

# Traffic Impact Analysis

## Catoctin Creek Apartments

Town on Purcellville, Virginia

December 2012

Prepared for:

**S.L. Nusbaum Realty Company**

Prepared by:

**Bowman**  
CONSULTING

Bowman Project Number: 5384-01-001

# Traffic Impact Analysis

## Catoctin Creek Apartments Town of Purcellville, Virginia

December 2012

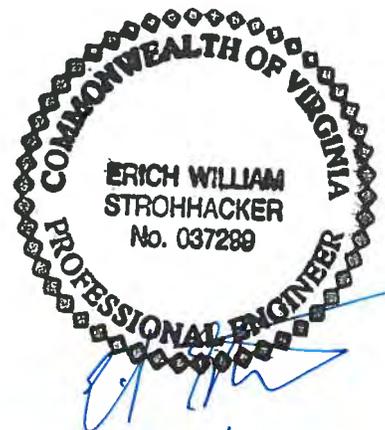
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12/5/12

Bowman Project Number: 5384-01-001

**TRAFFIC IMPACT ANALYSIS REPORT  
CATOCTIN CREEK APARTMENTS  
TOWN OF PURCELLVILLE, VIRGINIA**

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# TRAFFIC IMPACT ANALYSIS REPORT

## CATOCTIN CREEK APARTMENTS

### TOWN OF PURCELLVILLE, VIRGINIA

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# **TRAFFIC IMPACT ANALYSIS REPORT**

## **CATOCTIN CREEK APARTMENTS**

### **TOWN OF PURCELLVILLE, VIRGINIA**

## **1. INTRODUCTION AND SUMMARY**

### **1.1. Purpose and Study Objectives**

This report summarizes the findings of the traffic impact analysis that was performed for the proposed Catoctin Creek Apartments development in the Town of Purcellville, Virginia. The purpose of this study is to determine the impact to the surrounding roadway network caused by the traffic generated by the proposed development.

### **1.2. Executive Summary**

The subject property is generally located south of Hirst Road, northwest of Maple Avenue, and north of Skyline Drive in the Town of Purcellville, Virginia. The approximately 20.4 acre site is currently zoned Transitional (X) with a portion of the site in the Floodplain District. The Applicant, S.L. Nusbaum Realty Company, is applying for a Comprehensive Plan Amendment for the entire 20.4 acre site and proposes residential multi-family and mixed use commercial land use designations for the site. The Applicant is also applying for a Zoning Map Amendment for 13.7 acres of the site (western portion) to rezone that portion to Planned Development Housing (PDH-15) and develop that portion with 176 multi-family residential units. The remaining 6.7 acres of the site will remain zoned Transitional (X) pending submission and approval of a future rezoning application.

The scope of this study was developed in consultation with Virginia Department of Transportation (VDOT) and Town of Purcellville staff at a scoping meeting on October 2, 2012. A copy of the signed scoping documents is included in Appendix A.

The Applicant is proposing to develop the western portion of the site with approximately 176 multi-family residential dwelling units. No development is

planned at this time on the eastern portion of the site and any development proposal would be contingent upon a separate rezoning for that portion of the site.

For purposes of this analysis, development of the site was assumed to occur by 2014. When complete, on an average weekday, the development would generate approximately 90 new trips during the AM peak hour (18 in and 72 out), 114 new trips during the PM peak hour (74 in and 40 out), and 1,190 new daily trips over a 24-hour period.

Access to the site is proposed via a full movement entrance off of Hirst Road. This entrance would serve the residential portion only and would not serve any future commercial development.

Based on the scoping agreement shown in Appendix A, it was determined that the study area should include the following intersections:

1. Hirst Road (VA Route F962)/21<sup>st</sup> Street North (VA Route 690)
2. Hirst Road (VA Route F962)/Hatcher Avenue (VA Route 611)
3. Hirst Road (VA Route F962)/Site Entrance
4. Hirst Road (VA Route F962)/Maple Avenue (VA Route 722)
5. Hirst Road (VA Route F962)/Berlin Turnpike (VA Route 287)
6. Main Street (VA Route 7 Business)/Hatcher Avenue (VA Route 611)
7. Main Street (VA Route 7 Business)/Maple Avenue (VA Route 722)

As part of the proposed development, the Applicant has committed to constructing turn lanes at the site entrance if and when warranted by the Town.

The analysis indicates that **without** the buildout of the Catoclin Creek Apartments development, traffic conditions would necessitate multiple improvements to the study intersections in 2014 and 2020. **With** the buildout of the proposed development, no additional improvements would be required.

## **2. BACKGROUND INFORMATION**

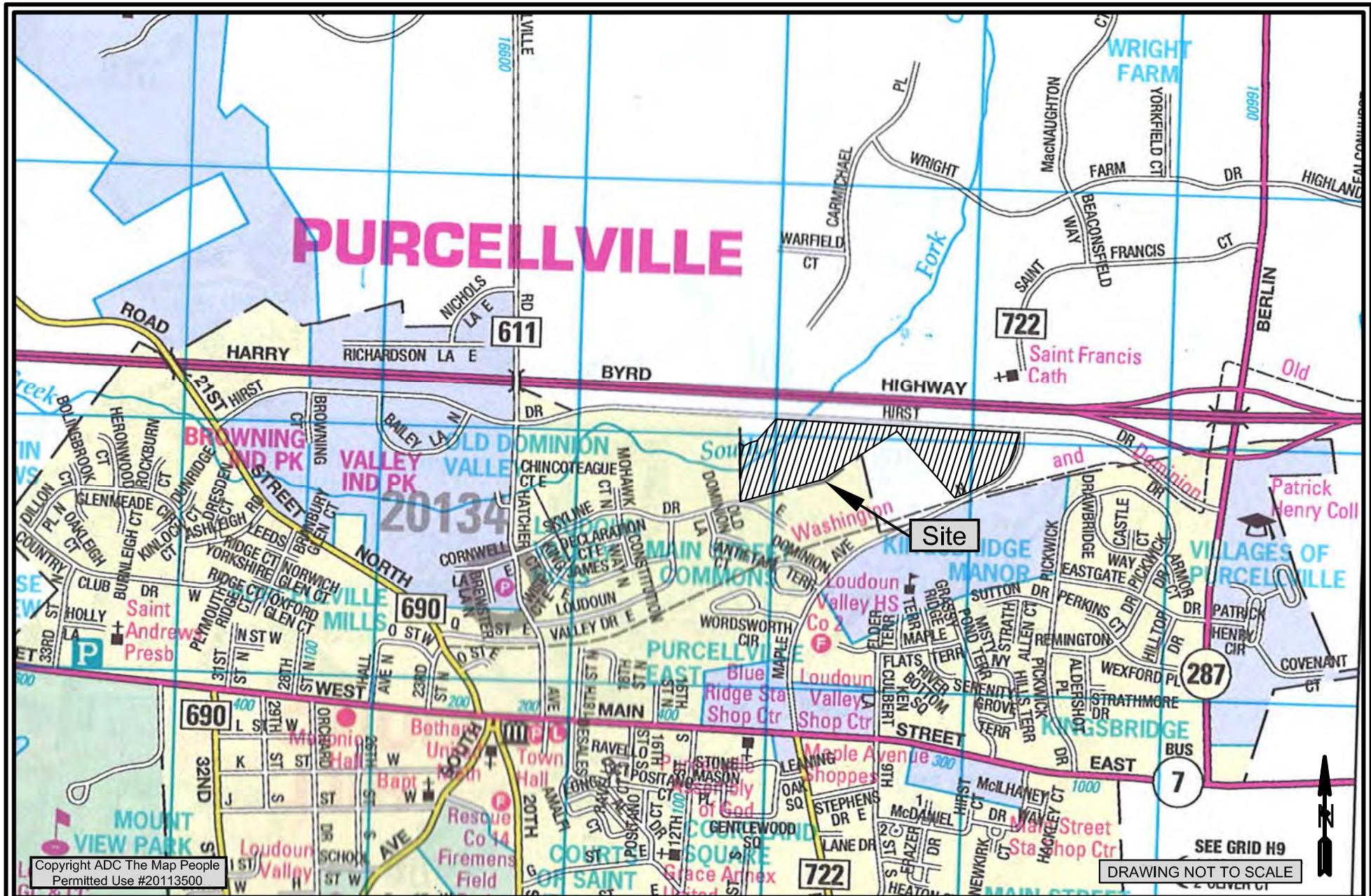
The development is generally located south of Hirst Road, northwest of Maple Avenue, and north of Skyline Drive in the Town of Purcellville, Virginia as shown on Figure 1. The approximately 20.4 acre site is currently zoned Transitional (X) with a portion of the site in the Floodplain District. The Applicant, S.L. Nusbaum Realty Company, is applying for a Comprehensive Plan Amendment for the entire 20.4 acre site and proposes residential multi-family and mixed use commercial land use designations for the site. The Applicant is also applying for a Zoning Map Amendment for 13.7 acres of the site (western portion) to rezone that portion to Planned Development Housing (PDH-15) and develop that portion with 176 multi-family residential units. The remaining 6.7 acres of the site will remain zoned Transitional (X) pending submission and approval of a future rezoning application.

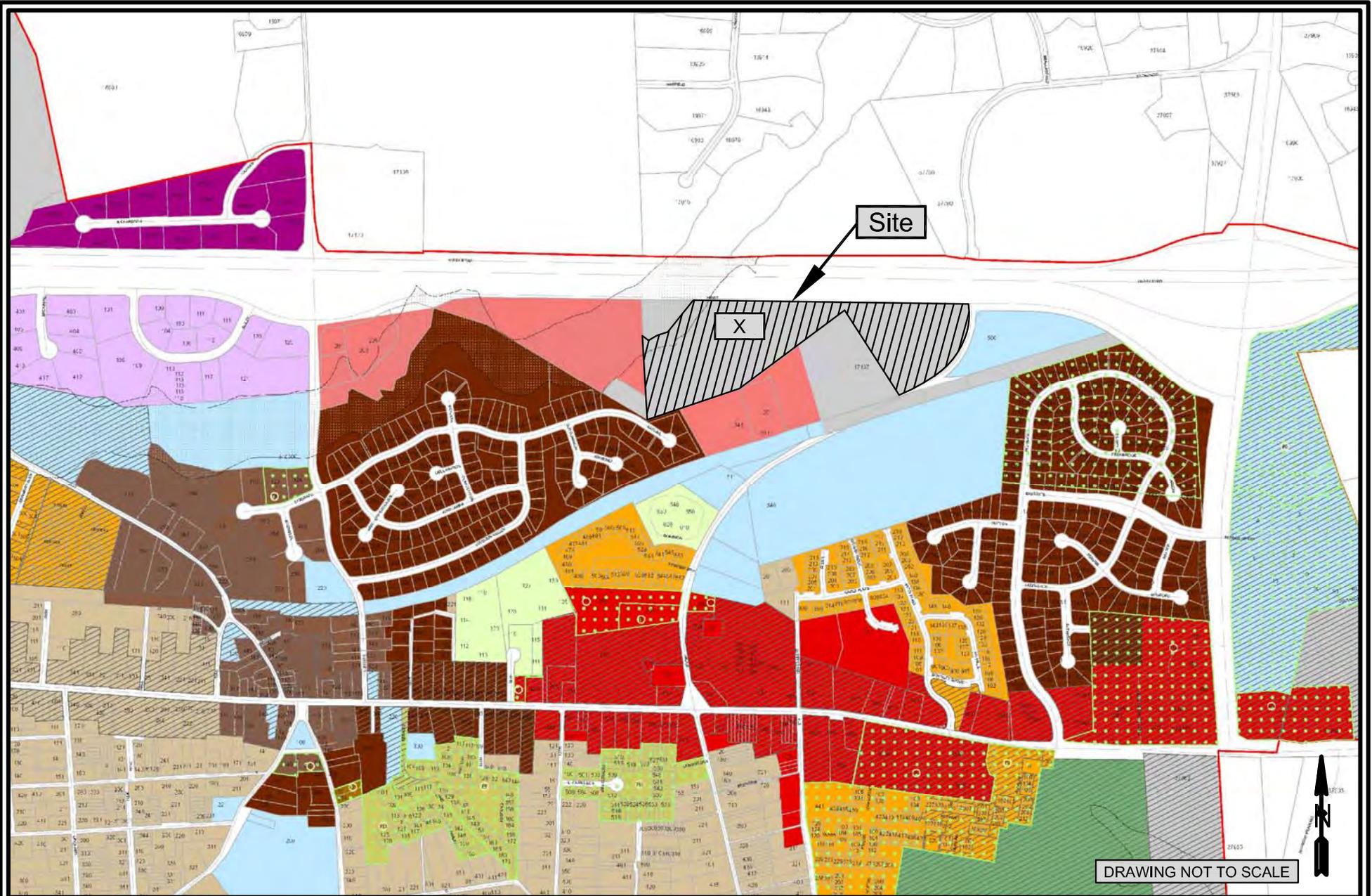
Refer to Figure 2 for a map of the subject parcel including the current zoning and Figure 3 for the Concept Development Plan.

### **2.1. Existing Land Uses and Zoning**

The subject parcel is bordered by a single family residential development to the southwest, a manufacturing facility (Loudoun Stairs) to the south, the Purcellville Volunteer Fire Station to the east (across Maple Avenue) and Hirst Road and VA Route 7 Bypass to the north.

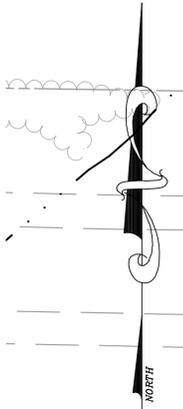
The land surrounding the site is predominantly zoned Transitional (X), Institutional and Public Use (IP), Office Commercial (C-1), and Duplex Residential (R-3). Refer to Figure 4 for the existing zoning in the study area.





**LEGEND**

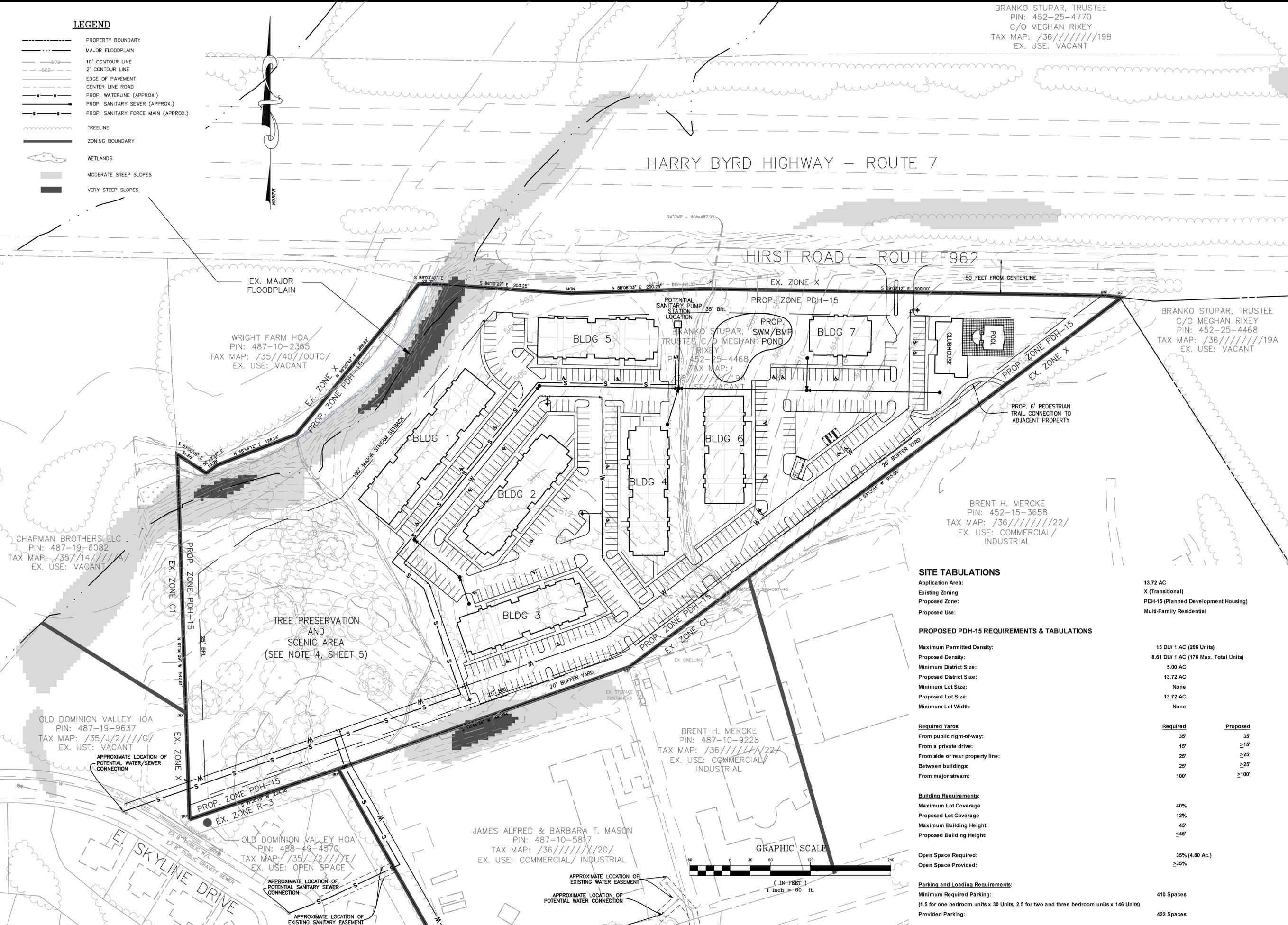
- PROPERTY BOUNDARY
- MAJOR FLOODPLAIN
- 10' CONTOUR LINE
- 2' CONTOUR LINE
- EDGE OF PAVEMENT
- CENTER LINE ROAD
- PROP. WATERLINE (APPROX.)
- PROP. SANITARY SEWER (APPROX.)
- PROP. SANITARY FORCE MAIN (APPROX.)
- TREELINE
- ZONING BOUNDARY
- WETLANDS
- MODERATE STEEP SLOPES
- VERY STEEP SLOPES



BRANKO STUPAR, TRUSTEE  
 PIN: 452-25-4770  
 C/O MEGHAN RIXEY  
 TAX MAP: /36//////19B  
 EX. USE: VACANT

HARRY BYRD HIGHWAY - ROUTE 7

HIRST ROAD - ROUTE F962



EX. MAJOR FLOODPLAIN  
 WRIGHT FARM HOA  
 PIN: 487-10-2365  
 TAX MAP: /35//40//OUTC/  
 EX. USE: VACANT

CHAPMAN BROTHERS, LLC  
 PIN: 487-19-6082  
 TAX MAP: /35//14////A/  
 EX. USE: VACANT

TREE PRESERVATION AND SCENIC AREA (SEE NOTE 4, SHEET 5)

OLD DOMINION VALLEY HOA  
 PIN: 487-19-9637  
 TAX MAP: /35//J/2////G/  
 EX. USE: VACANT

OLD DOMINION VALLEY HOA  
 PIN: 488-49-4570  
 TAX MAP: /35//J/2////E/  
 EX. USE: OPEN SPACE

JAMES ALFRED & BARBARA T. MASON  
 PIN: 487-10-5817  
 TAX MAP: /36//////X/20/  
 EX. USE: COMMERCIAL/ INDUSTRIAL

BRENT H. MERCKE  
 PIN: 487-10-9228  
 TAX MAP: /36//////X/22/  
 EX. USE: COMMERCIAL/ INDUSTRIAL

BRENT H. MERCKE  
 PIN: 452-15-3658  
 TAX MAP: /36//////22/  
 EX. USE: COMMERCIAL/ INDUSTRIAL

BRANKO STUPAR, TRUSTEE  
 C/O MEGHAN RIXEY  
 PIN: 452-25-4468  
 TAX MAP: /36//////19A  
 EX. USE: VACANT

**SITE TABULATIONS**

Application Area: 13.72 AC  
 Existing Zoning: X (Transitional)  
 Proposed Zone: PDH-15 (Planned Development Housing)  
 Proposed Use: Multi-Family Residential

**PROPOSED PDH-15 REQUIREMENTS & TABULATIONS**

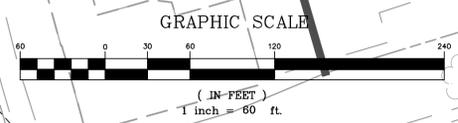
Maximum Permitted Density: 15 DU/1 AC (206 Units)  
 Proposed Density: 8.61 DU/1 AC (176 Max. Total Units)  
 Minimum District Size: 5.00 AC  
 Proposed District Size: 13.72 AC  
 Minimum Lot Size: None  
 Proposed Lot Size: 13.72 AC  
 Minimum Lot Width: None

Required Yards:	Required	Proposed
From public right-of-way:	35'	35'
From a private drive:	15'	≥15'
From side or rear property line:	25'	≥25'
Between buildings:	25'	≥25'
From major stream:	100'	≥100'

**Building Requirements:**  
 Maximum Lot Coverage: 40%  
 Proposed Lot Coverage: 12%  
 Maximum Building Height: 45'  
 Proposed Building Height: <45'

**Open Space Required:** 35% (4.80 Ac.)  
**Open Space Provided:** ≥35%

**Parking and Loading Requirements:**  
 Minimum Required Parking: 410 Spaces  
 (1.5 for one bedroom units x 30 Units, 2.5 for two and three bedroom units x 146 Units)  
 Provided Parking: 422 Spaces

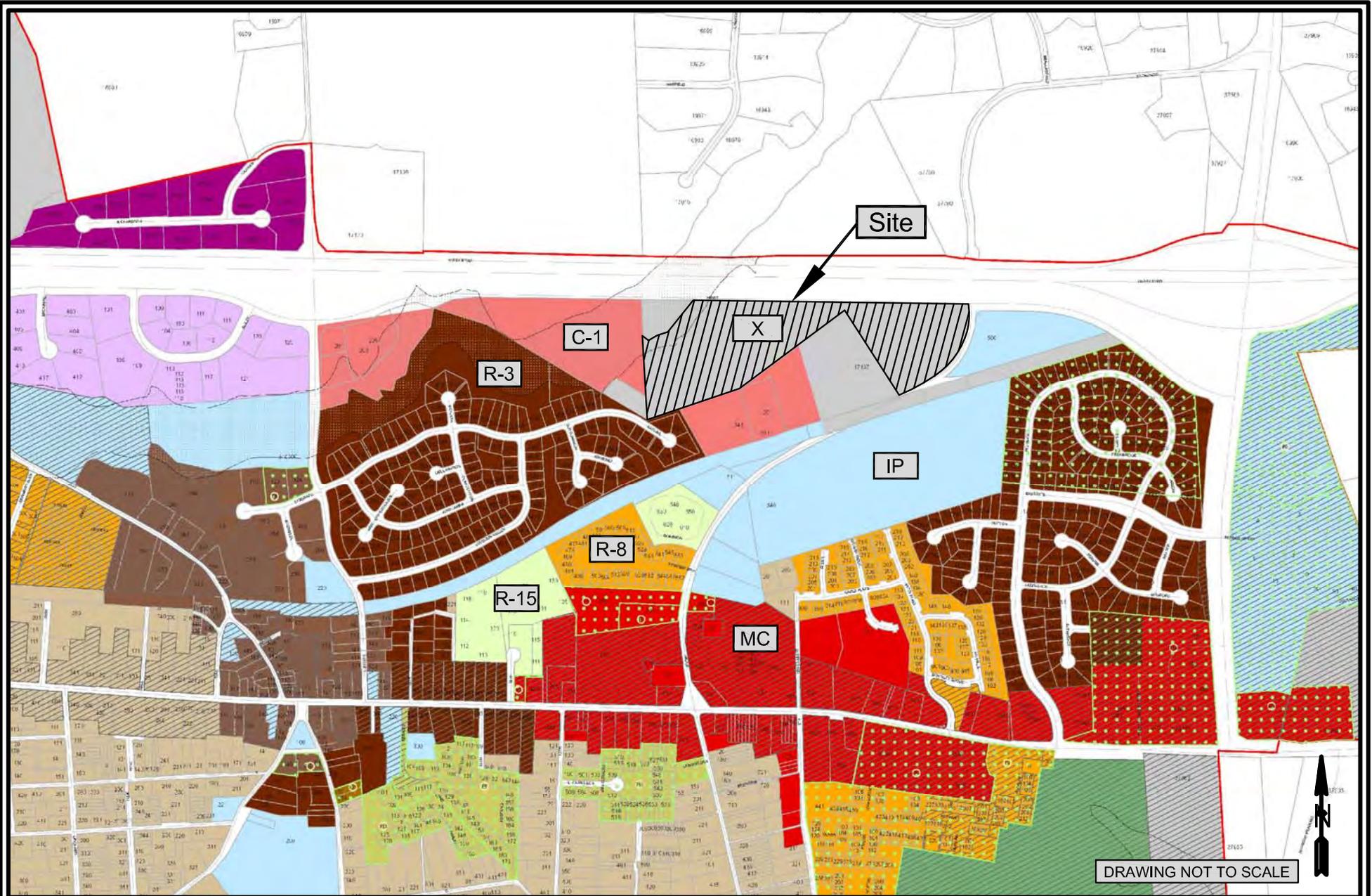


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CONCEPT DEVELOPMENT PLAN  
 CATOCTIN CREEK APARTMENTS  
 ZONING MAP AMENDMENT  
 & COMPREHENSIVE PLAN AMENDMENT  
 TOWN OF PURCELLVILLE, VIRGINIA

PLAN STATUS		
DATE	DESCRIPTION	
JAE DESIGN	JAE DRAWN	CMM CHKD
SCALE	H: 1"=60' V: 1"=25'	
JOB No.	5384-01-001	
DATE	AUGUST 31, 2012	
FILE No.	5384-D-ZP-001	
SHEET	4 OF 6	

Code file name: \\c:\p\new\_projects\5384 - Purcellville Town Center Apartments\5384-01-001 (PLAN) - Purcellville Town Center Apartments\Planning\Reconcept\_Development\_Plan.dwg



## 2.2. Proposed Land Uses and Zoning

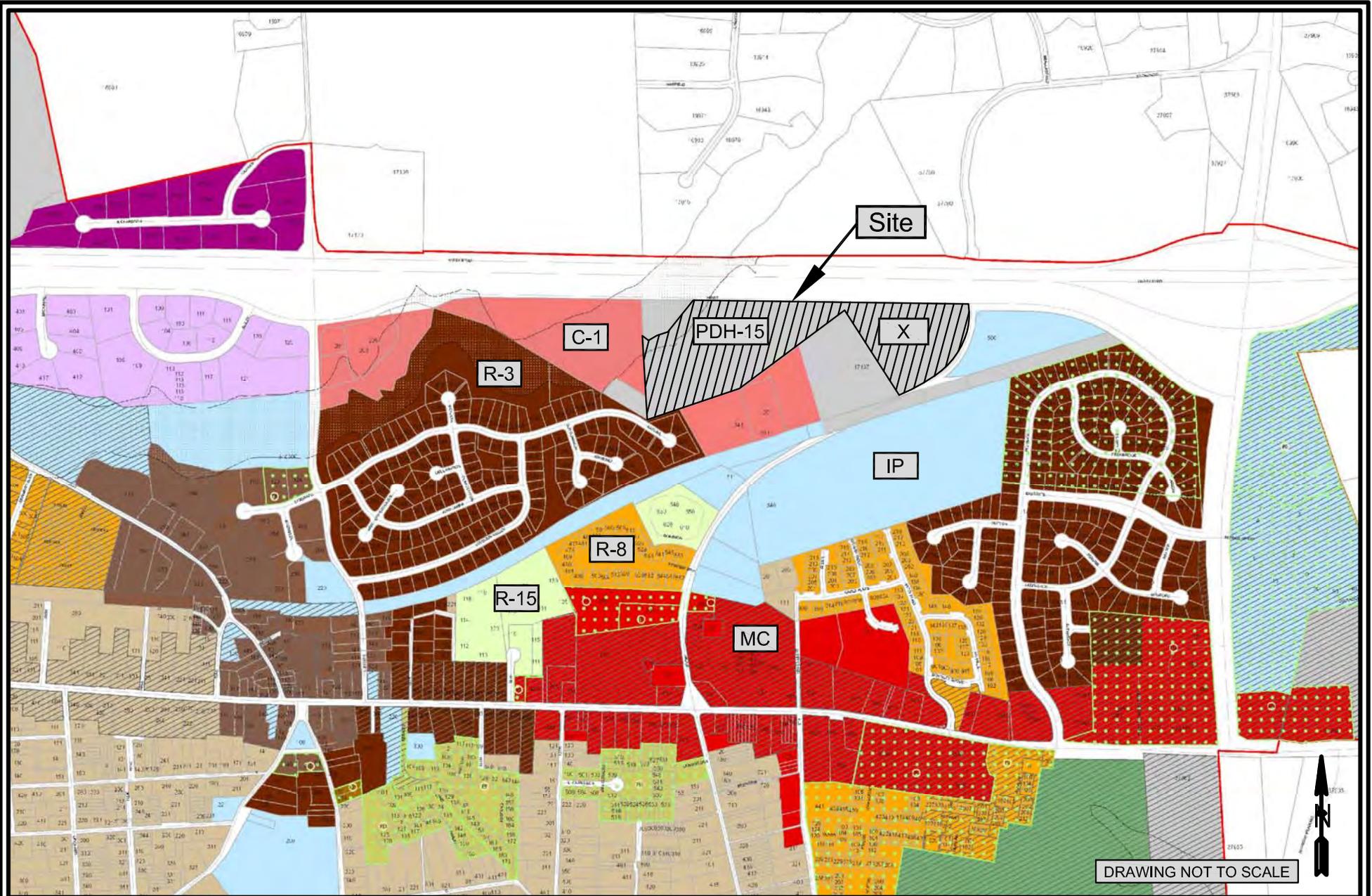
The Applicant is applying for a Comprehensive Plan Amendment for the entire 20.4 acre site and proposes residential multi-family and mixed use commercial land use designations for the site. The Applicant is also applying for a Zoning Map Amendment for 13.7 acres of the site (western portion) to rezone that portion to Planned Development Housing (PDH-15). The remaining 6.7 acres of the site will remain zoned Transitional (X) pending submission and approval of a future rezoning application. The proposed zoning is shown on Figure 5.

## 2.3. Existing Roadway Network

Regional access to the site would be provided via Berlin Turnpike (VA Route 287) and Main Street (VA Route 7 Business). Local access would be provided via Hirst Road (VA Route F962), Maple Avenue (VA Route 722), Hatcher Avenue (VA Route 611), and 21<sup>st</sup> Street North (VA Route 690).

Berlin Turnpike (VA Route 287) is a two lane undivided urban minor arterial roadway (VDOT Classification) with a posted speed limit of 45 mph that connects Main Street (VA Route 7 Business) to the south with VA Route 7 Bypass and Charles Town Pike (VA Route 9) to the north. According to the most recent VDOT data (2011), Berlin Turnpike carries approximately 5,200 vehicles per day in the vicinity of the site. Turn lanes are provided at some intersections and the intersection with Hirst Road is signalized. For purposes of this analysis, Berlin Turnpike was assumed to run north/south through the study area.

Main Street (VA Route 7 Business) is a variable two to three lane undivided urban minor arterial roadway (VDOT Classification) with a posted speed limit of 25 mph. Main Street connects Berlin Turnpike to the east with VA Route 7 Bypass to the west and provides east/west access through the Town of Purcellville. According to the most recent VDOT data (2011), Main Street carries approximately 10,000 vehicles per day in the vicinity of the site. Turn lanes are provided at some intersections and the intersections with Maple Avenue and Hatcher Avenue are



signalized. Sidewalks are provided along both sides of the street for the majority of the length of Main Street. For purposes of this analysis, Main Street was assumed to run east/west through the study area.

Hirst Road (Route F962) is a two lane undivided local roadway (VDOT Classification) that serves as a frontage road along VA Route 7 Bypass. Hirst Road has a posted speed limit of 45 miles per hour and connects Berlin Turnpike to the east with 21<sup>st</sup> Street North to the west. VDOT does not have any historic traffic data for Hirst Road. The Washington and Old Dominion Trail (W&OD), which is a multi-use paved recreational trail described in section 2.4 below, crosses Hirst Road approximately 900 feet west of the intersection with Berlin Turnpike. For purposes of this analysis, Hirst Road was assumed to run east/west through the study area.

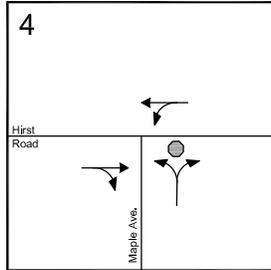
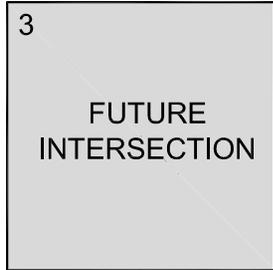
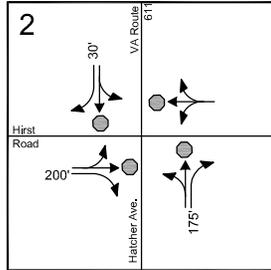
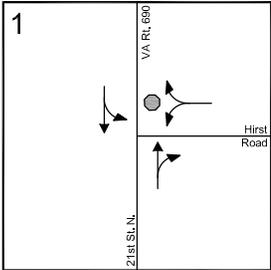
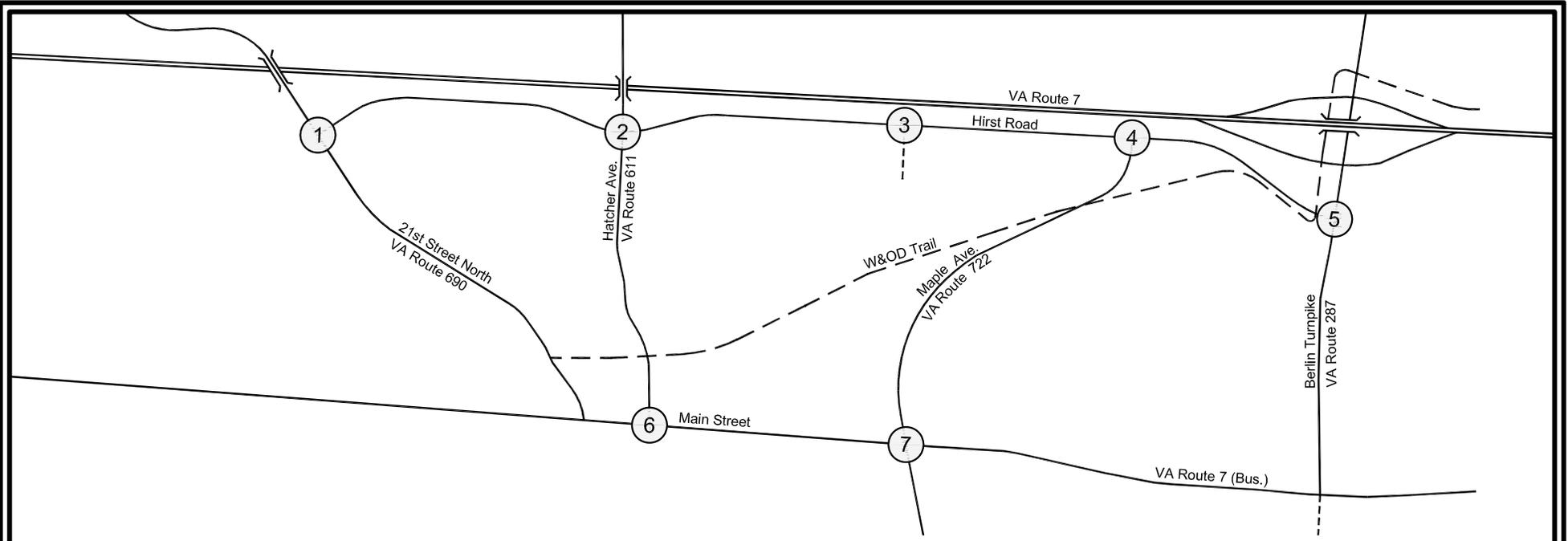
Maple Avenue (VA Route 722) is a variable two to three lane undivided local roadway (VDOT Classification) with a posted speed limit of 25 mph. Maple Avenue connects Hirst Road to the north with Main Street to the south before becoming Lincoln Road. Turn lanes are provided at some intersections and the intersection with Main Street is signalized. Maple Avenue provides access to Loudoun Valley High School and the W&OD trail crosses Maple Avenue approximately 1,100 feet south of the intersection with Hirst Road. A sidewalk is provided along one side of Maple Avenue from Main Street to Loudoun Valley High School. According to the most recent VDOT data (2011), Maple Avenue carries approximately 4,900 vehicles per day south of Loudoun Valley High School and 1,200 vehicles per day north of the school. For purposes of this analysis, Maple Avenue was assumed to run north/south through the study area.

Hatcher Avenue (VA Route 611) is a two lane undivided urban collector roadway (VDOT Classification) with a posted speed limit of 25 mph. Hatcher Avenue connects Main Street to the south with Hirst Road to the north before becoming Purcellville Road and continuing on to VA Route 9. Turn lanes are provided at some intersections and the intersection with Main Street is signalized. The W&OD

trail crosses Hatcher Avenue approximately 650 feet north of the intersection with Main Street. Sidewalks are provided along one or both sides of Hatcher Avenue for the majority of the roadway length within the Town. According to the most recent VDOT data (2011), Hatcher Avenue carries approximately 5,200 vehicles per day in the vicinity of the site. For purposes of this analysis, Hatcher Avenue was assumed to run north/south through the study area.

21<sup>st</sup> Street North (VA Route 690) is a two lane undivided urban minor arterial collector roadway (VDOT Classification) with a posted speed limit of 25 mph. 21<sup>st</sup> Street North connects Main Street to the south with Hirst Road to the north before becoming Hillsboro Road and continuing on to VA Route 9. Turn lanes are provided at some intersections and the intersection with Main Street is signalized. The W&OD trail terminates at 21<sup>st</sup> Street North approximately 800 feet north of the intersection with Main Street. Sidewalks are provided along one or both sides of 21<sup>st</sup> Street North from Main Street to the intersection with the W&OD Trail. According to the most recent VDOT data (2011), 21<sup>st</sup> Street North carries approximately 2,300 vehicles per day in the vicinity of the site. For purposes of this analysis, 21<sup>st</sup> Street North was assumed to run north/south through the study area.

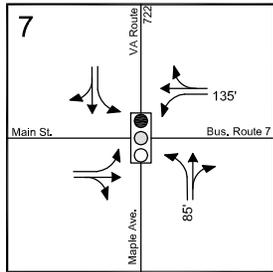
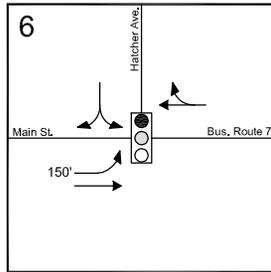
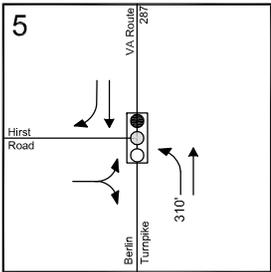
Existing lane configurations (number of traffic lanes on the intersection approaches), storage lane lengths, and other intersection and roadway information within the study area were collected through field reconnaissance and are shown on Figure 6.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- Full Width Storage



**Existing Lane Use and Traffic Control**  
 Catoctin Creek Apartments  
 Purcellville, Virginia

**Figure 6**  
 Job # 5384-01-001  
 12

## 2.4. Other Modes of Transportation

This study also reviews the potential for walking, bicycling, and transit trips to and from the area.

Sidewalks – There are sidewalks along at least one side of Main Street, Maple Avenue, Hatcher Avenue, and 21<sup>st</sup> Street North in the vicinity of the site. There are no sidewalks along Berlin Turnpike or Hirst Road. The 2009 Townwide Transportation Plan calls for future sidewalks along 21<sup>st</sup> North from the W&OD trail north to Hirst Road and along Maple Avenue from the high school north to Hirst Road.

On-Street Bicycling Facilities – Currently, there are no bicycling facilities on any of the roadways in the vicinity of the site and the 2009 Townwide Transportation Plan does not call for any future on-street facilities on the study roadways.

Washington and Old Dominion Trail (W&OD Trail) – the W&OD trail is a paved, two-lane, shared use path that originates in Purcellville near the intersection of 21<sup>st</sup> Street North and 23<sup>rd</sup> Street North. The path generally follows the east-west alignment of VA Route 7 in Loudoun County and travels 45 miles from Purcellville east to Arlington County. The trail is frequently used both for recreation and commuting purposes. The W&OD Trail has at-grade crossings of Hatcher Avenue, Maple Avenue, and Hirst Road and connects to the sidewalk network at Hatcher Avenue and 21<sup>st</sup> Street North.

While it is possible that trips to/from the site could be made via walking or biking, in order to be conservative, no trip reduction was applied for walking or biking in this study.

Transit Facilities – The Town of Purcellville is served by two separate bus services that offer local and regional routes. The Virginia Regional Transit (VRT) operates service from several stops within Purcellville to the Loudoun County Government

Center in Leesburg which serves as a hub for other bus routes. The closest stop to the site is located at the Giant Grocery Store (1000 East Main Street) which is approximately 1.25 miles from the site via the W&OD Trail and sidewalks on Maple Avenue and Main Street.

The Loudoun County Transit Commuter bus offers service from Purcellville to various destinations (Rosslyn, Crystal City, The Pentagon, Washington, D.C.) in the Washington D.C. area. The Purcellville stop is located at St. Andrew Presbyterian Church (711 West Main Street) which is approximately 1.75 miles from the site via the W&OD Trail, 21<sup>st</sup> North, and Main Street. A significant portion of the Main Street portion does not have sidewalks.

Given the distance from the transit stops to the site, it is unlikely that a significant portion of trips would be made exclusively via transit. Therefore, no reduction for transit trips was taken in this study.

## **2.5. Future Roadway Network and Improvements**

At the time of this analysis, there are no known committed or funded improvements to any of the study intersections.

On a more regional basis, the Southern Collector Roadway is under construction and is expected to be completed in Summer 2013. When finished, the road will connect William T. Druham Boulevard to Berlin Turnpike and form the fourth leg of the roundabout at the Berlin Turnpike/Main Street intersection. This improvement is expected to divert some of the existing traffic along Main Street.

The analysis indicates that **without** the buildout of the Catoclin Creek Apartments development, traffic conditions would necessitate multiple improvements to the study intersections in 2014 and 2020. These improvements include the following:

### In 2014:

- Separate westbound left turn lane at the Hirst Road/Hatcher Avenue intersection.

- Separate northbound left turn lane at the Hirst Road/Maple Avenue intersection.
- Separate eastbound left turn lane at the Hirst Road/Berlin Turnpike intersection with associated traffic signal modifications. The applicant will provide a monetary contribution towards the completion of these improvements.

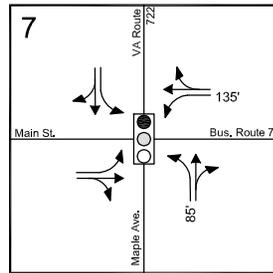
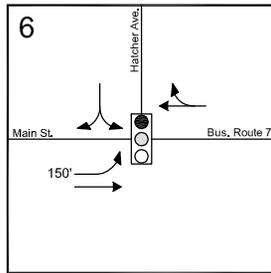
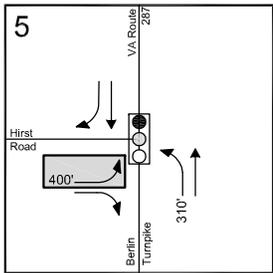
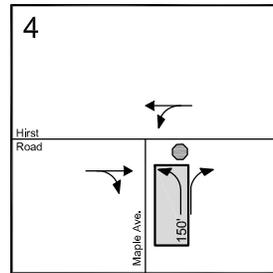
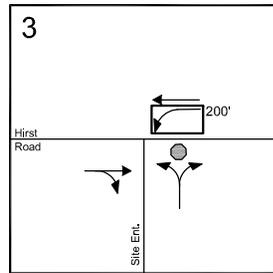
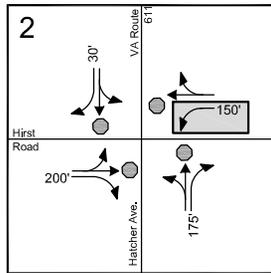
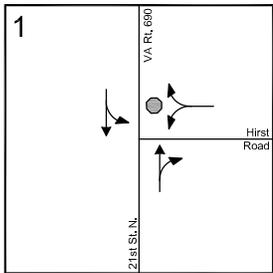
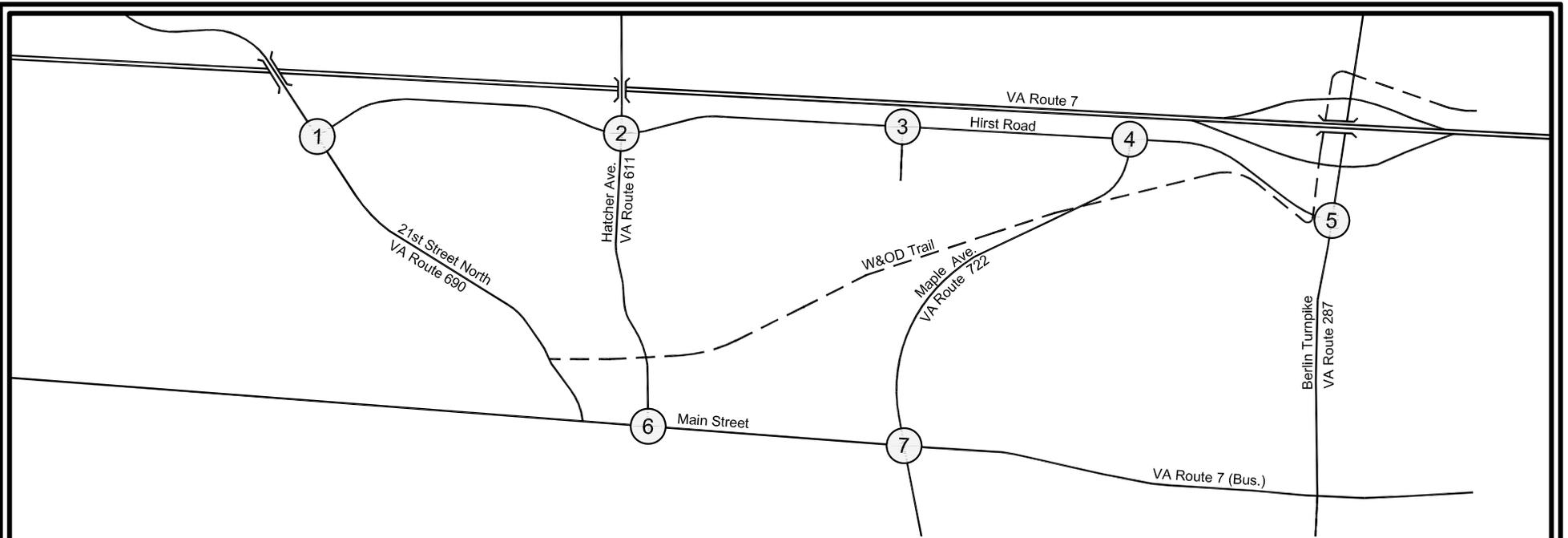
In 2020 (in addition to the 2014 improvements noted above):

- Separate westbound left turn lane at the Hirst Road/21<sup>St</sup> Street North intersection
- As recommended in the Route 7 Bypass and Route 287 Interchange Study, a free-flow southbound right turn lane, second northbound through lane, and conversion of the eastbound right turn lane to a shared left-right at the Hirst Road/Berlin Turnpike Intersection.

These improved are necessitated by the existing traffic, assumed 2.0%/year background traffic growth rate and the other approved developments in the study area. These improvements would be required regardless of the development of the Catoctin Creek Apartments project.

With development of the Catoctin Creek Apartments project, the Applicant is committed to constructing turn lanes at the site entrance if and when warranted by the Town.

Figure 7 shows the Future Lane Use and Traffic Control in 2014 with all the improvements noted above. The Recommended Lane Use and Traffic Control (2020) is shown later in the report of Figure 22.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Full Width Storage
- Background Improvements (By Others)
- Site Improvements



## 2.6. Geographic Scope and Limits of Study Area

Based on the pre-scope of work meeting held with VDOT and Town of Purcellville staff, the scope of the study was agreed upon and is summarized in the signed pre-scope of work forms included in Appendix A.

As a result, the following intersections were identified to be studied in this analysis:

1. Hirst Road (VA Route F962)/21<sup>st</sup> Street North (VA Route 690)
2. Hirst Road (VA Route F962)/Hatcher Avenue (VA Route 611)
3. Hirst Road (VA Route F962)/Site Entrance
4. Hirst Road (VA Route F962)/Maple Avenue (VA Route 722)
5. Hirst Road (VA Route F962)/Berlin Turnpike (VA Route 287)
6. Main Street (VA Route 7 Business)/Hatcher Avenue (VA Route 611)
7. Main Street (VA Route 7 Business)/Maple Avenue (VA Route 722)

## 2.7. Scenario Scope

Based on the pre-scope of work meeting, the following scenarios were identified to be studied with this report:

- Existing (2012) conditions
- 2014 Background Future Conditions (consists of existing traffic, 2.0% growth in existing traffic compounded annually over 2 years, and partial development of other approved but unbuilt developments as discussed in section 4)
- 2014 Total Future Conditions (consists of existing traffic, 2.0% growth in existing traffic compounded annually over 2 years, partial development of other approved but unbuilt developments as discussed in section 4, and buildout of the residential portion only of the proposed Catoctin Creek Apartments Development)
- 2020 Background Future Conditions (consists of existing traffic, 2.0% growth in existing traffic compounded annually over 8 years, and complete buildout of other approved but unbuilt developments as discussed in section 4)

- 2020 (Buildout plus six years) Total Future Conditions (consists of existing traffic, 2.0% growth in existing traffic compounded annually over 8 years, complete buildout of other approved but unbuilt developments as discussed in section 4, and buildout of the residential and commercial portions of the proposed Catoctin Creek Apartments Development).

The development of the commercial portion is purely speculative, would require a separate rezoning, and is included for informational purposes only at the request of the Town. For purposes of this analysis, the commercial portion (6.71 acres) was assumed to be developed at a FAR of 0.2 which yields approximately 60,000 S.F. of commercial space.

## **2.8. Traffic Analysis Procedure**

The study intersections were analyzed for each scenario using the 2000 Highway Capacity Manual (HCM) methodologies using the computer software package Synchro 7 with SimTraffic. 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 1 shows the LOS for intersections as defined by the HCM.

**Table 1 - HCM Level of Service Criteria**

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 1 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 95<sup>th</sup> percentile queues. 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.

## **2.9. Traffic Analysis Software Inputs**

Signal timing data for existing intersections was provided by VDOT and is included in Appendix B. All signal timings and offsets were optimized under future conditions with and without the development. In accordance with the scoping agreement, data collected in the field was used to input the peak hour factor and heavy vehicle percentage for the existing conditions analysis only. All future scenarios use the default peak hour factor of 0.92, heavy vehicle percentage of 2%, and optimized cycle lengths and splits. All other software defaults remain unchanged.

### **3. EXISTING TRAFFIC CONDITIONS (2012)**

#### **3.1. Existing Peak Hour Traffic Counts**

Existing peak hour turning movement traffic counts were conducted by Bowman Consulting at each of the existing study intersections in May and October, 2012 when public schools were in session. The counts were conducted on a typical weekday from 7:00 to 9:00 AM and 4:00 to 6:00 PM.

The raw traffic data is included in Appendix C and is summarized on Figure 8. The counts were balanced as necessary, and Figure 8 shows the AM and PM peak hour counts. Estimates of the Average Daily Traffic (ADT) as published in the most recent VDOT data (2011) are also included on Figure 8 for select road segments.

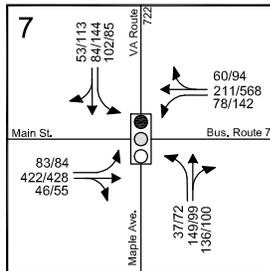
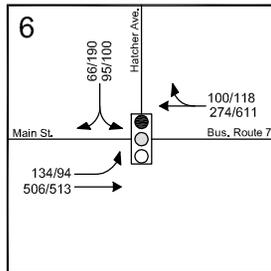
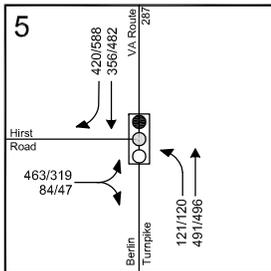
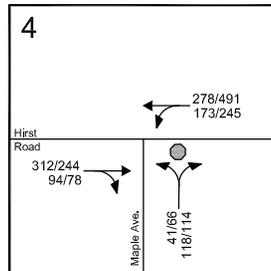
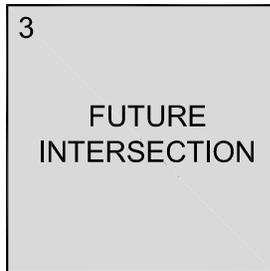
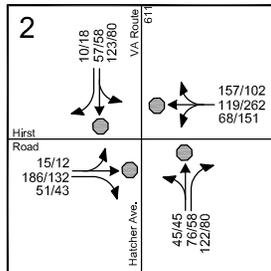
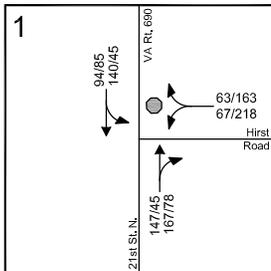
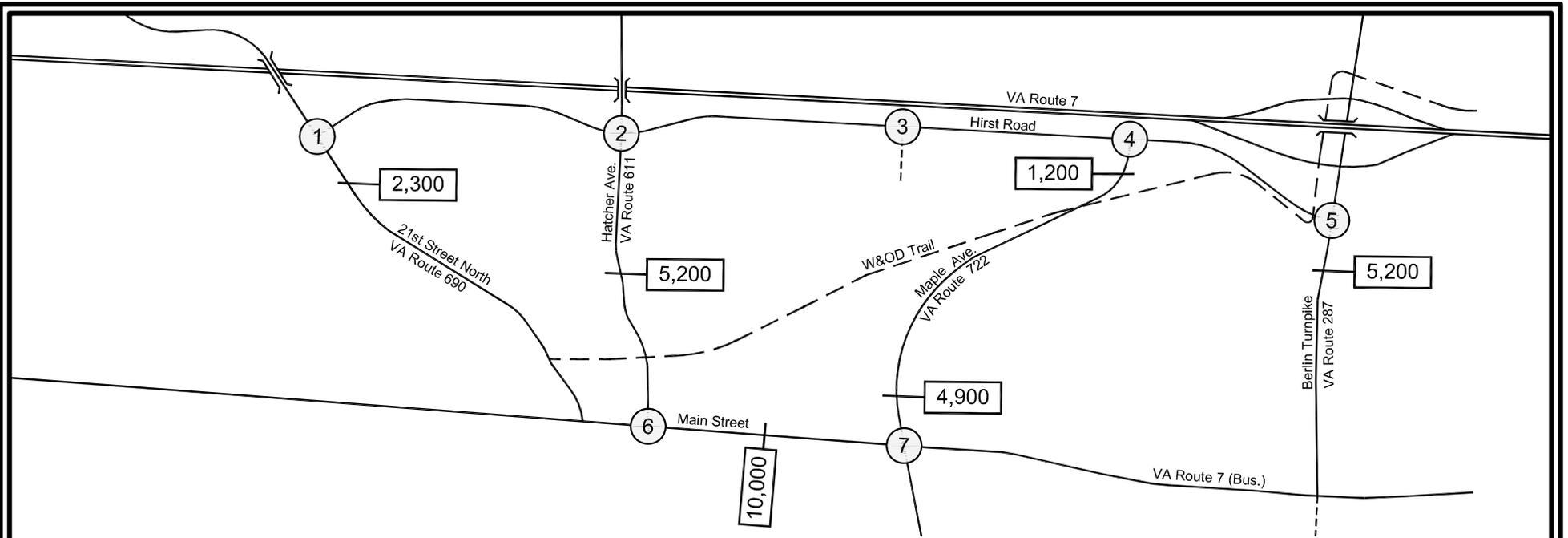
#### **3.2. Analysis of Existing Peak Hour Traffic Conditions**

The analysis of existing peak hour traffic conditions was based on the analysis procedures described above, the existing lane use and traffic control shown on Figure 6 and the existing peak hour traffic counts shown on Figure 8.

The calculation worksheets are included in Appendix D and the results of the analysis are summarized in Table 2 and shown graphically on Figure 9. Table 2 also indicates the assumed direction of each roadway at the intersection.

As shown in Table 2, each of the intersections and approaches currently operate at overall LOS "D" or better during each of the peak hours with the following exceptions:

- The westbound shared left-through-right approach to the Hirst Road/Hatcher Avenue intersection (Study Intersection # 2) currently operates at LOS "E" and "F" during the AM and PM peak hours, respectively.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT) (VDOT 2011 Data)



**Table 2 – Analysis Summary of Existing Peak Hour Conditions**

Intersection	Control	Lane Group	Available Storage <sup>(1)</sup> (ft)	Existing, 2012					
				AM Peak Hour			PM Peak Hour		
				Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)
1. Hirst Road (E-W)/ 21 <sup>st</sup> Street North (N-S)	Stop	SBTL	~	A	6.2	16	A	3.2	4
		WBLR	~	D	25.7	71	C	23.1	146
2. Hirst Road (E-W)/ Hatcher Avenue (N-S) <sup>(3)</sup>	Stop	NBTL	~	B	14.6	80	B	12.5	68
		NBR	175	B	11.8	61	B	10.4	49
		SBTL	~	C	20.6	91	B	14.9	76
		SBR	30	A	9.3	36	A	8.9	47
		EBTL	~	C	17.3	87	B	12.3	78
		EBR	200	A	9.9	49	A	9.2	42
		WBLTR	~	E	44.8	125	F	90.6	233
3. Hirst Road (E-W)/ Site Entrance (N-S)	Stop	NBLR	~	-	-	-	-	-	-
		WBTL	~	-	-	-	-	-	-
4. Hirst Road (E-W)/ Maple Avenue (N-S)	Stop	NBLR	~	D	29.8	117	F	79.0	196
		WBTL	~	A	4.6	17	A	5.4	24
5. Hirst Road (E-W)/ Berlin Turnpike (N-S)	Signal	NBL	310	A	9.1	232	B	11.6	65
		NBT	~	B	10.8	247	B	11.8	293
		SBT	~	C	20.0	26	C	21.2	424
		SBR	~	B	17.5	#807	B	19.3	55
		EBLR	~	F	<u>433.0</u>	<u>50</u>	F	<u>129.4</u>	<u>#662</u>
		<b>Overall Intersection</b>			<b>F</b>	<b>131.5</b>		<b>D</b>	<b>37.7</b>
6. Main Street (E-W)/ Hatcher Avenue	Signal	SBLR	~	C	25.6	116	C	30.9	191
		EBL	150	A	7.5	55	B	14.8	46
		EBT	~	A	9.5	237	A	9.7	274
		WBTL	~	C	<u>21.5</u>	<u>282</u>	D	<u>48.4</u>	<u>#748</u>
<b>Overall Intersection</b>			<b>B</b>	<b>15.5</b>		<b>C</b>	<b>30.6</b>		
7. Main Street (E-W)/ Maple Avenue (N-S)	Signal	NBL	85	D	36.9	53	D	38.3	#132
		NBTR	~	D	49.5	281	D	35.2	229
		SBL	~	F	90.4	180	D	35.3	121
		SBTR	~	D	39.1	162	D	43.1	262
		EBL	~	B	19.4	84	B	16.9	40
		EBT	~	D	40.6	694	C	25.5	364
		WBL	135	C	21.2	77	B	13.5	64
		WBTR	~	C	<u>27.4</u>	<u>345</u>	C	<u>30.5</u>	<u>570</u>
<b>Overall Intersection</b>			<b>D</b>	<b>40.9</b>		<b>C</b>	<b>30.3</b>		

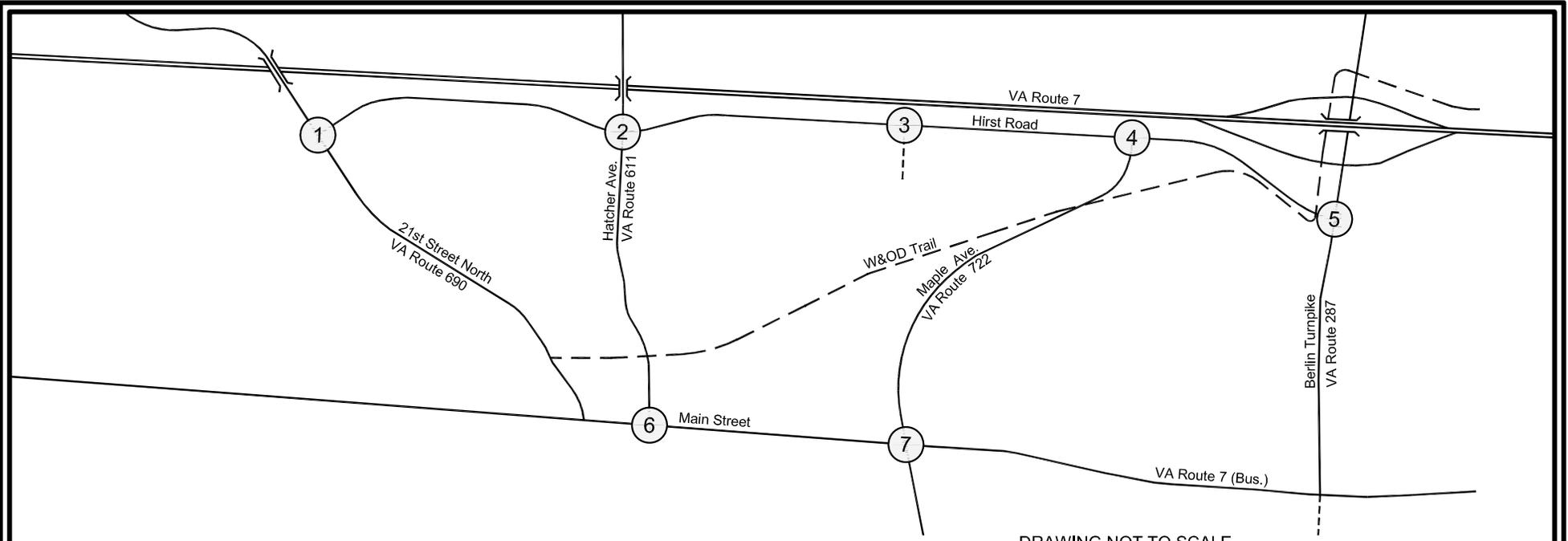
Notes:

(1) ~ Indicates a continuous lane.

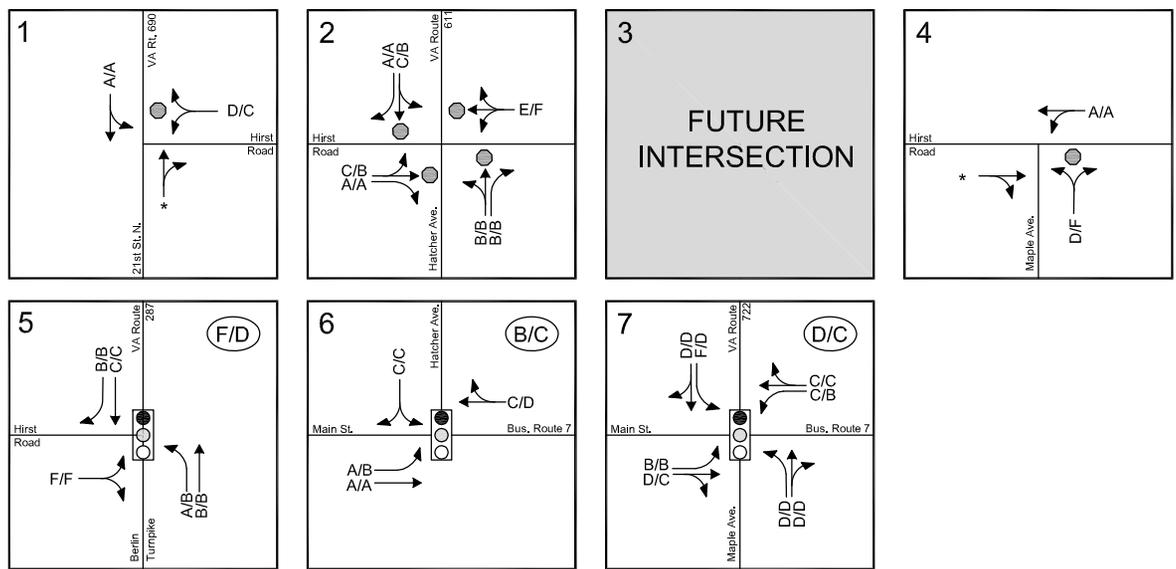
(2) Queues are 95th percentile queues as reported by Synchro.

(3) Queues for this intersection only are 95th percentile queues as reported by SimTraffic as Synchro cannot model queues for all way stop control.

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



DRAWING NOT TO SCALE



**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- X/X AM/PM Peak Hour Level of Service
- (X/X) Overall Intersection Level of Service
- \* Free Flow Condition



**Existing Peak Hour Levels of Service (2012)**  
 Catoclin Creek Apartments  
 Purcellville, Virginia

**Figure 9**  
 Job # 5384-01-001  
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- The northbound shared left-right approach to the Hirst Road/Maple Avenue (Study Intersection #4) intersection currently operates at LOS “F” during the PM peak hour.
- The Hirst Road/Berlin Turnpike intersection (Study Intersection #5) currently operates at an overall LOS “F” during the AM peak hour with the eastbound shared left-right approach operating at LOS “F” during both the AM and PM peak hours.
- The southbound left turn lane at the Main Street/Maple Avenue intersection currently operates at LOS “F” during the AM peak hour.

As shown in Table 2, each of the 95<sup>th</sup> percentile queues are adequately contained within the available storage.

#### **4. BACKGROUND FUTURE TRAFFIC CONDITIONS (2014)**

In order to analyze future traffic conditions, without the development of the proposed Catoclin Creek Apartments project, background traffic conditions were forecasted based on the existing traffic counts, the existing traffic that would divert, or change paths, to use the Southern Collector, other proposed but unbuilt developments in the area, and historic traffic growth.

##### **4.1. Southern Collector Roadway Diversions**

The Southern Collector Roadway is under construction and anticipated to be finished by summer 2013. When complete, the road will connect William T. Druham Boulevard to Berlin Turnpike and form the fourth leg of the roundabout at the Berlin Turnpike/Main Street intersection.

In order to account for traffic that would utilize the new roadway, existing traffic diversions were developed based on information contained in the “Route 7 Bypass and Route 287 Interchange Study” prepared by HNTB and dated August 21, 2012. The HNTB references other recently approved traffic studies (“Catoclin Corner Revised Traffic Impact Analysis” prepared by PHR+A and dated May 28, 2010)

which assume a 48% reduction in existing traffic for the eastbound approach to the Main Street/Berlin Turnpike intersection.

Since the Southern Collector will connect Berlin Turnpike with William T. Druham Boulevard and eventually Maple Avenue, it is reasonable to assume that some existing traffic at the Main Street/Maple Avenue would divert from the existing path to utilize the Southern Collector.

Based on the HNTB study, it was assumed that 48% of the existing northbound right and westbound left turn traffic would divert and use the Southern Collector. These diversions are shown on Figure 10.

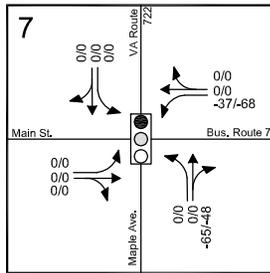
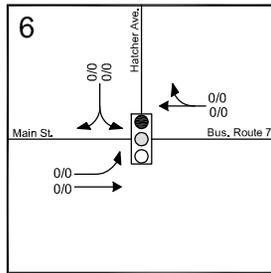
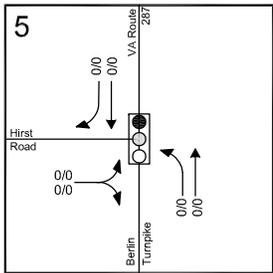
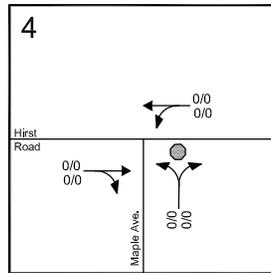
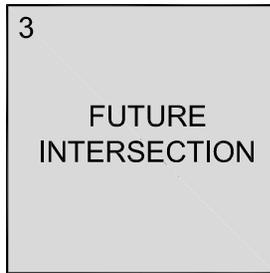
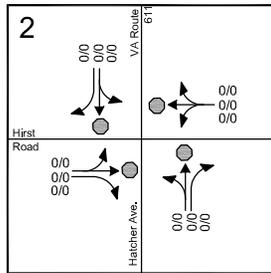
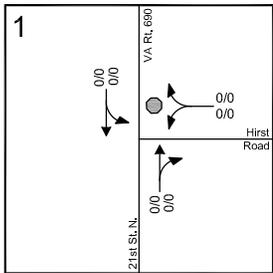
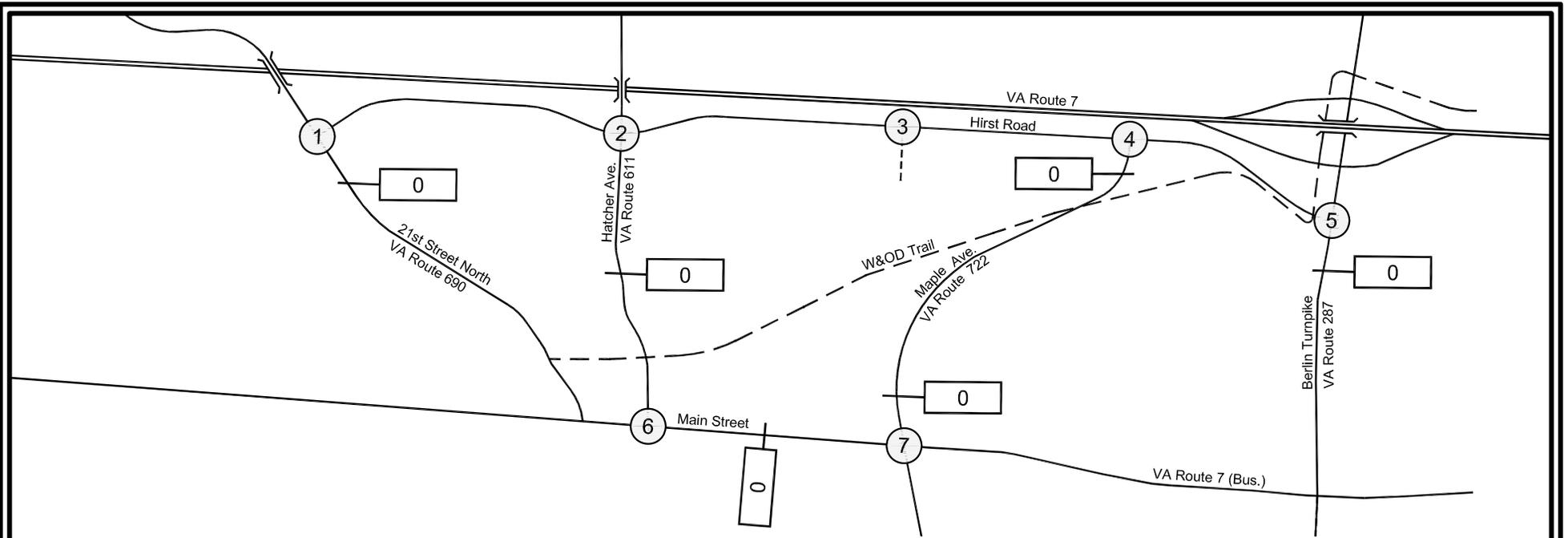
#### **4.2. Other Developments**

In accordance with the scoping agreement, there are four other developments in the vicinity of the site. These developments include:

1. Catoctin Corner – 48,900 S.F. of commercial space
2. Purcellville Gateway – partially built in 2012. At full buildout, the development would include an additional 27,500 S.F. of retail space, 22,000 S.F. of office space, and 6 single family dwelling units.
3. Loudoun Valley Shopping Center – Phase I is built and occupied. Phase II would add an additional 60,815 S.F. of commercial space.
4. Patrick Henry College – expansion to include facilities for 700 additional students.

In accordance with the scoping agreement, 35% of Catoctin Corner (17,115) and all retail/office space (no residential) at Purcellville Gateway was assumed to be built and occupied by 2014. The remainder of the developments were assumed to be complete and occupied by 2020.

The location of the other developments is shown on Figure 11 and the trips that would be generated by the 2014 levels of development are shown in Table 3.

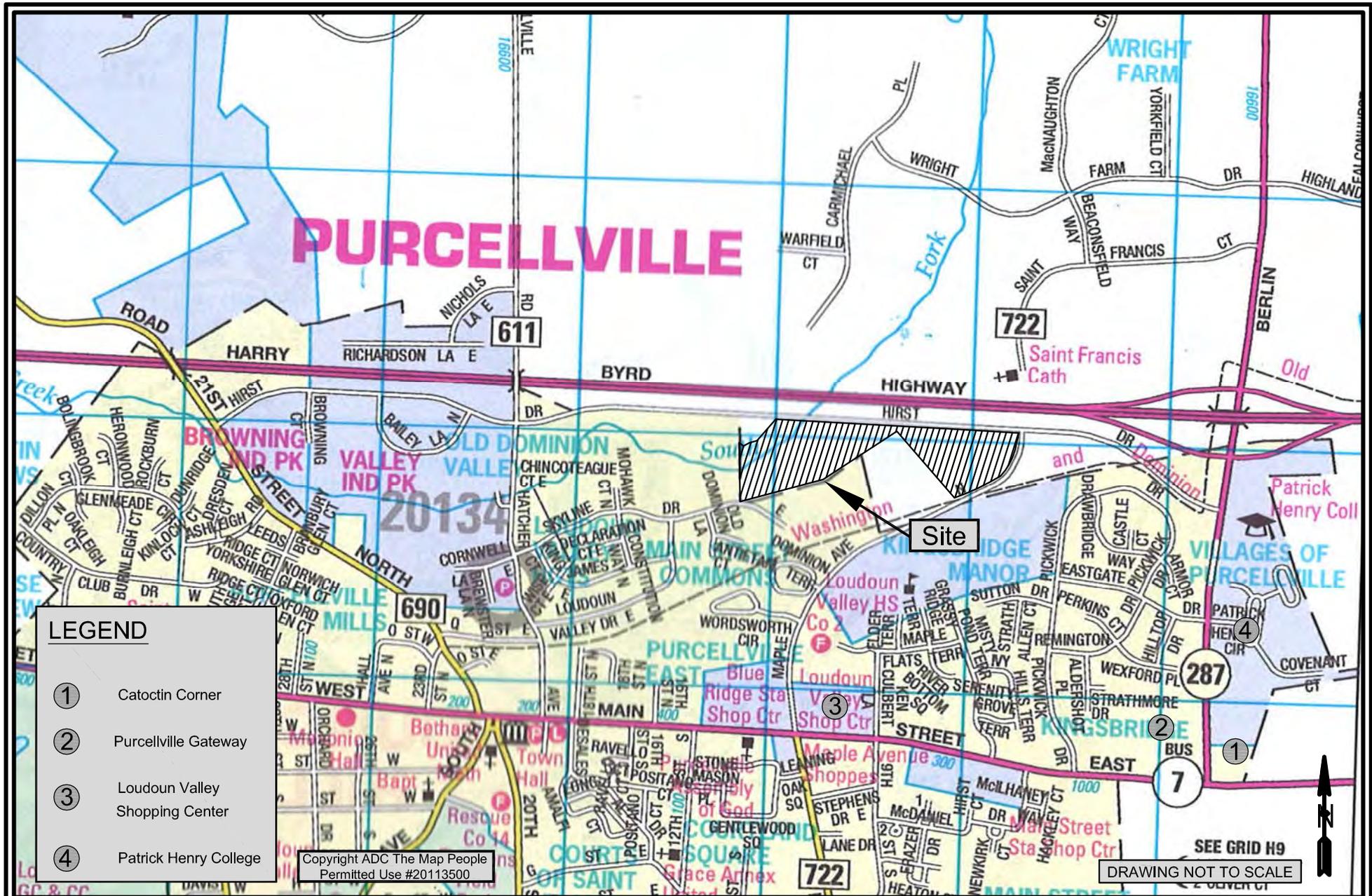


DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)





**LEGEND**

- ① Catoctin Corner
- ② Purcellville Gateway
- ③ Loudoun Valley Shopping Center
- ④ Patrick Henry College

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**Location of Other Developments**  
Catoctin Creek Apartments  
Purcellville, Virginia

**Figure 11**

Job # 5384-01-001

**Table 3 – Other Development Trip Generation Analysis (2014)**

Land Use	Size	Units	Land Use Code	Weekday						
				AM Peak Hour			PM Peak Hour			Daily Trips
				In	Out	Total	In	Out	Total	
<b>Background Developments -2014</b>										
<u>Catoctin Corner<sup>(1)</sup></u>										
Commercial	17,115 S.F.			85	76	161	141	129	270	2,975
<u>Purcellville Gateway<sup>(2)</sup></u>										
Retail	27,500 S.F.			98	79	177	214	201	415	3,699
Office	22,000 S.F.		710	49	7	56	18	85	103	416
<i>Total Purcellville Gateway Trips</i>				147	86	233	232	286	518	4,115
<b>Total Background Development Trips - 2014</b>				<b>232</b>	<b>162</b>	<b>394</b>	<b>373</b>	<b>415</b>	<b>788</b>	<b>7,090</b>

Notes: (1) Assumes 35% Development by 2014. Trip generation taken from Table 6B of "Catoctin Corner Revised Traffic Impact Analysis" prepared by PHR+A dated May 28,2010. Table 6B trips were multiplied by 35% for assumed 2014 levels.

(2) Retail portion of development under construction at time of existing traffic counts. Grocery store and 4/14 of retail stores (28.6 % or 11,000 S.F.) were open at time of existing traffic counts. 2014 Development levels assume completion of remainder of retail (71.4% or 27,500 S.F.) and all office (22,000 S.F.) Trips taken from Table 3-2 in Appendix K of "Loudoun Valley Shopping Center Traffic Impact Analysis" prepared by Wells + Associates dated May 21, 2010.

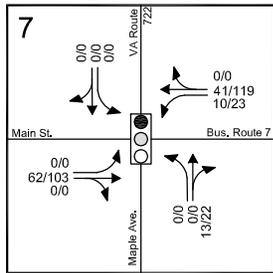
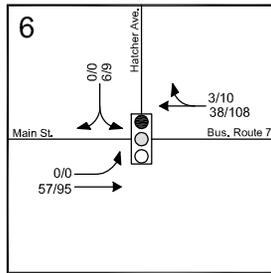
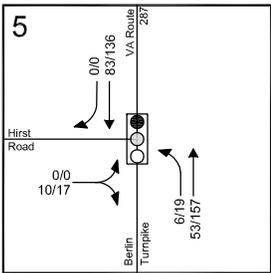
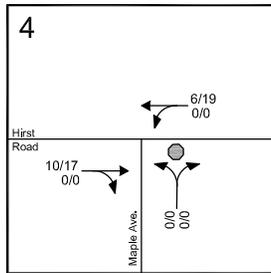
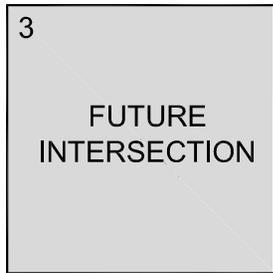
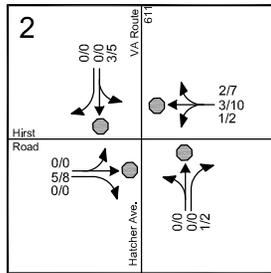
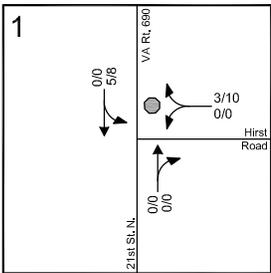
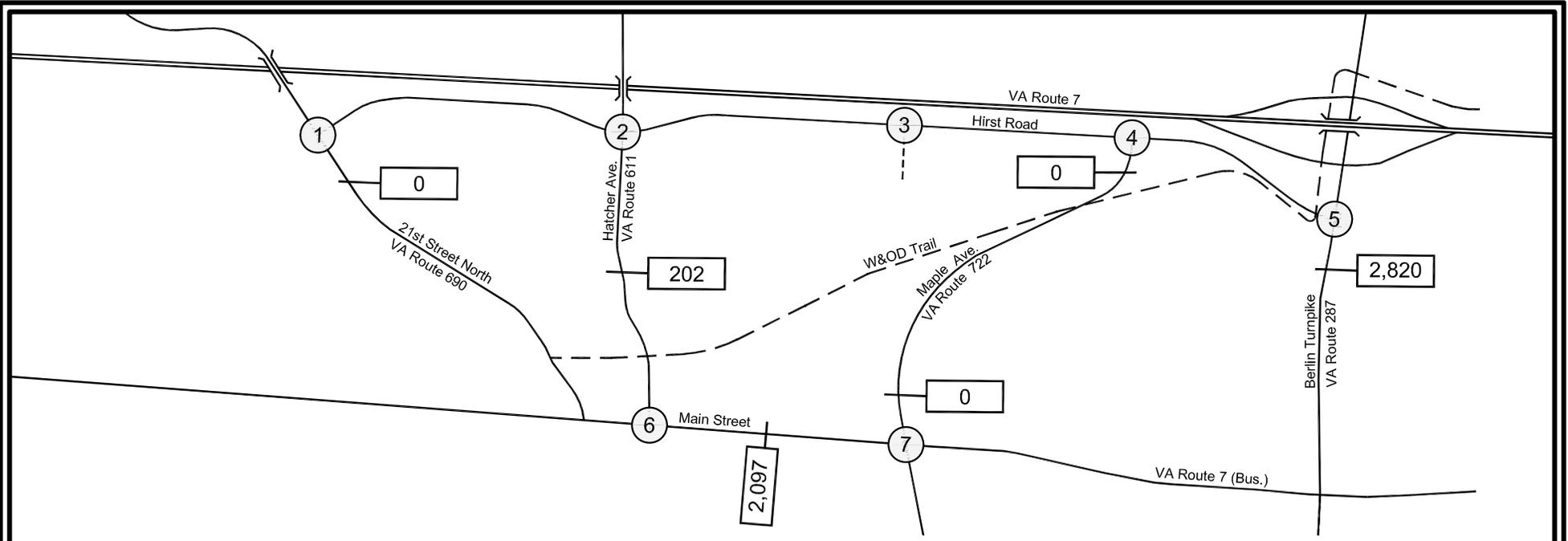
**4.3. Other Development Trip Distribution and Assignment**

The trips that would be generated by the other developments were taken directly from their respective traffic studies as indicated in the footnotes of Table 3. The traffic assignments for each development are shown in Appendix E and summed on Figure 12.

**4.4. Background Traffic Growth**

In order to account for development outside of the study area, a background traffic growth rate of 2% per year, compounded annually, was agreed upon in the scoping agreement.

In order to determine 2014 traffic conditions, the annual 2.0% growth rate was compounded annually for the two-year period from the date of the existing counts. Background traffic growth was, therefore, estimated at 4.04% for the 2014 scenario. This growth rate was applied to all movements on the roadways.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



**Other Development Traffic  
Assignments (2014)**  
Catoctin Creek Apartments  
Purcellville, Virginia

**Figure 12**

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Job # 5384-01-001

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#### **4.5. 2014 Background Future Traffic Forecasts (without Development)**

The background traffic growth discussed above was then added to the Existing Traffic Counts shown on Figure 8, the Existing Traffic Diversions shown on Figure 10, and the Other Development Traffic Assignments (2014) shown on Figure 12 to yield the 2014 Total Background Traffic Forecasts (2014). These forecasts are shown on Figure 13 and show the AM and PM peak hour forecasts as well as the weekday ADT (rounded to the nearest 100).

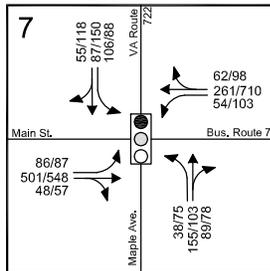
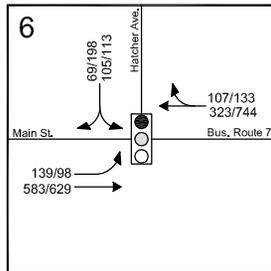
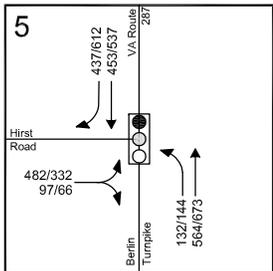
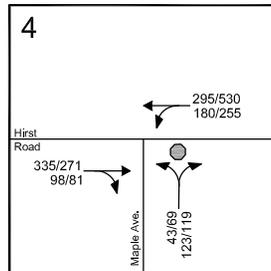
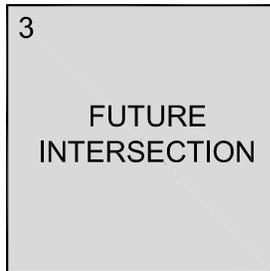
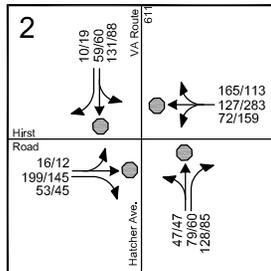
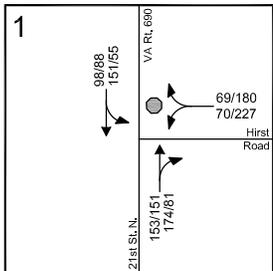
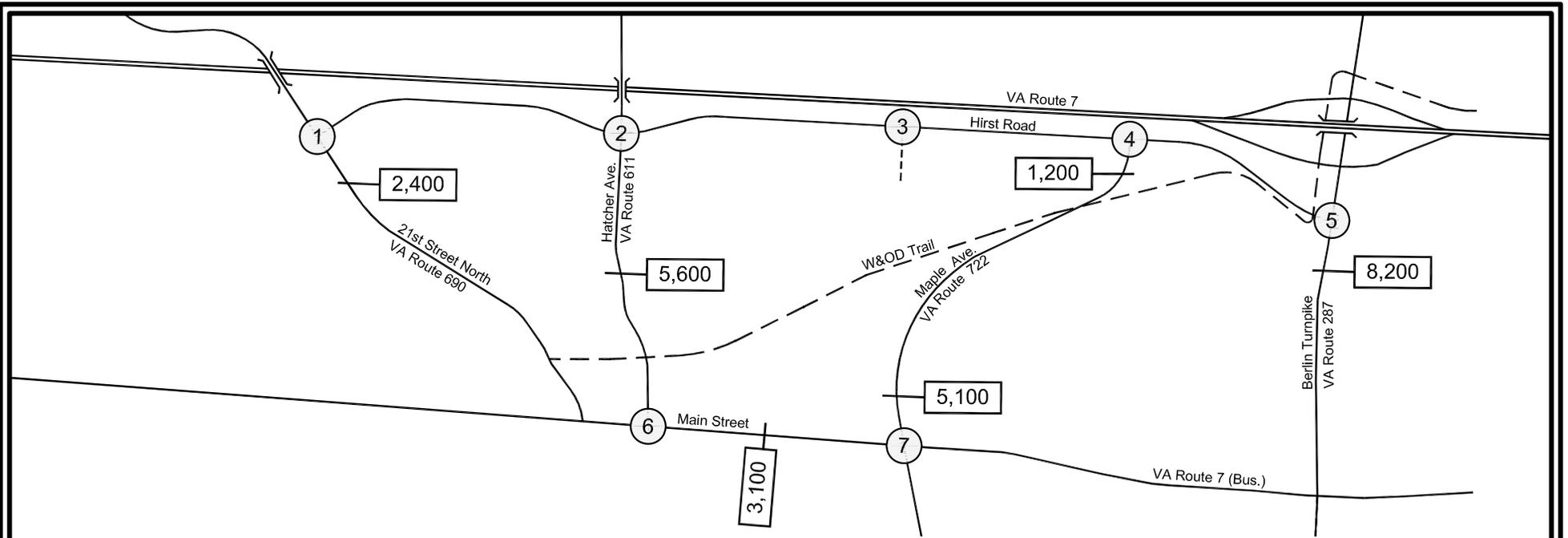
#### **4.6. Analysis of 2014 Background Peak Hour Traffic Conditions (without Development)**

The analysis of 2014 Background Peak Hour Traffic Conditions was based on the analysis procedures described above, the future lane use and traffic control shown on Figure 7 and the Total Background Traffic Forecasts (2014) shown on Figure 13. As indicated in Section 2.9, all future analysis scenarios assume a default peak hour factor of 0.92 and heavy vehicle percentage of 2.0% along with optimized cycle lengths and splits.

The calculation worksheets are included in Appendix F and the results of the analysis are summarized in Table 4 and shown graphically on Figure 14 (with the required improvements noted below). Table 4 also indicates the assumed direction of each roadway at the intersection.

As shown on Table 4, each of the intersections and approached would continue to operate at LOS "D" or better with the following exceptions:

- The westbound shared left-through-right approach to the Hirst Road/Hatcher Avenue (Study Intersection #2) intersection would operate at LOS "F" during the PM peak hour.
  - o Mitigation (By others): With construction of a separate westbound left turn lane with 150 feet of storage, the westbound left turn lane and shared through-right turn lane would operate at LOS "B" and "D",



DRAWING NOT TO SCALE

**LEGEND**

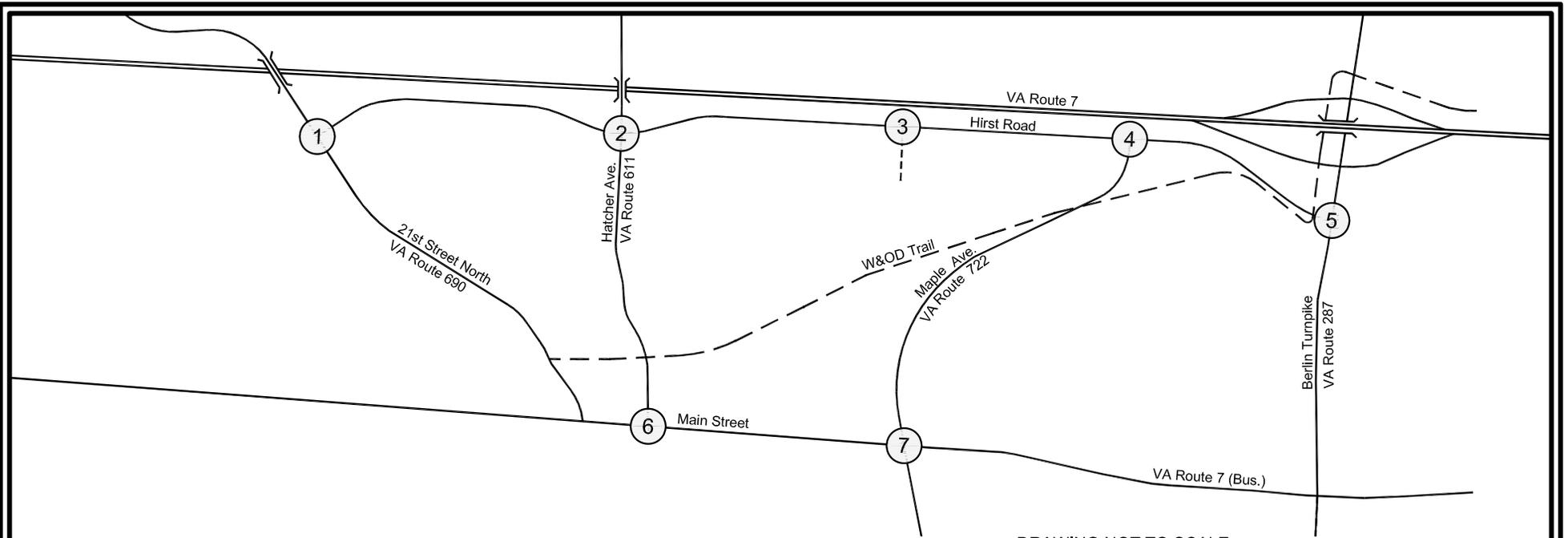
- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



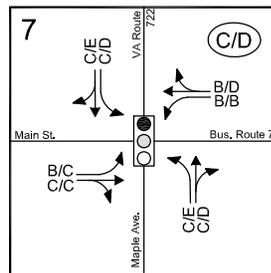
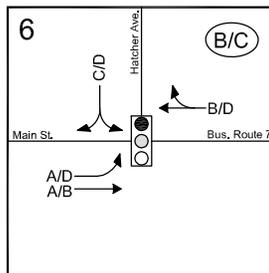
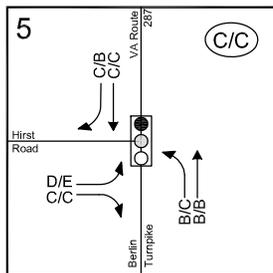
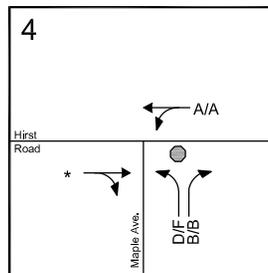
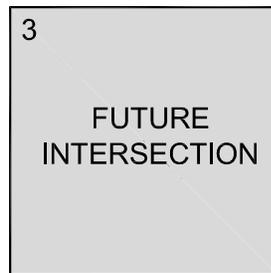
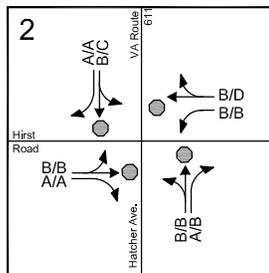
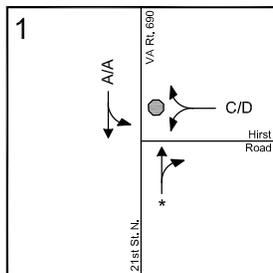
**Table 4 – Analysis Summary of Background (2014) Peak Hour Conditions**

Intersection	Control	Lane Group	Available Storage <sup>(1)</sup> (ft)	Background, 2014						Total Future, 2014					
				AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
				Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)
1. Hirst Road (E-W)/ 21 <sup>st</sup> Street North (N-S)	Stop	SBTL WBLR	~ ~	A C	5.6 15.8	12 33	A D	3.6 29.1	5 191	A C	5.6 16.2	12 36	A D	3.8 31.6	5 206
2. Hirst Road (E-W)/ Hatcher Avenue (N-S) <sup>(3)</sup>	Stop	NBTL NBR SBTL SBR EBTL EBR WBLTR	~ 175 ~ 30 ~ 200 ~	B B C A B A C	12.2 10.6 15.4 8.5 14.5 8.8 23.8	68 77 97 44 87 42 136	B B C A B A F	12.9 10.7 15.8 9.0 13.0 9.4 131.3	64 41 72 37 74 51 252	B B C A C D	12.5 10.9 15.9 8.7 15.1 8.9 27.7	67 54 120 43 90 40 122	B B C A B A F	13.1 11.0 16.5 9.1 13.7 9.5 150.9	101 51 84 60 55 48 291
<i>with construction of a separate westbound left turn lane with 150' of storage.</i>	Stop	NBTL NBR SBTL SBR EBTL EBR WBL WBTR	~ 175 ~ 30 ~ 200 150 ~	B A B A B A B B	11.4 9.9 14.1 8.1 13.6 8.4 10.1 14.9	64 65 106 38 93 37 53 106	B B C A B A B D	12.6 10.4 15.4 8.8 12.8 9.3 13.2 31.2	56 40 72 38 70 49 90 164	B B B A B A B C	11.6 10.1 14.5 8.2 14.0 8.5 10.3 16.2	74 53 100 42 95 41 66 97	B B C A B A B D	12.9 10.8 16.2 9.0 13.7 9.5 13.7 36.1	85 60 87 52 62 48 123 153
3. Hirst Road (E-W)/ Site Entrance (N-S)	Stop	NBLR WBL	~ 200	- -	- -	- -	- -	- -	- -	B A	14.5 8.4	15 1	C A	15.9 8.3	10 4
4. Hirst Road (E-W)/ Maple Avenue (N-S)	Stop	NBLR WBTL	~ ~	C A	22.0 4.7	59 16	F A	134.5 5.7	266 27	D A	25.8 4.8	73 17	F A	288.8 5.9	410 28
<i>with construction of a separate northbound left turn lane with 150' of storage.</i>	Stop	NBL NBR WBTL	150 ~ ~	D B A	30.9 12.2 4.7	24 20 16	F B A	136.3 11.9 5.7	121 21 27	D B A	34.8 12.6 4.8	30 21 17	F B A	259.8 12.2 5.9	197 22 28
5. Hirst Road (E-W)/ Berlin Turnpike (N-S)	Signal	NBL NBT SBT SBR EBLR	310 ~ ~ ~ ~	B C D C D	19.8 23.6 37.3 25.2 51.7	89 425 #437 69 #691	C C D C E	27.1 21.7 37.3 25.5 75.4	101 604 765 68 #602	C C D C D	22.2 25.1 37.8 25.4 53.0	#94 434 #437 69 #621	C C D C E	30.1 22.7 39.5 26.8 76.0	106 616 779 71 #627
<i>with construction of a separate eastbound left turn lane with 400' of storage.</i>	Signal	NBL NBT SBT SBR EBL EBR	310 ~ ~ ~ 400 ~	B B C C D C	16.3 19.6 30.6 22.4 45.4 22.5	86 407 396 65 #464 33	C B C C E C	21.7 14.4 31.2 18.0 61.0 27.1	67 364 #554 58 #363 18	B C C C D C	17.2 20.7 32.3 23.3 45.3 21.8	89 416 403 67 #487 34	C B C B E C	26.0 15.2 33.5 18.8 58.7 26.5	#75 376 #566 60 #369 18
<b>Overall Intersection</b>				<b>C</b>	<b>34.1</b>		<b>D</b>	<b>35.9</b>		<b>D</b>	<b>35.3</b>		<b>D</b>	<b>37.5</b>	
<b>Overall Intersection</b>				<b>C</b>	<b>28.1</b>		<b>C</b>	<b>26.7</b>		<b>C</b>	<b>29.1</b>		<b>C</b>	<b>27.7</b>	
6. Main Street (E-W)/ Hatcher Avenue	Signal	SBLR EBL EBT WBTL	~ 150 ~ ~	C A A B	24.7 7.2 8.8 19.5	137 53 263 272	D D B D	51.7 36.8 10.5 37.5	#315 #85 318 #847	C A A B	24.7 7.3 8.9 19.5	140 54 265 273	D D B D	52.1 43.7 10.5 37.5	#317 #96 318 #847
<b>Overall Intersection</b>				<b>B</b>	<b>14.2</b>		<b>C</b>	<b>30.7</b>		<b>B</b>	<b>14.3</b>		<b>C</b>	<b>31.3</b>	
7. Main Street (E-W)/ Maple Avenue (N-S)	Signal	NBL NBTR SBL SBTR EBL EBT WBL WBTR	75 ~ ~ ~ ~ ~ 135 ~	C C C C B C B B	27.6 33.3 33.6 29.4 10.3 23.1 13.0 18.5	57 273 146 157 53 501 37 256	E D D E C C B D	73.2 41.3 42.5 56.9 25.0 25.5 15.5 37.5	#158 215 127 280 62 523 57 #947	C C D C B C B B	27.6 32.9 35.2 29.4 10.8 23.9 13.6 19.2	59 276 166 161 58 528 40 275	E D D E C C B D	79.0 42.1 45.5 58.4 29.2 25.6 15.6 40.1	#159 213 137 279 79 537 58 #998
<b>Overall Intersection</b>				<b>C</b>	<b>24.1</b>		<b>D</b>	<b>37.0</b>		<b>C</b>	<b>24.7</b>		<b>D</b>	<b>38.7</b>	

Notes:  
 (1) ~ Indicates a continuous lane.  
 (2) Queues are 95th percentile queues as reported by Synchro.  
 (3) Queues for this intersection only are 95th percentile queues as reported by SimTraffic as Synchro cannot model queues for all way stop control.  
 # Indicates 95th percentile volume exceeds capacity, queue may be longer.



DRAWING NOT TO SCALE



**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- X/X AM/PM Peak Hour Level of Service
- (X/X) Overall Intersection Level of Service
- \* Free Flow Condition



respectively in the PM peak hour. It should be noted that the growth in existing traffic and the traffic generated by the other approved developments accounts for 5.2% and 6.7% of the overall traffic at the intersection in 2014 in the AM and PM peak hours, respectively.

- The northbound shared left-right approach to the Hirst Road/Maple Avenue intersection (Study Intersection #4) would operate at LOS “F” during the PM peak hour.
  - o Mitigation (By others): With construction of a separate northbound left turn lane with 150 feet of storage, the northbound right turn (which carries the majority of traffic) would operate at LOS “B”. The northbound left turn lane would still operate at LOS “F” but the 95<sup>th</sup> percentile queue would be adequately contained within the available storage. It should be noted that the growth in existing traffic and the traffic generated by the other approved developments accounts for 5.4% and 6.6% of the overall traffic at the intersection in 2014 in the AM and PM peak hours, respectively.
  
- The eastbound shared left-right approach to the Hirst Road/Berlin Turnpike intersection (Study Intersection #5) would operate at LOS “E” (75.4 seconds of average delay and a 95<sup>th</sup> percentile queue of 602 feet) during the PM peak hour. The overall intersection would operate at a LOS “D” with an average delay of 35.9 seconds/vehicle.
  - o Mitigation (By others): With construction of a separate eastbound left turn lane with 400’ of storage, the eastbound left turn lane would operate at a lower LOS “E” (61.0 seconds of average delay) and the eastbound right turn would operate at LOS “C”. The overall intersection would operate at LOS “C” with an average delay of 26.7 seconds per vehicle. Additionally, the eastbound left turn 95<sup>th</sup> percentile queue would drop to 363 feet and would be adequately contained within the available storage. It should be noted that the growth in existing traffic and the traffic generated by the other

approved developments accounts for 10.6% and 13.2% of the overall traffic at the intersection in 2014 in the AM and PM peak hours, respectively.

- The northbound left lane at the Main Street/Maple Avenue intersection (Study Intersection #7) would operate at LOS "E" (73.2 seconds of average delay and a 95<sup>th</sup> percentile queue of 158 feet) during the PM peak hour.
  - o Mitigation (By others): Given the low volume of traffic (75 vehicles in the PM peak hour) making a northbound left turn, no mitigation is recommended.

### 5. SITE TRIP GENERATION (2014)

The Applicant is proposing to develop the site with approximately 176 multi-family residential dwelling units with access to the site proposed via a full movement entrance on Hirst Road.

The average weekday AM and PM peak hour and average daily trips that are expected to be generated by the development were estimated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 8<sup>th</sup> edition and are shown in Table 5.

As shown in Table 5, the proposed development would generate approximately 90 new trips during the AM peak hour (18 in and 72 out), 114 new trips during the PM peak hour (74 in and 40 out), and 1,190 new daily trips over a 24-hour period.

**Table 5 – Site Trip Generation Analysis**

Land Use	Size	Units	Land Use Code	Weekday						
				AM Peak Hour			PM Peak Hour			Daily Trips
				In	Out	Total	In	Out	Total	
<b><u>Proposed Catoctin Creek Apartments Development - ITE Trips<sup>(1)</sup></u></b>										
<u>Residential</u>										
Apartments	176 D.U.	220		18	72	90	74	40	114	1,190

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 8th Edition.

## **6. SITE TRIP DISTRIBUTION AND ASSIGNMENTS**

### **6.1 Site Trip Distribution and Assignments**

Site trip distributions were based on the nature of the development, the location within the Town, local/regional employment, and the local roadway network,

Specifically, the overall site trip distributions were assumed as follows and as shown on Figure 15:

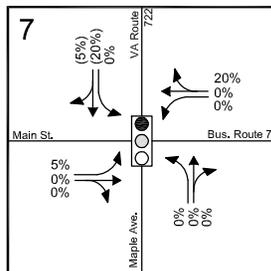
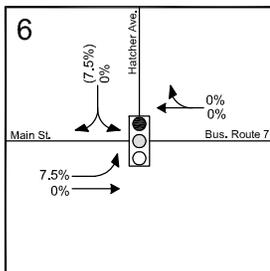
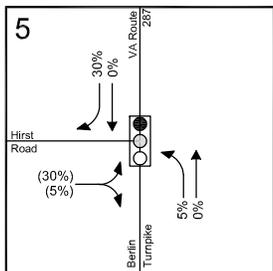
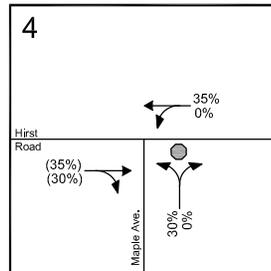
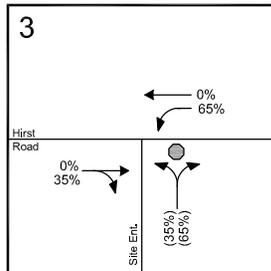
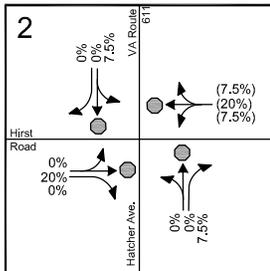
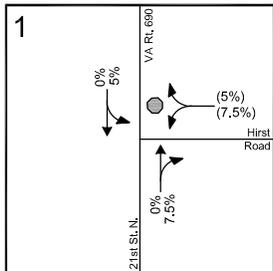
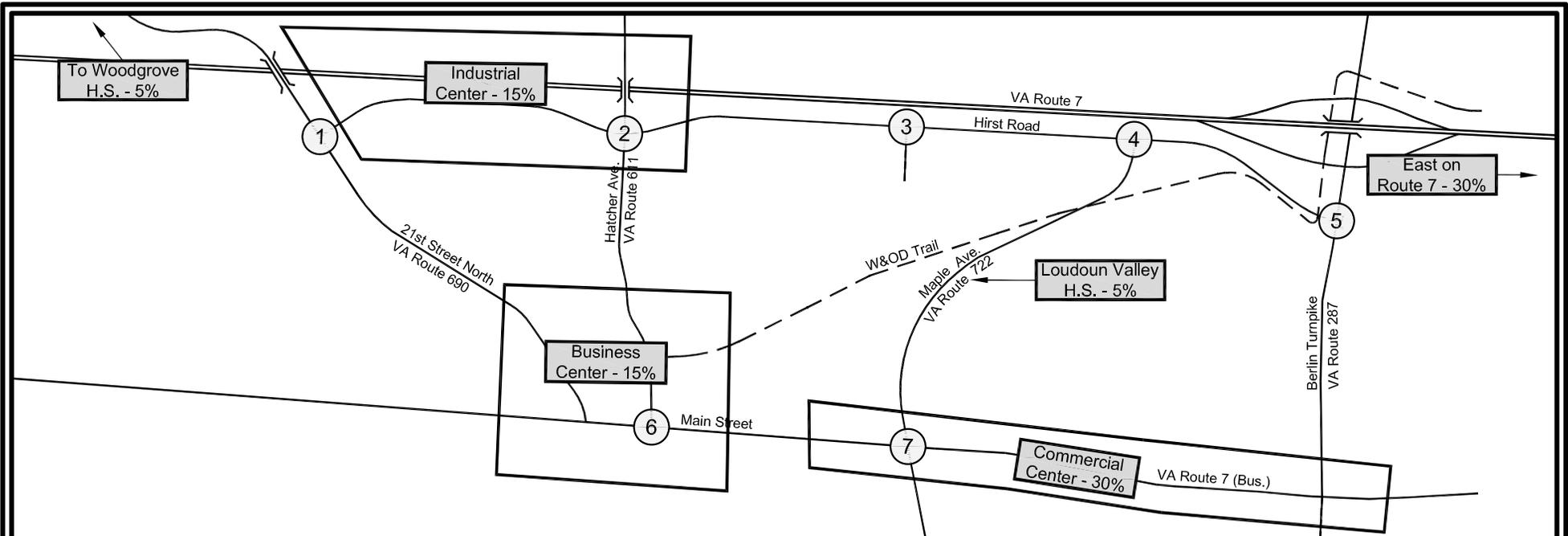
- 30% to/from the East on Route 7 By-pass
- 30% to/from the Commercial Center
- 15% to/from the Business Center
- 15% to/from the Industrial Center
- 5% to/from Loudoun Valley High School
- 5% to/from Woodgrove High School

The overall distributions were then assigned to the local roadway network and site entrance as shown on Figure 15. The trips shown in Table 5 were then distributed to the study intersections using the percentages shown on Figure 15. The resulting Site Generated Traffic Assignments (2014) are shown on Figure 16.

## **7. 2014 TOTAL FUTURE TRAFFIC CONDITIONS**

### **7.1. 2014 Total Future Traffic Forecasts (with Development)**

The Site Traffic Assignments (2014) shown on Figure 16 were then added to the Total Background Traffic Forecasts (2014) shown on Figure 14 to yield to Total Future Traffic Forecasts (2014). These forecasts are shown on Figure 17 and show the AM and PM peak hour forecasts as well as the weekday ADT (rounded to the nearest 100).

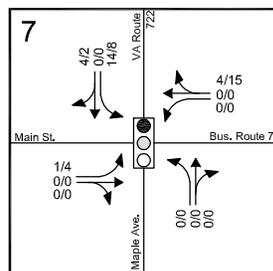
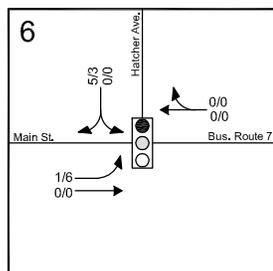
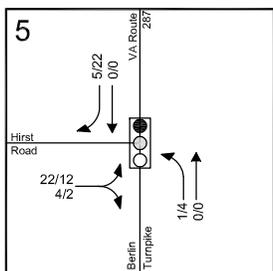
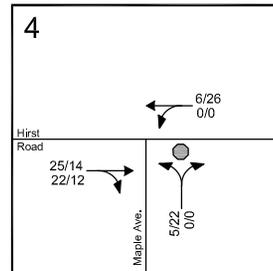
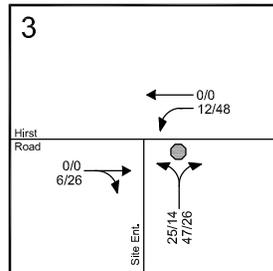
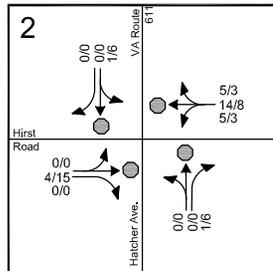
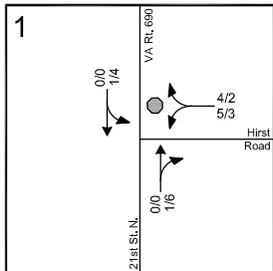
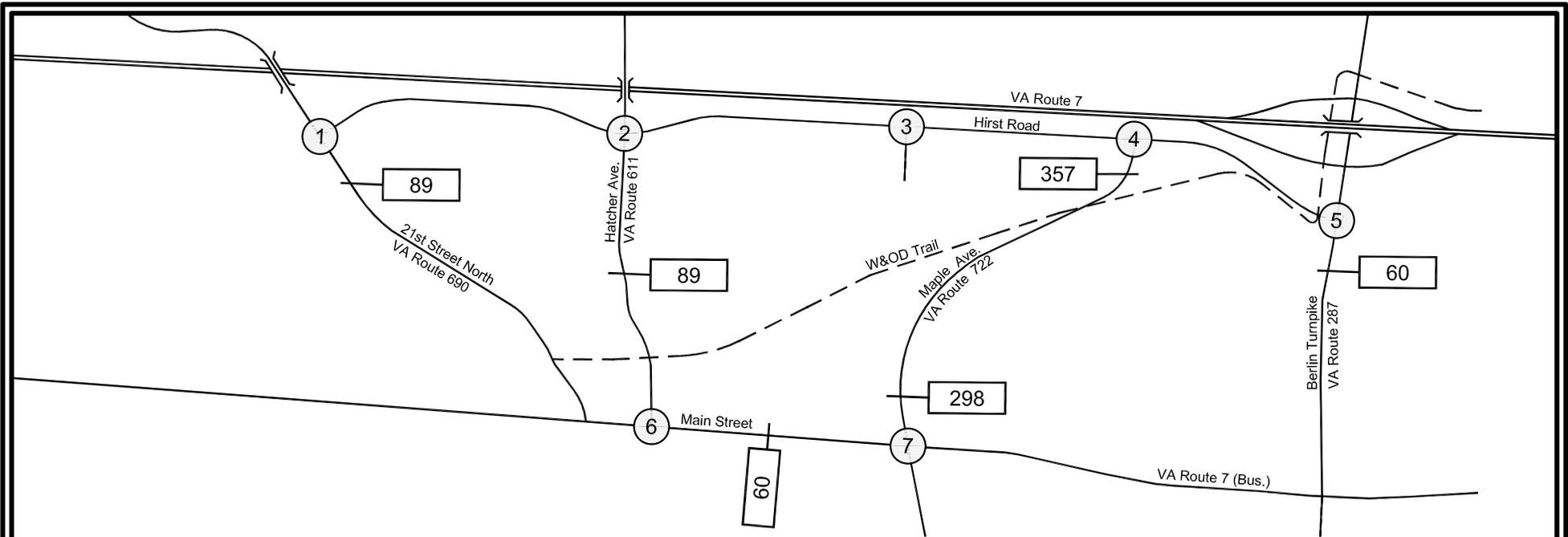


DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- xx%: Inbound Distribution
- (yy%): Outbound Distribution
- XX% → Overall Direction of Approach

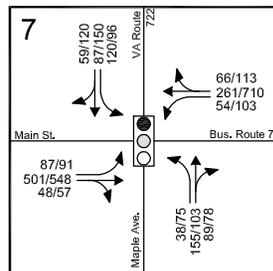
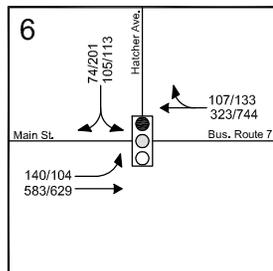
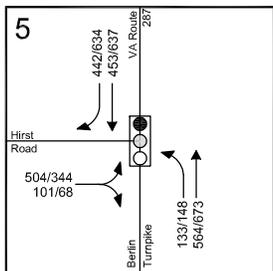
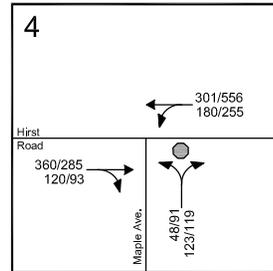
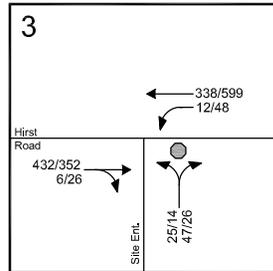
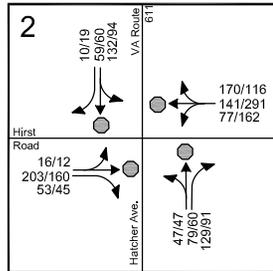
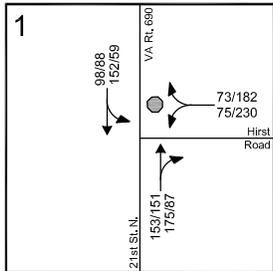
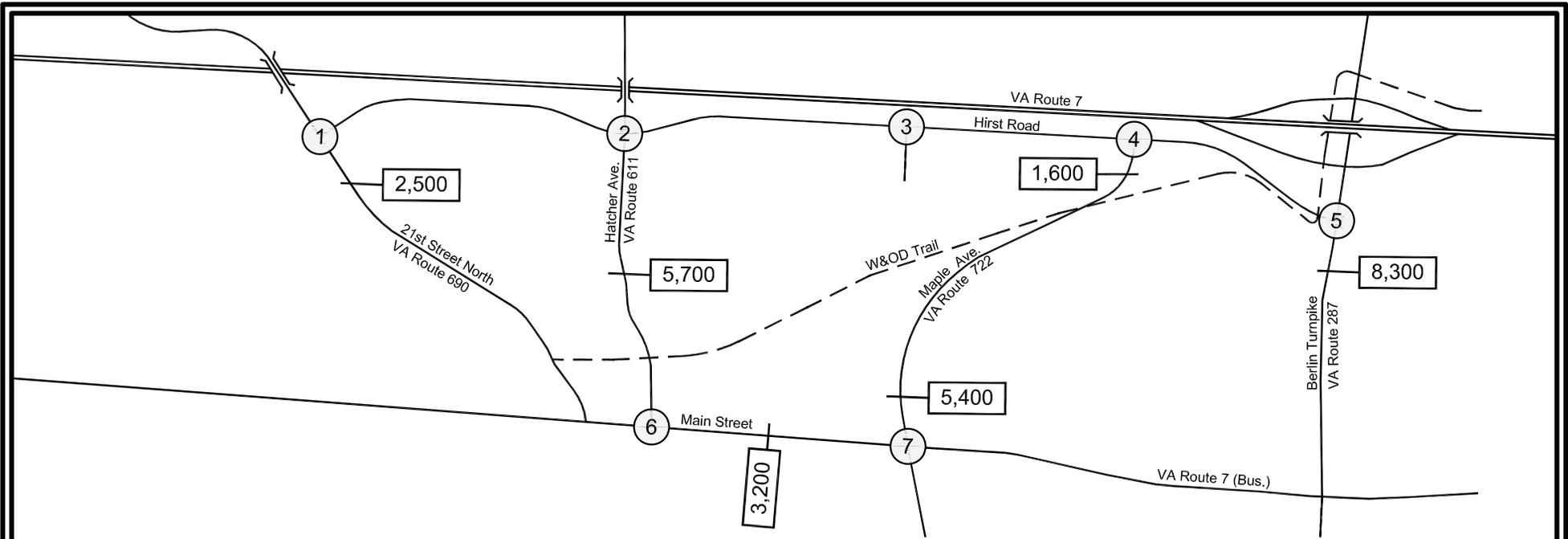




DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



## 7.2. Analysis of 2014 Total Future Peak Hour Traffic Conditions

The analysis of 2014 Total Future Peak Hour Traffic Conditions was based on the analysis procedures described above, the future lane use and traffic control shown on Figure 7 and the Total Future Traffic Forecasts (2014) shown on Figure 17.

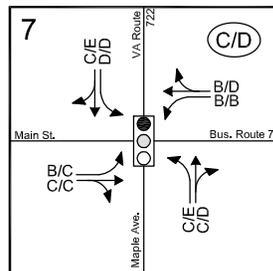
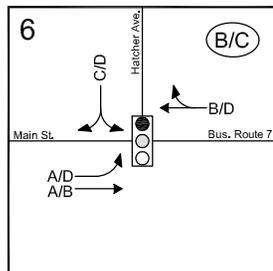
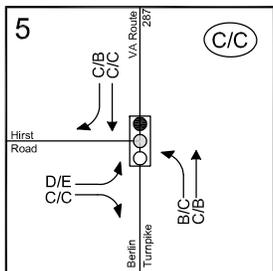
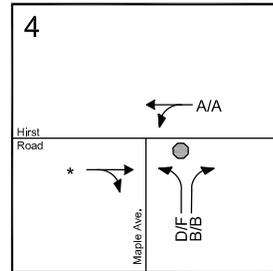
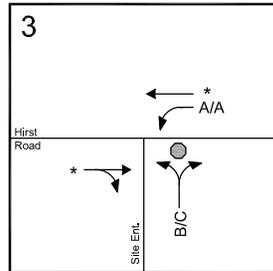
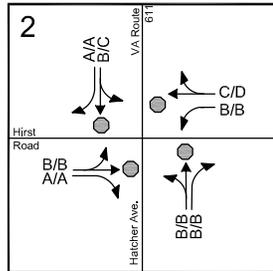
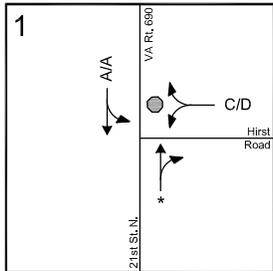
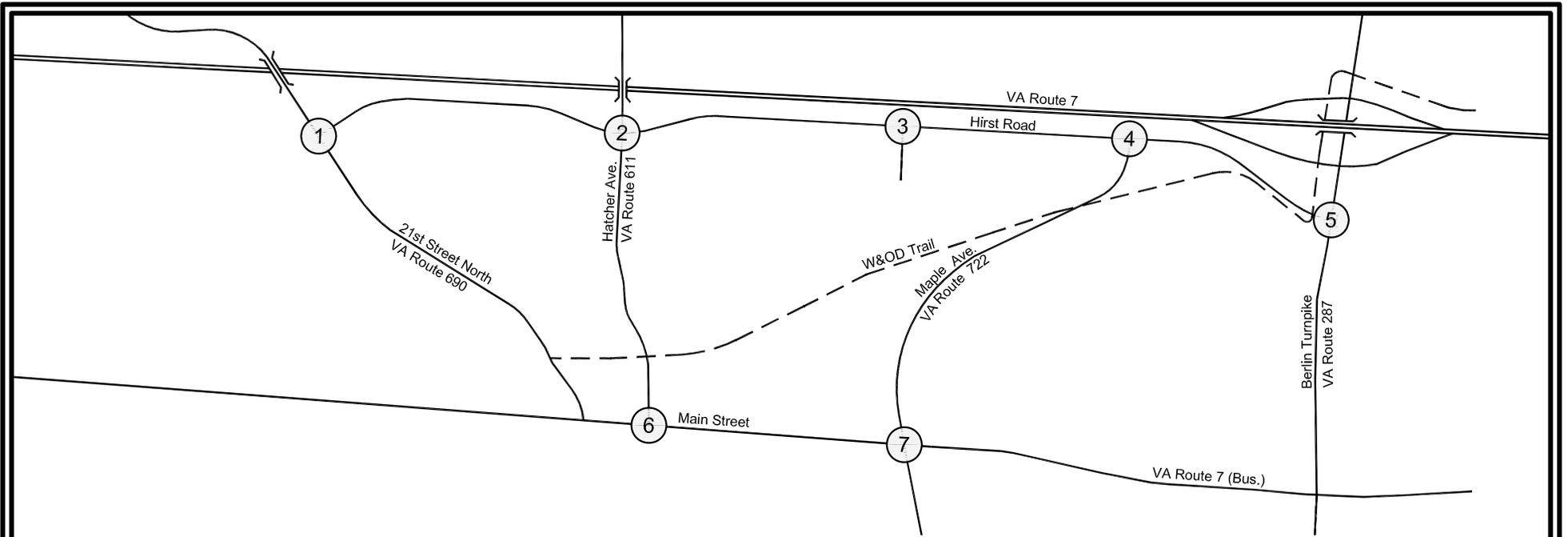
The calculation worksheets are included in Appendix G and the results of the analysis are summarized in Table 4 and shown graphically on Figure 18. Table 4 also indicates the assumed direction of each roadway at the intersection.

As shown in Table 4, under Total Future 2014 conditions and with the improvements committed to by the site, each of the intersections are expected to operate at comparable or better levels of service to the background conditions.

As shown in Table 4, under Total Future 2014 conditions, each of the 95<sup>th</sup> percentile queues are expected to continue to be contained within the available storage with the exceptions noted under background conditions.

At the intersections that required improvements under background conditions, it should be noted that the site traffic would account for the following percent of traffic in 2014:

- Hirst Road/Hatcher Avenue (Study Intersection #2): 2.7% and 3.5% in the AM and PM peak hours, respectively.
- Hirst Road/Maple Avenue (Study Intersection #4): 5.1% and 5.2% in the AM and PM peak hours, respectively.
- Hirst Road/Berlin Turnpike (Study Intersection #5): 1.5% and 1.7% in the AM and PM peak hours, respectively.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- AM/PM Peak Hour Level of Service
- Overall Intersection Level of Service
- Free Flow Condition



## **8. BACKGROUND FUTURE TRAFFIC CONDITIONS (2020)**

In order to analyze future traffic conditions beyond the buildout of the site, a Buildout Plus Six Years Scenario (2020) was developed. This accounts for development of the site and complete development of any other developments in the vicinity.

In order to develop forecasts for 2020 traffic conditions, background traffic was forecasted based on the existing traffic counts, existing traffic diversions for the Southern Collector, full buildout of the other proposed but unbuilt developments discussed above, and historic traffic growth.

### **8.1. Other Developments**

As discussed in Section 4, we are aware of four other developments in the study area. It was assumed that all four developments would be completely built and occupied by 2020.

The trips that would be generated by the completed developments are shown in Table 6.

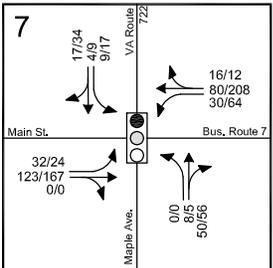
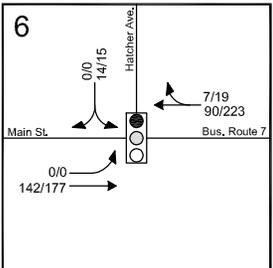
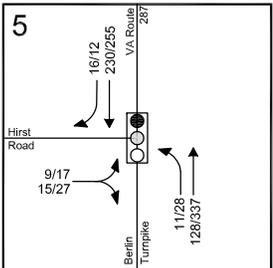
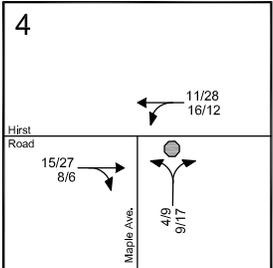
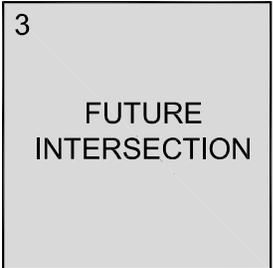
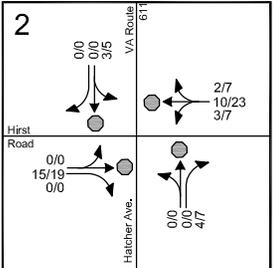
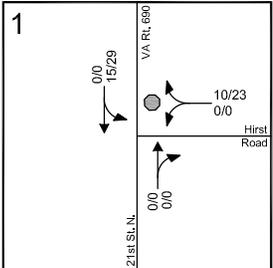
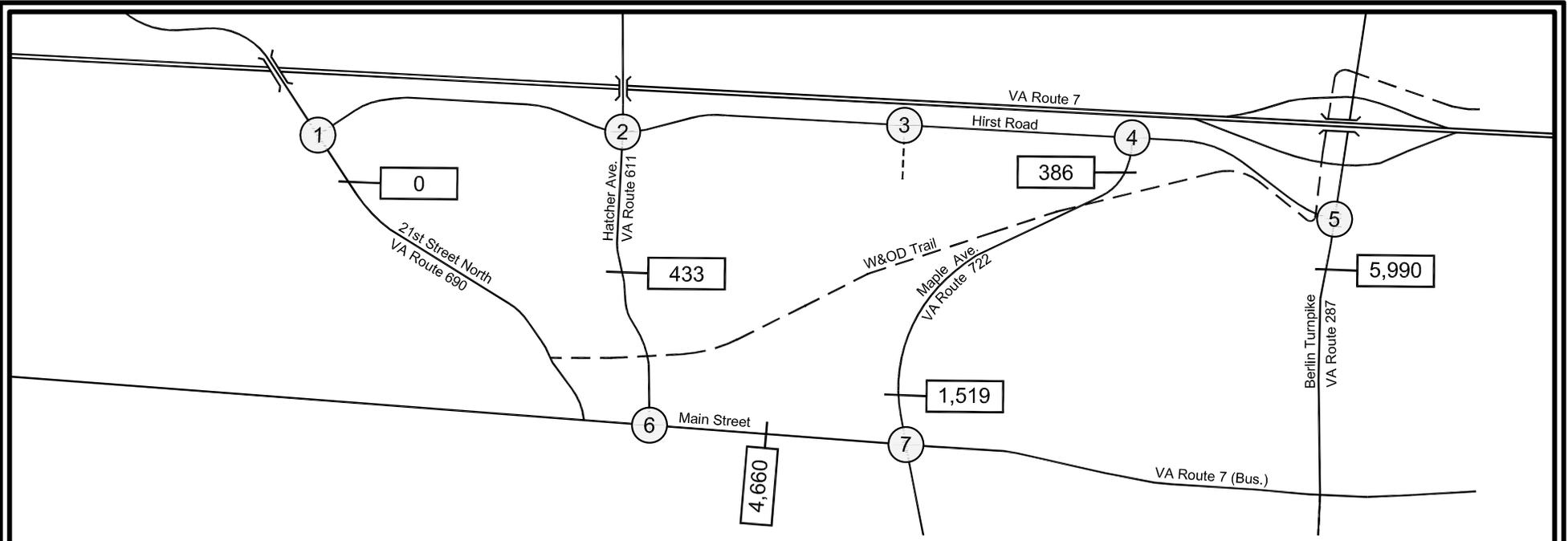
**Table 6 – Other Development Site Trip Generation Analysis (2020)**

Land Use	Size	Units	Land Use Code	AM Peak Hour			Weekday PM Peak Hour			Daily Trips
				In	Out	Total	In	Out	Total	
<b><u>Background Developments -2020<sup>(1)</sup></u></b>										
<b><u>Catoctin Corner<sup>(2)</sup></u></b>										
Commercial	48,900 S.F.			244	218	462	403	369	772	8,501
<b><u>Purcellville Gateway<sup>(3)</sup></u></b>										
Residential	6 D.U.	210		1	4	5	4	2	6	57
Retail	27,500 S.F.			98	79	177	214	201	415	3,699
Office	22,000 S.F.		710	<u>49</u>	<u>7</u>	<u>56</u>	<u>18</u>	<u>85</u>	<u>103</u>	<u>416</u>
<i>Total Purcellville Gateway Trips</i>				<i>148</i>	<i>90</i>	<i>238</i>	<i>236</i>	<i>288</i>	<i>524</i>	<i>4,172</i>
<b><u>Loudoun Valley Shopping Center - Phase 2<sup>(4)</sup></u></b>										
Commercial	60,815 S.F.			157	84	241	120	174	294	2,575
<b><u>Patrick Henry College Expansion<sup>(5)</sup></u></b>										
University/College	700 Students	550		118	29	147	44	103	147	1,666
<b>Total Background Development Trips - 2020</b>				<b>520</b>	<b>335</b>	<b>855</b>	<b>571</b>	<b>648</b>	<b>1,219</b>	<b>12,799</b>

- Notes: (1) Table shows trips total trips generated by development.  
 (2) Assumes complete development by 2020. Trip generation taken from Table 6B of "Catoctin Corner Revised Traffic Impact Analysis" prepared by PHR+A dated May 28,2010.  
 (3) Assumes complete development by 2020 which would add 6 Single Family Residential units. Trips taken from Table 3-2 in Appendix K of "Loudoun Valley Shopping Center Traffic Impact Analysis" prepared by Wells + Associates dated May 21, 2010.  
 (4) Trips shown are "Total New Trips" of Table 5-2 minus "Total New Trips" of Table 5-1 in "Loudoun Valley Shopping Center Traffic Impact Analysis" prepared by Wells + Associates dated May 21, 2010.  
 (5) Trips taken from Table 4 of "Catoctin Corner Revised Traffic Impact Analysis" prepared by PHR+A dated May 28,2010.

**8.2. Other Development Trip Distribution and Assignment**

The trips that would be generated by the other developments were taken directly from their respective traffic studies as indicated in the footnotes of Table 6. The traffic assignments for each development are shown in Appendix H and summed on Figure 19.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



**Other Development Traffic Assignments (2020)**  
 Catoctin Creek Apartments  
 Purcellville, Virginia

<b>Figure 19</b>
Job # 5384-01-001
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### **8.3. Background Traffic Growth**

In order to determine 2020 traffic conditions, the annual 2.0% growth rate discussed in Section 4.3 was compounded annually for the eight-year period from the date of the existing counts. Background traffic growth was, therefore, estimated at 17.07% for the 2020 scenario.

This growth rate was applied to all movements on the roadways.

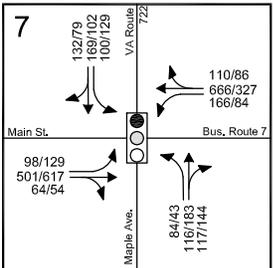
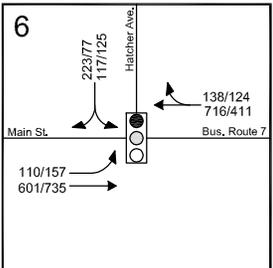
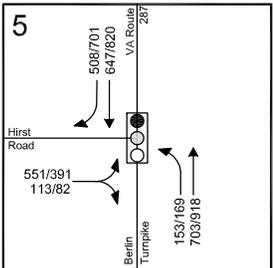
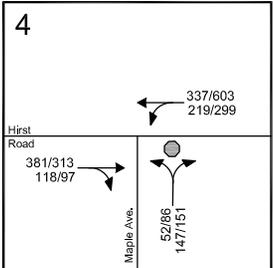
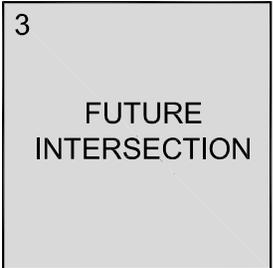
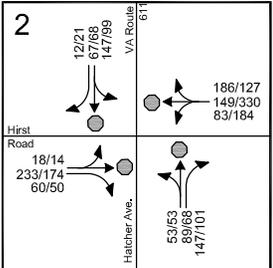
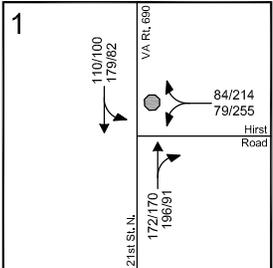
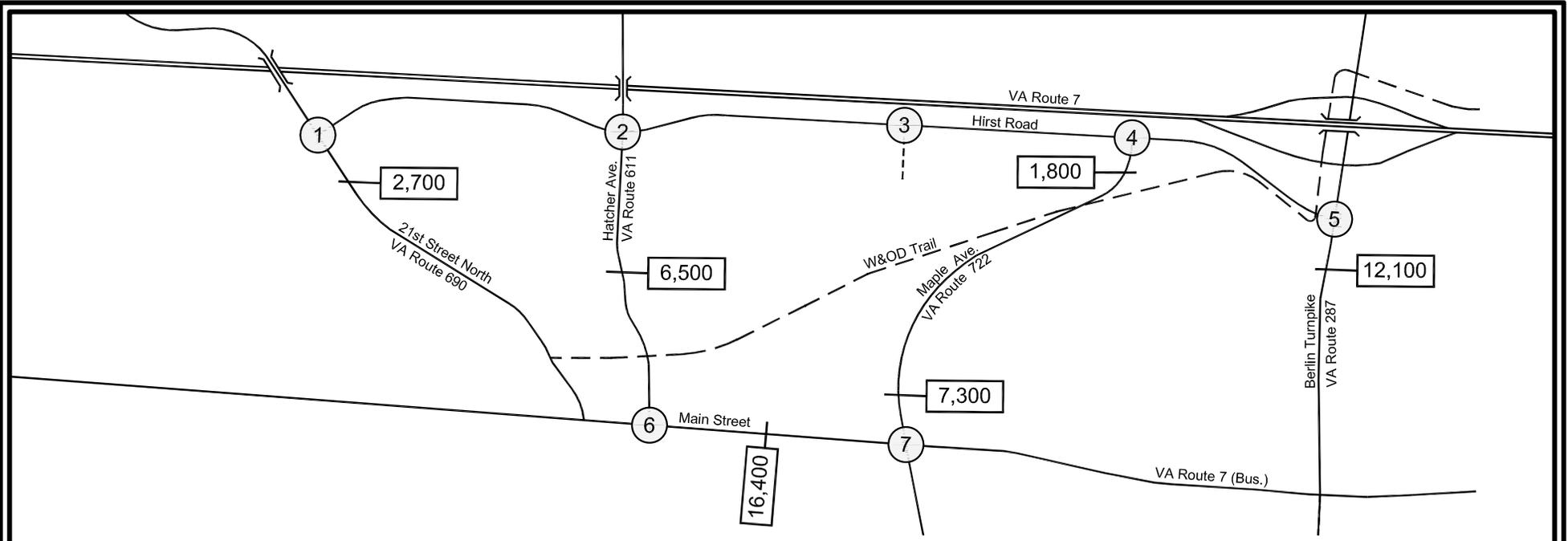
### **8.4. 2020 Total Background Traffic Forecasts**

The background traffic growth discussed above was then added to the Existing Traffic Counts shown on Figure 8, the Existing Traffic Diversions shown on Figure 10, and the Other Development Traffic Assignments (2020) shown on Figure 19 to yield the Total Background Traffic Forecasts (2020). These forecasts are shown on Figure 20 which shows the AM and PM peak hour forecasts as well as the weekday ADT (rounded to the nearest 100).

### **8.5. Analysis of 2020 Background Peak Hour Traffic Conditions (without Development)**

The analysis of 2020 Background Peak Hour Traffic Conditions was based on the analysis procedures described above, the future lane use and traffic control shown on Figure 7 and the Total Background Traffic Forecasts (2020) shown on Figure 20. As indicated in Section 2.9, all future analysis scenarios assume a default peak hour factor of 0.92 and heavy vehicle percentage of 2.0% along with optimized cycle lengths and splits.

The calculation worksheets are included in Appendix I and the results of the analysis are summarized in Table 7 and shown graphically on Figure 21 (with the improvements noted below). Table 7 also indicates the assumed direction of each roadway at the intersection.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



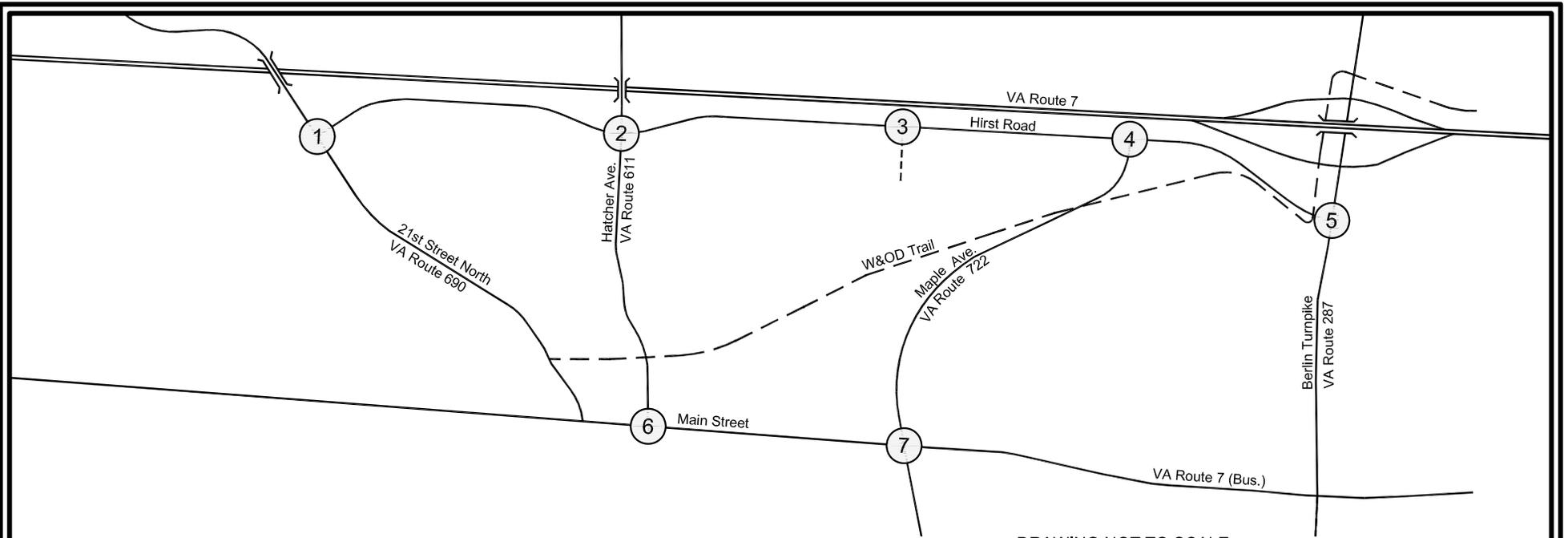
**Background Future Traffic Forecasts (2020)**  
 Catoctin Creek Apartments  
 Purcellville, Virginia

**Figure 20**  
 Job # 5384-01-001  
 47

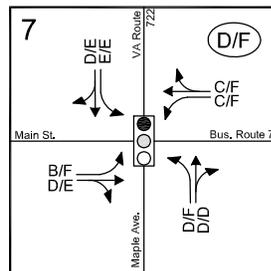
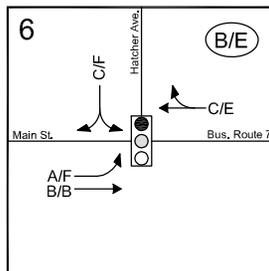
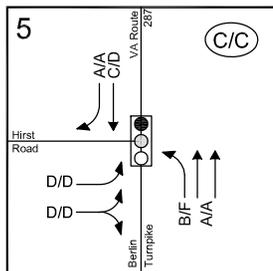
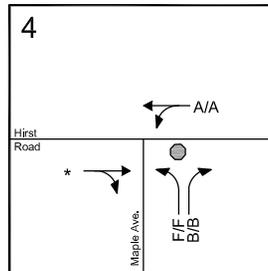
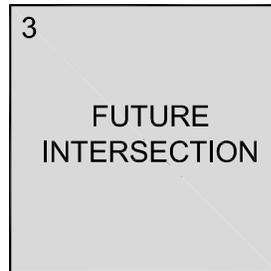
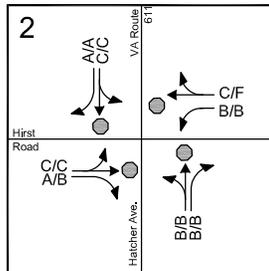
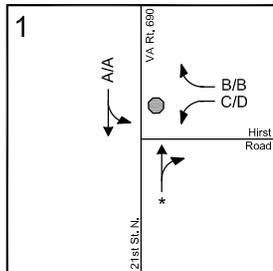
**Table 7 – Analysis Summary of Total Future (2020) Peak Hour Conditions**

Intersection	Control	Lane Group	Available Storage <sup>(1)</sup> (ft)	Background, 2020						Total Future, 2020						
				AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			
				Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	Lane LOS	Lane Delay (sec/veh)	Queue <sup>(2)</sup> (ft)	
1. Hirst Road (E-W)/ 21 <sup>st</sup> Street North (N-S)	Stop	SBTL	~	A	6.0	15	A	4.3	7	A	6.1	15	A	4.6	8	
		WBTL	~	C	19.3	50	F	75.5	393	C	20.5	58	F	100.6	471	
	Stop	SBTL	~	A	6.0	15	A	4.3	7	A	6.1	15	A	4.6	8	
		WBL WBR	150 ~	C B	22.2 10.5	30 10	D B	29.8 12.2	123 40	C B	23.3 10.6	34 11	E B	35.6 12.4	148 43	
2. Hirst Road (E-W)/ Hatcher Avenue (N-S) <sup>(3)</sup>	Stop	NBTL	~	B	14.3	74	B	14.1	67	C	15.1	85	B	14.5	63	
	Stop	NBR	175	B	12.5	73	B	11.6	47	B	13.4	63	B	12.4	45	
	Stop	SBTL	~	C	19.5	97	C	18.3	78	C	21.5	86	C	20.1	86	
	Stop	SBR	30	A	9.3	43	A	9.3	64	A	9.6	49	A	9.5	61	
	Stop	EBTL	~	C	19.4	85	C	15.2	72	C	22.1	124	C	17.5	103	
	Stop	EBR	200	A	9.7	51	B	10.0	43	B	10.0	46	B	10.2	39	
	Stop	WBLTR	~	E	42.4	123	F	241.6	259	F	61.6	209	F	308.8	274	
	with construction of a separate westbound left turn lane with 150' of storage.	Stop	NBTL	~	B	13.0	99	B	14.2	59	B	13.4	86	B	14.5	67
		Stop	NBR	175	B	11.3	71	B	11.7	50	B	11.8	54	B	12.4	52
		Stop	SBTL	~	C	17.2	94	C	18.5	84	C	18.2	97	C	20.4	82
		Stop	SBR	30	A	8.7	43	A	9.4	64	A	8.9	43	A	9.5	62
		Stop	EBTL	~	C	17.3	94	C	15.6	77	C	18.8	136	C	17.9	90
		Stop	EBR	200	A	9.1	52	B	10.2	43	A	9.3	47	B	10.4	35
		Stop	WBL	150	B	11.0	99	B	15.8	135	B	11.3	58	B	17.3	74
Stop		WBTR	~	C	20.6	139	F	67.9	224	C	24.7	117	F	103.2	116	
3. Hirst Road (E-W)/ Site Entrance (N-S)	Stop	NBLR	~	-	-	-	-	-	-	C	16.6	19	C	19.5	13	
	Stop	WBL	200	-	-	-	-	-	-	A	8.6	1	A	8.6	4	
4. Hirst Road (E-W)/ Maple Avenue (N-S)	Stop	NBLR	~	E	39.6	122	F	509.7	574	F	79.4	204	F	Err	Err	
	Stop	WBTL	~	A	5.5	22	A	7.0	37	A	5.7	24	A	8.1	42	
	Stop	NBL	150	F	50.9	47	F	467.0	233	F	76.8	80	F	Err	Err	
		NBR WBTL	~	B A	13.4 5.5	27 22	B A	13.4 7.0	33 37	B A	14.2 5.7	30 24	B A	14.8 8.1	38 42	
5. Hirst Road (E-W)/ Berlin Turnpike (N-S)	Signal	NBL	310	E	63.3	#183	F	130.1	#284	E	74.8	#193	F	149.2	#307	
		NBT	~	C	28.3	565	D	37.9	1,040	C	30.1	#592	D	42.3	#1,101	
		SBT	~	E	71.9	#701	E	76.8	#1,200	E	78.8	#711	F	86.1	#1,222	
		SBR	~	C	24.5	69	C	30.0	30.0	C	25.2	72	C	32.7	245	
		EBLR	~	F	111.4	#762	F	129.3	#832	F	119.9	#803	F	148.7	#923	
	<b>Overall Intersection</b>				<b>E</b>	<b>60.8</b>		<b>E</b>	<b>66.4</b>		<b>E</b>	<b>66.2</b>		<b>E</b>	<b>75.8</b>	-
	with improvements called for in Route 7 Bypass and Route 287 Interchange Study (2nd NBT free flow SBR, shared EBLR)	Signal	NBL	310	B	17.8	71	F	80.0	#189	B	19.0	#74	F	81.2	#196
			NBT	~	A	8.7	134	A	8.5	187	A	8.9	134	A	8.9	187
			SBT	~	C	29.5	#545	D	50.1	#842	C	29.5	#540	E	56.7	#848
			SBR	~	A	0.6	0	A	1.1	0	A	0.6	0	A	1.3	0
			EBL, LR	~	D	47.6	#301	D	46.0	220	D	52.3	#325	D	49.6	#261
<b>Overall Intersection</b>				<b>C</b>	<b>22.4</b>		<b>C</b>	<b>28.0</b>		<b>C</b>	<b>23.9</b>		<b>C</b>	<b>30.6</b>		
6. Main Street (E-W)/ Hatcher Avenue	Signal	SBLR	~	C	29.4	179	F	118.0	#602	C	29.7	184	F	111.2	#545	
		EBL	150	A	9.2	66	F	124.0	#179	A	9.3	68	F	125.0	#176	
		EBT	~	B	11.5	428	B	14.8	552	B	11.6	429	B	14.4	511	
		WBTL	~	C	21.8	381	E	70.4	#1545	C	21.8	382	F	80.7	#1401	
<b>Overall Intersection</b>				<b>B</b>	<b>16.9</b>		<b>E</b>	<b>61.7</b>		<b>B</b>	<b>17.0</b>		<b>E</b>	<b>65.7</b>		
7. Main Street (E-W)/ Maple Avenue (N-S)	Signal	NBL	75	D	36.0	82	F	229.4	#235	C	33.9	73	F	261.2	#228	
		NBTR	~	D	46.2	488	D	49.6	322	D	43.0	438	D	46.6	302	
		SBL	~	E	66.9	263	E	70.3	#212	E	71.9	#292	F	99.1	#266	
		SBTR	~	D	38.6	253	E	71.9	399	D	36.5	230	E	72.1	383	
		EBL	~	B	15.9	120	F	138.3	#223	B	16.2	115	F	130.9	#224	
		EBT	~	D	36.9	975	E	57.6	#954	D	37.8	912	E	59.5	#919	
		WBL	135	C	21.6	81	F	95.7	#272	C	22.3	77	F	88.7	#249	
		WBTR	~	C	25.4	498	F	103.6	#1512	C	26.8	491	F	130.0	#1520	
		<b>Overall Intersection</b>				<b>D</b>	<b>36.1</b>		<b>F</b>	<b>85.1</b>		<b>D</b>	<b>36.6</b>		<b>F</b>	<b>96.0</b>

Notes:  
 (1) ~ Indicates a continuous lane.  
 (2) Queues are 95th percentile queues as reported by Synchro.  
 (3) Queues for this intersection only are 95th percentile queues as reported by SimTraffic as Synchro cannot model queues for all way stop control.  
 # Indicates 95th percentile volume exceeds capacity, queue may be longer.  
 Err indicates delay in excess of 999.9 seconds.



DRAWING NOT TO SCALE



**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- AM/PM Peak Hour Level of Service
- Overall Intersection Level of Service
- Free Flow Condition



- The westbound shared left-right approach to the Hirst Road/21<sup>st</sup> Street North intersection (Study Intersection #1) would operate at LOS “F” during the PM peak hour.
  - o Mitigation (By others): With construction of a separate westbound left turn lane with 150’ of storage, the westbound left and right turn lanes would operate at a LOS “D” and “B”, respectively, during the PM peak hour. It should be noted that the growth in existing traffic and the traffic generated by the other approved developments accounts for 17.3% and 30.4% of the overall traffic at the intersection in 2014 in the AM and PM peak hours, respectively.
  
- The northbound left turn lane at the Hirst Road/Maple Avenue intersection (Study Intersection #4) would operate at LOS “F” during both peak hours.
  - o Mitigation (By others): Given the low volume of traffic (86 vehicles in the PM peak hour) making a northbound left turn, no mitigation is recommended.
  
- Multiple approaches to the Hirst Road/Berlin Turnpike intersection (Study Intersection #5) would operate at LOS “E” or “F” during both peak hours. The “Route 7 Bypass and Route 287 Interchange Study” prepared by HNTB recommends several improvements to the intersection
  - o Mitigation (By Others): The “Route 7 Bypass and Route 287 Interchange Study” prepared by HNTB recommends several improvements to the intersection. These improvements include construction of a free-flow southbound right turn lane, a second northbound through lane, and signal adjustments to allow for an eastbound left and shared left-right turn lane. It should be noted that the growth in existing traffic and the traffic generated by the other approved developments accounts for 27.7% and 33.4% of the overall traffic at the intersection in 2014 in the AM and PM peak hours, respectively.

- Both the Main Street/Hatcher Avenue and Main Street/Maple Avenue intersections (Study Intersections #6 and #7 )would operate at an overall LOS “E” or “F” during the PM peak hours.
  - o Mitigation: Given the tight right-of-way and downtown nature of the intersections, no mitigation is recommended.

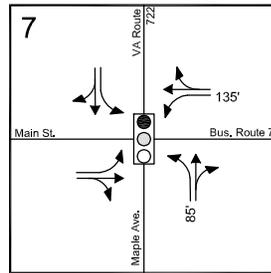
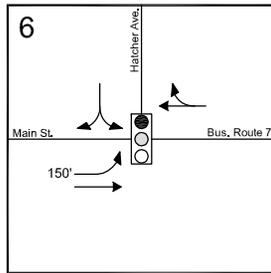
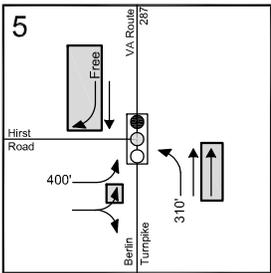
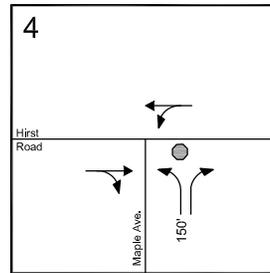
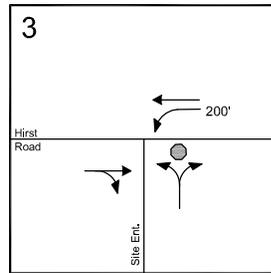
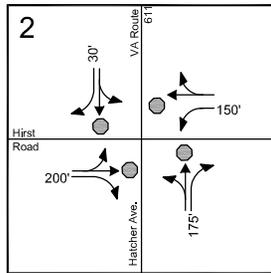
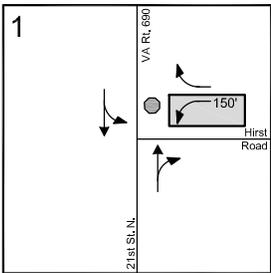
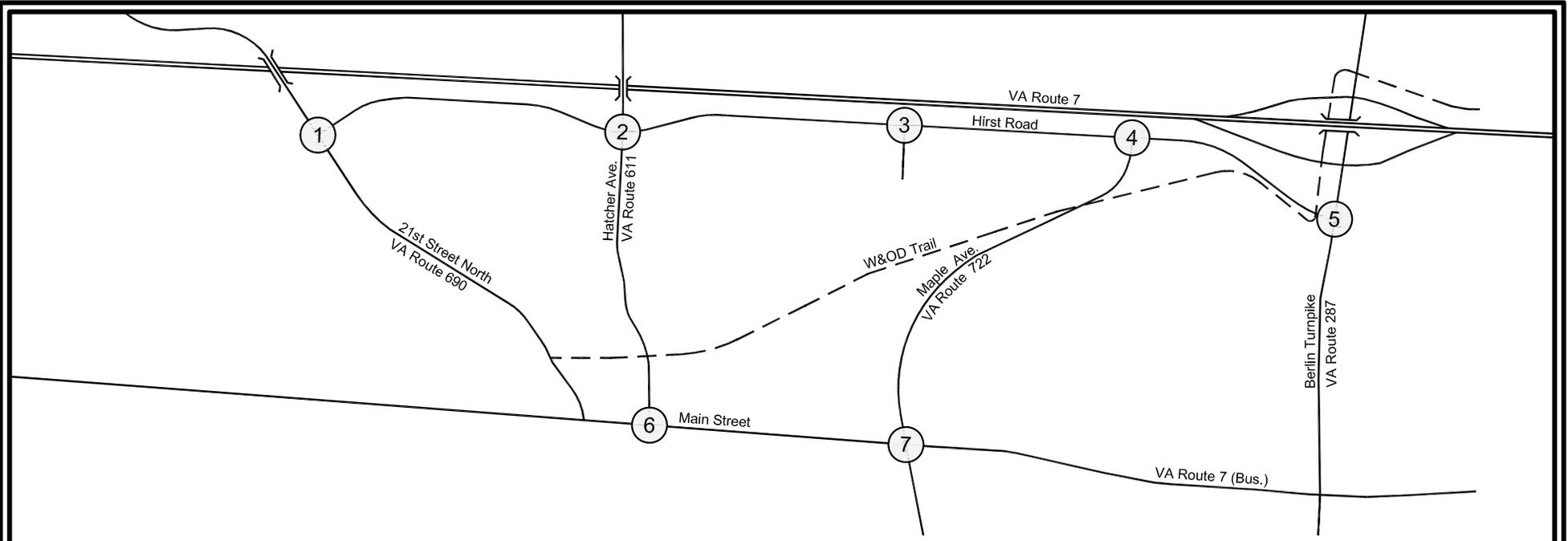
The Recommended Lane Use and Traffic Control (2020) is shown on Figure 22.

## **9. SITE TRIP GENERATION (2020)**

The Applicant is not proposing to develop the remaining 6.71 acres of the site. However, at the request of the Town, development of that portion was assumed for the 2020 scenario. The development of the commercial portion is purely speculative, would require a separate rezoning, and is included for informational purposes only at the request of the Town. For purposes of this analysis, the commercial portion (6.71 acres) was assumed to be developed at a FAR of 0.2 which yields approximately 60,000 S.F. of commercial space.

Access to the commercial portion would be via a separate entrance from the residential portion. For purposes of this analysis, that access was assumed to be from Hirst Road.

The average weekday AM and PM peak hour and average daily trips that are expected to be generated by the development were estimated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 8<sup>th</sup> edition and are shown in Table 8.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- XX' Full Width Storage
- Background Improvements (By Others)
- Site Improvements



As shown in Table 8, the proposed commercial development would generate an additional 60 new trips during the AM peak hour (37 in and 23 out), 163 new trips during the PM peak hour (72 in and 91 out), and 2,659 new daily trips over a 24-hour period.

**Table 8 – Site Trip Generation Analysis**

Land Use	Size	Units	Land Use Code	Weekday						
				AM Peak Hour			PM Peak Hour			Daily Trips
				In	Out	Total	In	Out	Total	
<b><u>Proposed Catoctin Creek Apartments Development - ITE Trips<sup>(1)</sup></u></b>										
<b><u>Phase 1 - Residential</u></b>										
Apartments	176 D.U.		220	18	72	90	74	40	114	1,190
<b><u>Phase 2 - Commercial<sup>(2,3)</sup></u></b>										
Specialty Retail	60,000 S.F.		814	37	23	60	72	91	163	2,659
<b>Total Catoctin Creek Trips</b>				<b>55</b>	<b>95</b>	<b>150</b>	<b>146</b>	<b>131</b>	<b>277</b>	<b>3,849</b>

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 8th Edition.

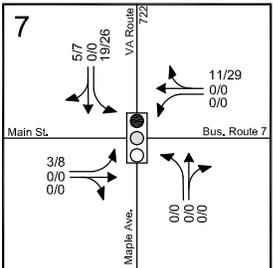
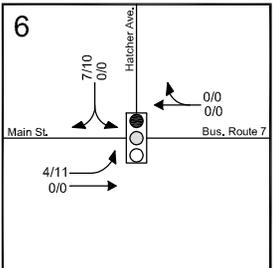
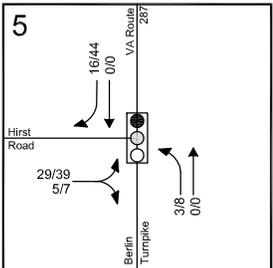
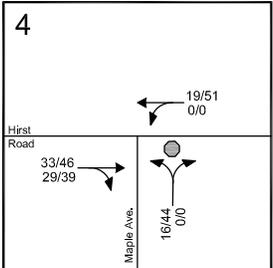
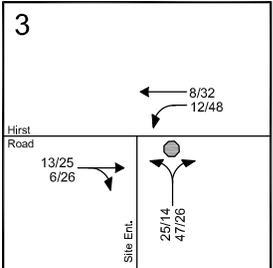
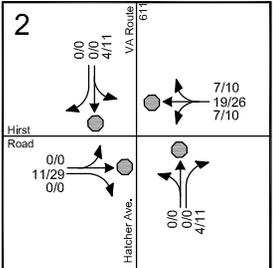
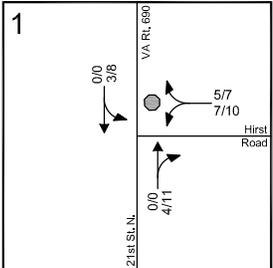
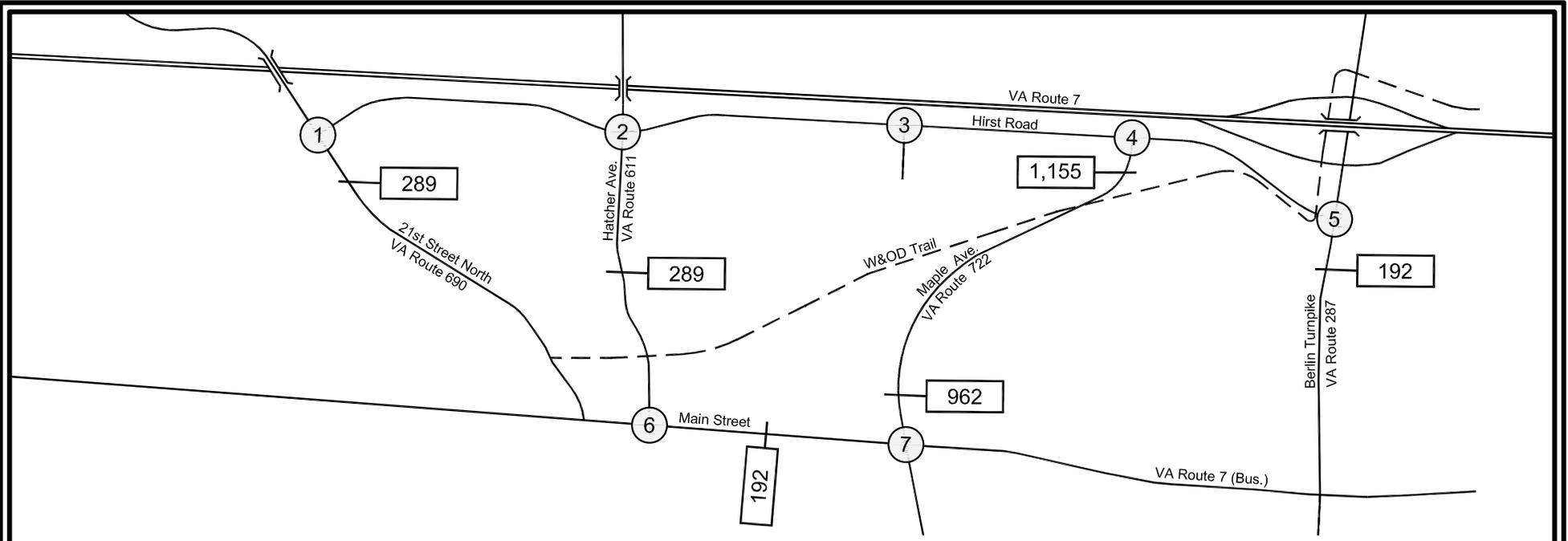
(2) Any commercial development would require a separate rezoning. Land use assumptions are speculative and based on an assumed 0.2 FAR.

(3) AM peak hour trips based on Land Use 820 average rates as ITE does not have AM data for Land Use 814.

## 10. SITE TRIP DISTRIBUTION AND ASSIGNMENTS

### 10.1 Site Trip Distribution and Assignments

The trips that would be generated by the residential and commercial portions of the site were assigned to the local roadway network using the trip distributions discussed in Section 6.1. The resulting Site Generated Traffic Assignments (2020) are shown on Figure 23.



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)



## **11. 2020 TOTAL FUTURE TRAFFIC CONDITIONS**

### **11.1. 2020 Total Future Traffic Forecasts (with Development)**

The Site Traffic Assignments (2020) shown on Figure 23 were then added to the Total Background Traffic Forecasts (2020) shown on Figure 20 to yield to Total Future Traffic Forecasts (2020). These forecasts are shown on Figure 24 and show the AM and PM peak hour forecasts as well as the weekday ADT (rounded to the nearest 100).

### **11.2. Analysis of 2020 Total Future Peak Hour Traffic Conditions**

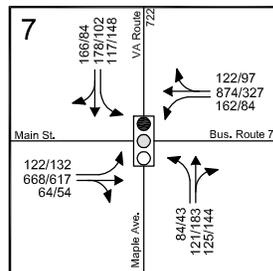
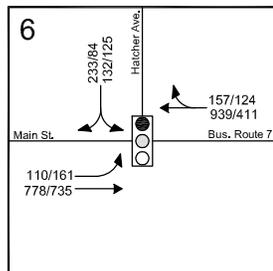
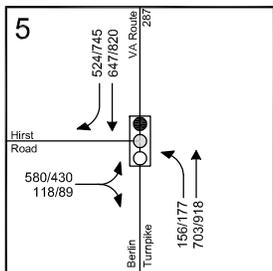
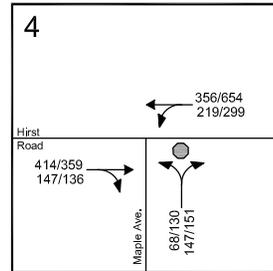
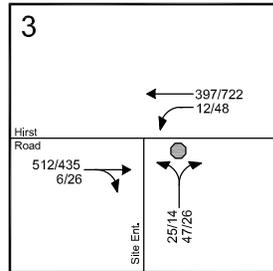
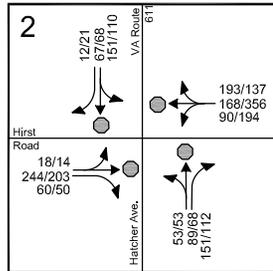
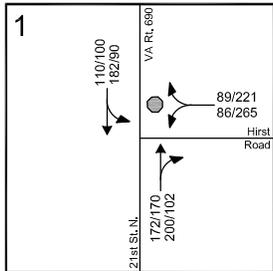
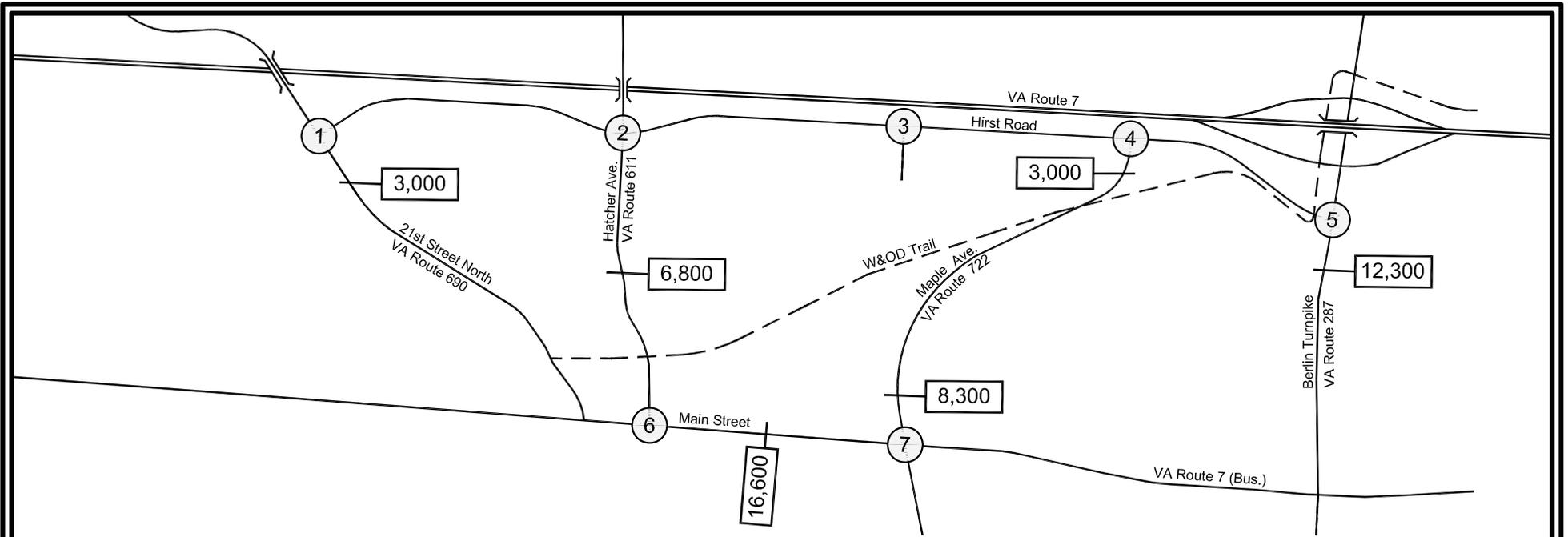
The analysis of 2020 Total Future Peak Hour Traffic Conditions was based on the analysis procedures described above, the Recommended Future Lane Use and Traffic Control shown (2020) on Figure 22 and the Total Future Traffic Forecasts (2020) shown on Figure 24.

The calculation worksheets are included in Appendix J and the results of the analysis are summarized in Table 7 and shown graphically on Figure 25. Table 7 also indicates the assumed direction of each roadway at the intersection.

As shown in Table 7, under Total Future 2020 conditions and with the improvements committed to by the site and the recommended 2020 improvements, each of the intersections are expected to operate at comparable or better levels of service to the background conditions.

As shown in Table 7, under Total Future 2020 conditions, each of the 95<sup>th</sup> percentile queues are expected to continue to be contained within the available storage with the exceptions noted under background conditions.

At the intersections that required improvements under background conditions, it should be noted that the site traffic would account for the following percent of traffic in 2020:

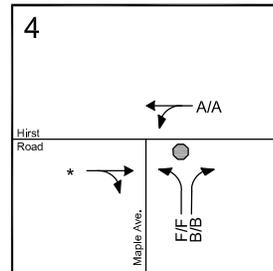
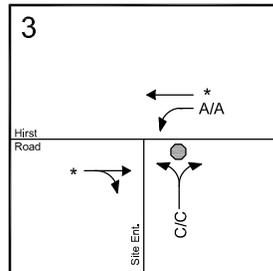
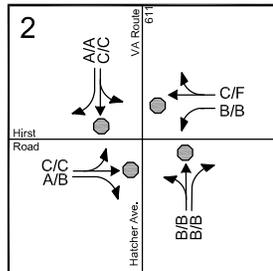
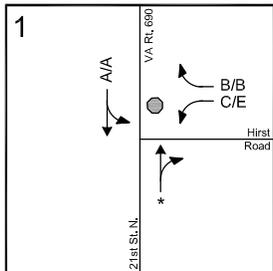
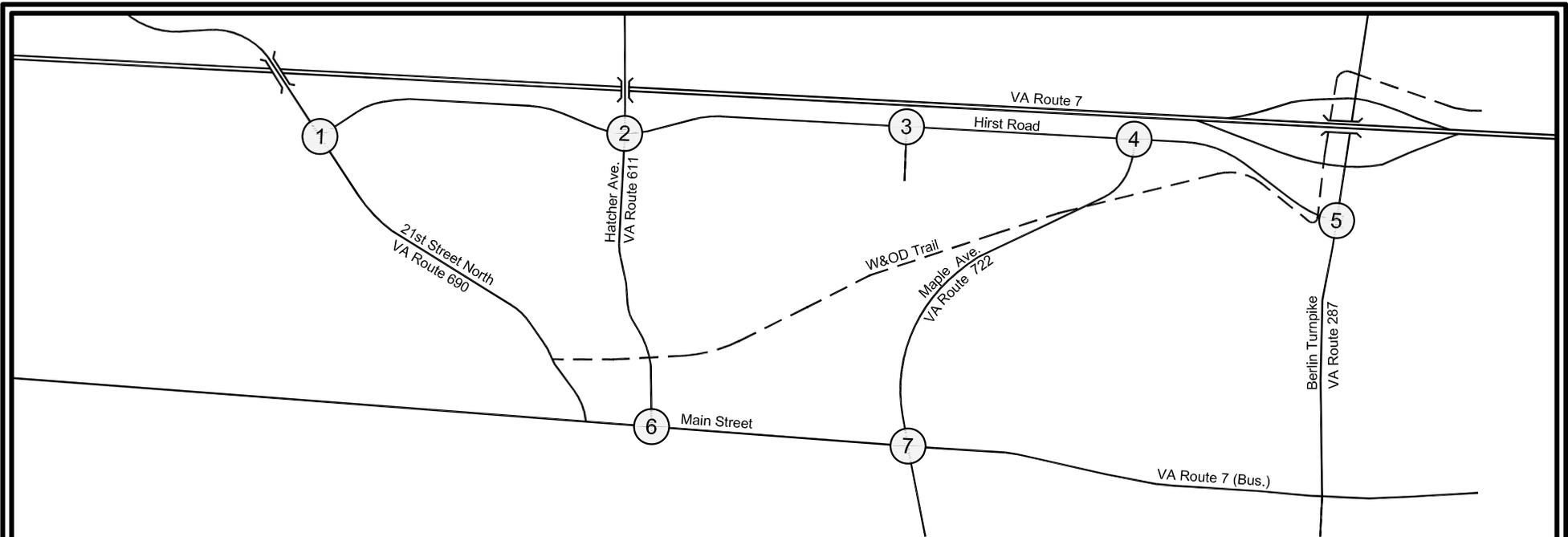


DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)

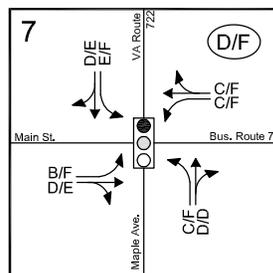
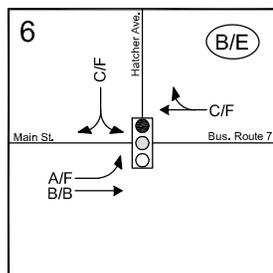
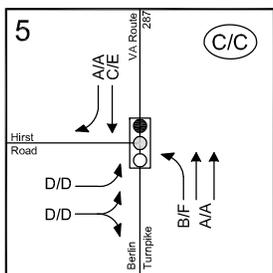




DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- AM/PM Peak Hour Level of Service
- Overall Intersection Level of Service
- Free Flow Condition



- Hirst Road/21<sup>st</sup> Street North (Study Intersection #1): 2.3% and 3.8% in the AM and PM peak hours, respectively.
- Hirst Road/Berlin Turnpike (Study Intersection #5): 1.9% and 3.1% in the AM and PM peak hours, respectively.

The above percentages account for the speculative development of the commercial portion of the site.

**12. TURN LANE WARRANT ANALYSIS**

An analysis was conducted to see if right and left turn lanes would be warranted at the residential site entrance on Hirst Road (Study Intersection #3). The analysis was completed using the Total Future Traffic Forecasts (2014) shown on Figure 17 and Figures 3-11 and 3-26 from Appendix F of the VDOT Road Design Manual. The results of the analyses are included in Appendix K and summarized in Table 9.

**Table 9 – Turn Lane Warrant Analysis Summary**

Intersection	Approach	<u>Total Future, 2014</u> Turn Lane Warranted?
3. Hirst Road/ Site Entrance	Eastbound Right Westbound Left	No Yes (200' Storage)

As shown in Table 9, a westbound left turn lane with 200 feet of storage is warranted at the residential site entrance.

### 13. CONCLUSIONS

The conclusions of the Traffic Impact Analysis completed for the proposed Catoclin Creek Apartments development indicates that **without** the buildout of the Catoclin Creek Apartments development, traffic conditions would necessitate multiple improvements to the study intersections in 2014 and 2020. **With** the buildout of the proposed development, no additional improvements would be required.

**APPENDIX A**  
**SCOPING AGREEMENT**



## 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.

<b>Contact Information</b>				
Consultant Name: Tele: E-mail:	Erich Strohacker, PE, PTOE 804 616-3240 estrohacker@bowmancg.com			
Developer/Owner Name: Tele: E-mail:	S.L. Nusbaum Realty Company			
<b>Project Information</b>				
Project Name:	Catoctin Creek Apartments	Locality/County:	Purcellville	
Project Location: <small>(Attach regional and site specific location map)</small>	Refer to the attached site location map (Figure 1).			
Submission Type	Comp Plan <input type="checkbox"/>	Rezoning <input checked="" type="checkbox"/>	Site Plan <input type="checkbox"/>	Subd Plat <input type="checkbox"/>
Project Description: <small>(Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)</small>	A 13.72 acres site with an existing zoning of X (transitional). Proposed zoning to be PDH-15 (Planned Development Housing). The site is to consist of 176 apartment units with a single point of access to Hirst Road. Refer to the attached site plan for further details.			
Proposed Use(s): <small>(Check all that apply; attach additional pages as necessary)</small>	Residential <input checked="" type="checkbox"/>	Commercial <input type="checkbox"/>	Mixed Use <input type="checkbox"/>	Other <input type="checkbox"/>
	<b>Residential Uses(s)</b> Number of Units:            176 ITE LU Code(s):            220 _____ _____ <b>Commercial Use(s)</b> ITE LU Code(s):            _____ _____ _____ Square Ft or Other Variable:		<b>Other Use(s)</b> ITE LU Code(s):            _____ _____ _____ Independent Variable(s): _____ _____ _____	
Total Peak Hour Trip Projection:	Less than 100 <input type="checkbox"/>	100 – 499 <input checked="" type="checkbox"/>	500 – 999 <input type="checkbox"/>	1,000 or more <input type="checkbox"/>

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.

<b>Traffic Impact Analysis Assumptions</b>			
Study Period	Existing Year: 2012	Build-out Year: 2014	Design Year: 2020
Study Area Boundaries (Attach map)	North: Hirst Road	South: Main Street	
	East: Berlin Turnpike	West: 21st Street North	
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	Patrick Henry College (information to be obtained from the HNTB Corridor Study / no growth for 2014 / 700 students for 2020); Purcellville Gateway Development (Grocery in operation 2012 / 28% of general retail in operation 2012 / Phase one in operation by 2014 / full buildout by 2020); Catocin Corner (HNTB Study / 35% of development in operation by 2014 / full buildout by 2020); Loudoun Valley Shopping Center (full buildout in operation 2012 / no need to consider an approved background development)		
Consistency With Comprehensive Plan (Land use, transportation plan)	Will seek to obtain Comprehensive Plan Amendment		
Available Traffic Data (Historical, forecasts)	BCG will collect all relevant traffic data needs.		
Trip Distribution (Attach sketch)	Road Name: Route 7 - East 20%	Road Name: Hirst - East 55% / West 45%	
	Road Name: Main - East 30% / West 20%	Road Name: Hatcher - 10% ; 21st - 10% ; Maple - 30%	
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
		Peak Hour of the Generator	
Study Intersections and/or Road Segments (Attach additional sheets as necessary)	1.Hirst / Berlin	6.Main / Hatcher	
	2.Hirst / Maple	7.	
	3.Hirst / Hatcher	8.	
	4.Hirst / 21st Street North	9.	
	5.Main / Maple	10.	
Trip Adjustment Factors	Internal allowance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Reduction: _____% trips	Pass-by allowance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Reduction: _____% 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 _____		
Traffic Signal Proposed or Affected (Analysis software to be used,	Hirst / Berlin; Main / Maple; Main / Hatcher - Timings to be obtained from VDOT and Town.		

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.

progression speed, cycle length)	
Improvement(s) Assumed or to be Considered	No improvements assumed within study area.
Background Traffic Studies Considered	HNTB Berlin Corridor Study; Catoctin Corner TIA; Loudoun Valley Shopping Center TIA
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 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 type="checkbox"/> TDM Measures <input type="checkbox"/> Other _____

NOTES on ASSUMPTIONS: Existing traffic conditions to be analyzed assuming count peak hour factors. All subsequent analysis scenarios to assume a peak hour factor of 0.92. Per BCG field reconnaissance, Loudoun Valley Shopping Center Phase 1 is built out and will not need to be included as part of the background development numbers. Loudoun Valley Shopping Center Phase 2 will not be included in this study. Comprehensive plan amendment to assume 6.71 acre commercial site to the east of the development on the southwest quadrant of the intersection of Hirst and Maple. Traffic from this property to be assumed in 2020 buildout analysis. Access to adjacent commercial property will be separate from proposed residential access location. Hatcher / Main Bank development and East Cornwall Vet Facility to be assumed in the 2% growth for background traffic conditions. South Connector will be in place; however, traffic conditions will not be adjusted to reflect change in traffic patterns due to new facility. Study to provide a total of 5 analysis scenarios (existing, background, buildout, background plus 6, buildout plus 6). Report figures to follow Chapter 527 formatting. Study will inventory bike/ped facilities. Access management standards to be based on Town requirements. Site distribution percentages to be based on local demographic. All Level of Service, delay, and queues will be reported by movement.

SIGNED: EA DATE: 10/17/12  
Applicant or Consultant

PRINT NAME: Eric Strohacker  
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.

### 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:

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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: EA DATE: 10/17/12  
Applicant or Consultant

PRINT NAME: Erich Strohnacker  
Applicant or Consultant

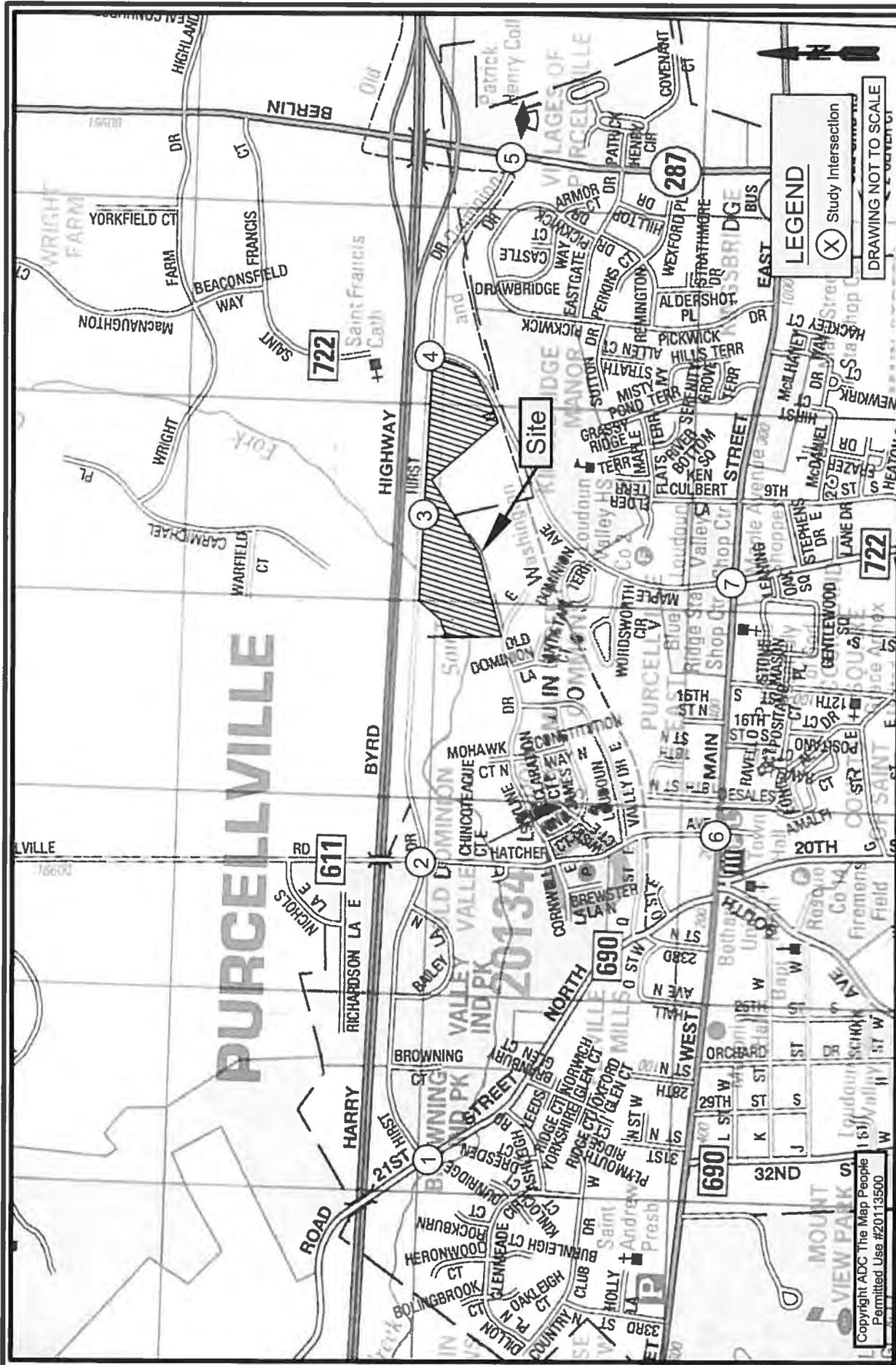
SIGNED: \_\_\_\_\_ DATE: \_\_\_\_\_  
VDOT Representative

PRINT NAME: \_\_\_\_\_  
VDOT Representative

SIGNED: \_\_\_\_\_ DATE: \_\_\_\_\_  
Local Government Representative

PRINT NAME: \_\_\_\_\_  
Local Government Representative





Copyright ADC The Map People  
 Permitted Use #20113500

**LEGEND**  
 X Study Intersection

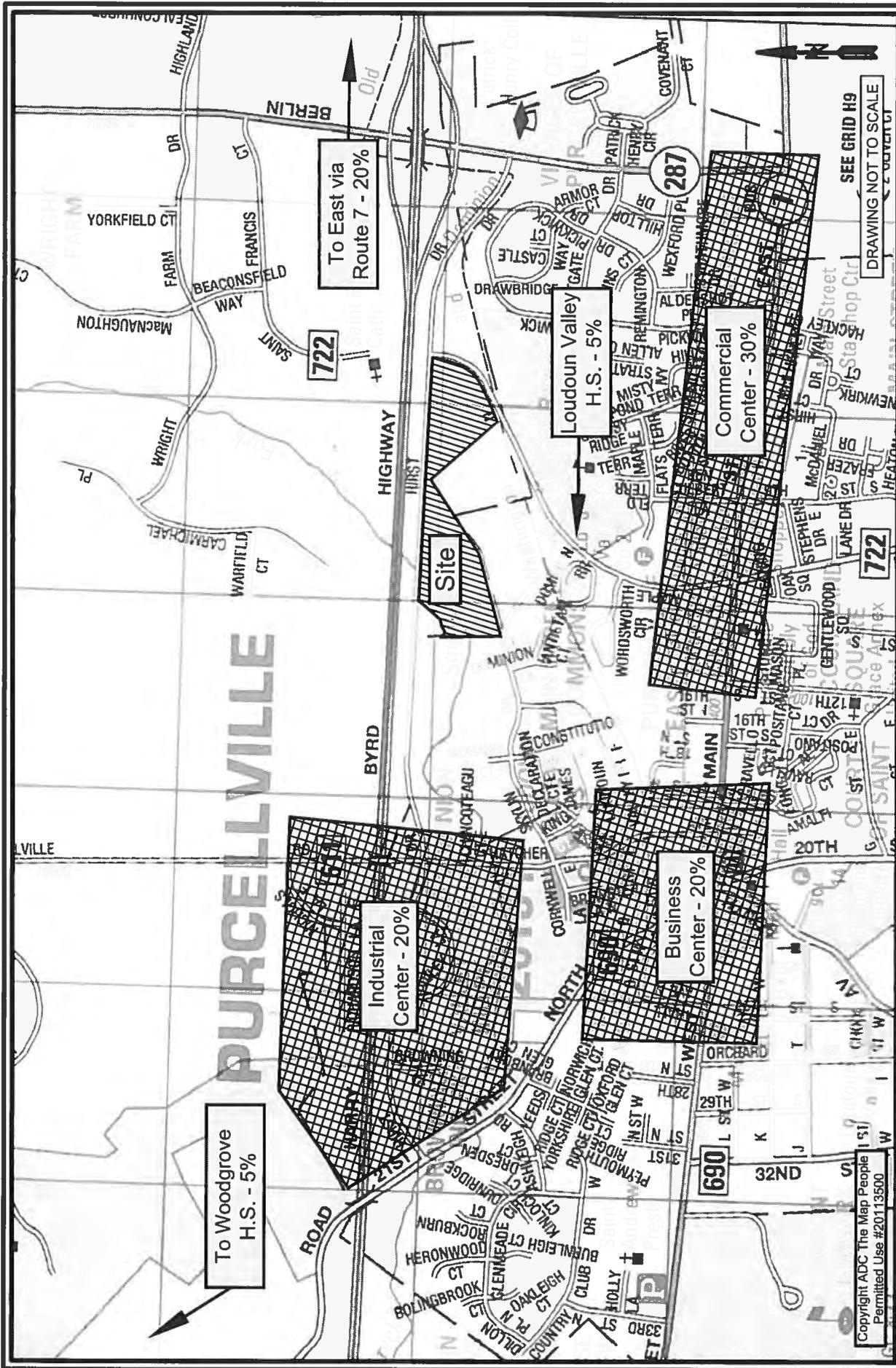
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**Bowman**  
 CONSULTING

**Site Location and Study Intersections Map**  
 Catocin Creek Apartments  
 Purcellville, Virginia

**Figure 1**

Job # 5384-01-001



**Bowman**  
CONSULTING

**Site Trip Distributions**  
Catocin Creek Apartments  
Purcellville, Virginia

**Figure 2**

Job # 5384-01-001

**Table 1 - ITE Site Trip Generation Analysis**

Land Use	Size	Units	Land Use Code	AM Peak Hour			Weekday PM Peak Hour			Daily Trips
				In	Out	Total	In	Out	Total	
<b><u>Proposed Catoclin Creek Apartments Development - ITE Trips<sup>(1)</sup></u></b>										
<b><u>Residential</u></b>										
Apartments		176 D.U.	220	18	72	90	74	40	114	1,190

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 8th Edition.

# MEMO via email

Date: October 22, 2012

To: Eric Strohacker, PD, PTOE

CC: Samer Beidas, Dale E. Lehnig, Alex Vanegas, Geoff Giffin, Tracey Shiflet, Thomas VanPoole

From: Patrick Sullivan, AICP CED

Re: VDOT Scoping Documentation

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The town through its traffic consultant Kimley-Horn has reviewed the VDOT scoping documentation for the Catoctin Creek Apartments that was signed and dated 10/16/2012. The Town has the following comments:

Page 1, Submission Type - this should include Comprehensive Plan as well as the rezoning. The plan and the rezoning will be reviewed concurrently.

Page 1, Project Description -suggest mentioning the adjacent commercial property and Comprehensive Plan Amendment

Page 1, Proposed Uses – Should add adjoining commercial property assumed land uses and quantities

Page 2, External Factors – Consider adding Phase 2 of Loudoun Valley Shopping Center (LVSC)

Page 2, External Factors – Consideration should be given to the Southern Collector connection and the resulting traffic pattern changes

Page 2, Available Traffic Data – HNTB’s study has some traffic count data that could be used

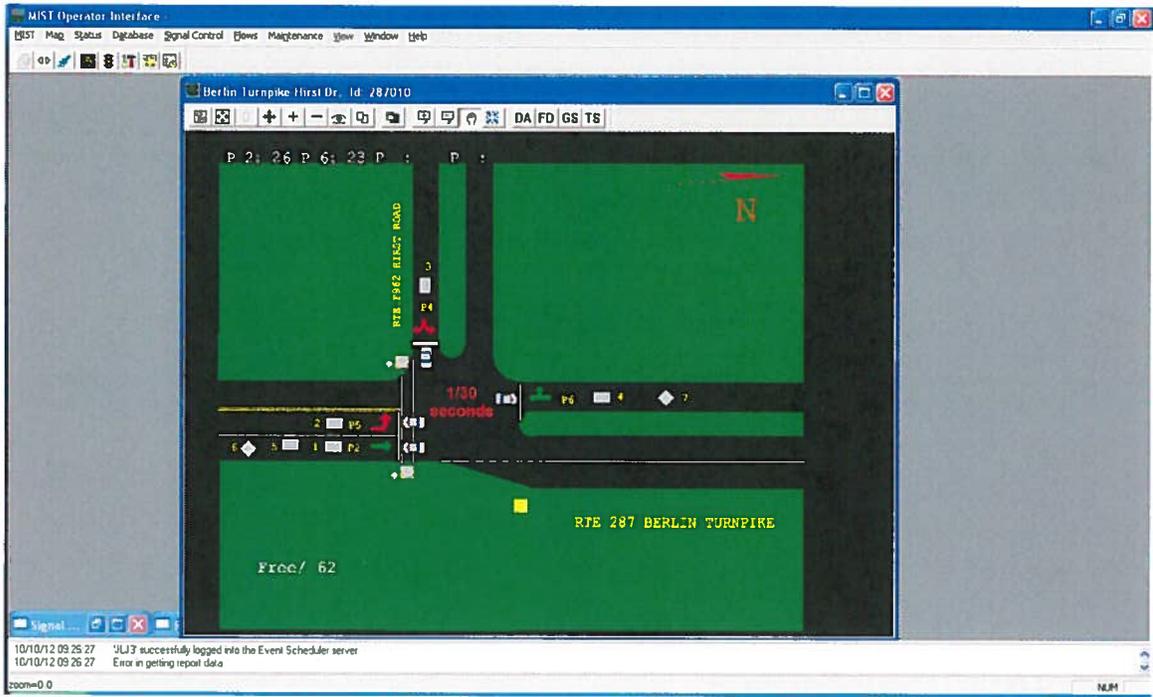
Page 2, Trip Distribution – It seems that the distribution assumption understates the traffic to/from the east along Route 7. I would expect a higher percentage in that direction due to the significant employment and activity centers to the east.

Page 3, Improvements Assumed to be Considered – the Southern Collector Road connection will be complete by the project build-out and will change traffic patterns through town.

Page 3, Additional Issues – Add turn lane warrants (as requested by VDOT)

Page 3, Notes on Assumptions – similar comments as before 1) Do not exclude LVSC Phase 2; and 2) suggest providing specific assumptions for the commercial property

**APPENDIX B**  
**EXISTING SIGNAL TIMINGS**





PHASE TIMING BANK #1

Column Number ->	Phase								<<+0+F=1>	Column Numbers ->	Max Initial	Alt Walk	Alt FDW	Alt Initial	Alt Extension
	1	2	3	4	5	6	7	8							
0 - Ped Walk	0	0	0	7	0	0	0	0	1 - Phase 1	0	0	0	0	0.0	
1 - Ped FDW	0	0	0	14	0	0	0	0	2 - Phase 2	0	0	0	0	0.0	
2 - Min Green	0	20	0	7	5	20	0	0	3 - Phase 3	0	0	0	0	0.0	
3 - Type 3 Disconnect	0	0	0	0	0	0	0	0	4 - Phase 4	0	0	0	0	0.0	
4 - Added per Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5 - Phase 5	0	0	0	0	0.0	
5 - Veh Extension	0.0	3.5	0.0	3.5	2.5	3.5	0.0	0.0	6 - Phase 6	0	0	0	0	0.0	
6 - Max Gap	0.0	3.5	0.0	3.5	2.5	3.5	0.0	0.0	7 - Phase 7	0	0	0	0	0.0	
7 - Min Gap	0.0	3.5	0.0	3.5	2.5	3.5	0.0	0.0	8 - Phase 8	0	0	0	0	0.0	
8 - Max Limit	0	65	0	40	25	65	0	0							
9 - Max Limit 2	0	0	0	0	0	0	0	0	<b>All Red Start</b>						
A - Adv/Delay Walk	0	0	0	0	0	0	0	0	<(F)I+C+0>	<input type="text" value="0"/>					
B - RR Min Ped FDW	0	0	0	0	0	0	0	0	<b>Red Revert</b>						
C - Cond Serv Check	0	0	0	0	0	0	0	0	<(F)I+0+F>	<input type="text" value="5.0"/>					
D - Reduce Every	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
E - Yellow Change	0.0	4.5	0.0	4.5	4.5	4.5	0.0	0.0							
F - Red Clear	0.0	2.0	0.0	2.5	3.0	2.0	0.0	0.0							

Site: 287010 Berlin Turnpike Hirst Dr - Type: FIELD Data - Last Uploaded: October 10, 2012 09:50:20

Timing Sheets Help

File Tables Download Print Export

### COORDINATION AND TIMING PARAMETERS

**Phase Functions**

<<C+D+F=1>> Column F

Phase #/LED #	1	2	3	4	5	6	7	8
0 - Permt	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 - Red Lock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 - Yellow Lock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 - Min Recall	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 - Ped Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 - Rest in Walk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 - Red Rest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 - Dual Entry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 - Max Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A - Soft Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B - Max 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C - Cond. Service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D - Man Cntrl Calls	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E - Yellow Start	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F - First Phases	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Phases**

	1	2	3	4	5	6	7	8
Coord Extra <C/S+I+C>	<input type="checkbox"/>	<input type="checkbox"/>						
Excess Time <C/S+I+D>	<input type="checkbox"/>	<input type="checkbox"/>						
External Lag <F/I+E+E>	<input type="checkbox"/>	<input checked="" type="checkbox"/>						
Lag Free <F/I+E+F>	<input type="checkbox"/>	<input checked="" type="checkbox"/>						

Note: The LED lights are not used to display the values for Coord Extra and Excess Time. These values are displayed as the decimal equivalent of the binary number represented by the phase check boxes. For example, if the checkboxes for phases 1, 2, and 3 are checked, the controller will display the decimal value 7.

start | P211 Operator Interf... | Doc1 - Microsoft Word | Doc2 - Microsoft Word | Dokument1 - Microsoft | Site: 287010 Berlin T... | 9/10/2012

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### COORDINATION SHEET #1

<<C40+C=1>  
Plans 1 - 15

Column Number -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	100	0	100	120	0	0	100	0	100	0	100	150	0	0	0
1 - Phase 1 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 - Phase 2 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 - Phase 3 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 - Phase 4 Force Off	28	0	30	34	0	0	38	0	38	0	40	40	0	0	0
5 - Phase 5 Force Off	46	0	47	52	0	0	55	0	55	0	57	59	0	0	0
6 - Phase 6 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Phase 7 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - Phase 8 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - Ring Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Offset 1	21	0	88	112	0	0	21	0	21	0	88	112	0	0	0
D - Perm 1 End	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E - Hold Release	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255
F - Zone Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

<<C40+C=3>  
Plans 16 - 30

Column Numbers -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 - Phase 1 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

start | 1837 Operator Interf | Doc1 - Microsoft Word | Doc2 - Microsoft Word | Doc3 - Microsoft Word | Doc4 - Microsoft Word | Site: 287010 Berlin T... | 9:51 AM

COORDINATION SHEET 2: Plans 1-8

<<C+0+C=2>

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8
Column Numbers >	1	2	3	4	5	6	7	8
0 - Pod Adjustment	0	0	0	0	0	0	0	0
1 - Perm 2 Start	0	0	0	0	0	0	0	0
2 - Perm 2 End	0	0	0	0	0	0	0	0
3 - Perm 3 Start	0	0	0	0	0	0	0	0
4 - Perm 3 End	0	0	0	0	0	0	0	0
5 - Reserve Time	0	0	0	0	0	0	0	0

	Plan 1 <<C+0+C=1> Column 1								Plan 2 <<C+0+C=1> Column 2								Plan 3 <<C+0+C=1> Column 3							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
B - Sync Phases	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
C - Lag Phases	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

	<<C+0+C=2> Column 1								<<C+0+C=2> Column 2								<<C+0+C=2> Column 3							
6 - Reserve Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Max Inhibit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8 - Pretimed Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - Max Recall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Perm1 Veh Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B - Perm1 Ped Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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### PHASE TIMING BANK #1

<<C+D+F=1>

Column Number ->	1	2	3	4	5	6	7	8	Column Numbers ->	9	A	B	C	D
0 - Ped Walk	0	0	0	7	0	7	0	0	1 - Phase 1	0	0	0	0	0.0
1 - Ped FDW	0	0	0	13	0	16	0	0	2 - Phase 2	0	0	0	0	0.0
2 - Min Green	0	15	0	5	5	15	0	0	3 - Phase 3	0	0	0	0	0.0
3 - Type 3 Disconnect	0	0	0	0	0	0	0	0	4 - Phase 4	0	0	0	0	0.0
4 - Added per Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5 - Phase 5	0	0	0	0	0.0
5 - Veh Extension	0.0	6.0	0.0	4.0	2.0	6.0	0.0	0.0	6 - Phase 6	0	0	0	0	0.0
6 - Max Gap	0.0	6.0	0.0	4.0	2.0	6.0	0.0	0.0	7 - Phase 7	0	0	0	0	0.0
7 - Min Gap	0.0	6.0	0.0	4.0	2.0	6.0	0.0	0.0	8 - Phase 8	0	0	0	0	0.0
8 - Max Limit	0	80	0	25	15	80	0	0	All Red Start	<input type="text" value="0"/>				
9 - Max Limit 2	0	80	0	25	15	80	0	0	<(F/1+C+0)>	<input type="text" value="0"/>				
A - Adv/Delay Walk	0	0	0	0	0	0	0	0	Red Revert	<input type="text" value="5.0"/>				
B - RR Min Ped FDW	0	0	0	0	0	0	0	0	<(F/1+0+F)>	<input type="text" value="5.0"/>				
C - Cond Serv Check	0	0	0	0	0	0	0	0						
D - Reduce Every	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
E - Yellow Change	0.0	4.0	0.0	4.0	4.0	4.0	0.0	0.0						
F - Red Clear	0.0	2.5	0.0	2.0	2.0	2.5	0.0	0.0						

start

Operator: [unreadable]

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100 sec cycles

84  
1

5 ✓  
2 -

1 6

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### COORDINATION AND TIMING PARAMETERS

**Phase Functions**  
<C+D+F=1> Column F

Phase #/LED #	1	2	3	4	5	6	7	8
D - Permit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 - Red Lock	<input type="checkbox"/>							
2 - Yellow Lock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 - Min Recall	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 - Ped Recall	<input type="checkbox"/>							
6 - Rest in Walk	<input type="checkbox"/>							
7 - Red Rest	<input type="checkbox"/>							
8 - Dual Entry	<input type="checkbox"/>							
9 - Max Recall	<input type="checkbox"/>							
A - Soft Recall	<input type="checkbox"/>							
B - Max 2	<input type="checkbox"/>							
C - Cond. Service	<input type="checkbox"/>							
D - Man Cntrl Calls	<input checked="" type="checkbox"/>							
E - Yellow Start	<input type="checkbox"/>							
F - First Phases	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Phases**

	1	2	3	4	5	6	7	8
Coord Extra <C/S+1+C>	<input type="checkbox"/>	<input type="checkbox"/>						
Excess Time <C/S+1+D>	<input type="checkbox"/>	<input type="checkbox"/>						
External Lag <F/1+E+E>	<input type="checkbox"/>	<input type="checkbox"/>						
Lag Free <F/1+E+F>	<input type="checkbox"/>	<input checked="" type="checkbox"/>						

Note: The LED lights are not used to display the values for Coord Extra and Excess Time. These values are displayed as the decimal equivalent of the binary number represented by the phase check boxes.  
For example, if the checkboxes for phases 1, 2, and 3 are checked, the controller will display the decimal value 7.

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### COORDINATION SHEET #1

<C+D+C=1>  
Plans 1 - 15

Column Number -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1 - Phase 1 Force Off	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
2 - Phase 2 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 - Phase 3 Force Off	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
4 - Phase 4 Force Off	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
5 - Phase 5 Force Off	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
6 - Phase 6 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Phase 7 Force Off	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
8 - Phase 8 Force Off	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
9 - Ring Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Offset 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D - Perm 1 End	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
E - Hold Release	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255
F - Zone Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

<C+D+C=3>  
Plans 16 - 30

Column Numbers -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 - Phase 1 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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1 PLAN

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### COORDINATION SHEET 2: Plans 1-8

<<C+D+C=2>

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8
Column Numbers ->	1	2	3	4	5	6	7	8
0 - Ped Adjustment	0	0	0	0	0	0	0	0
1 - Perm 2 Start	0	0	0	0	0	0	0	0
2 - Perm 2 End	0	0	0	0	0	0	0	0
3 - Perm 3 Start	0	0	0	0	0	0	0	0
4 - Perm 3 End	0	0	0	0	0	0	0	0
5 - Reservoic Time	0	0	0	0	0	0	0	0

	Plan 1 <<C+D+C=1> Column 1								Plan 2 <<C+D+C=1> Column 2								Plan 3 <<C+D+C=1> Column 3							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
B - Sync Phases	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
C - Leg Phases	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

	<<C+D+C=2> Column 1								<<C+D+C=2> Column 2								<<C+D+C=2> Column 3							
6 - Reservoic Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Max Inhibit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - Protimed Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - Max Recal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Perm1 Veh Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B - Perm1 Ped Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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### TIME BASED COORDINATION EVENTS

Bank 1  
<C+0+9=0.1>

Day of Week

Row	Hour	Min	Plan	S	M	T	W	T	F	S
0	0	0	62	<input checked="" type="checkbox"/>						
1	0	0	0	<input type="checkbox"/>						
2	0	0	0	<input type="checkbox"/>						
3	0	0	0	<input type="checkbox"/>						
4	0	0	0	<input type="checkbox"/>						
5	0	0	0	<input type="checkbox"/>						
6	0	0	0	<input type="checkbox"/>						
7	0	0	0	<input type="checkbox"/>						
8	0	0	0	<input type="checkbox"/>						
9	0	0	0	<input type="checkbox"/>						
A	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
C	0	0	0	<input type="checkbox"/>						
D	0	0	0	<input type="checkbox"/>						
E	0	0	0	<input type="checkbox"/>						
F	0	0	0	<input type="checkbox"/>						

Bank 2  
<C+0+9=0.2>

Day of Week

Row	Hour	Min	Plan	S	M	T	W	T	F	S
0	0	0	0	<input type="checkbox"/>						
1	0	0	0	<input type="checkbox"/>						
2	0	0	0	<input type="checkbox"/>						
3	0	0	0	<input type="checkbox"/>						
4	0	0	0	<input type="checkbox"/>						
5	0	0	0	<input type="checkbox"/>						
6	0	0	0	<input type="checkbox"/>						
7	0	0	0	<input type="checkbox"/>						
8	0	0	0	<input type="checkbox"/>						
9	0	0	0	<input type="checkbox"/>						
A	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
C	0	0	0	<input type="checkbox"/>						
D	0	0	0	<input type="checkbox"/>						
E	0	0	0	<input type="checkbox"/>						
F	0	0	0	<input type="checkbox"/>						

start

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### TIME OF DAY FUNCTIONS

Normal TOD Functions

Column 4  
<C+D+7=1>      <C+D+E=27>

Day of Week      Phase/Bits

Row	Hour	Min	Func	S	M	T	W	T	F	S	1	2	3	4	5	6	7	8
0	7	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
1	9	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
2	16	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				
3	18	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
4	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

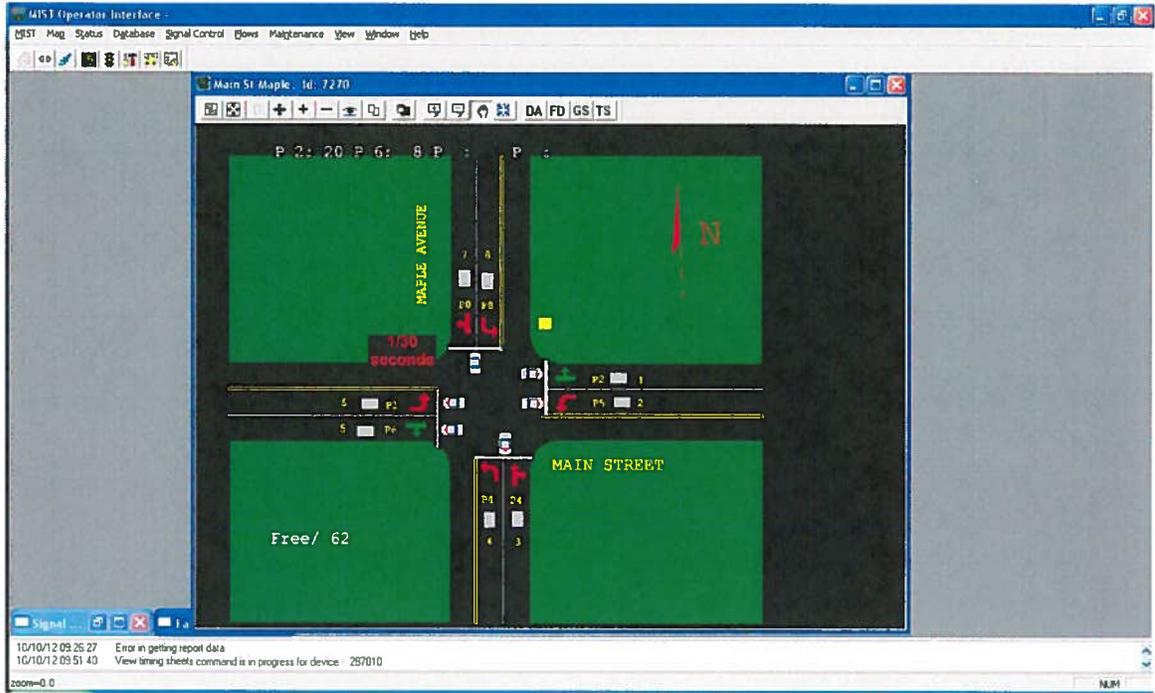
TOD Function Definitions

- 0=Exclusive Phases
- 1=Red Lock
- 2=Yellow Lock
- 3=Vehicle Min Recall
- 4=Ped Recall
- 5=not used
- 6=Lock at Week
- 7=Red Rest
- 8=Double Entry
- 9=Vehicle Max Recall
- 10=Vehicle Soft Recall
- 11=Max 2
- 12=Conditional Service
- 13=Lag Phases
- 14=Bit 1 - Local Override
- Bit 4 - Disable Det. Off Monitor
- Bit 8 - Real-time Split Monitor
- 15=TOD Output Bits 1-8

Holiday TOD Functions

Column 4  
<C+D+7=2>      <C+D+E=28>

start    TST - Operat...    Site - 7280 N...    Doc1 - Phases...    Doc2 - Phases...    Doc3 - Phases...    Doc4 - Phases...    Doc5 - Phases...    Document6...



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### PHASE TIMING BANK #1

<C+0+F=1>

Column Number >	Phase								Column Numbers >	Max Initial	AR Walk	AR FDW	AR Initial	AR Extension
	1	2	3	4	5	6	7	8	9	A	B	C	D	
0 - Ped Walk	0	7	0	7	0	7	0	7	1 - Phase 1	0	0	0	0	0.0
1 - Ped FDW	0	21	0	14	0	17	0	21	2 - Phase 2	0	0	0	0	0.0
2 - Min Green	5	15	0	6	5	15	0	6	3 - Phase 3	0	0	0	0	0.0
3 - Type 3 Disconnect	0	0	0	0	0	0	0	0	4 - Phase 4	0	0	0	0	0.0
4 - Added per Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5 - Phase 5	0	0	0	0	0.0
5 - Veh Extension	2.0	6.0	0.0	4.0	2.0	6.0	0.0	4.0	6 - Phase 6	0	0	0	0	0.0
6 - Max Gap	2.0	6.0	0.0	4.0	2.0	6.0	0.0	4.0	7 - Phase 7	0	0	0	0	0.0
7 - Min Gap	2.0	6.0	0.0	4.0	2.0	6.0	0.0	4.0	8 - Phase 8	0	0	0	0	0.0
8 - Max Limit	20	65	0	25	20	65	0	25	<b>All Red Start</b>					<input type="text" value="0"/>
9 - Max Limit 2	20	65	0	70	45	65	0	70	<P/1+C+0>					
A - Adv/Delay Walk	0	0	0	0	0	0	0	0	<b>Red Revert</b>					<input type="text" value="5.0"/>
B - RR Min Ped FDW	0	0	0	0	0	0	0	0	<P/1+0+F>					
C - Cond Serv Check	0	0	0	0	0	0	0	0						
D - Reduce Every	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
E - Yellow Change	4.0	4.0	0.0	4.5	4.0	4.0	4.0	4.5						
F - Red Clear	2.5	3.0	0.0	3.0	2.5	3.0	0.0	3.0						

Windows taskbar: start | MSST - Oper/Mor Inter... | Lock - Microsoft Word | Document2 - Microsof... | Site: 7270 Main St Maple

COORDINATION AND TIMING PARAMETERS

Phase #/LED #	Phase Functions <C+D+F=1> Column F								Coord Extra <C/S+I+C>	Phases							
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
0 - Permit	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 - Red Lock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 - Yellow Lock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 - Min Recall	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 - Ped Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6 - Rest in Walk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 - Red Rest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 - Dual Entry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 - Max Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A - Soft Recall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B - Max 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C - Cond. Service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D - Man Cntrl Calls	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E - Yellow Start	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F - First Phases	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: The LED lights are not used to display the values for Coord Extra and Excess Time. These values are displayed as the decimal equivalent of the binary number represented by the phase check boxes.  
 For example, if the checkboxes for phases 1, 2, and 3 are checked, the controller will display the decimal value 7.

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### COORDINATION SHEET #1

<<C+0+C=1>>  
Plans 1 - 15

Column Number -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	150	120	150	90	90	100	100	100	100	0	0	0	0	0	0
1 - Phase 1 Force Off	64	74	67	41	49	55	55	55	55	0	0	0	0	0	0
2 - Phase 2 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 - Phase 3 Force Off	0	0	0	0	0	20	20	20	20	0	0	0	0	0	0
4 - Phase 4 Force Off	47	43	42	26	34	40	40	40	40	0	0	0	0	0	0
5 - Phase 5 Force Off	64	63	57	41	49	55	55	55	55	0	0	0	0	0	0
6 - Phase 6 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Phase 7 Force Off	0	0	0	0	0	20	20	20	20	0	0	0	0	0	0
8 - Phase 8 Force Off	0	0	0	0	0	40	40	40	40	0	0	0	0	0	0
9 - Ramp Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Offset 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D - Perm 1 End	5	5	5	5	5	5	5	5	5	0	0	0	0	0	0
E - Hold Release	255	255	255	255	255	255	255	255	255	0	0	0	0	0	0
F - Zone Offset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

<<C+0+C=3>>  
Plans 16 - 30

Column Numbers -->	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 - Cycle Length	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 - Phase 1 Force Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

start | MST Operator 3: user | Excel - Microsoft Word | Doc2 - Microsoft Word | Doc3 - Microsoft Word | Document64 - Microsoft... | Site: 7270 Main St-Maple | 10:41 AM

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### COORDINATION SHEET 2: Plans 1-8

<<+0+C=2>

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8
Column Numbers ->	1	2	3	4	5	6	7	8
0 - Ped Adjustment	0	0	0	0	0	0	0	0
1 - Perm 2 Start	0	0	0	0	0	0	0	0
2 - Perm 2 End	0	0	0	0	0	0	0	0
3 - Perm 3 Start	0	0	0	0	0	0	0	0
4 - Perm 3 End	0	0	0	0	0	0	0	0
5 - Reservice Time	0	0	0	0	0	0	0	0

	Plan 1 <C+0+C=1> Column 1								Plan 2 <C+0+C=1> Column 2								Plan 3 <C+0+C=1> Column 3							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
B - Sync Phases	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
C - Lag Phases	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

	<C+0+C=2> Column 1								<C+0+C=2> Column 2								<C+0+C=2> Column 3							
6 - Reservice Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - Max Inhibit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8 - Prohibit Phases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - Max Recall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A - Perm1 Veh Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B - Perm1 Ped Phase	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

start | MST HyperM... | Doc1 - Microsoft... | Doc2 - Microsoft... | Doc3 - Microsoft... | Doc4 - Microsoft... | DocumentE - Pac... | Site: 7270 Main... | 10/10/12

Site: 7270 Main St. Maple Type: FIELD Data Last Uploaded: October 10, 2017 09:57:37

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### TIME BASED COORDINATION EVENTS

Bank 1  
<C+D+9=0.1>

Day of Week

Row	Hour	Min	Plan	S	M	T	W	T	F	S
0	0	0	62	<input checked="" type="checkbox"/>						
1	0	0	0	<input type="checkbox"/>						
2	0	0	0	<input type="checkbox"/>						
3	0	0	0	<input type="checkbox"/>						
4	0	0	0	<input type="checkbox"/>						
5	0	0	0	<input type="checkbox"/>						
6	0	0	0	<input type="checkbox"/>						
7	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
9	0	0	0	<input type="checkbox"/>						
A	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
C	0	0	0	<input type="checkbox"/>						
D	0	0	0	<input type="checkbox"/>						
E	0	0	0	<input type="checkbox"/>						
F	0	0	0	<input type="checkbox"/>						

Bank 2  
<C+D+9=0.2>

Day of Week

Row	Hour	Min	Plan	S	M	T	W	T	F	S
0	0	0	0	<input type="checkbox"/>						
1	0	0	0	<input type="checkbox"/>						
2	0	0	0	<input type="checkbox"/>						
3	0	0	0	<input type="checkbox"/>						
4	0	0	0	<input type="checkbox"/>						
5	0	0	0	<input type="checkbox"/>						
6	0	0	0	<input type="checkbox"/>						
7	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
9	0	0	0	<input type="checkbox"/>						
A	0	0	0	<input type="checkbox"/>						
B	0	0	0	<input type="checkbox"/>						
C	0	0	0	<input type="checkbox"/>						
D	0	0	0	<input type="checkbox"/>						
E	0	0	0	<input type="checkbox"/>						
F	0	0	0	<input type="checkbox"/>						

start | MST Operational | Doc1 - Files... | Doc2 - Files... | Doc3 - Files... | Doc4 - Files... | Doc5 - Files... | Doc6 - Files... | Size: 7170 B | 10/10/17 10:10 AM

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### TIME OF DAY FUNCTIONS

Normal TOD Functions

Column 4  
<C+0+7=1>      <C+0+E=27>

Row	Hour	Min	Func	Day of Week							Phase/Bits								TOD Function Defnibers	
				S	M	T	W	T	F	S	1	2	3	4	5	6	7	8		
0	8	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0=Excludes Phases 1=Red Lock 2=Yellow Lock 3=Vehicle Min Recall 4=Ped Recall 5=Max Used 6=Rest In Walk 7=Red Rest 8=Double Entry 9=Vehicle Max Recall 10=Vehicle Soft Recall 11=Max 2 12=Conditional Service 13=Log Phases 14=Bit 1 - Local Override Bit 4 - Disable Det OFF Monitor Bit 8 - Real-time Spk Monitor 15=TOD Output Bits 1-8
1	9	0	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
2	15	20	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
3	16	20	11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4	0	0	11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
5	10	0	11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>								
6	13	0	11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
8	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
9	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
A	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
B	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
C	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
D	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
E	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
F	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								

Holiday TOD Functions

Column 4

**APPENDIX C**  
**RAW TRAFFIC DATA**



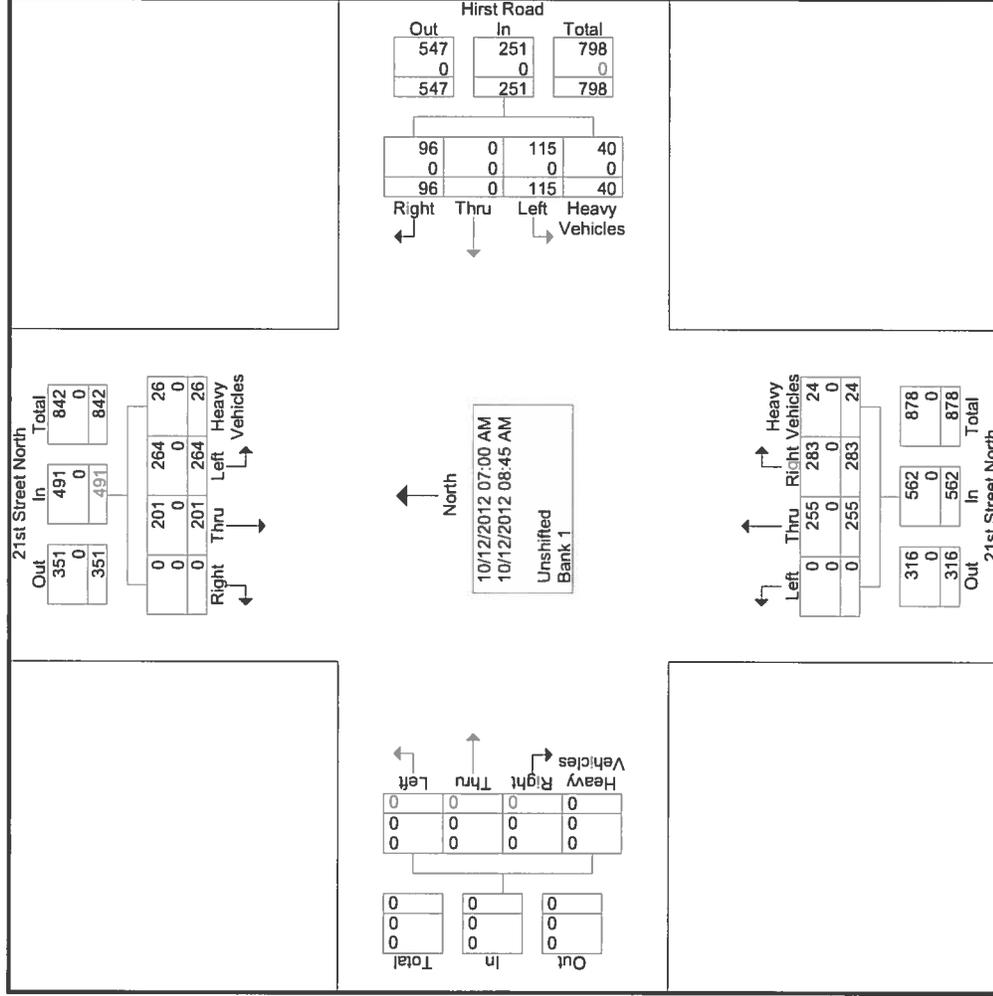
# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150

Richmond, Virginia 23233

Project: Catocin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and 21St N AM  
Site Code : 00003333  
Start Date : 10/12/2012  
Page No : 2





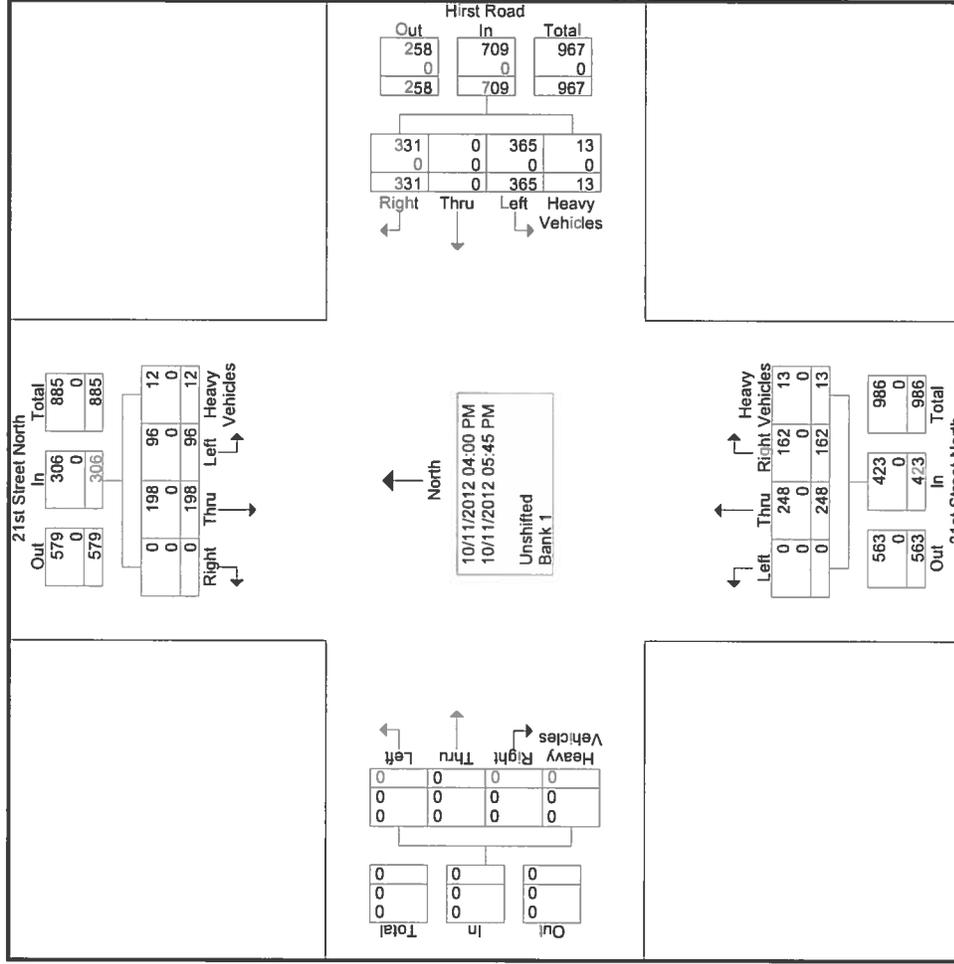


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and 21St N PM  
Site Code : 00003333  
Start Date : 10/11/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and 21St N PM  
Site Code : 00003333  
Start Date : 10/11/2012  
Page No : 3

Start Time	21st Street North From North			Hirst Road From East			21st Street North From South			From West			Int. Total	
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Thru	Left	App. Total		App. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
05:00 PM	0	18	7	42	0	50	18	29	0	1	48	0	0	0
05:15 PM	0	24	15	52	0	61	24	30	0	1	55	0	0	0
05:30 PM	0	25	8	36	0	56	21	42	0	0	63	0	0	0
05:45 PM	0	18	15	33	0	51	15	44	0	0	59	0	0	0
Total Volume	0	85	45	163	0	218	78	145	0	2	225	0	0	0
% App. Total	0	64.9	34.4	41.7	0	55.8	34.7	64.4	0	0.9	893	0	0	0
PHF	.000	.850	.750	.784	.000	.893	.813	.824	.000	.500	.893	.000	.000	.000

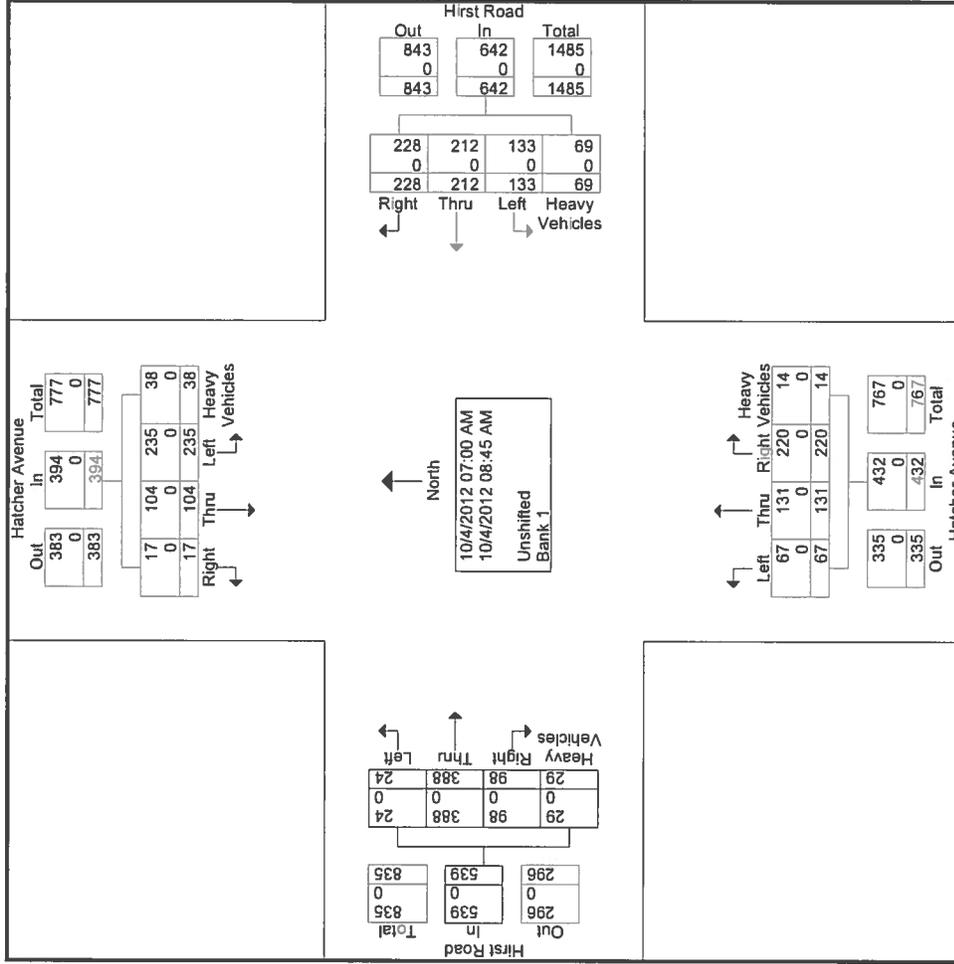


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catcotin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Hatcher AM  
Site Code : 00002222  
Start Date : 10/4/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catcotin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Hatcher AM  
Site Code : 00002222  
Start Date : 10/4/2012  
Page No : 3

Start Time	Hatcher Avenue From North				Hirst Road From East				Hatcher Avenue From South				Hirst Road From West								
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total				
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	4	20	42	1	24	22	15	4	65	23	15	10	0	48	17	49	5	3	74	254	
08:00 AM	5	12	22	2	41	21	21	3	86	31	23	6	0	60	9	53	2	6	70	257	
08:15 AM	1	10	24	1	46	31	19	25	121	34	15	17	5	71	11	43	6	1	61	289	
08:30 AM	0	15	35	7	46	45	13	24	128	34	23	12	4	73	14	41	2	3	60	318	
Total Volume	10	57	123	11	157	119	68	56	400	122	76	45	9	252	51	186	15	13	265	1118	
% App. Total	5	28.4	61.2	5.5	39.2	29.8	17	14	48.4	30.2	17.9	3.6		19.2	70.2	5.7	4.9				
PHF	.500	.713	.732	.393	.853	.661	.810	.560	.781	.897	.826	.662	.450	.863	.750	.877	.625	.542			.879

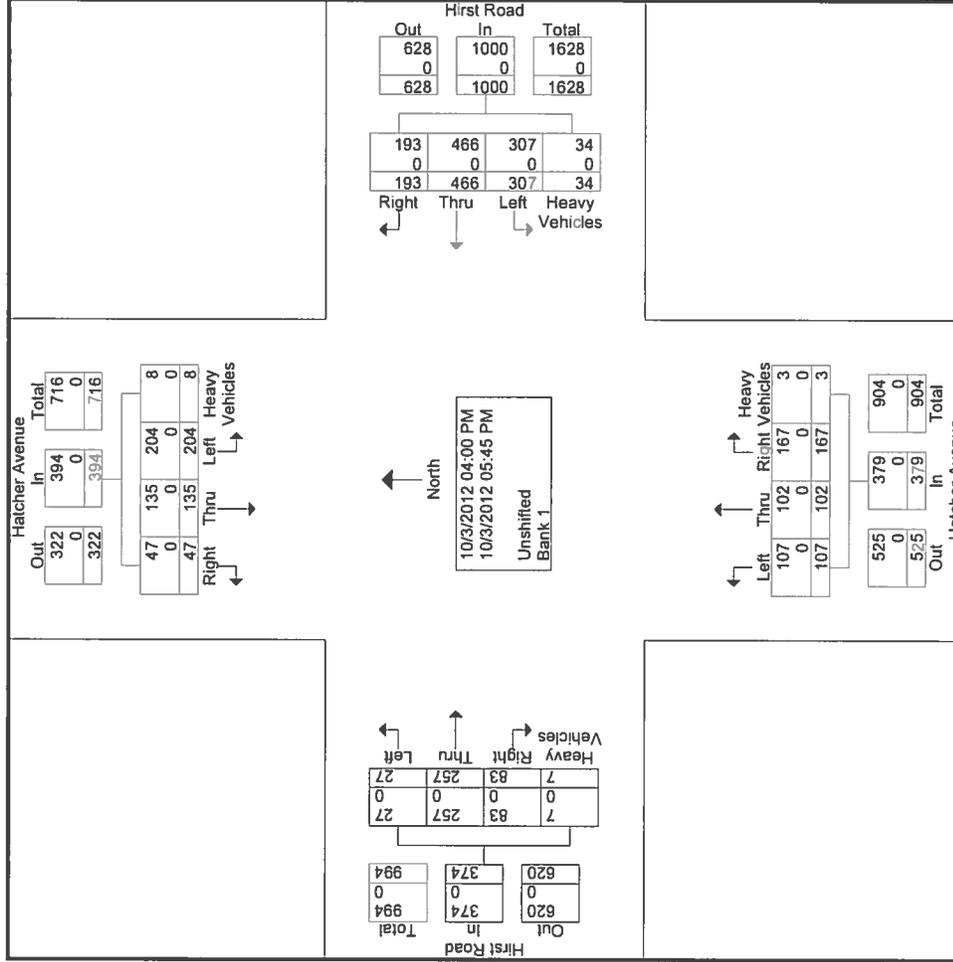


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Hatcher PM  
Site Code : 00000222  
Start Date : 10/3/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Hatcher PM  
Site Code : 00000222  
Start Date : 10/3/2012  
Page No : 3

Start Time	Hatcher Avenue From North				Hirst Road From East				Hatcher Avenue From South				Hirst Road From West				Int. Total			
	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles				
04:00 PM	6	39	59	5	29	49	44	2	124	30	16	12	0	58	7	44	4	3	58	349
04:15 PM	10	11	21	2	23	51	37	8	119	13	11	20	0	44	6	27	5	1	39	246
04:30 PM	8	12	22	0	23	52	41	5	121	20	7	17	0	44	18	23	1	2	44	251
04:45 PM	5	15	22	0	16	52	34	0	102	24	10	13	0	47	9	31	5	0	45	236
Total Volume	29	77	124	7	91	204	156	15	466	87	44	62	0	193	40	125	15	6	186	1082
% App. Total	12.2	32.5	52.3	3	19.5	43.8	33.5	3.2	45.1	22.8	32.1	0	0	21.5	67.2	8.1	3.2	500	802	775
PHF	.725	.494	.525	.350	.784	.981	.886	.469	.940	.725	.688	.775	.000	.832	.556	.710	.750	.500	.802	.775

Peak Hour for Entire Intersection Begins at 04:00 PM  
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1





# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Maple AM  
Site Code : 00000111  
Start Date : 10/2/2012  
Page No : 3

Start Time	From North			Hirst Road From East			Maple Avenue From South			Hirst Road From West			Int. Total					
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		App. Total				
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 08:00 AM																		
08:00 AM	0	0	0	0	71	41	1	113	20	0	12	0	32	18	57	0	3	78
08:15 AM	0	0	0	0	90	48	30	168	54	0	11	5	70	37	86	0	4	127
08:30 AM	0	0	0	0	90	62	21	173	53	0	28	17	98	40	84	0	8	132
08:45 AM	0	0	0	0	49	34	3	86	38	0	27	5	70	35	74	0	8	117
Total Volume	0	0	0	0	300	185	55	540	165	0	78	27	270	130	301	0	23	454
% App. Total	0	0	0	0	55.6	34.3	10.2	61.1	61.1	0	28.9	10	28.6	28.6	66.3	0	5.1	860
PHF	.000	.000	.000	.000	.833	.746	.458	.780	.764	.000	.696	.397	.689	.813	.875	.000	.719	.860





# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Bruce Clarke  
Weather:

File Name : Hirst and Maple PM  
Site Code : 00000111  
Start Date : 10/1/2012  
Page No : 3

Start Time	From North			Hirst Road From East			Maple Avenue From South			Hirst Road From West			Int. Total						
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		App. Total	Heavy Vehicles	App. Total			
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 05:00 PM																			
05:00 PM	0	0	0	0	128	71	2	201	25	0	16	0	41	28	70	0	0	98	340
05:15 PM	0	0	0	0	123	56	5	184	27	0	20	0	47	19	73	0	0	92	323
05:30 PM	0	0	0	0	113	52	10	175	36	0	19	0	55	16	52	0	1	69	299
05:45 PM	0	0	0	0	127	66	7	200	26	0	11	0	37	15	49	0	0	64	301
Total Volume	0	0	0	0	491	245	24	760	114	0	66	0	180	78	244	0	1	323	1263
% App. Total	0	0	0	0	64.6	32.2	3.2	63.3	63.3	0	36.7	0	24.1	24.1	75.5	0	0.3	824	929
PHF	0.00	0.00	0.00	0.00	959	863	600	945	792	0.00	825	0.00	818	696	836	0.00	250	824	929

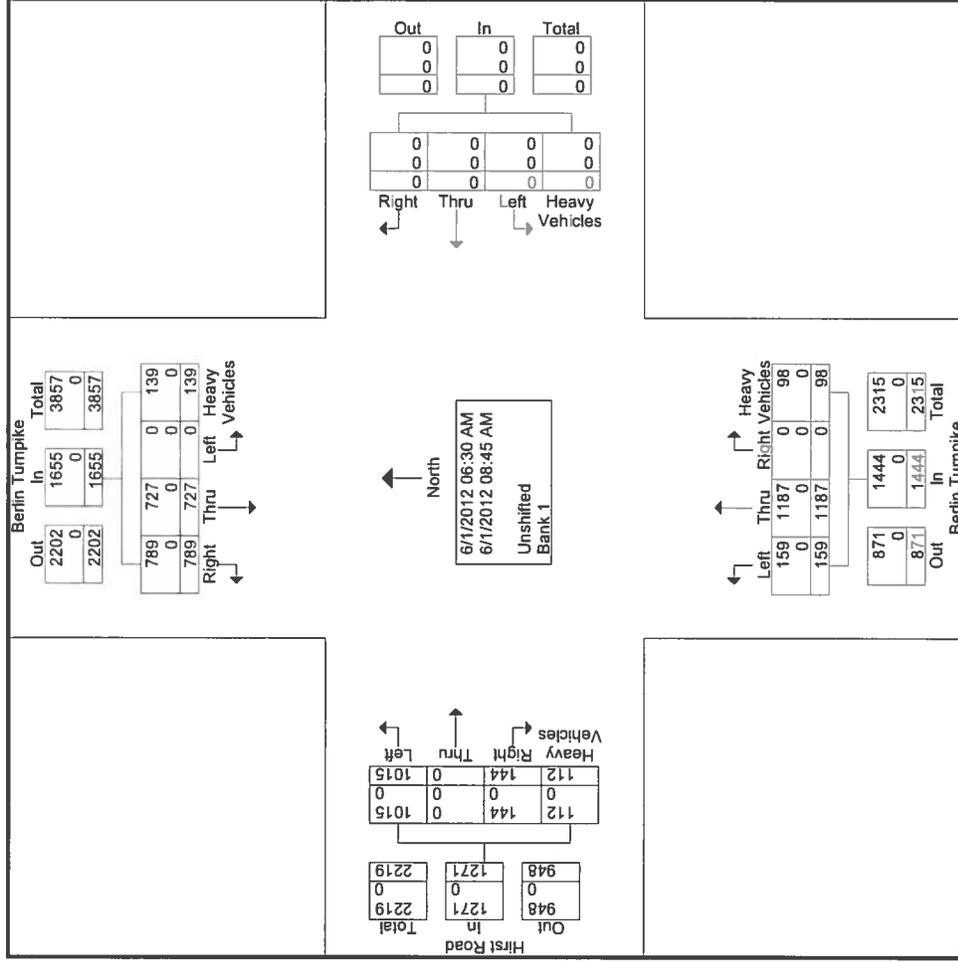


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Purcellville Town Center Apt  
Counter: Jesse Bogart  
Weather:

File Name : Berlin and Hirst AM  
Site Code : 00000000  
Start Date : 6/1/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Purcellville Town Center Apt  
Counter: Jesse Bogart  
Weather:

File Name : Berlin and Hirst AM  
Site Code : 00000000  
Start Date : 6/1/2012  
Page No : 3

Start Time	Berlin Turnpike From North				From East				Berlin Turnpike From South				Hirst Road From West								
	Right	Thru	Left	Heavy Vehicles	App. Total	Right	Thru	Left	Heavy Vehicles	App. Total	Right	Thru	Left	Heavy Vehicles	App. Total	Right	Thru	Left	Heavy Vehicles	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	78	79	0	10	167	0	0	0	0	0	0	144	17	6	167	12	0	136	7	155	489
08:00 AM	106	108	0	33	247	0	0	0	0	0	0	124	16	5	145	20	0	116	11	147	539
08:15 AM	105	95	0	14	214	0	0	0	0	0	0	119	46	37	202	22	0	111	10	143	559
08:30 AM	131	74	0	9	214	0	0	0	0	0	0	104	42	10	156	30	0	100	17	147	517
Total Volume	420	356	0	66	842	0	0	0	0	0	0	491	121	58	670	84	0	463	45	592	2104
% App Total	49.9	42.3	0	7.8		0	0	0	0	0	0	73.3	18.1	8.7		14.2	0	78.2	7.6		
PHF	802	824	000	500	852	000	000	000	000	000	000	852	658	392	829	700	000	851	662	955	941

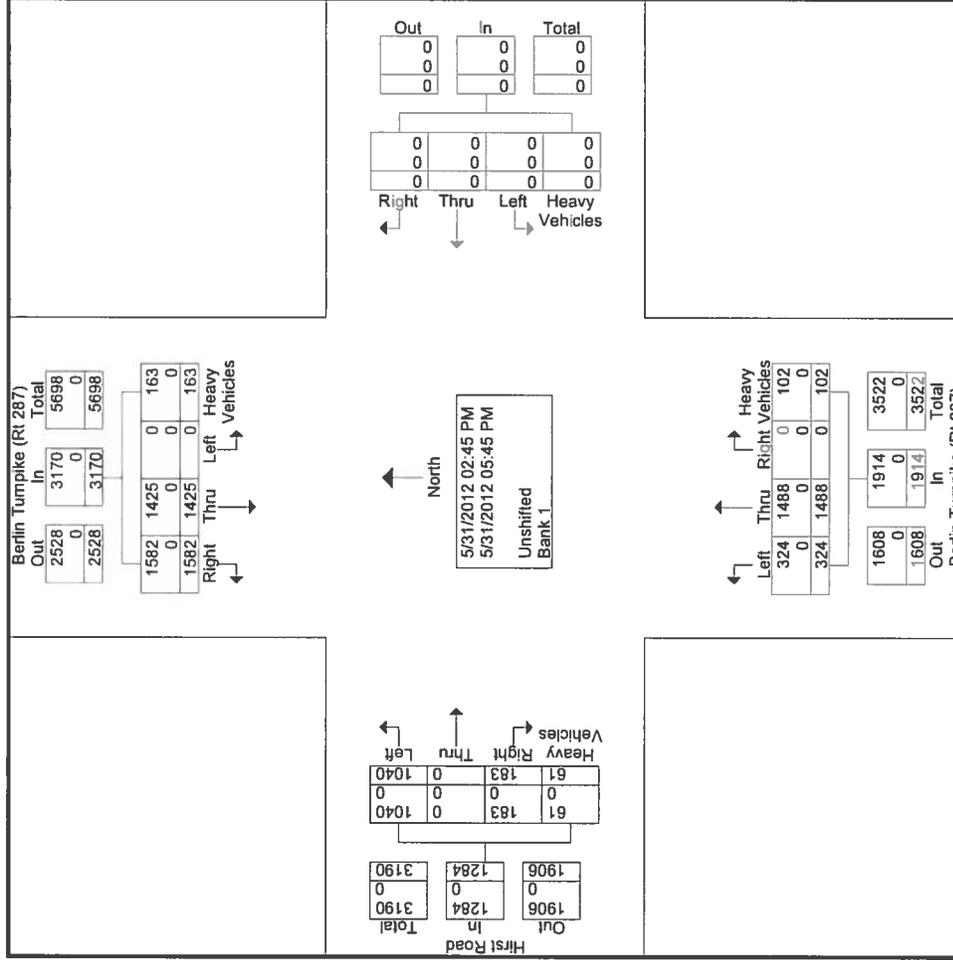


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Purcellville Town Center Apt  
Counter: Jesse Bogart  
Weather:

File Name : Berlin and Hirst PM  
Site Code : 00000000  
Start Date : 5/31/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Purcellville Town Center Apt  
Counter: Jesse Bogart  
Weather:

File Name : Berlin and Hirst PM  
Site Code : 00000000  
Start Date : 5/31/2012  
Page No : 3

Start Time	Berlin Turnpike (Rt 287) From North				Berlin Turnpike (Rt 287) From East				Berlin Turnpike (Rt 287) From South				Hirst Road From West					
	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles	Right	Thru	Left	Heavy Vehicles	App. Total	Int. Total
Peak Hour Analysis From 02:45 PM to 05:45 PM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 05:00 PM																		
05:00 PM	150	128	0	10	0	0	0	0	0	121	28	7	17	0	74	4	156	539
05:15 PM	125	105	0	5	0	0	0	0	0	145	37	3	12	0	91	3	185	526
05:30 PM	160	135	0	18	0	0	0	0	0	131	25	3	5	0	85	0	159	562
05:45 PM	153	114	0	13	0	0	0	0	0	99	30	2	13	0	69	0	131	493
Total Volume	588	482	0	46	0	0	0	0	0	496	120	15	47	0	319	7	631	2120
% App. Total	52.7	43.2	0	4.1	0	0	0	0	0	78.6	19	2.4	12.6	0	85.5	1.9	85.3	880
PHF	.919	.893	.000	.639	.000	.000	.000	.000	.000	.855	.811	.536	.691	.000	.876	.438	.853	.943







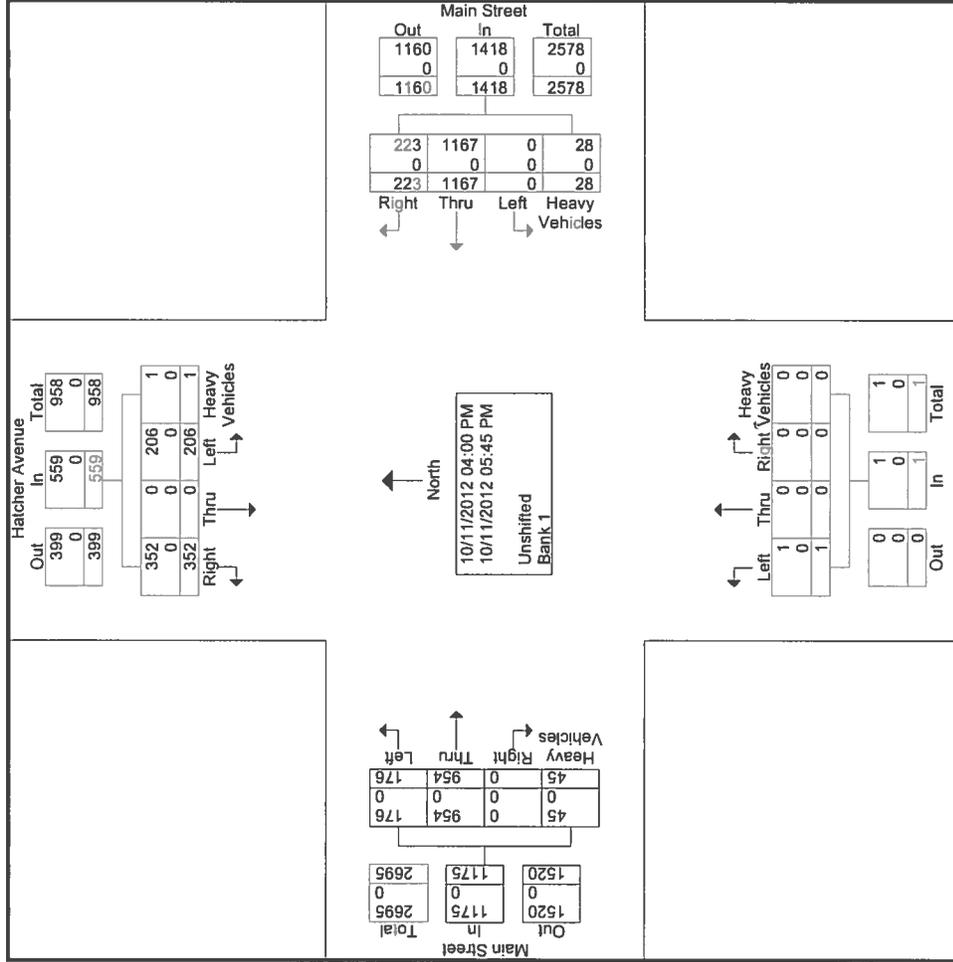


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catoctin Corner  
Counter: Ed Tatum  
Weather:

File Name : Main and Hatcher PM  
Site Code : 00000002  
Start Date : 10/11/2012  
Page No : 2





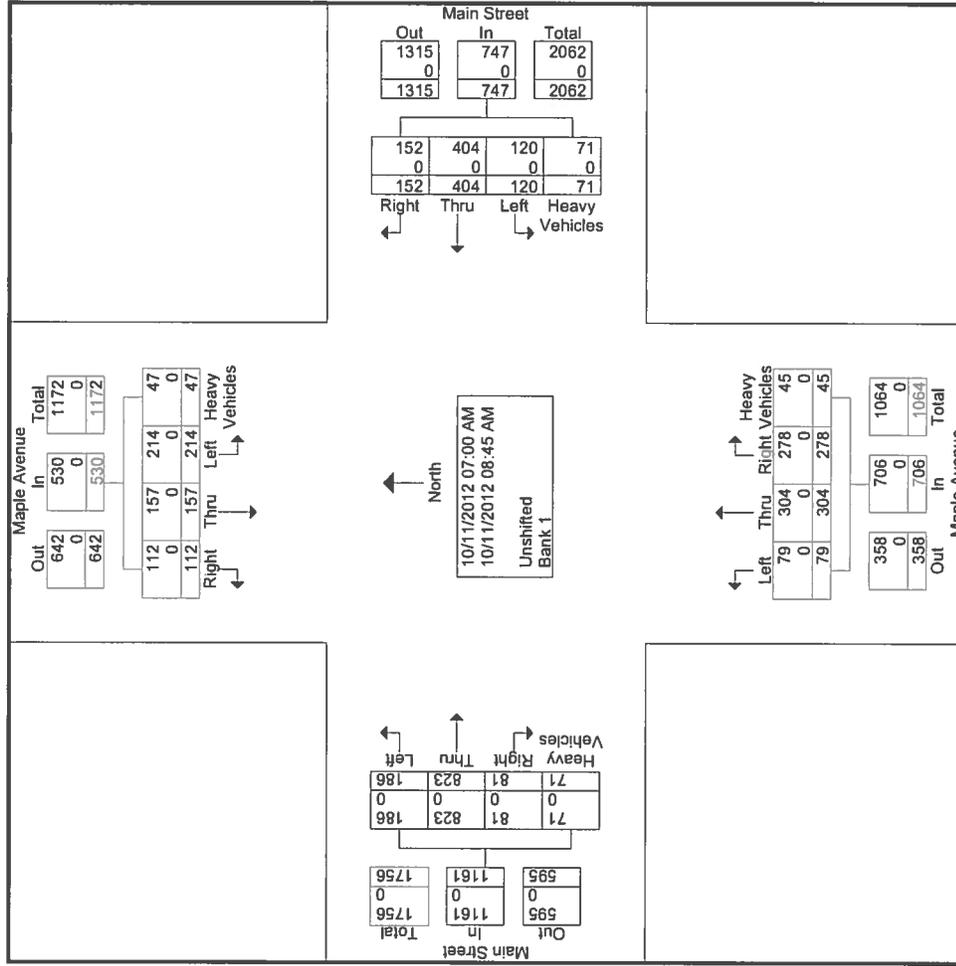


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catocfin Corner  
Counter: Ed Tatum  
Weather:

File Name : Main and Maple AM  
Site Code : 00000001  
Start Date : 10/11/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catocin Corner  
Counter: Ed Tatum  
Weather:

File Name : Main and Maple AM  
Site Code : 00000001  
Start Date : 10/11/2012  
Page No : 3

Start Time	Maple Avenue From North				Main Street From East				Maple Avenue From South				Main Street From West				Int. Total				
	Right	Thru	Left	Heavy Vehicles	App. Total	Right	Thru	Left	Heavy Vehicles	App. Total	Right	Thru	Left	Heavy Vehicles	App. Total	Right		Thru	Left	Heavy Vehicles	App. Total
08:00 AM	13	27	34	3	77	22	47	23	8	100	28	32	16	3	79	11	100	27	7	145	401
08:15 AM	18	22	28	10	78	14	55	29	17	115	36	60	10	14	120	7	96	23	18	144	457
08:30 AM	23	31	24	13	91	41	63	14	10	128	26	84	15	20	145	8	103	48	16	175	539
08:45 AM	25	28	50	13	116	34	77	14	5	130	26	46	12	3	87	10	97	34	9	150	483
Total Volume	79	108	136	39	362	111	242	80	40	473	116	222	53	40	431	36	396	132	50	614	1880
% App. Total	21.8	29.8	37.6	10.8	780	23.5	51.2	16.9	8.5	910	26.9	51.5	12.3	9.3	743	5.9	64.5	21.5	8.1	877	2443
PHF	.790	.871	.680	.750	.780	.677	.786	.690	.588	.910	.806	.661	.828	.500	.743	.818	.961	.688	.694	.877	.872

Peak Hour for Entire Intersection Begins at 08:00 AM

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

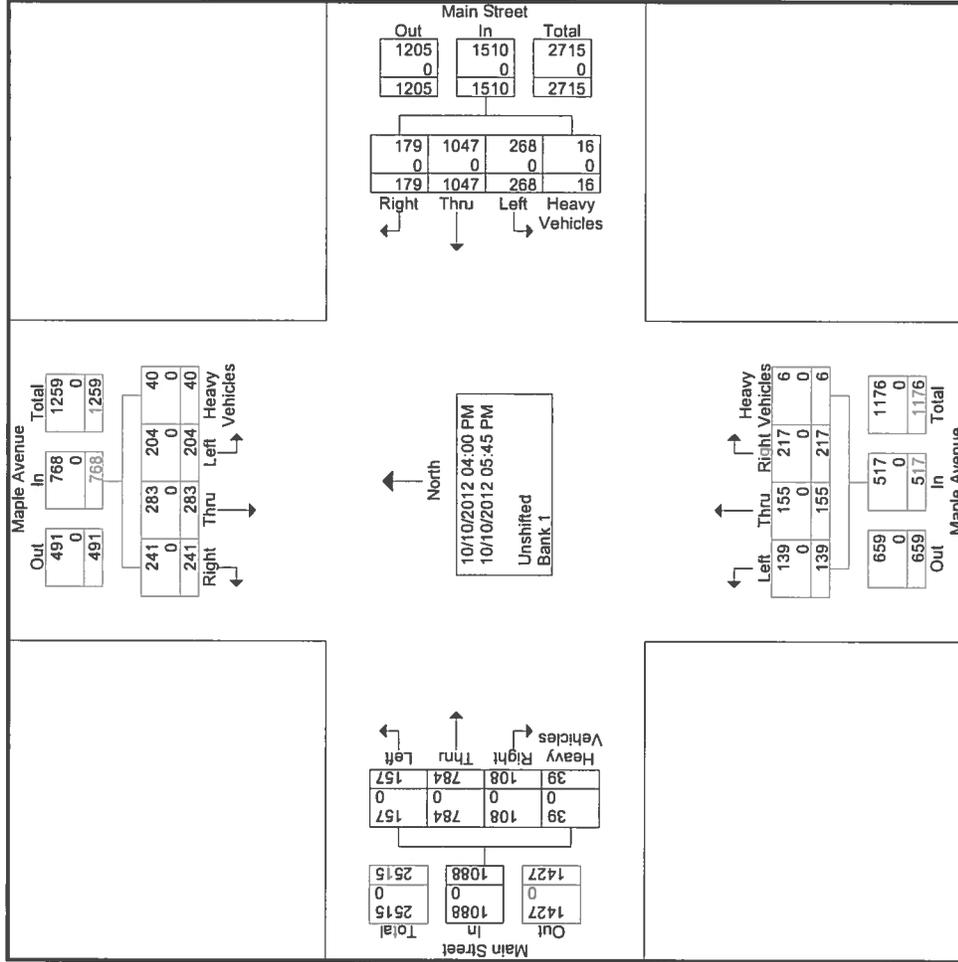


# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catocin Corner  
Counter: Ed Tatum  
Weather:

File Name : Main and Maple PM  
Site Code : 00000001  
Start Date : 10/10/2012  
Page No : 2



# BOWMAN CONSULTING

3951 Westerre Parkway  
Suite 150  
Richmond, Virginia 23233

Project: Catocfin Corner  
Counter: Ed Tatum  
Weather:

File Name : Main and Maple PM  
Site Code : 00000001  
Start Date : 10/10/2012  
Page No : 3

Start Time	Maple Avenue From North			Main Street From East			Maple Avenue From South			Main Street From West			Int. Total				
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		App. Total	Heavy Vehicles		
05:00 PM	23	40	26	20	145	33	16	18	17	0	51	16	95	14	5	130	473
05:15 PM	35	22	17	17	154	32	35	29	20	0	84	10	129	25	7	171	533
05:30 PM	26	31	24	27	140	36	25	26	20	1	72	14	112	24	2	152	509
05:45 PM	29	51	18	30	129	41	24	26	15	1	66	15	92	21	1	129	493
Total Volume	113	144	85	94	568	142	100	99	72	2	273	55	428	84	15	582	2008
% App. Total	32.8	41.9	24.7	11.6	70.2	17.6	36.6	36.3	26.4	0.7	9.5	9.5	73.5	14.4	2.6	851	942
PHF	807	706	817	783	922	866	714	853	900	500	813	859	829	840	536	851	942

Peak Hour for Entire Intersection Begins at 05:00 PM  
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

**APPENDIX D**  
**EXISTING PEAK HOUR ANALYSIS WORKSHEETS**

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
 11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	67	63	147	167	140	94
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.61	0.88	0.77	0.89	0.67	0.78
Hourly flow rate (vph)	110	72	191	188	209	121
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	823	285			379	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	823	285			379	
tC, single (s)	6.6	6.4			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.5			2.2	
p0 queue free %	58	90			82	
cM capacity (veh/h)	263	715			1164	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	181	379	329			
Volume Left	110	0	209			
Volume Right	72	188	0			
cSH	351	1700	1164			
Volume to Capacity	0.52	0.22	0.18			
Queue Length 95th (ft)	71	0	16			
Control Delay (s)	25.7	0.0	6.2			
Lane LOS	D		A			
Approach Delay (s)	25.7	0.0	6.2			
Approach LOS	D					
Intersection Summary						
Average Delay			7.5			
Intersection Capacity Utilization			48.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
 11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	218	163	145	78	45	85
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	245	209	177	96	60	100
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	445	225			273	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	445	225			273	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	55	74			95	
cM capacity (veh/h)	542	812			1296	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	454	273	160			
Volume Left	245	0	60			
Volume Right	209	96	0			
cSH	640	1700	1296			
Volume to Capacity	0.71	0.16	0.05			
Queue Length 95th (ft)	146	0	4			
Control Delay (s)	23.1	0.0	3.2			
Lane LOS	C		A			
Approach Delay (s)	23.1	0.0	3.2			
Approach LOS	C					
Intersection Summary						
Average Delay			12.4			
Intersection Capacity Utilization			51.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	186	51	68	119	157	45	76	122	123	57	10
Peak Hour Factor	0.63	0.88	0.75	0.81	0.66	0.85	0.66	0.83	0.90	0.73	0.71	0.50
Hourly flow rate (vph)	24	211	68	84	180	185	68	92	136	168	80	20
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	235	68	449	160	136	249	20					
Volume Left (vph)	24	0	84	68	0	168	0					
Volume Right (vph)	0	68	185	0	136	0	20					
Hadj (s)	0.14	-0.61	0.03	0.28	-0.63	0.42	-0.61					
Departure Headway (s)	7.8	7.0	7.2	8.2	7.3	8.3	7.2					
Degree Utilization, x	0.51	0.13	0.89	0.36	0.27	0.57	0.04					
Capacity (veh/h)	425	489	449	413	471	419	473					
Control Delay (s)	17.3	9.9	44.8	14.6	11.8	20.6	9.3					
Approach Delay (s)	15.6		44.8	13.3		19.8						
Approach LOS	C		E	B		C						
Intersection Summary												
Delay			25.9									
HCM Level of Service			D									
Intersection Capacity Utilization			56.7%		ICU Level of Service		B					
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	95	70	128	85	66	103	51
Average Queue (ft)	53	18	77	48	39	57	8
95th Queue (ft)	87	49	125	80	61	91	36
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						21	1
Queuing Penalty (veh)						2	1

HCM Unsignalized Intersection Capacity Analysis  
 2: Hirst Road & Hatcher Avenue

Catoclin Creek Apartments  
 11/5/2012

															
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR			
Lane Configurations															
Sign Control		Stop			Stop			Stop			Stop				
Volume (vph)	12	132	43	151	262	102	45	58	80	80	58	18			
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80			
Hourly flow rate (vph)	20	140	75	184	301	124	60	72	108	107	84	22			
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2								
Volume Total (vph)	160	75	610	132	108	191	23								
Volume Left (vph)	20	0	184	60	0	107	0								
Volume Right (vph)	0	75	124	0	108	0	23								
Hadj (s)	0.08	-0.68	0.01	0.26	-0.67	0.30	-0.68								
Departure Headway (s)	7.1	6.4	6.5	7.7	6.8	7.8	6.8								
Degree Utilization, x	0.32	0.13	1.09	0.28	0.20	0.41	0.04								
Capacity (veh/h)	482	538	548	451	509	449	509								
Control Delay (s)	12.3	9.2	90.6	12.5	10.4	14.9	8.9								
Approach Delay (s)	11.3		90.6	11.6		14.2									
Approach LOS	B		F	B		B									
Intersection Summary															
Delay			49.0												
HCM Level of Service			E												
Intersection Capacity Utilization			60.1%				ICU Level of Service				B				
Analysis Period (min)			15												

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	92	49	244	75	49	77	54
Average Queue (ft)	46	20	139	42	26	48	12
95th Queue (ft)	78	42	233	68	49	76	47
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						19	1
Queuing Penalty (veh)						3	1

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↗	
Volume (veh/h)	312	94	173	278	41	118
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.64	0.90	0.77	0.73	0.55
Hourly flow rate (vph)	347	147	192	361	56	215
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			494		1166	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			494		1166	420
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			81		68	66
cM capacity (veh/h)			1035		173	629
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	494	553	271			
Volume Left	0	192	56			
Volume Right	147	0	215			
cSH	1700	1035	407			
Volume to Capacity	0.29	0.19	0.67			
Queue Length 95th (ft)	0	17	117			
Control Delay (s)	0.0	4.6	29.8			
Lane LOS		A	D			
Approach Delay (s)	0.0	4.6	29.8			
Approach LOS			D			
<b>Intersection Summary</b>						
Average Delay			8.1			
Intersection Capacity Utilization			65.9%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/5/2012

	→	↘	↙	←	↗	↖
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↗	↘	
Volume (veh/h)	244	78	245	491	66	114
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	290	111	285	511	80	144
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			402		1427	346
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			402		1427	346
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			75		30	79
cM capacity (veh/h)			1151		113	701
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	402	796	224			
Volume Left	0	285	80			
Volume Right	111	0	144			
cSH	1700	1151	246			
Volume to Capacity	0.24	0.25	0.91			
Queue Length 95th (ft)	0	24	196			
Control Delay (s)	0.0	5.4	79.0			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.4	79.0			
Approach LOS			F			
Intersection Summary						
Average Delay			15.4			
Intersection Capacity Utilization			77.6%	ICU Level of Service		D
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoclin Creek Apartments  
11/5/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	463	84	121	491	356	420
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1649		1656	1743	1759	1495
Flt Permitted	0.96		0.35	1.00	1.00	1.00
Satd. Flow (perm)	1649		611	1743	1759	1495
Peak-hour factor, PHF	0.85	0.70	0.66	0.85	0.82	0.80
Adj. Flow (vph)	545	120	183	578	434	525
RTOR Reduction (vph)	8	0	0	0	0	272
Lane Group Flow (vph)	657	0	183	578	434	253
Heavy Vehicles (%)	8%	8%	9%	9%	8%	8%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	21.5		65.0	65.0	48.2	48.2
Effective Green, g (s)	21.5		65.0	65.0	48.2	48.2
Actuated g/C Ratio	0.22		0.65	0.65	0.48	0.48
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	355		494	1133	848	721
v/s Ratio Prot	c0.40		0.03	c0.33	0.25	
v/s Ratio Perm			0.21			0.17
v/c Ratio	1.85		0.37	0.51	0.51	0.35
Uniform Delay, d1	39.2		8.8	9.2	17.8	16.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	393.7		0.3	1.6	2.2	1.3
Delay (s)	433.0		9.1	10.8	20.0	17.5
Level of Service	F		A	B	C	B
Approach Delay (s)	433.0			10.4	18.6	
Approach LOS	F			B	B	

Intersection Summary			
HCM Average Control Delay		131.5	HCM Level of Service F
HCM Volume to Capacity ratio		0.84	
Actuated Cycle Length (s)		100.0	Sum of lost time (s) 13.5
Intersection Capacity Utilization		73.7%	ICU Level of Service D
Analysis Period (min)		15	

c Critical Lane Group

## Queues

## 5: Hirst Road &amp; Route 287

11/5/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	665	183	578	434	525
v/c Ratio	1.83	0.38	0.51	0.51	0.53
Control Delay	411.2	9.6	11.1	20.9	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	411.2	9.6	11.1	20.9	3.6
Queue Length 50th (ft)	~648	43	174	184	0
Queue Length 95th (ft)	#807	50	232	247	26
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	363	505	1133	848	993
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.83	0.36	0.51	0.51	0.53

## Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoclin Creek Apartments  
11/5/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	319	47	120	496	482	588
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1749		1770	1863	1827	1553
Flt Permitted	0.96		0.32	1.00	1.00	1.00
Satd. Flow (perm)	1749		597	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	362	68	148	577	542	639
RTOR Reduction (vph)	5	0	0	0	0	273
Lane Group Flow (vph)	425	0	148	577	542	366
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	33.5		103.0	103.0	86.0	86.0
Effective Green, g (s)	33.5		103.0	103.0	86.0	86.0
Actuated g/C Ratio	0.22		0.69	0.69	0.57	0.57
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	391		484	1279	1047	890
v/s Ratio Prot	c0.24		0.02	c0.31	c0.30	
v/s Ratio Perm			0.19			0.24
v/c Ratio	1.09		0.31	0.45	0.52	0.41
Uniform Delay, d1	58.2		11.3	10.7	19.4	17.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	71.2		0.3	1.2	1.8	1.4
Delay (s)	129.4		11.6	11.8	21.2	19.3
Level of Service	F		B	B	C	B
Approach Delay (s)	129.4			11.8	20.2	
Approach LOS	F			B	C	

Intersection Summary			
HCM Average Control Delay	37.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues

5: Hirst Road & Route 287

11/5/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	430	148	577	542	639
v/c Ratio	1.09	0.31	0.45	0.52	0.55
Control Delay	122.8	10.1	12.0	21.9	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	122.8	10.1	12.0	21.9	3.1
Queue Length 50th (ft)	~467	47	238	310	0
Queue Length 95th (ft)	#662	65	293	424	55
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	396	500	1279	1048	1163
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.09	0.30	0.45	0.52	0.55

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	134	506	274	100	95	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.96		0.94	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1687	1776	1683		1672	
Flt Permitted	0.29	1.00	1.00		0.97	
Satd. Flow (perm)	515	1776	1683		1672	
Peak-hour factor, PHF	0.91	0.83	0.89	0.69	0.77	0.69
Adj. Flow (vph)	147	610	308	145	123	96
RTOR Reduction (vph)	0	0	15	0	32	0
Lane Group Flow (vph)	147	610	438	0	187	0
Heavy Vehicles (%)	7%	7%	8%	8%	4%	4%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	40.5	40.5	25.8		14.1	
Effective Green, g (s)	40.5	40.5	25.8		14.1	
Actuated g/C Ratio	0.60	0.60	0.38		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	463	1072	647		351	
v/s Ratio Prot	0.04	c0.34	c0.26		c0.11	
v/s Ratio Perm	0.15					
v/c Ratio	0.32	0.57	0.68		0.53	
Uniform Delay, d1	7.4	8.0	17.2		23.6	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.1	1.4	4.3		2.0	
Delay (s)	7.5	9.5	21.5		25.6	
Level of Service	A	A	C		C	
Approach Delay (s)		9.1	21.5		25.6	
Approach LOS		A	C		C	

Intersection Summary			
HCM Average Control Delay		15.5	HCM Level of Service B
HCM Volume to Capacity ratio		0.66	
Actuated Cycle Length (s)		67.1	Sum of lost time (s) 19.0
Intersection Capacity Utilization		52.7%	ICU Level of Service A
Analysis Period (min)		15	

c Critical Lane Group

Queues  
6: Main Street & Hatcher Avenue



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	147	610	453	219
v/c Ratio	0.32	0.57	0.69	0.57
Control Delay	8.1	11.2	23.8	27.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.1	11.2	23.8	27.2
Queue Length 50th (ft)	23	133	143	67
Queue Length 95th (ft)	55	237	282	116
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	672	1515	836	781
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.22	0.40	0.54	0.28

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoclin Creek Apartments  
11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	94	513	611	118	100	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Fr <sub>t</sub>	1.00	1.00	0.98		0.91	
Fl <sub>t</sub> Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1752	1845	1838		1698	
Fl <sub>t</sub> Permitted	0.10	1.00	1.00		0.98	
Satd. Flow (perm)	191	1845	1838		1698	
Peak-hour factor, PHF	0.78	0.86	0.92	0.87	0.93	0.83
Adj. Flow (vph)	121	597	664	136	108	229
RTOR Reduction (vph)	0	0	6	0	84	0
Lane Group Flow (vph)	121	597	794	0	253	0
Heavy Vehicles (%)	3%	3%	1%	1%	0%	0%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	45.2	45.2	32.7		16.8	
Effective Green, g (s)	45.2	45.2	32.7		16.8	
Actuated g/C Ratio	0.61	0.61	0.44		0.23	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	252	1119	807		383	
v/s Ratio Prot	0.04	c0.32	c0.43		c0.15	
v/s Ratio Perm	0.25					
v/c Ratio	0.48	0.53	0.98		0.66	
Uniform Delay, d <sub>1</sub>	14.2	8.5	20.6		26.3	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d <sub>2</sub>	0.5	1.2	27.8		4.7	
Delay (s)	14.8	9.7	48.4		30.9	
Level of Service	B	A	D		C	
Approach Delay (s)		10.5	48.4		30.9	
Approach LOS		B	D		C	

Intersection Summary			
HCM Average Control Delay		30.6	HCM Level of Service C
HCM Volume to Capacity ratio		0.88	
Actuated Cycle Length (s)		74.5	Sum of lost time (s) 19.0
Intersection Capacity Utilization		77.2%	ICU Level of Service D
Analysis Period (min)		15	

c Critical Lane Group

Queues  
6: Main Street & Hatcher Avenue



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	121	597	800	337
v/c Ratio	0.42	0.54	0.97	0.71
Control Delay	12.9	12.0	50.0	26.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	12.9	12.0	50.0	26.9
Queue Length 50th (ft)	21	142	~376	99
Queue Length 95th (ft)	46	274	#748	191
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	551	1468	825	765
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.22	0.41	0.97	0.44

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	422	46	78	211	60	37	149	136	102	84	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	1747		1597	1618		1703	1685		1556	1540	
Flt Permitted	0.49	1.00		0.20	1.00		0.59	1.00		0.29	1.00	
Satd. Flow (perm)	862	1747		337	1618		1064	1685		476	1540	
Peak-hour factor, PHF	0.77	0.79	0.72	0.67	0.80	0.68	0.58	0.62	0.85	0.75	0.78	0.74
Adj. Flow (vph)	108	534	64	116	264	88	64	240	160	136	108	72
RTOR Reduction (vph)	0	2	0	0	6	0	0	12	0	0	12	0
Lane Group Flow (vph)	108	596	0	116	346	0	64	388	0	136	168	0
Heavy Vehicles (%)	7%	7%	7%	13%	13%	13%	6%	6%	6%	16%	16%	16%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4				8
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	75.9	66.3		84.3	70.5		47.7	47.7		47.7	47.7	
Effective Green, g (s)	75.9	66.3		84.3	70.5		47.7	47.7		47.7	47.7	
Actuated g/C Ratio	0.51	0.45		0.57	0.47		0.32	0.32		0.32	0.32	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	493	778		308	767		341	540		153	494	
v/s Ratio Prot	0.01	c0.34		c0.03	c0.21			0.23				0.11
v/s Ratio Perm	0.10			0.18			0.06			c0.29		
v/c Ratio	0.22	0.77		0.38	0.45		0.19	0.72		0.89	0.34	
Uniform Delay, d1	19.3	34.7		20.9	26.2		36.5	44.6		48.0	38.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	5.8		0.3	1.2		0.4	4.9		42.4	0.6	
Delay (s)	19.4	40.6		21.2	27.4		36.9	49.5		90.4	39.1	
Level of Service	B	D		C	C		D	D		F	D	
Approach Delay (s)		37.3			25.9			47.7			61.2	
Approach LOS		D			C			D			E	

Intersection Summary

HCM Average Control Delay	40.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	148.8	Sum of lost time (s)	28.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues

7: Main Street & Maple Avenue

11/5/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	108	598	116	352	64	400	136	180
v/c Ratio	0.22	0.77	0.38	0.46	0.19	0.73	0.89	0.36
Control Delay	18.4	46.3	20.4	31.3	36.9	50.2	98.5	35.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.4	46.3	20.4	31.3	36.9	50.2	98.5	35.9
Queue Length 50th (ft)	45	488	49	222	45	326	124	119
Queue Length 95th (ft)	84	694	77	345	53	281	180	162
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	605	777	584	999	508	815	227	745
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.77	0.20	0.35	0.13	0.49	0.60	0.24

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoclin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	428	55	142	568	94	72	99	100	85	144	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.92		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1814		1787	1835		1787	1726		1787	1766	
Flt Permitted	0.16	1.00		0.25	1.00		0.32	1.00		0.47	1.00	
Satd. Flow (perm)	293	1814		476	1835		602	1726		889	1766	
Peak-hour factor, PHF	0.84	0.83	0.86	0.87	0.92	0.78	0.90	0.85	0.71	0.82	0.71	0.81
Adj. Flow (vph)	100	516	64	163	617	121	80	116	141	104	203	140
RTOR Reduction (vph)	0	4	0	0	6	0	0	31	0	0	17	0
Lane Group Flow (vph)	100	576	0	163	732	0	80	226	0	104	326	0
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	54.4	47.5		58.6	49.6		25.4	25.4		25.4	25.4	
Effective Green, g (s)	54.4	47.5		58.6	49.6		25.4	25.4		25.4	25.4	
Actuated g/C Ratio	0.53	0.46		0.57	0.48		0.25	0.25		0.25	0.25	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	253	837		386	885		149	426		219	436	
v/s Ratio Prot	0.03	0.32		c0.04	c0.40			0.13			c0.18	
v/s Ratio Perm	0.18			0.20			0.13			0.12		
v/c Ratio	0.40	0.69		0.42	0.83		0.54	0.53		0.47	0.75	
Uniform Delay, d1	16.5	21.9		13.3	23.0		33.6	33.6		33.1	35.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	3.6		0.3	7.5		4.7	1.6		2.2	7.3	
Delay (s)	16.9	25.5		13.5	30.5		38.3	35.2		35.3	43.1	
Level of Service	B	C		B	C		D	D		D	D	
Approach Delay (s)		24.2			27.4			35.9			41.3	
Approach LOS		C			C			D			D	

Intersection Summary

HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	102.9	Sum of lost time (s)	14.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

## Queues

## 7: Main Street &amp; Maple Avenue

11/5/2012

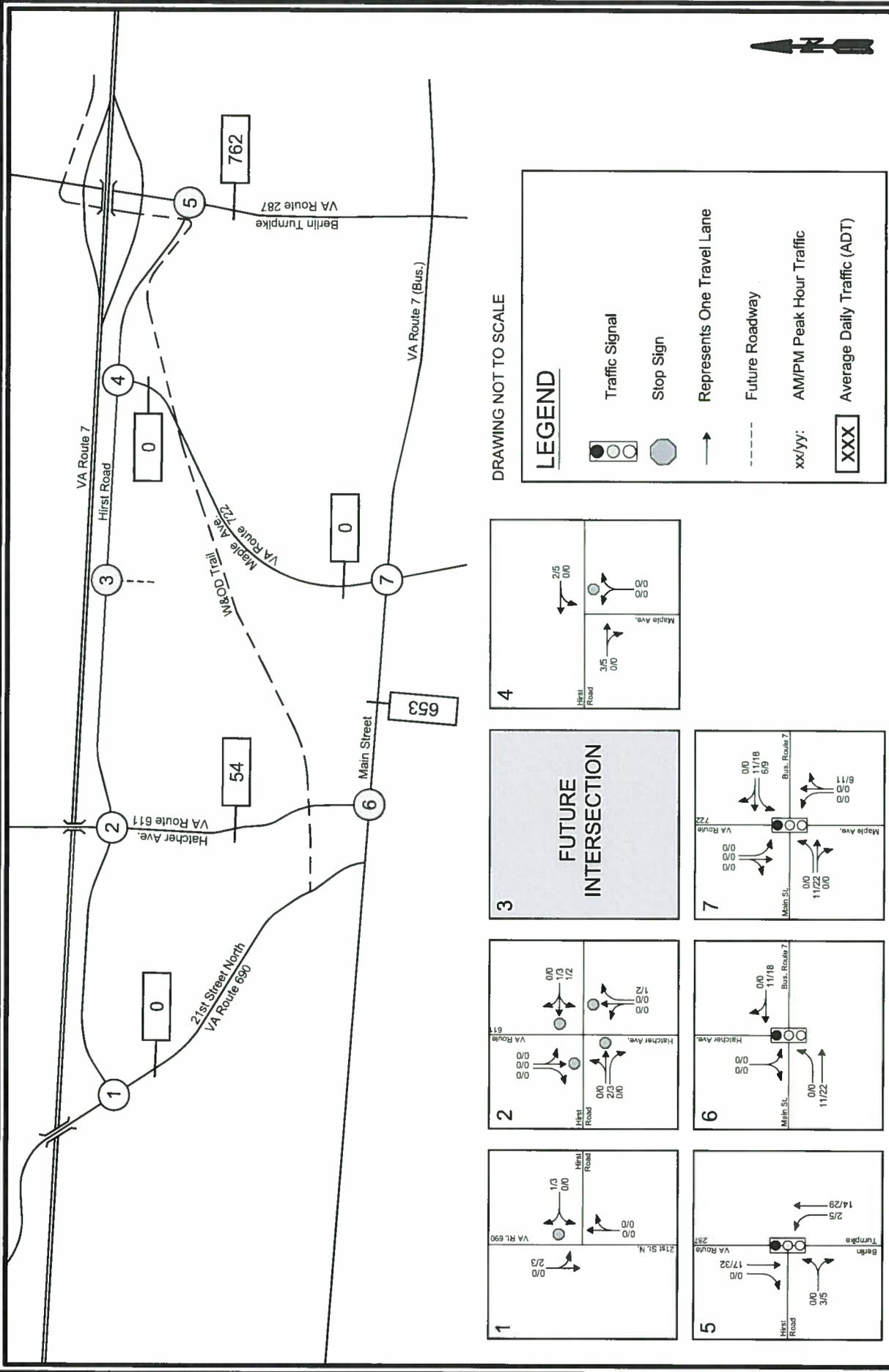


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	100	580	163	738	80	257	104	343
v/c Ratio	0.39	0.69	0.42	0.83	0.54	0.56	0.48	0.76
Control Delay	12.7	26.2	11.4	31.7	54.0	36.6	45.9	48.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.7	26.2	11.4	31.7	54.0	36.6	45.9	48.2
Queue Length 50th (ft)	24	288	41	395	46	126	59	198
Queue Length 95th (ft)	40	364	64	570	#132	229	121	262
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	468	1162	551	1177	148	456	218	452
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.50	0.30	0.63	0.54	0.56	0.48	0.76

## Intersection Summary

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

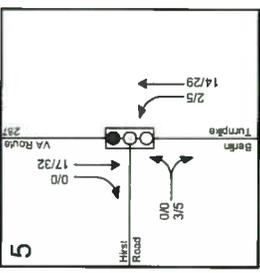
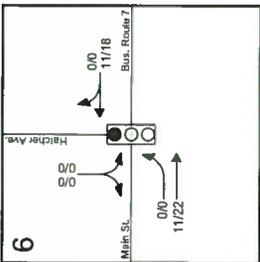
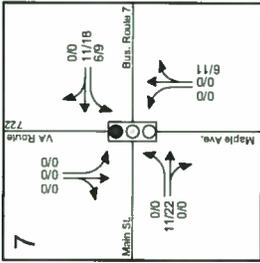
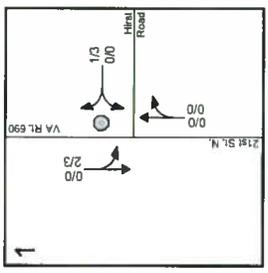
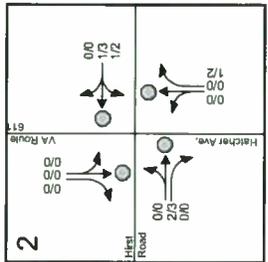
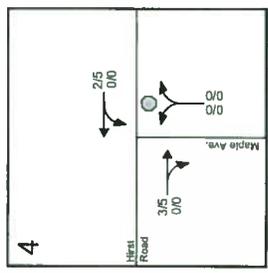
**APPENDIX E**  
**OTHER DEVELOPMENT TRAFFIC ASSIGNMENTS (2014)**



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX: Average Daily Traffic (ADT)

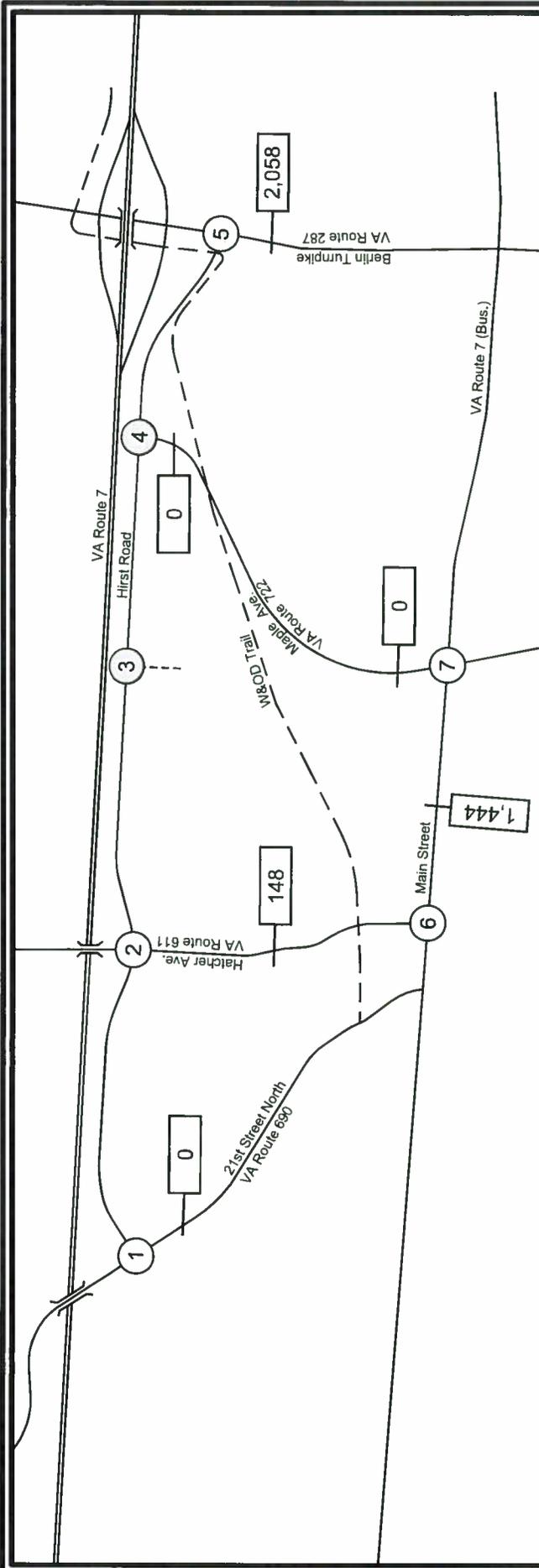


**Figure E.1**

**Catoclin Corner Traffic Forecasts (2014)**  
 Catoclin Creek Apartments  
 Purcellville, Virginia



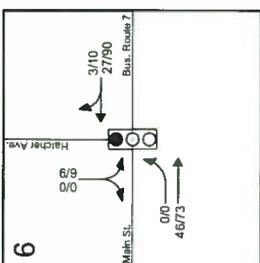
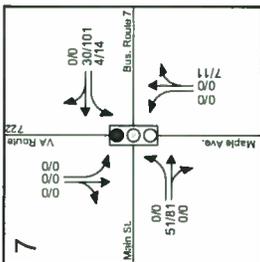
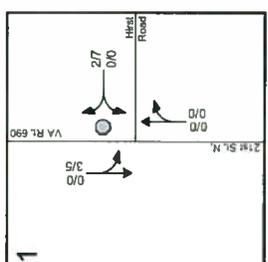
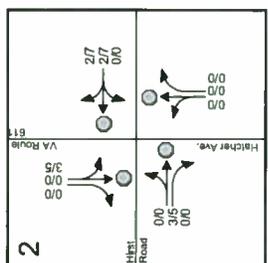
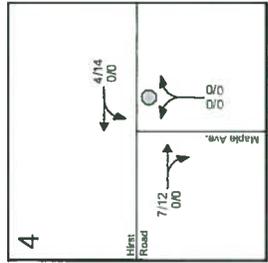
Job # 5384-01-001



DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX: Average Daily Traffic (ADT)



**Bowman**  
CONSULTING

**Purcellville Gateway Traffic Forecasts (2014)**  
Catoclin Creek Apartments  
Purcellville, Virginia

**Figure E.2**

Job # 5384-01-001

**APPENDIX F**  
**BACKGROUND (2014) PEAK HOUR**  
**ANALYSIS WORKSHEETS**

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
 11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	69	153	174	151	98
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	75	166	189	164	107
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	696	261			355	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	696	261			355	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	90			86	
cM capacity (veh/h)	352	778			1203	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	151	355	271			
Volume Left	76	0	164			
Volume Right	75	189	0			
cSH	484	1700	1203			
Volume to Capacity	0.31	0.21	0.14			
Queue Length 95th (ft)	33	0	12			
Control Delay (s)	15.8	0.0	5.6			
Lane LOS	C		A			
Approach Delay (s)	15.8	0.0	5.6			
Approach LOS	C					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization			50.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
 11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	227	180	151	81	55	88
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	255	231	184	100	73	104
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	484	234			284	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	484	234			284	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	50	71			94	
cM capacity (veh/h)	509	802			1284	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	486	284	177			
Volume Left	255	0	73			
Volume Right	231	100	0			
cSH	616	1700	1284			
Volume to Capacity	0.79	0.17	0.06			
Queue Length 95th (ft)	191	0	5			
Control Delay (s)	29.1	0.0	3.6			
Lane LOS	D		A			
Approach Delay (s)	29.1	0.0	3.6			
Approach LOS	D					
Intersection Summary						
Average Delay			15.6			
Intersection Capacity Utilization			54.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 2: Hirst Road & Hatcher Avenue

Catoclin Creek Apartments  
 11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	199	53	72	127	165	47	79	128	131	59	10
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)	17	216	58	78	138	179	51	86	139	142	64	11
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	234	58	396	137	139	207	11					
Volume Left (vph)	17	0	78	51	0	142	0					
Volume Right (vph)	0	58	179	0	139	0	11					
Hadj (s)	0.07	-0.67	-0.20	0.22	-0.67	0.38	-0.67					
Departure Headway (s)	7.0	6.3	6.5	7.5	6.6	7.7	6.6					
Degree Utilization, x	0.45	0.10	0.71	0.28	0.25	0.44	0.02					
Capacity (veh/h)	482	534	540	438	501	435	495					
Control Delay (s)	14.5	8.8	23.8	12.2	10.6	15.4	8.5					
Approach Delay (s)	13.4		23.8	11.4		15.0						
Approach LOS	B		C	B		C						
Intersection Summary												
Delay			16.7									
HCM Level of Service			C									
Intersection Capacity Utilization			59.1%		ICU Level of Service		B					
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	86	49	190	68	85	113	54
Average Queue (ft)	55	24	74	42	40	64	11
95th Queue (ft)	87	42	136	68	77	97	44
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						24	1
Queuing Penalty (veh)						2	1

HCM Unsignalized Intersection Capacity Analysis  
 2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
 11/5/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗		↔			↔	↗		↔	↗
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	12	145	45	159	283	113	47	60	85	88	60	19
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	20	154	79	194	325	138	63	74	115	117	87	24
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	174	79	657	137	115	204	24					
Volume Left (vph)	20	0	194	63	0	117	0					
Volume Right (vph)	0	79	138	0	115	0	24					
Hadj (s)	0.07	-0.68	0.00	0.26	-0.67	0.30	-0.68					
Departure Headway (s)	7.3	6.5	6.6	7.8	6.9	7.9	6.9					
Degree Utilization, x	0.35	0.14	1.21	0.30	0.22	0.45	0.05					
Capacity (veh/h)	474	527	539	445	501	444	503					
Control Delay (s)	13.0	9.4	131.3	12.9	10.7	15.8	9.0					
Approach Delay (s)	11.9		131.3	11.9		15.1						
Approach LOS	B		F	B		C						

**Intersection Summary**

Delay	68.9		
HCM Level of Service	F		
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	93	51	267	70	48	77	38
Average Queue (ft)	41	27	147	37	28	45	10
95th Queue (ft)	74	51	252	64	41	72	37
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						14	1
Queuing Penalty (veh)						3	1

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	199	53	72	127	165	47	79	128	131	59	10
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)	17	216	58	78	138	179	51	86	139	142	64	11
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	234	58	78	317	137	139	207	11				
Volume Left (vph)	17	0	78	0	51	0	142	0				
Volume Right (vph)	0	58	0	179	0	139	0	11				
Hadj (s)	0.07	-0.67	0.53	-0.36	0.22	-0.67	0.38	-0.67				
Departure Headway (s)	6.7	6.0	7.0	6.1	7.1	6.2	7.3	6.2				
Degree Utilization, x	0.44	0.10	0.15	0.54	0.27	0.24	0.42	0.02				
Capacity (veh/h)	508	562	485	563	469	542	467	533				
Control Delay (s)	13.6	8.4	10.1	14.9	11.4	9.9	14.1	8.1				
Approach Delay (s)	12.6		14.0		10.6		13.8					
Approach LOS	B		B		B		B					
Intersection Summary												
Delay			12.8									
HCM Level of Service			B									
Intersection Capacity Utilization			55.2%		ICU Level of Service				B			
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	108	27	50	132	53	69	119	55
Average Queue (ft)	57	23	31	59	39	37	67	9
95th Queue (ft)	93	37	53	106	64	65	106	38
Link Distance (ft)	2674		4479		2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		100		175		30	
Storage Blk Time (%)					1		26	
Queuing Penalty (veh)					1		3	

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	12	145	45	159	283	113	47	60	85	88	60	19
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	20	154	79	194	325	138	63	74	115	117	87	24
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	174	79	194	463	137	115	204	24				
Volume Left (vph)	20	0	194	0	63	0	117	0				
Volume Right (vph)	0	79	0	138	0	115	0	24				
Hadj (s)	0.07	-0.68	0.57	-0.14	0.26	-0.67	0.30	-0.68				
Departure Headway (s)	7.2	6.4	7.1	6.4	7.7	6.7	7.7	6.7				
Degree Utilization, x	0.35	0.14	0.38	0.82	0.29	0.22	0.44	0.04				
Capacity (veh/h)	474	525	492	552	435	500	443	499				
Control Delay (s)	12.8	9.3	13.2	31.2	12.6	10.4	15.4	8.8				
Approach Delay (s)	11.7		25.9		11.6		14.7					
Approach LOS	B		D		B		B					
Intersection Summary												
Delay			18.9									
HCM Level of Service			C									
Intersection Capacity Utilization			54.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	74	52	123	174	53	47	76	39
Average Queue (ft)	40	27	48	96	37	28	46	10
95th Queue (ft)	70	49	90	164	56	40	72	38
Link Distance (ft)	2674		4479		2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		100		175		30	
Storage Blk Time (%)			0		6		14	
Queuing Penalty (veh)			0		9		3	

# HCM Unsignalized Intersection Capacity Analysis

## 4: Hirst Road & Maple Avenue

Catoclin Creek Apartments

11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	
Volume (veh/h)	335	98	180	295	43	123
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	364	107	196	321	47	134
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			471		1129	417
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			471		1129	417
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			82		75	79
cM capacity (veh/h)			1091		185	635
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	471	516	180			
Volume Left	0	196	47			
Volume Right	107	0	134			
cSH	1700	1091	390			
Volume to Capacity	0.28	0.18	0.46			
Queue Length 95th (ft)	0	16	59			
Control Delay (s)	0.0	4.7	22.0			
Lane LOS		A	C			
Approach Delay (s)	0.0	4.7	22.0			
Approach LOS			C			
Intersection Summary						
Average Delay			5.5			
Intersection Capacity Utilization			69.0%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↘	
Volume (veh/h)	271	81	255	530	69	119
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	323	116	297	552	83	151
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		1526	380
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			438		1526	380
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		14	78
cM capacity (veh/h)			1116		96	671
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	438	849	234			
Volume Left	0	297	83			
Volume Right	116	0	151			
cSH	1700	1116	215			
Volume to Capacity	0.26	0.27	1.09			
Queue Length 95th (ft)	0	27	266			
Control Delay (s)	0.0	5.7	134.5			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.7	134.5			
Approach LOS			F			
Intersection Summary						
Average Delay			23.8			
Intersection Capacity Utilization			82.3%	ICU Level of Service		E
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/5/2012

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	335	98	180	295	43	123
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	364	107	196	321	47	134
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			471		1129	417
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			471		1129	417
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			82		75	79
cM capacity (veh/h)			1091		185	635
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	471	516	47	134		
Volume Left	0	196	47	0		
Volume Right	107	0	0	134		
cSH	1700	1091	185	635		
Volume to Capacity	0.28	0.18	0.25	0.21		
Queue Length 95th (ft)	0	16	24	20		
Control Delay (s)	0.0	4.7	30.9	12.2		
Lane LOS		A	D	B		
Approach Delay (s)	0.0	4.7	17.0			
Approach LOS			C			
Intersection Summary						
Average Delay			4.7			
Intersection Capacity Utilization			62.4%	ICU Level of Service	B	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↖	↗
Volume (veh/h)	271	81	255	530	69	119
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	323	116	297	552	83	151
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			380
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			438			380
tC, single (s)			4.1			6.2
tC, 2 stage (s)						
tF (s)			2.2			3.3
p0 queue free %			73			78
cM capacity (veh/h)			1116			671
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	438	849	83	151		
Volume Left	0	297	83	0		
Volume Right	116	0	0	151		
cSH	1700	1116	96	671		
Volume to Capacity	0.26	0.27	0.86	0.22		
Queue Length 95th (ft)	0	27	121	21		
Control Delay (s)	0.0	5.7	136.3	11.9		
Lane LOS	A		F	B		
Approach Delay (s)	0.0	5.7	56.1			
Approach LOS			F			
Intersection Summary						
Average Delay			11.8			
Intersection Capacity Utilization			75.0%	ICU Level of Service	D	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catocin Creek Apartments  
11/5/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	482	97	132	564	453	437
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1748		1770	1863	1863	1583
Flt Permitted	0.96		0.19	1.00	1.00	1.00
Satd. Flow (perm)	1748		355	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	524	105	143	613	492	475
RTOR Reduction (vph)	7	0	0	0	0	310
Lane Group Flow (vph)	622	0	143	613	492	165
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	37.8		48.7	48.7	34.7	34.7
Effective Green, g (s)	37.8		48.7	48.7	34.7	34.7
Actuated g/C Ratio	0.38		0.49	0.49	0.35	0.35
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	661		265	907	646	549
v/s Ratio Prot	c0.36		0.04	c0.33	c0.26	
v/s Ratio Perm			0.23			0.10
v/c Ratio	0.94		0.54	0.68	0.76	0.30
Uniform Delay, d1	30.0		18.2	19.6	29.0	23.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	21.7		1.6	4.0	8.3	1.4
Delay (s)	51.7		19.8	23.6	37.2	25.2
Level of Service	D		B	C	D	C
Approach Delay (s)	51.7			22.9	31.3	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	34.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues

5: Hirst Road & Route 287



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	629	143	613	492	475
v/c Ratio	0.94	0.55	0.68	0.76	0.55
Control Delay	53.3	24.0	24.7	38.7	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	53.3	24.0	24.7	38.7	5.1
Queue Length 50th (ft)	368	51	295	281	0
Queue Length 95th (ft)	#591	89	425	#437	69
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	689	261	907	646	859
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.55	0.68	0.76	0.55

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoclin Creek Apartments  
11/5/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	332	66	144	673	637	612
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1742		1770	1863	1827	1553
Flt Permitted	0.96		0.15	1.00	1.00	1.00
Satd. Flow (perm)	1742		286	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	377	96	178	783	716	665
RTOR Reduction (vph)	6	0	0	0	0	332
Lane Group Flow (vph)	467	0	178	783	716	333
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	43.3		93.2	93.2	75.2	75.2
Effective Green, g (s)	43.3		93.2	93.2	75.2	75.2
Actuated g/C Ratio	0.29		0.62	0.62	0.50	0.50
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	503		282	1158	916	779
v/s Ratio Prot	c0.27		0.04	c0.42	c0.39	
v/s Ratio Perm			0.35			0.21
v/c Ratio	0.93		0.63	0.68	0.78	0.43
Uniform Delay, d1	51.8		23.1	18.5	30.7	23.7
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	23.6		4.0	3.2	6.6	1.7
Delay (s)	75.4		27.1	21.7	37.3	25.5
Level of Service	E		C	C	D	C
Approach Delay (s)	75.4			22.7	31.6	
Approach LOS	E			C	C	

Intersection Summary			
HCM Average Control Delay	35.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

## Queues

## 5: Hirst Road &amp; Route 287

11/5/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	473	178	783	716	665
v/c Ratio	0.93	0.64	0.68	0.78	0.60
Control Delay	76.0	23.7	22.9	39.1	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	76.0	23.7	22.9	39.1	4.1
Queue Length 50th (ft)	433	75	502	593	0
Queue Length 95th (ft)	#602	101	604	765	68
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	541	289	1158	916	1110
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.62	0.68	0.78	0.60

## Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoclin Creek Apartments  
11/5/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	482	97	132	564	453	437
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.23	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	434	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	524	105	143	613	492	475
RTOR Reduction (vph)	0	70	0	0	0	291
Lane Group Flow (vph)	524	35	143	613	492	184
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	33.7	33.7	52.8	52.8	38.8	38.8
Effective Green, g (s)	33.7	33.7	52.8	52.8	38.8	38.8
Actuated g/C Ratio	0.34	0.34	0.53	0.53	0.39	0.39
Clearance Time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5	3.5	2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	596	533	316	984	723	614
v/s Ratio Prot	c0.30		0.03	c0.33	c0.26	
v/s Ratio Perm		0.02	0.21			0.12
v/c Ratio	0.88	0.07	0.45	0.62	0.68	0.30
Uniform Delay, d1	31.2	22.5	15.5	16.6	25.4	21.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.2	0.1	0.8	3.0	5.1	1.3
Delay (s)	45.4	22.5	16.3	19.6	30.6	22.4
Level of Service	D	C	B	B	C	C
Approach Delay (s)	41.6			19.0	26.6	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	28.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	524	105	143	613	492	475
v/c Ratio	0.88	0.17	0.46	0.62	0.68	0.52
Control Delay	48.1	5.0	18.8	21.0	32.3	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.1	5.0	18.8	21.0	32.3	4.5
Queue Length 50th (ft)	299	0	48	277	268	0
Queue Length 95th (ft)	#464	33	86	407	396	65
Internal Link Dist (ft)	1865			1079	4613	
Turn Bay Length (ft)			310			400
Base Capacity (vph)	655	652	312	984	724	905
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.16	0.46	0.62	0.68	0.52

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catocin Creek Apartments  
11/6/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	332	66	144	673	637	612
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>	1.00	0.85	1.00	1.00	1.00	0.85
Fl <sub>t</sub> Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1827	1553
Fl <sub>t</sub> Permitted	0.95	1.00	0.13	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	244	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	377	96	178	783	716	665
RTOR Reduction (vph)	0	74	0	0	0	356
Lane Group Flow (vph)	377	22	178	783	716	309
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	20.7	20.7	55.8	55.8	41.8	41.8
Effective Green, g (s)	20.7	20.7	55.8	55.8	41.8	41.8
Actuated g/C Ratio	0.23	0.23	0.62	0.62	0.46	0.46
Clearance Time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5	3.5	2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	407	364	261	1155	849	721
v/s Ratio Prot	c0.21		0.05	c0.42	c0.39	
v/s Ratio Perm		0.01	0.37			0.20
v/c Ratio	0.93	0.06	0.68	0.68	0.84	0.43
Uniform Delay, d1	33.9	27.1	15.1	11.2	21.2	16.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	27.1	0.1	6.6	3.2	10.0	1.9
Delay (s)	61.0	27.1	21.7	14.4	31.2	18.0
Level of Service	E	C	C	B	C	B
Approach Delay (s)	54.2			15.8	24.8	
Approach LOS	D			B	C	

Intersection Summary

HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	377	96	178	783	716	665
v/c Ratio	0.92	0.22	0.69	0.68	0.85	0.62
Control Delay	64.7	7.6	24.0	15.1	32.7	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.7	7.6	24.0	15.1	32.7	4.1
Queue Length 50th (ft)	210	0	41	268	348	0
Queue Length 95th (ft)	#363	18	67	364	#554	58
Internal Link Dist (ft)	1865			1079	4613	
Turn Bay Length (ft)	400		310			400
Base Capacity (vph)	413	443	259	1154	847	1077
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.22	0.69	0.68	0.85	0.62

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoclin Creek Apartments  
11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	139	583	323	107	105	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.97		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	1863	1800		1711	
Flt Permitted	0.28	1.00	1.00		0.97	
Satd. Flow (perm)	530	1863	1800		1711	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	151	634	351	116	114	75
RTOR Reduction (vph)	0	0	13	0	26	0
Lane Group Flow (vph)	151	634	454	0	163	0
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	39.8	39.8	25.5		12.9	
Effective Green, g (s)	39.8	39.8	25.5		12.9	
Actuated g/C Ratio	0.61	0.61	0.39		0.20	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	481	1137	704		339	
v/s Ratio Prot	0.04	c0.34	c0.25		c0.10	
v/s Ratio Perm	0.15					
v/c Ratio	0.31	0.56	0.64		0.48	
Uniform Delay, d1	7.1	7.5	16.2		23.2	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.1	1.3	3.3		1.5	
Delay (s)	7.2	8.8	19.5		24.7	
Level of Service	A	A	B		C	
Approach Delay (s)		8.5	19.5		24.7	
Approach LOS		A	B		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			14.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			65.2		Sum of lost time (s)	19.0
Intersection Capacity Utilization			56.7%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

Queues  
6: Main Street & Hatcher Avenue



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	151	634	467	189
v/c Ratio	0.31	0.56	0.66	0.52
Control Delay	7.5	10.3	21.4	27.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.5	10.3	21.4	27.0
Queue Length 50th (ft)	21	128	139	55
Queue Length 95th (ft)	53	263	272	137
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	522	1691	1334	699
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.37	0.35	0.27

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments

11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	98	629	744	133	113	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.98		0.91	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1752	1845	1841		1701	
Flt Permitted	0.07	1.00	1.00		0.98	
Satd. Flow (perm)	125	1845	1841		1701	
Peak-hour factor, PHF	0.78	0.86	0.92	0.87	0.93	0.83
Adj. Flow (vph)	126	731	809	153	122	239
RTOR Reduction (vph)	0	0	7	0	71	0
Lane Group Flow (vph)	126	731	955	0	290	0
Heavy Vehicles (%)	3%	3%	1%	1%	0%	0%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	64.0	64.0	53.0		19.9	
Effective Green, g (s)	64.0	64.0	53.0		19.9	
Actuated g/C Ratio	0.66	0.66	0.55		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	167	1225	1012		351	
v/s Ratio Prot	0.04	c0.40	c0.52		c0.17	
v/s Ratio Perm	0.46					
v/c Ratio	0.75	0.60	0.94		0.83	
Uniform Delay, d1	21.1	9.0	20.3		36.6	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	15.7	1.5	17.2		15.2	
Delay (s)	36.8	10.5	37.5		51.7	
Level of Service	D	B	D		D	
Approach Delay (s)		14.3	37.5		51.7	
Approach LOS		B	D		D	

Intersection Summary

HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	96.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
6: Main Street & Hatcher Avenue



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	126	731	962	361
v/c Ratio	0.75	0.60	0.94	0.86
Control Delay	41.1	11.9	39.5	48.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	41.1	11.9	39.5	48.1
Queue Length 50th (ft)	27	240	543	167
Queue Length 95th (ft)	#85	318	#847	#315
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	169	1259	1053	459
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.75	0.58	0.91	0.79

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoclin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	501	48	54	261	62	38	155	89	106	87	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.95		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1838		1770	1809		1770	1760		1770	1755	
Flt Permitted	0.46	1.00		0.27	1.00		0.66	1.00		0.48	1.00	
Satd. Flow (perm)	855	1838		508	1809		1227	1760		886	1755	
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)	93	545	52	59	284	67	41	168	97	115	95	60
RTOR Reduction (vph)	0	2	0	0	5	0	0	11	0	0	12	0
Lane Group Flow (vph)	93	595	0	59	346	0	41	254	0	115	143	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	50.7	43.2		47.1	41.4		22.6	22.6		22.6	22.6	
Effective Green, g (s)	50.7	43.2		47.1	41.4		22.6	22.6		22.6	22.6	
Actuated g/C Ratio	0.55	0.47		0.51	0.45		0.24	0.24		0.24	0.24	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	543	858		336	810		300	430		216	429	
v/s Ratio Prot	c0.01	c0.32		0.01	0.19			c0.14			0.08	
v/s Ratio Perm	0.08			0.08			0.03			0.13		
v/c Ratio	0.17	0.69		0.18	0.43		0.14	0.59		0.53	0.33	
Uniform Delay, d1	10.3	19.4		13.0	17.5		27.3	30.9		30.4	28.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	3.6		0.1	1.0		0.3	2.4		3.2	0.6	
Delay (s)	10.3	23.1		13.0	18.5		27.6	33.3		33.6	29.4	
Level of Service	B	C		B	B		C	C		C	C	
Approach Delay (s)		21.4			17.7			32.5			31.2	
Approach LOS		C			B			C			C	

Intersection Summary

HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	92.5	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	93	597	59	351	41	265	115	155
v/c Ratio	0.17	0.69	0.16	0.45	0.14	0.60	0.53	0.35
Control Delay	9.6	25.6	9.7	20.0	33.0	38.0	44.6	31.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.6	25.6	9.7	20.0	33.0	38.0	44.6	31.3
Queue Length 50th (ft)	20	264	12	127	19	128	58	66
Queue Length 95th (ft)	53	501	37	256	57	273	146	157
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	610	1779	418	1745	855	1230	616	1227
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.34	0.14	0.20	0.05	0.22	0.19	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catocin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	548	57	103	710	98	75	103	78	88	150	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.93		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1820		1787	1842		1787	1747		1787	1766	
Flt Permitted	0.08	1.00		0.20	1.00		0.25	1.00		0.48	1.00	
Satd. Flow (perm)	152	1820		382	1842		464	1747		905	1766	
Peak-hour factor, PHF	0.84	0.83	0.86	0.87	0.92	0.78	0.90	0.85	0.71	0.82	0.71	0.81
Adj. Flow (vph)	104	660	66	118	772	126	83	121	110	107	211	146
RTOR Reduction (vph)	0	3	0	0	5	0	0	25	0	0	19	0
Lane Group Flow (vph)	104	723	0	118	893	0	83	206	0	107	338	0
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4				8
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	70.5	63.8		70.7	63.9		27.6	27.6		27.6	27.6	
Effective Green, g (s)	70.5	63.8		70.7	63.9		27.6	27.6		27.6	27.6	
Actuated g/C Ratio	0.59	0.54		0.59	0.54		0.23	0.23		0.23	0.23	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	180	974		307	987		107	405		210	409	
v/s Ratio Prot	c0.03	0.40		0.02	c0.49			0.12			c0.19	
v/s Ratio Perm	0.31			0.21			0.18			0.12		
v/c Ratio	0.58	0.74		0.38	0.91		0.78	0.51		0.51	0.83	
Uniform Delay, d1	22.2	21.4		15.2	24.9		42.9	39.9		39.9	43.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	4.2		0.3	12.6		30.3	1.4		2.6	13.3	
Delay (s)	25.0	25.5		15.5	37.5		73.2	41.3		42.5	56.9	
Level of Service	C	C		B	D		E	D		D	E	
Approach Delay (s)		25.5			35.0			49.7			53.6	
Approach LOS		C			C			D			D	

Intersection Summary

HCM Average Control Delay	37.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	119.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	92.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Queues  
7: Main Street & Maple Avenue

Catoclin Creek Apartments  
11/5/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	104	726	118	898	83	231	107	357
v/c Ratio	0.58	0.75	0.38	0.91	0.78	0.54	0.51	0.84
Control Delay	25.8	27.5	12.2	39.7	88.4	40.8	52.0	59.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.8	27.5	12.2	39.7	88.4	40.8	52.0	59.9
Queue Length 50th (ft)	30	444	35	646	65	146	79	268
Queue Length 95th (ft)	62	523	57	#947	#158	215	127	280
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	190	1108	314	1120	126	497	245	496
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.66	0.38	0.80	0.66	0.46	0.44	0.72

Intersection Summary

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

**APPENDIX G**  
**TOTAL FUTURE (2014) PEAK HOUR**  
**ANALYSIS WORKSHEETS**

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catocin Creek Apartments  
11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	73	153	175	152	98
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	79	166	190	165	107
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	698	261			357	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	698	261			357	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	77	90			86	
cM capacity (veh/h)	351	777			1202	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	161	357	272			
Volume Left	82	0	165			
Volume Right	79	190	0			
cSH	481	1700	1202			
Volume to Capacity	0.33	0.21	0.14			
Queue Length 95th (ft)	36	0	12			
Control Delay (s)	16.2	0.0	5.6			
Lane LOS	C		A			
Approach Delay (s)	16.2	0.0	5.6			
Approach LOS	C					
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization			51.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catocin Creek Apartments  
 11/5/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	230	182	151	87	59	88
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	258	233	184	107	79	104
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	499	238			292	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	499	238			292	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	48	71			94	
cM capacity (veh/h)	497	799			1276	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	492	292	182			
Volume Left	258	0	79			
Volume Right	233	107	0			
cSH	605	1700	1276			
Volume to Capacity	0.81	0.17	0.06			
Queue Length 95th (ft)	206	0	5			
Control Delay (s)	31.6	0.0	3.8			
Lane LOS	D		A			
Approach Delay (s)	31.6	0.0	3.8			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			16.8			
Intersection Capacity Utilization			55.0%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/12/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	203	53	77	141	170	47	79	129	132	59	10
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)	17	221	58	84	153	185	51	86	140	143	64	11
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	238	58	422	137	140	208	11					
Volume Left (vph)	17	0	84	51	0	143	0					
Volume Right (vph)	0	58	185	0	140	0	11					
Hadj (s)	0.07	-0.67	-0.19	0.22	-0.67	0.38	-0.67					
Departure Headway (s)	7.1	6.4	6.5	7.6	6.7	7.8	6.7					
Degree Utilization, x	0.47	0.10	0.76	0.29	0.26	0.45	0.02					
Capacity (veh/h)	475	525	537	429	490	426	484					
Control Delay (s)	15.1	8.9	27.7	12.5	10.9	15.9	8.7					
Approach Delay (s)	13.9		27.7	11.7		15.5						
Approach LOS	B		D	B		C						
Intersection Summary												
Delay			18.5									
HCM Level of Service			C									
Intersection Capacity Utilization			60.7%	ICU Level of Service	B							
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	98	48	128	72	50	138	53
Average Queue (ft)	56	26	76	41	35	70	11
95th Queue (ft)	90	40	122	67	54	120	43
Link Distance (ft)	2673		2809	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200		175			30
Storage Blk Time (%)						29	1
Queuing Penalty (veh)						3	2

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoclin Creek Apartments  
11/12/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	12	160	45	162	291	116	47	60	91	94	60	19
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	20	170	79	198	334	141	63	74	123	125	87	24
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	190	79	674	137	123	212	24					
Volume Left (vph)	20	0	198	63	0	125	0					
Volume Right (vph)	0	79	141	0	123	0	24					
Hadj (s)	0.07	-0.68	0.00	0.26	-0.67	0.31	-0.68					
Departure Headway (s)	7.3	6.6	6.7	7.9	7.0	7.9	6.9					
Degree Utilization, x	0.39	0.14	1.25	0.30	0.24	0.47	0.05					
Capacity (veh/h)	470	521	524	440	495	440	498					
Control Delay (s)	13.7	9.5	150.9	13.1	11.0	16.5	9.1					
Approach Delay (s)	12.5		150.9	12.1		15.8						
Approach LOS	B		F	B		C						
Intersection Summary												
Delay			77.8									
HCM Level of Service			F									
Intersection Capacity Utilization			65.4%	ICU Level of Service	C							
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	54	51	302	97	70	92	55
Average Queue (ft)	37	24	167	53	31	56	23
95th Queue (ft)	55	48	291	101	51	84	60
Link Distance (ft)	2673		2817	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						19	2
Queuing Penalty (veh)						4	3

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	203	53	77	141	170	47	79	129	132	59	10
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)	17	221	58	84	153	185	51	86	140	143	64	11
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	238	58	84	338	137	140	208	11				
Volume Left (vph)	17	0	84	0	51	0	143	0				
Volume Right (vph)	0	58	0	185	0	140	0	11				
Hadj (s)	0.07	-0.67	0.53	-0.35	0.22	-0.67	0.38	-0.67				
Departure Headway (s)	6.8	6.0	7.1	6.2	7.2	6.3	7.4	6.3				
Degree Utilization, x	0.45	0.10	0.16	0.58	0.27	0.24	0.42	0.02				
Capacity (veh/h)	503	556	483	551	462	533	460	525				
Control Delay (s)	14.0	8.5	10.3	16.2	11.6	10.1	14.5	8.2				
Approach Delay (s)	12.9		15.0		10.8		14.1					
Approach LOS	B		C		B		B					
Intersection Summary												
Delay			13.4									
HCM Level of Service			B									
Intersection Capacity Utilization			56.5%		ICU Level of Service				B			
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	117	48	86	106	71	50	97	53
Average Queue (ft)	55	26	31	59	45	34	60	11
95th Queue (ft)	95	41	66	97	74	53	100	42
Link Distance (ft)	2674			2810	2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		200	100			175		30
Storage Blk Time (%)			0	1			27	1
Queuing Penalty (veh)			0	1			3	2

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	12	160	45	162	291	116	47	60	91	94	60	19
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	20	170	79	198	334	141	63	74	123	125	87	24
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	190	79	198	476	137	123	212	24				
Volume Left (vph)	20	0	198	0	63	0	125	0				
Volume Right (vph)	0	79	0	141	0	123	0	24				
Hadj (s)	0.07	-0.68	0.57	-0.14	0.26	-0.67	0.31	-0.68				
Departure Headway (s)	7.3	6.6	7.2	6.5	7.8	6.9	7.8	6.8				
Degree Utilization, x	0.39	0.14	0.40	0.86	0.30	0.23	0.46	0.05				
Capacity (veh/h)	468	516	485	544	440	494	437	493				
Control Delay (s)	13.7	9.5	13.7	36.1	12.9	10.8	16.2	9.0				
Approach Delay (s)	12.4		29.5		11.9		15.5					
Approach LOS	B		D		B		C					

Intersection Summary

Delay	20.8											
HCM Level of Service		C										
Intersection Capacity Utilization		56.5%			ICU Level of Service				B			
Analysis Period (min)		15										

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	71	51	124	193	93	92	98	54
Average Queue (ft)	40	24	61	91	46	31	55	17
95th Queue (ft)	62	48	123	153	85	60	87	52
Link Distance (ft)	2674		2819		2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		100		175		30	
Storage Blk Time (%)			0		5		21	
Queuing Penalty (veh)			0		7		4	

HCM Unsignalized Intersection Capacity Analysis  
3: Hirst Road & Site Entrance

Catoclin Creek Apartments  
11/5/2012

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	432	6	12	338	25	47
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	470	7	13	367	27	51
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			476			473
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			476			473
tC, single (s)			4.1			6.2
tC, 2 stage (s)						
tF (s)			2.2			3.3
p0 queue free %			99			91
cM capacity (veh/h)			1086			591
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	476	13	367	78		
Volume Left	0	13	0	27		
Volume Right	7	0	0	51		
cSH	1700	1086	1700	457		
Volume to Capacity	0.28	0.01	0.22	0.17		
Queue Length 95th (ft)	0	1	0	15		
Control Delay (s)	0.0	8.4	0.0	14.5		
Lane LOS	A		B			
Approach Delay (s)	0.0	0.3	14.5			
Approach LOS					B	
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			34.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
3: Hirst Road & Site Entrance

Catoctin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↖	↗	↘	
Volume (veh/h)	352	26	48	599	14	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	383	28	52	651	15	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			411		1152	397
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			411		1152	397
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		93	96
cM capacity (veh/h)			1148		209	653
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	411	52	651	43		
Volume Left	0	52	0	15		
Volume Right	28	0	0	28		
cSH	1700	1148	1700	374		
Volume to Capacity	0.24	0.05	0.38	0.12		
Queue Length 95th (ft)	0	4	0	10		
Control Delay (s)	0.0	8.3	0.0	15.9		
Lane LOS		A		C		
Approach Delay (s)	0.0	0.6		15.9		
Approach LOS				C		
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			41.5%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
 11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↖	↗	
Volume (veh/h)	360	120	180	301	48	123
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	391	130	196	327	52	134
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			522		1175	457
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			522		1175	457
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			81		70	78
cM capacity (veh/h)			1045		172	604
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	522	523	186			
Volume Left	0	196	52			
Volume Right	130	0	134			
cSH	1700	1045	354			
Volume to Capacity	0.31	0.19	0.52			
Queue Length 95th (ft)	0	17	73			
Control Delay (s)	0.0	4.8	25.8			
Lane LOS		A	D			
Approach Delay (s)	0.0	4.8	25.8			
Approach LOS			D			
<b>Intersection Summary</b>						
Average Delay			5.9			
Intersection Capacity Utilization			72.3%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↘	
Volume (veh/h)	285	93	255	556	91	119
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	339	133	297	579	110	151
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			472		1578	406
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			472		1578	406
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		0	77
cM capacity (veh/h)			1084		88	650
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	472	876	260			
Volume Left	0	297	110			
Volume Right	133	0	151			
cSH	1700	1084	177			
Volume to Capacity	0.28	0.27	1.47			
Queue Length 95th (ft)	0	28	410			
Control Delay (s)	0.0	5.9	288.8			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.9	288.8			
Approach LOS			F			
<b>Intersection Summary</b>						
Average Delay			49.9			
Intersection Capacity Utilization			86.4%	ICU Level of Service		E
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↖	↖
Volume (veh/h)	360	120	180	301	48	123
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	391	130	196	327	52	134
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			522		1175	457
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			522		1175	457
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			81		70	78
cM capacity (veh/h)			1045		172	604
<b>Direction, Lane #</b>						
	EB 1	WB 1	NB 1	NB 2		
Volume Total	522	523	52	134		
Volume Left	0	196	52	0		
Volume Right	130	0	0	134		
cSH	1700	1045	172	604		
Volume to Capacity	0.31	0.19	0.30	0.22		
Queue Length 95th (ft)	0	17	30	21		
Control Delay (s)	0.0	4.8	34.8	12.6		
Lane LOS		A	D	B		
Approach Delay (s)	0.0	4.8	18.9			
Approach LOS			C			
<b>Intersection Summary</b>						
Average Delay			4.9			
Intersection Capacity Utilization			65.4%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↖	↘	↗
Volume (veh/h)	285	93	255	556	91	119
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	339	133	297	579	110	151
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			472		1578	406
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			472		1578	406
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		0	77
cM capacity (veh/h)			1084		88	650
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	472	876	110	151		
Volume Left	0	297	110	0		
Volume Right	133	0	0	151		
cSH	1700	1084	88	650		
Volume to Capacity	0.28	0.27	1.24	0.23		
Queue Length 95th (ft)	0	28	197	22		
Control Delay (s)	0.0	5.9	259.8	12.2		
Lane LOS		A	F	B		
Approach Delay (s)	0.0	5.9	116.5			
Approach LOS			F			
Intersection Summary						
Average Delay			22.0			
Intersection Capacity Utilization			79.1%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	Y
Volume (vph)	504	101	133	564	453	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1748		1770	1863	1863	1583
Flt Permitted	0.96		0.19	1.00	1.00	1.00
Satd. Flow (perm)	1748		349	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	548	110	145	613	492	480
RTOR Reduction (vph)	7	0	0	0	0	315
Lane Group Flow (vph)	651	0	145	613	492	165
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	39.1		47.4	47.4	34.4	34.4
Effective Green, g (s)	39.1		47.4	47.4	34.4	34.4
Actuated g/C Ratio	0.39		0.47	0.47	0.34	0.34
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	683		244	883	641	545
v/s Ratio Prot	c0.37		0.03	c0.33	c0.26	
v/s Ratio Perm			0.25			0.10
v/c Ratio	0.95		0.59	0.69	0.77	0.30
Uniform Delay, d1	29.6		19.0	20.6	29.2	24.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5		3.2	4.5	8.6	1.4
Delay (s)	53.0		22.2	25.1	37.8	25.4
Level of Service	D		C	C	D	C
Approach Delay (s)	53.0			24.6	31.7	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	35.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	658	145	613	492	480
v/c Ratio	0.95	0.60	0.69	0.77	0.56
Control Delay	54.5	28.4	26.1	39.1	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	54.5	28.4	26.1	39.1	5.1
Queue Length 50th (ft)	388	53	302	281	0
Queue Length 95th (ft)	#621	#94	434	#437	69
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	706	240	883	641	860
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.93	0.60	0.69	0.77	0.56

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	344	68	148	673	637	634
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1742		1770	1863	1827	1553
Flt Permitted	0.96		0.14	1.00	1.00	1.00
Satd. Flow (perm)	1742		266	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	391	99	183	783	716	689
RTOR Reduction (vph)	6	0	0	0	0	351
Lane Group Flow (vph)	484	0	183	783	716	338
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	44.5		92.0	92.0	73.5	73.5
Effective Green, g (s)	44.5		92.0	92.0	73.5	73.5
Actuated g/C Ratio	0.30		0.61	0.61	0.49	0.49
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	517		273	1143	895	761
v/s Ratio Prot	c0.28		0.05	c0.42	c0.39	
v/s Ratio Perm			0.36			0.22
v/c Ratio	0.94		0.67	0.69	0.80	0.44
Uniform Delay, d1	51.4		24.3	19.3	32.1	24.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	24.6		5.8	3.3	7.4	1.9
Delay (s)	76.0		30.1	22.7	39.5	26.8
Level of Service	E		C	C	D	C
Approach Delay (s)	76.0			24.1	33.3	
Approach LOS	E			C	C	

Intersection Summary

HCM Average Control Delay	37.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	490	183	783	716	689
v/c Ratio	0.94	0.68	0.69	0.80	0.62
Control Delay	76.0	26.5	23.9	41.3	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	76.0	26.5	23.9	41.3	4.3
Queue Length 50th (ft)	450	79	511	604	0
Queue Length 95th (ft)	#627	106	616	779	71
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	553	280	1142	895	1113
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.89	0.65	0.69	0.80	0.62

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/5/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	504	101	133	564	453	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.22	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	412	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	548	110	145	613	492	480
RTOR Reduction (vph)	0	72	0	0	0	300
Lane Group Flow (vph)	548	38	145	613	492	180
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	34.9	34.9	51.6	51.6	37.6	37.6
Effective Green, g (s)	34.9	34.9	51.6	51.6	37.6	37.6
Actuated g/C Ratio	0.35	0.35	0.52	0.52	0.38	0.38
Clearance Time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5	3.5	2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	618	552	301	961	700	595
v/s Ratio Prot	c0.31		0.03	c0.33	c0.26	
v/s Ratio Perm		0.02	0.22			0.11
v/c Ratio	0.89	0.07	0.48	0.64	0.70	0.30
Uniform Delay, d1	30.7	21.7	16.3	17.5	26.5	22.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.7	0.1	0.9	3.2	5.8	1.3
Delay (s)	45.3	21.8	17.2	20.7	32.3	23.3
Level of Service	D	C	B	C	C	C
Approach Delay (s)	41.4			20.0	27.8	
Approach LOS	D			C	C	

Intersection Summary			
HCM Average Control Delay	29.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/5/2012



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	548	110	145	613	492	480
v/c Ratio	0.89	0.18	0.49	0.64	0.70	0.54
Control Delay	48.0	4.8	20.4	22.2	34.1	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.0	4.8	20.4	22.2	34.1	4.7
Queue Length 50th (ft)	311	0	51	286	274	0
Queue Length 95th (ft)	#487	34	89	416	403	67
Internal Link Dist (ft)	1865			1079	4613	
Turn Bay Length (ft)	400		310			400
Base Capacity (vph)	673	670	297	961	701	895
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.16	0.49	0.64	0.70	0.54

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	344	68	148	673	637	634
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>	1.00	0.85	1.00	1.00	1.00	0.85
Fl <sub>t</sub> Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1827	1553
Fl <sub>t</sub> Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	226	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	391	99	183	783	716	689
RTOR Reduction (vph)	0	75	0	0	0	376
Lane Group Flow (vph)	391	24	183	783	716	313
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	21.6	21.6	54.9	54.9	40.9	40.9
Effective Green, g (s)	21.6	21.6	54.9	54.9	40.9	40.9
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.45	0.45
Clearance Time (s)	7.0	7.0	7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5	3.5	2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	425	380	249	1136	830	706
v/s Ratio Prot	c0.22		0.05	c0.42	c0.39	
v/s Ratio Perm		0.02	0.39			0.20
v/c Ratio	0.92	0.06	0.73	0.69	0.86	0.44
Uniform Delay, d <sub>1</sub>	33.4	26.4	15.9	11.8	22.0	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d <sub>2</sub>	25.4	0.1	10.1	3.4	11.5	2.0
Delay (s)	58.7	26.5	26.0	15.2	33.5	18.8
Level of Service	E	C	C	B	C	B
Approach Delay (s)	52.2			17.3	26.3	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay		27.7	HCM Level of Service C
HCM Volume to Capacity ratio		0.90	
Actuated Cycle Length (s)		90.0	Sum of lost time (s) 20.0
Intersection Capacity Utilization		78.3%	ICU Level of Service D
Analysis Period (min)		15	

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	391	99	183	783	716	689
v/c Ratio	0.92	0.22	0.74	0.69	0.86	0.64
Control Delay	62.7	7.3	29.6	15.9	34.9	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.7	7.3	29.6	15.9	34.9	4.4
Queue Length 50th (ft)	216	0	43	277	356	0
Queue Length 95th (ft)	#369	18	#75	376	#566	60
Internal Link Dist (ft)	1865			1079	4613	
Turn Bay Length (ft)	400		310			400
Base Capacity (vph)	433	462	247	1137	831	1082
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.21	0.74	0.69	0.86	0.64

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoclin Creek Apartments  
11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↘		↘	
Volume (vph)	140	583	323	107	105	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.97		0.94	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	1863	1800		1709	
Flt Permitted	0.28	1.00	1.00		0.97	
Satd. Flow (perm)	529	1863	1800		1709	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	634	351	116	114	80
RTOR Reduction (vph)	0	0	13	0	27	0
Lane Group Flow (vph)	152	634	454	0	167	0
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	39.9	39.9	25.6		13.1	
Effective Green, g (s)	39.9	39.9	25.6		13.1	
Actuated g/C Ratio	0.61	0.61	0.39		0.20	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	480	1135	704		342	
v/s Ratio Prot	0.04	c0.34	c0.25		c0.10	
v/s Ratio Perm	0.15					
v/c Ratio	0.32	0.56	0.64		0.49	
Uniform Delay, d1	7.1	7.6	16.2		23.2	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.1	1.3	3.3		1.5	
Delay (s)	7.3	8.9	19.5		24.7	
Level of Service	A	A	B		C	
Approach Delay (s)		8.6	19.5		24.7	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay		14.3	HCM Level of Service B
HCM Volume to Capacity ratio		0.63	
Actuated Cycle Length (s)		65.5	Sum of lost time (s) 19.0
Intersection Capacity Utilization		57.0%	ICU Level of Service B
Analysis Period (min)		15	
c Critical Lane Group			

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	152	634	467	194
v/c Ratio	0.32	0.56	0.66	0.53
Control Delay	7.6	10.4	21.5	27.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.6	10.4	21.5	27.1
Queue Length 50th (ft)	22	128	140	57
Queue Length 95th (ft)	54	265	273	140
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	520	1686	1330	696
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.38	0.35	0.28
<b>Intersection Summary</b>				

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	104	629	744	133	113	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Fr <sub>t</sub>	1.00	1.00	0.98		0.91	
Fl <sub>t</sub> Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1752	1845	1841		1701	
Fl <sub>t</sub> Permitted	0.07	1.00	1.00		0.98	
Satd. Flow (perm)	125	1845	1841		1701	
Peak-hour factor, PHF	0.78	0.86	0.92	0.87	0.93	0.83
Adj. Flow (vph)	133	731	809	153	122	242
RTOR Reduction (vph)	0	0	7	0	73	0
Lane Group Flow (vph)	133	731	955	0	291	0
Heavy Vehicles (%)	3%	3%	1%	1%	0%	0%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	64.0	64.0	53.0		19.9	
Effective Green, g (s)	64.0	64.0	53.0		19.9	
Actuated g/C Ratio	0.66	0.66	0.55		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	167	1225	1012		351	
v/s Ratio Prot	0.04	c0.40	c0.52		c0.17	
v/s Ratio Perm	0.49					
v/c Ratio	0.80	0.60	0.94		0.83	
Uniform Delay, d <sub>1</sub>	22.4	9.0	20.3		36.6	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d <sub>2</sub>	21.2	1.5	17.2		15.5	
Delay (s)	43.7	10.5	37.5		52.1	
Level of Service	D	B	D		D	
Approach Delay (s)		15.6	37.5		52.1	
Approach LOS		B	D		D	

Intersection Summary			
HCM Average Control Delay	31.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	96.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/5/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	133	731	962	364
v/c Ratio	0.79	0.60	0.94	0.86
Control Delay	47.1	11.9	39.5	48.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	47.1	11.9	39.5	48.1
Queue Length 50th (ft)	32	240	543	168
Queue Length 95th (ft)	#96	318	#847	#317
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	168	1258	1052	461
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.79	0.58	0.91	0.79

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	501	48	54	261	66	38	155	89	120	87	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Fr <sub>t</sub>	1.00	0.99		1.00	0.97		1.00	0.95		1.00	0.94	
Fl <sub>t</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1838		1770	1806		1770	1760		1770	1750	
Fl <sub>t</sub> Permitted	0.45	1.00		0.27	1.00		0.66	1.00		0.48	1.00	
Satd. Flow (perm)	841	1838		500	1806		1222	1760		892	1750	
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)	95	545	52	59	284	72	41	168	97	130	95	64
RTOR Reduction (vph)	0	2	0	0	6	0	0	11	0	0	13	0
Lane Group Flow (vph)	95	595	0	59	350	0	41	254	0	130	146	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	51.7	44.1		48.1	42.3		24.1	24.1		24.1	24.1	
Effective Green, g (s)	51.7	44.1		48.1	42.3		24.1	24.1		24.1	24.1	
Actuated g/C Ratio	0.54	0.46		0.51	0.45		0.25	0.25		0.25	0.25	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	532	853		331	804		310	446		226	444	
v/s Ratio Prot	c0.01	c0.32		0.01	0.19			0.14			0.08	
v/s Ratio Perm	0.08			0.08			0.03			c0.15		
v/c Ratio	0.18	0.70		0.18	0.44		0.13	0.57		0.58	0.33	
Uniform Delay, d <sub>1</sub>	10.8	20.2		13.5	18.1		27.4	30.9		31.0	28.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d <sub>2</sub>	0.1	3.7		0.1	1.1		0.3	2.0		4.2	0.6	
Delay (s)	10.8	23.9		13.6	19.2		27.6	32.9		35.2	29.4	
Level of Service	B	C		B	B		C	C		D	C	
Approach Delay (s)		22.1			18.4			32.2			32.0	
Approach LOS		C			B			C			C	

Intersection Summary

HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	95	597	59	356	41	265	130	159
v/c Ratio	0.18	0.70	0.17	0.46	0.13	0.58	0.57	0.35
Control Delay	10.3	26.8	10.5	21.1	32.8	37.1	45.9	30.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.3	26.8	10.5	21.1	32.8	37.1	45.9	30.8
Queue Length 50th (ft)	22	276	13	135	19	130	68	68
Queue Length 95th (ft)	58	528	40	275	59	276	166	161
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	578	1751	407	1715	874	1263	638	1257
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.34	0.14	0.21	0.05	0.21	0.20	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	91	548	57	103	710	113	75	103	78	96	150	120	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5		
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		
Fr <sub>t</sub>	1.00	0.99		1.00	0.98		1.00	0.93		1.00	0.94		
Fl <sub>t</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1752	1820		1787	1837		1787	1747		1787	1765		
Fl <sub>t</sub> Permitted	0.07	1.00		0.20	1.00		0.24	1.00		0.48	1.00		
Satd. Flow (perm)	131	1820		385	1837		450	1747		898	1765		
Peak-hour factor, PHF	0.84	0.83	0.86	0.87	0.92	0.78	0.90	0.85	0.71	0.82	0.71	0.81	
Adj. Flow (vph)	108	660	66	118	772	145	83	121	110	117	211	148	
RTOR Reduction (vph)	0	3	0	0	5	0	0	25	0	0	20	0	
Lane Group Flow (vph)	108	723	0	118	912	0	83	206	0	117	339	0	
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%	
Turn Type	pm+pt			pm+pt			Perm			Perm			
Protected Phases	1	6		5	2			4				8	
Permitted Phases	6			2			4			8			
Actuated Green, G (s)	72.4	65.4		72.6	65.5		28.1	28.1		28.1	28.1		
Effective Green, g (s)	72.4	65.4		72.6	65.5		28.1	28.1		28.1	28.1		
Actuated g/C Ratio	0.60	0.54		0.60	0.54		0.23	0.23		0.23	0.23		
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5		
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0		
Lane Grp Cap (vph)	171	979		312	990		104	404		208	408		
v/s Ratio Prot	c0.04	0.40		0.02	c0.50			0.12			c0.19		
v/s Ratio Perm	0.34			0.20			0.18			0.13			
v/c Ratio	0.63	0.74		0.38	0.92		0.80	0.51		0.56	0.83		
Uniform Delay, d <sub>1</sub>	23.7	21.5		15.3	25.7		44.1	40.7		41.3	44.5		
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d <sub>2</sub>	5.5	4.1		0.3	14.4		34.9	1.4		4.2	14.0		
Delay (s)	29.2	25.6		15.6	40.1		79.0	42.1		45.5	58.4		
Level of Service	C	C		B	D		E	D		D	E		
Approach Delay (s)		26.1			37.3			51.9			55.3		
Approach LOS		C			D			D			E		

**Intersection Summary**

HCM Average Control Delay	38.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	121.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/5/2012

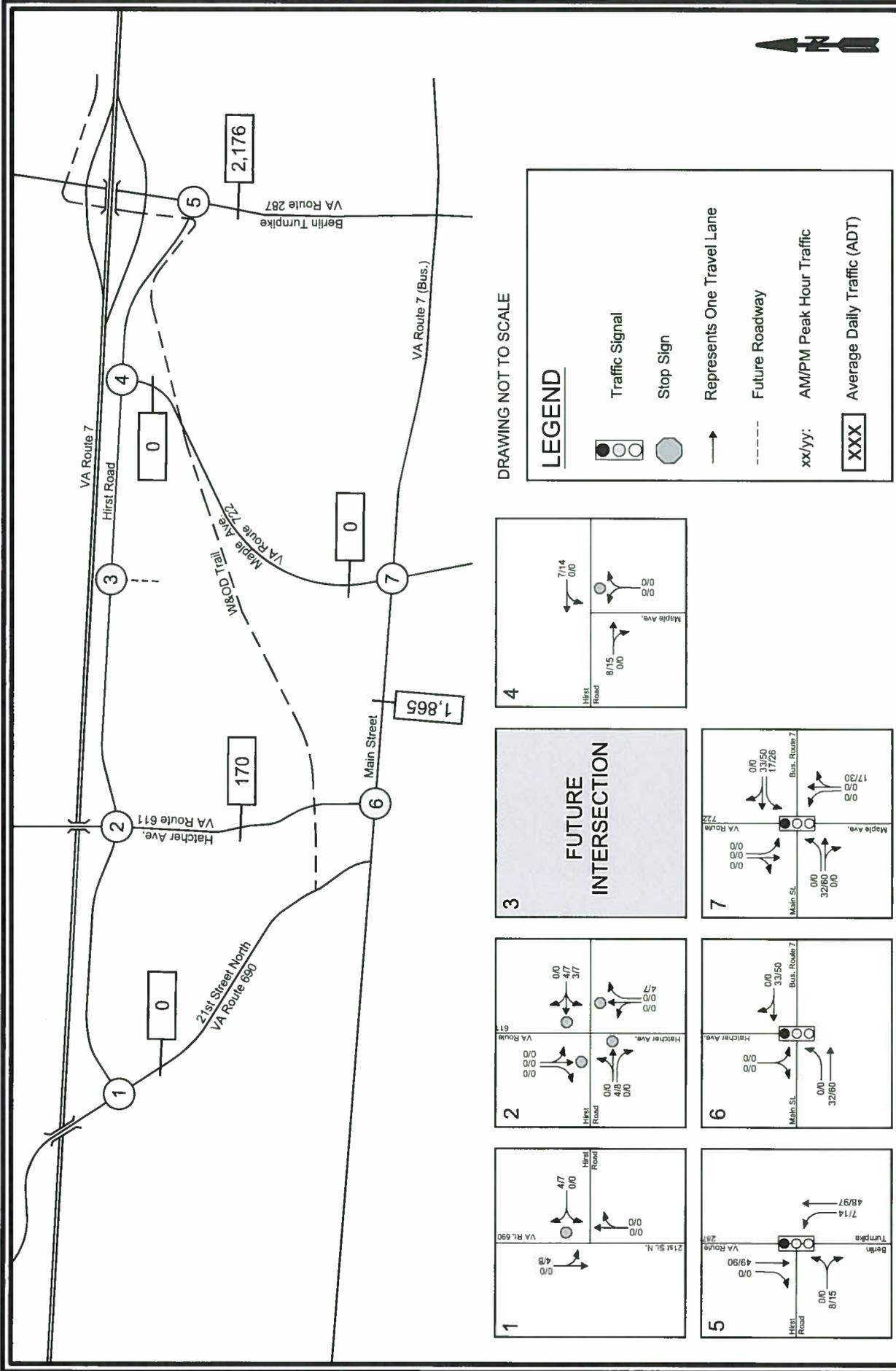


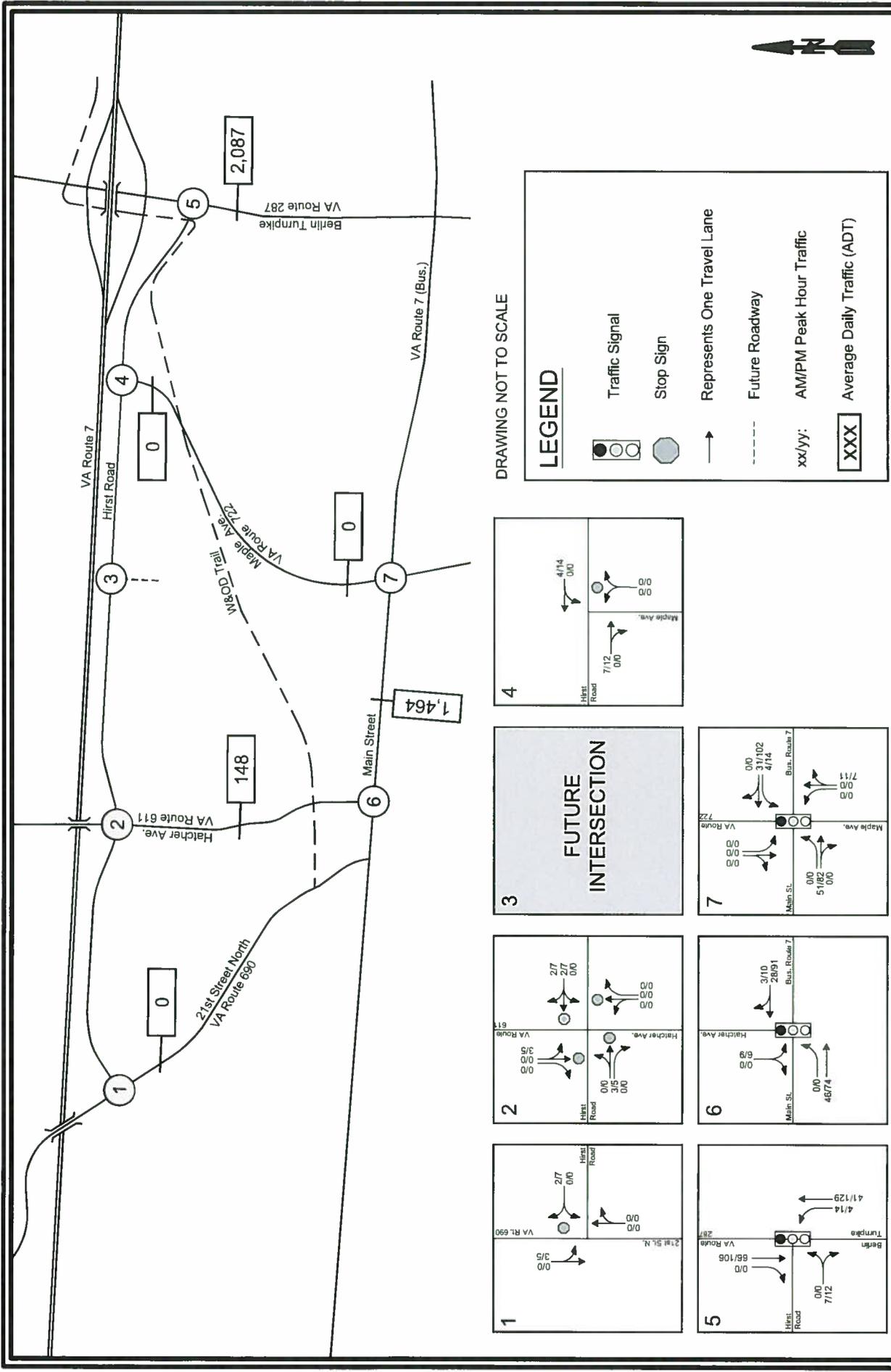
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	108	726	118	917	83	231	117	359
v/c Ratio	0.63	0.74	0.38	0.93	0.80	0.54	0.57	0.84
Control Delay	33.7	27.9	12.2	42.3	93.4	40.9	54.4	60.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	27.9	12.2	42.3	93.4	40.9	54.4	60.4
Queue Length 50th (ft)	31	448	34	675	65	145	86	267
Queue Length 95th (ft)	79	537	58	#998	#159	213	137	279
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	180	1060	324	1075	122	497	243	497
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.68	0.36	0.85	0.68	0.46	0.48	0.72

Intersection Summary

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

**APPENDIX H**  
**OTHER DEVELOPMENT TRAFFIC ASSIGNMENTS (2020)**





DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy:** AM/PM Peak Hour Traffic
- XXX** Average Daily Traffic (ADT)

**1**

**2**

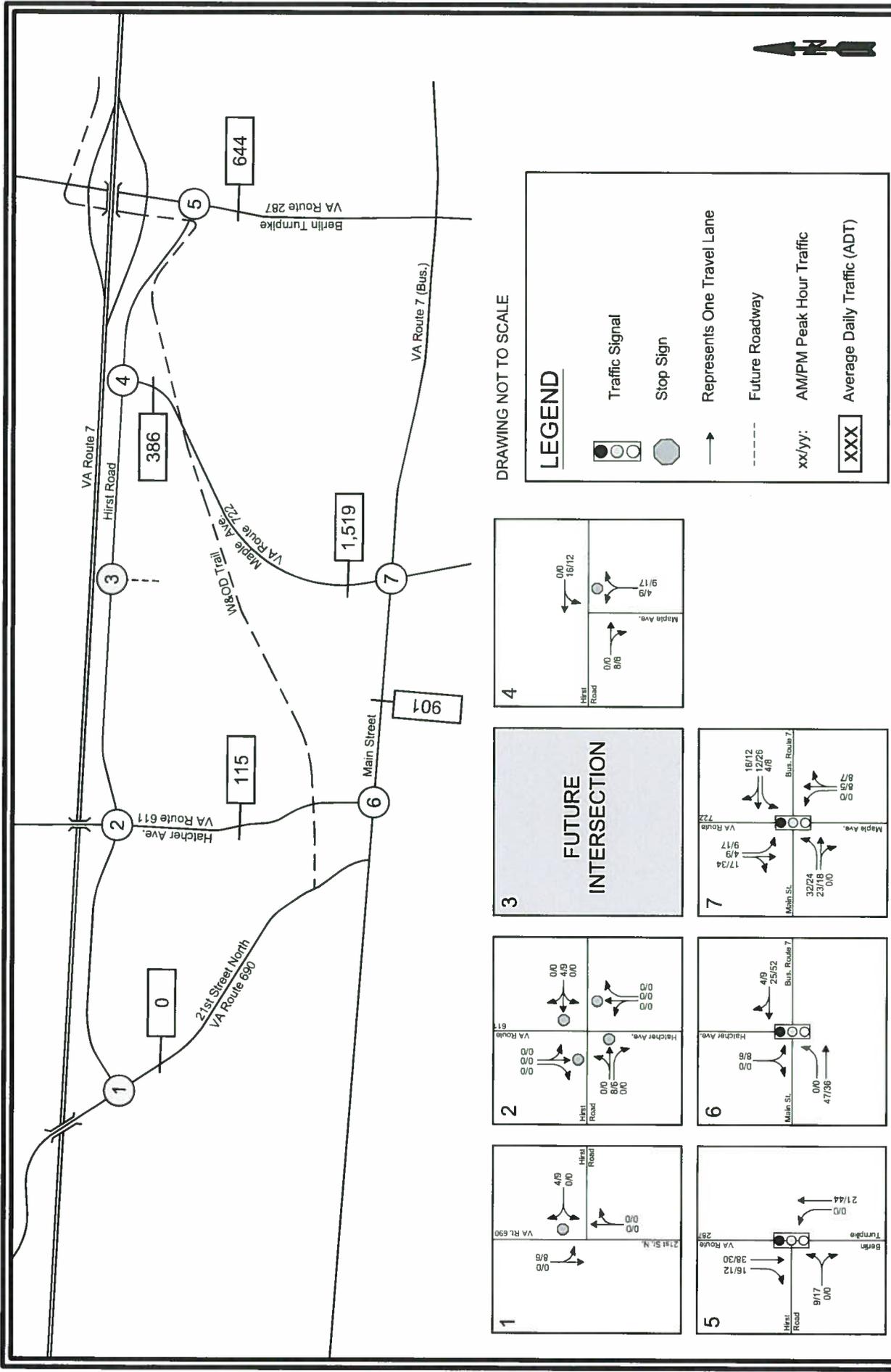
**3**

**4**

**5**

**6**

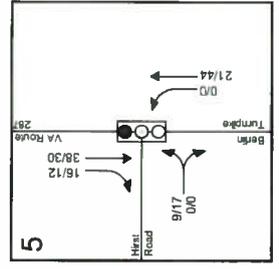
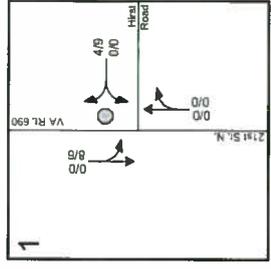
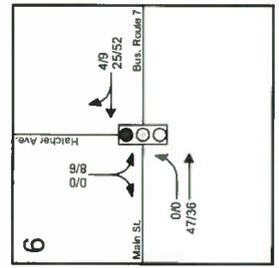
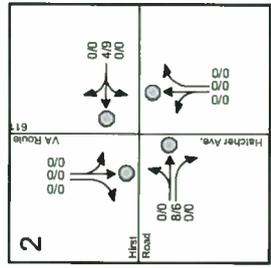
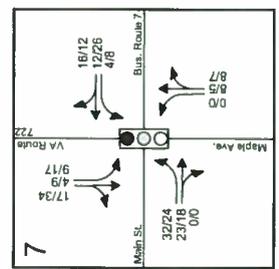
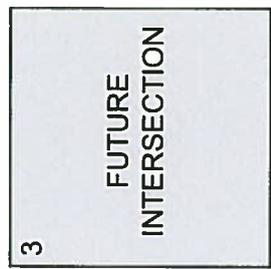
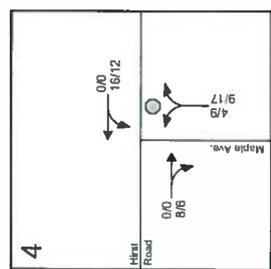
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DRAWING NOT TO SCALE

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX Average Daily Traffic (ADT)

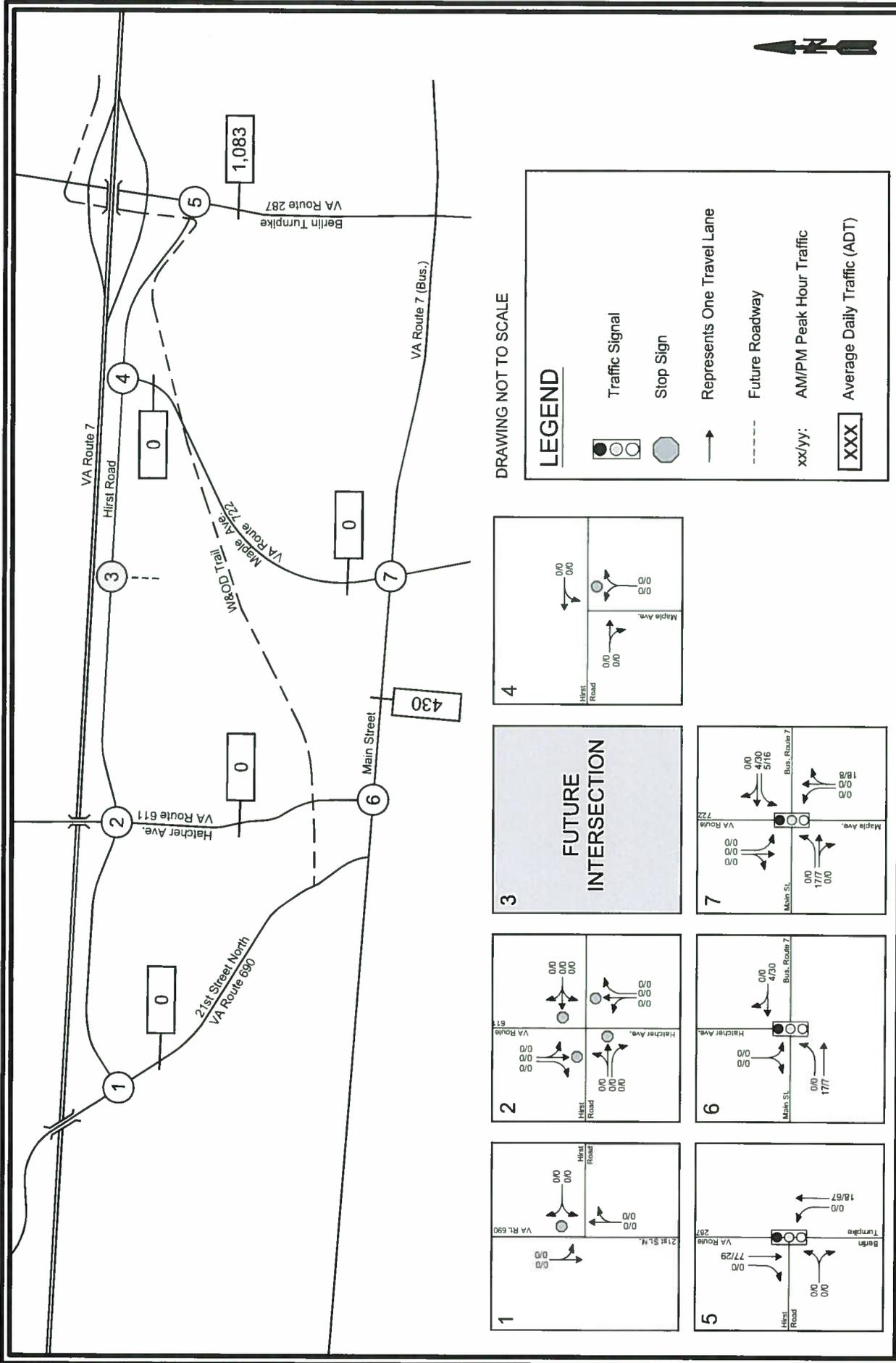


**Bowman**  
CONSULTING

**Figure H.3**

Loudoun Valley Shopping Center  
Traffic Forecasts (2020)  
Catoctin Creek Apartments  
Purcellville, Virginia

Job # 5384-01-001



**1**

VA Rt. 690	Hirst Road	0/0	0/0
21st St. N.	Hirst Road	0/0	0/0

**2**

VA Route 611	Hirst Road	0/0	0/0
Hatcher Ave.	Hirst Road	0/0	0/0
Hatcher Ave.	Main St.	0/0	0/0
Hatcher Ave.	VA Route 680	0/0	0/0

**3**

**FUTURE INTERSECTION**

**4**

Hirst Road	Maple Ave.	0/0	0/0
Hirst Road	Maple Ave.	0/0	0/0

**5**

Hirst Road	VA Route 287	0/0	0/0
Hirst Road	VA Route 287	77/29	0/0
Hirst Road	Berlin Turnpike	0/0	0/0
Hirst Road	Berlin Turnpike	18/67	0/0

**6**

Hatcher Ave.	Main St.	0/0	177
Hatcher Ave.	Bus. Route 7	0/0	430

**7**

VA Route 722	Main St.	0/0	177
VA Route 722	Maple Ave.	0/0	0/0
VA Route 722	Bus. Route 7	0/0	516
VA Route 722	Maple Ave.	0/0	18/8

**LEGEND**

- Traffic Signal
- Stop Sign
- Represents One Travel Lane
- Future Roadway
- xx/yy: AM/PM Peak Hour Traffic
- XXX: Average Daily Traffic (ADT)

**DRAWING NOT TO SCALE**

**APPENDIX I**  
**BACKGROUND (2020) PEAK HOUR**  
**ANALYSIS WORKSHEETS**

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
 11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	79	84	172	196	179	110
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	86	91	187	213	195	120
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	802	293			400	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	802	293			400	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	71	88			83	
cM capacity (veh/h)	294	746			1159	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	177	400	314			
Volume Left	86	0	195			
Volume Right	91	213	0			
cSH	427	1700	1159			
Volume to Capacity	0.41	0.24	0.17			
Queue Length 95th (ft)	50	0	15			
Control Delay (s)	19.3	0.0	6.0			
Lane LOS	C		A			
Approach Delay (s)	19.3	0.0	6.0			
Approach LOS	C					
Intersection Summary						
Average Delay			5.9			
Intersection Capacity Utilization			56.3%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catocin Creek Apartments  
 11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	255	214	170	91	82	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	287	274	207	112	109	118
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	600	263			320	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	600	263			320	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	32	64			91	
cM capacity (veh/h)	422	773			1246	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	561	320	227			
Volume Left	287	0	109			
Volume Right	274	112	0			
cSH	542	1700	1246			
Volume to Capacity	1.03	0.19	0.09			
Queue Length 95th (ft)	393	0	7			
Control Delay (s)	75.5	0.0	4.3			
Lane LOS	F		A			
Approach Delay (s)	75.5	0.0	4.3			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			39.1			
Intersection Capacity Utilization			61.5%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catocin Creek Apartments  
11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	79	84	172	196	179	110
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	86	91	187	213	195	120
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	802	293			400	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	802	293			400	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	71	88			83	
cM capacity (veh/h)	294	746			1159	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	86	91	400	314
Volume Left	86	0	0	195
Volume Right	0	91	213	0
cSH	294	746	1700	1159
Volume to Capacity	0.29	0.12	0.24	0.17
Queue Length 95th (ft)	30	10	0	15
Control Delay (s)	22.2	10.5	0.0	6.0
Lane LOS	C	B		A
Approach Delay (s)	16.2		0.0	6.0
Approach LOS	C			

Intersection Summary			
Average Delay		5.3	
Intersection Capacity Utilization		51.1%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 1: Hirst Road & Route 690 N

Catoctin Creek Apartments  
 11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	255	214	170	91	82	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	287	274	207	112	109	118
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	600	263			320	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	600	263			320	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	32	64			91	
cM capacity (veh/h)	422	773			1246	
Direction, Lane #	WB 1	WB 2	NB 1	SB 1		
Volume Total	287	274	320	227		
Volume Left	287	0	0	109		
Volume Right	0	274	112	0		
cSH	422	773	1700	1246		
Volume to Capacity	0.68	0.36	0.19	0.09		
Queue Length 95th (ft)	123	40	0	7		
Control Delay (s)	29.8	12.2	0.0	4.3		
Lane LOS	D	B		A		
Approach Delay (s)	21.2		0.0	4.3		
Approach LOS	C					
Intersection Summary						
Average Delay			11.6			
Intersection Capacity Utilization			48.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/12/2012

												
<b>Movement</b>	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕			↕	↗		↕	↗
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	18	233	60	83	149	186	53	89	147	147	67	12
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)	20	253	65	90	162	202	58	97	160	160	73	13
<b>Direction, Lane #</b>	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	273	65	454	154	160	233	13					
Volume Left (vph)	20	0	90	58	0	160	0					
Volume Right (vph)	0	65	202	0	160	0	13					
Hadj (s)	0.07	-0.67	-0.19	0.22	-0.67	0.38	-0.67					
Departure Headway (s)	7.6	6.9	7.0	8.2	7.3	8.4	7.3					
Degree Utilization, x	0.58	0.12	0.88	0.35	0.32	0.54	0.03					
Capacity (veh/h)	436	486	454	413	468	413	465					
Control Delay (s)	19.4	9.7	42.4	14.3	12.5	19.5	9.3					
Approach Delay (s)	17.5		42.4	13.4		19.0						
Approach LOS	C		E	B		C						
<b>Intersection Summary</b>												
Delay			25.2									
HCM Level of Service			D									
Intersection Capacity Utilization			65.4%	ICU Level of Service								C
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	96	51	131	75	91	119	55
Average Queue (ft)	56	28	82	47	38	57	10
95th Queue (ft)	85	51	123	74	73	97	43
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						29	1
Queuing Penalty (veh)						3	2

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoclin Creek Apartments  
11/12/2012

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control		Stop			Stop			Stop			Stop		
Volume (vph)	14	174	50	184	330	127	53	68	101	99	68	21	
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80	
Hourly flow rate (vph)	23	185	88	224	379	155	71	84	136	132	99	26	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	208	88	759	155	136	231	26						
Volume Left (vph)	23	0	224	71	0	132	0						
Volume Right (vph)	0	88	155	0	136	0	26						
Hadj (s)	0.07	-0.68	0.00	0.26	-0.67	0.30	-0.68						
Departure Headway (s)	7.6	6.8	7.0	8.1	7.2	8.1	7.1						
Degree Utilization, x	0.44	0.17	1.47	0.35	0.27	0.52	0.05						
Capacity (veh/h)	456	504	519	432	484	431	486						
Control Delay (s)	15.2	10.0	241.6	14.1	11.6	18.3	9.3						
Approach Delay (s)	13.7		241.6	12.9		17.4							
Approach LOS	B		F	B		C							
Intersection Summary													
Delay			122.0										
HCM Level of Service			F										
Intersection Capacity Utilization			70.9%	ICU Level of Service									C
Analysis Period (min)			15										

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	91	50	263	73	49	79	55
Average Queue (ft)	52	22	163	37	28	53	25
95th Queue (ft)	72	43	259	67	47	78	64
Link Distance (ft)	2673		4479	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200		175			30
Storage Blk Time (%)						23	3
Queuing Penalty (veh)						5	5

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	18	233	60	83	149	186	53	89	147	147	67	12
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)	20	253	65	90	162	202	58	97	160	160	73	13
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	273	65	90	364	154	160	233	13				
Volume Left (vph)	20	0	90	0	58	0	160	0				
Volume Right (vph)	0	65	0	202	0	160	0	13				
Hadj (s)	0.07	-0.67	0.53	-0.35	0.22	-0.67	0.38	-0.67				
Departure Headway (s)	7.2	6.5	7.5	6.6	7.6	6.7	7.8	6.7				
Degree Utilization, x	0.54	0.12	0.19	0.67	0.32	0.30	0.50	0.02				
Capacity (veh/h)	480	526	460	524	441	505	429	497				
Control Delay (s)	17.3	9.1	11.0	20.6	13.0	11.3	17.2	8.7				
Approach Delay (s)	15.7		18.7		12.1		16.7					
Approach LOS	C		C		B		C					
Intersection Summary												
Delay			16.1									
HCM Level of Service			C									
Intersection Capacity Utilization			60.8%		ICU Level of Service				B			
Analysis Period (min)			15									

Queuing and Blocking Report  
 Background AM Peak Hour - 2020

Catoctin Creek Apartments  
 11/6/2012

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	95	52	174	217	139	72	103	55
Average Queue (ft)	59	28	38	69	51	46	58	10
95th Queue (ft)	94	52	99	139	99	71	94	43
Link Distance (ft)	2674		4485		2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		150		175		30	
Storage Blk Time (%)					1		29	
Queuing Penalty (veh)					1		4	

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	174	50	184	330	127	53	68	101	99	68	21
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	23	185	88	224	379	155	71	84	136	132	99	26
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	208	88	224	534	155	136	231	26				
Volume Left (vph)	23	0	224	0	71	0	132	0				
Volume Right (vph)	0	88	0	155	0	136	0	26				
Hadj (s)	0.07	-0.68	0.57	-0.13	0.26	-0.67	0.30	-0.68				
Departure Headway (s)	7.7	7.0	7.5	6.8	8.1	7.2	8.2	7.2				
Degree Utilization, x	0.45	0.17	0.47	1.01	0.35	0.27	0.52	0.05				
Capacity (veh/h)	453	497	468	534	432	483	430	481				
Control Delay (s)	15.6	10.2	15.8	67.9	14.2	11.7	18.5	9.4				
Approach Delay (s)	14.0		52.5		13.0		17.6					
Approach LOS	B		F		B		C					
Intersection Summary												
Delay			32.6									
HCM Level of Service			D									
Intersection Capacity Utilization			60.8%		ICU Level of Service				B			
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	91	50	168	317	68	49	101	54
Average Queue (ft)	55	22	60	114	38	29	56	25
95th Queue (ft)	77	43	135	224	59	50	84	64
Link Distance (ft)	2674			4485	2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		200	150			175		30
Storage Blk Time (%)			0	4			22	3
Queuing Penalty (veh)			0	7			5	5

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	
Volume (veh/h)	381	118	219	337	52	147
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	414	128	238	366	57	160
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			542		1321	478
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			542		1321	478
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		57	73
cM capacity (veh/h)			1026		133	587
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	542	604	216			
Volume Left	0	238	57			
Volume Right	128	0	160			
cSH	1700	1026	310			
Volume to Capacity	0.32	0.23	0.70			
Queue Length 95th (ft)	0	22	122			
Control Delay (s)	0.0	5.5	39.6			
Lane LOS		A	E			
Approach Delay (s)	0.0	5.5	39.6			
Approach LOS			E			
Intersection Summary						
Average Delay			8.7			
Intersection Capacity Utilization			79.0%	ICU Level of Service	D	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	
Volume (veh/h)	313	97	299	603	86	151
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	373	139	348	628	104	191
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			511		1765	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			511		1765	442
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			67		0	69
cM capacity (veh/h)			1049		62	620
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	511	976	295			
Volume Left	0	348	104			
Volume Right	139	0	191			
cSH	1700	1049	150			
Volume to Capacity	0.30	0.33	1.97			
Queue Length 95th (ft)	0	37	574			
Control Delay (s)	0.0	7.0	509.7			
Lane LOS		A	F			
Approach Delay (s)	0.0	7.0	509.7			
Approach LOS			F			
Intersection Summary						
Average Delay			88.2			
Intersection Capacity Utilization			94.7%	ICU Level of Service		F
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/6/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↖	↗
Volume (veh/h)	381	118	219	337	52	147
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	414	128	238	366	57	160
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			542		1321	478
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			542		1321	478
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		57	73
cM capacity (veh/h)			1026		133	587
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	542	604	57	160		
Volume Left	0	238	57	0		
Volume Right	128	0	0	160		
cSH	1700	1026	133	587		
Volume to Capacity	0.32	0.23	0.43	0.27		
Queue Length 95th (ft)	0	22	47	27		
Control Delay (s)	0.0	5.5	50.9	13.4		
Lane LOS		A	F	B		
Approach Delay (s)	0.0	5.5	23.2			
Approach LOS			C			
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			70.4%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/6/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↖	↖
Volume (veh/h)	313	97	299	603	86	151
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	373	139	348	628	104	191
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			511		1765	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			511		1765	442
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			67		0	69
cM capacity (veh/h)			1049		62	620
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	511	976	104	191		
Volume Left	0	348	104	0		
Volume Right	139	0	0	191		
cSH	1700	1049	62	620		
Volume to Capacity	0.30	0.33	1.66	0.31		
Queue Length 95th (ft)	0	37	233	33		
Control Delay (s)	0.0	7.0	467.0	13.4		
Lane LOS		A	F	B		
Approach Delay (s)	0.0	7.0	172.8			
Approach LOS			F			
Intersection Summary						
Average Delay			32.4			
Intersection Capacity Utilization			85.4%		ICU Level of Service	E
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoclin Creek Apartments  
11/12/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	551	113	153	703	647	508
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1747		1770	1863	1863	1583
Flt Permitted	0.96		0.09	1.00	1.00	1.00
Satd. Flow (perm)	1747		168	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	599	123	166	764	703	552
RTOR Reduction (vph)	8	0	0	0	0	348
Lane Group Flow (vph)	714	0	166	764	703	204
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	36.0		50.5	50.5	36.9	36.9
Effective Green, g (s)	36.0		50.5	50.5	36.9	36.9
Actuated g/C Ratio	0.36		0.50	0.50	0.37	0.37
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	629		183	941	687	584
v/s Ratio Prot	c0.41		0.06	c0.41	c0.38	
v/s Ratio Perm			0.40			0.13
v/c Ratio	1.14		0.91	0.81	1.02	0.35
Uniform Delay, d1	32.0		22.5	20.8	31.6	22.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	79.4		40.8	7.6	40.4	1.6
Delay (s)	111.4		63.3	28.3	71.9	24.5
Level of Service	F		E	C	E	C
Approach Delay (s)	111.4			34.6	51.1	
Approach LOS	F			C	D	
<b>Intersection Summary</b>						
HCM Average Control Delay			60.8		HCM Level of Service	E
HCM Volume to Capacity ratio			1.10			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	20.0
Intersection Capacity Utilization			97.4%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	722	166	764	703	552
v/c Ratio	1.13	0.92	0.81	1.02	0.59
Control Delay	109.5	69.2	29.3	72.9	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	109.5	69.2	29.3	72.9	4.9
Queue Length 50th (ft)	~536	57	392	~479	0
Queue Length 95th (ft)	#762	#183	565	#701	69
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	637	181	941	687	932
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.13	0.92	0.81	1.02	0.59

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	391	82	169	918	820	701
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1741		1770	1863	1827	1553
Flt Permitted	0.96		0.05	1.00	1.00	1.00
Satd. Flow (perm)	1741		92	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	444	119	209	1067	921	762
RTOR Reduction (vph)	6	0	0	0	0	337
Lane Group Flow (vph)	557	0	209	1067	921	425
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	43.0		93.5	93.5	73.3	73.3
Effective Green, g (s)	43.0		93.5	93.5	73.3	73.3
Actuated g/C Ratio	0.29		0.62	0.62	0.49	0.49
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	499		199	1161	893	759
v/s Ratio Prot	c0.32		0.09	c0.57	0.50	
v/s Ratio Perm			c0.56			0.27
v/c Ratio	1.12		1.05	0.92	1.03	0.56
Uniform Delay, d1	53.5		52.4	24.9	38.4	27.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	75.8		77.7	13.0	38.4	3.0
Delay (s)	129.3		130.1	37.9	76.8	30.0
Level of Service	F		F	D	E	C
Approach Delay (s)	129.3			53.0	55.6	
Approach LOS	F			D	E	

Intersection Summary			
HCM Average Control Delay	66.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	563	209	1067	921	762
v/c Ratio	1.11	1.05	0.92	1.03	0.70
Control Delay	122.9	118.1	38.7	76.0	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	122.9	118.1	38.7	76.0	7.6
Queue Length 50th (ft)	~625	~171	877	~963	54
Queue Length 95th (ft)	#832	#284	1040	#1200	195
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	505	199	1161	893	1096
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.11	1.05	0.92	1.03	0.70

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 5: Hirst Road & Route 287

Catoctin Creek Apartments

11/6/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	551	113	153	703	647	508
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	4.0
Lane Util. Factor	0.97		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3381		1770	3539	1863	1583
Flt Permitted	0.96		0.14	1.00	1.00	1.00
Satd. Flow (perm)	3381		256	3539	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	599	123	166	764	703	552
RTOR Reduction (vph)	20	0	0	0	0	0
Lane Group Flow (vph)	702	0	166	764	703	552
Turn Type			pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases			2			Free
Actuated Green, G (s)	20.7		55.8	55.8	41.5	90.0
Effective Green, g (s)	20.7		55.8	55.8	41.5	90.0
Actuated g/C Ratio	0.23		0.62	0.62	0.46	1.00
Clearance Time (s)	7.0		7.5	6.5	6.5	
Vehicle Extension (s)	3.5		2.5	3.5	3.5	
Lane Grp Cap (vph)	778		273	2194	859	1583
v/s Ratio Prot	c0.21		0.05	0.22	c0.38	
v/s Ratio Perm			0.33			c0.35
v/c Ratio	0.90		0.61	0.35	0.82	0.35
Uniform Delay, d1	33.7		14.5	8.3	21.0	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	13.9		3.2	0.4	8.5	0.6
Delay (s)	47.6		17.8	8.7	29.5	0.6
Level of Service	D		B	A	C	A
Approach Delay (s)	47.6			10.3	16.8	
Approach LOS	D			B	B	

### Intersection Summary

HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	722	166	764	703	552
v/c Ratio	0.90	0.61	0.35	0.82	0.35
Control Delay	49.0	18.6	8.9	30.8	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	49.0	18.6	8.9	30.8	0.6
Queue Length 50th (ft)	198	38	101	337	0
Queue Length 95th (ft)	#301	71	134	#545	0
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)	400	310			400
Base Capacity (vph)	808	272	2193	859	1583
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.89	0.61	0.35	0.82	0.35

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	  			 		
Volume (vph)	391	82	169	918	820	701
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	4.0
Lane Util. Factor	0.97		1.00	0.95	1.00	1.00
Fr <sub>t</sub>	0.97		1.00	1.00	1.00	0.85
Fl <sub>t</sub> Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3366		1770	3539	1827	1553
Fl <sub>t</sub> Permitted	0.96		0.07	1.00	1.00	1.00
Satd. Flow (perm)	3366		127	3539	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	444	119	209	1067	921	762
RTOR Reduction (vph)	26	0	0	0	0	0
Lane Group Flow (vph)	537	0	209	1067	921	762
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases			2			Free
Actuated Green, G (s)	19.7		66.8	66.8	51.2	100.0
Effective Green, g (s)	19.7		66.8	66.8	51.2	100.0
Actuated g/C Ratio	0.20		0.67	0.67	0.51	1.00
Clearance Time (s)	7.0		7.5	6.5	6.5	
Vehicle Extension (s)	3.5		2.5	3.5	3.5	
Lane Grp Cap (vph)	663		218	2364	935	1553
v/s Ratio Prot	c0.16		c0.08	0.30	0.50	
v/s Ratio Perm			c0.56			0.49
v/c Ratio	0.81		0.96	0.45	0.99	0.49
Uniform Delay, d <sub>1</sub>	38.4		31.3	7.9	24.0	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d <sub>2</sub>	7.6		48.7	0.6	26.0	1.1
Delay (s)	46.0		80.0	8.5	50.1	1.1
Level of Service	D		F	A	D	A
Approach Delay (s)	46.0			20.2	27.9	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	563	209	1067	921	762
v/c Ratio	0.82	0.96	0.45	0.99	0.49
Control Delay	46.5	78.0	8.8	51.9	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	78.0	8.8	51.9	1.1
Queue Length 50th (ft)	165	85	159	~581	0
Queue Length 95th (ft)	220	#189	187	#842	0
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)	400	310			400
Base Capacity (vph)	732	217	2363	935	1553
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.77	0.96	0.45	0.99	0.49

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↷	↷		↷	
Volume (vph)	157	735	411	124	125	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.97		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	1863	1804		1714	
Flt Permitted	0.22	1.00	1.00		0.97	
Satd. Flow (perm)	412	1863	1804		1714	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	171	799	447	135	136	84
RTOR Reduction (vph)	0	0	12	0	23	0
Lane Group Flow (vph)	171	799	570	0	197	0
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	47.3	47.3	33.0		15.3	
Effective Green, g (s)	47.3	47.3	33.0		15.3	
Actuated g/C Ratio	0.63	0.63	0.44		0.20	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	410	1173	793		349	
v/s Ratio Prot	0.05	c0.43	0.32		c0.11	
v/s Ratio Perm	0.22					
v/c Ratio	0.42	0.68	0.72		0.56	
Uniform Delay, d1	8.9	9.0	17.3		26.9	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	2.5	4.5		2.5	
Delay (s)	9.2	11.5	21.8		29.4	
Level of Service	A	B	C		C	
Approach Delay (s)		11.1	21.8		29.4	
Approach LOS		B	C		C	

Intersection Summary			
HCM Average Control Delay		16.9	HCM Level of Service B
HCM Volume to Capacity ratio		0.65	
Actuated Cycle Length (s)		75.1	Sum of lost time (s) 12.5
Intersection Capacity Utilization		64.9%	ICU Level of Service C
Analysis Period (min)		15	
c Critical Lane Group			

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	171	799	582	220
v/c Ratio	0.42	0.69	0.73	0.60
Control Delay	9.3	13.5	23.7	32.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.3	13.5	23.7	32.7
Queue Length 50th (ft)	28	210	208	81
Queue Length 95th (ft)	66	428	381	179
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	429	1566	1220	589
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.40	0.51	0.48	0.37

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoclin Creek Apartments  
11/6/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↗		↘	↙
Volume (vph)	110	778	939	157	132	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Flt	1.00	1.00	0.98		0.91	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1752	1845	1843		1703	
Flt Permitted	0.04	1.00	1.00		0.98	
Satd. Flow (perm)	75	1845	1843		1703	
Peak-hour factor, PHF	0.78	0.86	0.92	0.87	0.93	0.83
Adj. Flow (vph)	141	905	1021	180	142	269
RTOR Reduction (vph)	0	0	4	0	45	0
Lane Group Flow (vph)	141	905	1197	0	366	0
Heavy Vehicles (%)	3%	3%	1%	1%	0%	0%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	106.5	106.5	92.5		31.0	
Effective Green, g (s)	106.5	106.5	92.5		31.0	
Actuated g/C Ratio	0.71	0.71	0.62		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	143	1310	1137		352	
v/s Ratio Prot	c0.05	0.49	c0.65		c0.21	
v/s Ratio Perm	0.65					
v/c Ratio	0.99	0.69	1.05		1.04	
Uniform Delay, d1	53.7	12.4	28.8		59.5	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	70.3	2.4	41.7		58.5	
Delay (s)	124.0	14.8	70.4		118.0	
Level of Service	F	B	E		F	
Approach Delay (s)		29.5	70.4		118.0	
Approach LOS		C	E		F	

Intersection Summary

HCM Average Control Delay	61.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	141	905	1201	411
v/c Ratio	0.98	0.69	1.05	1.04
Control Delay	105.5	15.9	70.1	103.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	105.5	15.9	70.1	103.4
Queue Length 50th (ft)	88	463	~1276	~384
Queue Length 95th (ft)	#179	552	#1545	#602
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	144	1310	1141	397
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.98	0.69	1.05	1.04

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	129	617	54	84	327	86	43	183	144	129	102	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.93		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1840		1770	1805		1770	1740		1770	1741	
Flt Permitted	0.38	1.00		0.15	1.00		0.56	1.00		0.32	1.00	
Satd. Flow (perm)	703	1840		274	1805		1052	1740		603	1741	
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)	140	671	59	91	355	93	47	199	157	140	111	86
RTOR Reduction (vph)	0	2	0	0	5	0	0	15	0	0	15	0
Lane Group Flow (vph)	140	728	0	91	443	0	47	341	0	140	182	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	75.3	65.6		74.9	65.4		39.5	39.5		39.5	39.5	
Effective Green, g (s)	75.3	65.6		74.9	65.4		39.5	39.5		39.5	39.5	
Actuated g/C Ratio	0.56	0.48		0.55	0.48		0.29	0.29		0.29	0.29	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	467	890		256	871		306	507		176	507	
v/s Ratio Prot	0.02	c0.40		c0.02	0.25			0.20			0.10	
v/s Ratio Perm	0.15			0.17			0.04			c0.23		
v/c Ratio	0.30	0.82		0.36	0.51		0.15	0.67		0.80	0.36	
Uniform Delay, d1	15.7	29.9		21.3	24.1		35.6	42.4		44.3	38.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	7.0		0.3	1.3		0.3	3.8		22.6	0.6	
Delay (s)	15.9	36.9		21.6	25.4		36.0	46.2		66.9	38.6	
Level of Service	B	D		C	C		D	D		E	D	
Approach Delay (s)		33.5			24.8			45.0			50.4	
Approach LOS		C			C			D			D	

Intersection Summary

HCM Average Control Delay	36.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	140	730	91	448	47	356	140	197
v/c Ratio	0.30	0.83	0.36	0.52	0.16	0.69	0.81	0.38
Control Delay	15.5	41.6	17.9	28.3	41.9	50.0	82.8	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.5	41.6	17.9	28.3	41.9	50.0	82.8	38.9
Queue Length 50th (ft)	48	527	31	253	30	259	112	121
Queue Length 95th (ft)	120	975	81	498	82	488	263	253
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	511	1409	279	1366	571	955	327	956
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.52	0.33	0.33	0.08	0.37	0.43	0.21

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments

11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	668	64	162	874	122	84	121	125	117	178	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.92		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1821		1787	1841		1787	1725		1787	1754	
Flt Permitted	0.05	1.00		0.05	1.00		0.15	1.00		0.35	1.00	
Satd. Flow (perm)	98	1821		94	1841		276	1725		662	1754	
Peak-hour factor, PHF	0.84	0.83	0.86	0.87	0.92	0.78	0.90	0.85	0.71	0.82	0.71	0.81
Adj. Flow (vph)	145	805	74	186	950	156	93	142	176	143	251	205
RTOR Reduction (vph)	0	2	0	0	4	0	0	30	0	0	20	0
Lane Group Flow (vph)	145	877	0	186	1102	0	93	288	0	143	436	0
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	82.6	75.1		92.4	80.0		41.5	41.5		41.5	41.5	
Effective Green, g (s)	82.6	75.1		92.4	80.0		41.5	41.5		41.5	41.5	
Actuated g/C Ratio	0.55	0.50		0.62	0.53		0.28	0.28		0.28	0.28	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	137	912		198	982		76	477		183	485	
v/s Ratio Prot	0.05	0.48		c0.08	c0.60			0.17			0.25	
v/s Ratio Perm	0.53			0.50			c0.34			0.22		
v/c Ratio	1.06	0.96		0.94	1.12		1.22	0.60		0.78	0.90	
Uniform Delay, d1	45.0	36.1		49.8	35.0		54.2	47.1		50.1	52.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	93.3	21.5		45.9	68.6		175.1	2.5		20.2	19.7	
Delay (s)	138.3	57.6		95.7	103.6		229.4	49.6		70.3	71.9	
Level of Service	F	E		F	F		F	D		E	E	
Approach Delay (s)		69.0			102.5			90.3			71.5	
Approach LOS		E			F			F			E	

Intersection Summary

HCM Average Control Delay	85.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	108.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	145	879	186	1106	93	318	143	456
v/c Ratio	1.06	0.96	0.94	1.12	1.21	0.63	0.78	0.90
Control Delay	128.3	57.8	90.1	101.5	214.3	47.4	78.8	71.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	128.3	57.8	90.1	101.5	214.3	47.4	78.8	71.3
Queue Length 50th (ft)	~104	809	131	~1243	~111	240	130	411
Queue Length 95th (ft)	#223	#954	#272	#1512	#235	322	#212	399
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	137	914	198	986	77	507	183	505
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.06	0.96	0.94	1.12	1.21	0.63	0.78	0.90

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

**APPENDIX J**  
**TOTAL FUTURE (2021) PEAK HOUR**  
**ANALYSIS WORKSHEETS**

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catoctin Creek Apartments  
11/12/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	86	89	172	200	182	110
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	93	97	187	217	198	120
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	811	296			404	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	296			404	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	68	87			83	
cM capacity (veh/h)	289	744			1154	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	190	404	317			
Volume Left	93	0	198			
Volume Right	97	217	0			
cSH	420	1700	1154			
Volume to Capacity	0.45	0.24	0.17			
Queue Length 95th (ft)	58	0	15			
Control Delay (s)	20.5	0.0	6.1			
Lane LOS	C		A			
Approach Delay (s)	20.5	0.0	6.1			
Approach LOS	C					
Intersection Summary						
Average Delay			6.4			
Intersection Capacity Utilization		57.4%		ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catoctin Creek Apartments  
11/12/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	265	221	170	102	90	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	298	283	207	126	120	118
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	628	270			333	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	628	270			333	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	26	63			90	
cM capacity (veh/h)	402	766			1232	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	581	333	238
Volume Left	298	0	120
Volume Right	283	126	0
cSH	523	1700	1232
Volume to Capacity	1.11	0.20	0.10
Queue Length 95th (ft)	471	0	8
Control Delay (s)	100.6	0.0	4.6
Lane LOS	F		A
Approach Delay (s)	100.6	0.0	4.6
Approach LOS	F		

Intersection Summary			
Average Delay		51.7	
Intersection Capacity Utilization		63.6%	ICU Level of Service
Analysis Period (min)		15	B

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catoclin Creek Apartments  
11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	86	89	172	200	182	110
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	93	97	187	217	198	120
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	811	296			404	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	296			404	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	68	87			83	
cM capacity (veh/h)	289	744			1154	
Direction, Lane #	WB 1	WB 2	NB 1	SB 1		
Volume Total	93	97	404	317		
Volume Left	93	0	0	198		
Volume Right	0	97	217	0		
cSH	289	744	1700	1154		
Volume to Capacity	0.32	0.13	0.24	0.17		
Queue Length 95th (ft)	34	11	0	15		
Control Delay (s)	23.3	10.6	0.0	6.1		
Lane LOS	C	B		A		
Approach Delay (s)	16.8		0.0	6.1		
Approach LOS	C					
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			51.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
1: Hirst Road & Route 690 N

Catoctin Creek Apartments  
11/6/2012

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	265	221	170	102	90	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.78	0.82	0.81	0.75	0.85
Hourly flow rate (vph)	298	283	207	126	120	118
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	628	270			333	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	628	270			333	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	26	63			90	
cM capacity (veh/h)	402	766			1232	
Direction, Lane #	WB 1	WB 2	NB 1	SB 1		
Volume Total	298	283	333	238		
Volume Left	298	0	0	120		
Volume Right	0	283	126	0		
cSH	402	766	1700	1232		
Volume to Capacity	0.74	0.37	0.20	0.10		
Queue Length 95th (ft)	148	43	0	8		
Control Delay (s)	35.6	12.4	0.0	4.6		
Lane LOS	E	B		A		
Approach Delay (s)	24.3		0.0	4.6		
Approach LOS	C					
Intersection Summary						
Average Delay			13.2			
Intersection Capacity Utilization			50.1%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/12/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	18	244	60	90	168	193	53	89	151	151	67	12
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)	20	265	65	98	183	210	58	97	164	164	73	13
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	285	65	490	154	164	237	13					
Volume Left (vph)	20	0	98	58	0	164	0					
Volume Right (vph)	0	65	210	0	164	0	13					
Hadj (s)	0.07	-0.67	-0.18	0.22	-0.67	0.38	-0.67					
Departure Headway (s)	7.9	7.2	7.2	8.5	7.6	8.7	7.6					
Degree Utilization, x	0.63	0.13	0.98	0.36	0.35	0.57	0.03					
Capacity (veh/h)	451	493	495	420	468	413	465					
Control Delay (s)	22.1	10.0	61.6	15.1	13.4	21.5	9.6					
Approach Delay (s)	19.8		61.6	14.2		20.8						
Approach LOS	C		F	B		C						
Intersection Summary												
Delay			33.3									
HCM Level of Service			D									
Intersection Capacity Utilization			68.0%	ICU Level of Service	C							
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	143	50	237	93	70	99	52
Average Queue (ft)	79	25	113	52	38	59	13
95th Queue (ft)	124	46	209	85	63	86	49
Link Distance (ft)	2673		2809	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200		175			30
Storage Blk Time (%)						31	1
Queuing Penalty (veh)						4	2

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoclin Creek Apartments  
11/12/2012

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control		Stop			Stop			Stop			Stop		
Volume (vph)	14	203	50	194	356	137	53	68	112	110	68	21	
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80	
Hourly flow rate (vph)	23	216	88	237	409	167	71	84	151	147	99	26	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	239	88	813	155	151	245	26						
Volume Left (vph)	23	0	237	71	0	147	0						
Volume Right (vph)	0	88	167	0	151	0	26						
Hadj (s)	0.07	-0.68	0.00	0.26	-0.67	0.32	-0.68						
Departure Headway (s)	7.7	7.0	7.2	8.2	7.3	8.2	7.3						
Degree Utilization, x	0.51	0.17	1.62	0.35	0.31	0.56	0.05						
Capacity (veh/h)	449	494	509	423	473	424	476						
Control Delay (s)	17.5	10.2	308.8	14.5	12.4	20.1	9.5						
Approach Delay (s)	15.5		308.8	13.4		19.1							
Approach LOS	C		F	B		C							
Intersection Summary													
Delay			154.5										
HCM Level of Service			F										
Intersection Capacity Utilization			75.6%	ICU Level of Service									D
Analysis Period (min)			15										

Queuing and Blocking Report  
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Catoctin Creek Apartments  
 11/12/2012

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	LT	R	LT	R
Maximum Queue (ft)	115	48	294	68	47	97	55
Average Queue (ft)	65	28	158	36	27	54	25
95th Queue (ft)	103	39	274	63	45	86	61
Link Distance (ft)	2673		2817	2619		3915	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200			175		30
Storage Blk Time (%)						22	3
Queuing Penalty (veh)						5	6

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments

11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	18	244	60	90	168	193	53	89	151	151	67	12
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)	20	265	65	98	183	210	58	97	164	164	73	13
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	285	65	98	392	154	164	237	13				
Volume Left (vph)	20	0	98	0	58	0	164	0				
Volume Right (vph)	0	65	0	210	0	164	0	13				
Hadj (s)	0.07	-0.67	0.53	-0.34	0.22	-0.67	0.38	-0.67				
Departure Headway (s)	7.3	6.6	7.6	6.7	7.8	6.9	8.0	6.9				
Degree Utilization, x	0.58	0.12	0.21	0.73	0.33	0.31	0.52	0.03				
Capacity (veh/h)	472	515	455	518	431	490	420	484				
Control Delay (s)	18.8	9.3	11.3	24.7	13.4	11.8	18.2	8.9				
Approach Delay (s)	17.0		22.0		12.6		17.7					
Approach LOS	C		C		B		C					
Intersection Summary												
Delay			17.9									
HCM Level of Service			C									
Intersection Capacity Utilization			63.0%		ICU Level of Service				B			
Analysis Period (min)			15									

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	161	50	71	113	96	51	120	53
Average Queue (ft)	84	26	35	79	52	35	62	11
95th Queue (ft)	136	47	58	117	86	54	97	43
Link Distance (ft)	2672			2810	2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		200	150			175		30
Storage Blk Time (%)							34	1
Queuing Penalty (veh)							4	2

HCM Unsignalized Intersection Capacity Analysis  
2: Hirst Road & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	203	50	194	356	137	53	68	112	110	68	21
Peak Hour Factor	0.60	0.94	0.57	0.82	0.87	0.82	0.75	0.81	0.74	0.75	0.69	0.80
Hourly flow rate (vph)	23	216	88	237	409	167	71	84	151	147	99	26
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	239	88	237	576	155	151	245	26				
Volume Left (vph)	23	0	237	0	71	0	147	0				
Volume Right (vph)	0	88	0	167	0	151	0	26				
Hadj (s)	0.07	-0.68	0.57	-0.13	0.26	-0.67	0.32	-0.68				
Departure Headway (s)	7.8	7.1	7.7	7.0	8.3	7.4	8.3	7.3				
Degree Utilization, x	0.52	0.17	0.51	1.13	0.35	0.31	0.57	0.05				
Capacity (veh/h)	446	488	457	514	424	474	423	472				
Control Delay (s)	17.9	10.4	17.3	103.2	14.5	12.4	20.4	9.5				
Approach Delay (s)	15.9		78.2		13.5		19.3					
Approach LOS	C		F		B		C					
Intersection Summary												
Delay			45.5									
HCM Level of Service			E									
Intersection Capacity Utilization			64.9%		ICU Level of Service				C			
Analysis Period (min)			15									

Queuing and Blocking Report  
 TF PM Peak Hour - 2020

Catoctin Creek Apartments  
 11/6/2012

Intersection: 2: Hirst Road & Hatcher Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	LT	R	LT	R
Maximum Queue (ft)	96	44	72	119	69	51	79	55
Average Queue (ft)	61	27	49	79	36	30	55	26
95th Queue (ft)	90	35	74	116	67	52	82	62
Link Distance (ft)	2672		2819		2612		3909	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		150		175		30	
Storage Blk Time (%)							24	3
Queuing Penalty (veh)							5	6

HCM Unsignalized Intersection Capacity Analysis  
3: Hirst Road & Site Entrance

Catoctin Creek Apartments  
11/6/2012

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	512	6	12	397	25	47
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	557	7	13	432	27	51
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			563		1017	560
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			563		1017	560
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		90	90
cM capacity (veh/h)			1008		260	528

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	563	13	432	78
Volume Left	0	13	0	27
Volume Right	7	0	0	51
cSH	1700	1008	1700	389
Volume to Capacity	0.33	0.01	0.25	0.20
Queue Length 95th (ft)	0	1	0	19
Control Delay (s)	0.0	8.6	0.0	16.6
Lane LOS		A		C
Approach Delay (s)	0.0	0.3		16.6
Approach LOS				C

Intersection Summary			
Average Delay		1.3	
Intersection Capacity Utilization		38.3%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
3: Hirst Road & Site Entrance

Catoctin Creek Apartments  
11/6/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↖	↗	↖	
Volume (veh/h)	435	26	48	722	14	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	473	28	52	785	15	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			501		1376	487
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			501		1376	487
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		90	95
cM capacity (veh/h)			1063		152	581
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	501	52	785	43		
Volume Left	0	52	0	15		
Volume Right	28	0	0	28		
cSH	1700	1063	1700	292		
Volume to Capacity	0.29	0.05	0.46	0.15		
Queue Length 95th (ft)	0	4	0	13		
Control Delay (s)	0.0	8.6	0.0	19.5		
Lane LOS		A		C		
Approach Delay (s)	0.0	0.5		19.5		
Approach LOS				C		
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			48.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Volume (veh/h)	414	147	219	356	68	147
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	450	160	238	387	74	160
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			610		1393	530
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			610		1393	530
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			75		37	71
cM capacity (veh/h)			969		118	549
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	610	625	234			
Volume Left	0	238	74			
Volume Right	160	0	160			
cSH	1700	969	254			
Volume to Capacity	0.36	0.25	0.92			
Queue Length 95th (ft)	0	24	204			
Control Delay (s)	0.0	5.7	79.4			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.7	79.4			
Approach LOS			F			
Intersection Summary						
Average Delay			15.1			
Intersection Capacity Utilization			84.4%	ICU Level of Service		E
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/12/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	
Volume (veh/h)	359	136	299	654	130	151
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	427	194	348	681	157	191
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			622		1901	525
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			622		1901	525
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			64		0	66
cM capacity (veh/h)			954		49	557
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	622	1029	348			
Volume Left	0	348	157			
Volume Right	194	0	191			
cSH	1700	954	98			
Volume to Capacity	0.37	0.36	3.55			
Queue Length 95th (ft)	0	42	Err			
Control Delay (s)	0.0	8.1	Err			
Lane LOS		A	F			
Approach Delay (s)	0.0	8.1	Err			
Approach LOS			F			
<b>Intersection Summary</b>						
Average Delay			1744.2			
Intersection Capacity Utilization			104.6%	ICU Level of Service		G
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoctin Creek Apartments  
11/6/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	↗
Volume (veh/h)	414	147	219	356	68	147
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	450	160	238	387	74	160
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			610		1393	530
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			610		1393	530
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			75		37	71
cM capacity (veh/h)			969		118	549
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	610	625	74	160		
Volume Left	0	238	74	0		
Volume Right	160	0	0	160		
cSH	1700	969	118	549		
Volume to Capacity	0.36	0.25	0.63	0.29		
Queue Length 95th (ft)	0	24	80	30		
Control Delay (s)	0.0	5.7	76.8	14.2		
Lane LOS		A	F	B		
Approach Delay (s)	0.0	5.7	34.0			
Approach LOS			D			
Intersection Summary						
Average Delay			7.9			
Intersection Capacity Utilization			75.4%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Hirst Road & Maple Avenue

Catoclin Creek Apartments  
11/6/2012

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	359	136	299	654	130	151
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.70	0.86	0.96	0.83	0.79
Hourly flow rate (vph)	427	194	348	681	157	191
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			622		1901	525
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			622		1901	525
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			64		0	66
cM capacity (veh/h)			954		49	557
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>NB 2</b>		
Volume Total	622	1029	157	191		
Volume Left	0	348	157	0		
Volume Right	194	0	0	191		
cSH	1700	954	49	557		
Volume to Capacity	0.37	0.36	3.21	0.34		
Queue Length 95th (ft)	0	42	Err	38		
Control Delay (s)	0.0	8.1	Err	14.8		
Lane LOS		A	F	B		
Approach Delay (s)	0.0	8.1	4511.5			
Approach LOS			F			
<b>Intersection Summary</b>						
Average Delay			789.3			
Intersection Capacity Utilization			95.3%	ICU Level of Service		F
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	580	118	156	703	647	524
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Fr <sub>t</sub>	0.98		1.00	1.00	1.00	0.85
Fl <sub>t</sub> Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1748		1770	1863	1863	1583
Fl <sub>t</sub> Permitted	0.96		0.09	1.00	1.00	1.00
Satd. Flow (perm)	1748		171	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	630	128	170	764	703	570
RTOR Reduction (vph)	8	0	0	0	0	364
Lane Group Flow (vph)	750	0	170	764	703	206
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	37.0		49.5	49.5	36.1	36.1
Effective Green, g (s)	37.0		49.5	49.5	36.1	36.1
Actuated g/C Ratio	0.37		0.50	0.50	0.36	0.36
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	647		179	922	673	571
v/s Ratio Prot	c0.43		0.06	c0.41	c0.38	
v/s Ratio Perm			0.41			0.13
v/c Ratio	1.16		0.95	0.83	1.04	0.36
Uniform Delay, d <sub>1</sub>	31.5		22.7	21.6	31.9	23.5
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d <sub>2</sub>	88.4		52.0	8.5	46.9	1.8
Delay (s)	119.9		74.8	30.1	78.8	25.2
Level of Service	F		E	C	E	C
Approach Delay (s)	119.9			38.2	54.8	
Approach LOS	F			D	D	

Intersection Summary

HCM Average Control Delay	66.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	758	170	764	703	570
v/c Ratio	1.16	0.96	0.83	1.04	0.61
Control Delay	118.4	79.8	31.2	79.6	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	118.4	79.8	31.2	79.6	5.1
Queue Length 50th (ft)	~573	59	401	~489	0
Queue Length 95th (ft)	#803	#193	#592	#711	72
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	654	177	922	673	936
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.16	0.96	0.83	1.04	0.61

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	Y
Volume (vph)	430	89	177	918	820	745
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	6.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1741		1770	1863	1827	1553
Flt Permitted	0.96		0.05	1.00	1.00	1.00
Satd. Flow (perm)	1741		94	1863	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	489	129	219	1067	921	810
RTOR Reduction (vph)	6	0	0	0	0	359
Lane Group Flow (vph)	612	0	219	1067	921	451
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	45.0		91.5	91.5	71.5	71.5
Effective Green, g (s)	45.0		91.5	91.5	71.5	71.5
Actuated g/C Ratio	0.30		0.61	0.61	0.48	0.48
Clearance Time (s)	7.0		7.5	6.5	6.5	6.5
Vehicle Extension (s)	3.5		2.5	3.5	3.5	3.5
Lane Grp Cap (vph)	522		197	1136	871	740
v/s Ratio Prot	c0.35		0.09	c0.57	0.50	
v/s Ratio Perm			c0.58			0.29
v/c Ratio	1.17		1.11	0.94	1.06	0.61
Uniform Delay, d1	52.5		51.9	26.7	39.2	29.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	96.2		97.3	15.6	46.8	3.7
Delay (s)	148.7		149.2	42.3	86.1	32.7
Level of Service	F		F	D	F	C
Approach Delay (s)	148.7			60.5	61.1	
Approach LOS	F			E	E	

Intersection Summary

HCM Average Control Delay	75.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/12/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	618	219	1067	921	810
v/c Ratio	1.17	1.11	0.94	1.06	0.74
Control Delay	139.6	136.2	43.0	84.8	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	139.6	136.2	43.0	84.8	9.1
Queue Length 50th (ft)	~713	~194	912	~985	71
Queue Length 95th (ft)	#923	#307	#1101	#1222	245
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)		310			400
Base Capacity (vph)	529	197	1136	871	1099
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.17	1.11	0.94	1.06	0.74

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	YY		Y	↑↑	↑	↑
Volume (vph)	580	118	156	703	647	524
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	4.0
Lane Util. Factor	0.97		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3382		1770	3539	1863	1583
Flt Permitted	0.96		0.14	1.00	1.00	1.00
Satd. Flow (perm)	3382		256	3539	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	630	128	170	764	703	570
RTOR Reduction (vph)	19	0	0	0	0	0
Lane Group Flow (vph)	739	0	170	764	703	570
Turn Type			pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases			2			Free
Actuated Green, G (s)	21.0		55.5	55.5	41.5	90.0
Effective Green, g (s)	21.0		55.5	55.5	41.5	90.0
Actuated g/C Ratio	0.23		0.62	0.62	0.46	1.00
Clearance Time (s)	7.0		7.5	6.5	6.5	
Vehicle Extension (s)	3.5		2.5	3.5	3.5	
Lane Grp Cap (vph)	789		267	2182	859	1583
v/s Ratio Prot	c0.22		0.05	0.22	c0.38	
v/s Ratio Perm			0.35			c0.36
v/c Ratio	0.94		0.64	0.35	0.82	0.36
Uniform Delay, d1	33.8		14.7	8.4	21.0	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	18.4		4.3	0.4	8.5	0.6
Delay (s)	52.3		19.0	8.9	29.5	0.6
Level of Service	D		B	A	C	A
Approach Delay (s)	52.3			10.7	16.6	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	758	170	764	703	570
v/c Ratio	0.94	0.64	0.35	0.82	0.36
Control Delay	53.7	20.5	9.0	30.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	53.7	20.5	9.0	30.6	0.6
Queue Length 50th (ft)	212	39	101	333	0
Queue Length 95th (ft)	#325	#74	134	#540	0
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)	400	310			400
Base Capacity (vph)	808	264	2182	859	1583
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.94	0.64	0.35	0.82	0.36

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↶↷		↶	↶↷	↶	↶↷
Volume (vph)	430	89	177	918	820	745
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0		7.5	6.5	6.5	4.0
Lane Util. Factor	0.97		1.00	0.95	1.00	1.00
Fr't	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3367		1770	3539	1827	1553
Flt Permitted	0.96		0.07	1.00	1.00	1.00
Satd. Flow (perm)	3367		130	3539	1827	1553
Peak-hour factor, PHF	0.88	0.69	0.81	0.86	0.89	0.92
Adj. Flow (vph)	489	129	219	1067	921	810
RTOR Reduction (vph)	25	0	0	0	0	0
Lane Group Flow (vph)	593	0	219	1067	921	810
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%
Turn Type			pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases			2			Free
Actuated Green, G (s)	20.4		66.1	66.1	50.0	100.0
Effective Green, g (s)	20.4		66.1	66.1	50.0	100.0
Actuated g/C Ratio	0.20		0.66	0.66	0.50	1.00
Clearance Time (s)	7.0		7.5	6.5	6.5	
Vehicle Extension (s)	3.5		2.5	3.5	3.5	
Lane Grp Cap (vph)	687		227	2339	914	1553
v/s Ratio Prot	c0.18		c0.08	0.30	0.50	
v/s Ratio Perm			c0.56			0.52
v/c Ratio	0.86		0.96	0.46	1.01	0.52
Uniform Delay, d1	38.5		31.9	8.2	25.0	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2		49.4	0.6	31.7	1.3
Delay (s)	49.6		81.2	8.9	56.7	1.3
Level of Service	D		F	A	E	A
Approach Delay (s)	49.6			21.2	30.7	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues  
5: Hirst Road & Route 287

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	618	219	1067	921	810
v/c Ratio	0.87	0.97	0.46	1.01	0.52
Control Delay	50.4	78.3	9.1	58.3	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	78.3	9.1	58.3	1.3
Queue Length 50th (ft)	187	91	159	~600	0
Queue Length 95th (ft)	#261	#196	187	#848	0
Internal Link Dist (ft)	1865		1079	4613	
Turn Bay Length (ft)	400	310			400
Base Capacity (vph)	732	226	2339	914	1553
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.84	0.97	0.46	1.01	0.52

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↗		↘	
Volume (vph)	161	735	411	124	125	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Flt	1.00	1.00	0.97		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	1863	1804		1711	
Flt Permitted	0.22	1.00	1.00		0.97	
Satd. Flow (perm)	412	1863	1804		1711	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	175	799	447	135	136	91
RTOR Reduction (vph)	0	0	12	0	25	0
Lane Group Flow (vph)	175	799	570	0	202	0
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	47.5	47.5	33.2		15.5	
Effective Green, g (s)	47.5	47.5	33.2		15.5	
Actuated g/C Ratio	0.63	0.63	0.44		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	408	1172	793		351	
v/s Ratio Prot	0.05	c0.43	0.32		c0.12	
v/s Ratio Perm	0.22					
v/c Ratio	0.43	0.68	0.72		0.57	
Uniform Delay, d1	9.0	9.1	17.3		27.0	
Progression Factor	1.00					
Incremental Delay, d2	0.3	2.5	4.5		2.7	
Delay (s)	9.3	11.6	21.8		29.7	
Level of Service	A	B	C		C	
Approach Delay (s)		11.2	21.8		29.7	
Approach LOS		B	C		C	

Intersection Summary

HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	12.5
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	175	799	582	227
v/c Ratio	0.43	0.69	0.74	0.61
Control Delay	9.5	13.6	23.9	32.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.5	13.6	23.9	32.8
Queue Length 50th (ft)	29	211	210	83
Queue Length 95th (ft)	68	429	382	184
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	428	1560	1214	588
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.41	0.51	0.48	0.39

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↗		↘	↘
Volume (vph)	121	778	939	157	132	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.5	6.5		6.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.98		0.91	
Fit Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1752	1845	1843		1701	
Fit Permitted	0.05	1.00	1.00		0.98	
Satd. Flow (perm)	88	1845	1843		1701	
Peak-hour factor, PHF	0.78	0.86	0.92	0.87	0.93	0.83
Adj. Flow (vph)	155	905	1021	180	142	281
RTOR Reduction (vph)	0	0	5	0	55	0
Lane Group Flow (vph)	155	905	1196	0	368	0
Heavy Vehicles (%)	3%	3%	1%	1%	0%	0%
Turn Type	pm+pt					
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	90.5	90.5	77.5		27.0	
Effective Green, g (s)	90.5	90.5	77.5		27.0	
Actuated g/C Ratio	0.70	0.70	0.60		0.21	
Clearance Time (s)	6.0	6.5	6.5		6.0	
Vehicle Extension (s)	2.0	6.0	6.0		4.0	
Lane Grp Cap (vph)	151	1284	1099		353	
v/s Ratio Prot	0.06	c0.49	c0.65		c0.22	
v/s Ratio Perm	0.66					
v/c Ratio	1.03	0.70	1.09		1.04	
Uniform Delay, d1	44.6	11.8	26.2		51.5	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	80.4	2.6	54.5		59.7	
Delay (s)	125.0	14.4	80.7		111.2	
Level of Service	F	B	F		F	
Approach Delay (s)		30.6	80.7		111.2	
Approach LOS		C	F		F	

Intersection Summary				
HCM Average Control Delay		65.7	HCM Level of Service	E
HCM Volume to Capacity ratio		1.08		
Actuated Cycle Length (s)		130.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization		102.7%	ICU Level of Service	G
Analysis Period (min)		15		

c Critical Lane Group

Queues  
6: Main Street & Hatcher Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	155	905	1201	423
v/c Ratio	1.02	0.70	1.09	1.04
Control Delay	108.7	15.6	80.7	96.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	108.7	15.6	80.7	96.2
Queue Length 50th (ft)	~87	414	~1134	~335
Queue Length 95th (ft)	#176	511	#1401	#545
Internal Link Dist (ft)		744	988	2618
Turn Bay Length (ft)	150			
Base Capacity (vph)	152	1284	1104	408
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.02	0.70	1.09	1.04

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	617	54	84	327	97	43	183	144	148	102	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Fr't	1.00	0.99		1.00	0.97		1.00	0.93		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1840		1770	1799		1770	1740		1770	1737	
Flt Permitted	0.35	1.00		0.14	1.00		0.57	1.00		0.34	1.00	
Satd. Flow (perm)	653	1840		267	1799		1053	1740		631	1737	
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)	143	671	59	91	355	105	47	199	157	161	111	91
RTOR Reduction (vph)	0	2	0	0	6	0	0	17	0	0	17	0
Lane Group Flow (vph)	143	728	0	91	454	0	47	339	0	161	185	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	72.4	62.7		69.6	61.3		39.7	39.7		39.7	39.7	
Effective Green, g (s)	72.4	62.7		69.6	61.3		39.7	39.7		39.7	39.7	
Actuated g/C Ratio	0.55	0.48		0.53	0.47		0.30	0.30		0.30	0.30	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	441	876		236	837		317	525		190	524	
v/s Ratio Prot	0.02	c0.40		c0.02	0.25			0.20			0.11	
v/s Ratio Perm	0.15			0.18			0.04			c0.26		
v/c Ratio	0.32	0.83		0.39	0.54		0.15	0.65		0.85	0.35	
Uniform Delay, d1	16.1	29.9		21.9	25.2		33.6	39.9		43.2	36.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	7.9		0.4	1.6		0.3	3.0		28.8	0.6	
Delay (s)	16.2	37.8		22.3	26.8		33.9	43.0		71.9	36.5	
Level of Service	B	D		C	C		C	D		E	D	
Approach Delay (s)		34.3			26.1			41.9			52.2	
Approach LOS		C			C			D			D	

Intersection Summary

HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	131.7	Sum of lost time (s)	14.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	143	730	91	460	47	356	161	202
v/c Ratio	0.33	0.84	0.39	0.55	0.15	0.67	0.86	0.38
Control Delay	16.3	42.4	19.5	29.9	38.8	45.8	84.4	35.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	42.4	19.5	29.9	38.8	45.8	84.4	35.7
Queue Length 50th (ft)	52	536	32	272	30	252	131	120
Queue Length 95th (ft)	115	912	77	491	73	438	#292	230
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	487	1287	245	1222	532	893	319	891
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.57	0.37	0.38	0.09	0.40	0.50	0.23

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
7: Main Street & Maple Avenue

Catoclin Creek Apartments  
11/6/2012

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	668	64	162	874	151	84	121	125	143	178	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flt	1.00	0.99		1.00	0.97		1.00	0.92		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1821		1787	1833		1787	1725		1787	1751	
Flt Permitted	0.06	1.00		0.05	1.00		0.14	1.00		0.36	1.00	
Satd. Flow (perm)	107	1821		103	1833		258	1725		672	1751	
Peak-hour factor, PHF	0.84	0.83	0.86	0.87	0.92	0.78	0.90	0.85	0.71	0.82	0.71	0.81
Adj. Flow (vph)	155	805	74	186	950	194	93	142	176	174	251	214
RTOR Reduction (vph)	0	3	0	0	5	0	0	32	0	0	22	0
Lane Group Flow (vph)	155	876	0	186	1139	0	93	286	0	174	443	0
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	76.5	69.0		84.5	73.0		38.5	38.5		38.5	38.5	
Effective Green, g (s)	76.5	69.0		84.5	73.0		38.5	38.5		38.5	38.5	
Actuated g/C Ratio	0.55	0.49		0.60	0.52		0.28	0.28		0.28	0.28	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.5	7.5		7.5	7.5	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	147	897		200	956		71	474		185	482	
v/s Ratio Prot	0.06	0.48		c0.08	c0.62			0.17			0.25	
v/s Ratio Perm	0.52			0.48			c0.36			0.26		
v/c Ratio	1.05	0.98		0.93	1.19		1.31	0.60		0.94	0.92	
Uniform Delay, d1	41.4	34.7		45.0	33.5		50.8	44.1		49.6	49.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	89.4	24.7		43.7	96.5		210.4	2.5		49.5	22.9	
Delay (s)	130.9	59.5		88.7	130.0		261.2	46.6		99.1	72.1	
Level of Service	F	E		F	F		F	D		F	E	
Approach Delay (s)		70.2			124.2			95.2			79.5	
Approach LOS		E			F			F			E	

Intersection Summary

HCM Average Control Delay	96.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Queues  
7: Main Street & Maple Avenue

Catoctin Creek Apartments  
11/6/2012



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	155	879	186	1144	93	318	174	465
v/c Ratio	1.05	0.98	0.92	1.19	1.31	0.63	0.94	0.92
Control Delay	122.2	59.8	81.7	127.0	251.0	44.4	102.2	71.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	122.2	59.8	81.7	127.0	251.0	44.4	102.2	71.4
Queue Length 50th (ft)	~103	766	118	~1253	~109	221	156	391
Queue Length 95th (ft)	#224	#919	#249	#1520	#228	302	#266	383
Internal Link Dist (ft)		1116		1752		3283		3611
Turn Bay Length (ft)			135		85		150	
Base Capacity (vph)	147	899	205	962	71	506	185	503
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.98	0.91	1.19	1.31	0.63	0.94	0.92

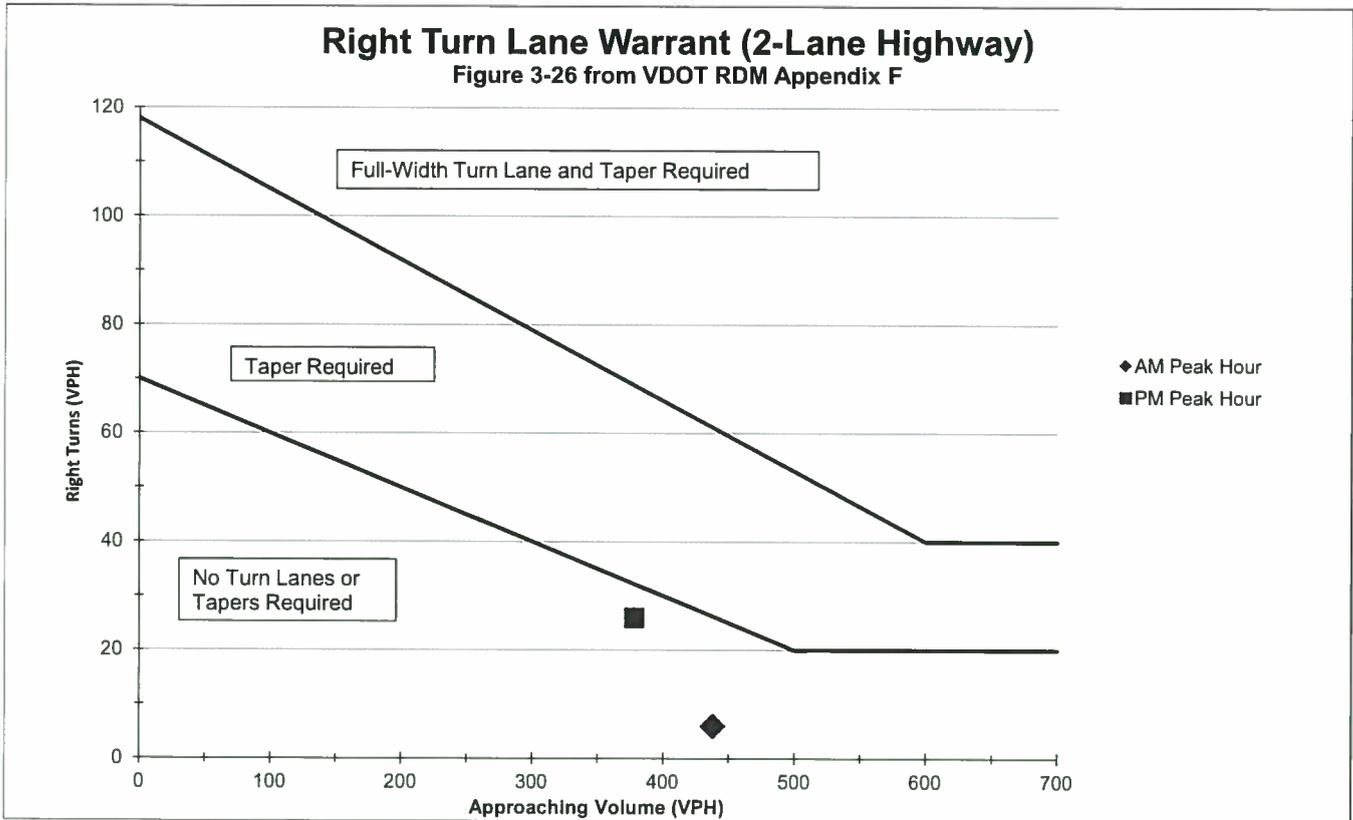
Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

**APPENDIX K**  
**TURN LANE WARRANT ANALYSIS**

## Right Turn Lane Warrant (2-Lane Highway)

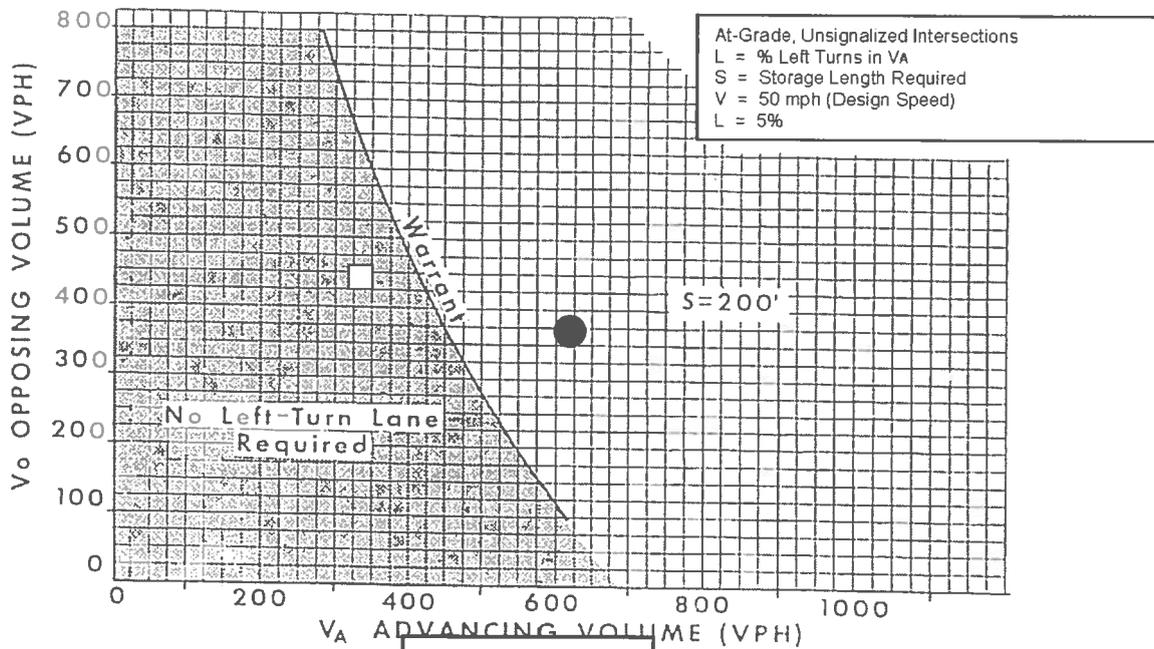
Figure 3-26 from VDOT RDM Appendix F



Intersection: Hirst Road/Site Entrance  
 Approach: Eastbound Right  
 Scenario: Total Future 2014  
 Speed Limit: 45 mph

	AM Peak Hour	PM Peak Hour
Approaching Volume	438	378
Right Turns	6	26
Right Turn Adjustment:	No	No
Adjusted Right Turns:	N/A	N/A

## WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAYS



**FIGURE 3-11**

Intersection: Hirst Road/Site Entrance  
 Approach: Westbound Left  
 Scenario: Total Future 2014

	AM Peak Hour	PM Peak Hour
VO, Opposing Volume	438	378
VA, Advancing Volume	350	647
VL, Left Turning Volume	12	48
Percent Left Turns	3.4%	7.4%
Symbol	□	●