349		127	108
v/s Ratio Prot	0.06	c0.38	0.00	c0.19	0.27			c0.03	0.10		c0.04	
v/s Ratio Perm			0.02			0.00			0.03			0.00
v/c Ratio	0.90	0.80	0.05	1.09	0.47	0.01		0.69	0.56		0.53	0.03
Uniform Delay, d1	60.1	28.7	15.1	53.5	15.4	11.2		61.1	44.8		58.5	56.5
Progression Factor	1.00	1.00	1.00	1.58	0.13	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	58.3	3.1	0.0	61.3	0.5	0.0		21.0	1.9		3.9	0.1
Delay (s)	118.4	31.8	15.2	145.7	2.5	11.2		82.1	46.8		62.4	56.6
Level of Service	F	C	B	F	A	B		F	D		E	E
Approach Delay (s)		36.0			52.0			51.8			60.0	
Approach LOS		D			D			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		45.1										
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		130.0							30.0			
Intersection Capacity Utilization		76.5%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis
























## 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	1731	84	361	1632	73	62	20	37	63	55	32
Future Volume (vph)	13	1731	84	361	1632	73	62	20	37	63	55	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	14	1902	92	397	1793	80	68	22	41	69	60	35
RTOR Reduction (vph)	0	0	39	0	0	24	0	0	33	0	0	33
Lane Group Flow (vph)	14	1902	53	397	1793	56	44	46	8	69	60	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	67.3	74.9	18.0	81.3	90.4	7.6	7.6	25.6	9.1	9.1	9.1
Effective Green, g (s)	4.0	67.3	74.9	18.0	81.3	90.4	7.6	7.6	25.6	9.1	9.1	9.1
Actuated g/C Ratio	0.03	0.52	0.58	0.14	0.63	0.70	0.06	0.06	0.20	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2376	997	475	2870	1186	97	100	310	122	129	109
v/s Ratio Prot	0.01	c0.41	0.00	c0.12	0.39	0.00	0.03	c0.03	0.00	c0.04	0.03	
v/s Ratio Perm			0.03			0.03			0.00			0.00
v/c Ratio	0.26	0.80	0.05	0.84	0.62	0.05	0.45	0.46	0.03	0.57	0.47	0.02
Uniform Delay, d1	61.6	25.8	12.0	54.6	15.0	6.2	59.2	59.2	42.1	58.5	58.1	56.3
Progression Factor	0.65	0.36	0.00	1.04	0.40	0.00	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	1.9	0.0	9.2	0.6	0.0	3.3	3.3	0.0	5.9	2.6	0.1
Delay (s)	41.9	11.2	0.0	65.7	6.6	0.0	63.2	63.3	42.2	64.4	60.8	56.4
Level of Service	D	B	A	E	A	A	E	E	D	E	E	E
Approach Delay (s)		10.9			16.7			56.7			61.4	
Approach LOS		B			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		16.9										
HCM 2000 Volume to Capacity ratio		0.76										
Actuated Cycle Length (s)		130.0							28.0			
Intersection Capacity Utilization		71.4%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	1713	9	30	1986	251	35	21	28	117	15	45
Future Volume (vph)	80	1713	9	30	1986	251	35	21	28	117	15	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	86	1842	10	32	2135	270	38	23	30	126	16	48
RTOR Reduction (vph)	0	0	4	0	0	65	0	0	29	0	0	42
Lane Group Flow (vph)	86	1842	6	32	2135	205	38	23	1	0	142	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	11.7	75.4	75.4	5.4	68.6	84.1	5.2	5.2	5.2		15.5	15.5
Effective Green, g (s)	11.7	75.4	75.4	5.4	68.6	84.1	5.2	5.2	5.2		15.5	15.5
Actuated g/C Ratio	0.09	0.58	0.58	0.04	0.53	0.65	0.04	0.04	0.04		0.12	0.12
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	160	2675	922	72	2397	1013	138	74	63		209	186
v/s Ratio Prot	c0.05	c0.40		0.02	c0.47	0.02	0.01	c0.01			c0.08	
v/s Ratio Perm			0.00			0.11			0.00			0.00
v/c Ratio	0.54	0.69	0.01	0.44	0.89	0.20	0.28	0.31	0.02		0.68	0.03
Uniform Delay, d1	56.6	19.1	11.5	60.8	27.4	9.3	60.6	60.7	59.9		54.9	50.6
Progression Factor	0.62	2.05	1.00	0.94	0.70	1.51	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.9	0.0	2.9	3.8	0.1	1.1	2.4	0.1		8.5	0.1
Delay (s)	37.4	40.1	11.5	59.8	22.8	14.1	61.7	63.1	60.1		63.4	50.7
Level of Service	D	D	B	E	C	B	E	E	E		E	D
Approach Delay (s)		39.8			22.4			61.5			60.1	
Approach LOS		D			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			31.9				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			130.0				Sum of lost time (s)			29.0		
Intersection Capacity Utilization			75.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/15/2017


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1780	30	74	2631	0	12	0	54	0	0	0
Future Volume (vph)	0	1780	30	74	2631	0	12	0	54	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00			
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599			
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1978	33	82	2923	0	13	0	60	0	0	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	57	0	0	0
Lane Group Flow (vph)	0	1978	24	82	2923	0	6	7	3	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm			
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		92.9	92.9	10.0	109.9		5.6	5.6	5.6			
Effective Green, g (s)		92.9	92.9	10.0	109.9		5.6	5.6	5.6			
Actuated g/C Ratio		0.71	0.71	0.08	0.85		0.04	0.04	0.04			
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0			
Lane Grp Cap (vph)		3263	1125	262	3860		73	73	68			
v/s Ratio Prot		0.43		0.02	c0.64		0.00	c0.00				
v/s Ratio Perm			0.01						0.00			
v/c Ratio		0.61	0.02	0.31	0.76		0.08	0.10	0.04			
Uniform Delay, d1		9.3	5.4	56.8	4.3		59.7	59.8	59.6			
Progression Factor		0.38	1.00	1.05	4.32		1.00	1.00	1.00			
Incremental Delay, d2		0.7	0.0	0.0	0.1		0.2	0.2	0.1			
Delay (s)		4.2	5.4	59.9	18.8		59.9	60.0	59.7			
Level of Service		A	A	E	B		E	E	E			
Approach Delay (s)		4.2			19.9			59.7			0.0	
Approach LOS		A			B			E			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		14.3				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		68.8%				ICU Level of Service		C				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)


11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↑	↱	↰	↑	↱
Traffic Volume (vph)	190	1653	12	126	2375	111	24	32	85	144	41	135
Future Volume (vph)	190	1653	12	126	2375	111	24	32	85	144	41	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1797	1560	1656	1696	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1797	1560	1656	1696	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	209	1816	13	138	2610	122	26	35	93	158	45	148
RTOR Reduction (vph)	0	0	6	0	0	63	0	0	86	0	0	135
Lane Group Flow (vph)	209	1816	7	138	2610	59	0	61	7	101	102	13
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	17.4	67.7	67.7	12.5	63.3	63.3		9.8	9.8	11.0	11.0	11.0
Effective Green, g (s)	17.4	67.7	67.7	12.5	63.3	63.3		9.8	9.8	11.0	11.0	11.0
Actuated g/C Ratio	0.13	0.52	0.52	0.10	0.49	0.49		0.08	0.08	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	2402	828	326	2212	763		135	117	140	143	132
v/s Ratio Prot	0.12	c0.39		0.04	c0.57			c0.03		c0.06	0.06	
v/s Ratio Perm			0.00			0.04			0.00			0.01
v/c Ratio	0.88	0.76	0.01	0.42	1.18	0.08		0.45	0.06	0.72	0.71	0.09
Uniform Delay, d1	55.3	24.6	15.0	55.4	33.4	17.8		57.5	55.8	58.0	58.0	54.9
Progression Factor	1.20	0.25	1.00	0.52	0.20	0.07		1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.3	1.9	0.0	0.1	81.4	0.0		2.4	0.2	16.7	15.5	0.3
Delay (s)	91.6	8.1	15.0	28.8	88.2	1.3		65.0	56.0	74.7	73.5	55.2
Level of Service	F	A	B	C	F	A		E	E	E	E	E
Approach Delay (s)		16.7			81.6			59.6			66.1	
Approach LOS		B			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		55.5			HCM 2000 Level of Service			E				
HCM 2000 Volume to Capacity ratio		1.03										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			29.0				
Intersection Capacity Utilization		86.1%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis
























10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗	↖	↑↑↑	↗	↖	↖	↗	↖	↖	↗
Traffic Volume (vph)	87	1769	38	119	2546	172	44	16	77	210	22	98
Future Volume (vph)	87	1769	38	119	2546	172	44	16	77	210	22	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1736	1591	1664	1683	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1736	1591	1664	1683	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	93	1882	40	127	2709	183	47	17	82	223	23	104
RTOR Reduction (vph)	0	0	17	0	0	66	0	0	76	0	0	94
Lane Group Flow (vph)	93	1882	23	127	2709	117	31	33	6	123	123	10
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	15.0	66.2	76.2	13.4	64.6	77.0	10.0	10.0	10.0	12.4	12.4	12.4
Effective Green, g (s)	15.0	66.2	76.2	13.4	64.6	77.0	10.0	10.0	10.0	12.4	12.4	12.4
Actuated g/C Ratio	0.12	0.51	0.59	0.10	0.50	0.59	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	396	2337	927	181	2269	932	130	133	122	158	160	149
v/s Ratio Prot	0.03	c0.41	0.00	0.07	c0.59	0.01	0.02	c0.02		c0.07	0.07	
v/s Ratio Perm			0.01			0.06			0.00			0.01
v/c Ratio	0.23	0.81	0.03	0.70	1.19	0.13	0.24	0.25	0.05	0.78	0.77	0.07
Uniform Delay, d1	52.3	26.5	11.3	56.4	32.7	11.7	56.4	56.5	55.6	57.5	57.4	53.5
Progression Factor	0.71	0.51	1.00	1.01	0.71	1.62	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	2.1	0.0	5.6	89.5	0.0	1.0	1.0	0.2	21.1	19.6	0.2
Delay (s)	37.5	15.7	11.3	62.3	112.8	18.9	57.4	57.4	55.8	78.5	77.0	53.7
Level of Service	D	B	B	E	F	B	E	E	E	E	E	D
Approach Delay (s)		16.6			105.0			56.5			70.6	
Approach LOS		B			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		69.3			HCM 2000 Level of Service			E				
HCM 2000 Volume to Capacity ratio		1.01										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			28.0				
Intersection Capacity Utilization		88.1%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	1787	6	22	2761	104	1	0	11	56	1	35
Future Volume (vph)	34	1787	6	22	2761	104	1	0	11	56	1	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	1942	7	24	3001	113	1	0	12	61	1	38
RTOR Reduction (vph)	0	0	3	0	0	37	0	0	12	0	0	36
Lane Group Flow (vph)	37	1942	4	24	3001	76	0	1	0	31	31	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	5.5	83.3	83.3	8.7	87.0	87.0		3.2	3.2	5.8	5.8	5.8
Effective Green, g (s)	5.5	83.3	83.3	8.7	87.0	87.0		3.2	3.2	5.8	5.8	5.8
Actuated g/C Ratio	0.04	0.64	0.64	0.07	0.67	0.67		0.02	0.02	0.04	0.04	0.04
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	75	2955	1019	228	3056	1054		42	67	73	74	69
v/s Ratio Prot	0.02	c0.42		0.01	c0.66			c0.00		c0.02	0.02	
v/s Ratio Perm			0.00			0.05			0.00			0.00
v/c Ratio	0.49	0.66	0.00	0.11	0.98	0.07		0.02	0.00	0.42	0.42	0.02
Uniform Delay, d1	60.9	14.5	8.4	57.0	20.7	7.5		61.9	61.8	60.5	60.5	59.4
Progression Factor	1.42	0.24	1.00	0.90	0.78	0.94		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.7	0.0	0.1	8.4	0.1		0.2	0.0	3.9	3.8	0.1
Delay (s)	89.7	4.1	8.4	51.5	24.7	7.1		62.1	61.9	64.4	64.3	59.5
Level of Service	F	A	A	D	C	A		E	E	E	E	E
Approach Delay (s)		5.7			24.3			61.9			62.5	
Approach LOS		A			C			E			E	





















## Intersection Summary

HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)






























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1846	43	35	2974	56	18	5	10	5	5	34
Future Volume (vph)	0	1846	43	35	2974	56	18	5	10	5	5	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.96			0.90	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.99	
Satd. Flow (prot)		5806		1761	4567	1575		1657			1606	
Flt Permitted		1.00		0.95	1.00	1.00		0.85			0.95	
Satd. Flow (perm)		5806		1761	4567	1575		1444			1536	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2051	48	39	3304	62	20	6	11	6	6	38
RTOR Reduction (vph)	0	2	0	0	0	10	0	10	0	0	36	0
Lane Group Flow (vph)	0	2097	0	39	3304	52	0	27	0	0	14	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3				3
Permitted Phases						2	3			3		
Actuated Green, G (s)		95.1		7.3	109.4	109.4		7.1			7.1	
Effective Green, g (s)		95.1		7.3	109.4	109.4		7.1			7.1	
Actuated g/C Ratio		0.73		0.06	0.84	0.84		0.05			0.05	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4247		98	3843	1325		78			83	
v/s Ratio Prot		0.36		0.02	c0.72							
v/s Ratio Perm						0.03		c0.02			0.01	
v/c Ratio		0.49		0.40	0.86	0.04		0.34			0.17	
Uniform Delay, d1		7.3		59.2	5.9	1.7		59.2			58.6	
Progression Factor		0.15		1.31	2.21	0.00		1.00			1.00	
Incremental Delay, d2		0.3		0.2	0.3	0.0		2.6			1.0	
Delay (s)		1.4		78.0	13.3	0.0		61.8			59.6	
Level of Service		A		E	B	A		E			E	
Approach Delay (s)		1.4			13.8			61.8			59.6	
Approach LOS		A			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		9.9					HCM 2000 Level of Service		A			
HCM 2000 Volume to Capacity ratio		0.88										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		20.5			
Intersection Capacity Utilization		74.8%					ICU Level of Service		D			
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)













11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  				 	 	 	
Traffic Volume (vph)	59	1818	40	167	2935	458	48	12	133	363	60	54
Future Volume (vph)	59	1818	40	167	2935	458	48	12	133	363	60	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	5806		1761	5755	1575		1782	2773	3237	1655	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	5806		1761	5755	1575		1782	2773	3237	1655	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	66	2043	45	188	3298	515	54	13	149	408	67	61
RTOR Reduction (vph)	0	2	0	0	0	104	0	0	111	0	0	56
Lane Group Flow (vph)	66	2086	0	188	3298	411	0	67	38	314	161	5
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	11.6	63.8		16.8	69.0	80.0		9.4	33.2	11.0	11.0	11.0
Effective Green, g (s)	11.6	63.8		16.8	69.0	80.0		9.4	33.2	11.0	11.0	11.0
Actuated g/C Ratio	0.09	0.49		0.13	0.53	0.62		0.07	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	2849		227	3054	969		128	708	273	140	134
v/s Ratio Prot	0.04	c0.36		0.11	c0.57	0.04		c0.04	0.01	0.10	c0.10	
v/s Ratio Perm						0.23						0.00
v/c Ratio	0.42	0.73		0.83	1.08	0.42		0.52	0.05	1.15	1.15	0.04
Uniform Delay, d1	56.0	26.3		55.2	30.5	13.0		58.1	36.5	59.5	59.5	54.6
Progression Factor	0.59	0.30		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	1.5		22.2	42.7	0.3		5.0	0.0	101.3	122.0	0.1
Delay (s)	34.7	9.3		77.4	73.2	13.3		63.1	36.6	160.8	181.5	54.8
Level of Service	C	A		E	E	B		E	D	F	F	D
Approach Delay (s)		10.1			65.7			44.8			154.9	
Approach LOS		B			E			D			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		54.6										
HCM 2000 Volume to Capacity ratio		1.01										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		79.5%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Unsignalized Intersection Capacity Analysis

3:























10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↗	↗	↗	↗	↗
Traffic Volume (veh/h)	33	16	4	5	4	80	80	26	5	50	5	4
Future Volume (Veh/h)	33	16	4	5	4	80	80	26	5	50	5	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	17	4	5	4	87	87	28	5	54	5	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	390	320	2	325	319	14	9			33		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	390	320	2	325	319	14	9			33		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	97	100	99	99	92	95			97		
cM capacity (veh/h)	463	544	1080	549	545	1062	1609			1577		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	57	96	87	14	14	5	54	2	2	4		
Volume Left	36	5	87	0	0	0	54	0	0	0		
Volume Right	4	87	0	0	0	5	0	0	0	4		
cSH	506	976	1609	1700	1700	1700	1577	1700	1700	1700		
Volume to Capacity	0.11	0.10	0.05	0.01	0.01	0.00	0.03	0.00	0.00	0.00		
Queue Length 95th (ft)	9	8	4	0	0	0	3	0	0	0		
Control Delay (s)	13.0	9.1	7.4	0.0	0.0	0.0	7.4	0.0	0.0	0.0		
Lane LOS	B	A	A				A					
Approach Delay (s)	13.0	9.1	5.3				6.3					
Approach LOS	B	A										
Intersection Summary												
Average Delay			7.9									
Intersection Capacity Utilization			27.3%			ICU Level of Service				A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	78	1	28	0	4	6	16	112	7	0	35	28
Future Volume (Veh/h)	78	1	28	0	4	6	16	112	7	0	35	28
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	78	1	28	0	4	6	16	112	7	0	35	28
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	131	186	18	190	207	56	63			119		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	131	186	18	190	207	56	63			119		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	97	100	99	99	99			100		
cM capacity (veh/h)	813	700	1057	726	681	999	1538			1467		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	78	29	4	6	16	56	56	7	0	18	18	28
Volume Left	78	0	0	0	16	0	0	0	0	0	0	0
Volume Right	0	28	0	6	0	0	0	7	0	0	0	28
cSH	813	1039	681	999	1538	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.03	0.01	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.02
Queue Length 95th (ft)	8	2	0	0	1	0	0	0	0	0	0	0
Control Delay (s)	9.9	8.6	10.3	8.6	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A	B	A	A							
Approach Delay (s)	9.5		9.3		0.9				0.0			
Approach LOS	A		A									
Intersection Summary												
Average Delay			3.9									
Intersection Capacity Utilization			25.2%		ICU Level of Service				A			
Analysis Period (min)			15									













# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	0	9	0	5	5	2	0	1	6	12	16
Future Volume (Veh/h)	17	0	9	0	5	5	2	0	1	6	12	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	17	0	9	0	5	5	2	0	1	6	12	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	36	29	12	38	44	0	28			1		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	36	29	12	38	44	0	28			1		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	100	99	100	100			100		
cM capacity (veh/h)	958	860	1069	956	843	1084	1585			1622		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	17	9	10	2	1	6	12	16				
Volume Left	17	0	0	2	0	6	0	0				
Volume Right	0	9	5	0	1	0	0	16				
cSH	958	1069	949	1585	1700	1622	1700	1700				
Volume to Capacity	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.01				
Queue Length 95th (ft)	1	1	1	0	0	0	0	0				
Control Delay (s)	8.8	8.4	8.8	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.7		8.8	4.8		1.3						
Approach LOS	A		A									
Intersection Summary												
Average Delay			5.1									
Intersection Capacity Utilization			20.0%			ICU Level of Service				A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↱	↰	↱	↱	↰	↱
Traffic Volume (veh/h)	22	10	9	39	34	13	1	63	56	26	23	48
Future Volume (Veh/h)	22	10	9	39	34	13	1	63	56	26	23	48
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	22	10	9	39	34	13	1	63	56	26	23	48
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	138	196	12	142	188	32	71			119		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	138	196	12	142	188	32	71			119		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	99	99	95	95	99	100			98		
cM capacity (veh/h)	767	686	1066	786	693	1035	1527			1467		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	32	9	73	13	1	32	32	56	26	12	12	48
Volume Left	22	0	39	0	1	0	0	0	26	0	0	0
Volume Right	0	9	0	13	0	0	0	56	0	0	0	48
cSH	739	1066	740	1035	1527	1700	1700	1700	1467	1700	1700	1700
Volume to Capacity	0.04	0.01	0.10	0.01	0.00	0.02	0.02	0.03	0.02	0.01	0.01	0.03
Queue Length 95th (ft)	3	1	8	1	0	0	0	0	1	0	0	0
Control Delay (s)	10.1	8.4	10.4	8.5	7.4	0.0	0.0	0.0	7.5	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	9.7		10.1		0.1				2.0			
Approach LOS	A		B									
<b>Intersection Summary</b>												
Average Delay			4.3									
Intersection Capacity Utilization			25.4%		ICU Level of Service				A			
Analysis Period (min)			15									

Queuing and Blocking Report  
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Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB
Directions Served	L	TR	R
Maximum Queue (ft)	30	25	12
Average Queue (ft)	27	14	2
95th Queue (ft)	30	34	10
Link Distance (ft)		1010	815
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	185		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	LT	R
Maximum Queue (ft)	149	345	333	255	50	366	374	10	32	48	97	171
Average Queue (ft)	100	260	217	188	26	229	250	2	10	22	66	121
95th Queue (ft)	147	376	372	312	47	417	413	9	30	48	104	181
Link Distance (ft)		2762	2762	2762				728	728	728	748	748
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				410	690	690					
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	68	38
Average Queue (ft)	39	14
95th Queue (ft)	79	37
Link Distance (ft)		453
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	65	
Storage Blk Time (%)	28	
Queuing Penalty (veh)	12	

Queuing and Blocking Report  
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Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	B26	B26	B26	WB	WB	WB	WB
Directions Served	L	T	T	T	R	T	T	T	L	L	T	T
Maximum Queue (ft)	22	366	415	369	18	15	95	20	125	128	85	55
Average Queue (ft)	9	168	190	196	4	3	19	4	71	80	24	21
95th Queue (ft)	26	342	385	376	16	13	82	18	130	133	76	56
Link Distance (ft)		282	282	282		728	728	728			489	489
Upstream Blk Time (%)		5	4	7								
Queuing Penalty (veh)		33	26	42								
Storage Bay Dist (ft)	185				200				400	400		
Storage Blk Time (%)		7		7								
Queuing Penalty (veh)		1		6								

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	WB	NB	NB	NB	SB	SB
Directions Served	T	L	LT	R	L	T
Maximum Queue (ft)	99	42	64	40	107	73
Average Queue (ft)	44	27	28	15	59	41
95th Queue (ft)	107	52	65	39	105	82
Link Distance (ft)	489	2137	2137		552	552
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)				160		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report  
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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	60	307	369	394	18	299	312	296	200	51	52	137
Average Queue (ft)	38	197	245	263	4	174	132	151	89	31	21	69
95th Queue (ft)	64	382	453	469	15	348	328	341	235	51	55	149
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		7				6		5	0			
Queuing Penalty (veh)		5				2		13	1			

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	151	43
Average Queue (ft)	90	26
95th Queue (ft)	167	52
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	180	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	T	T	L	L	T	T	T	L
Maximum Queue (ft)	22	42	67	48	70	116	123	16
Average Queue (ft)	4	8	42	37	14	23	25	3
95th Queue (ft)	19	36	65	52	61	100	106	14
Link Distance (ft)	571	571			734	734	734	602
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			400	400				
Storage Blk Time (%)							0	
Queuing Penalty (veh)							0	

Queuing and Blocking Report  
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Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	B65	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	T	LT
Maximum Queue (ft)	306	151	132	174	44	46	156	180	187	20	55	52
Average Queue (ft)	168	48	50	53	23	36	121	113	138	17	11	38
95th Queue (ft)	321	133	124	158	46	53	186	191	243	21	48	55
Link Distance (ft)		585	585	585			490	490	490		563	799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				290	290				400		
Storage Blk Time (%)												0
Queuing Penalty (veh)												0

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	48	145	176	169
Average Queue (ft)	27	54	115	73
95th Queue (ft)	52	130	177	162
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)		0	15	0
Queuing Penalty (veh)		1	30	1

Queuing and Blocking Report  
am

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Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	L	T	T	T	L	T	T	T	R	L	LT
Maximum Queue (ft)	74	92	128	167	166	114	345	417	354	325	24	63
Average Queue (ft)	27	51	64	86	92	93	287	326	303	82	14	13
95th Queue (ft)	72	100	140	178	182	122	374	430	359	283	34	54
Link Distance (ft)			563	563	563		2403	2403	2403		852	852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				400				300		
Storage Blk Time (%)									9	0		
Queuing Penalty (veh)									15	0		

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	44	152	164	46
Average Queue (ft)	20	88	84	27
95th Queue (ft)	43	146	159	53
Link Distance (ft)		366	366	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	90			130
Storage Blk Time (%)			4	
Queuing Penalty (veh)			4	

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	L	L	T	T	T	R	L	R
Maximum Queue (ft)	30	52	58	62	12	8	209	196	179	15	86	69
Average Queue (ft)	7	11	30	23	5	3	137	146	141	3	46	37
95th Queue (ft)	26	45	62	58	14	8	224	214	178	13	92	75
Link Distance (ft)		2403	2403	2403			951	951	951		607	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300				250		150
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	L	T	T	T	LTR	LTR
Maximum Queue (ft)	25	66	24	42	28	179	200	202	39	66
Average Queue (ft)	10	13	5	8	8	49	63	60	20	39
95th Queue (ft)	31	57	20	36	27	164	189	185	48	67
Link Distance (ft)	951	951	951	951		849	849	849	486	933
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					150					
Storage Blk Time (%)						2				
Queuing Penalty (veh)						1				

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	42	110	171	198	167	175	643	703	633	600	185	74
Average Queue (ft)	21	56	71	90	77	165	505	502	456	383	159	43
95th Queue (ft)	45	124	182	230	197	196	724	755	703	643	245	70
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)							32			31	1	
Queuing Penalty (veh)							54			142	6	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	117	138	280	252	188	46
Average Queue (ft)	81	43	214	193	130	39
95th Queue (ft)	127	124	289	272	204	50
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					3	
Queuing Penalty (veh)					1	

Queuing and Blocking Report  
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Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (ft)	24	28
Average Queue (ft)	18	24
95th Queue (ft)	32	29
Link Distance (ft)	1628	2167
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	SW	SW
Directions Served	LT	R	LT	T	T
Maximum Queue (ft)	14	6	29	29	23
Average Queue (ft)	8	4	23	10	7
95th Queue (ft)	18	7	41	28	22
Link Distance (ft)	865	865	2100	1812	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				155	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	WB
Directions Served	TR	LTR
Maximum Queue (ft)	18	27
Average Queue (ft)	14	11
95th Queue (ft)	25	32
Link Distance (ft)	2563	3446
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Queuing and Blocking Report am

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### Intersection: 67: McWhirt Loop & Banks Ford Parkway

Movement	EB	EB	WB	WB
Directions Served	LT	R	LT	R
Maximum Queue (ft)	23	18	28	20
Average Queue (ft)	13	7	16	4
95th Queue (ft)	30	22	37	17
Link Distance (ft)	927	927	626	626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

### Network Summary

Network wide Queuing Penalty: 395

# HCM Signalized Intersection Capacity Analysis

5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)

























	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↑	↱		↰	↱
Traffic Volume (vph)	57	1558	15	155	1698	11	61	51	196	22	28	95
Future Volume (vph)	57	1558	15	155	1698	11	61	51	196	22	28	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	63	1731	17	172	1887	12	68	57	218	24	31	106
RTOR Reduction (vph)	0	0	8	0	0	5	0	0	129	0	0	98
Lane Group Flow (vph)	63	1731	9	172	1887	7	0	125	89	0	55	8
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.6	67.6	23.0	75.6	75.6		6.0	29.0		9.4	9.4
Effective Green, g (s)	9.0	61.6	67.6	23.0	75.6	75.6		6.0	29.0		9.4	9.4
Actuated g/C Ratio	0.07	0.47	0.52	0.18	0.58	0.58		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2174	823	607	2669	920		82	349		132	115
v/s Ratio Prot	c0.04	c0.38	0.00	0.05	c0.41			c0.07	0.05		c0.03	
v/s Ratio Perm			0.01			0.00			0.01			0.00
v/c Ratio	0.52	0.80	0.01	0.28	0.71	0.01		1.52	0.26		0.42	0.07
Uniform Delay, d1	58.4	28.9	15.1	46.4	19.3	11.4		62.0	41.6		57.7	56.2
Progression Factor	1.00	1.00	1.00	1.52	0.23	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	14.8	3.1	0.0	0.8	1.1	0.0		288.2	0.4		2.1	0.2
Delay (s)	73.2	32.0	15.1	71.1	5.6	11.4		350.2	42.0		59.8	56.5
Level of Service	E	C	B	E	A	B		F	D		E	E
Approach Delay (s)		33.3			11.0			154.3			57.6	
Approach LOS		C			B			F			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		33.1										
HCM 2000 Volume to Capacity ratio		0.75										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		74.7%										
Analysis Period (min)		15										

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# HCM Signalized Intersection Capacity Analysis

6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)





























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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	1783	158	56	1770	80	160	50	105	63	55	32
Future Volume (vph)	21	1783	158	56	1770	80	160	50	105	63	55	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1715	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1715	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	23	1959	174	62	1945	88	176	55	115	69	60	35
RTOR Reduction (vph)	0	0	68	0	0	30	0	0	90	0	0	33
Lane Group Flow (vph)	23	1959	106	62	1945	58	114	117	25	69	60	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	6.0	64.9	74.9	18.0	76.9	86.0	10.0	10.0	28.0	9.1	9.1	9.1
Effective Green, g (s)	6.0	64.9	74.9	18.0	76.9	86.0	10.0	10.0	28.0	9.1	9.1	9.1
Actuated g/C Ratio	0.05	0.50	0.58	0.14	0.59	0.66	0.08	0.08	0.22	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	81	2291	997	475	2715	1132	128	131	339	122	129	109
v/s Ratio Prot	0.01	c0.43	0.01	0.02	c0.42	0.00	0.07	c0.07	0.01	c0.04	0.03	
v/s Ratio Perm			0.06			0.03			0.01			0.00
v/c Ratio	0.28	0.86	0.11	0.13	0.72	0.05	0.89	0.89	0.07	0.57	0.47	0.02
Uniform Delay, d1	59.9	28.4	12.4	49.1	18.8	7.7	59.5	59.5	40.7	58.5	58.1	56.3
Progression Factor	0.65	0.35	0.00	1.21	0.28	0.00	1.00	1.00	1.19	1.00	1.00	1.00
Incremental Delay, d2	1.4	3.2	0.0	0.3	1.0	0.0	47.8	47.6	0.1	5.9	2.6	0.1
Delay (s)	40.3	13.3	0.0	59.7	6.3	0.0	107.5	107.2	48.3	64.4	60.8	56.4
Level of Service	D	B	A	E	A	A	F	F	D	E	E	E
Approach Delay (s)		12.5			7.6			87.7			61.4	
Approach LOS		B			A			F			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.5				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			130.0				Sum of lost time (s)			28.0		
Intersection Capacity Utilization			62.6%				ICU Level of Service			B		
Analysis Period (min)			15									

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# HCM Signalized Intersection Capacity Analysis

7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/15/2017































												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  		 					
Traffic Volume (vph)	100	1824	27	48	1680	168	80	16	68	230	23	130
Future Volume (vph)	100	1824	27	48	1680	168	80	16	68	230	23	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	108	1961	29	52	1806	181	86	17	73	247	25	140
RTOR Reduction (vph)	0	0	14	0	0	59	0	0	69	0	0	118
Lane Group Flow (vph)	108	1961	15	52	1806	122	86	17	4	0	272	22
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	13.1	67.0	67.0	7.4	60.8	80.8	7.1	7.1	7.1		20.0	20.0
Effective Green, g (s)	13.1	67.0	67.0	7.4	60.8	80.8	7.1	7.1	7.1		20.0	20.0
Actuated g/C Ratio	0.10	0.52	0.52	0.06	0.47	0.62	0.05	0.05	0.05		0.15	0.15
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	179	2377	819	99	2125	973	188	102	86		270	240
v/s Ratio Prot	c0.06	c0.43		0.03	0.40	0.02	c0.02	0.01			c0.15	
v/s Ratio Perm			0.01			0.06			0.00			0.01
v/c Ratio	0.60	0.82	0.02	0.53	0.85	0.13	0.46	0.17	0.05		1.01	0.09
Uniform Delay, d1	56.0	26.6	15.4	59.6	30.6	10.1	59.6	58.6	58.2		55.0	47.2
Progression Factor	0.54	1.87	1.00	0.85	0.78	2.25	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.2	1.9	0.0	4.0	3.6	0.0	1.8	0.8	0.2		56.7	0.2
Delay (s)	33.1	51.7	15.4	54.7	27.3	22.7	61.3	59.4	58.5		111.7	47.4
Level of Service	C	D	B	D	C	C	E	E	E		F	D
Approach Delay (s)		50.2			27.6			60.0			89.8	
Approach LOS		D			C			E			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			44.3									HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			130.0							29.0		
Intersection Capacity Utilization			77.9%									ICU Level of Service D
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)
























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	2028	50	52	2045	0	17	0	76	2	0	1
Future Volume (vph)	0	2028	50	52	2045	0	17	0	76	2	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.95	
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599		1722	
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599		1722	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2253	56	58	2272	0	19	0	84	2	0	1
RTOR Reduction (vph)	0	0	19	0	0	0	0	0	79	0	3	0
Lane Group Flow (vph)	0	2253	37	58	2272	0	9	10	5	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Effective Green, g (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Actuated g/C Ratio		0.65	0.65	0.06	0.77		0.05	0.05	0.05		0.01	
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		2989	1031	210	3516		91	91	86		18	
v/s Ratio Prot		c0.49		0.02	c0.50		0.01	c0.01			c0.00	
v/s Ratio Perm			0.02						0.00			
v/c Ratio		0.75	0.04	0.28	0.65		0.10	0.11	0.05		0.00	
Uniform Delay, d1		15.3	7.9	58.2	6.8		58.5	58.5	58.4		63.6	
Progression Factor		0.21	1.00	1.06	2.87		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.0	0.0	0.1	0.4		0.2	0.2	0.1		0.0	
Delay (s)		4.3	8.0	62.0	20.0		58.7	58.7	58.4		63.6	
Level of Service		A	A	E	C		E	E	E		E	
Approach Delay (s)		4.4			21.1			58.5			63.6	
Approach LOS		A			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		13.8				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.70										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		68.8%				ICU Level of Service		C				
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

11/15/2017

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SEB	SEB	SBR
Lane Configurations												
Traffic Volume (vph)	233	1727	40	82	1876	107	26	98	224	106	32	169
Future Volume (vph)	233	1727	40	82	1876	107	26	98	224	106	32	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	256	1898	44	90	2062	118	29	108	246	116	35	186
RTOR Reduction (vph)	0	0	22	0	0	62	0	0	197	0	0	172
Lane Group Flow (vph)	256	1898	22	90	2062	56	0	137	49	74	77	14
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	66.2	66.2	12.5	61.2	61.2		12.5	12.5	9.8	9.8	9.8
Effective Green, g (s)	18.0	66.2	66.2	12.5	61.2	61.2		12.5	12.5	9.8	9.8	9.8
Actuated g/C Ratio	0.14	0.51	0.51	0.10	0.47	0.47		0.10	0.10	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2349	810	326	2139	737		174	150	124	127	117
v/s Ratio Prot	c0.14	0.41		0.03	c0.45			c0.08		0.04	c0.05	
v/s Ratio Perm			0.01			0.04			0.03			0.01
v/c Ratio	1.04	0.81	0.03	0.28	0.96	0.08		0.79	0.33	0.60	0.61	0.12
Uniform Delay, d1	56.0	26.6	15.9	54.5	33.3	18.9		57.5	54.8	58.2	58.2	56.1
Progression Factor	1.28	0.24	1.00	0.55	0.25	0.03		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	59.8	2.3	0.0	0.4	9.0	0.1		20.6	1.3	7.5	7.9	0.5
Delay (s)	131.2	8.7	15.9	30.1	17.2	0.7		78.0	56.1	65.7	66.2	56.5
Level of Service	F	A	B	C	B	A		E	E	E	E	E
Approach Delay (s)		23.1			16.8			63.9			60.7	
Approach LOS		C			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		25.8										
HCM 2000 Volume to Capacity ratio		0.92										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		80.3%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	1755	67	55	1804	266	71	40	158	273	24	154
Future Volume (vph)	169	1755	67	55	1804	266	71	40	158	273	24	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1754	1591	1664	1682	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1754	1591	1664	1682	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	180	1867	71	59	1919	283	76	43	168	290	26	164
RTOR Reduction (vph)	0	0	27	0	0	118	0	0	155	0	0	148
Lane Group Flow (vph)	180	1867	44	59	1919	165	59	60	13	157	159	16
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	16.4	70.0	80.0	9.0	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Effective Green, g (s)	16.4	70.0	80.0	9.0	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Actuated g/C Ratio	0.13	0.54	0.62	0.07	0.48	0.58	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	2471	974	121	2199	915	130	134	122	166	168	156
v/s Ratio Prot	0.05	c0.41	0.00	0.03	c0.42	0.02	c0.03	0.03		0.09	c0.09	
v/s Ratio Perm			0.02			0.09			0.01			0.01
v/c Ratio	0.42	0.76	0.04	0.49	0.87	0.18	0.45	0.45	0.11	0.95	0.95	0.11
Uniform Delay, d1	52.4	23.3	9.9	58.3	30.1	12.7	57.4	57.4	55.8	58.1	58.2	53.2
Progression Factor	0.71	0.32	0.20	1.08	0.43	2.21	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.3	0.0	1.7	3.0	0.1	2.5	2.4	0.4	53.5	53.3	0.3
Delay (s)	37.4	8.7	2.0	64.8	15.9	28.1	59.9	59.7	56.2	111.7	111.4	53.5
Level of Service	D	A	A	E	B	C	E	E	E	F	F	D
Approach Delay (s)		10.9			18.7			57.7			91.7	
Approach LOS		B			B			E			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		24.5										
HCM 2000 Volume to Capacity ratio		0.84										
Actuated Cycle Length (s)		130.0							28.0			
Intersection Capacity Utilization		75.5%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis



























## 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	72	2120	15	74	2058	50	80	4	166	144	1	78
Future Volume (vph)	72	2120	15	74	2058	50	80	4	166	144	1	78
ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	2304	16	80	2237	54	87	4	180	157	1	85
RTOR Reduction (vph)	0	0	8	0	0	23	0	0	167	0	0	79
Lane Group Flow (vph)	78	2304	8	80	2237	31	0	91	13	78	80	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	7.9	66.6	66.6	15.9	75.1	75.1		9.6	9.6	8.9	8.9	8.9
Effective Green, g (s)	7.9	66.6	66.6	15.9	75.1	75.1		9.6	9.6	8.9	8.9	8.9
Actuated g/C Ratio	0.06	0.51	0.51	0.12	0.58	0.58		0.07	0.07	0.07	0.07	0.07
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	108	2363	815	417	2638	909		129	202	113	113	106
v/s Ratio Prot	0.04	c0.50		0.02	c0.49			c0.05		0.05	c0.05	
v/s Ratio Perm			0.01			0.02			0.00			0.00
v/c Ratio	0.72	0.98	0.01	0.19	0.85	0.03		0.71	0.07	0.69	0.71	0.05
Uniform Delay, d1	60.0	30.9	15.5	51.3	22.7	11.8		58.8	56.0	59.2	59.3	56.6
Progression Factor	1.34	0.51	1.00	0.64	0.34	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.7	10.3	0.0	0.2	2.9	0.1		16.1	0.1	16.6	18.3	0.2
Delay (s)	95.2	26.3	15.6	32.9	10.5	11.9		74.9	56.2	75.8	77.6	56.8
Level of Service	F	C	B	C	B	B		E	E	E	E	E
Approach Delay (s)		28.4			11.3			62.5			69.8	
Approach LOS		C			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		24.4										
HCM 2000 Volume to Capacity ratio		0.93										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		74.8%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 			 	
Traffic Volume (vph)	0	2393	27	11	2162	32	12	0	7	48	1	13
Future Volume (vph)	0	2393	27	11	2162	32	12	0	7	48	1	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.95			0.97	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.96	
Satd. Flow (prot)		5810		1761	4567	1575		1632			1685	
Flt Permitted		1.00		0.95	1.00	1.00		0.82			0.76	
Satd. Flow (perm)		5810		1761	4567	1575		1374			1329	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2659	30	12	2402	36	13	0	8	53	1	14
RTOR Reduction (vph)	0	1	0	0	0	7	0	19	0	0	7	0
Lane Group Flow (vph)	0	2688	0	12	2402	29	0	2	0	0	61	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)		96.4		3.0	106.4	106.4		10.1			10.1	
Effective Green, g (s)		96.4		3.0	106.4	106.4		10.1			10.1	
Actuated g/C Ratio		0.74		0.02	0.82	0.82		0.08			0.08	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4308		40	3737	1289		106			103	
v/s Ratio Prot		0.46		0.01	c0.53							
v/s Ratio Perm						0.02		0.00			c0.05	
v/c Ratio		0.62		0.30	0.64	0.02		0.02			0.59	
Uniform Delay, d1		8.1		62.5	4.5	2.2		55.4			57.9	
Progression Factor		0.10		1.42	1.01	1.00		1.00			1.00	
Incremental Delay, d2		0.3		2.6	0.5	0.0		0.1			8.3	
Delay (s)		1.1		91.5	5.1	2.2		55.4			66.3	
Level of Service		A		F	A	A		E			E	
Approach Delay (s)		1.1			5.5			55.4			66.3	
Approach LOS		A			A			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		4.2										
HCM 2000 Volume to Capacity ratio		0.68										
Actuated Cycle Length (s)		130.0						20.5				
Intersection Capacity Utilization		57.5%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	2418	21	140	2064	428	43	16	435	601	34	132
Future Volume (vph)	98	2418	21	140	2064	428	43	16	435	601	34	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	110	2717	24	157	2319	481	48	18	489	675	38	148
RTOR Reduction (vph)	0	1	0	0	0	148	0	0	119	0	0	135
Lane Group Flow (vph)	110	2740	0	157	2319	333	0	66	370	472	241	13
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	14.5	64.1		15.9	65.5	76.5		10.0	32.9	11.0	11.0	11.0
Effective Green, g (s)	14.5	64.1		15.9	65.5	76.5		10.0	32.9	11.0	11.0	11.0
Actuated g/C Ratio	0.11	0.49		0.12	0.50	0.59		0.08	0.25	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	2864		215	2899	926		137	701	273	138	134
v/s Ratio Prot	0.06	c0.47		0.09	c0.40	0.03		0.04	c0.13	0.15	c0.15	
v/s Ratio Perm						0.18						0.01
v/c Ratio	0.56	0.96		0.73	0.80	0.36		0.48	0.53	1.73	1.75	0.09
Uniform Delay, d1	54.7	31.6		55.0	26.8	14.0		57.5	41.9	59.5	59.5	54.9
Progression Factor	0.65	0.37		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	8.2		12.8	2.4	0.2		3.6	0.9	343.0	364.0	0.3
Delay (s)	38.3	19.9		67.7	29.2	14.2		61.1	42.8	402.5	423.5	55.2
Level of Service	D	B		E	C	B		E	D	F	F	E
Approach Delay (s)		20.6			28.8			45.0			348.7	
Approach LOS		C			C			D			F	

## Intersection Summary













HCM 2000 Control Delay	64.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 3: Hyannis/Bolivar & Celebrate VA























10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↙	↕	↗	↙	↕	↗
Traffic Volume (veh/h)	40	5	2	6	6	82	2	30	12	89	44	43
Future Volume (Veh/h)	40	5	2	6	6	82	2	30	12	89	44	43
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	2	7	7	89	2	33	13	97	48	47
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None								None			
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	355	292	24	260	326	16	95	46				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	355	292	24	260	326	16	95	46				
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	91	99	100	99	99	92	100	94				
cM capacity (veh/h)	497	578	1047	634	553	1058	1497	1560				
Direction, Lane.#	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	50	103	2	16	16	13	97	24	24	47		
Volume Left	43	7	2	0	0	0	97	0	0	0		
Volume Right	2	89	0	0	0	13	0	0	0	47		
cSH	515	956	1497	1700	1700	1700	1560	1700	1700	1700		
Volume to Capacity	0.10	0.11	0.00	0.01	0.01	0.01	0.06	0.01	0.01	0.03		
Queue Length 95th (ft)	8	9	0	0	0	0	5	0	0	0		
Control Delay (s)	12.7	9.2	7.4	0.0	0.0	0.0	7.5	0.0	0.0	0.0		
Lane LOS	B	A	A	A								
Approach Delay (s)	12.7	9.2	0.3	3.8								
Approach LOS	B	A										
Intersection Summary												
Average Delay			5.9									
Intersection Capacity Utilization			27.5%	ICU Level of Service					A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	9	12	12	15	4	49	85	34	1	168	345
Future Volume (Veh/h)	27	9	12	12	15	4	49	85	34	1	168	345
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	27	9	12	12	15	4	49	85	34	1	168	345
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	322	387	84	286	698	42	513			119		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	322	387	84	286	698	42	513			119		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	99	98	96	100	95			100		
cM capacity (veh/h)	564	520	958	605	346	1019	1049			1467		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	27	21	27	4	49	42	42	34	1	84	84	345
Volume Left	27	0	12	0	49	0	0	0	1	0	0	0
Volume Right	0	12	0	4	0	0	0	34	0	0	0	345
cSH	564	704	427	1019	1049	1700	1700	1700	1467	1700	1700	1700
Volume to Capacity	0.05	0.03	0.06	0.00	0.05	0.03	0.03	0.02	0.00	0.05	0.05	0.20
Queue Length 95th (ft)	4	2	5	0	4	0	0	0	0	0	0	0
Control Delay (s)	11.7	10.3	14.0	8.5	8.6	0.0	0.0	0.0	7.5	0.0	0.0	0.0
Lane LOS	B	B	B	A	A				A			
Approach Delay (s)	11.1		13.3		2.5				0.0			
Approach LOS	B		B									
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			38.0%		ICU Level of Service				A			
Analysis Period (min)			15									























# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	1	2	0	5	5	4	6	4	7	11	23
Future Volume (Veh/h)	17	1	2	0	5	5	4	6	4	7	11	23
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	17	1	2	0	5	5	4	6	4	7	11	23
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	46	43	11	44	64	8	34				10	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	46	43	11	44	64	8	34				10	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	98	100	100	100	99	100	100				100	
cM capacity (veh/h)	941	843	1070	951	821	1074	1578				1610	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	17	3	10	4	10	7	11	23				
Volume Left	17	0	0	4	0	7	0	0				
Volume Right	0	2	5	0	4	0	0	23				
cSH	941	982	931	1578	1700	1610	1700	1700				
Volume to Capacity	0.02	0.00	0.01	0.00	0.01	0.00	0.01	0.01				
Queue Length 95th (ft)	1	0	1	0	0	0	0	0				
Control Delay (s)	8.9	8.7	8.9	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.9		8.9	2.1		1.2						
Approach LOS	A		A									
Intersection Summary												
Average Delay	4.1											
Intersection Capacity Utilization	20.1%			ICU Level of Service					A			
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	17	6	33	32	10	21	13	62	6	66	174
Future Volume (Veh/h)	26	17	6	33	32	10	21	13	62	6	66	174
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	26	17	6	33	32	10	21	13	62	6	66	174
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	152	195	33	114	307	6	240			75		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	152	195	33	114	307	6	240			75		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	99	96	95	99	98			100		
cM capacity (veh/h)	748	685	1033	817	594	1074	1324			1522		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	43	6	65	10	21	6	6	62	6	33	33	174
Volume Left	26	0	33	0	21	0	0	0	6	0	0	0
Volume Right	0	6	0	10	0	0	0	62	0	0	0	174
cSH	722	1033	689	1074	1324	1700	1700	1700	1522	1700	1700	1700
Volume to Capacity	0.06	0.01	0.09	0.01	0.02	0.00	0.00	0.04	0.00	0.02	0.02	0.10
Queue Length 95th (ft)	5	0	8	1	1	0	0	0	0	0	0	0
Control Delay (s)	10.3	8.5	10.8	8.4	7.8	0.0	0.0	0.0	7.4	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	10.1		10.4		1.7				0.2			
Approach LOS	B		B									
<b>Intersection Summary</b>												
Average Delay			3.2									
Intersection Capacity Utilization			27.6%			ICU Level of Service			A			
Analysis Period (min)			15									

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	LT	R	L	R
Maximum Queue (ft)	26	29	21	14	24	6
Average Queue (ft)	20	15	8	6	18	2
95th Queue (ft)	36	35	25	17	32	6
Link Distance (ft)		1010	815	815		2137
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	185				50	
Storage Blk Time (%)						
Queuing Penalty (veh)						

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	LT
Maximum Queue (ft)	19	220	228	210	68	82	53	95	70	354	136	70
Average Queue (ft)	8	196	201	173	34	42	22	53	41	290	32	26
95th Queue (ft)	23	221	239	216	65	85	54	103	82	348	119	65
Link Distance (ft)		2762	2762	2762				728	728	728	748	748
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				690	690						65
Storage Blk Time (%)												14
Queuing Penalty (veh)												13

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	SB
Directions Served	R
Maximum Queue (ft)	57
Average Queue (ft)	27
95th Queue (ft)	55
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	L
Maximum Queue (ft)	25	200	270	296	22	42	81	199	298	311	12	88
Average Queue (ft)	17	163	176	169	13	13	28	64	71	128	4	75
95th Queue (ft)	33	194	264	282	30	42	74	180	260	348	11	104
Link Distance (ft)		282	282	282				489	489	489		2137
Upstream Blk Time (%)			0	1								
Queuing Penalty (veh)			1	5								
Storage Bay Dist (ft)	185				200	400	400				300	
Storage Blk Time (%)		0		2						1		
Queuing Penalty (veh)		0		3						1		

## Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	86	41	112	114	68
Average Queue (ft)	67	24	64	64	31
95th Queue (ft)	93	49	127	111	75
Link Distance (ft)	2137		552	552	552
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		160			
Storage Blk Time (%)					
Queuing Penalty (veh)					

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	184	526	594	579	38	429	442	434	200	50	94	30
Average Queue (ft)	112	329	387	377	14	224	260	254	126	22	68	15
95th Queue (ft)	209	582	645	595	37	439	458	428	276	53	109	37
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)			0									
Queuing Penalty (veh)			2									
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		12				10		13	0			
Queuing Penalty (veh)		12				5		21	0			

## Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	294	205
Average Queue (ft)	202	135
95th Queue (ft)	337	276
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	10	0
Queuing Penalty (veh)	13	0

## Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	B71	WB	WB	WB	WB	WB	NB
Directions Served	T	T	T	R	T	L	L	T	T	T	L
Maximum Queue (ft)	46	23	42	12	448	37	49	142	131	197	16
Average Queue (ft)	26	9	12	2	90	14	23	48	40	79	7
95th Queue (ft)	53	27	40	11	386	43	50	147	127	228	19
Link Distance (ft)	571	571	571	571	497			734	734	734	602
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)						400	400				
Storage Blk Time (%)										4	
Queuing Penalty (veh)										0	

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	LT
Maximum Queue (ft)	264	133	148	179	18	26	23	45	120	152	44	196
Average Queue (ft)	183	57	95	92	4	18	13	30	74	108	23	163
95th Queue (ft)	327	142	183	212	16	33	31	57	124	161	51	216
Link Distance (ft)		585	585	585				490	490	490		799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				350	290	290				400	
Storage Blk Time (%)												41
Queuing Penalty (veh)												91

## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	95	144	174	169
Average Queue (ft)	93	67	114	90
95th Queue (ft)	99	158	186	157
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)	25	1	12	
Queuing Penalty (veh)	31	2	27	

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	105	115	73	103	150	26	48	180	215	178	53	67
Average Queue (ft)	52	73	43	84	118	5	30	81	111	127	22	34
95th Queue (ft)	116	123	72	117	154	22	59	187	239	199	55	70
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	64	46	237	251	155
Average Queue (ft)	41	44	158	154	100
95th Queue (ft)	77	47	265	267	203
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90			130
Storage Blk Time (%)				24	6
Queuing Penalty (veh)				37	9

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	R
Maximum Queue (ft)	52	142	151	148	12	28	191	225	233	104	191	179
Average Queue (ft)	30	83	115	109	4	16	112	119	144	53	106	53
95th Queue (ft)	51	165	160	161	11	34	180	216	249	101	179	158
Link Distance (ft)		2403	2403	2403			951	951	951	669	669	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300						220
Storage Blk Time (%)									0			
Queuing Penalty (veh)									0			

## Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	196	119	48
Average Queue (ft)	95	55	28
95th Queue (ft)	186	124	54
Link Distance (ft)	607		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	150
Storage Blk Time (%)	4		
Queuing Penalty (veh)	6		

## Intersection: 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	T	TR	L	T	T	T	LTR	LTR
Maximum Queue (ft)	21	81	24	28	72	73	72	103
Average Queue (ft)	8	16	12	11	14	25	26	70
95th Queue (ft)	25	70	30	33	62	69	79	119
Link Distance (ft)	951	951		849	849	849	486	933
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			150					
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	130	182	186	196	211	175	426	400	238	180	35	94
Average Queue (ft)	65	84	87	92	97	165	331	296	199	149	23	57
95th Queue (ft)	133	183	193	205	223	196	458	426	261	190	44	89
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)						7	29			1		
Queuing Penalty (veh)						35	41			2		

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	328	271	401	394	337	155
Average Queue (ft)	228	190	327	292	210	123
95th Queue (ft)	330	288	410	406	365	206
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					39	13
Queuing Penalty (veh)					51	31

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW	SW
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	47	14
Average Queue (ft)	18	24	3
95th Queue (ft)	33	49	12
Link Distance (ft)	1628	2167	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			165
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	SW	SW	SW
Directions Served	LT	R	LT	L	T	T
Maximum Queue (ft)	77	11	49	9	40	34
Average Queue (ft)	41	6	26	2	20	15
95th Queue (ft)	74	12	52	8	45	38
Link Distance (ft)	865	865	2100		1812	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)				390		155
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	WB
Directions Served	L	LTR
Maximum Queue (ft)	22	29
Average Queue (ft)	16	15
95th Queue (ft)	30	36
Link Distance (ft)		3446
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	120	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 67: McWhirt Loop & Banks Ford Parkway


Movement	EB	EB	WB	NB
Directions Served	LT	R	LT	L
Maximum Queue (ft)	69	16	26	25
Average Queue (ft)	22	3	20	9
95th Queue (ft)	69	13	36	29
Link Distance (ft)	927	927	626	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			195	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 439

# HCM Signalized Intersection Capacity Analysis

5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↰	↱		↰	↱
Traffic Volume (vph)	99	1591	73	597	1156	9	16	35	310	10	50	44
Future Volume (vph)	99	1591	73	597	1156	9	16	35	310	10	50	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1815	1567		1857	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1815	1567		1857	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	110	1768	81	663	1284	10	18	39	344	11	56	49
RTOR Reduction (vph)	0	0	39	0	0	4	0	0	149	0	0	46
Lane Group Flow (vph)	110	1768	42	663	1284	6	0	57	195	0	67	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	62.1	68.1	23.0	76.1	76.1		6.0	29.0		8.9	8.9
Effective Green, g (s)	9.0	62.1	68.1	23.0	76.1	76.1		6.0	29.0		8.9	8.9
Actuated g/C Ratio	0.07	0.48	0.52	0.18	0.59	0.59		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2192	829	607	2686	926		83	349		127	108
v/s Ratio Prot	0.06	c0.39	0.00	c0.19	0.28			c0.03	0.10		c0.04	
v/s Ratio Perm			0.02			0.00			0.03			0.00
v/c Ratio	0.90	0.81	0.05	1.09	0.48	0.01		0.69	0.56		0.53	0.03
Uniform Delay, d1	60.1	28.8	15.1	53.5	15.5	11.2		61.1	44.8		58.5	56.5
Progression Factor	1.00	1.00	1.00	1.55	0.17	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	58.3	3.3	0.0	61.1	0.5	0.0		21.0	1.9		3.9	0.1
Delay (s)	118.4	32.1	15.2	143.8	3.2	11.2		82.1	46.8		62.4	56.6
Level of Service	F	C	B	F	A	B		F	D		E	E
Approach Delay (s)		36.3			50.9			51.8			60.0	
Approach LOS		D			D			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		44.8			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.84										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			30.0				
Intersection Capacity Utilization		76.8%			ICU Level of Service			D				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)
























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	1739	92	361	1648	73	78	20	37	63	55	32
Future Volume (vph)	13	1739	92	361	1648	73	78	20	37	63	55	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%			1%			2%		
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1709	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1709	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	14	1911	101	397	1811	80	86	22	41	69	60	35
RTOR Reduction (vph)	0	0	40	0	0	25	0	0	33	0	0	33
Lane Group Flow (vph)	14	1911	61	397	1811	55	53	55	8	69	60	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	66.9	74.9	18.0	80.9	90.0	8.0	8.0	26.0	9.1	9.1	9.1
Effective Green, g (s)	4.0	66.9	74.9	18.0	80.9	90.0	8.0	8.0	26.0	9.1	9.1	9.1
Actuated g/C Ratio	0.03	0.51	0.58	0.14	0.62	0.69	0.06	0.06	0.20	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2362	997	475	2856	1181	102	105	315	122	129	109
v/s Ratio Prot	0.01	c0.42	0.00	c0.12	0.39	0.00	0.03	c0.03	0.00	c0.04	0.03	
v/s Ratio Perm			0.03			0.03			0.00			0.00
v/c Ratio	0.26	0.81	0.06	0.84	0.63	0.05	0.52	0.52	0.03	0.57	0.47	0.02
Uniform Delay, d1	61.6	26.2	12.1	54.6	15.3	6.4	59.1	59.2	41.8	58.5	58.1	56.3
Progression Factor	0.65	0.36	0.00	1.09	0.25	0.00	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	2.0	0.0	8.5	0.5	0.0	4.4	4.7	0.0	5.9	2.6	0.1
Delay (s)	41.4	11.5	0.0	67.8	4.4	0.0	64.0	64.4	41.9	64.4	60.8	56.4
Level of Service	D	B	A	E	A	A	E	E	D	E	E	E
Approach Delay (s)	11.1			15.2			58.1			61.4		
Approach LOS	B			B			E			E		
Intersection Summary												
HCM 2000 Control Delay	16.5			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.77											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			28.0					
Intersection Capacity Utilization	71.6%			ICU Level of Service			C					
Analysis Period (min)	15											

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	1713	17	38	1986	251	51	21	92	117	15	45
Future Volume (vph)	80	1713	17	38	1986	251	51	21	92	117	15	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1757	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	86	1842	18	41	2135	270	55	23	99	126	16	48
RTOR Reduction (vph)	0	0	8	0	0	67	0	0	94	0	0	42
Lane Group Flow (vph)	86	1842	10	41	2135	203	55	23	5	0	142	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	11.7	72.5	72.5	7.1	67.4	82.9	6.4	6.4	6.4		15.5	15.5
Effective Green, g (s)	11.7	72.5	72.5	7.1	67.4	82.9	6.4	6.4	6.4		15.5	15.5
Actuated g/C Ratio	0.09	0.56	0.56	0.05	0.52	0.64	0.05	0.05	0.05		0.12	0.12
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	160	2572	887	95	2355	999	169	92	78		209	186
v/s Ratio Prot	c0.05	c0.40		0.02	c0.47	0.02	c0.02	0.01			c0.08	
v/s Ratio Perm			0.01			0.11			0.00			0.00
v/c Ratio	0.54	0.72	0.01	0.43	0.91	0.20	0.33	0.25	0.06		0.68	0.03
Uniform Delay, d1	56.6	21.2	12.8	59.5	28.4	9.8	59.7	59.5	58.9		54.9	50.6
Progression Factor	0.62	2.02	1.00	0.92	0.72	1.54	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	1.0	0.0	1.9	4.1	0.1	1.1	1.4	0.3		8.5	0.1
Delay (s)	37.2	43.9	12.8	56.5	24.6	15.2	60.8	60.9	59.3		63.4	50.7
Level of Service	D	D	B	E	C	B	E	E	E		E	D
Approach Delay (s)		43.3			24.1			60.0			60.1	
Approach LOS		D			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		34.7										
HCM 2000 Volume to Capacity ratio		0.81										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		75.1%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/20/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	1844	30	82	2687	0	12	0	94	0	0	0
Future Volume (vph)	0	1844	30	82	2687	0	12	0	94	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00			
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599			
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2049	33	91	2986	0	13	0	104	0	0	0
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	98	0	0	0
Lane Group Flow (vph)	0	2049	23	91	2986	0	6	7	6	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm			
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		91.5	91.5	10.0	108.5		7.0	7.0	7.0			
Effective Green, g (s)		91.5	91.5	10.0	108.5		7.0	7.0	7.0			
Actuated g/C Ratio		0.70	0.70	0.08	0.83		0.05	0.05	0.05			
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0			
Lane Grp Cap (vph)		3214	1108	262	3811		91	91	86			
v/s Ratio Prot		0.45		0.03	c0.65		0.00	c0.00				
v/s Ratio Perm			0.01						0.00			
v/c Ratio		0.64	0.02	0.35	0.78		0.07	0.08	0.07			
Uniform Delay, d1		10.3	5.8	56.9	5.1		58.4	58.4	58.4			
Progression Factor		0.32	1.00	1.05	4.08		1.00	1.00	1.00			
Incremental Delay, d2		0.7	0.0	0.0	0.2		0.1	0.1	0.1			
Delay (s)		4.0	5.8	60.0	21.1		58.5	58.6	58.5			
Level of Service		A	A	E	C		E	E	E			
Approach Delay (s)		4.0			22.3			58.5			0.0	
Approach LOS		A			C			E			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		15.9				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.84										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		69.8%				ICU Level of Service		C				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

11/20/2017

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	1757	12	126	2439	111	24	32	110	144	41	135
Future Volume (vph)	190	1757	12	126	2439	111	24	32	110	144	41	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1797	1560	1656	1696	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1797	1560	1656	1696	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	209	1931	13	138	2680	122	26	35	121	158	45	148
RTOR Reduction (vph)	0	0	6	0	0	63	0	0	112	0	0	135
Lane Group Flow (vph)	209	1931	7	138	2680	59	0	61	9	101	102	13
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	17.4	67.7	67.7	12.5	63.3	63.3		9.8	9.8	11.0	11.0	11.0
Effective Green, g (s)	17.4	67.7	67.7	12.5	63.3	63.3		9.8	9.8	11.0	11.0	11.0
Actuated g/C Ratio	0.13	0.52	0.52	0.10	0.49	0.49		0.08	0.08	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	2402	828	326	2212	763		135	117	140	143	132
v/s Ratio Prot	0.12	c0.42		0.04	c0.59			c0.03		c0.06	0.06	
v/s Ratio Perm			0.00			0.04			0.01			0.01
v/c Ratio	0.88	0.80	0.01	0.42	1.21	0.08		0.45	0.08	0.72	0.71	0.09
Uniform Delay, d1	55.3	25.7	15.0	55.4	33.4	17.8		57.5	55.9	58.0	58.0	54.9
Progression Factor	1.28	0.18	1.00	0.52	0.20	0.07		1.08	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.5	2.3	0.0	0.1	95.6	0.0		2.4	0.3	16.7	15.5	0.3
Delay (s)	95.4	7.0	15.0	28.7	102.3	1.3		64.6	56.2	74.7	73.5	55.2
Level of Service	F	A	B	C	F	A		E	E	E	E	E
Approach Delay (s)		15.6			94.6			59.0			66.1	
Approach LOS		B			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			61.5				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			1.06									
Actuated Cycle Length (s)			130.0				Sum of lost time (s)			29.0		
Intersection Capacity Utilization			87.3%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	87	1898	38	119	2610	172	44	16	77	210	22	98
Future Volume (vph)	87	1898	38	119	2610	172	44	16	77	210	22	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%			1%			-1%			2%		
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1736	1591	1664	1683	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1736	1591	1664	1683	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	93	2019	40	127	2777	183	47	17	82	223	23	104
RTOR Reduction (vph)	0	0	17	0	0	65	0	0	76	0	0	94
Lane Group Flow (vph)	93	2019	23	127	2777	118	31	33	6	123	123	10
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	15.0	66.2	76.2	13.4	64.6	77.0	10.0	10.0	10.0	12.4	12.4	12.4
Effective Green, g (s)	15.0	66.2	76.2	13.4	64.6	77.0	10.0	10.0	10.0	12.4	12.4	12.4
Actuated g/C Ratio	0.12	0.51	0.59	0.10	0.50	0.59	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	396	2337	927	181	2269	932	130	133	122	158	160	149
v/s Ratio Prot	0.03	c0.44	0.00	0.07	c0.61	0.01	0.02	c0.02		c0.07	0.07	
v/s Ratio Perm			0.01			0.06			0.00			0.01
v/c Ratio	0.23	0.86	0.03	0.70	1.22	0.13	0.24	0.25	0.05	0.78	0.77	0.07
Uniform Delay, d1	52.3	28.0	11.3	56.4	32.7	11.7	56.4	56.5	55.6	57.5	57.4	53.5
Progression Factor	0.71	0.52	1.00	1.00	0.71	1.57	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	3.2	0.0	5.2	102.6	0.0	1.0	1.0	0.2	21.1	19.6	0.2
Delay (s)	37.1	17.9	11.3	61.7	125.9	18.4	57.4	57.4	55.8	78.5	77.0	53.7
Level of Service	D	B	B	E	F	B	E	E	E	E	E	D
Approach Delay (s)	18.6			116.9			56.5			70.6		
Approach LOS	B			F			E			E		
























## Intersection Summary

HCM 2000 Control Delay	75.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)


























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	1916	6	22	2825	104	1	0	11	56	1	35
Future Volume (vph)	34	1916	6	22	2825	104	1	0	11	56	1	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1663	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	2083	7	24	3071	113	1	0	12	61	1	38
RTOR Reduction (vph)	0	0	3	0	0	37	0	0	12	0	0	36
Lane Group Flow (vph)	37	2083	4	24	3071	76	0	1	0	31	31	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	5.5	83.3	83.3	8.7	87.0	87.0		3.2	3.2	5.8	5.8	5.8
Effective Green, g (s)	5.5	83.3	83.3	8.7	87.0	87.0		3.2	3.2	5.8	5.8	5.8
Actuated g/C Ratio	0.04	0.64	0.64	0.07	0.67	0.67		0.02	0.02	0.04	0.04	0.04
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	75	2955	1019	228	3056	1054		42	67	73	74	69
v/s Ratio Prot	0.02	c0.45		0.01	c0.67			c0.00		c0.02	0.02	
v/s Ratio Perm			0.00			0.05			0.00			0.00
v/c Ratio	0.49	0.70	0.00	0.11	1.00	0.07		0.02	0.00	0.42	0.42	0.02
Uniform Delay, d1	60.9	15.3	8.4	57.0	21.5	7.5		61.9	61.8	60.5	60.5	59.4
Progression Factor	1.41	0.26	1.00	0.90	0.78	0.89		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	0.8	0.0	0.1	12.8	0.1		0.2	0.0	3.9	3.8	0.1
Delay (s)	88.5	4.7	8.4	51.6	29.4	6.7		62.1	61.9	64.4	64.3	59.5
Level of Service	F	A	A	D	C	A		E	E	E	E	E
Approach Delay (s)		6.2			28.8			61.9			62.5	
Approach LOS		A			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		20.7										
HCM 2000 Volume to Capacity ratio		0.96										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		83.3%										
Analysis Period (min)		15										
c Critical Lane Group												
<div> <div>HCM 2000 Level of Service</div> <div>C</div> </div> <div> <div>Sum of lost time (s)</div> <div>29.0</div> </div> <div> <div>ICU Level of Service</div> <div>E</div> </div>												

# HCM Signalized Intersection Capacity Analysis

12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 			 	
Traffic Volume (vph)	0	1975	43	35	3038	56	18	5	10	5	5	34
Future Volume (vph)	0	1975	43	35	3038	56	18	5	10	5	5	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.96			0.90	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.99	
Satd. Flow (prot)		5806		1761	4567	1575		1657			1606	
Flt Permitted		1.00		0.95	1.00	1.00		0.85			0.95	
Satd. Flow (perm)		5806		1761	4567	1575		1444			1536	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2194	48	39	3376	62	20	6	11	6	6	38
RTOR Reduction (vph)	0	1	0	0	0	10	0	10	0	0	36	0
Lane Group Flow (vph)	0	2241	0	39	3376	52	0	27	0	0	14	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)		95.1		7.3	109.4	109.4		7.1			7.1	
Effective Green, g (s)		95.1		7.3	109.4	109.4		7.1			7.1	
Actuated g/C Ratio		0.73		0.06	0.84	0.84		0.05			0.05	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4247		98	3843	1325		78			83	
v/s Ratio Prot		0.39		0.02	c0.74							
v/s Ratio Perm						0.03		c0.02			0.01	
v/c Ratio		0.53		0.40	0.88	0.04		0.34			0.17	
Uniform Delay, d1		7.6		59.2	6.3	1.7		59.2			58.6	
Progression Factor		0.13		1.31	2.27	0.00		1.00			1.00	
Incremental Delay, d2		0.4		0.2	0.3	0.0		2.6			1.0	
Delay (s)		1.4		77.8	14.5	0.0		61.8			59.6	
Level of Service		A		E	B	A		E			E	
Approach Delay (s)		1.4			14.9			61.8			59.6	
Approach LOS		A			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		10.4			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.90										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			20.5				
Intersection Capacity Utilization		76.0%			ICU Level of Service			D				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	1947	40	167	2999	458	48	12	133	363	60	54
Future Volume (vph)	59	1947	40	167	2999	458	48	12	133	363	60	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	5807		1761	5755	1575		1782	2773	3237	1655	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	5807		1761	5755	1575		1782	2773	3237	1655	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	66	2188	45	188	3370	515	54	13	149	408	67	61
RTOR Reduction (vph)	0	2	0	0	0	102	0	0	111	0	0	56
Lane Group Flow (vph)	66	2231	0	188	3370	413	0	67	38	314	161	5
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	11.6	63.8		16.8	69.0	80.0		9.4	33.2	11.0	11.0	11.0
Effective Green, g (s)	11.6	63.8		16.8	69.0	80.0		9.4	33.2	11.0	11.0	11.0
Actuated g/C Ratio	0.09	0.49		0.13	0.53	0.62		0.07	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	2849		227	3054	969		128	708	273	140	134
v/s Ratio Prot	0.04	c0.38		0.11	c0.59	0.04		c0.04	0.01	0.10	c0.10	
v/s Ratio Perm						0.23						0.00
v/c Ratio	0.42	0.78		0.83	1.10	0.43		0.52	0.05	1.15	1.15	0.04
Uniform Delay, d1	56.0	27.4		55.2	30.5	13.0		58.1	36.5	59.5	59.5	54.6
Progression Factor	0.62	0.34		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	2.0		22.2	52.2	0.3		5.0	0.0	101.3	122.0	0.1
Delay (s)	36.2	11.2		77.4	82.7	13.3		63.1	36.6	160.8	181.5	54.8
Level of Service	D	B		E	F	B		E	D	F	F	D
Approach Delay (s)		11.9			73.7			44.8			154.9	
Approach LOS		B			E			D			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		59.0										
HCM 2000 Volume to Capacity ratio		1.04										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		80.4%										
Analysis Period (min)		15										
c Critical Lane Group												
HCM 2000 Level of Service						E						
Sum of lost time (s)						29.0						
ICU Level of Service						D						

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

11/13/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	78	1	28	14	4	6	16	128	35	0	43	28
Future Volume (Veh/h)	78	1	28	14	4	6	16	128	35	0	43	28
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	78	1	28	14	4	6	16	128	35	0	43	28
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	147	238	22	210	231	64	71			163		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	147	238	22	210	231	64	71			163		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	97	98	99	99	99			100		
cM capacity (veh/h)	792	655	1051	703	661	987	1527			1413		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	78	29	18	6	16	64	64	35	0	22	22	28
Volume Left	78	0	14	0	16	0	0	0	0	0	0	0
Volume Right	0	28	0	6	0	0	0	35	0	0	0	28
cSH	792	1029	693	987	1527	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.03	0.03	0.01	0.01	0.04	0.04	0.02	0.00	0.01	0.01	0.02
Queue Length 95th (ft)	8	2	2	0	1	0	0	0	0	0	0	0
Control Delay (s)	10.0	8.6	10.3	8.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A	B	A	A							
Approach Delay (s)	9.7		9.9		0.7				0.0			
Approach LOS	A		A									
Intersection Summary												
Average Delay	3.6											
Intersection Capacity Utilization	25.2%											
Analysis Period (min)	15											
ICU Level of Service												
A												






















# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

11/13/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	0	9	0	5	5	2	189	1	6	106	16
Future Volume (Veh/h)	17	0	9	0	5	5	2	189	1	6	106	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	17	0	9	0	5	5	2	189	1	6	106	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	318	312	106	320	328	190	122			190		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	318	312	106	320	328	190	122			190		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	100	99	99	100			100		
cM capacity (veh/h)	624	600	948	624	588	852	1465			1384		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	17	9	10	2	190	6	106	16				
Volume Left	17	0	0	2	0	6	0	0				
Volume Right	0	9	5	0	1	0	0	16				
cSH	624	948	696	1465	1700	1384	1700	1700				
Volume to Capacity	0.03	0.01	0.01	0.00	0.11	0.00	0.06	0.01				
Queue Length 95th (ft)	2	1	1	0	0	0	0	0				
Control Delay (s)	10.9	8.8	10.2	7.5	0.0	7.6	0.0	0.0				
Lane LOS	B	A	B	A		A						
Approach Delay (s)	10.2		10.2	0.1		0.4						
Approach LOS	B		B									
Intersection Summary												
Average Delay			1.2									
Intersection Capacity Utilization			24.3%			ICU Level of Service			A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway













11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	10	9	39	34	13	1	103	81	26	31	48
Future Volume (Veh/h)	22	10	9	39	34	13	1	103	81	26	31	48
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	22	10	9	39	34	13	1	103	81	26	31	48
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (ft)	718											
PX, platoon unblocked												
vC, conflicting volume	166	269	16	186	236	52	79	184				
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	166	269	16	186	236	52	79	184				
IC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1	4.1				
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	97	98	99	95	95	99	100	98				
cM capacity (veh/h)	730	624	1060	730	651	1005	1517	1388				
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	32	9	73	13	1	52	52	81	26	16	16	48
Volume Left	22	0	39	0	1	0	0	0	26	0	0	0
Volume Right	0	9	0	13	0	0	0	81	0	0	0	48
cSH	693	1060	691	1005	1517	1700	1700	1700	1388	1700	1700	1700
Volume to Capacity	0.05	0.01	0.11	0.01	0.00	0.03	0.03	0.05	0.02	0.01	0.01	0.03
Queue Length 95th (ft)	4	1	9	1	0	0	0	0	1	0	0	0
Control Delay (s)	10.4	8.4	10.8	8.6	7.4	0.0	0.0	0.0	7.6	0.0	0.0	0.0
Lane LOS	B	A	B	A	A	A						
Approach Delay (s)	10.0	10.5		0.0		1.9						
Approach LOS	B	B										
Intersection Summary												
Average Delay	3.6											
Intersection Capacity Utilization	25.4%			ICU Level of Service			A					
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis

3:

11/16/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↑↑	↔	↔	↑↑	↔
Traffic Volume (veh/h)	33	16	4	4	4	80	0	215	5	50	118	13
Future Volume (Veh/h)	33	16	4	4	4	80	0	215	5	50	118	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	17	4	4	4	87	0	234	5	54	128	14
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	442	475	64	418	484	117	142			239		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442	475	64	418	484	117	142			239		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	96	100	99	99	90	100			96		
cM capacity (veh/h)	435	467	987	487	462	913	1438			1325		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	57	95	0	117	117	5	54	64	64	14		
Volume Left	36	4	0	0	0	0	54	0	0	0		
Volume Right	4	87	0	0	0	5	0	0	0	14		
cSH	462	847	1700	1700	1700	1700	1325	1700	1700	1700		
Volume to Capacity	0.12	0.11	0.00	0.07	0.07	0.00	0.04	0.04	0.04	0.01		
Queue Length 95th (ft)	10	9	0	0	0	0	3	0	0	0		
Control Delay (s)	13.9	9.8	0.0	0.0	0.0	0.0	7.8	0.0	0.0	0.0		
Lane LOS	B	A					A					
Approach Delay (s)	13.9	9.8	0.0				2.2					
Approach LOS	B	A										
Intersection Summary												
Average Delay			3.7									
Intersection Capacity Utilization			28.9%			ICU Level of Service				A		
Analysis Period (min)			15									

Queuing and Blocking Report  
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Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	NB
Directions Served	L	TR	R	L
Maximum Queue (ft)	30	24	16	22
Average Queue (ft)	27	19	9	4
95th Queue (ft)	30	34	21	19
Link Distance (ft)	1010		815	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185		50	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	LT	R
Maximum Queue (ft)	207	255	228	229	27	342	377	13	37	7	98	107
Average Queue (ft)	160	181	201	162	19	212	230	7	9	3	57	79
95th Queue (ft)	216	309	271	297	35	410	435	17	33	8	111	126
Link Distance (ft)	2762		2762	2762				728	728	728	748	748
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				410	690	690					
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	70	58
Average Queue (ft)	48	30
95th Queue (ft)	90	62
Link Distance (ft)	453	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	65	
Storage Blk Time (%)	13	0
Queuing Penalty (veh)	6	0

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Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	L	LT
Maximum Queue (ft)	24	252	262	302	21	155	164	117	86	118	64	86
Average Queue (ft)	7	116	104	156	16	86	106	23	21	47	30	45
95th Queue (ft)	23	251	241	284	30	181	193	100	76	113	67	86
Link Distance (ft)		282	282	282				489	489	489	2137	2137
Upstream Blk Time (%)				2								
Queuing Penalty (veh)				14								
Storage Bay Dist (ft)	185				200	400	400					
Storage Blk Time (%)		4		4								
Queuing Penalty (veh)		1		4								

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB
Directions Served	R	L	T
Maximum Queue (ft)	38	69	114
Average Queue (ft)	14	42	68
95th Queue (ft)	38	70	124
Link Distance (ft)		552	552
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	160		
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	184	330	396	412	224	365	334	347	200	50	74	30
Average Queue (ft)	107	252	312	307	57	273	217	251	131	31	43	6
95th Queue (ft)	229	323	437	456	196	362	361	383	270	61	78	26
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		15				15		11	0			
Queuing Penalty (veh)		12				6		26	1			

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	237	205
Average Queue (ft)	120	55
95th Queue (ft)	220	179
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	5	0
Queuing Penalty (veh)	2	0

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	T	T	T	L	L	T	T	T	LT
Maximum Queue (ft)	44	22	18	92	58	136	114	133	11
Average Queue (ft)	17	8	4	54	37	54	41	51	4
95th Queue (ft)	52	26	15	97	59	163	124	153	13
Link Distance (ft)	571	571	571			734	734	734	602
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)				400	400				
Storage Blk Time (%)								1	
Queuing Penalty (veh)								0	

Queuing and Blocking Report  
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Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	B65
Directions Served	L	T	T	T	R	L	L	T	T	T	R	T
Maximum Queue (ft)	265	64	48	44	23	48	46	223	178	193	15	541
Average Queue (ft)	173	28	32	35	8	12	33	152	139	140	6	108
95th Queue (ft)	294	62	65	52	26	42	50	269	209	245	18	465
Link Distance (ft)		585	585	585				490	490	490		563
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				350	290	290				400	
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	B65	B65	NB	NB	SB	SB	SB
Directions Served	T	T	LT	R	L	LT	R
Maximum Queue (ft)	590	551	151	95	144	154	148
Average Queue (ft)	118	110	80	61	85	144	115
95th Queue (ft)	508	474	141	100	177	170	176
Link Distance (ft)	563	563	799			980	
Upstream Blk Time (%)	1	0					
Queuing Penalty (veh)	9	0					
Storage Bay Dist (ft)				70	120		145
Storage Blk Time (%)			8	12	0	11	3
Queuing Penalty (veh)			9	7	1	22	5

Queuing and Blocking Report  
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Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	L	T	T	T	L	T	T	T	R	L	LT
Maximum Queue (ft)	90	96	156	156	158	116	700	743	840	314	26	45
Average Queue (ft)	30	52	107	98	94	81	454	450	472	86	14	20
95th Queue (ft)	85	92	166	169	161	127	751	763	836	276	33	45
Link Distance (ft)			563	563	563		2403	2403	2403		852	852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				400				300		
Storage Blk Time (%)							16		25	0		
Queuing Penalty (veh)							18		42	0		

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	42	134	111	114
Average Queue (ft)	29	77	69	63
95th Queue (ft)	57	152	123	113
Link Distance (ft)		366	366	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	90			130
Storage Blk Time (%)			0	0
Queuing Penalty (veh)			0	0

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	R	L	LT	R
Maximum Queue (ft)	7	6	23	41	244	274	228	15	24	68	28	29
Average Queue (ft)	4	1	9	8	143	157	161	3	5	43	6	23
95th Queue (ft)	8	5	27	36	276	309	265	13	21	73	24	42
Link Distance (ft)		2403	2403	2403	951	951	951		669	607		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440						250			150	150	
Storage Blk Time (%)												
Queuing Penalty (veh)												

# Queuing and Blocking Report

am

11/20/2017

## Intersection: 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	L	T	T	LTR	LTR
Maximum Queue (ft)	68	49	43	23	69	52	27	53	62
Average Queue (ft)	28	19	17	5	33	10	5	23	42
95th Queue (ft)	72	49	44	20	76	45	24	57	68
Link Distance (ft)	951	951	951	951		849	849	486	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)					150				
Storage Blk Time (%)									
Queuing Penalty (veh)									

## Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	44	131	154	171	185	175	636	620	561	615	185	50
Average Queue (ft)	30	86	79	94	94	141	389	386	341	319	146	30
95th Queue (ft)	56	162	156	200	217	208	619	613	569	607	266	62
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)						14	29			32	0	
Queuing Penalty (veh)						103	48			145	2	

## Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	116	52	299	245	198	45
Average Queue (ft)	84	10	244	218	157	25
95th Queue (ft)	119	45	297	271	225	46
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					23	
Queuing Penalty (veh)					12	

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW	SW
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	29	18
Average Queue (ft)	17	28	7
95th Queue (ft)	31	31	20
Link Distance (ft)	1628	2167	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			165
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NE	NE	SW	SW
Directions Served	LT	R	LT	L	R	T	T
Maximum Queue (ft)	14	10	52	51	56	65	47
Average Queue (ft)	13	4	41	30	11	19	15
95th Queue (ft)	15	9	63	61	48	62	46
Link Distance (ft)	865	865	2100		8392	1812	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)				325			155
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	EB
Directions Served	L	TR
Maximum Queue (ft)	21	17
Average Queue (ft)	8	3
95th Queue (ft)	25	14
Link Distance (ft)		2563
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	120	
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Queuing and Blocking Report am

11/20/2017

### Intersection: 67: McWhirt Loop & Banks Ford Parkway


Movement	EB	EB	WB	WB
Directions Served	LT	R	LT	R
Maximum Queue (ft)	26	18	47	21
Average Queue (ft)	19	14	26	8
95th Queue (ft)	36	26	51	25
Link Distance (ft)	927	927	626	626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

### Network Summary

Network wide Queuing Penalty: 496

# HCM Signalized Intersection Capacity Analysis

5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	1590	15	155	1732	11	61	51	196	22	28	95
Future Volume (vph)	57	1590	15	155	1732	11	61	51	196	22	28	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	63	1767	17	172	1924	12	68	57	218	24	31	106
RTOR Reduction (vph)	0	0	8	0	0	5	0	0	128	0	0	98
Lane Group Flow (vph)	63	1767	9	172	1924	7	0	125	90	0	55	8
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.6	67.6	23.0	75.6	75.6		6.0	29.0		9.4	9.4
Effective Green, g (s)	9.0	61.6	67.6	23.0	75.6	75.6		6.0	29.0		9.4	9.4
Actuated g/C Ratio	0.07	0.47	0.52	0.18	0.58	0.58		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2174	823	607	2669	920		82	349		132	115
v/s Ratio Prot	c0.04	c0.38	0.00	0.05	c0.42			c0.07	0.05		c0.03	
v/s Ratio Perm			0.01			0.00			0.01			0.00
v/c Ratio	0.52	0.81	0.01	0.28	0.72	0.01		1.52	0.26		0.42	0.07
Uniform Delay, d1	58.4	29.3	15.1	46.4	19.6	11.4		62.0	41.6		57.7	56.2
Progression Factor	1.00	1.00	1.00	1.50	0.26	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	14.8	3.5	0.0	0.8	1.2	0.0		288.2	0.4		2.1	0.2
Delay (s)	73.2	32.7	15.1	70.2	6.2	11.4		350.2	42.0		59.8	56.5
Level of Service	E	C	B	E	A	B		F	D		E	E
Approach Delay (s)		33.9			11.4			154.3			57.6	
Approach LOS		C			B			F			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			33.4				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			130.0				Sum of lost time (s)			30.0		
Intersection Capacity Utilization			75.4%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	1799	174	56	1787	80	177	50	105	63	55	32
Future Volume (vph)	21	1799	174	56	1787	80	177	50	105	63	55	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%					0%					2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1712	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1712	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	23	1977	191	62	1964	88	195	55	115	69	60	35
RTOR Reduction (vph)	0	0	74	0	0	30	0	0	90	0	0	33
Lane Group Flow (vph)	23	1977	117	62	1964	58	123	127	25	69	60	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	6.0	64.9	74.9	18.0	76.9	86.0	10.0	10.0	28.0	9.1	9.1	9.1
Effective Green, g (s)	6.0	64.9	74.9	18.0	76.9	86.0	10.0	10.0	28.0	9.1	9.1	9.1
Actuated g/C Ratio	0.05	0.50	0.58	0.14	0.59	0.66	0.08	0.08	0.22	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	81	2291	997	475	2715	1132	128	131	339	122	129	109
v/s Ratio Prot	0.01	c0.43	0.01	0.02	c0.43	0.00	0.07	c0.07	0.01	c0.04	0.03	
v/s Ratio Perm			0.07			0.03			0.01			0.00
v/c Ratio	0.28	0.86	0.12	0.13	0.72	0.05	0.96	0.97	0.07	0.57	0.47	0.02
Uniform Delay, d1	59.9	28.6	12.5	49.1	19.0	7.7	59.8	59.8	40.7	58.5	58.1	56.3
Progression Factor	0.66	0.36	0.00	1.21	0.27	0.00	1.00	1.01	1.17	1.00	1.00	1.00
Incremental Delay, d2	1.4	3.3	0.0	0.3	1.0	0.0	67.2	68.3	0.1	5.9	2.6	0.1
Delay (s)	40.7	13.6	0.0	60.0	6.1	0.0	127.3	128.5	47.7	64.4	60.8	56.4
Level of Service	D	B	A	E	A	A	F	F	D	E	E	E
Approach Delay (s)	12.7				7.4				102.7			
Approach LOS	B				A				F			
























## Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	1824	43	64	1680	168	97	16	135	230	23	130
Future Volume (vph)	100	1824	43	64	1680	168	97	16	135	230	23	130
ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	108	1961	46	69	1806	181	104	17	145	247	25	140
RTOR Reduction (vph)	0	0	23	0	0	59	0	0	137	0	0	118
Lane Group Flow (vph)	108	1961	23	69	1806	122	104	17	8	0	272	22
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	13.1	66.3	66.3	7.8	60.5	80.5	7.4	7.4	7.4		20.0	20.0
Effective Green, g (s)	13.1	66.3	66.3	7.8	60.5	80.5	7.4	7.4	7.4		20.0	20.0
Actuated g/C Ratio	0.10	0.51	0.51	0.06	0.47	0.62	0.06	0.06	0.06		0.15	0.15
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	179	2352	811	105	2114	970	196	106	90		270	240
v/s Ratio Prot	c0.06	c0.43		0.04	0.40	0.02	c0.03	0.01			c0.15	
v/s Ratio Perm			0.01			0.06			0.01			0.01
v/c Ratio	0.60	0.83	0.03	0.66	0.85	0.13	0.53	0.16	0.09		1.01	0.09
Uniform Delay, d1	56.0	27.2	15.8	59.8	30.8	10.2	59.6	58.3	58.1		55.0	47.2
Progression Factor	0.54	1.85	1.00	0.85	0.74	2.09	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.1	2.0	0.0	10.8	3.6	0.0	2.7	0.7	0.4		56.7	0.2
Delay (s)	33.3	52.4	15.9	61.8	26.5	21.4	62.4	59.1	58.6		111.7	47.4
Level of Service	C	D	B	E	C	C	E	E	E		F	D
Approach Delay (s)		50.6			27.2			60.1			89.8	
Approach LOS		D			C			E			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		44.5										
HCM 2000 Volume to Capacity ratio		0.86										
Actuated Cycle Length (s)		130.0							29.0			
Intersection Capacity Utilization		77.9%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/20/2017


												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	2095	50	68	2158	0	17	0	118	2	0	1
Future Volume (vph)	0	2095	50	68	2158	0	17	0	118	2	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.95	
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599		1722	
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599		1722	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2328	56	76	2398	0	19	0	131	2	0	1
RTOR Reduction (vph)	0	0	19	0	0	0	0	0	124	0	3	0
Lane Group Flow (vph)	0	2328	37	76	2398	0	9	10	7	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Effective Green, g (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Actuated g/C Ratio		0.65	0.65	0.06	0.77		0.05	0.05	0.05		0.01	
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		2989	1031	210	3516		91	91	86		18	
v/s Ratio Prot		c0.51		0.02	c0.53		0.01	c0.01			c0.00	
v/s Ratio Perm			0.02						0.00			
v/c Ratio		0.78	0.04	0.36	0.68		0.10	0.11	0.08		0.00	
Uniform Delay, d1		15.8	7.9	58.6	7.2		58.5	58.5	58.4		63.6	
Progression Factor		0.27	1.00	1.06	3.01		1.03	1.03	1.00		1.00	
Incremental Delay, d2		1.2	0.0	0.1	0.3		0.2	0.2	0.1		0.0	
Delay (s)		5.5	8.0	62.3	22.1		60.4	60.5	58.6		63.6	
Level of Service		A	A	E	C		E	E	E		E	
Approach Delay (s)		5.5			23.4			58.8			63.6	
Approach LOS		A			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		16.0				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.73										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		71.5%				ICU Level of Service		C				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

11/20/2017

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↑	↱	↰	↑	↱
Traffic Volume (vph)	233	1836	40	82	2005	107	26	98	249	106	32	169
Future Volume (vph)	233	1836	40	82	2005	107	26	98	249	106	32	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1697	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	256	2018	44	90	2203	118	29	108	274	116	35	186
RTOR Reduction (vph)	0	0	22	0	0	62	0	0	197	0	0	172
Lane Group Flow (vph)	256	2018	22	90	2203	56	0	137	77	74	77	14
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	66.2	66.2	12.5	61.2	61.2		12.5	12.5	9.8	9.8	9.8
Effective Green, g (s)	18.0	66.2	66.2	12.5	61.2	61.2		12.5	12.5	9.8	9.8	9.8
Actuated g/C Ratio	0.14	0.51	0.51	0.10	0.47	0.47		0.10	0.10	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2349	810	326	2139	737		174	150	124	127	117
v/s Ratio Prot	0.14	c0.44		0.03	c0.48			c0.08		0.04	c0.05	
v/s Ratio Perm			0.01			0.04			0.05			0.01
v/c Ratio	1.04	0.86	0.03	0.28	1.03	0.08		0.79	0.51	0.60	0.61	0.12
Uniform Delay, d1	56.0	27.8	15.9	54.5	34.4	18.9		57.5	55.9	58.2	58.2	56.1
Progression Factor	1.27	0.30	1.00	0.54	0.24	0.05		1.01	1.04	1.00	1.00	1.00
Incremental Delay, d2	58.9	3.1	0.0	0.3	22.7	0.1		20.6	2.9	7.5	7.9	0.5
Delay (s)	130.1	11.4	15.9	29.7	30.8	1.0		78.8	61.3	65.7	66.2	56.5
Level of Service	F	B	B	C	C	A		E	E	E	E	E
Approach Delay (s)		24.6			29.3			67.1			60.7	
Approach LOS		C			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		32.1										
HCM 2000 Volume to Capacity ratio		0.97										
Actuated Cycle Length (s)		130.0							29.0			
Intersection Capacity Utilization		82.8%							E			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






























10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	1889	67	55	1933	266	71	40	158	273	24	154
Future Volume (vph)	169	1889	67	55	1933	266	71	40	158	273	24	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%			1%			-1%			2%		
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1754	1591	1664	1682	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1754	1591	1664	1682	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	180	2010	71	59	2056	283	76	43	168	290	26	164
RTOR Reduction (vph)	0	0	27	0	0	118	0	0	155	0	0	148
Lane Group Flow (vph)	180	2010	44	59	2056	165	59	60	13	157	159	16
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	16.4	70.0	80.0	9.0	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Effective Green, g (s)	16.4	70.0	80.0	9.0	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Actuated g/C Ratio	0.13	0.54	0.62	0.07	0.48	0.58	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	2471	974	121	2199	915	130	134	122	166	168	156
v/s Ratio Prot	0.05	c0.44	0.00	0.03	c0.45	0.02	c0.03	0.03		0.09	c0.09	
v/s Ratio Perm			0.02			0.09			0.01			0.01
v/c Ratio	0.42	0.81	0.04	0.49	0.93	0.18	0.45	0.45	0.11	0.95	0.95	0.11
Uniform Delay, d1	52.4	24.6	9.9	58.3	31.8	12.7	57.4	57.4	55.8	58.1	58.2	53.2
Progression Factor	0.71	0.36	0.18	1.07	0.46	2.35	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.6	0.0	1.5	4.9	0.0	2.5	2.4	0.4	53.5	53.3	0.3
Delay (s)	37.3	10.4	1.8	63.9	19.6	29.9	59.9	59.7	56.2	111.7	111.4	53.5
Level of Service	D	B	A	E	B	C	E	E	E	F	F	D
Approach Delay (s)	12.3			21.9			57.7			91.7		
Approach LOS	B			C			E			F		
Intersection Summary												
HCM 2000 Control Delay	26.0			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.89											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			28.0					
Intersection Capacity Utilization	78.0%			ICU Level of Service			D					
Analysis Period (min)	15											
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

11/15/2017





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  				 			
Traffic Volume (vph)	72	2254	15	74	2187	50	80	4	166	144	1	78
Future Volume (vph)	72	2254	15	74	2187	50	80	4	166	144	1	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	2450	16	80	2377	54	87	4	180	157	1	85
RTOR Reduction (vph)	0	0	8	0	0	23	0	0	167	0	0	79
Lane Group Flow (vph)	78	2450	8	80	2377	31	0	91	13	78	80	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	7.9	66.6	66.6	15.9	75.1	75.1		9.6	9.6	8.9	8.9	8.9
Effective Green, g (s)	7.9	66.6	66.6	15.9	75.1	75.1		9.6	9.6	8.9	8.9	8.9
Actuated g/C Ratio	0.06	0.51	0.51	0.12	0.58	0.58		0.07	0.07	0.07	0.07	0.07
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	108	2363	815	417	2638	909		129	202	113	113	106
v/s Ratio Prot	0.04	c0.53		0.02	c0.52			c0.05		0.05	c0.05	
v/s Ratio Perm			0.01			0.02			0.00			0.00
v/c Ratio	0.72	1.04	0.01	0.19	0.90	0.03		0.71	0.07	0.69	0.71	0.05
Uniform Delay, d1	60.0	31.7	15.5	51.3	24.2	11.8		58.8	56.0	59.2	59.3	56.6
Progression Factor	1.34	0.51	1.00	0.70	0.44	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.6	25.2	0.0	0.2	4.2	0.1		16.1	0.1	16.6	18.3	0.2
Delay (s)	93.8	41.3	15.6	36.2	14.8	11.9		74.9	56.2	75.8	77.6	56.8
Level of Service	F	D	B	D	B	B		E	E	E	E	E
Approach Delay (s)		42.7			15.4			62.5			69.8	
Approach LOS		D			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		32.6					HCM 2000 Level of Service		C			
HCM 2000 Volume to Capacity ratio		0.98										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		77.4%					ICU Level of Service		D			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis























12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2527	27	11	2291	32	12	0	7	48	1	13
Future Volume (vph)	0	2527	27	11	2291	32	12	0	7	48	1	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.95			0.97	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.96	
Satd. Flow (prot)		5810		1761	4567	1575		1632			1685	
Flt Permitted		1.00		0.95	1.00	1.00		0.82			0.76	
Satd. Flow (perm)		5810		1761	4567	1575		1374			1329	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2808	30	12	2546	36	13	0	8	53	1	14
RTOR Reduction (vph)	0	1	0	0	0	7	0	19	0	0	7	0
Lane Group Flow (vph)	0	2837	0	12	2546	29	0	2	0	0	61	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)		96.4		3.0	106.4	106.4		10.1			10.1	
Effective Green, g (s)		96.4		3.0	106.4	106.4		10.1			10.1	
Actuated g/C Ratio		0.74		0.02	0.82	0.82		0.08			0.08	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4308		40	3737	1289		106			103	
v/s Ratio Prot		0.49		0.01	c0.56							
v/s Ratio Perm						0.02		0.00			c0.05	
v/c Ratio		0.66		0.30	0.68	0.02		0.02			0.59	
Uniform Delay, d1		8.5		62.5	4.8	2.2		55.4			57.9	
Progression Factor		0.11		1.37	1.08	1.00		1.00			1.00	
Incremental Delay, d2		0.3		2.3	0.6	0.0		0.1			8.3	
Delay (s)		1.2		88.0	5.8	2.2		55.4			66.3	
Level of Service		A		F	A	A		E			E	
Approach Delay (s)		1.2			6.1			55.4			66.3	
Approach LOS		A			A			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		4.5										
HCM 2000 Volume to Capacity ratio		0.72										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		60.0%										
Analysis Period (min)		15										
c Critical Lane Group												
<div> <div>HCM 2000 Level of Service</div> <div>A</div> </div> <div> <div>Sum of lost time (s)</div> <div>20.5</div> </div> <div> <div>ICU Level of Service</div> <div>B</div> </div>												

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

11/15/2017























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	2552	21	140	2193	428	43	16	435	601	34	132
Future Volume (vph)	98	2552	21	140	2193	428	43	16	435	601	34	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	110	2867	24	157	2464	481	48	18	489	675	38	148
RTOR Reduction (vph)	0	1	0	0	0	139	0	0	119	0	0	135
Lane Group Flow (vph)	110	2890	0	157	2464	342	0	66	370	472	241	13
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	14.5	64.1		15.9	65.5	76.5		10.0	32.9	11.0	11.0	11.0
Effective Green, g (s)	14.5	64.1		15.9	65.5	76.5		10.0	32.9	11.0	11.0	11.0
Actuated g/C Ratio	0.11	0.49		0.12	0.50	0.59		0.08	0.25	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	2864		215	2899	926		137	701	273	138	134
v/s Ratio Prot	0.06	c0.50		0.09	c0.43	0.03		0.04	c0.13	0.15	c0.15	
v/s Ratio Perm						0.19						0.01
v/c Ratio	0.56	1.01		0.73	0.85	0.37		0.48	0.53	1.73	1.75	0.09
Uniform Delay, d1	54.7	33.0		55.0	28.0	14.1		57.5	41.9	59.5	59.5	54.9
Progression Factor	0.66	0.40		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	17.5		12.8	3.4	0.3		3.6	0.9	343.0	364.0	0.3
Delay (s)	38.9	30.6		67.7	31.3	14.3		61.1	42.8	402.5	423.5	55.2
Level of Service	D	C		E	C	B		E	D	F	F	E
Approach Delay (s)		30.9			30.5			45.0			348.7	
Approach LOS		C			C			D			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		68.2					HCM 2000 Level of Service		E			
HCM 2000 Volume to Capacity ratio		1.08										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		82.2%					ICU Level of Service		E			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

11/13/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	9	12	41	15	4	49	102	64	1	184	345
Future Volume (Veh/h)	27	9	12	41	15	4	49	102	64	1	184	345
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	27	9	12	41	15	4	49	102	64	1	184	345
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	346	450	92	310	731	51	529			166		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	346	450	92	310	731	51	529			166		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	99	93	95	100	95			100		
cM capacity (veh/h)	541	479	947	580	331	1006	1034			1410		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	27	21	56	4	49	51	51	64	1	92	92	345
Volume Left	27	0	41	0	49	0	0	0	1	0	0	0
Volume Right	0	12	0	4	0	0	0	64	0	0	0	345
cSH	541	667	483	1006	1034	1700	1700	1700	1410	1700	1700	1700
Volume to Capacity	0.05	0.03	0.12	0.00	0.05	0.03	0.03	0.04	0.00	0.05	0.05	0.20
Queue Length 95th (ft)	4	2	10	0	4	0	0	0	0	0	0	0
Control Delay (s)	12.0	10.6	13.4	8.6	8.7	0.0	0.0	0.0	7.6	0.0	0.0	0.0
Lane LOS	B	B	B	A	A				A			
Approach Delay (s)	11.4		13.1		2.0				0.0			
Approach LOS	B		B									
Intersection Summary												
Average Delay			2.1									
Intersection Capacity Utilization			38.0%		ICU Level of Service				A			
Analysis Period (min)			15									


# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

11/13/2017

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	17	1	2	0	5	5	4	204	4	7	201	23	
Future Volume (Veh/h)	17	1	2	0	5	5	4	204	4	7	201	23	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour 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	
Hourly flow rate (vph)	17	1	2	0	5	5	4	204	4	7	201	23	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	434	431	201	432	452	206	224						208
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	434	431	201	432	452	206	224						208
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	97	100	100	100	99	99	100						99
cM capacity (veh/h)	521	513	840	529	499	835	1345						1363
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3					
Volume Total	17	3	10	4	208	7	201	23					
Volume Left	17	0	0	4	0	7	0	0					
Volume Right	0	2	5	0	4	0	0	23					
cSH	521	693	625	1345	1700	1363	1700	1700					
Volume to Capacity	0.03	0.00	0.02	0.00	0.12	0.01	0.12	0.01					
Queue Length 95th (ft)	3	0	1	0	0	0	0	0					
Control Delay (s)	12.1	10.2	10.9	7.7	0.0	7.7	0.0	0.0					
Lane LOS	B	B	B	A		A							
Approach Delay (s)	11.9		10.9	0.1		0.2							
Approach LOS	B		B										
Intersection Summary													
Average Delay				0.9									
Intersection Capacity Utilization				25.3%			ICU Level of Service			A			
Analysis Period (min)				15									

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway





















11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↖	↗	↘	↖	↗	↘	↖	↗
Traffic Volume (veh/h)	26	17	6	33	32	10	6	108	199	21	29	62
Future Volume (Veh/h)	26	17	6	33	32	10	6	108	199	21	29	62
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	26	17	6	33	32	10	6	108	199	21	29	62
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	163	390	14	191	253	54	91			307		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	163	390	14	191	253	54	91			307		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	97	99	95	95	99	100			98		
cM capacity (veh/h)	737	533	1062	718	636	1002	1502			1250		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	43	6	65	10	6	54	54	199	21	14	14	62
Volume Left	26	0	33	0	6	0	0	0	21	0	0	0
Volume Right	0	6	0	10	0	0	0	199	0	0	0	62
cSH	640	1062	675	1002	1502	1700	1700	1700	1250	1700	1700	1700
Volume to Capacity	0.07	0.01	0.10	0.01	0.00	0.03	0.03	0.12	0.02	0.01	0.01	0.04
Queue Length 95th (ft)	5	0	8	1	0	0	0	0	1	0	0	0
Control Delay (s)	11.0	8.4	10.9	8.6	7.4	0.0	0.0	0.0	7.9	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	10.7		10.6		0.1				1.5			
Approach LOS	B		B									
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			29.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

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11/16/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	5	2	6	6	82	2	228	12	89	234	43
Future Volume (Veh/h)	40	5	2	6	6	82	2	228	12	89	234	43
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	2	7	7	89	2	248	13	97	254	47
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	668	713	127	578	747	124	301			261		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	668	713	127	578	747	124	301			261		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	98	100	98	98	90	100			93		
cM capacity (veh/h)	287	329	900	371	314	904	1257			1300		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	50	103	2	124	124	13	97	127	127	47		
Volume Left	43	7	2	0	0	0	97	0	0	0		
Volume Right	2	89	0	0	0	13	0	0	0	47		
cSH	299	737	1257	1700	1700	1700	1300	1700	1700	1700		
Volume to Capacity	0.17	0.14	0.00	0.07	0.07	0.01	0.07	0.07	0.07	0.03		
Queue Length 95th (ft)	15	12	0	0	0	0	6	0	0	0		
Control Delay (s)	19.5	10.7	7.9	0.0	0.0	0.0	8.0	0.0	0.0	0.0		
Lane LOS	C	B	A				A					
Approach Delay (s)	19.5	10.7	0.1				1.9					
Approach LOS	C	B										
Intersection Summary												
Average Delay			3.5									
Intersection Capacity Utilization			30.5%			ICU Level of Service				A		
Analysis Period (min)			15									

# Queuing and Blocking Report

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11/20/2017

## Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	NB
Directions Served	L	TR	LT	L
Maximum Queue (ft)	44	30	45	22
Average Queue (ft)	19	15	18	9
95th Queue (ft)	47	35	47	27
Link Distance (ft)		1010	815	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185			50
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	LT
Maximum Queue (ft)	82	243	203	194	18	38	80	96	28	95	107	43
Average Queue (ft)	22	188	173	150	8	32	20	39	15	61	73	19
95th Queue (ft)	73	241	213	196	22	49	70	101	35	96	120	43
Link Distance (ft)		2762	2762	2762			728	728	728	748	748	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				690	690						65
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	SB
Directions Served	R
Maximum Queue (ft)	46
Average Queue (ft)	28
95th Queue (ft)	49
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	L	LT	R
Maximum Queue (ft)	25	185	267	151	21	15	40	33	89	110	107	98
Average Queue (ft)	5	117	166	123	14	7	28	9	39	65	51	34
95th Queue (ft)	22	203	271	162	27	18	52	30	98	111	105	91
Link Distance (ft)		282	282	282			489	489	489	2137	2137	
Upstream Blk Time (%)			0									
Queuing Penalty (veh)			1									
Storage Bay Dist (ft)	185				200	400						160
Storage Blk Time (%)		5										
Queuing Penalty (veh)		1										

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	48	74
Average Queue (ft)	33	41
95th Queue (ft)	63	83
Link Distance (ft)	552	552
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	185	540	484	529	81	241	209	410	200	51	74	29
Average Queue (ft)	156	409	428	427	29	174	183	230	84	16	45	6
95th Queue (ft)	250	557	510	554	86	252	218	380	235	50	76	25
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		21				4		8	0			
Queuing Penalty (veh)		21				3		13	1			

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	171	199
Average Queue (ft)	143	97
95th Queue (ft)	170	231
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	0	0
Queuing Penalty (veh)	0	1

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	T	T	L	L	T	T	T	L	LT	LTR
Maximum Queue (ft)	71	86	40	37	46	119	114	174	19	11	22
Average Queue (ft)	31	28	11	30	21	68	58	82	8	4	4
95th Queue (ft)	77	77	37	39	55	161	138	202	23	13	19
Link Distance (ft)	571	571	571			734	734	734	602	602	110
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)				400	400						
Storage Blk Time (%)								3			
Queuing Penalty (veh)								0			

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	LT
Maximum Queue (ft)	264	69	91	87	37	26	68	130	87	106	46	469
Average Queue (ft)	187	27	45	55	11	17	40	53	57	65	13	278
95th Queue (ft)	297	71	92	105	35	34	83	128	107	112	43	521
Link Distance (ft)		585	585	585				490	490	490		799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				350	290	290				400	
Storage Blk Time (%)												36
Queuing Penalty (veh)												89

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	95	116	133	144
Average Queue (ft)	86	38	96	76
95th Queue (ft)	115	109	152	141
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)	32	0	3	1
Queuing Penalty (veh)	40	1	6	1

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	53	91	293	307	250	26	72	241	184	276	31	87
Average Queue (ft)	42	53	123	123	118	15	46	100	133	166	18	27
95th Queue (ft)	62	103	271	282	253	35	72	223	190	280	43	80
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)			0									
Queuing Penalty (veh)			0									

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	109	110	152	214	155
Average Queue (ft)	49	79	128	144	90
95th Queue (ft)	111	135	153	209	180
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90			130
Storage Blk Time (%)	2	10		8	10
Queuing Penalty (veh)	4	7		13	16

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	R
Maximum Queue (ft)	54	198	184	173	34	28	213	302	331	103	90	53
Average Queue (ft)	41	119	122	133	11	16	101	138	138	67	74	28
95th Queue (ft)	70	196	183	192	34	34	247	319	331	113	96	55
Link Distance (ft)		2403	2403	2403			951	951	951	669	669	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300						220
Storage Blk Time (%)									7			
Queuing Penalty (veh)									3			

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	287	175	110
Average Queue (ft)	167	122	77
95th Queue (ft)	277	209	115
Link Distance (ft)	607		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	150
Storage Blk Time (%)	12	1	
Queuing Penalty (veh)	18	1	

Intersection: 12: Victor Neilsen Dr./Mclanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	T	T	R	LTR	LTR
Maximum Queue (ft)	108	25	44	21	50	24	30	53	100
Average Queue (ft)	22	15	29	16	10	5	6	19	51
95th Queue (ft)	93	34	48	29	43	21	26	51	92
Link Distance (ft)	951	951	951	951	849	849		486	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)							240		
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	152	238	157	175	171	175	380	354	323	285	185	114
Average Queue (ft)	76	122	79	102	98	73	253	245	204	147	88	50
95th Queue (ft)	161	244	160	170	184	166	454	415	379	323	219	112
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)							25			5	0	
Queuing Penalty (veh)							34			20	1	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	339	291	392	308	380	155
Average Queue (ft)	253	213	335	275	272	142
95th Queue (ft)	343	308	386	309	380	185
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					56	8
Queuing Penalty (veh)					74	18

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (ft)	24	42
Average Queue (ft)	16	28
95th Queue (ft)	29	39
Link Distance (ft)	1628	2167
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NE	SW	SW	SW
Directions Served	LT	R	LT	L	L	T	T
Maximum Queue (ft)	116	11	88	25	13	81	81
Average Queue (ft)	55	7	49	20	3	32	32
95th Queue (ft)	116	12	85	36	11	94	96
Link Distance (ft)	865	865	2100			1812	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)				325	390		155
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	EB
Directions Served	L	TR
Maximum Queue (ft)	26	17
Average Queue (ft)	17	5
95th Queue (ft)	32	16
Link Distance (ft)		2563
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	120	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 67: McWhirt Loop & Banks Ford Parkway

Movement	EB	EB	WB	WB	SB
Directions Served	LT	R	LT	R	L
Maximum Queue (ft)	26	17	50	20	22
Average Queue (ft)	18	3	30	8	4
95th Queue (ft)	34	14	46	24	19
Link Distance (ft)	927	927	626	626	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 387

## **Capacity Analysis Results**

*Design Year*

# HCM Signalized Intersection Capacity Analysis

## 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)
































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	111	1774	82	673	1266	10	18	40	349	11	56	49
Future Volume (vph)	111	1774	82	673	1266	10	18	40	349	11	56	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	123	1971	91	748	1407	11	20	44	388	12	62	54
RTOR Reduction (vph)	0	0	44	0	0	5	0	0	146	0	0	50
Lane Group Flow (vph)	123	1971	47	748	1407	6	0	64	242	0	74	4
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.8	67.8	23.0	75.8	75.8		6.0	29.0		9.2	9.2
Effective Green, g (s)	9.0	61.8	67.8	23.0	75.8	75.8		6.0	29.0		9.2	9.2
Actuated g/C Ratio	0.07	0.48	0.52	0.18	0.58	0.58		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2182	825	607	2676	923		83	349		131	112
v/s Ratio Prot	0.07	c0.43	0.00	c0.22	0.31			c0.04	0.12		c0.04	
v/s Ratio Perm			0.03			0.00			0.03			0.00
v/c Ratio	1.01	0.90	0.06	1.23	0.53	0.01		0.77	0.69		0.56	0.03
Uniform Delay, d1	60.5	31.4	15.3	53.5	16.3	11.3		61.3	46.4		58.5	56.3
Progression Factor	1.00	1.00	1.00	1.52	0.14	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	83.7	6.7	0.0	115.4	0.6	0.0		34.8	5.9		5.5	0.1
Delay (s)	144.2	38.0	15.4	196.6	2.8	11.4		96.2	52.3		63.9	56.4
Level of Service	F	D	B	F	A	B		F	D		E	E
Approach Delay (s)		43.1			69.8			58.5			60.8	
Approach LOS		D			E			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			56.7				HCM 2000 Level of Service				E	
HCM 2000 Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			130.0				Sum of lost time (s)			30.0		
Intersection Capacity Utilization			82.9%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	15	1949	95	406	1838	82	70	22	41	71	62	36
Future Volume (vph)	15	1949	95	406	1838	82	70	22	41	71	62	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1715	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1715	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	2142	104	446	2020	90	77	24	45	78	68	40
RTOR Reduction (vph)	0	0	39	0	0	28	0	0	36	0	0	37
Lane Group Flow (vph)	16	2142	65	446	2020	62	50	51	9	78	68	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	66.9	74.7	18.0	80.9	90.2	7.8	7.8	25.8	9.3	9.3	9.3
Effective Green, g (s)	4.0	66.9	74.7	18.0	80.9	90.2	7.8	7.8	25.8	9.3	9.3	9.3
Actuated g/C Ratio	0.03	0.51	0.57	0.14	0.62	0.69	0.06	0.06	0.20	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2362	994	475	2856	1183	100	102	312	125	131	112
v/s Ratio Prot	0.01	c0.47	0.00	c0.13	0.44	0.00	c0.03	0.03	0.00	c0.04	0.04	
v/s Ratio Perm			0.04			0.04			0.00			0.00
v/c Ratio	0.30	0.91	0.07	0.94	0.71	0.05	0.50	0.50	0.03	0.62	0.52	0.03
Uniform Delay, d1	61.6	28.7	12.2	55.5	16.6	6.3	59.2	59.2	42.0	58.7	58.2	56.1
Progression Factor	0.70	0.41	0.00	1.10	0.39	0.00	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	3.5	0.0	12.5	0.5	0.0	3.9	3.8	0.0	9.3	3.4	0.1
Delay (s)	44.9	15.4	0.0	73.6	7.0	0.0	63.7	63.8	42.0	68.0	61.6	56.2
Level of Service	D	B	A	E	A	A	E	E	D	E	E	E
Approach Delay (s)		14.9			18.4			57.0			63.1	
Approach LOS		B			B			E			E	






























### Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  		 				 	
Traffic Volume (vph)	91	1929	10	34	2236	283	40	23	32	132	16	51
Future Volume (vph)	91	1929	10	34	2236	283	40	23	32	132	16	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1756	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1756	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	98	2074	11	37	2404	304	43	25	34	142	17	55
RTOR Reduction (vph)	0	0	5	0	0	66	0	0	33	0	0	48
Lane Group Flow (vph)	98	2074	6	37	2404	238	43	25	1	0	159	7
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	12.6	74.3	74.3	5.5	66.7	83.1	5.3	5.3	5.3		16.4	16.4
Effective Green, g (s)	12.6	74.3	74.3	5.5	66.7	83.1	5.3	5.3	5.3		16.4	16.4
Actuated g/C Ratio	0.10	0.57	0.57	0.04	0.51	0.64	0.04	0.04	0.04		0.13	0.13
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	2636	909	74	2331	1001	140	76	64		221	196
v/s Ratio Prot	c0.06	c0.45		0.02	c0.53	0.03	0.01	c0.01			c0.09	
v/s Ratio Perm			0.00			0.12			0.00			0.00
v/c Ratio	0.57	0.79	0.01	0.50	1.03	0.24	0.31	0.33	0.02		0.72	0.04
Uniform Delay, d1	56.1	21.7	12.0	60.9	31.6	10.0	60.6	60.6	59.9		54.6	49.9
Progression Factor	0.62	1.98	1.00	0.89	0.85	1.35	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.0	1.1	0.0	2.8	22.6	0.1	1.2	2.5	0.1		10.7	0.1
Delay (s)	37.0	44.1	12.0	56.8	49.5	13.5	61.8	63.2	60.0		65.3	49.9
Level of Service	D	D	B	E	D	B	E	E	E		E	D
Approach Delay (s)		43.7			45.6			61.5			61.3	
Approach LOS		D			D			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			45.8									
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			130.0						29.0			
Intersection Capacity Utilization			81.4%									
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/15/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2004	34	84	2962	0	14	0	60	0	0	0
Future Volume (vph)	0	2004	34	84	2962	0	14	0	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00			
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599			
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2227	38	93	3291	0	16	0	67	0	0	0
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	64	0	0	0
Lane Group Flow (vph)	0	2227	27	93	3291	0	8	8	3	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm			
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		92.9	92.9	10.0	109.9		5.6	5.6	5.6			
Effective Green, g (s)		92.9	92.9	10.0	109.9		5.6	5.6	5.6			
Actuated g/C Ratio		0.71	0.71	0.08	0.85		0.04	0.04	0.04			
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0			
Lane Grp Cap (vph)		3263	1125	262	3860		73	73	68			
v/s Ratio Prot		0.49		0.03	c0.72		c0.00	0.00				
v/s Ratio Perm			0.02						0.00			
v/c Ratio		0.68	0.02	0.35	0.85		0.11	0.11	0.04			
Uniform Delay, d1		10.3	5.4	56.9	5.6		59.8	59.8	59.6			
Progression Factor		0.36	1.00	1.06	4.24		1.00	1.00	1.00			
Incremental Delay, d2		0.8	0.0	0.0	0.2		0.2	0.2	0.1			
Delay (s)		4.6	5.4	60.4	23.8		60.0	60.0	59.7			
Level of Service		A	A	E	C		E	E	E			
Approach Delay (s)		4.6			24.8			59.8			0.0	
Approach LOS		A			C			E			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.3			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.93									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			28.5			
Intersection Capacity Utilization			75.1%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	214	1861	14	141	2674	125	27	36	96	162	47	152
Future Volume (vph)	214	1861	14	141	2674	125	27	36	96	162	47	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	235	2045	15	155	2938	137	30	40	105	178	52	167
RTOR Reduction (vph)	0	0	7	0	0	72	0	0	97	0	0	152
Lane Group Flow (vph)	235	2045	8	155	2938	65	0	70	8	114	116	15
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	66.6	66.6	12.5	61.6	61.6		10.3	10.3	11.6	11.6	11.6
Effective Green, g (s)	18.0	66.6	66.6	12.5	61.6	61.6		10.3	10.3	11.6	11.6	11.6
Actuated g/C Ratio	0.14	0.51	0.51	0.10	0.47	0.47		0.08	0.08	0.09	0.09	0.09
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2363	815	326	2153	742		142	123	147	151	139
v/s Ratio Prot	0.13	c0.44		0.05	c0.65			c0.04		c0.07	0.07	
v/s Ratio Perm			0.00			0.04			0.01			0.01
v/c Ratio	0.96	0.87	0.01	0.48	1.36	0.09		0.49	0.07	0.78	0.77	0.11
Uniform Delay, d1	55.6	27.8	15.5	55.6	34.2	18.8		57.3	55.4	57.9	57.9	54.4
Progression Factor	1.20	0.37	1.00	0.52	0.22	0.05		1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	37.5	3.5	0.0	0.1	164.4	0.0		2.7	0.2	22.1	20.6	0.3
Delay (s)	104.1	13.7	15.6	29.0	171.9	1.1		64.9	55.6	80.1	78.5	54.8
Level of Service	F	B	B	C	F	A		E	E	F	E	D
Approach Delay (s)		22.9			157.8			59.4			69.0	
Approach LOS		C			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		98.4					HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio		1.16										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		93.8%					ICU Level of Service		F			
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	1992	43	135	2868	194	49	18	86	236	25	110
Future Volume (vph)	97	1992	43	135	2868	194	49	18	86	236	25	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1737	1591	1664	1684	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1737	1591	1664	1684	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	103	2119	46	144	3051	206	52	19	91	251	27	117
RTOR Reduction (vph)	0	0	19	0	0	66	0	0	84	0	0	106
Lane Group Flow (vph)	103	2119	27	144	3051	140	35	36	7	138	140	11
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	15.0	65.4	75.4	13.9	64.3	77.0	10.0	10.0	10.0	12.7	12.7	12.7
Effective Green, g (s)	15.0	65.4	75.4	13.9	64.3	77.0	10.0	10.0	10.0	12.7	12.7	12.7
Actuated g/C Ratio	0.12	0.50	0.58	0.11	0.49	0.59	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	396	2309	918	188	2258	932	130	133	122	162	164	153
v/s Ratio Prot	0.03	c0.46	0.00	0.08	c0.67	0.01	0.02	c0.02		0.08	c0.08	
v/s Ratio Perm			0.01			0.07			0.00			0.01
v/c Ratio	0.26	0.92	0.03	0.77	1.35	0.15	0.27	0.27	0.06	0.85	0.85	0.07
Uniform Delay, d1	52.4	29.8	11.7	56.5	32.9	11.9	56.6	56.6	55.6	57.7	57.7	53.3
Progression Factor	0.68	0.50	1.00	0.98	0.72	1.39	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	4.2	0.0	1.7	158.3	0.0	1.1	1.1	0.2	32.6	32.6	0.2
Delay (s)	35.8	19.0	11.7	56.9	181.8	16.5	57.7	57.7	55.8	90.3	90.3	53.5
Level of Service	D	B	B	E	F	B	E	E	E	F	F	D
Approach Delay (s)		19.6			166.5			56.6			79.4	
Approach LOS		B			F			E			E	

## Intersection Summary






























HCM 2000 Control Delay	104.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

11/15/2017


























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  				 			
Traffic Volume (vph)	38	2013	7	25	3109	117	1	0	12	63	1	40
Future Volume (vph)	38	2013	7	25	3109	117	1	0	12	63	1	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1662	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1662	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	2188	8	27	3379	127	1	0	13	68	1	43
RTOR Reduction (vph)	0	0	3	0	0	44	0	0	13	0	0	41
Lane Group Flow (vph)	41	2188	5	27	3379	83	0	1	0	35	34	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	7.1	83.0	83.0	8.7	85.1	85.1		3.2	3.2	6.1	6.1	6.1
Effective Green, g (s)	7.1	83.0	83.0	8.7	85.1	85.1		3.2	3.2	6.1	6.1	6.1
Actuated g/C Ratio	0.05	0.64	0.64	0.07	0.65	0.65		0.02	0.02	0.05	0.05	0.05
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	97	2945	1015	228	2989	1031		42	67	77	77	73
v/s Ratio Prot	0.02	c0.47		0.01	c0.74			c0.00		c0.02	0.02	
v/s Ratio Perm			0.00			0.05			0.00			0.00
v/c Ratio	0.42	0.74	0.01	0.12	1.13	0.08		0.02	0.00	0.45	0.44	0.03
Uniform Delay, d1	59.5	16.2	8.5	57.0	22.5	8.2		61.9	61.8	60.3	60.3	59.1
Progression Factor	1.39	0.31	1.00	0.90	0.73	0.73		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.8	0.0	0.1	60.5	0.1		0.2	0.0	4.2	4.0	0.2
Delay (s)	83.7	5.7	8.5	51.4	76.9	6.0		62.1	61.9	64.5	64.3	59.3
Level of Service	F	A	A	D	E	A		E	E	E	E	E
Approach Delay (s)		7.2			74.2			61.9			62.4	
Approach LOS		A			E			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		48.5					HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio		1.07										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		88.8%					ICU Level of Service		E			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 			 	
Traffic Volume (vph)	0	2078	48	40	3350	63	21	5	11	5	5	38
Future Volume (vph)	0	2078	48	40	3350	63	21	5	11	5	5	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.96			0.90	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.99	
Satd. Flow (prot)		5806		1761	4567	1575		1657			1603	
Flt Permitted		1.00		0.95	1.00	1.00		0.87			0.95	
Satd. Flow (perm)		5806		1761	4567	1575		1480			1537	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2309	53	44	3722	70	23	6	12	6	6	42
RTOR Reduction (vph)	0	2	0	0	0	11	0	11	0	0	40	0
Lane Group Flow (vph)	0	2360	0	44	3722	59	0	30	0	0	14	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)		94.5		7.6	109.1	109.1		7.4			7.4	
Effective Green, g (s)		94.5		7.6	109.1	109.1		7.4			7.4	
Actuated g/C Ratio		0.73		0.06	0.84	0.84		0.06			0.06	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4220		102	3832	1321		84			87	
v/s Ratio Prot		0.41		0.02	c0.81							
v/s Ratio Perm						0.04		c0.02			0.01	
v/c Ratio		0.56		0.43	0.97	0.04		0.35			0.17	
Uniform Delay, d1		8.2		59.1	9.1	1.7		59.0			58.4	
Progression Factor		0.14		1.32	2.31	0.00		1.00			1.00	
Incremental Delay, d2		0.4		0.3	1.3	0.0		2.6			0.9	
Delay (s)		1.6		78.5	22.3	0.0		61.6			59.3	
Level of Service		A		E	C	A		E			E	
Approach Delay (s)		1.6			22.6			61.6			59.3	
Approach LOS		A			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		15.3					HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio		0.99										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		20.5			
Intersection Capacity Utilization		83.4%					ICU Level of Service		E			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

11/15/2017




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	2047	45	188	3306	516	54	14	150	409	67	60
Future Volume (vph)	66	2047	45	188	3306	516	54	14	150	409	67	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	5806		1761	5755	1575		1783	2773	3237	1655	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	5806		1761	5755	1575		1783	2773	3237	1655	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	74	2300	51	211	3715	580	61	16	169	460	75	67
RTOR Reduction (vph)	0	2	0	0	0	104	0	0	117	0	0	61
Lane Group Flow (vph)	74	2349	0	211	3715	476	0	77	52	354	181	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	11.6	63.0		17.4	68.8	79.8		9.6	34.0	11.0	11.0	11.0
Effective Green, g (s)	11.6	63.0		17.4	68.8	79.8		9.6	34.0	11.0	11.0	11.0
Actuated g/C Ratio	0.09	0.48		0.13	0.53	0.61		0.07	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	2813		235	3045	966		131	725	273	140	134
v/s Ratio Prot	0.04	c0.40		0.12	c0.65	0.04		c0.04	0.02	0.11	c0.11	
v/s Ratio Perm						0.26						0.00
v/c Ratio	0.47	0.84		0.90	1.22	0.49		0.59	0.07	1.30	1.29	0.04
Uniform Delay, d1	56.3	29.0		55.4	30.6	13.9		58.3	36.1	59.5	59.5	54.7
Progression Factor	0.64	0.38		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	2.7		33.1	102.2	0.4		7.7	0.1	157.9	174.6	0.1
Delay (s)	38.0	13.7		88.5	132.8	14.3		66.0	36.2	217.4	234.1	54.8
Level of Service	D	B		F	F	B		E	D	F	F	D
Approach Delay (s)		14.5			115.5			45.5			204.3	
Approach LOS		B			F			D			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		88.6										
HCM 2000 Volume to Capacity ratio		1.14										
Actuated Cycle Length (s)		130.0							29.0			
Intersection Capacity Utilization		85.8%							E			
Analysis Period (min)		15										

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 3: Hyannis/Bolivar & Celebrate VA























10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	18	4	5	4	91	91	29	5	56	5	4
Future Volume (Veh/h)	37	18	4	5	4	91	91	29	5	56	5	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	20	4	5	4	99	99	32	5	61	5	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type									None		None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	442	362	2	368	361	16	9			37		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442	362	2	368	361	16	9			37		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	96	100	99	99	91	94			96		
cM capacity (veh/h)	416	509	1080	503	509	1059	1609			1572		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	64	108	99	16	16	5	61	2	2	4		
Volume Left	40	5	99	0	0	0	61	0	0	0		
Volume Right	4	99	0	0	0	5	0	0	0	4		
cSH	460	971	1609	1700	1700	1700	1572	1700	1700	1700		
Volume to Capacity	0.14	0.11	0.06	0.01	0.01	0.00	0.04	0.00	0.00	0.00		
Queue Length 95th (ft)	12	9	5	0	0	0	3	0	0	0		
Control Delay (s)	14.1	9.2	7.4	0.0	0.0	0.0	7.4	0.0	0.0	0.0		
Lane LOS	B	A	A	A								
Approach Delay (s)	14.1	9.2	5.4	6.4								
Approach LOS	B	A										
Intersection Summary												
Average Delay			8.1									
Intersection Capacity Utilization			28.3%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	88	1	32	0	4	7	18	126	8	0	40	32
Future Volume (Veh/h)	88	1	32	0	4	7	18	126	8	0	40	32
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	88	1	32	0	4	7	18	126	8	0	40	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	148	210	20	214	234	63	72	134				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148	210	20	214	234	63	72	134				
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	89	100	97	100	99	99	99	100				
cM capacity (veh/h)	789	678	1053	694	657	988	1526	1448				
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	88	33	4	7	18	63	63	8	0	20	20	32
Volume Left	88	0	0	0	18	0	0	0	0	0	0	0
Volume Right	0	32	0	7	0	0	0	8	0	0	0	32
cSH	789	1036	657	988	1526	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.11	0.03	0.01	0.01	0.01	0.04	0.04	0.00	0.00	0.01	0.01	0.02
Queue Length 95th (ft)	9	2	0	1	1	0	0	0	0	0	0	0
Control Delay (s)	10.1	8.6	10.5	8.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A	B	A	A							
Approach Delay (s)	9.7	9.3		0.9		0.0						
Approach LOS	A	A										
Intersection Summary												
Average Delay	4.0											
Intersection Capacity Utilization	25.9%			ICU Level of Service					A			
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane























10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	0	10	0	5	5	3	0	1	7	14	18
Future Volume (Veh/h)	19	0	10	0	5	5	3	0	1	7	14	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	19	0	10	0	5	5	3	0	1	7	14	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	42	35	14	44	52	0	32			1		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	42	35	14	44	52	0	32			1		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	100	99	100	100			100		
cM capacity (veh/h)	949	852	1066	944	834	1084	1580			1622		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	19	10	10	3	1	7	14	18				
Volume Left	19	0	0	3	0	7	0	0				
Volume Right	0	10	5	0	1	0	0	18				
cSH	949	1066	943	1580	1700	1622	1700	1700				
Volume to Capacity	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.01				
Queue Length 95th (ft)	2	1	1	0	0	0	0	0				
Control Delay (s)	8.9	8.4	8.9	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.7		8.9	5.5		1.3						
Approach LOS	A		A									
<b>Intersection Summary</b>												
Average Delay			5.0									
Intersection Capacity Utilization			20.2%			ICU Level of Service				A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 67: McWhirt Loop & Banks Ford Parkway

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	11	10	44	38	15	1	71	63	29	26	54
Future Volume (Veh/h)	25	11	10	44	38	15	1	71	63	29	26	54
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	25	11	10	44	38	15	1	71	63	29	26	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	156	220	13	160	211	36	80			134		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	156	220	13	160	211	36	80			134		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	99	94	94	99	100			98		
cM capacity (veh/h)	739	663	1064	761	671	1029	1516			1448		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	36	10	82	15	1	36	36	63	29	13	13	54
Volume Left	25	0	44	0	1	0	0	0	29	0	0	0
Volume Right	0	10	0	15	0	0	0	63	0	0	0	54
cSH	714	1064	717	1029	1516	1700	1700	1700	1448	1700	1700	1700
Volume to Capacity	0.05	0.01	0.11	0.01	0.00	0.02	0.02	0.04	0.02	0.01	0.01	0.03
Queue Length 95th (ft)	4	1	10	1	0	0	0	0	2	0	0	0
Control Delay (s)	10.3	8.4	10.7	8.5	7.4	0.0	0.0	0.0	7.5	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	9.9		10.3		0.1				2.0			
Approach LOS	A		B									
Intersection Summary												
Average Delay			4.4									
Intersection Capacity Utilization			26.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# Queuing and Blocking Report

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## Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB
Directions Served	L	TR
Maximum Queue (ft)	30	24
Average Queue (ft)	11	19
95th Queue (ft)	33	34
Link Distance (ft)	1010	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	185	
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	LT
Maximum Queue (ft)	260	258	253	250	23	471	531	14	30	7	0	98
Average Queue (ft)	208	153	161	166	9	301	322	5	11	1	0	60
95th Queue (ft)	267	290	303	299	27	504	548	16	29	6	0	118
Link Distance (ft)	2762		2762	2762				728	728	728		748
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				410	690	690				185	
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	NB	SB	SB
Directions Served	R	LT	R
Maximum Queue (ft)	380	84	200
Average Queue (ft)	173	69	70
95th Queue (ft)	349	91	183
Link Distance (ft)	748		453
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	65		
Storage Blk Time (%)	82		
Queuing Penalty (veh)	40		

Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	B26	B26	B26	WB	WB	WB	WB
Directions Served	L	T	T	T	R	T	T	T	L	L	T	T
Maximum Queue (ft)	25	366	386	406	215	101	127	127	139	189	102	199
Average Queue (ft)	12	197	227	248	54	20	25	25	93	120	32	70
95th Queue (ft)	29	366	383	408	187	87	109	110	139	182	94	198
Link Distance (ft)		282	282	282		728	728	728			489	489
Upstream Blk Time (%)		5	7	7								
Queuing Penalty (veh)		38	50	51								
Storage Bay Dist (ft)	185				200				400	400		
Storage Blk Time (%)		9		11	0							
Queuing Penalty (veh)		1		10	1							

Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	WB	NB	NB	NB	SB	SB
Directions Served	T	L	LT	R	L	T
Maximum Queue (ft)	206	66	64	19	89	92
Average Queue (ft)	69	30	30	4	60	53
95th Queue (ft)	194	67	66	16	88	103
Link Distance (ft)	489	2137	2137		552	552
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)				160		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report  
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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	185	545	538	631	224	523	489	402	75	27	74	50
Average Queue (ft)	106	316	398	452	50	328	290	225	31	19	32	25
95th Queue (ft)	230	607	589	707	194	567	551	456	80	36	83	52
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)				1		2	0					
Queuing Penalty (veh)				4		19	1					
Storage Bay Dist (ft)	160				200					175	775	
Storage Blk Time (%)		14				14		5				
Queuing Penalty (veh)		13				5		13				

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	195	42
Average Queue (ft)	107	24
95th Queue (ft)	209	49
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	2	
Queuing Penalty (veh)	1	

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	WB	WB
Directions Served	T	T	L	L
Maximum Queue (ft)	23	18	67	45
Average Queue (ft)	5	4	32	23
95th Queue (ft)	20	16	73	47
Link Distance (ft)	571	571		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			400	400
Storage Blk Time (%)				
Queuing Penalty (veh)				

Queuing and Blocking Report  
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Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	LT	R
Maximum Queue (ft)	178	131	176	188	69	47	196	208	220	43	91	73
Average Queue (ft)	148	86	104	108	32	42	139	156	164	21	34	49
95th Queue (ft)	201	161	228	239	70	56	242	254	271	40	90	79
Link Distance (ft)		585	585	585			490	490	490		799	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				290	290				400		70
Storage Blk Time (%)											9	13
Queuing Penalty (veh)											9	8

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	144	170	108
Average Queue (ft)	95	123	57
95th Queue (ft)	174	187	123
Link Distance (ft)		980	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	120		145
Storage Blk Time (%)	5	15	
Queuing Penalty (veh)	13	35	

Queuing and Blocking Report  
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Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	L	T	T	T	L	T	T	T	R	L	LT
Maximum Queue (ft)	31	53	257	292	306	424	642	771	705	325	91	65
Average Queue (ft)	12	40	183	220	219	167	449	537	525	221	60	13
95th Queue (ft)	37	57	278	334	352	383	701	793	719	430	89	56
Link Distance (ft)			563	563	563		2403	2403	2403		852	852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				400				300		
Storage Blk Time (%)							13		21	0		
Queuing Penalty (veh)							18		40	4		

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	65	132	130	63
Average Queue (ft)	26	103	91	31
95th Queue (ft)	67	131	133	67
Link Distance (ft)		366	366	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	90			130
Storage Blk Time (%)			5	
Queuing Penalty (veh)			5	

Queuing and Blocking Report  
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Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	R	R
Maximum Queue (ft)	30	136	289	255	12	8	273	268	293	267	24	29
Average Queue (ft)	12	62	109	87	5	5	189	197	218	56	5	6
95th Queue (ft)	29	129	265	231	15	10	315	282	340	230	21	25
Link Distance (ft)		2403	2403	2403			951	951	951		669	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300				250		220
Storage Blk Time (%)									3	0		
Queuing Penalty (veh)									3	1		

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	L	R
Maximum Queue (ft)	135	49
Average Queue (ft)	80	10
95th Queue (ft)	144	42
Link Distance (ft)	607	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 12: Victor Neilsen Dr./McInnes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	L	T	T	T	LTR	LTR
Maximum Queue (ft)	68	89	65	61	49	139	160	141	74	30
Average Queue (ft)	32	40	16	15	34	33	32	34	39	17
95th Queue (ft)	77	99	58	54	49	123	137	124	68	33
Link Distance (ft)	951	951	951	951		849	849	849	486	933
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					150					
Storage Blk Time (%)						0				
Queuing Penalty (veh)						0				

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	109	191	240	240	167	174	1181	1181	896	846	185	76
Average Queue (ft)	49	85	101	97	92	155	667	650	536	484	185	40
95th Queue (ft)	110	183	223	228	191	200	1095	1094	860	801	185	75
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)							4	2				
Queuing Penalty (veh)							0	0				
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)						31	32			48	1	
Queuing Penalty (veh)						253	61			246	11	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	194	181	281	268	165	67
Average Queue (ft)	130	92	222	183	97	37
95th Queue (ft)	185	211	274	260	191	66
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					2	
Queuing Penalty (veh)					1	

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (ft)	68	41
Average Queue (ft)	27	33
95th Queue (ft)	64	45
Link Distance (ft)	1628	2167
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Queuing and Blocking Report

am

11/15/2017

### Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NW	NE	SW	SW
Directions Served	LT	R	LT	R	L	T	T
Maximum Queue (ft)	34	10	44	25	23	54	86
Average Queue (ft)	13	4	26	10	5	41	44
95th Queue (ft)	32	10	50	29	20	61	85
Link Distance (ft)	865	865	2100	2100		1812	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)					325		155
Storage Blk Time (%)							
Queuing Penalty (veh)							

### Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	WB
Directions Served	L	LTR
Maximum Queue (ft)	20	23
Average Queue (ft)	8	9
95th Queue (ft)	24	27
Link Distance (ft)		3446
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	120	
Storage Blk Time (%)		
Queuing Penalty (veh)		

### Intersection: 67: McWhirt Loop & Banks Ford Parkway























Movement	EB	EB	WB	WB
Directions Served	LT	R	LT	R
Maximum Queue (ft)	26	18	72	20
Average Queue (ft)	23	4	35	4
95th Queue (ft)	25	15	75	17
Link Distance (ft)	927	927	626	626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

### Network Summary

Network wide Queuing Penalty: 958

# HCM Signalized Intersection Capacity Analysis

5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrenton Rd (Rte.1490)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	1754	16	174	1912	12	69	58	221	25	32	107
Future Volume (vph)	65	1754	16	174	1912	12	69	58	221	25	32	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Fr't	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	72	1949	18	193	2124	13	77	64	246	28	36	119
RTOR Reduction (vph)	0	0	9	0	0	6	0	0	121	0	0	110
Lane Group Flow (vph)	72	1949	9	193	2124	8	0	141	125	0	64	9
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.0	67.0	23.0	75.0	75.0		6.0	29.0		10.0	10.0
Effective Green, g (s)	9.0	61.0	67.0	23.0	75.0	75.0		6.0	29.0		10.0	10.0
Actuated g/C Ratio	0.07	0.47	0.52	0.18	0.58	0.58		0.05	0.22		0.08	0.08
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2153	815	607	2648	913		82	349		140	122
v/s Ratio Prot	c0.04	c0.42	0.00	0.06	c0.46			c0.08	0.06		c0.03	
v/s Ratio Perm			0.01			0.00			0.02			0.01
v/c Ratio	0.59	0.91	0.01	0.32	0.80	0.01		1.72	0.36		0.46	0.08
Uniform Delay, d1	58.7	31.8	15.4	46.7	21.7	11.7		62.0	42.6		57.4	55.7
Progression Factor	1.00	1.00	1.00	1.46	0.26	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	19.2	6.9	0.0	0.8	1.6	0.0		369.7	0.6		2.4	0.3
Delay (s)	77.9	38.7	15.4	69.0	7.2	11.7		431.7	43.3		59.8	56.0
Level of Service	E	D	B	E	A	B		F	D		E	E
Approach Delay (s)		39.9			12.3			184.8			57.3	
Approach LOS		D			B			F			E	

### Intersection Summary

























HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	2008	178	63	1993	91	180	56	118	71	62	36
Future Volume (vph)	23	2008	178	63	1993	91	180	56	118	71	62	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%			1%			2%		
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1716	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	25	2207	196	69	2190	100	198	62	130	78	68	40
RTOR Reduction (vph)	0	0	68	0	0	34	0	0	102	0	0	37
Lane Group Flow (vph)	25	2207	128	69	2190	66	129	131	28	78	68	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	6.0	64.7	74.7	18.0	76.7	86.0	10.0	10.0	28.0	9.3	9.3	9.3
Effective Green, g (s)	6.0	64.7	74.7	18.0	76.7	86.0	10.0	10.0	28.0	9.3	9.3	9.3
Actuated g/C Ratio	0.05	0.50	0.57	0.14	0.59	0.66	0.08	0.08	0.22	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	81	2284	994	475	2708	1132	128	132	339	125	131	112
v/s Ratio Prot	0.01	c0.48	0.01	0.02	c0.48	0.00	c0.08	0.08	0.01	c0.04	0.04	
v/s Ratio Perm			0.07			0.04			0.01			0.00
v/c Ratio	0.31	0.97	0.13	0.15	0.81	0.06	1.01	0.99	0.08	0.62	0.52	0.03
Uniform Delay, d1	60.0	31.6	12.7	49.2	20.9	7.7	60.0	60.0	40.7	58.7	58.2	56.1
Progression Factor	0.69	0.39	0.00	1.25	0.30	0.00	1.00	1.00	1.13	1.00	1.00	1.00
Incremental Delay, d2	1.3	8.7	0.0	0.3	1.2	0.0	81.6	75.7	0.1	9.3	3.4	0.1
Delay (s)	42.6	21.1	0.0	61.7	7.4	0.0	141.7	135.8	46.2	68.0	61.6	56.2
Level of Service	D	C	A	E	A	A	F	F	D	E	E	E
Approach Delay (s)	19.6			8.7			107.9			63.1		
Approach LOS	B			A			F			E		
























## Intersection Summary

HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	113	2054	30	54	1892	189	91	18	77	259	26	147
Future Volume (vph)	113	2054	30	54	1892	189	91	18	77	259	26	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	122	2209	32	58	2034	203	98	19	83	278	28	158
RTOR Reduction (vph)	0	0	16	0	0	60	0	0	78	0	0	134
Lane Group Flow (vph)	122	2209	16	58	2034	143	98	19	5	0	306	24
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	13.9	66.6	66.6	7.6	59.8	79.8	7.3	7.3	7.3		20.0	20.0
Effective Green, g (s)	13.9	66.6	66.6	7.6	59.8	79.8	7.3	7.3	7.3		20.0	20.0
Actuated g/C Ratio	0.11	0.51	0.51	0.06	0.46	0.61	0.06	0.06	0.06		0.15	0.15
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	190	2363	815	102	2090	961	193	105	89		270	240
v/s Ratio Prot	c0.07	c0.48		0.03	0.45	0.02	c0.03	0.01			c0.17	
v/s Ratio Perm			0.01			0.07			0.00			0.02
v/c Ratio	0.64	0.93	0.02	0.57	0.97	0.15	0.51	0.18	0.05		1.13	0.10
Uniform Delay, d1	55.7	29.7	15.6	59.6	34.3	10.7	59.6	58.5	58.1		55.0	47.3
Progression Factor	0.56	1.81	1.00	0.86	0.72	1.71	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.9	3.7	0.0	5.2	11.5	0.1	2.1	0.8	0.2		95.6	0.2
Delay (s)	34.0	57.3	15.6	56.6	36.1	18.3	61.7	59.3	58.3		150.6	47.5
Level of Service	C	E	B	E	D	B	E	E	E		F	D
Approach Delay (s)		55.5			35.1			60.1			115.5	
Approach LOS		E			D			E			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		52.1										
HCM 2000 Volume to Capacity ratio		0.95										
Actuated Cycle Length (s)		130.0							29.0			
Intersection Capacity Utilization		84.2%							E			
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/15/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2284	56	59	2304	0	19	0	85	3	0	1
Future Volume (vph)	0	2284	56	59	2304	0	19	0	85	3	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.96	
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599		1735	
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.96	
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599		1735	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2538	62	66	2560	0	21	0	94	3	0	1
RTOR Reduction (vph)	0	0	21	0	0	0	0	0	89	0	4	0
Lane Group Flow (vph)	0	2538	41	66	2560	0	10	11	5	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Effective Green, g (s)		85.1	85.1	8.0	100.1		7.0	7.0	7.0		1.4	
Actuated g/C Ratio		0.65	0.65	0.06	0.77		0.05	0.05	0.05		0.01	
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		2989	1031	210	3516		91	91	86		18	
v/s Ratio Prot		c0.56		0.02	c0.56		0.01	c0.01			c0.00	
v/s Ratio Perm			0.03						0.00			
v/c Ratio		0.85	0.04	0.31	0.73		0.11	0.12	0.06		0.00	
Uniform Delay, d1		17.5	8.0	58.4	7.8		58.5	58.6	58.4		63.6	
Progression Factor		0.25	1.00	1.08	3.16		1.04	1.02	1.00		1.00	
Incremental Delay, d2		1.3	0.0	0.0	0.1		0.2	0.2	0.1		0.0	
Delay (s)		5.7	8.0	63.0	24.8		61.0	60.0	58.5		63.6	
Level of Service		A	A	E	C		E	E	E		E	
Approach Delay (s)		5.8			25.8		58.8				63.6	
Approach LOS		A			C		E				E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		16.8				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.79										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		73.7%				ICU Level of Service		D				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	262	1945	45	92	2113	121	29	110	253	119	36	191
Future Volume (vph)	262	1945	45	92	2113	121	29	110	253	119	36	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1698	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1698	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	288	2137	49	101	2322	133	32	121	278	131	40	210
RTOR Reduction (vph)	0	0	24	0	0	71	0	0	197	0	0	194
Lane Group Flow (vph)	288	2137	25	101	2322	62	0	153	81	85	86	16
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	65.5	65.5	12.5	60.5	60.5		12.8	12.8	10.2	10.2	10.2
Effective Green, g (s)	18.0	65.5	65.5	12.5	60.5	60.5		12.8	12.8	10.2	10.2	10.2
Actuated g/C Ratio	0.14	0.50	0.50	0.10	0.47	0.47		0.10	0.10	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2324	801	326	2114	729		178	153	129	133	122
v/s Ratio Prot	c0.16	0.46		0.03	c0.51			c0.08		c0.05	0.05	
v/s Ratio Perm			0.02			0.04			0.05			0.01
v/c Ratio	1.17	0.92	0.03	0.31	1.10	0.08		0.86	0.53	0.66	0.65	0.14
Uniform Delay, d1	56.0	29.8	16.3	54.7	34.8	19.3		57.7	55.8	58.2	58.2	55.8
Progression Factor	1.26	0.40	1.00	0.55	0.26	0.04		1.01	1.02	1.00	1.00	1.00
Incremental Delay, d2	100.6	4.8	0.0	0.4	48.4	0.1		31.4	3.5	11.5	10.3	0.5
Delay (s)	170.9	16.6	16.3	30.6	57.3	1.0		89.5	60.4	69.7	68.5	56.3
Level of Service	F	B	B	C	E	A		F	E	E	E	E
Approach Delay (s)		34.6			53.4			70.7			62.0	
Approach LOS		C			D			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		47.3					HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio		1.04										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		87.3%					ICU Level of Service		E			
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	1977	76	62	2032	299	80	45	178	308	27	173
Future Volume (vph)	191	1977	76	62	2032	299	80	45	178	308	27	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%			1%			-1%			2%		
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1753	1591	1664	1681	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1753	1591	1664	1681	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	203	2103	81	66	2162	318	85	48	189	328	29	184
RTOR Reduction (vph)	0	0	31	0	0	108	0	0	174	0	0	166
Lane Group Flow (vph)	203	2103	50	66	2162	210	65	68	15	177	180	18
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	16.4	69.7	79.7	9.3	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Effective Green, g (s)	16.4	69.7	79.7	9.3	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Actuated g/C Ratio	0.13	0.54	0.61	0.07	0.48	0.58	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	2460	970	125	2199	915	130	134	122	166	168	156
v/s Ratio Prot	0.06	c0.46	0.00	0.04	c0.47	0.02	0.04	c0.04		0.11	c0.11	
v/s Ratio Perm			0.03			0.11			0.01			0.01
v/c Ratio	0.47	0.85	0.05	0.53	0.98	0.23	0.50	0.51	0.12	1.07	1.07	0.12
Uniform Delay, d1	52.8	25.8	10.0	58.2	33.2	13.1	57.6	57.6	55.9	58.5	58.5	53.3
Progression Factor	0.70	0.37	0.14	1.06	0.49	1.51	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.8	0.0	1.3	7.7	0.0	3.0	3.0	0.4	88.6	89.7	0.3
Delay (s)	37.2	11.3	1.4	63.0	23.8	19.9	60.6	60.6	56.3	147.1	148.2	53.6
Level of Service	D	B	A	E	C	B	E	E	E	F	F	D
Approach Delay (s)	13.2			24.4			58.1			115.7		
Approach LOS	B			C			E			F		
Intersection Summary												
HCM 2000 Control Delay	30.2			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.95											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			28.0					
Intersection Capacity Utilization	81.0%			ICU Level of Service			D					
Analysis Period (min)	15											

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)




















11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	81	2387	16	84	2317	56	91	4	187	162	1	88
Future Volume (vph)	81	2387	16	84	2317	56	91	4	187	162	1	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	2595	17	91	2518	61	99	4	203	176	1	96
RTOR Reduction (vph)	0	0	8	0	0	27	0	0	188	0	0	89
Lane Group Flow (vph)	88	2595	9	91	2518	34	0	103	15	88	89	7
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	9.5	67.5	67.5	14.5	73.0	73.0		9.8	9.8	9.2	9.2	9.2
Effective Green, g (s)	9.5	67.5	67.5	14.5	73.0	73.0		9.8	9.8	9.2	9.2	9.2
Actuated g/C Ratio	0.07	0.52	0.52	0.11	0.56	0.56		0.08	0.08	0.07	0.07	0.07
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	2395	826	381	2564	884		131	206	117	117	110
v/s Ratio Prot	0.05	c0.56		0.03	c0.55			c0.06		0.05	c0.05	
v/s Ratio Perm			0.01			0.02			0.01			0.00
v/c Ratio	0.68	1.08	0.01	0.24	0.98	0.04		0.79	0.07	0.75	0.76	0.06
Uniform Delay, d1	58.8	31.2	15.1	52.7	27.9	12.8		59.1	55.9	59.3	59.3	56.4
Progression Factor	1.33	0.51	1.00	0.76	0.51	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	42.2	0.0	0.2	11.2	0.1		26.0	0.2	23.5	24.8	0.2
Delay (s)	85.9	58.3	15.1	40.3	25.4	12.8		85.0	56.0	82.8	84.1	56.6
Level of Service	F	E	B	D	C	B		F	E	F	F	E
Approach Delay (s)		58.9			25.6			65.8			74.0	
Approach LOS		E			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		45.0										
HCM 2000 Volume to Capacity ratio		1.03										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		80.5%										
Analysis Period (min)		15										
c Critical Lane Group												
HCM 2000 Level of Service						D						
Sum of lost time (s)						29.0						
ICU Level of Service						D						

# HCM Signalized Intersection Capacity Analysis























12: Victor Neilsen Dr./Mclanes Dr. & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2695	30	12	2435	36	14	0	8	54	1	15
Future Volume (vph)	0	2695	30	12	2435	36	14	0	8	54	1	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.95			0.97	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.96	
Satd. Flow (prot)		5810		1761	4567	1575		1635			1683	
Flt Permitted		1.00		0.95	1.00	1.00		0.80			0.76	
Satd. Flow (perm)		5810		1761	4567	1575		1351			1327	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2994	33	13	2706	40	16	0	9	60	1	17
RTOR Reduction (vph)	0	1	0	0	0	8	0	23	0	0	8	0
Lane Group Flow (vph)	0	3026	0	13	2706	32	0	2	0	0	70	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)		95.5		3.1	105.6	105.6		10.9			10.9	
Effective Green, g (s)		95.5		3.1	105.6	105.6		10.9			10.9	
Actuated g/C Ratio		0.73		0.02	0.81	0.81		0.08			0.08	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4268		41	3709	1279		113			111	
v/s Ratio Prot		0.52		0.01	c0.59							
v/s Ratio Perm						0.02		0.00			c0.05	
v/c Ratio		0.71		0.32	0.73	0.03		0.02			0.63	
Uniform Delay, d1		9.6		62.4	5.6	2.3		54.6			57.6	
Progression Factor		0.20		1.36	1.05	1.00		1.00			1.00	
Incremental Delay, d2		0.1		2.1	0.6	0.0		0.1			10.6	
Delay (s)		2.0		87.3	6.5	2.4		54.7			68.2	
Level of Service		A		F	A	A		D			E	
Approach Delay (s)		2.0			6.8			54.7			68.2	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		5.4										
HCM 2000 Volume to Capacity ratio		0.77										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		63.3%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	2724	23	158	2324	482	48	18	490	677	38	148
Future Volume (vph)	110	2724	23	158	2324	482	48	18	490	677	38	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1778	5810		1761	5755	1575		1788	2773	3237	1635	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	124	3061	26	178	2611	542	54	20	551	761	43	166
RTOR Reduction (vph)	0	1	0	0	0	148	0	0	118	0	0	152
Lane Group Flow (vph)	124	3086	0	178	2611	394	0	74	433	533	271	14
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	14.5	63.4		16.6	65.5	76.5		10.0	33.6	11.0	11.0	11.0
Effective Green, g (s)	14.5	63.4		16.6	65.5	76.5		10.0	33.6	11.0	11.0	11.0
Actuated g/C Ratio	0.11	0.49		0.13	0.50	0.59		0.08	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	2833		224	2899	926		137	716	273	138	134
v/s Ratio Prot	0.07	c0.53		0.10	c0.45	0.04		0.04	c0.16	0.16	c0.17	
v/s Ratio Perm						0.21						0.01
v/c Ratio	0.63	1.09		0.79	0.90	0.43		0.54	0.60	1.95	1.96	0.10
Uniform Delay, d1	55.2	33.3		55.0	29.3	14.7		57.8	42.4	59.5	59.5	55.0
Progression Factor	0.70	0.45		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.8	45.5		18.3	5.1	0.3		5.4	1.7	441.7	458.8	0.3
Delay (s)	43.2	60.5		73.4	34.4	15.0		63.1	44.0	501.2	518.3	55.3
Level of Service	D	E		E	C	B		E	D	F	F	E
Approach Delay (s)		59.8			33.3			46.3			429.7	
Approach LOS		E			C			D			F	

## Intersection Summary





















HCM 2000 Control Delay	92.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 3: Hyannis/Bolivar & Celebrate VA























10/27/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	5	3	7	7	92	3	34	14	100	49	48
Future Volume (Veh/h)	45	5	3	7	7	92	3	34	14	100	49	48
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	5	3	8	8	100	3	37	15	109	53	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	400	329	26	293	366	18	105			52		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	400	329	26	293	366	18	105			52		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	99	100	99	98	91	100			93		
cM capacity (veh/h)	452	546	1043	596	521	1055	1484			1552		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	57	116	3	18	18	15	109	26	26	52		
Volume Left	49	8	3	0	0	0	109	0	0	0		
Volume Right	3	100	0	0	0	15	0	0	0	52		
cSH	474	939	1484	1700	1700	1700	1552	1700	1700	1700		
Volume to Capacity	0.12	0.12	0.00	0.01	0.01	0.01	0.07	0.02	0.02	0.03		
Queue Length 95th (ft)	10	11	0	0	0	0	6	0	0	0		
Control Delay (s)	13.6	9.4	7.4	0.0	0.0	0.0	7.5	0.0	0.0	0.0		
Lane LOS	B	A	A				A					
Approach Delay (s)	13.6	9.4	0.4				3.8					
Approach LOS	B	A										
<b>Intersection Summary</b>												
Average Delay			6.1									
Intersection Capacity Utilization			28.5%			ICU Level of Service				A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	10	14	14	16	4	55	96	38	1	189	388
Future Volume (Veh/h)	30	10	14	14	16	4	55	96	38	1	189	388
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	30	10	14	14	16	4	55	96	38	1	189	388
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	361	435	94	322	785	48	577			134		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	361	435	94	322	785	48	577			134		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	98	99	98	95	100	94			100		
cM capacity (veh/h)	522	484	944	564	305	1011	993			1448		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	30	24	30	4	55	48	48	38	1	94	94	388
Volume Left	30	0	14	0	55	0	0	0	1	0	0	0
Volume Right	0	14	0	4	0	0	0	38	0	0	0	388
cSH	522	676	388	1011	993	1700	1700	1700	1448	1700	1700	1700
Volume to Capacity	0.06	0.04	0.08	0.00	0.06	0.03	0.03	0.02	0.00	0.06	0.06	0.23
Queue Length 95th (ft)	5	3	6	0	4	0	0	0	0	0	0	0
Control Delay (s)	12.3	10.5	15.0	8.6	8.8	0.0	0.0	0.0	7.5	0.0	0.0	0.0
Lane LOS	B	B	C	A	A				A			
Approach Delay (s)	11.5		14.3		2.6				0.0			
Approach LOS	B		B									
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			40.7%		ICU Level of Service				A			
Analysis Period (min)			15									


# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	1	3	0	5	5	4	7	4	8	12	26
Future Volume (Veh/h)	19	1	3	0	5	5	4	7	4	8	12	26
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	19	1	3	0	5	5	4	7	4	8	12	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	50	47	12	48	71	9	38			11		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	50	47	12	48	71	9	38			11		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	100	100	99	100	100			100		
cM capacity (veh/h)	935	838	1069	943	813	1073	1572			1608		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	19	4	10	4	11	8	12	26				
Volume Left	19	0	0	4	0	8	0	0				
Volume Right	0	3	5	0	4	0	0	26				
cSH	935	1000	925	1572	1700	1608	1700	1700				
Volume to Capacity	0.02	0.00	0.01	0.00	0.01	0.00	0.01	0.02				
Queue Length 95th (ft)	2	0	1	0	0	0	0	0				
Control Delay (s)	8.9	8.6	8.9	7.3	0.0	7.2	0.0	0.0				
Lane LOS	A	A	A	A		A						
Approach Delay (s)	8.9		8.9	1.9		1.3						
Approach LOS	A		A									
Intersection Summary												
Average Delay	4.0											
Intersection Capacity Utilization	21.0%			ICU Level of Service					A			
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway

10/25/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗		↖	↗	↖	↕	↗	↖	↕	↗
Traffic Volume (veh/h)	29	19	7	37	11	23	7	74	196	23	15	70
Future Volume (Veh/h)	29	19	7	37	11	23	7	74	196	23	15	70
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	29	19	7	37	11	23	7	74	196	23	15	70
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	140	345	8	158	219	37	85			270		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	140	345	8	158	219	37	85			270		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	97	99	95	98	98	100			98		
cM capacity (veh/h)	774	564	1072	754	663	1027	1509			1290		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	48	7	48	23	7	37	37	196	23	8	8	70
Volume Left	29	0	37	0	7	0	0	0	23	0	0	0
Volume Right	0	7	0	23	0	0	0	196	0	0	0	70
cSH	674	1072	731	1027	1509	1700	1700	1700	1290	1700	1700	1700
Volume to Capacity	0.07	0.01	0.07	0.02	0.00	0.02	0.02	0.12	0.02	0.00	0.00	0.04
Queue Length 95th (ft)	6	0	5	2	0	0	0	0	1	0	0	0
Control Delay (s)	10.7	8.4	10.3	8.6	7.4	0.0	0.0	0.0	7.8	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	10.4		9.7		0.2				1.7			
Approach LOS	B		A									
<b>Intersection Summary</b>												
Average Delay			2.9									
Intersection Capacity Utilization			28.8%			ICU Level of Service				A		
Analysis Period (min)			15									

# Queuing and Blocking Report

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## Intersection: 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	LT	R	L	R
Maximum Queue (ft)	70	26	20	16	42	5
Average Queue (ft)	29	5	4	3	17	1
95th Queue (ft)	66	22	17	13	43	4
Link Distance (ft)	1010		815	815	2137	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	185				50	
Storage Blk Time (%)					2	
Queuing Penalty (veh)					1	

## Intersection: 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	
Directions Served	L	T	T	T	R	L	L	T	T	T	LT	R	
Maximum Queue (ft)	103	340	337	439	24	64	80	31	54	52	463	175	
Average Queue (ft)	41	237	215	279	8	24	66	10	30	23	299	116	
95th Queue (ft)	94	348	351	492	24	64	94	29	65	60	487	186	
Link Distance (ft)	2762		2762	2762					728	728	728	748	748
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	400					410	690	690					
Storage Blk Time (%)					4								
Queuing Penalty (veh)					1								

## Intersection: 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrent

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	86	82
Average Queue (ft)	43	28
95th Queue (ft)	92	73
Link Distance (ft)	453	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	65	
Storage Blk Time (%)	27	6
Queuing Penalty (veh)	29	3

Queuing and Blocking Report  
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Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	B26	B26	B26	WB	WB	WB	WB
Directions Served	L	T	T	T	R	T	T	T	L	T	T	T
Maximum Queue (ft)	48	366	386	369	225	139	226	258	39	16	36	55
Average Queue (ft)	19	290	310	304	53	36	67	58	15	3	26	38
95th Queue (ft)	49	405	453	419	196	125	206	224	39	13	45	61
Link Distance (ft)		282	282	282		728	728	728		489	489	489
Upstream Blk Time (%)		17	15	15								
Queuing Penalty (veh)		116	101	102								
Storage Bay Dist (ft)	185				200				400			
Storage Blk Time (%)		24		30								
Queuing Penalty (veh)		6		53								

Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	NB	NB	NB	SB	SB
Directions Served	L	LT	R	L	T
Maximum Queue (ft)	329	444	185	70	136
Average Queue (ft)	187	270	131	41	75
95th Queue (ft)	363	527	240	86	137
Link Distance (ft)	2137	2137		552	552
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			160		
Storage Blk Time (%)		50	0		
Queuing Penalty (veh)		59	1		

Queuing and Blocking Report  
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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	B63	B63	B63	WB	WB	WB	WB	WB
Directions Served	L	T	T	T	T	T	T	L	T	T	T	R
Maximum Queue (ft)	82	672	673	674	53	26	30	224	263	303	270	200
Average Queue (ft)	60	574	596	615	11	10	6	110	224	234	230	159
95th Queue (ft)	112	722	740	695	45	30	26	264	281	304	286	290
Link Distance (ft)		601	601	601	489	489	489		497	497	497	
Upstream Blk Time (%)		6	8	10								
Queuing Penalty (veh)		32	44	52								
Storage Bay Dist (ft)	160							200				175
Storage Blk Time (%)		27							7		12	0
Queuing Penalty (veh)		30							4		23	1

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	NB	NB	NB	SB	SB	B41
Directions Served	L	L	T	LT	R	T
Maximum Queue (ft)	78	91	30	397	205	276
Average Queue (ft)	23	58	9	385	203	74
95th Queue (ft)	71	96	29	408	209	247
Link Distance (ft)		1812	1812	325		344
Upstream Blk Time (%)				44		
Queuing Penalty (veh)				0		
Storage Bay Dist (ft)	775				180	
Storage Blk Time (%)				68	0	
Queuing Penalty (veh)				100	0	

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	L	L	T	T	T	L	LT	R	LTR
Maximum Queue (ft)	199	172	129	111	92	270	389	366	17	14	55	25
Average Queue (ft)	79	78	59	77	57	112	185	172	4	5	11	7
95th Queue (ft)	227	198	146	125	97	298	468	435	15	15	48	23
Link Distance (ft)	571	571	571			734	734	734	602	602		110
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)				400	400						460	
Storage Blk Time (%)								8				
Queuing Penalty (veh)								0				

Queuing and Blocking Report  
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Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	LT
Maximum Queue (ft)	272	176	225	218	22	46	44	159	172	143	19	247
Average Queue (ft)	241	105	164	151	8	27	35	110	95	87	4	150
95th Queue (ft)	285	192	254	268	25	45	52	189	215	182	16	275
Link Distance (ft)		585	585	585				490	490	490		799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				350	290	290				400	
Storage Blk Time (%)												27
Queuing Penalty (veh)												67

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	95	117	131	160
Average Queue (ft)	89	61	102	84
95th Queue (ft)	104	112	130	165
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)	38	0	2	5
Queuing Penalty (veh)	53	1	5	7

# Queuing and Blocking Report

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## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	97	97	135	185	220	26	132	195	239	269	73	69
Average Queue (ft)	59	77	74	87	112	10	82	130	171	210	39	46
95th Queue (ft)	118	103	126	176	214	31	145	210	254	296	67	79
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	142	115	178	172	154
Average Queue (ft)	59	65	129	117	54
95th Queue (ft)	151	131	180	174	138
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90		130	
Storage Blk Time (%)	2	8		5	0
Queuing Penalty (veh)	3	7		8	0

# Queuing and Blocking Report

am

11/15/2017

## Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	R
Maximum Queue (ft)	54	132	118	105	32	71	164	189	228	149	149	136
Average Queue (ft)	37	73	65	64	9	29	115	161	182	95	115	63
95th Queue (ft)	58	160	131	130	29	67	163	212	262	162	152	156
Link Distance (ft)		2403	2403	2403			951	951	951	669	669	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300						220
Storage Blk Time (%)												
Queuing Penalty (veh)												

## Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	179	175	51
Average Queue (ft)	129	106	44
95th Queue (ft)	217	239	58
Link Distance (ft)	607		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	150
Storage Blk Time (%)	13	1	
Queuing Penalty (veh)	23	0	

## Intersection: 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	T	T	T	LTR	LTR
Maximum Queue (ft)	66	46	66	66	41	27	47	31	52
Average Queue (ft)	13	14	35	29	8	5	15	25	33
95th Queue (ft)	56	44	65	68	35	23	47	37	53
Link Distance (ft)	951	951	951	951	849	849	849	486	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	83	213	216	290	337	174	383	356	297	218	173	94
Average Queue (ft)	59	154	140	160	167	146	344	313	262	171	74	74
95th Queue (ft)	84	247	225	297	353	203	394	367	309	234	159	106
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)						11	29			2	0	
Queuing Penalty (veh)						66	46			10	0	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	295	220	622	508	456	155
Average Queue (ft)	242	187	495	451	345	124
95th Queue (ft)	294	232	630	565	514	226
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)			2			
Queuing Penalty (veh)			0			
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					81	0
Queuing Penalty (veh)					120	1

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW	SW
Directions Served	LTR	LTR	L
Maximum Queue (ft)	22	52	16
Average Queue (ft)	12	32	3
95th Queue (ft)	28	49	14
Link Distance (ft)	1628	2167	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			165
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NW	NE	SW	SW	SW
Directions Served	LT	R	LT	R	L	L	T	T
Maximum Queue (ft)	36	10	72	24	28	37	80	76
Average Queue (ft)	22	8	37	9	13	7	38	35
95th Queue (ft)	41	12	77	28	33	32	84	79
Link Distance (ft)	865	865	2100	2100			1812	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)					325	390		155
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	EB	WB
Directions Served	L	TR	LTR
Maximum Queue (ft)	26	17	24
Average Queue (ft)	17	3	5
95th Queue (ft)	32	14	20
Link Distance (ft)		2563	3446
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	120		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 67: McWhirt Loop & Banks Ford Parkway


Movement	EB	WB	WB	NB	SB
Directions Served	LT	LT	R	R	L
Maximum Queue (ft)	45	47	22	16	19
Average Queue (ft)	29	25	8	3	4
95th Queue (ft)	56	50	25	14	17
Link Distance (ft)	927	626	626	2100	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1174

# HCM Signalized Intersection Capacity Analysis


## 5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte. 1490)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↑	↱		↑	↱
Traffic Volume (vph)	111	1790	82	673	1298	10	18	40	349	11	56	49
Future Volume (vph)	111	1790	82	673	1298	10	18	40	349	11	56	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.99	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1816	1567		1857	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	123	1989	91	748	1442	11	20	44	388	12	62	54
RTOR Reduction (vph)	0	0	44	0	0	5	0	0	146	0	0	50
Lane Group Flow (vph)	123	1989	47	748	1442	6	0	64	242	0	74	4
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.8	67.8	23.0	75.8	75.8		6.0	29.0		9.2	9.2
Effective Green, g (s)	9.0	61.8	67.8	23.0	75.8	75.8		6.0	29.0		9.2	9.2
Actuated g/C Ratio	0.07	0.48	0.52	0.18	0.58	0.58		0.05	0.22		0.07	0.07
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2182	825	607	2676	923		83	349		131	112
v/s Ratio Prot	0.07	c0.43	0.00	c0.22	0.31			c0.04	0.12		c0.04	
v/s Ratio Perm			0.03			0.00			0.03			0.00
v/c Ratio	1.01	0.91	0.06	1.23	0.54	0.01		0.77	0.69		0.56	0.03
Uniform Delay, d1	60.5	31.6	15.3	53.5	16.5	11.3		61.3	46.4		58.5	56.3
Progression Factor	1.00	1.00	1.00	1.49	0.17	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	83.7	7.2	0.0	115.3	0.6	0.0		34.8	5.9		5.5	0.1
Delay (s)	144.2	38.8	15.4	195.1	3.4	11.4		96.2	52.3		63.9	56.4
Level of Service	F	D	B	F	A	B		F	D		E	E
Approach Delay (s)		43.7			68.6			58.5			60.8	
Approach LOS		D			E			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		56.5										
HCM 2000 Volume to Capacity ratio		0.94										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		83.2%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis
























6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	15	1957	103	406	1854	82	86	22	41	71	62	36
Future Volume (vph)	15	1957	103	406	1854	82	86	22	41	71	62	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1709	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1709	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	2151	113	446	2037	90	95	24	45	78	68	40
RTOR Reduction (vph)	0	0	40	0	0	28	0	0	36	0	0	37
Lane Group Flow (vph)	16	2151	73	446	2037	62	59	60	9	78	68	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	4.0	66.5	74.7	18.0	80.5	89.8	8.2	8.2	26.2	9.3	9.3	9.3
Effective Green, g (s)	4.0	66.5	74.7	18.0	80.5	89.8	8.2	8.2	26.2	9.3	9.3	9.3
Actuated g/C Ratio	0.03	0.51	0.57	0.14	0.62	0.69	0.06	0.06	0.20	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	2347	994	475	2842	1178	105	107	317	125	131	112
v/s Ratio Prot	0.01	c0.47	0.00	c0.13	0.44	0.00	c0.04	0.04	0.00	c0.04	0.04	
v/s Ratio Perm			0.04			0.04			0.00			0.00
v/c Ratio	0.30	0.92	0.07	0.94	0.72	0.05	0.56	0.56	0.03	0.62	0.52	0.03
Uniform Delay, d1	61.6	29.2	12.3	55.5	16.9	6.5	59.2	59.2	41.7	58.7	58.2	56.1
Progression Factor	0.71	0.42	0.00	1.14	0.26	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	3.8	0.0	10.3	0.4	0.0	6.7	6.6	0.0	9.3	3.4	0.1
Delay (s)	45.0	15.9	0.0	73.3	4.8	0.0	66.0	65.9	41.7	68.0	61.6	56.2
Level of Service	D	B	A	E	A	A	E	E	D	E	E	E
Approach Delay (s)		15.3			16.5			59.3			63.1	
Approach LOS		B			B			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		19.0			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.86										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			28.0				
Intersection Capacity Utilization		77.5%			ICU Level of Service			D				
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis






























7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/21/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	1929	18	42	2236	283	56	23	96	132	16	51
Future Volume (vph)	91	1929	18	42	2236	283	56	23	96	132	16	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1756	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1756	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	98	2074	19	45	2404	304	60	25	103	142	17	55
RTOR Reduction (vph)	0	0	9	0	0	68	0	0	98	0	0	48
Lane Group Flow (vph)	98	2074	10	45	2404	236	60	25	5	0	159	7
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	12.6	71.3	71.3	7.2	65.4	81.8	6.6	6.6	6.6		16.4	16.4
Effective Green, g (s)	12.6	71.3	71.3	7.2	65.4	81.8	6.6	6.6	6.6		16.4	16.4
Actuated g/C Ratio	0.10	0.55	0.55	0.06	0.50	0.63	0.05	0.05	0.05		0.13	0.13
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	2530	872	97	2285	986	175	95	80		221	196
v/s Ratio Prot	c0.06	c0.45		0.03	c0.53	0.03	c0.02	0.01			c0.09	
v/s Ratio Perm			0.01			0.12			0.00			0.00
v/c Ratio	0.57	0.82	0.01	0.46	1.05	0.24	0.34	0.26	0.07		0.72	0.04
Uniform Delay, d1	56.1	24.1	13.3	59.5	32.3	10.5	59.6	59.4	58.8		54.6	49.9
Progression Factor	0.61	1.94	1.00	0.88	0.85	1.33	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.9	1.4	0.0	1.6	29.3	0.1	1.2	1.5	0.3		10.7	0.1
Delay (s)	36.3	48.2	13.4	53.7	56.9	14.1	60.8	60.8	59.1		65.3	49.9
Level of Service	D	D	B	D	E	B	E	E	E		E	D
Approach Delay (s)		47.4			52.1			59.9			61.3	
Approach LOS		D			D			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			50.8									HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			130.0									Sum of lost time (s) 29.0
Intersection Capacity Utilization			81.4%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/21/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  			 			 	
Traffic Volume (vph)	0	2068	34	92	3018	0	14	0	100	0	0	0
Future Volume (vph)	0	2068	34	92	3018	0	14	0	100	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00			
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599			
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00			
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2298	38	102	3353	0	16	0	111	0	0	0
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	105	0	0	0
Lane Group Flow (vph)	0	2298	27	102	3353	0	8	8	6	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm			
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases			2			6			4			
Actuated Green, G (s)		91.5	91.5	10.0	108.5		7.0	7.0	7.0			
Effective Green, g (s)		91.5	91.5	10.0	108.5		7.0	7.0	7.0			
Actuated g/C Ratio		0.70	0.70	0.08	0.83		0.05	0.05	0.05			
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0			
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0			
Lane Grp Cap (vph)		3214	1108	262	3811		91	91	86			
v/s Ratio Prot		0.50		0.03	0.73		0.00	0.00				
v/s Ratio Perm			0.02						0.00			
v/c Ratio		0.71	0.02	0.39	0.88		0.09	0.09	0.07			
Uniform Delay, d1		11.5	5.8	57.1	6.7		58.5	58.5	58.4			
Progression Factor		0.33	1.00	1.06	3.92		1.00	1.00	1.00			
Incremental Delay, d2		0.9	0.0	0.0	0.3		0.2	0.2	0.1			
Delay (s)		4.6	5.8	60.6	26.6		58.6	58.6	58.5			
Level of Service		A	A	E	C		E	E	E			
Approach Delay (s)		4.6			27.6			58.5			0.0	
Approach LOS		A			C			E			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		19.2				HCM 2000 Level of Service		B				
HCM 2000 Volume to Capacity ratio		0.95										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		76.2%				ICU Level of Service		D				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

11/21/2017

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	214	1965	14	141	2738	125	27	36	121	162	47	152
Future Volume (vph)	214	1965	14	141	2738	125	27	36	121	162	47	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1796	1560	1656	1696	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	235	2159	15	155	3009	137	30	40	133	178	52	167
RTOR Reduction (vph)	0	0	7	0	0	72	0	0	122	0	0	152
Lane Group Flow (vph)	235	2159	8	155	3009	65	0	70	11	114	116	15
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	66.6	66.6	12.5	61.6	61.6		10.3	10.3	11.6	11.6	11.6
Effective Green, g (s)	18.0	66.6	66.6	12.5	61.6	61.6		10.3	10.3	11.6	11.6	11.6
Actuated g/C Ratio	0.14	0.51	0.51	0.10	0.47	0.47		0.08	0.08	0.09	0.09	0.09
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2363	815	326	2153	742		142	123	147	151	139
v/s Ratio Prot	0.13	c0.47		0.05	c0.66			c0.04		c0.07	0.07	
v/s Ratio Perm			0.00			0.04			0.01			0.01
v/c Ratio	0.96	0.91	0.01	0.48	1.40	0.09		0.49	0.09	0.78	0.77	0.11
Uniform Delay, d1	55.6	29.1	15.5	55.6	34.2	18.8		57.3	55.5	57.9	57.9	54.4
Progression Factor	1.27	0.30	1.00	0.52	0.22	0.05		1.08	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.1	5.0	0.0	0.1	179.2	0.0		2.7	0.3	22.1	20.6	0.3
Delay (s)	106.8	13.6	15.5	28.9	186.7	1.0		64.4	55.8	80.1	78.5	54.8
Level of Service	F	B	B	C	F	A		E	E	F	E	D
Approach Delay (s)		22.7			171.6			58.7			69.0	
Approach LOS		C			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		104.7			HCM 2000 Level of Service			F				
HCM 2000 Volume to Capacity ratio		1.19										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)			29.0				
Intersection Capacity Utilization		95.1%			ICU Level of Service			F				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
























10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	2121	43	135	2932	194	49	18	86	236	25	110
Future Volume (vph)	97	2121	43	135	2932	194	49	18	86	236	25	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1737	1591	1664	1684	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1737	1591	1664	1684	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	103	2256	46	144	3119	206	52	19	91	251	27	117
RTOR Reduction (vph)	0	0	19	0	0	65	0	0	84	0	0	106
Lane Group Flow (vph)	103	2256	27	144	3119	141	35	36	7	138	140	11
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	15.0	65.4	75.4	13.9	64.3	77.0	10.0	10.0	10.0	12.7	12.7	12.7
Effective Green, g (s)	15.0	65.4	75.4	13.9	64.3	77.0	10.0	10.0	10.0	12.7	12.7	12.7
Actuated g/C Ratio	0.12	0.50	0.58	0.11	0.49	0.59	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	396	2309	918	188	2258	932	130	133	122	162	164	153
v/s Ratio Prot	0.03	c0.49	0.00	0.08	c0.68	0.01	0.02	c0.02		0.08	c0.08	
v/s Ratio Perm			0.01			0.07			0.00			0.01
v/c Ratio	0.26	0.98	0.03	0.77	1.38	0.15	0.27	0.27	0.06	0.85	0.85	0.07
Uniform Delay, d1	52.4	31.6	11.7	56.5	32.9	11.9	56.6	56.6	55.6	57.7	57.7	53.3
Progression Factor	0.66	0.48	1.00	0.98	0.72	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	8.5	0.0	1.7	171.8	0.0	1.1	1.1	0.2	32.6	32.6	0.2
Delay (s)	34.6	23.6	11.7	57.1	195.5	15.8	57.7	57.7	55.8	90.3	90.3	53.5
Level of Service	C	C	B	E	F	B	E	E	E	F	F	D
Approach Delay (s)		23.9			179.1			56.6			79.4	
Approach LOS		C			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		111.8										
HCM 2000 Volume to Capacity ratio		1.17										
Actuated Cycle Length (s)		130.0							28.0			
Intersection Capacity Utilization		96.3%										
Analysis Period (min)		15										
c Critical Lane Group												





















# HCM Signalized Intersection Capacity Analysis 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	2142	7	25	3173	117	1	0	12	63	1	40
Future Volume (vph)	38	2142	7	25	3173	117	1	0	12	63	1	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1662	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1743	2745	1656	1662	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	2328	8	27	3449	127	1	0	13	68	1	43
RTOR Reduction (vph)	0	0	3	0	0	44	0	0	13	0	0	41
Lane Group Flow (vph)	41	2328	5	27	3449	83	0	1	0	35	34	2
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	7.1	83.0	83.0	8.7	85.1	85.1		3.2	3.2	6.1	6.1	6.1
Effective Green, g (s)	7.1	83.0	83.0	8.7	85.1	85.1		3.2	3.2	6.1	6.1	6.1
Actuated g/C Ratio	0.05	0.64	0.64	0.07	0.65	0.65		0.02	0.02	0.05	0.05	0.05
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	97	2945	1015	228	2989	1031		42	67	77	77	73
v/s Ratio Prot	0.02	c0.50		0.01	c0.76			c0.00		c0.02	0.02	
v/s Ratio Perm			0.00			0.05			0.00			0.00
v/c Ratio	0.42	0.79	0.01	0.12	1.15	0.08		0.02	0.00	0.45	0.44	0.03
Uniform Delay, d1	59.5	17.2	8.5	57.0	22.5	8.2		61.9	61.8	60.3	60.3	59.1
Progression Factor	1.38	0.32	1.00	0.90	0.73	0.71		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.8	0.0	0.1	70.7	0.0		0.2	0.0	4.2	4.0	0.2
Delay (s)	83.1	6.3	8.5	51.4	87.0	5.9		62.1	61.9	64.5	64.3	59.3
Level of Service	F	A	A	D	F	A		E	E	E	E	E
Approach Delay (s)		7.6			83.9			61.9			62.4	
Approach LOS		A			F			E			E	
Intersection Summary												
HCM 2000 Control Delay			53.8	HCM 2000 Level of Service			D					
HCM 2000 Volume to Capacity ratio			1.09									
Actuated Cycle Length (s)			130.0	Sum of lost time (s)			29.0					
Intersection Capacity Utilization			90.1%	ICU Level of Service			E					
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2207	48	40	3414	63	21	5	11	5	5	38
Future Volume (vph)	0	2207	48	40	3414	63	21	5	11	5	5	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.96			0.90	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.99	
Sald. Flow (prot)		5807		1761	4567	1575		1657			1603	
Flt Permitted		1.00		0.95	1.00	1.00		0.87			0.95	
Sald. Flow (perm)		5807		1761	4567	1575		1480			1537	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2452	53	44	3793	70	23	6	12	6	6	42
RTOR Reduction (vph)	0	1	0	0	0	11	0	11	0	0	40	0
Lane Group Flow (vph)	0	2504	0	44	3793	59	0	30	0	0	14	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3				3
Permitted Phases						2	3			3		
Actuated Green, G (s)		94.5		7.6	109.1	109.1		7.4			7.4	
Effective Green, g (s)		94.5		7.6	109.1	109.1		7.4			7.4	
Actuated g/C Ratio		0.73		0.06	0.84	0.84		0.06			0.06	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4221		102	3832	1321		84			87	
v/s Ratio Prot		0.43		0.02	c0.83							
v/s Ratio Perm						0.04		c0.02			0.01	
v/c Ratio		0.59		0.43	0.99	0.04		0.35			0.17	
Uniform Delay, d1		8.5		59.1	9.9	1.7		59.0			58.4	
Progression Factor		0.14		1.32	2.32	0.00		1.00			1.00	
Incremental Delay, d2		0.5		0.3	2.6	0.0		2.6			0.9	
Delay (s)		1.6		78.5	25.6	0.0		61.6			59.3	
Level of Service		A		E	C	A		E			E	
Approach Delay (s)		1.6			25.8			61.6			59.3	
Approach LOS		A			C			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		17.0										
HCM 2000 Volume to Capacity ratio		1.01										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		84.6%										
Analysis Period (min)		15										
<b>Intersection Summary</b>												
HCM 2000 Control Delay		17.0										
HCM 2000 Volume to Capacity ratio		1.01										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		84.6%										
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)






















11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	2176	45	188	3370	516	54	14	150	409	67	60
Future Volume (vph)	66	2176	45	188	3370	516	54	14	150	409	67	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	5807		1761	5755	1575		1783	2773	3237	1655	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	5807		1761	5755	1575		1783	2773	3237	1655	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	74	2445	51	211	3787	580	61	16	169	460	75	67
RTOR Reduction (vph)	0	2	0	0	0	102	0	0	117	0	0	61
Lane Group Flow (vph)	74	2494	0	211	3787	478	0	77	52	354	181	6
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	11.6	63.0		17.4	68.8	79.8		9.6	34.0	11.0	11.0	11.0
Effective Green, g (s)	11.6	63.0		17.4	68.8	79.8		9.6	34.0	11.0	11.0	11.0
Actuated g/C Ratio	0.09	0.48		0.13	0.53	0.61		0.07	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	2814		235	3045	966		131	725	273	140	134
v/s Ratio Prot	0.04	c0.43		0.12	c0.66	0.04		c0.04	0.02	0.11	c0.11	
v/s Ratio Perm						0.26						0.00
v/c Ratio	0.47	0.89		0.90	1.24	0.49		0.59	0.07	1.30	1.29	0.04
Uniform Delay, d1	56.3	30.3		55.4	30.6	13.9		58.3	36.1	59.5	59.5	54.7
Progression Factor	0.65	0.40		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	3.9		33.1	112.6	0.4		7.7	0.1	157.9	174.6	0.1
Delay (s)	38.5	16.1		88.5	143.2	14.3		66.0	36.2	217.4	234.1	54.8
Level of Service	D	B		F	F	B		E	D	F	F	D
Approach Delay (s)		16.8			124.3			45.5			204.3	
Approach LOS		B			F			D			F	
Intersection Summary												
HCM 2000 Control Delay	93.4			HCM 2000 Level of Service			F					
HCM 2000 Volume to Capacity ratio	1.17											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			29.0					
Intersection Capacity Utilization	86.7%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

11/14/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	88	1	32	14	4	7	18	142	36	0	48	32
Future Volume (Veh/h)	88	1	32	14	4	7	18	142	36	0	48	32
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	88	1	32	14	4	7	18	142	36	0	48	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	164	262	24	234	258	71	80			178		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	164	262	24	234	258	71	80			178		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	100	97	98	99	99	99			100		
cM capacity (veh/h)	769	634	1047	672	637	977	1516			1395		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	88	33	18	7	18	71	71	36	0	24	24	32
Volume Left	88	0	14	0	18	0	0	0	0	0	0	0
Volume Right	0	32	0	7	0	0	0	36	0	0	0	32
cSH	769	1027	664	977	1516	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.11	0.03	0.03	0.01	0.01	0.04	0.04	0.02	0.00	0.01	0.01	0.02
Queue Length 95th (ft)	10	2	2	1	1	0	0	0	0	0	0	0
Control Delay (s)	10.3	8.6	10.6	8.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A	B	A	A							
Approach Delay (s)	9.8		10.1		0.7				0.0			
Approach LOS	A		B									
<b>Intersection Summary</b>												
Average Delay			3.7									
Intersection Capacity Utilization			25.9%			ICU Level of Service				A		
Analysis Period (min)			15									























# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

11/14/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	0	10	0	5	5	3	189	1	7	108	18
Future Volume (Veh/h)	19	0	10	0	5	5	3	189	1	7	108	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	19	0	10	0	5	5	3	189	1	7	108	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	324	318	108	328	336	190	126			190		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	324	318	108	328	336	190	126			190		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	100	99	99	100			99		
cM capacity (veh/h)	617	594	946	616	581	852	1460			1384		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	19	10	10	3	190	7	108	18				
Volume Left	19	0	0	3	0	7	0	0				
Volume Right	0	10	5	0	1	0	0	18				
cSH	617	946	691	1460	1700	1384	1700	1700				
Volume to Capacity	0.03	0.01	0.01	0.00	0.11	0.01	0.06	0.01				
Queue Length 95th (ft)	2	1	1	0	0	0	0	0				
Control Delay (s)	11.0	8.8	10.3	7.5	0.0	7.6	0.0	0.0				
Lane LOS	B	A	B	A		A						
Approach Delay (s)	10.3		10.3	0.1		0.4						
Approach LOS	B		B									
Intersection Summary												
Average Delay			1.3									
Intersection Capacity Utilization			24.4%		ICU Level of Service					A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway













11/21/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	11	10	44	38	15	1	111	88	29	34	54
Future Volume (Veh/h)	25	11	10	44	38	15	1	111	88	29	34	54
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	25	11	10	44	38	15	1	111	88	29	34	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											718	
pX, platoon unblocked												
vC, conflicting volume	184	293	17	204	259	56	88			199		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	184	293	17	204	259	56	88			199		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	99	94	94	98	100			98		
cM capacity (veh/h)	703	603	1058	707	630	999	1506			1371		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	36	10	82	15	1	56	56	88	29	17	17	54
Volume Left	25	0	44	0	1	0	0	0	29	0	0	0
Volume Right	0	10	0	15	0	0	0	88	0	0	0	54
cSH	669	1058	669	999	1506	1700	1700	1700	1371	1700	1700	1700
Volume to Capacity	0.05	0.01	0.12	0.02	0.00	0.03	0.03	0.05	0.02	0.01	0.01	0.03
Queue Length 95th (ft)	4	1	10	1	0	0	0	0	2	0	0	0
Control Delay (s)	10.7	8.4	11.1	8.7	7.4	0.0	0.0	0.0	7.7	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	10.2		10.7		0.0				1.9			
Approach LOS	B		B									
Intersection Summary												
Average Delay			3.8									
Intersection Capacity Utilization			26.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

3:

11/16/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↗	↗	↗	↗	↗
Traffic Volume (veh/h)	37	18	4	5	4	91	0	218	5	56	121	15
Future Volume (Veh/h)	37	18	4	5	4	91	0	218	5	56	121	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	20	4	5	4	99	0	237	5	61	132	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	474	496	66	439	507	118	148			242		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	474	496	66	439	507	118	148			242		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	96	100	99	99	89	100			95		
cM capacity (veh/h)	405	452	984	466	445	911	1431			1322		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	64	108	0	118	118	5	61	66	66	16		
Volume Left	40	5	0	0	0	0	61	0	0	0		
Volume Right	4	99	0	0	0	5	0	0	0	16		
cSH	435	841	1700	1700	1700	1700	1322	1700	1700	1700		
Volume to Capacity	0.15	0.13	0.00	0.07	0.07	0.00	0.05	0.04	0.04	0.01		
Queue Length 95th (ft)	13	11	0	0	0	0	4	0	0	0		
Control Delay (s)	14.7	9.9	0.0	0.0	0.0	0.0	7.9	0.0	0.0	0.0		
Lane LOS	B	A					A					
Approach Delay (s)	14.7	9.9	0.0				2.3					
Approach LOS	B	A										
Intersection Summary												
Average Delay			4.0									
Intersection Capacity Utilization			29.3%			ICU Level of Service				A		
Analysis Period (min)			15									

Queuing and Blocking Report  
am

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Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	WB
Directions Served	L	TR	LT	R
Maximum Queue (ft)	30	64	21	14
Average Queue (ft)	24	38	11	6
95th Queue (ft)	43	64	26	17
Link Distance (ft)		1010	815	815
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrento

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	LT	R
Maximum Queue (ft)	251	323	331	338	26	471	532	10	30	23	179	239
Average Queue (ft)	194	204	239	212	10	329	357	4	10	7	146	151
95th Queue (ft)	278	363	373	401	31	591	627	12	28	21	182	282
Link Distance (ft)		2762	2762	2762				728	728	728	748	748
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				410	690	690					
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrento

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	87	40
Average Queue (ft)	53	27
95th Queue (ft)	102	53
Link Distance (ft)		453
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	65	
Storage Blk Time (%)	23	
Queuing Penalty (veh)	11	

# Queuing and Blocking Report

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## Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	B26	B26	B26	WB	WB	WB	WB
Directions Served	L	T	T	T	R	T	T	T	L	L	T	T
Maximum Queue (ft)	22	366	368	393	214	43	96	52	128	148	18	16
Average Queue (ft)	7	243	248	257	51	9	19	20	71	94	8	3
95th Queue (ft)	21	416	419	434	186	37	83	61	144	177	21	14
Link Distance (ft)		282	282	282		728	728	728			489	489
Upstream Blk Time (%)		8	11	11								
Queuing Penalty (veh)		56	78	76								
Storage Bay Dist (ft)	185				200				400	400		
Storage Blk Time (%)		11		13	0							
Queuing Penalty (veh)		2		13	0							

## Intersection: 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	WB	NB	NB	NB	SB	SB
Directions Served	T	L	LT	R	L	T
Maximum Queue (ft)	36	66	43	40	69	93
Average Queue (ft)	7	48	38	19	51	59
95th Queue (ft)	31	75	52	48	66	95
Link Distance (ft)	489	2137	2137		552	552
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)				160		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report  
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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	T	T	T	R	L	L	T
Maximum Queue (ft)	184	570	593	607	40	496	487	464	200	26	36	30
Average Queue (ft)	100	444	465	515	31	296	273	238	101	21	20	15
95th Queue (ft)	189	640	686	673	46	473	459	457	232	30	40	38
Link Distance (ft)		601	601	601		497	497	497			1812	1812
Upstream Blk Time (%)			0	1		0	0					
Queuing Penalty (veh)			2	6		5	2					
Storage Bay Dist (ft)	160				200				175	775		
Storage Blk Time (%)		23				17		8	0			
Queuing Penalty (veh)		21				7		23	0			

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	SB	SB
Directions Served	LT	R
Maximum Queue (ft)	176	88
Average Queue (ft)	139	27
95th Queue (ft)	206	79
Link Distance (ft)	325	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		180
Storage Blk Time (%)	3	
Queuing Penalty (veh)	2	

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	L	L	T	T	T	L	LT
Maximum Queue (ft)	43	109	105	58	47	248	171	331	16	12
Average Queue (ft)	12	26	28	27	9	76	52	108	6	2
95th Queue (ft)	40	96	93	57	41	241	165	335	20	10
Link Distance (ft)	571	571	571			734	734	734	602	602
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)				400	400					
Storage Blk Time (%)								3		
Queuing Penalty (veh)								0		

# Queuing and Blocking Report

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## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	B65	NB
Directions Served	L	T	T	T	L	L	T	T	T	R	T	LT
Maximum Queue (ft)	292	218	231	249	48	67	195	198	233	39	536	157
Average Queue (ft)	188	122	132	138	24	49	151	165	168	16	107	85
95th Queue (ft)	329	221	257	250	60	77	206	208	235	39	461	161
Link Distance (ft)		585	585	585			490	490	490		563	799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				290	290				400		
Storage Blk Time (%)												17
Queuing Penalty (veh)												21

## Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	95	144	423	170
Average Queue (ft)	58	87	276	115
95th Queue (ft)	120	172	437	196
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)	9	1	56	
Queuing Penalty (veh)	6	2	130	

Queuing and Blocking Report  
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Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	30	73	193	161	197	26	413	588	624	665	325	46
Average Queue (ft)	12	56	85	84	105	5	157	366	398	405	94	14
95th Queue (ft)	36	70	188	172	203	22	372	575	649	652	285	43
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)							0	5		16		
Queuing Penalty (veh)							0	6		31		

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	97	107	152	157	154
Average Queue (ft)	43	41	87	83	96
95th Queue (ft)	90	101	160	154	175
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		90			130
Storage Blk Time (%)	5	0		3	3
Queuing Penalty (veh)	4	0		4	4

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB	SB
Directions Served	L	T	T	T	L	T	T	T	R	L	LT	R
Maximum Queue (ft)	27	27	24	81	51	199	196	270	24	66	27	52
Average Queue (ft)	5	11	10	23	16	117	116	140	9	46	19	44
95th Queue (ft)	23	32	28	76	50	226	235	282	28	65	37	59
Link Distance (ft)		2403	2403	2403		951	951	951	669	607		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300					150	150	
Storage Blk Time (%)								1				
Queuing Penalty (veh)								1				

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Intersection: 12: Victor Neilsen Dr./Mclanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	L	T	T	LTR	LTR
Maximum Queue (ft)	91	65	43	44	50	29	52	153	66
Average Queue (ft)	41	32	16	29	42	10	16	61	51
95th Queue (ft)	95	76	43	57	57	32	51	149	81
Link Distance (ft)	951	951	951	951		849	849	486	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)					150				
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	66	78	159	202	218	175	1205	1200	1198	1200	185	61
Average Queue (ft)	47	45	78	94	112	157	980	950	930	867	185	47
95th Queue (ft)	67	82	161	216	233	214	1410	1401	1377	1328	185	65
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)							27	15	14	13		
Queuing Penalty (veh)							0	0	0	0		
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)						23	33			48	1	
Queuing Penalty (veh)						195	62			246	8	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	LT	R
Maximum Queue (ft)	138	356	341	270	155
Average Queue (ft)	107	268	232	138	97
95th Queue (ft)	151	364	354	275	177
Link Distance (ft)	451	611	611	611	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				130	
Storage Blk Time (%)				24	
Queuing Penalty (veh)				14	

# Queuing and Blocking Report

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## Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW	SW
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	29	17
Average Queue (ft)	17	25	3
95th Queue (ft)	31	29	15
Link Distance (ft)	1628	2167	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			165
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NW	NE	SW	SW	SW
Directions Served	LT	R	LT	R	L	L	T	T
Maximum Queue (ft)	34	30	51	24	26	11	56	55
Average Queue (ft)	16	9	27	5	15	2	45	36
95th Queue (ft)	31	27	54	21	35	10	60	59
Link Distance (ft)	865	865	2100	2100			1812	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)					325	390		155
Storage Blk Time (%)								
Queuing Penalty (veh)								

## Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	WB
Directions Served	L	LTR
Maximum Queue (ft)	21	24
Average Queue (ft)	12	9
95th Queue (ft)	29	29
Link Distance (ft)		3446
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	120	
Storage Blk Time (%)		
Queuing Penalty (veh)		

## Queuing and Blocking Report am

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### Intersection: 67: McWhirt Loop & Banks Ford Parkway























Movement	EB	WB	WB	SB
Directions Served	LT	LT	R	L
Maximum Queue (ft)	26	69	21	22
Average Queue (ft)	20	31	7	4
95th Queue (ft)	36	67	21	19
Link Distance (ft)	927	626	626	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			200	
Storage Blk Time (%)				
Queuing Penalty (veh)				

### Network Summary

Network wide Queuing Penalty: 1040

# HCM Signalized Intersection Capacity Analysis

5: Geico/Stafford Lakes Pkwy (Rte.1490)/Stafford Lakes Pkwy (Rte.1490) & Warrenton Rd (Rte.1490)

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	1786	16	174	1946	12	69	58	221	25	32	107
Future Volume (vph)	65	1786	16	174	1946	12	69	58	221	25	32	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			2%			-1%	
Total Lost time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583		1795	1567		1832	1591
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	72	1984	18	193	2162	13	77	64	246	28	36	119
RTOR Reduction (vph)	0	0	9	0	0	6	0	0	121	0	0	110
Lane Group Flow (vph)	72	1984	9	193	2162	8	0	141	125	0	64	9
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	5	2	4	1	6		4	4	1	3	3	
Permitted Phases			2			6			4			3
Actuated Green, G (s)	9.0	61.0	67.0	23.0	75.0	75.0		6.0	29.0		10.0	10.0
Effective Green, g (s)	9.0	61.0	67.0	23.0	75.0	75.0		6.0	29.0		10.0	10.0
Actuated g/C Ratio	0.07	0.47	0.52	0.18	0.58	0.58		0.05	0.22		0.08	0.08
Clearance Time (s)	8.0	8.0	7.0	8.0	8.0	8.0		7.0	8.0		7.0	7.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0		3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	122	2153	815	607	2648	913		82	349		140	122
v/s Ratio Prot	c0.04	c0.43	0.00	0.06	c0.47			c0.08	0.06		c0.03	
v/s Ratio Perm			0.01			0.00			0.02			0.01
v/c Ratio	0.59	0.92	0.01	0.32	0.82	0.01		1.72	0.36		0.46	0.08
Uniform Delay, d1	58.7	32.3	15.4	46.7	22.0	11.7		62.0	42.6		57.4	55.7
Progression Factor	1.00	1.00	1.00	1.45	0.28	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	19.2	8.0	0.0	0.8	1.7	0.0		369.7	0.6		2.4	0.3
Delay (s)	77.9	40.3	15.4	68.4	7.9	11.7		431.7	43.3		59.8	56.0
Level of Service	E	D	B	E	A	B		F	D		E	E
Approach Delay (s)		41.4			12.9			184.8			57.3	
Approach LOS		D			B			F			E	
Intersection Summary												
HCM 2000 Control Delay		39.6		HCM 2000 Level of Service					D			
HCM 2000 Volume to Capacity ratio		0.86										
Actuated Cycle Length (s)		130.0		Sum of lost time (s)					30.0			
Intersection Capacity Utilization		80.3%		ICU Level of Service					D			
Analysis Period (min)		15										

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# HCM Signalized Intersection Capacity Analysis

## 6: Banks Ford Pkwy/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

11/15/2017



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	23	2024	194	63	2010	91	197	56	118	71	62	36
Future Volume (vph)	23	2024	194	63	2010	91	197	56	118	71	62	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4590	1583	3433	4590	1583	1673	1713	1575	1752	1844	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4590	1583	3433	4590	1583	1673	1713	1575	1752	1844	1567
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	25	2224	213	69	2209	100	216	62	130	78	68	40
RTOR Reduction (vph)	0	0	74	0	0	34	0	0	102	0	0	37
Lane Group Flow (vph)	25	2224	139	69	2209	66	138	140	28	78	68	3
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	Perm
Protected Phases	1	6	3	5	2	4	3	3	5	4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	6.0	64.7	74.7	18.0	76.7	86.0	10.0	10.0	28.0	9.3	9.3	9.3
Effective Green, g (s)	6.0	64.7	74.7	18.0	76.7	86.0	10.0	10.0	28.0	9.3	9.3	9.3
Actuated g/C Ratio	0.05	0.50	0.57	0.14	0.59	0.66	0.08	0.08	0.22	0.07	0.07	0.07
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	81	2284	994	475	2708	1132	128	131	339	125	131	112
v/s Ratio Prot	0.01	c0.48	0.01	0.02	c0.48	0.00	c0.08	0.08	0.01	c0.04	0.04	
v/s Ratio Perm			0.08			0.04			0.01			0.00
v/c Ratio	0.31	0.97	0.14	0.15	0.82	0.06	1.08	1.07	0.08	0.62	0.52	0.03
Uniform Delay, d1	60.0	31.8	12.8	49.2	21.1	7.7	60.0	60.0	40.7	58.7	58.2	56.1
Progression Factor	0.70	0.40	0.00	1.25	0.29	0.00	1.00	1.00	1.11	1.00	1.00	1.00
Incremental Delay, d2	1.3	9.5	0.0	0.3	1.3	0.0	102.0	98.2	0.1	9.3	3.4	0.1
Delay (s)	43.3	22.3	0.0	61.6	7.3	0.0	162.2	158.4	45.2	68.0	61.6	56.2
Level of Service	D	C	A	E	A	A	F	F	D	E	E	E
Approach Delay (s)		20.5			8.6			123.6			63.1	
Approach LOS		C			A			F			E	


### Intersection Summary

HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		

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# HCM Signalized Intersection Capacity Analysis

7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17) 11/20/2017























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱	↰	↑	↱		↰	↱
Traffic Volume (vph)	113	2054	46	70	1892	189	108	18	144	259	26	147
Future Volume (vph)	113	2054	46	70	1892	189	108	18	144	259	26	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			-1%			3%	
Total Lost time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	1778	4613	1591	1752	4544	1567	3450	1872	1591		1755	1560
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	122	2209	49	75	2034	203	116	19	155	278	28	158
RTOR Reduction (vph)	0	0	24	0	0	60	0	0	146	0	0	134
Lane Group Flow (vph)	122	2209	25	75	2034	143	116	19	9	0	306	24
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases			2			6			3			4
Actuated Green, G (s)	13.9	66.2	66.2	7.8	59.6	79.6	7.5	7.5	7.5		20.0	20.0
Effective Green, g (s)	13.9	66.2	66.2	7.8	59.6	79.6	7.5	7.5	7.5		20.0	20.0
Actuated g/C Ratio	0.11	0.51	0.51	0.06	0.46	0.61	0.06	0.06	0.06		0.15	0.15
Clearance Time (s)	7.5	7.5	7.5	7.0	7.5	7.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	190	2349	810	105	2083	959	199	108	91		270	240
v/s Ratio Prot	c0.07	c0.48		0.04	0.45	0.02	c0.03	0.01			c0.17	
v/s Ratio Perm			0.02			0.07			0.01			0.02
v/c Ratio	0.64	0.94	0.03	0.71	0.98	0.15	0.58	0.18	0.10		1.13	0.10
Uniform Delay, d1	55.7	30.0	15.9	60.0	34.5	10.8	59.7	58.3	58.0		55.0	47.3
Progression Factor	0.56	1.80	1.00	0.86	0.71	1.59	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	3.9	0.0	14.5	11.6	0.0	4.3	0.8	0.5		95.6	0.2
Delay (s)	33.9	57.9	15.9	66.0	36.3	17.1	64.0	59.1	58.5		150.6	47.5
Level of Service	C	E	B	E	D	B	E	E	E		F	D
Approach Delay (s)		55.8			35.6			60.8			115.5	
Approach LOS		E			D			E			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		52.6										
HCM 2000 Volume to Capacity ratio		0.96										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		84.2%										
Analysis Period (min)		15										
<b>Intersection Summary</b>												
HCM 2000 Control Delay		52.6										
HCM 2000 Volume to Capacity ratio		0.96										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		84.2%										
Analysis Period (min)		15										

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# HCM Signalized Intersection Capacity Analysis

## 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

11/20/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2351	56	75	2417	0	19	0	127	3	0	1
Future Volume (vph)	0	2351	56	75	2417	0	19	0	127	3	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			1%			-2%			0%	
Total Lost time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Lane Util. Factor		0.91	1.00	0.97	0.91		0.95	0.95	1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.96	
Satd. Flow (prot)		4567	1575	3416	4567		1698	1698	1599		1735	
Flt Permitted		1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.96	
Satd. Flow (perm)		4567	1575	3416	4567		1698	1698	1599		1735	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2612	62	83	2686	0	21	0	141	3	0	1
RTOR Reduction (vph)	0	0	22	0	0	0	0	0	133	0	4	0
Lane Group Flow (vph)	0	2612	40	83	2686	0	10	11	8	0	0	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		4	4		3		
Permitted Phases			2			6			4		3	
Actuated Green, G (s)		83.1	83.1	10.0	100.1		7.0	7.0	7.0		1.4	
Effective Green, g (s)		83.1	83.1	10.0	100.1		7.0	7.0	7.0		1.4	
Actuated g/C Ratio		0.64	0.64	0.08	0.77		0.05	0.05	0.05		0.01	
Clearance Time (s)		7.5	7.5	7.0	7.5		7.0	7.0	7.0		7.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		2919	1006	262	3516		91	91	86		18	
v/s Ratio Prot		c0.57		0.02	c0.59		0.01	c0.01			c0.00	
v/s Ratio Perm			0.03						0.00			
v/c Ratio		0.89	0.04	0.32	0.76		0.11	0.12	0.09		0.00	
Uniform Delay, d1		19.8	8.7	56.8	8.4		58.5	58.6	58.5		63.6	
Progression Factor		0.29	1.00	1.07	3.25		1.03	1.03	2.60		1.00	
Incremental Delay, d2		2.0	0.0	0.0	0.1		0.2	0.2	0.2		0.0	
Delay (s)		7.7	8.7	60.8	27.3		60.3	60.4	151.9		63.6	
Level of Service		A	A	E	C		E	E	F		E	
Approach Delay (s)		7.7			28.3			140.1			63.6	
Approach LOS		A			C			F			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		21.7				HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		130.0				Sum of lost time (s)		28.5				
Intersection Capacity Utilization		77.0%				ICU Level of Service		D				
Analysis Period (min)		15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

























11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	262	2054	45	92	2242	121	29	110	278	119	36	191
Future Volume (vph)	262	2054	45	92	2242	121	29	110	278	119	36	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			2%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1698	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1778	4613	1591	3399	4544	1567		1816	1560	1656	1698	1560
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	288	2257	49	101	2464	133	32	121	305	131	40	210
RTOR Reduction (vph)	0	0	24	0	0	71	0	0	197	0	0	194
Lane Group Flow (vph)	288	2257	25	101	2464	62	0	153	108	85	86	16
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	18.0	65.5	65.5	12.5	60.5	60.5		12.8	12.8	10.2	10.2	10.2
Effective Green, g (s)	18.0	65.5	65.5	12.5	60.5	60.5		12.8	12.8	10.2	10.2	10.2
Actuated g/C Ratio	0.14	0.50	0.50	0.10	0.47	0.47		0.10	0.10	0.08	0.08	0.08
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	4.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	246	2324	801	326	2114	729		178	153	129	133	122
v/s Ratio Prot	0.16	c0.49		0.03	c0.54			c0.08		c0.05	0.05	
v/s Ratio Perm			0.02			0.04			0.07			0.01
v/c Ratio	1.17	0.97	0.03	0.31	1.17	0.08		0.86	0.71	0.66	0.65	0.14
Uniform Delay, d1	56.0	31.3	16.3	54.7	34.8	19.3		57.7	56.8	58.2	58.2	55.8
Progression Factor	1.25	0.43	1.00	0.56	0.26	0.05		1.01	1.03	1.00	1.00	1.00
Incremental Delay, d2	98.3	8.6	0.0	0.3	76.7	0.1		31.4	14.0	11.5	10.3	0.5
Delay (s)	168.4	22.1	16.3	30.7	85.7	1.1		89.8	72.6	69.7	68.5	56.3
Level of Service	F	C	B	C	F	A		F	E	E	E	E
Approach Delay (s)		38.2			79.5			78.3			62.0	
Approach LOS		D			E			E			E	
Intersection Summary												
HCM 2000 Control Delay	60.8			HCM 2000 Level of Service			E					
HCM 2000 Volume to Capacity ratio	1.09											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			29.0					
Intersection Capacity Utilization	89.8%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

11/15/2017
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	2111	76	62	2161	299	80	45	178	308	27	173
Future Volume (vph)	191	2111	76	62	2161	299	80	45	178	308	27	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			1%			-1%			2%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3433	4590	1583	1761	4567	1575	1690	1753	1591	1664	1681	1567
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3433	4590	1583	1761	4567	1575	1690	1753	1591	1664	1681	1567
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	203	2246	81	66	2299	318	85	48	189	328	29	184
RTOR Reduction (vph)	0	0	31	0	0	108	0	0	174	0	0	166
Lane Group Flow (vph)	203	2246	50	66	2299	210	65	68	15	177	180	18
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6	4	5	2	3	4	4		3	3	
Permitted Phases			6			2			4			3
Actuated Green, G (s)	16.4	69.7	79.7	9.3	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Effective Green, g (s)	16.4	69.7	79.7	9.3	62.6	75.6	10.0	10.0	10.0	13.0	13.0	13.0
Actuated g/C Ratio	0.13	0.54	0.61	0.07	0.48	0.58	0.08	0.08	0.08	0.10	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	2460	970	125	2199	915	130	134	122	166	168	156
v/s Ratio Prot	0.06	c0.49	0.00	0.04	c0.50	0.02	0.04	c0.04		0.11	c0.11	
v/s Ratio Perm			0.03			0.11			0.01			0.01
v/c Ratio	0.47	0.91	0.05	0.53	1.05	0.23	0.50	0.51	0.12	1.07	1.07	0.12
Uniform Delay, d1	52.8	27.4	10.0	58.2	33.7	13.1	57.6	57.6	55.9	58.5	58.5	53.3
Progression Factor	0.70	0.40	0.14	1.06	0.51	1.51	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	2.5	0.0	0.4	22.0	0.0	3.0	3.0	0.4	88.6	89.7	0.3
Delay (s)	37.0	13.3	1.4	62.1	39.2	19.8	60.6	60.6	56.3	147.1	148.2	53.6
Level of Service	D	B	A	E	D	B	E	E	E	F	F	D
Approach Delay (s)		14.9			37.4			58.1			115.7	
Approach LOS		B			D			E			F	
Intersection Summary												
HCM 2000 Control Delay	36.1			HCM 2000 Level of Service			D					
HCM 2000 Volume to Capacity ratio	1.00											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			28.0					
Intersection Capacity Utilization	83.5%			ICU Level of Service			E					
Analysis Period (min)	15											

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)


11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	81	2521	16	84	2446	56	91	4	187	162	1	88
Future Volume (vph)	81	2521	16	84	2446	56	91	4	187	162	1	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			3%			3%	
Total Lost time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1778	4613	1591	3416	4567	1575		1751	2745	1656	1661	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	2740	17	91	2659	61	99	4	203	176	1	96
RTOR Reduction (vph)	0	0	8	0	0	27	0	0	188	0	0	89
Lane Group Flow (vph)	88	2740	9	91	2659	34	0	103	15	88	89	7
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2			3			4
Actuated Green, G (s)	9.5	67.5	67.5	14.5	73.0	73.0		9.8	9.8	9.2	9.2	9.2
Effective Green, g (s)	9.5	67.5	67.5	14.5	73.0	73.0		9.8	9.8	9.2	9.2	9.2
Actuated g/C Ratio	0.07	0.52	0.52	0.11	0.56	0.56		0.08	0.08	0.07	0.07	0.07
Clearance Time (s)	7.0	7.5	7.5	7.5	7.5	7.5		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	2395	826	381	2564	884		131	206	117	117	110
v/s Ratio Prot	0.05	c0.59		0.03	c0.58			c0.06		0.05	c0.05	
v/s Ratio Perm			0.01			0.02			0.01			0.00
v/c Ratio	0.68	1.14	0.01	0.24	1.04	0.04		0.79	0.07	0.75	0.76	0.06
Uniform Delay, d1	58.8	31.2	15.1	52.7	28.5	12.8		59.1	55.9	59.3	59.3	56.4
Progression Factor	1.33	0.51	1.00	0.80	0.59	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.8	67.5	0.0	0.2	25.2	0.1		26.0	0.2	23.5	24.8	0.2
Delay (s)	84.8	83.3	15.1	42.6	41.9	12.8		85.0	56.0	82.8	84.1	56.6
Level of Service	F	F	B	D	D	B		F	E	F	F	E
Approach Delay (s)		82.9			41.3			65.8			74.0	
Approach LOS		F			D			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		62.9					HCM 2000 Level of Service		E			
HCM 2000 Volume to Capacity ratio		1.08										
Actuated Cycle Length (s)		130.0					Sum of lost time (s)		29.0			
Intersection Capacity Utilization		83.1%					ICU Level of Service		E			
Analysis Period (min)		15										

c Critical Lane Group























# HCM Signalized Intersection Capacity Analysis 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱		↕			↕	
Traffic Volume (vph)	0	2829	30	12	2564	36	14	0	8	54	1	15
Future Volume (vph)	0	2829	30	12	2564	36	14	0	8	54	1	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			4%			1%	
Total Lost time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Lane Util. Factor		0.86		1.00	0.91	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.95			0.97	
Flt Protected		1.00		0.95	1.00	1.00		0.97			0.96	
Satd. Flow (prot)		5810		1761	4567	1575		1635			1683	
Flt Permitted		1.00		0.95	1.00	1.00		0.80			0.76	
Satd. Flow (perm)		5810		1761	4567	1575		1351			1327	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	3143	33	13	2849	40	16	0	9	60	1	17
RTOR Reduction (vph)	0	1	0	0	0	8	0	23	0	0	8	0
Lane Group Flow (vph)	0	3175	0	13	2849	32	0	2	0	0	70	0
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	5%	5%	5%	5%	5%	5%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			3				
Permitted Phases						2	3			3		
Actuated Green, G (s)		95.5		3.1	105.6	105.6		10.9			10.9	
Effective Green, g (s)		95.5		3.1	105.6	105.6		10.9			10.9	
Actuated g/C Ratio		0.73		0.02	0.81	0.81		0.08			0.08	
Clearance Time (s)		6.5		7.0	6.5	6.5		7.0			7.0	
Vehicle Extension (s)		5.0		3.0	5.0	5.0		3.0			3.0	
Lane Grp Cap (vph)		4268		41	3709	1279		113			111	
v/s Ratio Prot		0.55		0.01	c0.62							
v/s Ratio Perm						0.02		0.00			c0.05	
v/c Ratio		0.74		0.32	0.77	0.03		0.02			0.63	
Uniform Delay, d1		10.1		62.4	6.1	2.3		54.6			57.6	
Progression Factor		0.23		1.36	1.15	1.00		1.00			1.00	
Incremental Delay, d2		0.1		1.7	0.6	0.0		0.1			10.6	
Delay (s)		2.4		86.6	7.6	2.4		54.7			68.2	
Level of Service		A		F	A	A		D			E	
Approach Delay (s)		2.4			7.9			54.7			68.2	
Approach LOS		A			A			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		6.0										
HCM 2000 Volume to Capacity ratio		0.80										
Actuated Cycle Length (s)		130.0										
Intersection Capacity Utilization		65.8%										
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)























11/15/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	2858	23	158	2453	482	48	18	490	677	38	148
Future Volume (vph)	110	2858	23	158	2453	482	48	18	490	677	38	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-1%			1%			1%			-1%	
Total Lost time (s)	7.5	7.5		7.5	7.5	7.0		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.86		1.00	0.86	1.00		1.00	0.88	0.91	0.91	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1778	5811		1761	5755	1575		1788	2773	3237	1635	1591
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1778	5811		1761	5755	1575		1788	2773	3237	1635	1591
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	124	3211	26	178	2756	542	54	20	551	761	43	166
RTOR Reduction (vph)	0	1	0	0	0	140	0	0	118	0	0	152
Lane Group Flow (vph)	124	3236	0	178	2756	402	0	74	433	533	271	14
Heavy Vehicles (%)	2%	13%	2%	2%	13%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA	pt+ov	Split	NA	Perm
Protected Phases	1	6		5	2	3	4	4	4 5	3	3	
Permitted Phases						2						3
Actuated Green, G (s)	14.5	63.4		16.6	65.5	76.5		10.0	33.6	11.0	11.0	11.0
Effective Green, g (s)	14.5	63.4		16.6	65.5	76.5		10.0	33.6	11.0	11.0	11.0
Actuated g/C Ratio	0.11	0.49		0.13	0.50	0.59		0.08	0.26	0.08	0.08	0.08
Clearance Time (s)	7.5	7.5		7.5	7.5	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	3.0	5.0		4.0	5.0	3.0		4.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	2833		224	2899	926		137	716	273	138	134
v/s Ratio Prot	0.07	c0.56		0.10	c0.48	0.04		0.04	c0.16	0.16	c0.17	
v/s Ratio Perm						0.22						0.01
v/c Ratio	0.63	1.14		0.79	0.95	0.43		0.54	0.60	1.95	1.96	0.10
Uniform Delay, d1	55.2	33.3		55.0	30.7	14.8		57.8	42.4	59.5	59.5	55.0
Progression Factor	0.72	0.49		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	67.6		18.3	8.6	0.3		5.4	1.7	441.7	458.8	0.3
Delay (s)	44.2	83.9		73.4	39.3	15.1		63.1	44.0	501.2	518.3	55.3
Level of Service	D	F		E	D	B		E	D	F	F	E
Approach Delay (s)		82.4			37.3			46.3			429.7	
Approach LOS		F			D			D			F	
Intersection Summary												
HCM 2000 Control Delay	101.1			HCM 2000 Level of Service			F					
HCM 2000 Volume to Capacity ratio	1.22											
Actuated Cycle Length (s)	130.0			Sum of lost time (s)			29.0					
Intersection Capacity Utilization	90.0%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

# HCM Unsignalized Intersection Capacity Analysis





















## 2: Banks Ford Pkwy/Banks Ford Pkwy & Greenbank/Shopping Center

11/14/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	10	14	43	16	4	55	113	68	1	205	388
Future Volume (Veh/h)	30	10	14	43	16	4	55	113	68	1	205	388
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	30	10	14	43	16	4	55	113	68	1	205	388
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	386	498	102	346	818	56	593				181	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	386	498	102	346	818	56	593				181	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	94	98	98	92	95	100	94				100	
cM capacity (veh/h)	500	446	933	540	291	998	979				1392	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	30	24	59	4	55	56	56	68	1	102	102	388
Volume Left	30	0	43	0	55	0	0	0	1	0	0	0
Volume Right	0	14	0	4	0	0	0	68	0	0	0	388
cSH	500	641	439	998	979	1700	1700	1700	1392	1700	1700	1700
Volume to Capacity	0.06	0.04	0.13	0.00	0.06	0.03	0.03	0.04	0.00	0.06	0.06	0.23
Queue Length 95th (ft)	5	3	12	0	4	0	0	0	0	0	0	0
Control Delay (s)	12.7	10.8	14.5	8.6	8.9	0.0	0.0	0.0	7.6	0.0	0.0	0.0
Lane LOS	B	B	B	A	A	A						
Approach Delay (s)	11.8	14.1		2.1		0.0						
Approach LOS	B	B										
Intersection Summary												
Average Delay	2.1											
Intersection Capacity Utilization	40.7%		ICU Level of Service				A					
Analysis Period (min)	15											























# HCM Unsignalized Intersection Capacity Analysis 42: Celebrate Virginia Pkwy & Scott's Ford Lane

11/14/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	1	3	0	5	5	4	205	4	8	202	26
Future Volume (Veh/h)	19	1	3	0	5	5	4	205	4	8	202	26
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour 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
Hourly flow rate (vph)	19	1	3	0	5	5	4	205	4	8	202	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	438	435	202	436	459	207	228				209	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	438	435	202	436	459	207	228				209	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	96	100	100	100	99	99	100				99	
cM capacity (veh/h)	518	510	839	524	494	833	1340				1362	
Direction, Lane#	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	19	4	10	4	209	8	202	26				
Volume Left	19	0	0	4	0	8	0	0				
Volume Right	0	3	5	0	4	0	0	26				
cSH	518	722	620	1340	1700	1362	1700	1700				
Volume to Capacity	0.04	0.01	0.02	0.00	0.12	0.01	0.12	0.02				
Queue Length 95th (ft)	3	0	1	0	0	0	0	0				
Control Delay (s)	12.2	10.0	10.9	7.7	0.0	7.7	0.0	0.0				
Lane LOS	B	B	B	A		A						
Approach Delay (s)	11.8		10.9	0.1		0.3						
Approach LOS	B		B									
Intersection Summary												
Average Delay	1.0											
Intersection Capacity Utilization	25.4%			ICU Level of Service			A					
Analysis Period (min)	15											

# HCM Unsignalized Intersection Capacity Analysis 67: McWhirt Loop & Banks Ford Parkway





















11/20/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	19	7	37	36	11	7	116	221	23	31	70
Future Volume (Veh/h)	29	19	7	37	36	11	7	116	221	23	31	70
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour 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
Hourly flow rate (vph)	29	19	7	37	36	11	7	116	221	23	31	70
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	178	428	16	208	277	58	101			337		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	178	428	16	208	277	58	101			337		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	96	99	95	94	99	100			98		
cM capacity (veh/h)	712	506	1060	693	615	996	1489			1219		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	48	7	73	11	7	58	58	221	23	16	16	70
Volume Left	29	0	37	0	7	0	0	0	23	0	0	0
Volume Right	0	7	0	11	0	0	0	221	0	0	0	70
cSH	613	1060	652	996	1489	1700	1700	1700	1219	1700	1700	1700
Volume to Capacity	0.08	0.01	0.11	0.01	0.00	0.03	0.03	0.13	0.02	0.01	0.01	0.04
Queue Length 95th (ft)	6	0	9	1	0	0	0	0	1	0	0	0
Control Delay (s)	11.4	8.4	11.2	8.7	7.4	0.0	0.0	0.0	8.0	0.0	0.0	0.0
Lane LOS	B	A	B	A	A				A			
Approach Delay (s)	11.0		10.9		0.2				1.5			
Approach LOS	B		B									
Intersection Summary												
Average Delay												
Intersection Capacity Utilization												
Analysis Period (min)												

# HCM Unsignalized Intersection Capacity Analysis

3:

11/16/2017

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	5	3	7	7	92	3	232	14	100	239	48
Future Volume (Veh/h)	45	5	3	7	7	92	3	232	14	100	239	48
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	5	3	8	8	100	3	252	15	109	260	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	714	751	130	612	788	126	312			267		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	714	751	130	612	788	126	312			267		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	81	98	100	98	97	89	100			92		
cM capacity (veh/h)	259	309	896	347	294	901	1245			1294		
Direction, Lane, #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	57	116	3	126	126	15	109	130	130	52		
Volume Left	49	8	3	0	0	0	109	0	0	0		
Volume Right	3	100	0	0	0	15	0	0	0	52		
cSH	273	719	1245	1700	1700	1700	1294	1700	1700	1700		
Volume to Capacity	0.21	0.16	0.00	0.07	0.07	0.01	0.08	0.08	0.08	0.03		
Queue Length 95th (ft)	19	14	0	0	0	0	7	0	0	0		
Control Delay (s)	21.6	11.0	7.9	0.0	0.0	0.0	8.0	0.0	0.0	0.0		
Lane LOS	C	B	A				A					
Approach Delay (s)	21.6	11.0	0.1				2.1					
Approach LOS	C	B										
Intersection Summary												
Average Delay			3.9									
Intersection Capacity Utilization			31.6%				ICU Level of Service			A		
Analysis Period (min)			15									

# Queuing and Blocking Report

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## Intersection: 2: Banks Ford Pkwy/Banks Ford Pkway & Greenbank/Shopping Center

Movement	EB	EB	WB	NB
Directions Served	L	TR	LT	L
Maximum Queue (ft)	26	28	45	22
Average Queue (ft)	15	11	17	13
95th Queue (ft)	35	32	44	31
Link Distance (ft)	1010		815	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185		50	
Storage Blk Time (%)				
Queuing Penalty (veh)				

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	LT
Maximum Queue (ft)	86	455	344	360	127	144	35	54	29	686	132	87
Average Queue (ft)	46	259	237	215	53	109	9	18	17	489	88	65
95th Queue (ft)	93	498	368	378	130	174	32	54	40	717	137	89
Link Distance (ft)	2762		2762	2762			728	728	728	748	748	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400				690	690						
Storage Blk Time (%)	1											
Queuing Penalty (veh)	1											

## Intersection: 5: Geico/Stafford Lakes Pkway (Rte.1490)/Stafford Lakes Pkway (Rte.1490) & Warrent

Movement	SB
Directions Served	R
Maximum Queue (ft)	124
Average Queue (ft)	60
95th Queue (ft)	114
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	7
Queuing Penalty (veh)	4

Queuing and Blocking Report  
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Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	B26	B26	B26	WB	WB	WB	WB
Directions Served	L	T	T	T	R	T	T	T	L	L	T	T
Maximum Queue (ft)	67	403	368	388	225	182	154	211	23	41	62	55
Average Queue (ft)	26	289	289	287	108	48	52	62	15	17	34	21
95th Queue (ft)	63	459	439	420	270	164	160	192	31	39	67	56
Link Distance (ft)		282	282	282		728	728	728			489	489
Upstream Blk Time (%)		13	16	11								
Queuing Penalty (veh)		89	110	73								
Storage Bay Dist (ft)	185				200				400	400		
Storage Blk Time (%)		18		22								
Queuing Penalty (veh)		4		42								

Intersection: 6: Banks Ford Pkway/Berea Church Rd (Rte.654) & Warrenton Rd (Rte.17)

Movement	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	LT	R	L	T
Maximum Queue (ft)	77	6	132	130	106	114	120
Average Queue (ft)	37	1	108	105	65	73	58
95th Queue (ft)	79	5	142	148	112	130	122
Link Distance (ft)	489		2137	2137		552	552
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		300			160		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Queuing and Blocking Report  
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Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	B63	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	T	L	T	T	T	R	L	L
Maximum Queue (ft)	185	602	676	642	27	224	371	418	365	200	104	117
Average Queue (ft)	130	538	579	556	5	94	262	282	279	118	56	84
95th Queue (ft)	204	646	697	640	24	263	400	432	404	277	119	119
Link Distance (ft)		601	601	601	489		497	497	497			1812
Upstream Blk Time (%)		1	6	2								
Queuing Penalty (veh)		4	32	10								
Storage Bay Dist (ft)	160					200				175	775	
Storage Blk Time (%)	0	26				0	13		18	0		
Queuing Penalty (veh)	2	29				0	9		34	1		

Intersection: 7: Celebrate Virginia Parkway/International Parkway (700 N) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	B41
Directions Served	T	LT	R	T
Maximum Queue (ft)	29	397	199	85
Average Queue (ft)	23	314	132	29
95th Queue (ft)	33	473	216	88
Link Distance (ft)	1812	325		344
Upstream Blk Time (%)		22		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)			180	
Storage Blk Time (%)		41	0	
Queuing Penalty (veh)		60	1	

Queuing and Blocking Report  
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Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	B71	B71	WB	WB	WB	WB	WB	NB
Directions Served	T	T	T	R	T	T	L	L	T	T	T	L
Maximum Queue (ft)	179	132	88	13	490	523	59	70	170	173	228	41
Average Queue (ft)	62	52	35	3	98	105	23	31	93	81	113	15
95th Queue (ft)	170	145	105	11	422	450	55	71	220	201	270	40
Link Distance (ft)	571	571	571	571	497	497			734	734	734	602
Upstream Blk Time (%)					1	1						
Queuing Penalty (veh)					3	4						
Storage Bay Dist (ft)							400	400				
Storage Blk Time (%)											6	
Queuing Penalty (veh)											0	

Intersection: 8: Banks Ford Parkway/Car Dealership & Warrenton Rd (Rte.17)

Movement	NB	NB
Directions Served	LT	R
Maximum Queue (ft)	12	94
Average Queue (ft)	5	30
95th Queue (ft)	14	93
Link Distance (ft)	602	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		460
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report  
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Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	R	L	L	T	T	T	R	LT
Maximum Queue (ft)	365	380	215	238	16	69	62	189	188	211	19	304
Average Queue (ft)	290	161	139	147	3	43	32	162	163	144	11	152
95th Queue (ft)	429	368	257	279	13	70	60	212	195	226	26	283
Link Distance (ft)		585	585	585				490	490	490		799
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350				350	290	290				400	
Storage Blk Time (%)	18											52
Queuing Penalty (veh)	126											146

Intersection: 9: McWhirt Loop/Lichfield Boulevard (700 S) & Warrenton Rd (Rte.17)

Movement	NB	SB	SB	SB
Directions Served	R	L	LT	R
Maximum Queue (ft)	95	116	130	152
Average Queue (ft)	84	62	104	83
95th Queue (ft)	112	135	155	144
Link Distance (ft)			980	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70	120		145
Storage Blk Time (%)	18	1	5	2
Queuing Penalty (veh)	25	3	13	3

Queuing and Blocking Report  
am

11/20/2017

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	72	73	138	159	116	25	50	211	273	271	54	45
Average Queue (ft)	48	60	68	91	99	5	40	177	208	194	38	24
95th Queue (ft)	73	77	138	167	138	22	60	235	291	283	73	49
Link Distance (ft)			563	563	563			2403	2403	2403		852
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	290	290				535	400				300	
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 10: Commerce Parkway (1708)/Plantation Dr (1706) & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB
Directions Served	LT	R	L	LT	R
Maximum Queue (ft)	46	99	344	366	155
Average Queue (ft)	29	59	225	234	126
95th Queue (ft)	57	107	349	388	195
Link Distance (ft)	852		366	366	
Upstream Blk Time (%)				0	
Queuing Penalty (veh)				0	
Storage Bay Dist (ft)		90			130
Storage Blk Time (%)		3		49	0
Queuing Penalty (veh)		2		85	0

Queuing and Blocking Report  
am

11/20/2017

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	L	L	T	T	T	LT	R	R
Maximum Queue (ft)	140	183	193	207	37	74	216	241	292	130	106	29
Average Queue (ft)	80	98	109	113	27	60	156	179	201	95	84	11
95th Queue (ft)	155	205	232	245	43	89	290	329	371	131	108	35
Link Distance (ft)		2403	2403	2403			951	951	951	669	669	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	440				300	300						220
Storage Blk Time (%)									8			
Queuing Penalty (veh)									5			

Intersection: 11: Commuter Lot/Falls Run Dr & Warrenton Rd (Rte.17)

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	504	175	158
Average Queue (ft)	362	172	126
95th Queue (ft)	493	179	202
Link Distance (ft)	607		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	150
Storage Blk Time (%)	76	31	1
Queuing Penalty (veh)	130	25	0

Intersection: 12: Victor Neilsen Dr./McLanes Dr. & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	T	T	T	TR	L	T	T	LTR	LTR
Maximum Queue (ft)	40	46	45	42	26	41	29	31	88
Average Queue (ft)	8	18	26	12	13	8	6	6	49
95th Queue (ft)	34	47	54	40	31	35	25	27	82
Link Distance (ft)	951	951	951	951		849	849	486	933
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)					150				
Storage Blk Time (%)									
Queuing Penalty (veh)									

Queuing and Blocking Report  
am

11/20/2017

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB	NB
Directions Served	L	T	T	T	TR	L	T	T	T	T	R	LT
Maximum Queue (ft)	86	213	186	232	232	174	475	502	464	358	185	119
Average Queue (ft)	59	94	107	116	114	117	344	353	301	214	61	73
95th Queue (ft)	94	206	209	258	264	167	486	512	478	357	164	143
Link Distance (ft)		849	849	849	849		1166	1166	1166	1166		451
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	330					150					160	
Storage Blk Time (%)							29			10	0	
Queuing Penalty (veh)							46			48	0	

Intersection: 13: Sanford Dr./Stanstead Rd & Warrenton Rd (Rte.17)

Movement	NB	NB	SB	SB	SB	SB
Directions Served	R	R	L	L	LT	R
Maximum Queue (ft)	314	294	500	393	388	155
Average Queue (ft)	239	195	386	334	289	153
95th Queue (ft)	319	297	519	412	401	156
Link Distance (ft)	451	451	611	611	611	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					130	
Storage Blk Time (%)					69	0
Queuing Penalty (veh)					102	1

Intersection: 17: Celebrate Virginia Pkwy & Bolivar Point Lane/Hyannis Place

Movement	SE	NW	SW
Directions Served	LTR	LTR	L
Maximum Queue (ft)	46	29	14
Average Queue (ft)	20	24	5
95th Queue (ft)	44	28	16
Link Distance (ft)	1628	2167	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			165
Storage Blk Time (%)			
Queuing Penalty (veh)			

# Queuing and Blocking Report

11/20/2017

## Intersection: 28: Celebrate Virginia Pkwy & Banks Ford Pkwy

Movement	SE	SE	NW	NW	NE	SW	SW	SW
Directions Served	LT	R	LT	R	L	L	T	T
Maximum Queue (ft)	78	28	50	25	42	14	56	80
Average Queue (ft)	46	12	30	10	18	3	47	46
95th Queue (ft)	91	26	49	30	45	12	72	85
Link Distance (ft)	865	865	2100	2100			1812	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)					325	390		155
Storage Blk Time (%)								
Queuing Penalty (veh)								

## Intersection: 42: Celebrate Virginia Pkwy & Scott's Ford Lane

Movement	EB	EB	WB
Directions Served	L	TR	LTR
Maximum Queue (ft)	21	19	23
Average Queue (ft)	8	4	5
95th Queue (ft)	25	16	20
Link Distance (ft)		2563	3446
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	120		
Storage Blk Time (%)			
Queuing Penalty (veh)			

## Intersection: 67: McWhirt Loop & Banks Ford Parkway

Movement	EB	EB	WB	WB	SB
Directions Served	LT	R	LT	R	L
Maximum Queue (ft)	40	19	49	19	22
Average Queue (ft)	24	4	25	7	8
95th Queue (ft)	46	16	61	22	26
Link Distance (ft)	927	927	626	626	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

## Network Summary

Network wide Queuing Penalty: 1322

## **Capacity Analysis Results**

*Highway Capacity Software  
(Intersection: Celebrate Virginia Parkway and Banks Ford Parkway)*

# HCS7 Two-Way Stop-Control Report

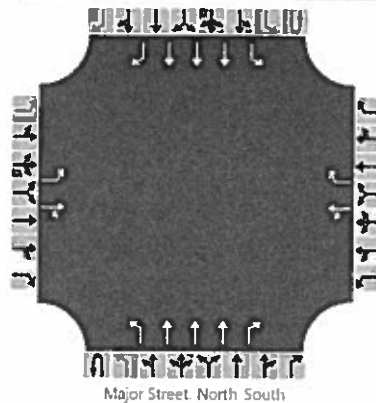
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	AM Existing conditions 2017

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		3	31	24		19	48	3		19	32	65		5	101	45
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		60		73		3		21				5		
Capacity, c (veh/h)		666		741		656		893		972				1109		
v/c Ratio		0.00		0.08		0.11		0.00		0.02				0.00		
95% Queue Length, Q <sub>95</sub> (veh)		0.0		0.3		0.4		0.0		0.1				0.0		
Control Delay (s/veh)		10.4		10.3		11.2		9.0		8.8				8.3		
Level of Service, LOS		B		B		B		A		A				A		
Approach Delay (s/veh)	10.3				11.1				1.5				0.3			
Approach LOS	B				B											

# HCS7 Two-Way Stop-Control Report

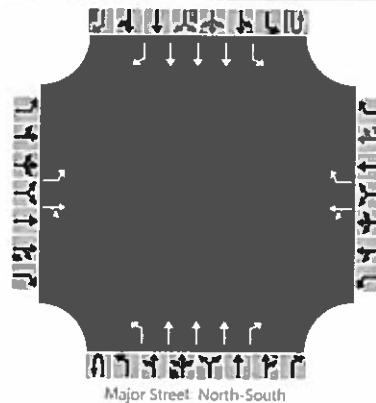
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	PM Existing conditions 2017

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		8	107	43		18	43	1		45	34	48		50	91	50
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		9		163		67		1		49				54		
Capacity, c (veh/h)		520		587		472		893		978				1106		
v/c Ratio		0.02		0.28		0.14		0.00		0.05				0.05		
95% Queue Length, Q <sub>95</sub> (veh)		0.1		1.1		0.5		0.0		0.2				0.2		
Control Delay (s/veh)		12.0		13.5		13.9		9.0		8.9				8.4		
Level of Service, LOS		B		B		B		A		A				A		
Approach Delay (s/veh)	13.4				13.8				3.2				2.2			
Approach LOS	B				B											

# HCS7 Two-Way Stop-Control Report

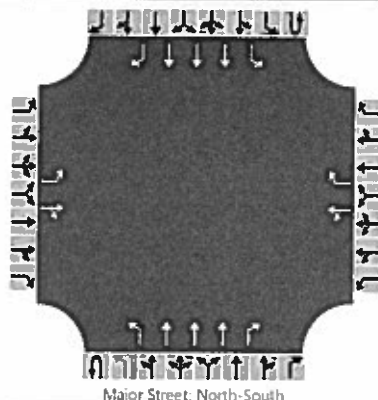
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	AM No Build 2027

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		4	3	29		23	59	4		6	123	55		23	39	79
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4		35		89		4		7				25		
Capacity, c (veh/h)		654		860		595		832		1005				998		
v/c Ratio		0.01		0.04		0.15		0.00		0.01				0.03		
95% Queue Length, Q <sub>95</sub> (veh)		0.0		0.1		0.5		0.0		0.0				0.1		
Control Delay (s/veh)		10.5		9.4		12.1		9.4		8.6				8.7		
Level of Service, LOS		B		A		B		A		A				A		
Approach Delay (s/veh)	9.5				12.0				0.3				1.4			
Approach LOS	A				B											

# HCS7 Two-Way Stop-Control Report

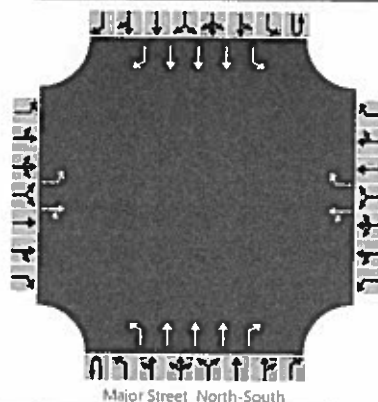
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	PM No Build 2027

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		10	130	52		22	52	1		55	41	59		61	111	61
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11		198		81		1		60				66		
Capacity, c (veh/h)		447		529		400		887		943				1097		
v/c Ratio		0.02		0.37		0.20		0.00		0.06				0.06		
95% Queue Length, Q <sub>95</sub> (veh)		0.1		1.8		0.8		0.0		0.2				0.2		
Control Delay (s/veh)		13.3		15.9		16.3		9.1		9.1				8.5		
Level of Service, LOS		B		C		C		A		A				A		
Approach Delay (s/veh)	15.7				16.2				3.2				2.2			
Approach LOS	C				C											

# HCS7 Two-Way Stop-Control Report

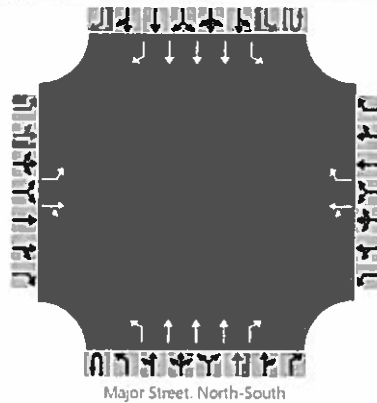
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	AM No Build 2033

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		4	43	33		26	66	4		26	44	89		7	139	62
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4		83		100		4		28				8		
Capacity, c (veh/h)		575		685		577		885		913				1093		
v/c Ratio		0.01		0.12		0.17		0.00		0.03				0.01		
95% Queue Length, Q <sub>95</sub> (veh)		0.0		0.4		0.6		0.0		0.1				0.0		
Control Delay (s/veh)		11.3		11.0		12.5		9.1		9.1				8.3		
Level of Service, LOS		B		B		B		A		A				A		
Approach Delay (s/veh)	11.0				12.4				1.5				0.3			
Approach LOS	B				B											

# HCS7 Two-Way Stop-Control Report

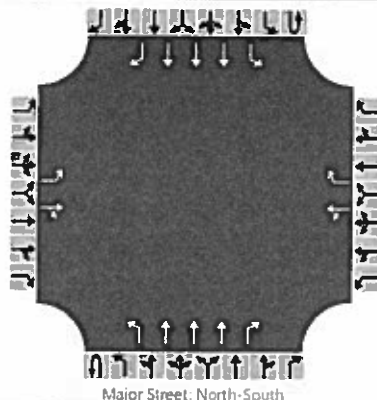
## General Information

Analyst	CGG
Agency/Co.	Bowman Consulting
Date Performed	11/15/2017
Analysis Year	2027
Time Analyzed	
Intersection Orientation	North-South
Project Description	PM No Build 2033

## Site Information

Intersection	Celebrate VA / Banks
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	1	0	1	3	1	0	1	3	1
Configuration		L		TR		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		11	147	59		25	59	1		62	47	66		69	125	69
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		12		224		91		1		67				75		
Capacity, c (veh/h)		401		490		354		882		920				1090		
v/c Ratio		0.03		0.46		0.26		0.00		0.07				0.07		
95% Queue Length, Q <sub>95</sub> (veh)		0.1		2.5		1.0		0.0		0.2				0.2		
Control Delay (s/veh)		14.3		18.5		18.7		9.1		9.2				8.5		
Level of Service, LOS		B		C		C		A		A				A		
Approach Delay (s/veh)	18.3				18.6				3.3				2.2			
Approach LOS	C				C											

# HCS7 Two-Way Stop-Control Report

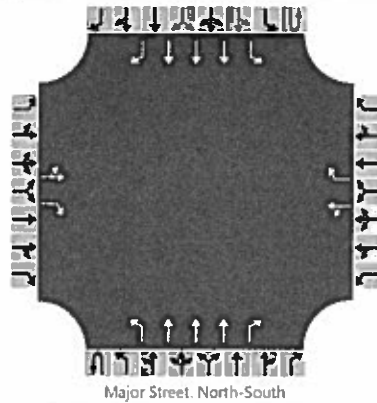
## General Information

Analyst	SBQ
Agency/Co.	
Date Performed	11/20/2017
Analysis Year	2017
Time Analyzed	
Intersection Orientation	North-South
Project Description	AM 2027 Build

## Site Information

Intersection	
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	1	0	1	3	1	0	1	3	1
Configuration		LT		R		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		10	130	97		38	52	1		102	125	126		61	240	61
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		152		105		98		1		111				66		
Capacity, c (veh/h)		271		759		211		830		812				996		
v/c Ratio		0.56		0.14		0.46		0.00		0.14				0.07		
95% Queue Length, Q <sub>95</sub> (veh)		3.2		0.5		2.2		0.0		0.5				0.2		
Control Delay (s/veh)		34.0		10.5		36.0		9.3		10.1				8.9		
Level of Service, LOS		D		B		E		A		B				A		
Approach Delay (s/veh)	24.4				35.8				2.9				1.5			
Approach LOS	C				E											

# HCS7 Two-Way Stop-Control Report

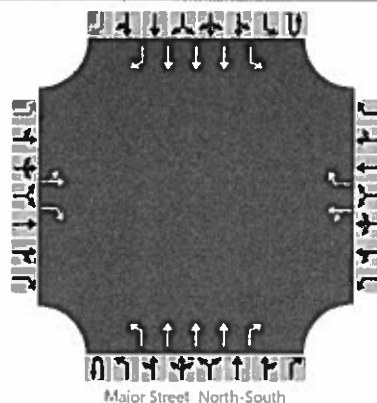
## General Information

Analyst	S8Q
Agency/Co.	
Date Performed	11/20/2017
Analysis Year	2017
Time Analyzed	
Intersection Orientation	North-South
Project Description	AM 2027 Build

## Site Information

Intersection	
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	1	0	1	3	1	0	1	3	1
Configuration		LT		R		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		4	38	29		31	59	4		37	119	144		6	187	55
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		45		32		98		4		40				7		
Capacity, c (veh/h)		490		790		478		835		870				1004		
v/c Ratio		0.09		0.04		0.20		0.00		0.05				0.01		
95% Queue Length, Q <sub>95</sub> (veh)		0.3		0.1		0.8		0.0		0.1				0.0		
Control Delay (s/veh)		13.1		9.7		14.5		9.3		9.3				8.6		
Level of Service, LOS		B		A		B		A		A				A		
Approach Delay (s/veh)	11.7				14.3				1.1				0.2			
Approach LOS	B				B											

# HCS7 Two-Way Stop-Control Report

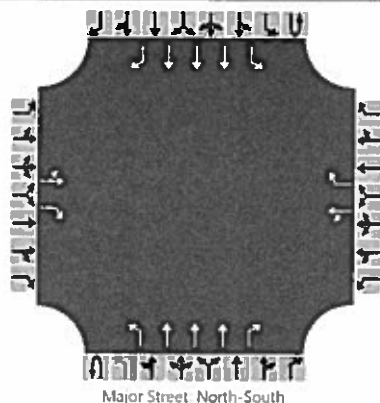
## General Information

Analyst	S8Q
Agency/Co.	
Date Performed	11/20/2017
Analysis Year	2017
Time Analyzed	
Intersection Orientation	North-South
Project Description	2033 AM Build

## Site Information

Intersection	
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	1	0	1	3	1	0	1	3	1
Configuration		LT		R		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		4	43	55		34	66	4		70	124	154		7	203	62
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		51		60		109		4		76				8		
Capacity, c (veh/h)		410		781		393		830		847				997		
v/c Ratio		0.12		0.08		0.28		0.00		0.09				0.01		
95% Queue Length, Q <sub>95</sub> (veh)		0.4		0.2		1.1		0.0		0.3				0.0		
Control Delay (s/veh)		15.0		10.0		17.6		9.4		9.7				8.6		
Level of Service, LOS		C		A		C		A		A				A		
Approach Delay (s/veh)	12.3				17.4				1.9				0.2			
Approach LOS	B				C											

# HCS7 Two-Way Stop-Control Report

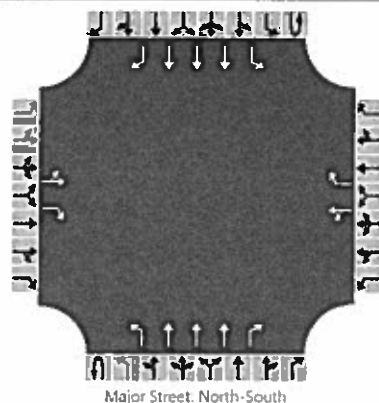
## General Information

Analyst	SBQ
Agency/Co.	
Date Performed	11/20/2017
Analysis Year	2017
Time Analyzed	
Intersection Orientation	North-South
Project Description	2033 PM BUILD

## Site Information

Intersection	
Jurisdiction	
East/West Street	
North/South Street	
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	1	0	1	3	1	0	1	3	1
Configuration		LT		R		LT		R		L	T	R		L	T	R
Volume, V (veh/h)		11	147	104		41	59	1		109	131	133		69	254	69
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				Yes				No			
Median Type/Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		6.4	6.5	7.1		6.4	6.5	7.1		5.3				5.3		
Critical Headway (sec)		6.46	6.56	7.16		6.46	6.56	7.16		5.36				5.36		
Base Follow-Up Headway (sec)		3.8	4.0	3.9		3.8	4.0	3.9		3.1				3.1		
Follow-Up Headway (sec)		3.83	4.03	3.93		3.83	4.03	3.93		3.13				3.13		

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		172		113		109		1		118				75		
Capacity, c (veh/h)		245		750		171		827		791				990		
v/c Ratio		0.70		0.15		0.64		0.00		0.15				0.08		
95% Queue Length, Q <sub>95</sub> (veh)		4.7		0.5		3.6		0.0		0.5				0.2		
Control Delay (s/veh)		48.1		10.6		56.9		9.4		10.3				8.9		
Level of Service, LOS		E		B		F		A		B				A		
Approach Delay (s/veh)	33.3				56.5				3.0				1.6			
Approach LOS	D				F											