Preliminary Draft
Montgomery County
Annual Development Approval and Congestion (ADAC) Report

Table of Contents

Executive Summary	Page 1
Introduction/Purpose	Page 2
Development Approvals and Planned Transportation Improvements	Page 3
Primer on Measuring and Tracking Traffic Congestion	Page 6
Current Congestion (Observed Data)	Page 8
• Critical Lane Volumes at Signalized Intersections	Page 9
• Intensity of Arterial Use	Page 13
• Average Freeway Speeds based upon Traffic Density	Page 22
• Route-Specific Arterial Speeds and Travel Times	Page 25
• Monitored Freeway Speeds from CHART Traffic Flow Detectors	Page 31
Projected Congestion (Forecast Data)	Page 35
Transportation Improvement Priorities	Page 37
• Analysis / Rationale for Priority Project Lists	Page 40
Items to Add in Next Report	Page 47

Montgomery County
Annual Development Approval and Congestion (ADAC) Report

1. Executive Summary

This is the first Annual Development Approval and Congestion report. This document provides a countywide snapshot of development approvals and traffic congestion, based on a review of available data sources. The report recommends a prioritized list of state and county roadway improvements to address congestion and new development. The list can be found in Section 7 on page 37.

Development Approval

- Montgomery County will experience about a 7% increase in households and about a 9% increase in jobs between 2005 and 2010, based on current forecasts.
- 60% of the remaining residential pipeline development is located in just seven policy areas: Clarksburg, Rockville City, White Flint, Bethesda CBD, Silver Spring CBD, Fairland / White Oak, and Germantown West.
- 70% of the new peak hour trips generated by the remaining residential pipeline development are in just eight policy areas: Clarksburg, Rockville City, Rural, Silver Spring CBD, Germantown West, Fairland / White Oak, White Flint, and Gaithersburg City.
- Nearly 25% of the remaining non-residential pipeline development is located in Rockville.
- 80% of the total remaining non-residential pipeline development is located in just nine policy areas: Rockville City, R&D Village, Germantown East, Germantown West, Fairland / White Oak, Gaithersburg City, North Bethesda, White Flint, and Silver Spring CBD.

Congestion Patterns

Simply stated, congestion is too many vehicles in the same general place at the same general time. This report uses different performance measures that sample the use of the roadway network from different data sources at different places and times to estimate congestion.

- Congestion continues to be worse during the PM peak periods than in the AM peak periods.
- **Peak Hour Intersection CLV:** In a sample of Critical Lane Volumes (CLVs) from 323 signalized intersections, 19% had CLVs exceeding the LATR standard during the AM peak hour, and 16% had CLVs exceeding the LATR standard during the PM peak hour. Another 24% (28% in the PM peak hour) of the intersections had CLVs closely approaching the LATR standard.
- **Intensity of Arterial Use:** Data from the traffic signal system shows that with very few exceptions among the locations sampled, those locations experiencing significant, recurring off-peak weekday and weekend congestion do so at levels *below* those experienced during the typical weekday peaks.

- **Average and Spot Speed on Freeways:** Observation from aerial surveillance of freeway congestion shows that the weekday peak periods typically have three to four hours of congested conditions, but data from the State Highway Administration traffic detectors show that there can be significant day-to-day variation.
- **Route Specific Speed and Travel Times:** Travel time and speed data for a sample of specific routes are periodically being collected by MWCOG and supplemental samples were collected for this report using probe vehicles equipped with Global Positioning System (GPS) tracking and recording devices. These data also show more congestion in the PM peak period than the AM and that while much congestion is based upon the alternating and conflicting flows of traffic at intersection, the location of the congestion can extend far back in queues from the intersection. The ratio of the slowest to the fastest route travel time may vary from 150% to 250% slower, which for long routes can be as much as 20 to 30 or more minutes of delay. There is a diurnal variation in route travel times that is similar to that observed for the variation in traffic volumes.
- **Short-term Forecasts of Congestion based on New Development**: When compared with the base case, in the year 2010 the County's road network will add 10% more lane-miles countywide through the transportation improvements contained in the regional Constrained Long Range Plan. Countywide during the PM peak hour, the network will also experience a 19% increase in vehicle-miles traveled, a 13% decrease in average speed, and a 65% increase in the number of lane miles operating between 80% and 100% of capacity.
- **Expanded Periodic Tracking of Congestion Including Sampling of Monitored Traffic Operations Data:** Enhanced data collection by directly tracking and periodically sampling congestion conditions, sampling the on-going monitoring of traffic operation activities, as well as changes in data policies will improve the analysis contained in future Annual Development Approval and Congestion Reports.

2. Introduction

On October 28, 2003, the County Council passed Resolution #15-375 approving the 2003-5 Annual Growth Policy (AGP) Policy Element. Section F4 of the resolution is titled Annual Development Approval Report, and states the following:

> *The Planning Board must submit to the County Council by September 1 each year an updated report listing and describing significant developments approved by that date or expected to be approved by the following July 1 that would impact road and school capacity. The report must include a prioritized list of road and intersection improvements based on current and projected congestion patterns and additional anticipated development.*

This report is intended to meet the requirements set forth in Section F4 of the resolution. The role of this report is to provide current information on both development approvals and the state of congestion in the County that enables the Council to make informed decisions on where to target roadway infrastructure and operational investment during the next state and county budget cycles. The report is presented annually, and because this is the first report of its kind to go to the Board and Council and there is a significant amount of new information, it is being presented well prior to September 1. As the report is given again in upcoming years, the depth and breadth of the data being reported will increase.

3. Development Approvals and Planned Transportation Improvements

According to the Round 6.3 Cooperative Forecasts, Montgomery County will add 23,000 households (a 7% increase) and 45,000 jobs (a 9% increase) during the years 2005 to 2010. Table 3.1 shows the forecasts for the years 2000-2010.

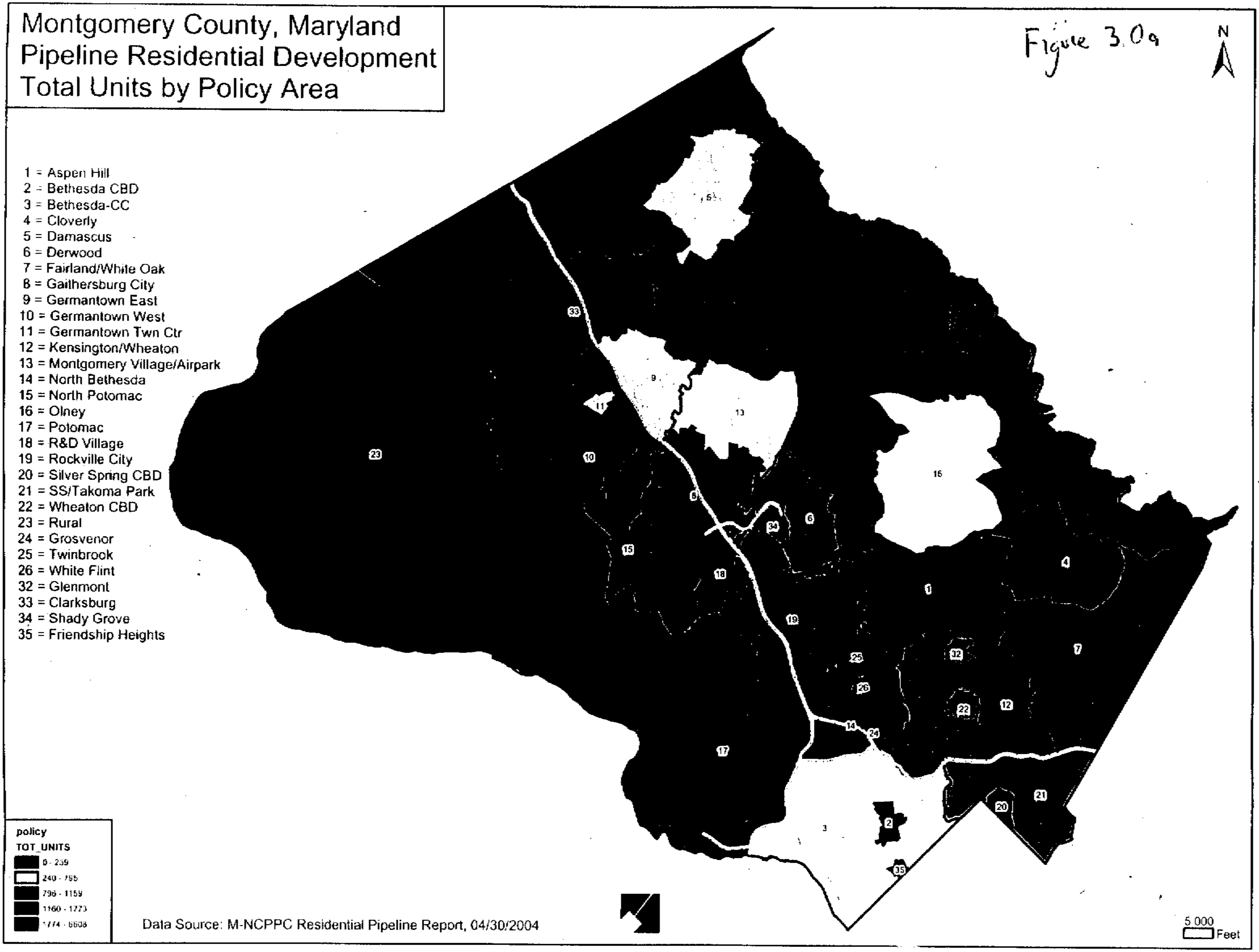
Table 3.1: Round 6.3 Forecasts 2000-2010, County Totals

2000	2005	2010
Round 6.3 Households 324,565	Round 6.3 Households 346,500	Round 6.3 Households 370,000
2000	**2005**	**2010**
Round 6.3 Jobs 545,000	Round 6.3 Jobs 585,000	Round 6.3 Jobs 630,000

In terms of absolute growth, the five fastest growing residential policy areas from 2000 to 2010 are Rockville City, Clarksburg, Gaithersburg City, Germantown West, and the Rural areas. The fastest growing employment areas are Rockville City, Fairland / White Oak, Bethesda CBD, Gaithersburg City, and Germantown East. In terms of percentage growth, the five fastest growing policy areas from 2000 to 2010 are Twinbrook, Germantown Town Center, Clarksburg, White Flint, and Shady Grove for households and Clarksburg, Germantown Town Center, Germantown East, R&D Village, and Germantown West for jobs. The complete breakdown of job and household forecasts by policy area may be found in Appendix A.

Figure 3.1 shows the number of new single-family, townhouse, and multi-family housing units remaining in the development pipeline. More than 50% of the remaining residential pipeline development is located just five policy areas: Clarksburg, Rockville City, White Flint, Bethesda CBD, and Silver Spring CBD, with another 9% located in Fairland/White Oak and Germantown West. The complete listing by policy area is in Appendix B.

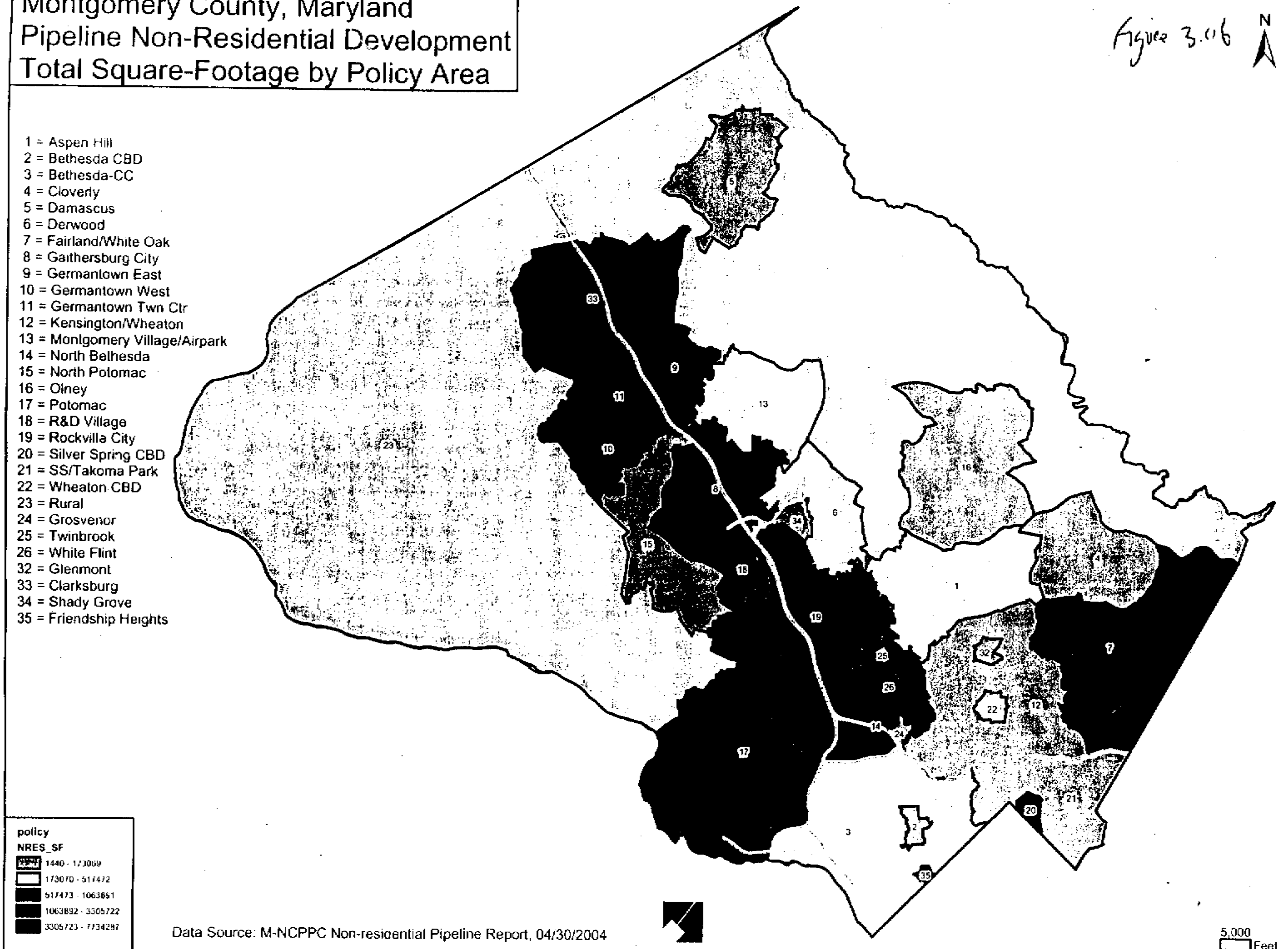
Figure 3.0a


Montgomery County, Maryland
Pipeline Residential Development
Total Units by Policy Area
1 = Aspen Hill
2 = Bethesda CBD
3 = Bethesda-CC
4 = Cloverly
5 = Damascus
6 = Derwood
7 = Fairland/White Oak
8 = Gaithersburg City
9 = Germantown East
10 = Germantown West
11 = Germantown Twn Ctr
12 = Kensington/Wheaton
13 = Montgomery Village/Airpark
14 = North Bethesda
15 = North Potomac
16 = Olney
17 = Potomac
18 = R&D Village
19 = Rockville City
20 = Silver Spring CBD
21 = SS/Takoma Park
22 = Wheaton CBD
23 = Rural
24 = Grosvenor
25 = Twinbrook
26 = White Flint
32 = Glenmont
33 = Clarksburg
34 = Shady Grove
35 = Friendship Heights
policy
TOT_UNITS
0 - 239
240 - 795
796 - 1159
1160 - 1773
1774 - 6608
N
5,000
Feet
Data Source: M-NCPPC Residential Pipeline Report, 04/30/2004

Montgomery County, Maryland
Pipeline Non-Residential Development
Total Square-Footage by Policy Area

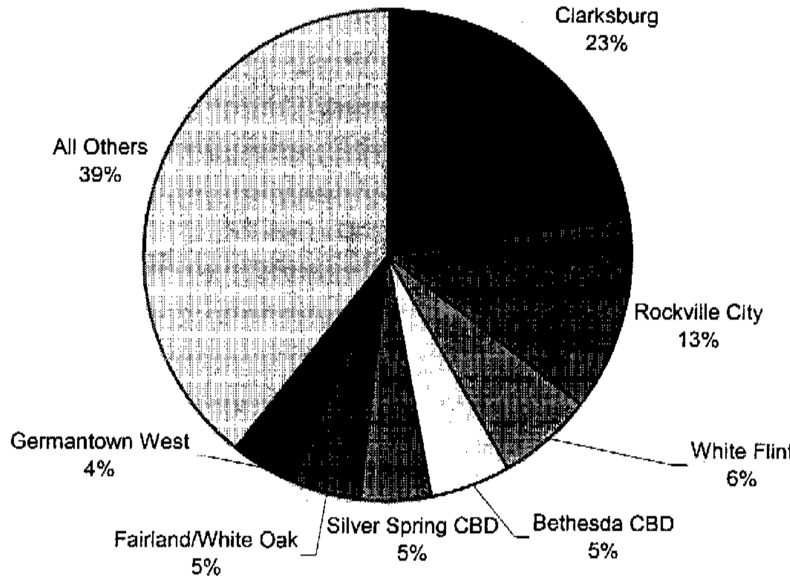
Figure 3.06

1 = Aspen Hill
2 = Bethesda CBD
3 = Bethesda-CC
4 = Cloverly
5 = Damascus
6 = Derwood
7 = Fairland/White Oak
8 = Gaithersburg City
9 = Germantown East
10 = Germantown West
11 = Germantown Twn Ctr
12 = Kensington/Wheaton
13 = Montgomery Village/Airpark
14 = North Bethesda
15 = North Potomac
16 = Olney
17 = Potomac
18 = R&D Village
19 = Rockville City
20 = Silver Spring CBD
21 = SS/Takoma Park
22 = Wheaton CBD
23 = Rural
24 = Grosvenor
25 = Twinbrook
26 = White Flint
32 = Glenmont
33 = Clarksburg
34 = Shady Grove
35 = Friendship Heights



Data Source: M-NCPPC Non-residential Pipeline Report, 04/30/2004

Figure 3.1 Location of Remaining Pipeline Residential Development (total residential pipeline=29,724 units)



The number of peak hour automobile trips generated by the remaining residential pipeline development, shown in Figure 3.2, generally mirrors the location of the pipeline development, except in metro station policy areas, where the trip generation rates are lower because of the availability and use of transit, particularly Metrorail. The complete breakdown of residential trip generation may be found in Appendix C.

Figure 3.3 shows the remaining non-residential (office, retail, industrial, other, warehouse, research and development, mixed-use) pipeline development. 80% of the remaining non-residential pipeline development is located in just nine policy areas: Rockville City , R&D Village, Germantown East, Germantown West, Fairland / White Oak, Gaithersburg City, North Bethesda, White Flint, and Silver Spring CBD. Almost one-quarter of the remaining non-residential pipeline development is located in Rockville. The complete breakdown of remaining non-residential pipeline development by policy area may be found in Appendix D.

There was insufficient time to research peak hour automobile trip generation rates for the remaining non-residential pipeline development for this report; due to the number of specialized trip generation rates used for the diverse types of non-residential land uses, reporting these data requires an individual review of hundreds of plan files. As more of this information is loaded with each case file into the development review database system, the ability to report on non-residential trip generation quickly and accurately should increase. Information on non-residential trip generation will appear in the next ADAC report.

Figure 3.2
Location of Peak Hour Trips Generated by Remaining Residential Pipeline Development

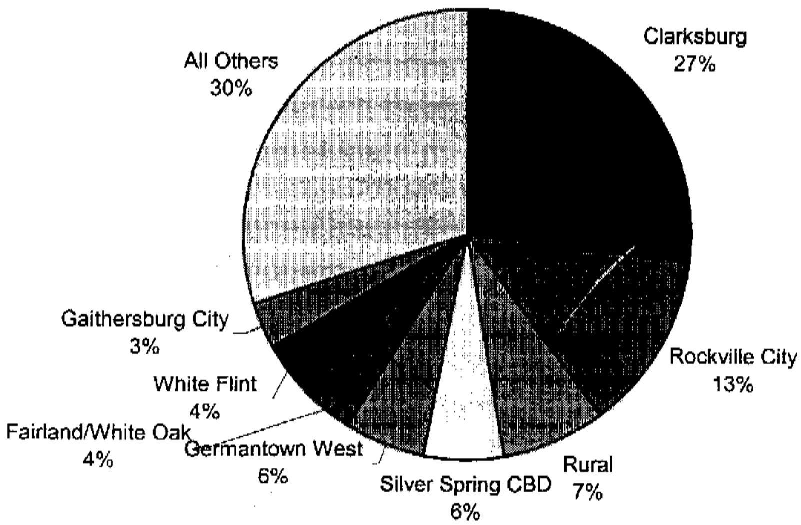
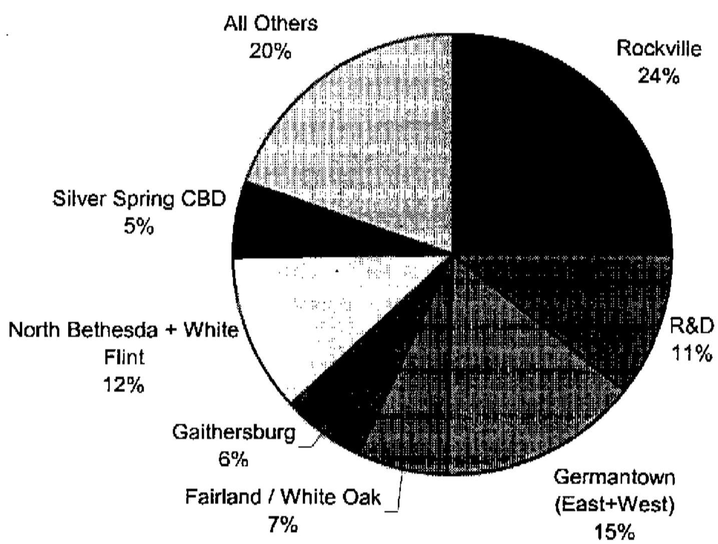


Figure 3.3 Location of Remaining Non-Residential Pipeline Development

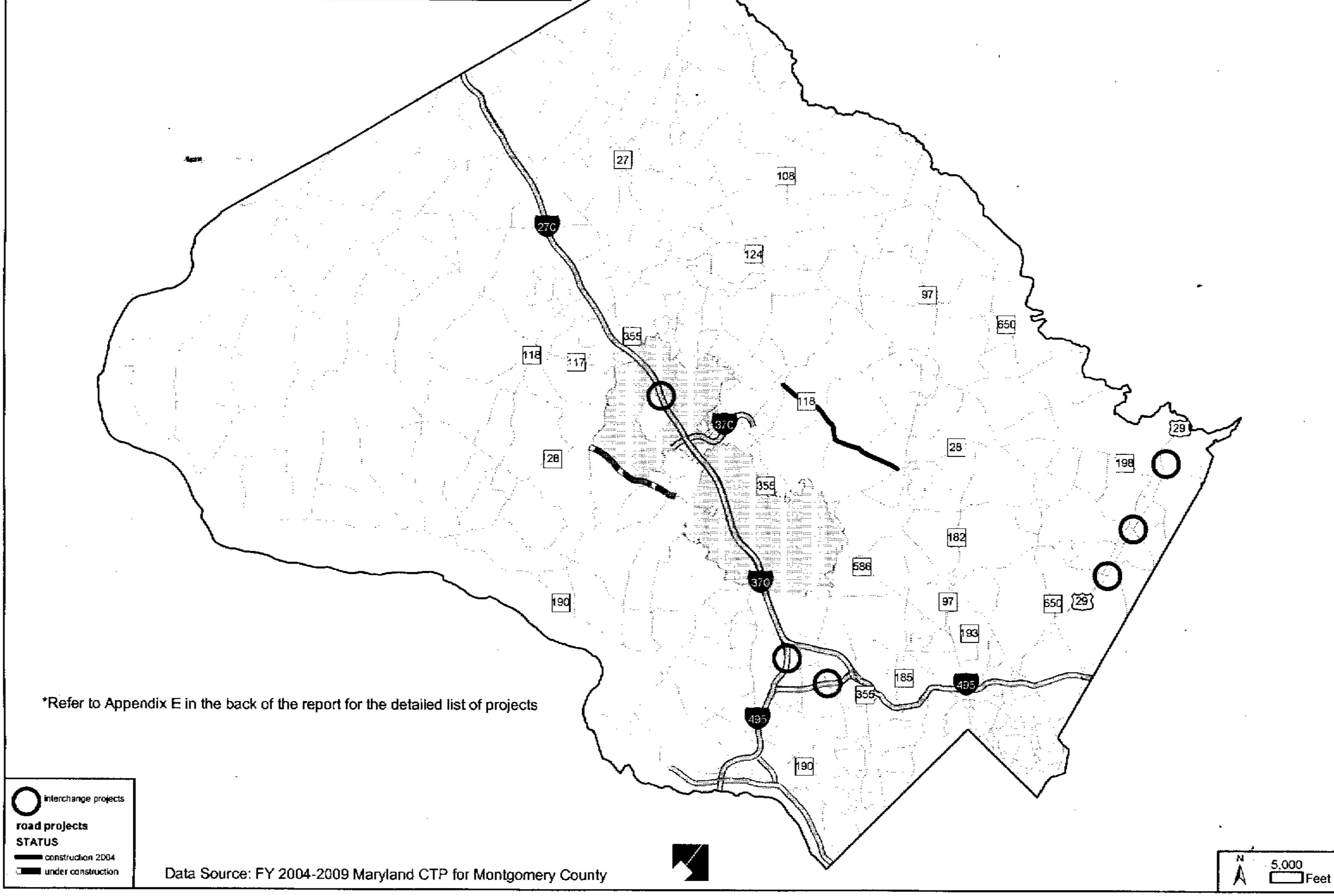


In general, non-residential trip generation, like residential trip generation, should mirror the location of the actual developments; however, more variation in the overall trip generation for non-residential development should be expected due to the diversity of uses and trip generation rates that reflect potential for trip chaining and other trip making behavior that is less uniform (in the aggregate) than that of residential development.

Montgomery County's transportation infrastructure constantly evolves to proactively respond to changing growth patterns. Figures 3.5 and 3.6 show the major construction projects

Major FY 04-09 Maryland CTP Roadway and Interchange Construction Projects for Montgomery County

Figure 3.5

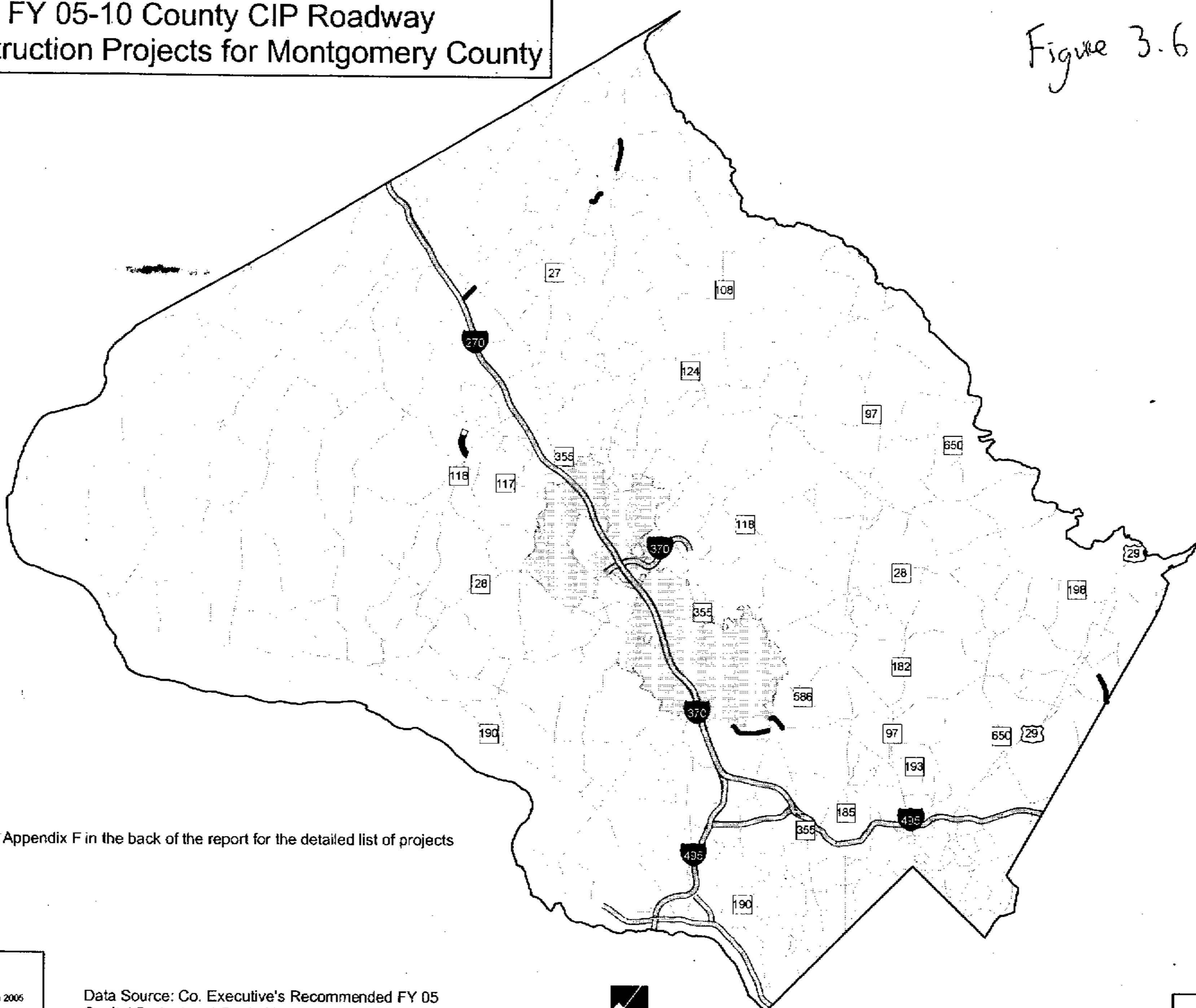


*Refer to Appendix E in the back of the report for the detailed list of projects

Data Source: FY 2004-2009 Maryland CTP for Montgomery County

Major FY 05-10 County CIP Roadway Construction Projects for Montgomery County

Figure 3.6



*Refer to Appendix F in the back of the report for the detailed list of projects

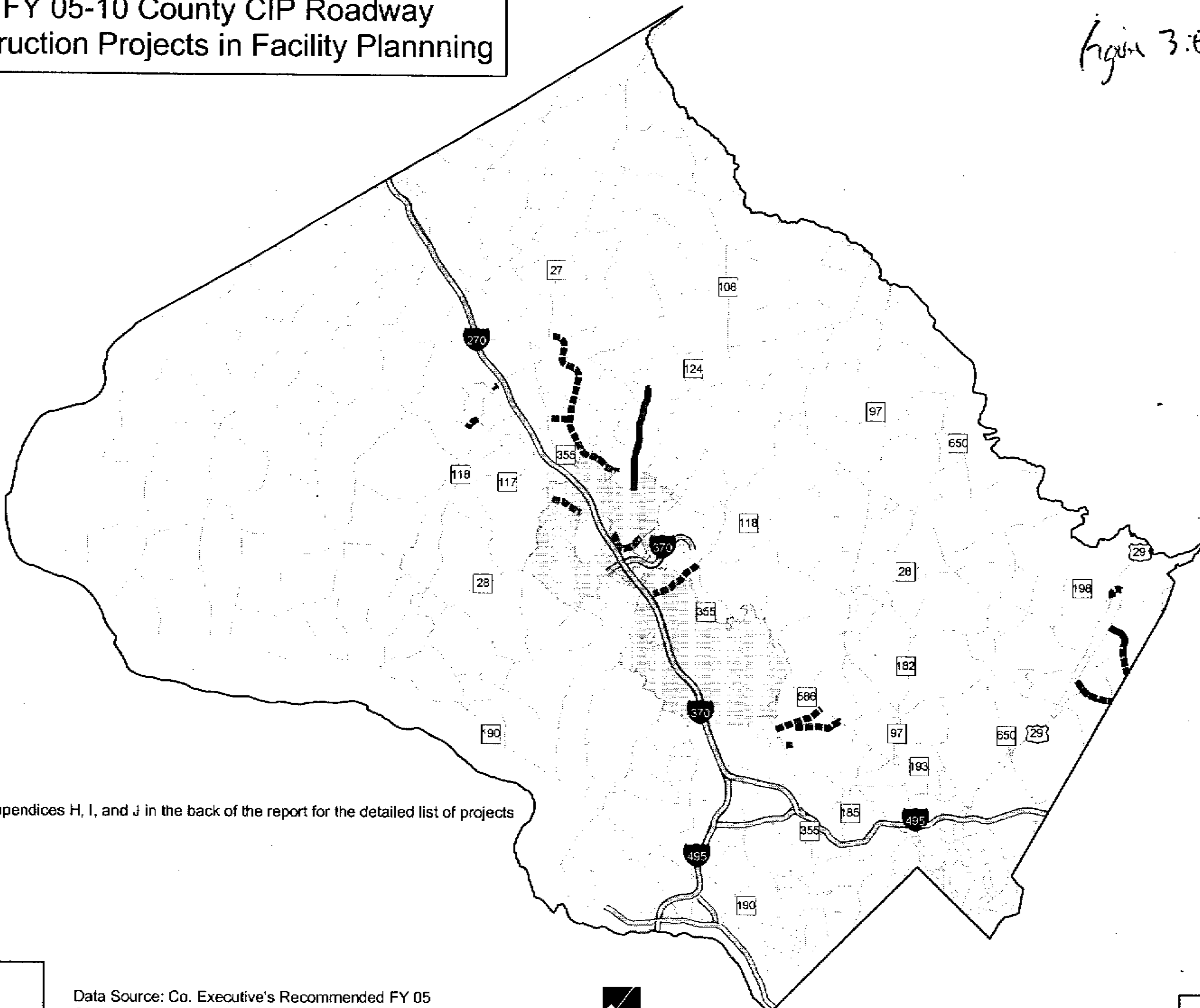
road projects
STATUS
construction 2005
under construction

Data Source: Co. Executive's Recommended FY 05
Capital Budget and Capital Improvements Program, January 2004

N
5,000
Feet

Major FY 05-10 County CIP Roadway Construction Projects in Facility Planning

Figure 3.6a



*Refer to Appendices H, I, and J in the back of the report for the detailed list of projects

road projects
STATUS
Phase I FP
Phase II FP

Data Source: Co. Executive's Recommended FY 05
Capital Budget and Capital Improvements Program, January 2004

N
4,700 Feet

and facility planning studies for the county contained in the current Capital Improvement Program (CIP) for the County, and in the State's Consolidated Transportation Program (CTP). Lists of the projects located on Figures 3.5 and 3.6 may be found in Appendices E through H.

The maps clearly illustrate that recent investment in transportation infrastructure improvements has closely tracked or anticipated future development, as a majority of the projects shown are located in the policy areas receiving the most new development shown in Figures 3.1 and 3.3. However, prioritizing future transportation improvements when resources are limited and growth is continuing in many parts of the county requires a different set of criteria than merely channeling transportation investment into growing areas. Decision makers also need to have information on how the existing transportation network is performing both in the growth areas and in the county as a whole.

4. Primer on Measuring and Tracking Traffic Congestion

Measuring and tracking traffic congestion requires the consistent use of various transportation related performance measures. Performance measures for transportation should be similar to other familiar performance measures for worker productivity, industrial output, government effectiveness, or any other arena where performance measures are used for evaluation and investment decisions. The characteristics of a good performance measure apply broadly, regardless of what context they are applied to or what the desired outcome of each individual measure may be for the appropriate decision makers. A good performance measure is:

Understandable: How the performance measure is constructed, calculated, applied, and interpreted or analyzed should be easily comprehensible to decision-makers and the general public.

Reliable: A performance measure should produce consistent results from observation to observation under controlled conditions or absent other significant change factors.

Reproducible: A good performance measure will generally yield the same results if measured the same way under the same conditions repeatedly.

Relevant: A good performance measure is on topic and on target.

While characteristics of a good performance measures apply broadly, what is actually *being* measured is particularly specific to the area of interest. This report measures the following characteristics:

Growth: Where, how many, and how quickly are jobs and people being added to the county?

Infrastructure: Where, how many, and what type of transportation facilities, residential structures, and non-residential structures are being added to the county?

Mobility: How can residents, workers, and visitors move around the county?

Congestion: Where, when, and to what degree is movement limited or impeded?

Utilization: How much travel is occurring in the county, by whom, to where, and by what mode?

Accessibility: How many and what type of destinations can a traveler reach in a given amount of time from particular origins?

Performance measures may either be quantitative or qualitative. Some transportation-based measures may be expressed both quantitatively and qualitatively – a volume-to-capacity ratio (V/C ratio) on a roadway link of 0.95 may also be assigned a letter grade of A to F corresponding with a level of service (LOS), or simply that a link is "badly congested." Transportation-based performance measures may also be rooted in two different perspectives of the transportation system – (1) the "bird's-eye" perspective of the system provider, which examines component parts of the system in relation to the overall functionality of the entire transportation system, and (2) the "worm's-eye" perspective of individual system users who are actually experiencing the system conditions over many but not all parts of the system while traveling on their journeys. Reviewing results of both qualitative and quantitative performance measures from both the provider and user perspectives is crucial to a well-balanced analysis of the transportation system that yields effective decision-support information.

Finally, an important thing to remember about performance measures is that their usefulness is vastly diminished if only reviewed a single time for a single set of decision-making. The power in performance measurement lies in consistent analysis over time and revisiting both the data and the actual measures periodically. The annual Urban Mobility Study issued by the Texas Transportation Institute (TTI) is a popular report that uses transportation performance measures to analyze overall, area-wide congestion in U.S. metropolitan areas.

The Urban Mobility Study is a good study in the effective use of transportation performance measures: it provides understandable results, gives fairly clear information about its performance measures, including data collection and calculation methodologies and shows changes to the measure set over time. But most importantly, the TTI report is an annual report; by reporting the same type of information in the same type of way each year, each metropolitan area can track its performance over time: i.e., is congestion getting better or worse (and why?). However, the TTI report has its flaws from our perspective in that it looks at the region and not specifically at Montgomery County, only considers peak periods, and relies on one main data source that at times consists not of direct observations, but rather estimated values.

The process of periodically studying this information and reporting the results is called congestion tracking. While the term congestion monitoring generally refers to the continuous uses of various traffic flow detectors to determine short-term changes in traffic conditions, it is also being used here to mean the periodic monitoring or the use of samples of such monitoring data.

The Annual Growth Policy legislation says that the draft annual growth policy must include a status report that includes the level of service conditions on major public facilities and other relevant monitoring measures. Thus, direct congestion tracking for planning purposes represents a refined mission for the Board and Council. In order to best achieve this refined mission, it is worth exploring the specific characteristics of congestion that are useful to monitor. In general, the more usable the available travel data, the better the monitoring and the more informed the decision-making. However, the data must be sufficiently reliable to be useful for analytic purposes, and too much data can be impossible to process for analysis into information. It is quite possible to effectively "drown" in data, and the appropriate level of data to use depends on thc both the purpose of the analysis and the comfort level and expectations of the audience. In general, the following characteristics of congestion are desirable to study through a congestion tracking or monitoring program:

Spatial / Geographic Extent: What area(s) of the county are congested? Are those areas a series of intersections, roadway links, an entire facility, or a central business district? Does the congestion occur in specific directions and/or between specific pairs of origins and destinations? Answering these questions requires wide geographic coverage in data samples.

Operational Intensity: How bad is the congestion? What are the standards to determine the severity of the congestion? How many signal cycles does it take to get through a congested intersection? Answering these questions requires data with a fine level of granularity and detail.

Temporal Duration: Is congestion limited to well-defined peak periods? Is there "peak spreading?" How many hours of congested conditions occur in a typical day? Answering these questions requires data that are both fine-grained and collected over a wide period of time.

Concurrent Variability Over Time and Space: From a congestion standpoint, what constitutes a typical day for the transportation system? Is there such a thing as a typical day? What are the fluctuations in the congestion patterns? Answering these questions requires data that are fine-grained, collected over a wide period of time, and collected over a wide area.

Recurrent and non-recurrent causality: Are congested areas being caused by recurring bottlenecks or by recurring incidents (i.e., a weave area that has a high rate of crashes), or by random incidents?

The success of a traffic congestion tracking and monitoring effort depends on how the available data and selected measures respond to the spatial-temporal, statistical, and point-of-view criteria for congestion measures, and how that data adheres to the overall characteristics of good performance measures. All of the following measures use actual observed data, except for one that uses forecasting results from the Department's travel demand model, TRAVEL/2.

5. Current Congestion (Observed Data)

Simply stated, congestion is too many people and/or vehicles in the same general place at the same general time. When the physical space for movement is constrained, or alternatively used as at intersections, the movement slows, sometimes stops, and queues often develop so that the people and vehicles can safely move in a proper turn.

There are more than 3,200 miles of state, county, and municipal roads in the County with over 750 signalized intersections. Directly measuring such congestion at all places at all times would be a Herculean task as would be the analysis and summary of the vast amount of data. As such this report uses different performance measures that sample the use of the roadway network from different data sources at different places and times to be able to estimate and report on the extent, intensity, duration, variability, and causality of congestion. Six measures that are reported on here, and their source of data include:

- Critical Lane Volumes (CLVs) at signalized intersections from M-NCPPC Database
- Intensity of Arterial Use from monitored traffic signal system data summarized in the DASH database of M-NCPPC
- Average Freeway Speeds and Travel Times from MWCOG-Skycomp
- Route-Specific Arterial Travel Times and Speeds from GPS probes of MWCOG and by Motion Maps LLC for the report
- Monitored Freeway Speeds and Travel Times from MDOT/SHA/CHART maintained in the University of Maryland Center for Advanced Transportation Technology archives
- Short-Range Forecasted (year 2010) V/C ratio and average speeds from the M-NCPPC TRAVEL/2 Model

Critical Lane Volumes (CLVs) at Signalized Intersections

The Critical Lane Volume method of calculating the level of congestion at a signalized or unsignalized intersection is generally accepted by most public agencies in Maryland, including SHA, DPWT, the Cities of Rockville, Gaithersburg, and Takoma Park, as well as the Transportation Planning staff at M-NCPPC. The CLV methodology will fit most intersection configurations and can be varied easily for special situations and unusual conditions. Whereas some assumptions, such as lane use factors, may vary from jurisdiction to jurisdiction, the general CLV methodology is consistent.[1] The Board recently reaffirmed the use of CLV in traffic impact studies during their review of the Local Area Transportation Review (LATR) guidelines.

To support LATR, the Department has been collecting CLV data (primarily at signalized intersections) submitted for traffic impact studies since the 1980s. Most of those counts sit in paper files; however, beginning in 2003, the LATR guidelines required submission of intersection turning movement traffic counts and CLV information in digital form for loading into the Department's intersection analysis database. The database has been further supplemented by using counts collected by SHA, and staff has performed considerable work converting paper counts from before 2003 into digital form and loading them into the database. The population of the database, while not yet complete for all locations, has enabled a richer analysis of CLVs over a large area of the county. Table 5.1 shows the 10 most congested intersections of those reported.

[1] Further information on CLV methodology can be found in the recently approved LATR guidelines or on the SHA website at http://www.sha.state.md.us/businesswithsha/permits/OHD/Impact_guide.asp

Table 5.1: The 10 Most Congested Intersections

Rank	Intersection Name	Policy Area	LATR Standard*	CLV**
1	Rockville Pike at W Cedar Ln	Bethesda/Chevy Chase	1600	2391
2	Rockville Pike at Jones Bridge/Center	Bethesda/Chevy Chase	1600	2299
3	Key West Ave at Darnestown Rd	North Potomac	1475	2225
4	Key West Ave at W Gude Dr	Rockville City	1500	2080
5	Montrose Rd at E Jefferson St	North Bethesda	1550	2077
6	Hungerford Dr at Middle Ln/Park Rd	Rockville City	1500	2040
7	Hungerford Ln (MD 355) at Gude Dr	Rockville City	1500	2028
8	Connecticut Ave at Veirs Mill Rd	Kensington/Wheaton	1600	1975
9	Connecticut Ave at Jones Bridge Rd	Bethesda/Chevy Chase	1600	1974
10	Shady Grove Rd at Midcounty Hwy	Derwood	1475	1961

*In effect starting July 1, 2004
**The maximum of the AM or PM peak hour CLV

Consult Appendix I for the full ranked sample of 320 signalized intersections within the county.[2] The congestion rankings are determined by the raw CLV; however, the tables also include the ratio of the CLV to the current LATR standard for that intersection's policy area, where a ratio of more than 1.00 means the CLV exceeds the LATR standard. Table 5.2 shows the LATR standards that go into effect on July 1, 2004.

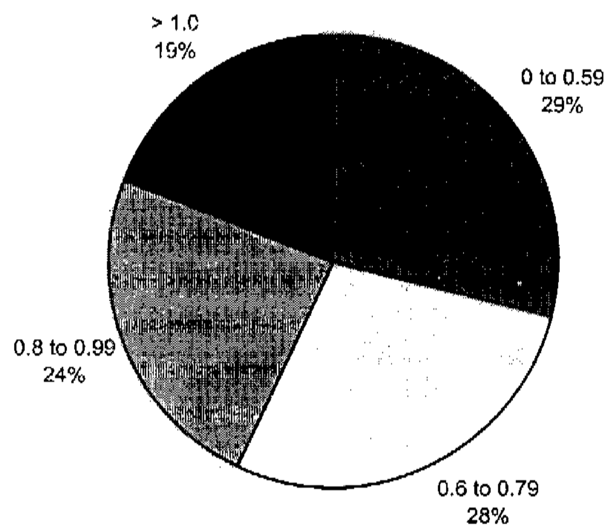
Table 5.2: LATR Congestion Standards

Congestion (CLV) Standard	Policy Area
1400	Rural Areas (Poolesville, Damascus, Goshen, Patuxent, Darnestown / Travilah)
1450	Clarksburg; Damascus; Gaithersburg City; Germantown Town Center; Germantown West; Germantown East; Montgomery Village / Airpark
1475	Cloverly; Derwood; North Potomac; Olney; Potomac; R&D Village
1500	Aspen Hill; Fairland / White Oak; Rockville City
1550	North Bethesda
1600	Bethesda / Chevy Chase; Kensington / Wheaton; Silver Spring / Takoma Park
1800	Bethesda CBD; Friendship Heights CBD; Glenmont; Grosvenor; Shady Grove; Silver Spring CBD; Twinbrook; Wheaton CBD; White Flint

[2] Representing approximately 40% of the signalized intersections in the county. Data are from the year 2000 and forward.

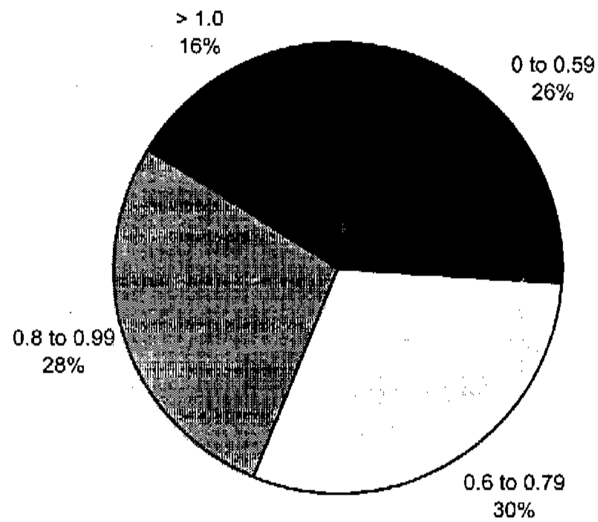
As seen in Figures 5.1 and 5.2, almost half of the intersections sampled had CLVs that were approaching or exceeding their LATR congestion standards during either their AM or PM peak hour (or both). These CLVs are for existing conditions. Under the LATR guidelines, applicants must mitigate traffic when the CLV for the total traffic condition[3] exceeds the area's congestion standard. This does not mean improvements at these congested intersections cannot be funded and built using other means.

Figure 5.1
AM Peak Hour CLVs -- Ratio to LATR Standard (number of intersections sampled = 320)



[3] Per the LATR Guidelines, total traffic is defined as the existing traffic, plus trips from approved but unbuilt developments, plus the trips from the proposed development during the peak hour of the weekday morning and evening peak periods.

Figure 5.2
PM Peak Hour CLVs -- Ratio to LATR Standard (number of intersections sampled=320)



Figures 5.3 through 5.7 show maps of the signalized intersection locations for the county. Where a recent CLV is contained in the database, the intersection is color-coded based on dividing the CLV by the LATR congestion standard.

- Within the CBD or Metro Station Policy Areas (MSPAs), Wheaton CBD, Silver Spring CBD, Bethesda CBD, and Friendship Heights CBD have most of their intersections with CLVs well below the standard of 1800.
- The remaining Metro Station Policy Areas, Shady Grove, Twinbrook, White Flint, Grosvenor, and Glenmont, have higher levels of congestion. These areas do not have the street grid density to adequately disperse and handle the corresponding level of automobile trips when compared with the first group of MSPAs above. They also lack a critical mass of transit-supportive and accessible land uses that encourage travelers to take Metrorail, which in turn takes auto trips off the network within the MSPA.
- The areas immediately outside the MSPAs, many of which are major gateways to CBDs or major job centers, have CLVs close to or exceeding the LATR standard for their respective areas. Bethesda / Chevy Chase and North Bethesda are good examples of this phenomenon, which is also observed in the Silver Spring / Takoma Park, Aspen Hill and Kensington / Wheaton policy areas along the gateways to Rockville (and to a lesser extent, White Flint). These results may also be attributed to a lack of street grid density in the outlying areas, as well as the impact of transit within the MSPAs. All the traffic has to move through a few intersections to access the street grid in the morning, and the traffic dispersed throughout the street grid converges back on those gateway intersections in the evening. Some of that traffic consists of through trips with destinations not

Fig 5.3: Bethesda - Chevy Chase - Potomac Existing Critical Lane Volumes Compared to Local Area Transportation Review Standards

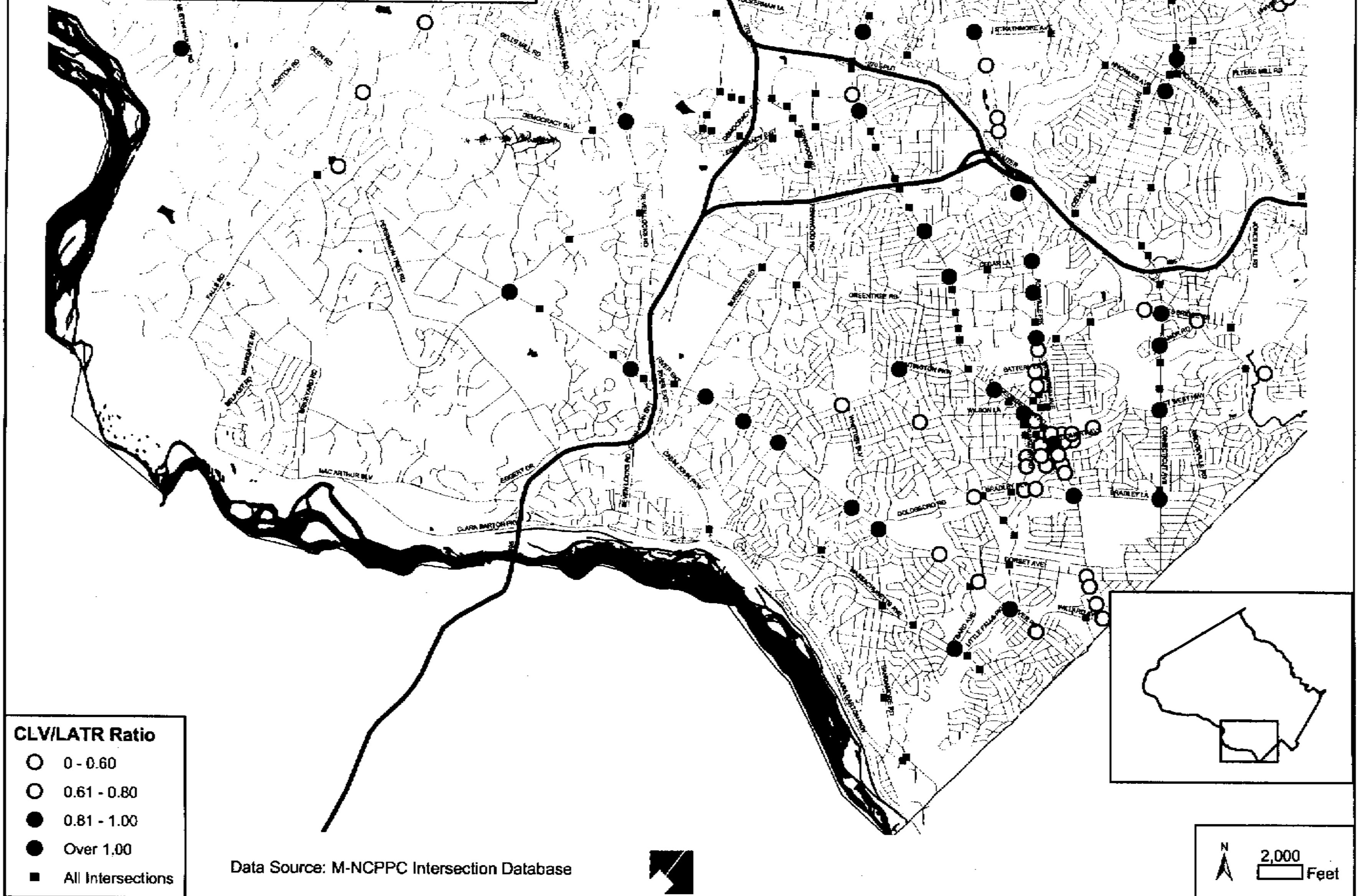


Fig 5.4: Germantown - Clarksburg - Gaithersburg East Existing Critical Lane Volumes Compared to Local Area Transportation Review Standards

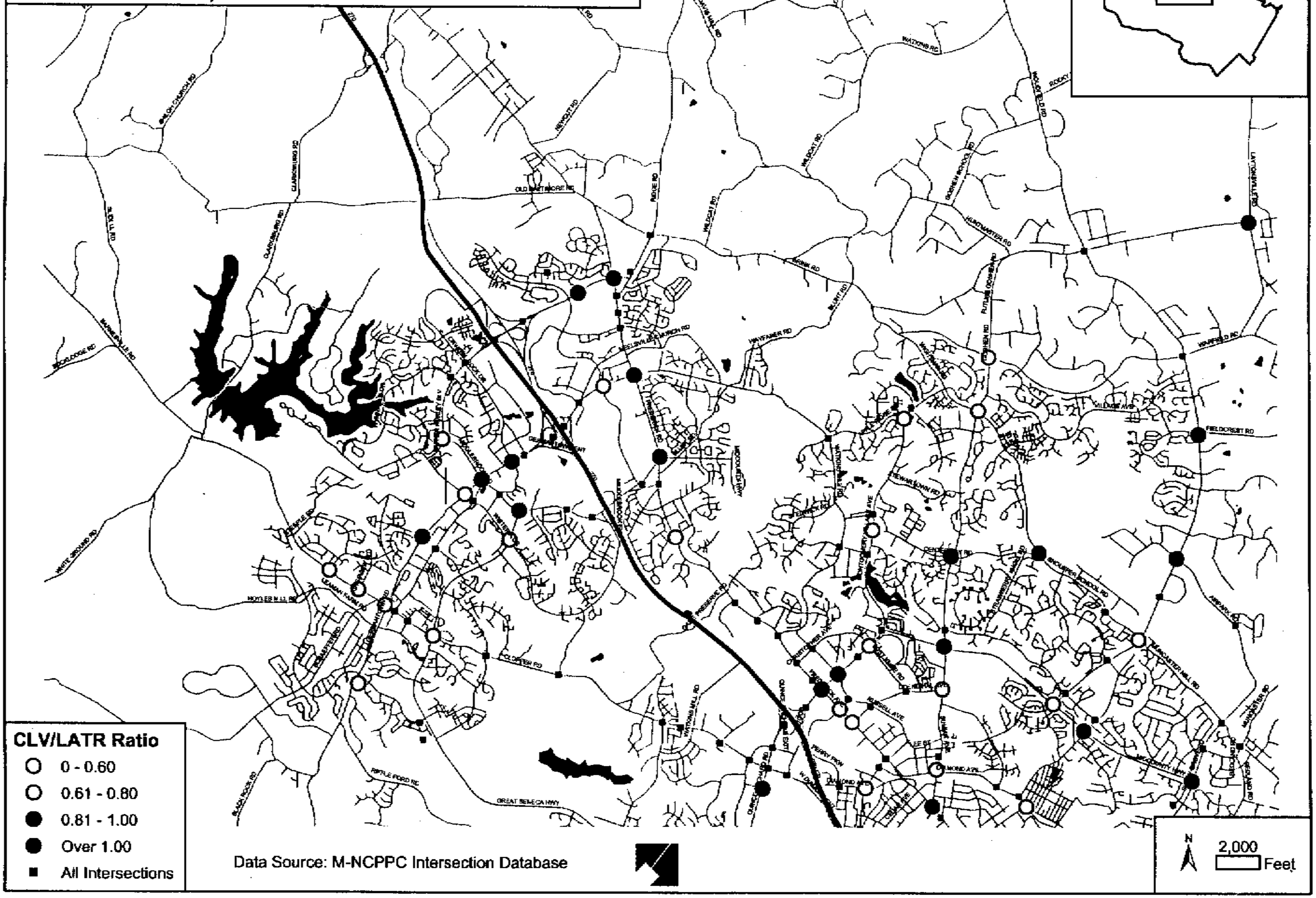
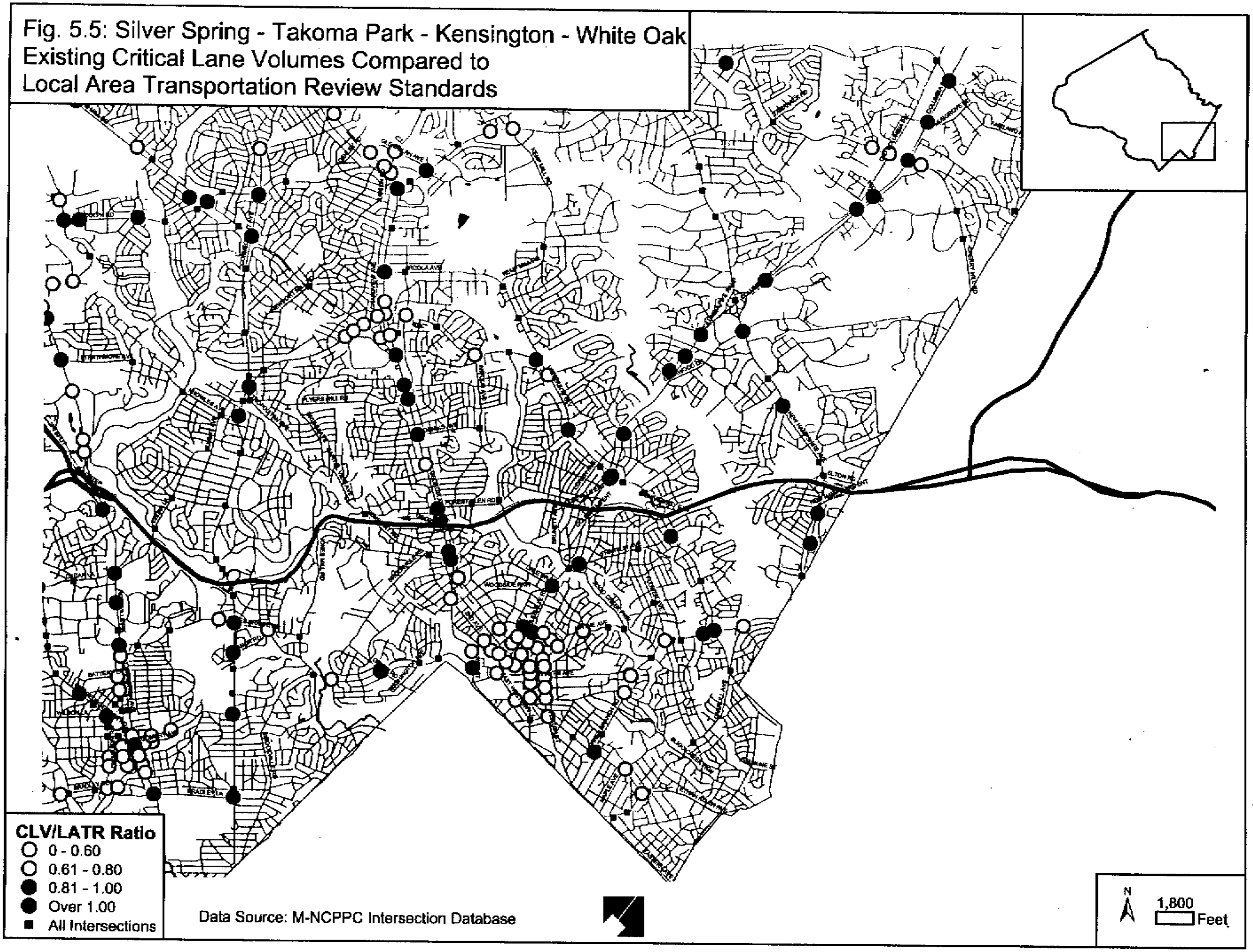


Fig. 5.5: Silver Spring - Takoma Park - Kensington - White Oak
Existing Critical Lane Volumes Compared to
Local Area Transportation Review Standards



Data Source: M-NCPPC Intersection Database

Fig. 5.6: Shady Grove - Rockville - Gaithersburg Existing Critical Lane Volumes Compared to Local Area Transportation Review Standards

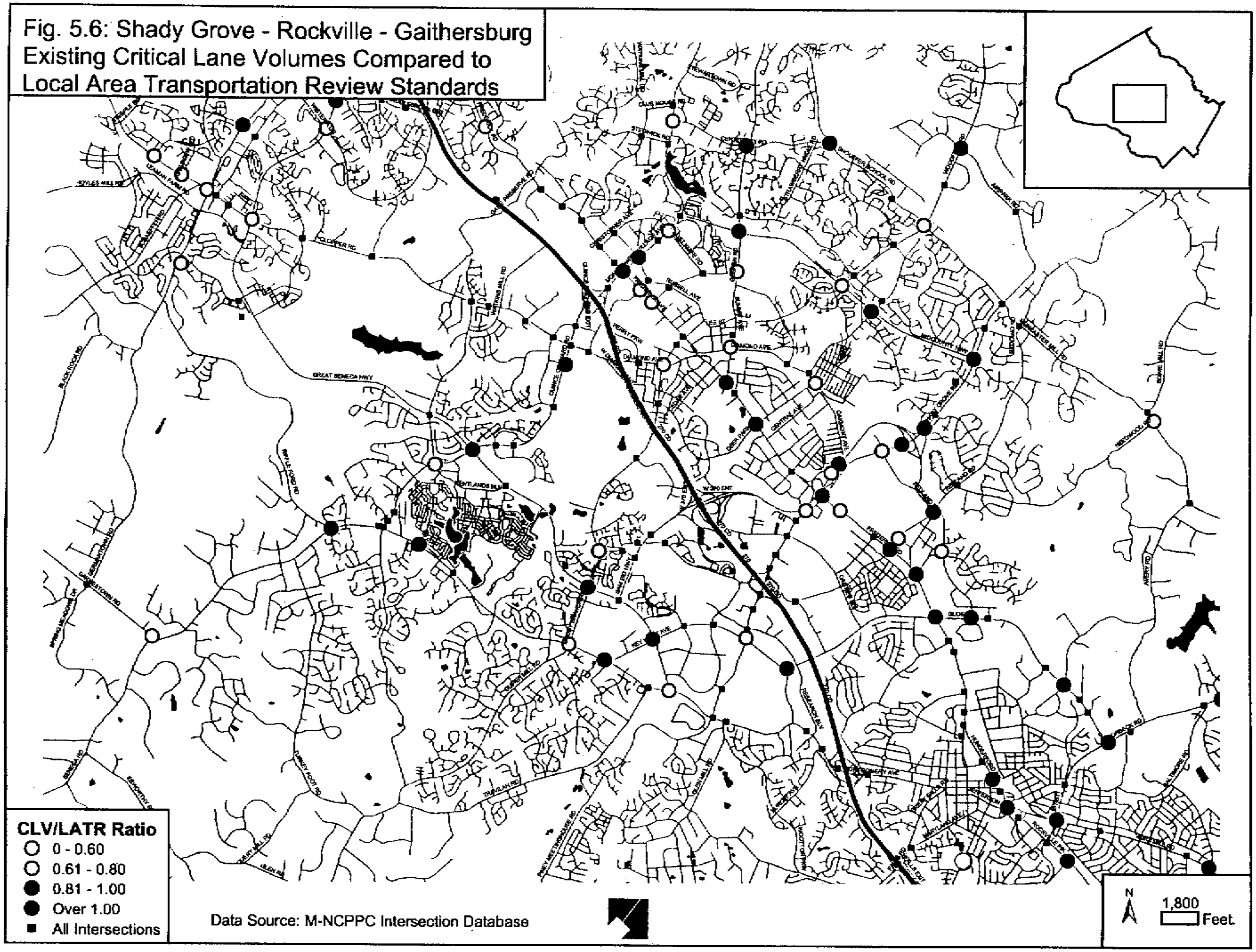
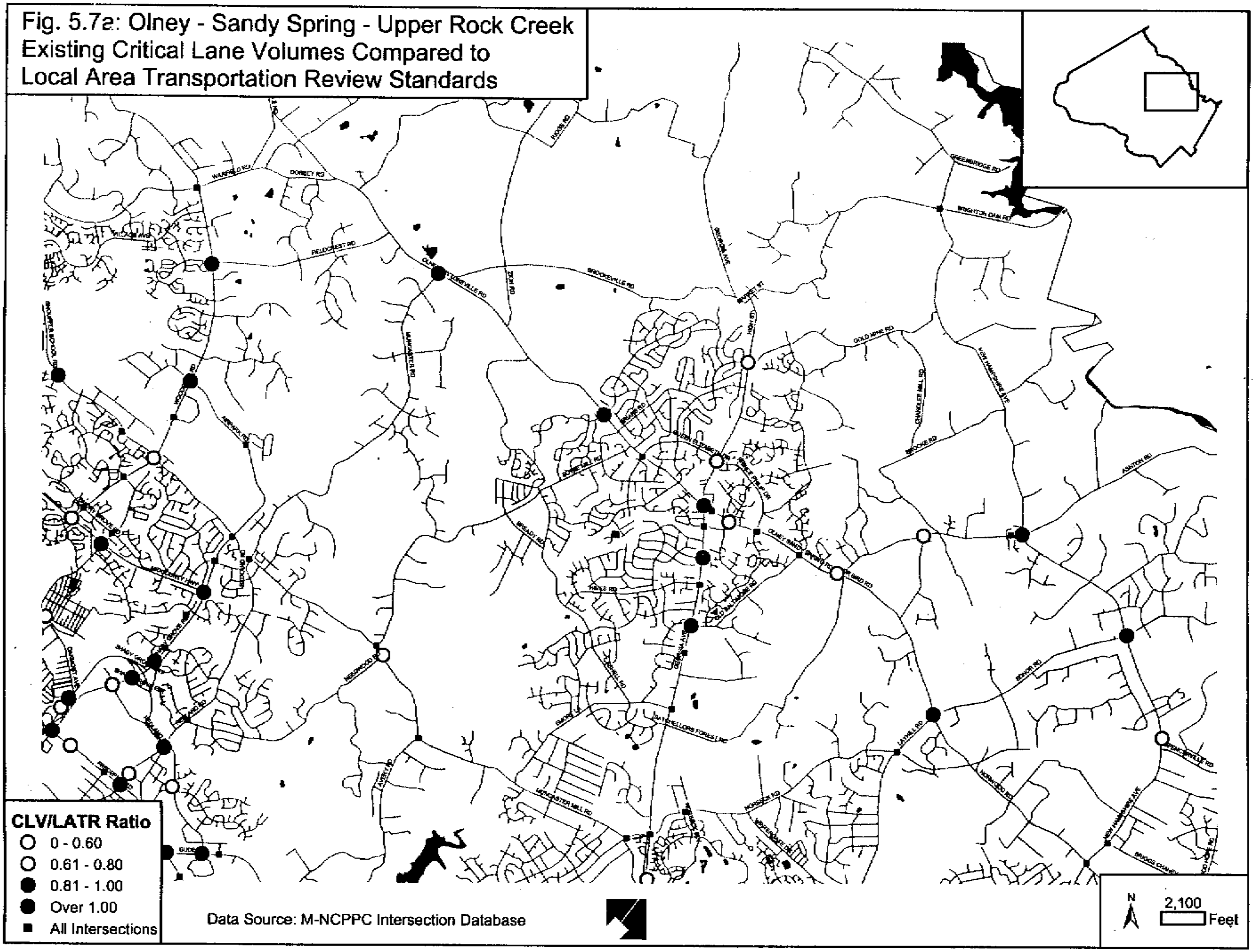


Fig. 5.7a: Olney - Sandy Spring - Upper Rock Creek
Existing Critical Lane Volumes Compared to
Local Area Transportation Review Standards



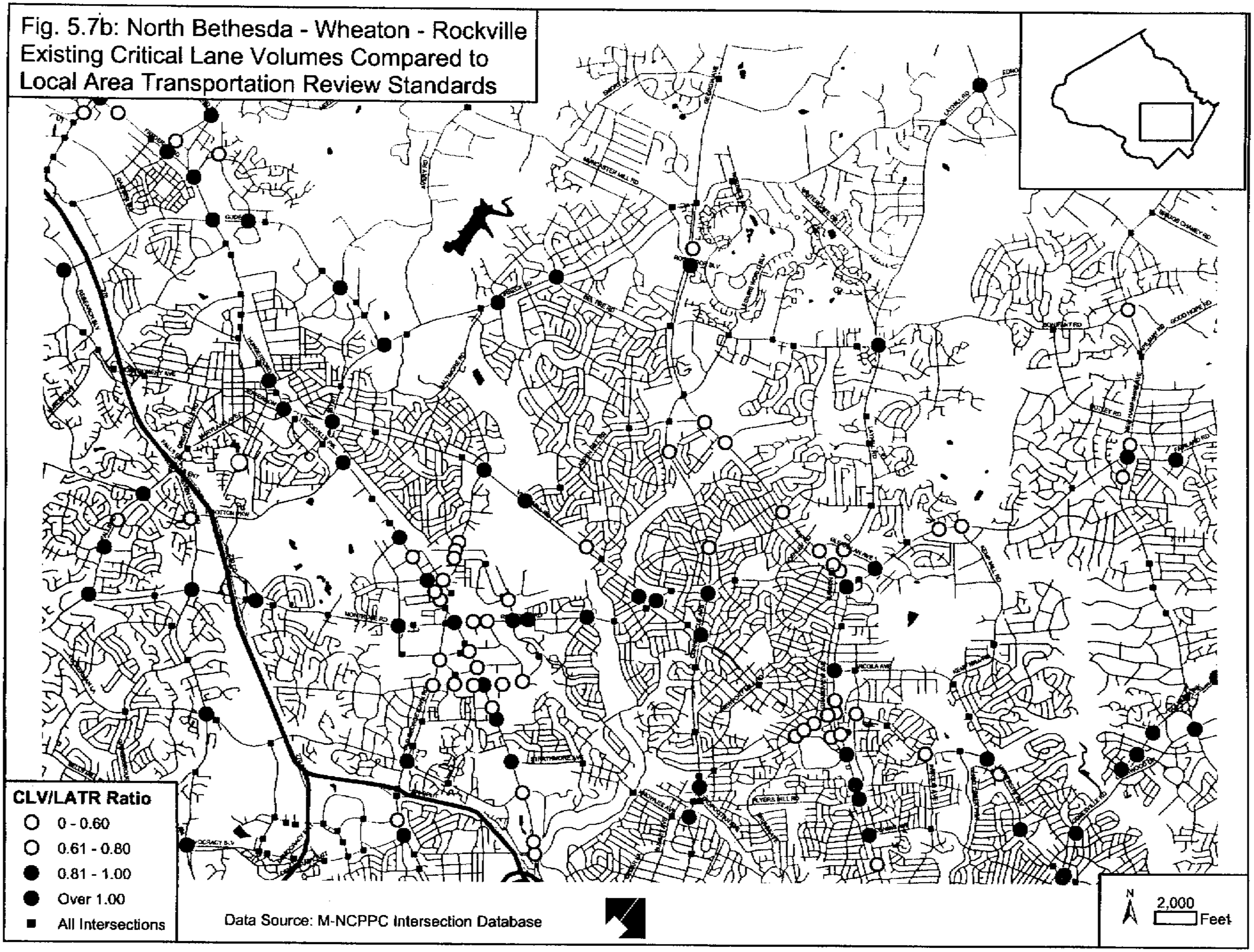


Fig. 5.7b: North Bethesda - Wheaton - Rockville
Existing Critical Lane Volumes Compared to
Local Area Transportation Review Standards
CLV/LATR Ratio
0 - 0.60
0.61 - 0.80
0.81 - 1.00
Over 1.00
All Intersections
Data Source: M-NCPPC Intersection Database
N
2,000
Feet

located in the policy area, such as traffic heading for the District of Columbia using Rockville Pike (MD 355) or Georgia Ave (MD 97).

- Countywide, the CLVs during the PM peak hour are still worse than CLVs in the AM peak hour: the average (mean) CLV for the AM peak hour was 1174, for the PM peak hour it was 1195; however, for the 25 intersections in the sample where *both* the AM and PM peak hour CLVs exceeded the LATR standard, 17 of those 25 intersections had higher CLVs during the AM peak hour.
- Continuous series of congested intersections can be found on most major north-south and east-west arterial routes, including Georgia Ave (MD 97), Connecticut Ave (MD 185), MD 355, Randolph Rd, Veirs Mill Rd (MD 586), US 29, River Rd (MD 190), MD 28, and Ridge Rd (MD 27).
- Many of these congested intersections have well-documented historical congestion and that congestion is being addressed through major capital improvements currently under construction or in project planning studies, such as along Columbia Pike (US 29), the intersections of Georgia Ave (MD 97) at Randolph Rd, Georgia Ave (MD 97) at Norbeck Rd (MD 28), and Rockville Pike (MD 355) at Montrose Rd / Randolph Rd.
- There are still many other "hot spot" intersections throughout the county where congestion needs to be addressed. Some of these intersections have improvements specified in master plans, but no facility planning has taken place to date; others may require spot improvements that are below the level of those usually considered in a master plan, which looks primarily at grade-separated interchanges, but can be addressed in a capital budget item.

Intensity of Arterial Use (DASH Data)

Historically, analysis of travel conditions in the county has focused on the weekday morning and evening peak periods and/or peak hours. However, as congestion has grown, more calls have come to examine both off-peak (midday) weekday and weekend travel conditions, with some suggesting that in certain locations in the county, the midday or weekend conditions are actually worse than those observed during the "traditional" peak periods.[4] While most manual data collection programs still only operate during weekdays and peak periods, the advent of automated data collection systems, such as DPWT's Advanced Transportation Management System (ATMS) and SHA's Coordinated Highways Action Response Team (CHART) allow for theoretical 24/7/365 travel monitoring.

Park and Planning's Data Acquisition Software and Hardware (DASH) system began archiving traffic volume data collected by the county ATMS in December 2000. While data coverage is often spotty due to individual detector failure or system problems, enough valid data has been collected to analyze the differences between peak and off-peak utilization of the county's arterial (non-freeway) network in certain geographic areas. For this report, as for the analysis performed for the recent review of the LATR guidelines, the analysis focused on areas of good data coverage in locations along or near major commercial corridors or centers, since those areas are most likely to generate high volumes of off-peak traffic. Locations along the following corridors were analyzed: Frederick Rd / Rockville Pike / Wisconsin Ave (MD 355),

[4] The Planning Board heard testimony on this matter during the public hearing on the updated LATR guidelines in April 2004.

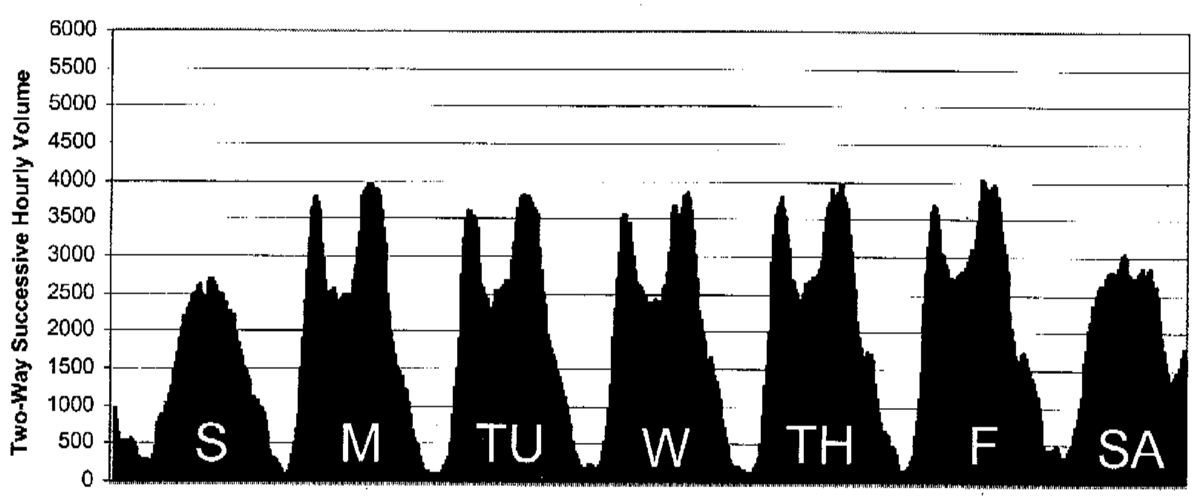
Democracy Blvd, Olney-Sandy Spring Rd (MD 108), Connecticut Ave (MD 185), Old Georgetown Rd (MD 187) and Georgia Ave (MD 97). The complete set of graphics for the observed data may be found in Appendix J.

The data contained in the DASH archive shows continuously observed volumes at the departing legs of signalized intersections at 15-minute intervals.[5] Depending the available data at each intersection location, observed volumes are from Sunday March 10, 2002 12:00am to Saturday, March 16, 2002 11:59pm, or from Sunday, September 8, 2002 12:00am to Saturday, September 14, 11:59pm. The 15-minute segments for both departing main line legs of the intersection were added together to create bi-directional successive hourly volumes for the intersection. While the available data are neither spatially nor temporally consistent enough to make any conclusions regarding congestion over a large area, they are able to provide some initial answers to common questions about the nature of congestion in certain parts of the county that will have future policy implications and will have more observations as data collection improves.

How Do Off-Peak Weekday and Weekend Volumes Compare With Traditional Peak Periods?

The typical distribution of travel on the arterial network in the county is a curve showing traditional weekday diurnal (morning and evening) peak periods and single, flatter peak of lower intensity on the weekends. An example of this pattern is shown for the intersection of Connecticut Ave (MD 185) and Jones Bridge Rd in Figure 5.9 below:

Figure 5.9: Connecticut Ave (MD 185) at Jones Bridge Rd
Two-Way Successive Hourly Volumes 3/10/02 to 3/17/02

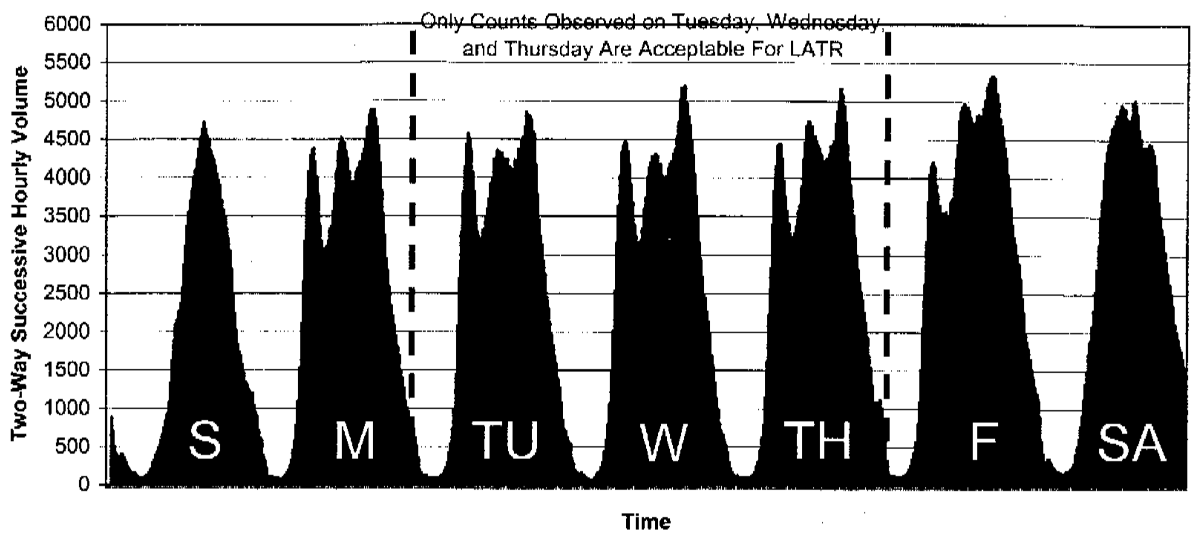


This pattern is representative of nearly all the other sampled locations. With very few

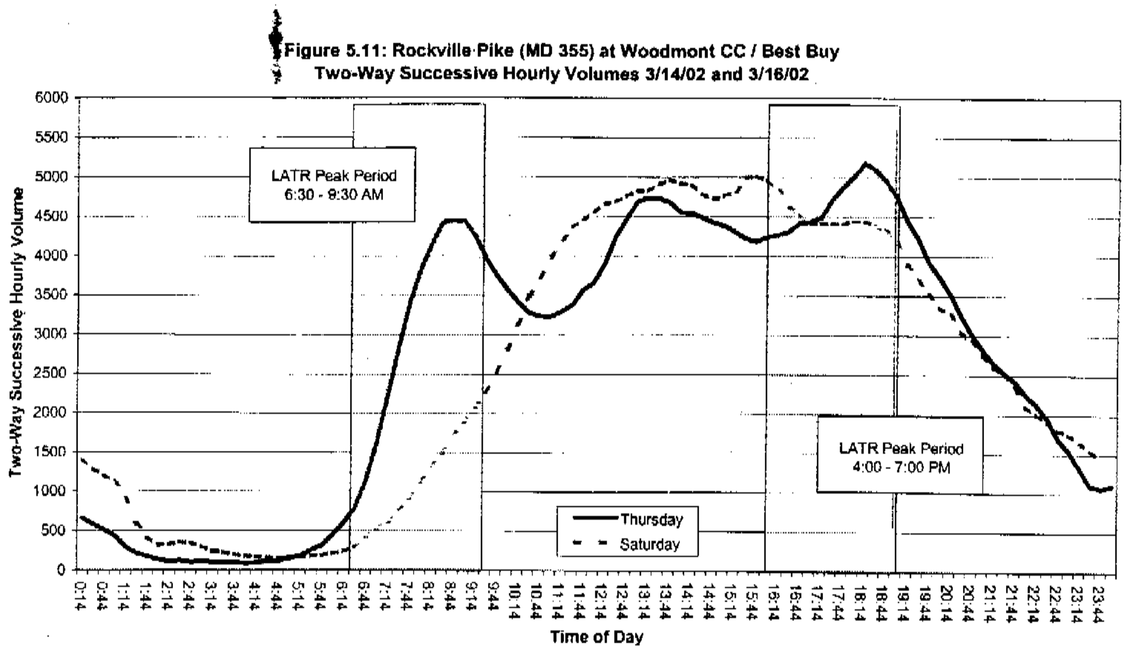
[5] The inductive loop and other detectors deployed by DPWT actually collect data every minute and produce summary volumes at 5 minute volumes for each detector. Those figures are collected and aggregated by the DASH system to produce the 15-minute departure leg volumes. Departure leg volumes from intersections cannot be used as turning movement counts, which require counts of approaching vehicles. Therefore, the DASH data cannot be used for CLV calculation.

exceptions, the data sampled for these corridors show that observed midday and weekend volumes rarely approach or exceed the observed weekday peak hour volumes. The notable exception to this pattern occurred along the Rockville Pike (MD 355) commercial corridor in North Bethesda, as seen below in Figure 5.10. At the intersection of Rockville Pike and the Best Buy Plaza, the midday volumes exceeded the morning peak hour volumes but did not exceed the evening peak hour volumes. This is reflective of the fact that many retail stores along Rockville Pike either are not open or experience low customer activity during the morning peak period.

Figure 5.10: Rockville Pike (MD 355) at Woodmont CC / Best Buy Plaza
Two-Way Successive Hourly Volumes 3/10/02 to 3/17/02



The locations sampled along Rockville Pike between the Rockville City line and the Capital Beltway (I-495) show a clearly defined mid-day weekday peak whose intensity approaches and sometimes exceeds that of the morning peak. This mid-day peak represents nearby workers venturing out onto Rockville Pike for lunch or errands, where most of them choose to make those trips in their cars. In some cases, the mid-day peak volumes never truly recede and are merely a precursor to the traditional evening peak period. This situation is illustrated by "drilling down" into the data from Figure 5.10 and showing one or two days at a time, as seen in figure 5.11 below.



Rather than displaying the traditional diurnal peaking that is typical around the rest of the county arterial network, the duration of peak traffic volumes on Thursday at this location is almost continuous from 12:30 pm until 7:30 pm, with volumes exceeding the morning peak period volume for nearly that entire time. In some locations not on Rockville Pike this pattern occurs, but on Fridays only.

Figure 5.11 also shows the different character of travel along Rockville Pike on Saturdays – there is a single peak that starts later in the morning and is more sustained over the afternoon and into the evening. The period of sustained peaking on the Saturday has higher volumes compared with the same time on the Thursday of the same week, a "typical" day, but not higher than those experienced during the weekday peak period. In one location in the sample, Rockville Pike (MD 355) at Old Georgetown Rd (MD 187), weekend two-way hourly volumes exceeded weekday two-way hourly volumes. This is reflective of the heavy retail activity along Rockville Pike on a typical Saturday, but does not necessarily suggest a higher level of congestion (i.e. a higher critical lane volume). Lower signal cycle lengths and efforts by County traffic operations staff to "balance" signal progression in both directions along Rockville Pike are factors that contribute to intersection congestion. The weekly data from this intersection are shown in Figure 5.12, and a comparison of Wednesday and Saturday volumes shown in Figure 5.13:

Figure 5.12: Rockville Pike (MD 355) at Old Georgetown Rd (MD 187)
Two-Way Successive Hourly Volumes 3/10/02 to 3/17/02

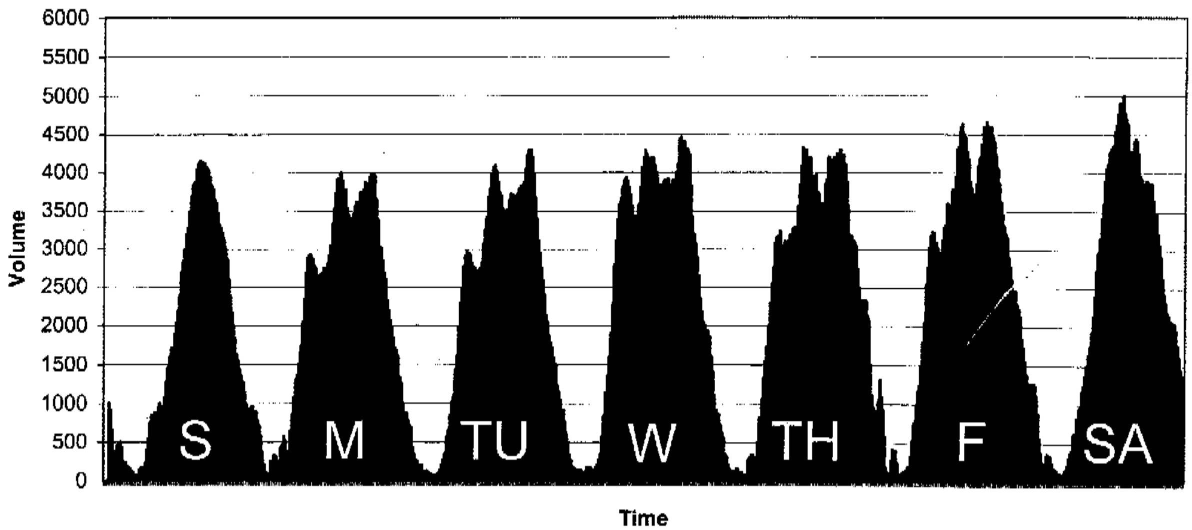
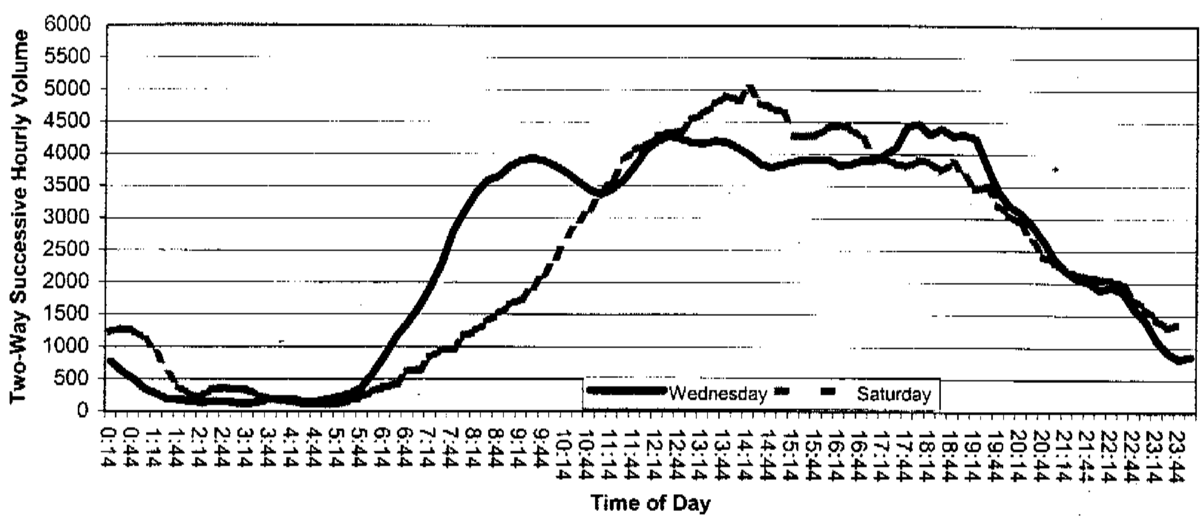


Figure 5.13: Rockville Pike (MD 355) at Old Georgetown Rd (MD 187)
Two-Way Successive Hourly Volumes Wednesday 3/13/02 and Saturday 3/16/02

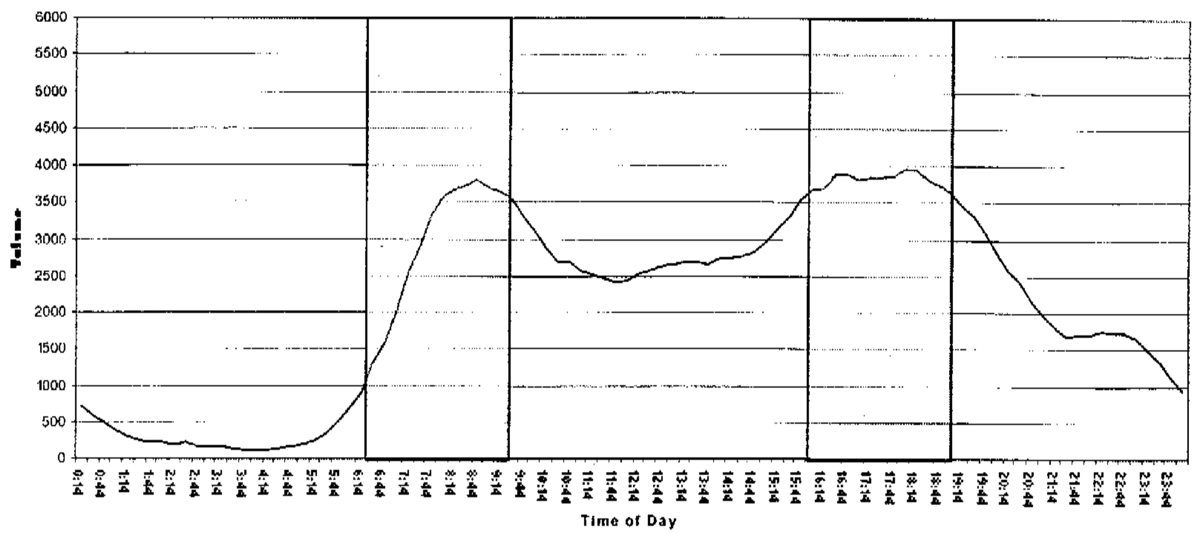


It is important to remember that the congestion patterns along Rockville Pike are unique in the County at present time. The results shown in Figure 5.12 were not found at any of the other sampled locations in the county, even though commercial destinations were present, and the infrequency of this type of congestion in the county is why the current LATR guidelines limiting required data collection only during the three-hour morning and evening peak periods on Tuesdays, Wednesdays, and Thursdays (except in special circumstances) were retained. However, if congestion is to be tracked to see if off-peak and weekend volumes increase in the future, then investment in improving the functionality of the DASH system and changing data collection policies to include collection of off-peak and weekend volumes represent the best means to ensure the availability of reliable data for this purpose. The ensuing data could also be used to provide more analysis on the questions below on the nature of congestion in the county.

Are we experiencing peak spreading?

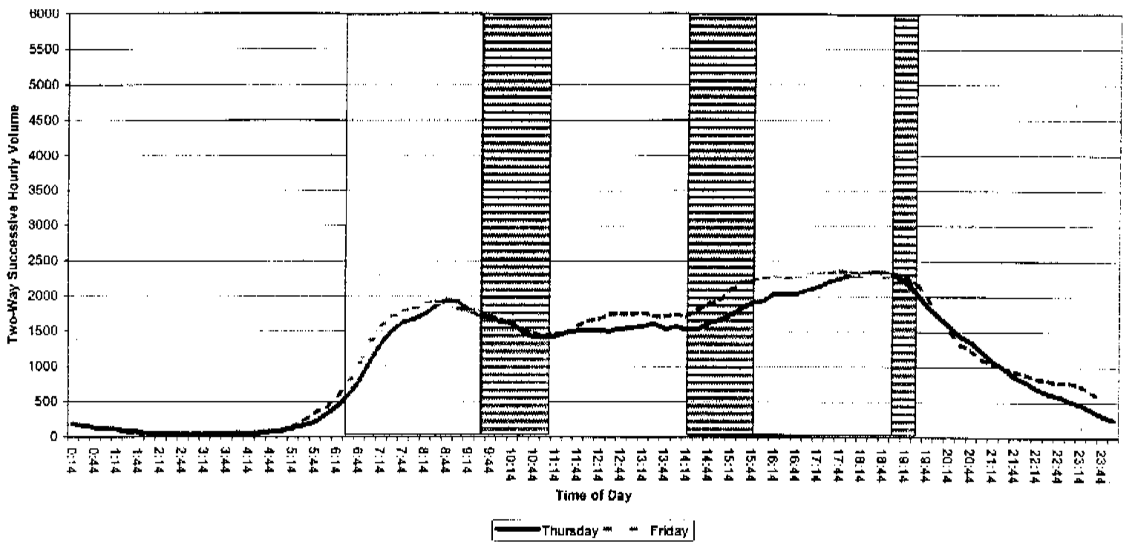
The phenomenon of peak spreading occurs when congestion during the traditional peak periods is so severe that the peak begins to flatten out, resulting in congested conditions during times outside the peak period, or a longer duration of congestion over the course of the day. Figures 5.14 and 5.15 show two-way volumes at intersections in Bethesda / Chevy Chase and Olney, respectively.

Figure 5.14: MD 185 at Jones Bridge Rd
Two-Way Successive Hourly Volumes 3/14/02 (TH)



The shaded bars represent the peak periods as defined in LATR. Very little if any peak spreading is occurring at this location during this time, even though a recent count at this intersection recorded a high CLV during the evening peak hour (see Appendix K).

Figure 5.15: MD 108 at MD 97
Two-Way Successive Hourly Volumes 3/14/02 and 3/15/02



The light shaded bars in Figure 5.15 represent the peak period as defined in LATR. The darker shaded bars represent areas falling outside of the traditional peak periods where volumes are still near those of the peak period. The best example above occurs during the evening peak period on Friday, which, again, is not a typical day for weekday traffic conditions and is not analyzed during LATR, except for special circumstances. However, peak spreading is clearly occurring during this time at the intersection at the heart of downtown Olney. The volumes are 30% of those observed along the lower sections of Rockville Pike, but the peak is spreading nonetheless.

How does the peak hour differ throughout the county?

Many of the county's arterials are long enough and cross multiple commute corridors (in addition to the road itself being a commuting corridor) that peak volumes occur at different times along different sections of the road. Like peak spreading, this phenomenon can also occur as a result of congestion and queuing, and will be discussed in the section on freeway travel times and speeds. In general, the peak in the county moves from north to south and east to west in the morning, and then the reverse direction in the evening; however, if there is a particularly capacity-constrained point in the network (e.g., a bottleneck), the peaks may behave somewhat differently over time. The situation observed in the CLV data, where gateways to CBDs or MSPAs were congested even though the denser areas were less congested also can add variation to the movement of the peak hour. Figure 5.16 compares the different characteristics of the peak periods along US 29 in Fairland / White Oak and the Silver Spring CBD. Figure 5.17 compares the different characteristics of the peak periods along New Hampshire Ave (MD 650) in Cloverly and Silver Spring / Takoma Park.

Figure 5.16: US 29 – Two-Way Successive Hourly Volumes Thursday 3/14/02

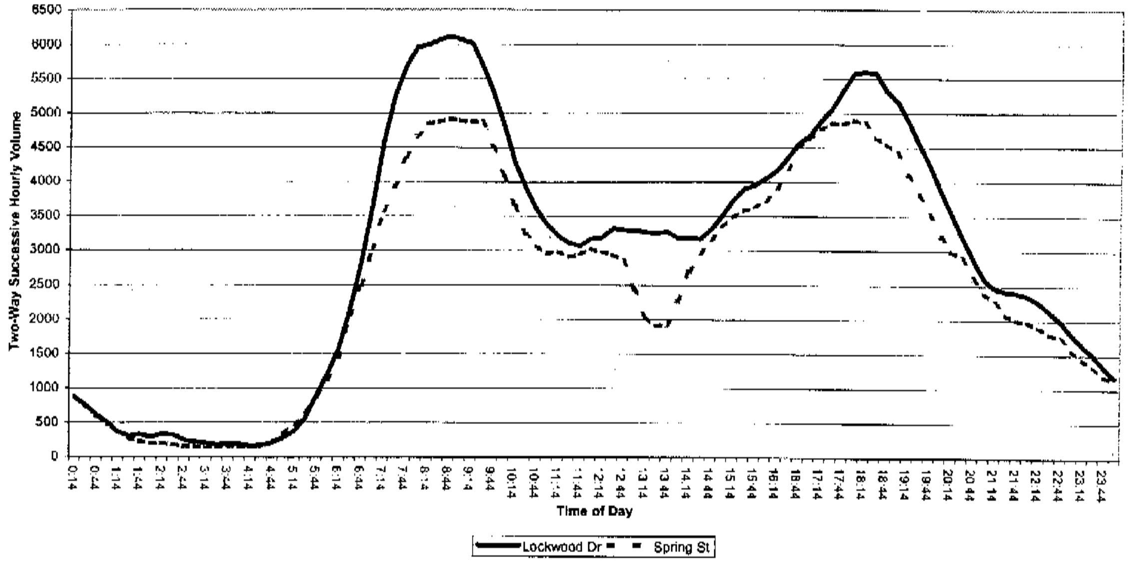
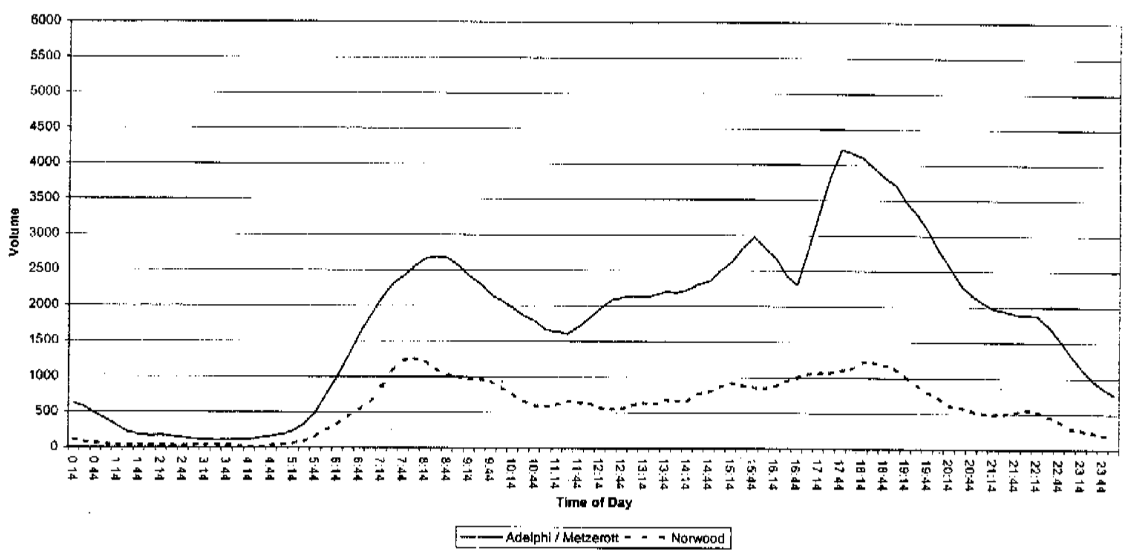


Figure 5.17
New Hampshire Ave (MD 650) – Two-Way Successive Hourly Volumes 3/13/02 (W)



On US 29 during the morning peak period, there is an overall high intensity of use, but the intensity decreases at Spring St compared with the upstream location at Lockwood Dr. This is probably caused by vehicles traveling south on US 29 that take the Outer Loop of I-495 to continue their journey, rather than continuing south along US 29 to Silver Spring and other destinations. During the evening peak period, the overall intensity at Lockwood is less when compared with the morning, and the differential between the volumes at Spring St and Lockwood is also less, but the peak of the peak period at Lockwood occurs 15 minutes later than the peak of the peak period at Spring St.

On New Hampshire Ave (MD 650) the overall intensity of use is much less than US 29, and the differential between the roadway at Norwood Rd and Adelphi Rd inside the Beltway is higher when compared with US 29 at Lockwood Dr and Spring St. Vehicles traveling south on

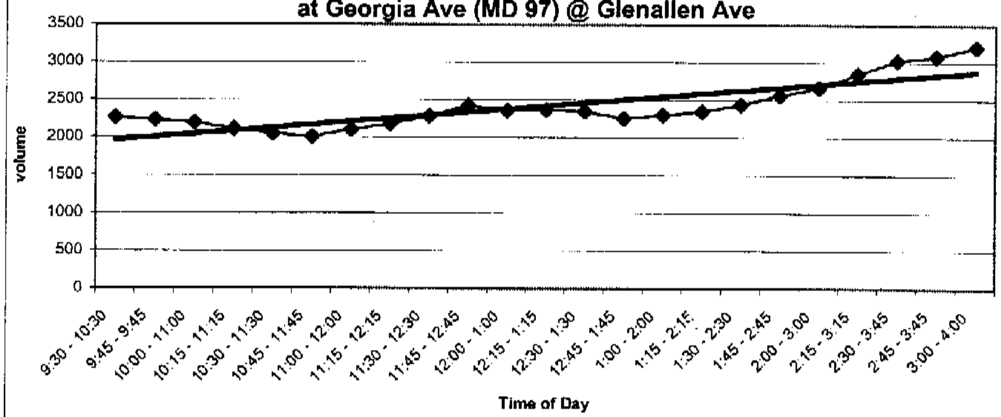
New Hampshire Ave at Norwood in the morning are likely to take one of the crossing east-west roadways, such as Bel Pre Rd / Bonifant Rd, or Randolph Rd, to reach destinations in the I-270 corridor. In addition, since New Hampshire does not directly connect with any major job centers inside the Beltway, vehicles that have not diverted onto Bel Pre or Randolph already most likely get on the Beltway, leading to the lower intensity of use shown crossing Adelphi Rd.

How Do Off-Peak CLVs Compare With Peak Hour CLVs?

An analysis of off-peak CLVs was conducted for 40 intersections throughout the County. The analysis relied heavily on data in the form of 12 and 13-hour turning movement counts collected by and obtained from SHA, since counts collected by the Department for LATR are only six hours in duration (6:30-9:30 am and 4:00-7:00pm). Through observation of successive hourly volumes between the hours of 9:30am and 4:00pm, Tuesday-Thursday, in conjunction with a series of calculations, the peak-hour of the off-peak period was identified for each intersection. The (off-peak) peak-hour volumes for each intersection were then used to calculate the off-peak CLVs. The complete list of intersections and CLVs may be found in Appendix M.

A majority of the intersections analyzed exhibited a similar trend with regards to distribution of volumes over the off-peak period, as shown in Figure 5.18. The distribution of volumes at most intersections appears to decrease slightly just as the morning rush concludes. The volumes remain constant throughout the course of the morning and early afternoon. Volumes then increase continuously during the early afternoon period leading up to the PM peak period, with the peak of the off-peak typically occurring just before the start of the PM peak period. A large portion of the increase in volumes just before the PM peak period can be directly attributed to the dismissal of schools.

Figure 5.18: Off Peak Two-Way Volumes at Georgia Ave (MD 97) @ Glenallen Ave



- 4 out of the 40 intersections analyzed had an off-peak CLV that exceeded the designated standard for their policy area:
  1. Connecticut Ave (MD 185) at Knowles Ave (MD 547)
  2. Georgia Ave (MD 97) at Olney-Sandy Spring/Laytonsville Rd (MD 108)
  3. Hungerford Ln (MD 355) at Gude Dr

4. Montgomery Village Ave (MD 124) at Russell Dr

- Of the 40 intersections analyzed, River Rd (MD 190) at Goldsboro Rd was the only intersection that had an off-peak CLV that was higher than both the existing AM and PM-peak CLVs for this location. This situation appears to be due to the close proximity of Walt Whitman High School.

Analysis of off-peak and weekend traffic, weekly distribution of traffic, peak spreading, spatio-temporal movement of the peaks, and off-peak CLVs all help paint a richer picture of congestion in the county. The examples shown here are based on a limited set of available data and for the most part are insufficient to draw any significant conclusions about the nature of traffic congestion over the entire county. The data are sufficient to begin to illustrate the nature of traffic congestion in a few geographic areas in the county over a short period of time, and with more detailed data covering longer time periods and collected over a larger geographic area, the questions about congestion lead to more detailed analysis that leads to more detailed answers. Some of the question about the nature of congestion in the county that are given an initial answer using the above datasets can also be explored using that is actually collected by a driver experiencing congestion on the transportation network, and is in some ways more understandable by the thousands of other individuals experiencing that same congestion as part of their daily travel.

Average Freeway Speeds based upon Traffic Density

Congestion on the freeway network throughout the Washington region has been a prime concern of the National Capital Region Transportation Planning Board (TPB) of the Metropolitan Washington Council of Governments (MWCOG). Since the early 1990's they have commissioned a series of studies that track the changes in freeway congestion through the use of the services of a company, Skycomp, Inc. that specializes in using aerial surveillance to assess freeway congestion. Studies have been conducted in 1993, 1996, 1999, and 2002. Skycomp analyzes sequential photographs of the density of directional freeway traffic between interchanges and from that makes an estimate of the average speed for that time period. By using one or more aircraft they can sample most of the regional freeway system on about an hourly rotation resulting in hour-by-hour estimates of speed by direction between interchanges for the AM and PM weekday peak periods. MWCOG and Skycomp made available data summaries of the regional results for use in this ADAC Report.

Analysis of that information and a reformatting of it have been done in order to prepare a series of displays that show congestion on freeways and parkways in and near Montgomery County on an hour-by-hour basis for the AM and PM peak periods. These displays are prepared using a Geographic Information System (GIS) that has been crafted to show the speed ranges of freeway segments for opposing directions as well as for the local lanes and High Occupancy Lanes on I-270. Figures 5.19 and 5.20 respectively show the peak hours for the AM and PM peak periods, in particular for the 8:00 to 9:00 AM and the 5:00 to 6:00 PM time periods. They show that in the morning congestion, slow speeds, down I-270 from Germantown to the split of I-270, westbound on I-495 (the Capital Beltway) from College Park and southbound on I-95 to the Beltway and then again from MD 190, River Road, into Northern Virginia. In the evening the congestion is less intensive and of shorter extent northbound on I-270 from Shady Grove to

Clarksburg; and that however, congestion on I-495 is more intensive extending all the way around from College Park back to Northern Virginia and then north on I-95 towards Laurel.

The series of displays for the other peak period hourly time periods show less extensive and intensive congestion but still a significant amount of congestion. Those displays are not directly in the ADAC Report but are available as part of the background material.

The overall body of surveying and sampling changes in traffic congestion patterns on the regional freeway system is an excellent example of a consistent, periodic, and long-term tracking of an important measurement of system performance. That full collection of information can be used to compare differences in congestion over time and associate that with changes in network infrastructure and/or operations. The reporting by Skycomp and MWCOG has indeed done such comparisons. In addition, there are sets of photographs and other display summaries that can be use to assess the particular details of the congestion at particular locations. However, the estimates of average speed are for relatively long sections averaging a mile or more and there is no information for the in-between-times during the hourly summary period. In addition, this performance measure is not as straight forwardly applied to measuring congestion on arterials. The next performance measure can address those two needs for more specificity and detail and can be easily applied to major highways, arterials, and local roads.

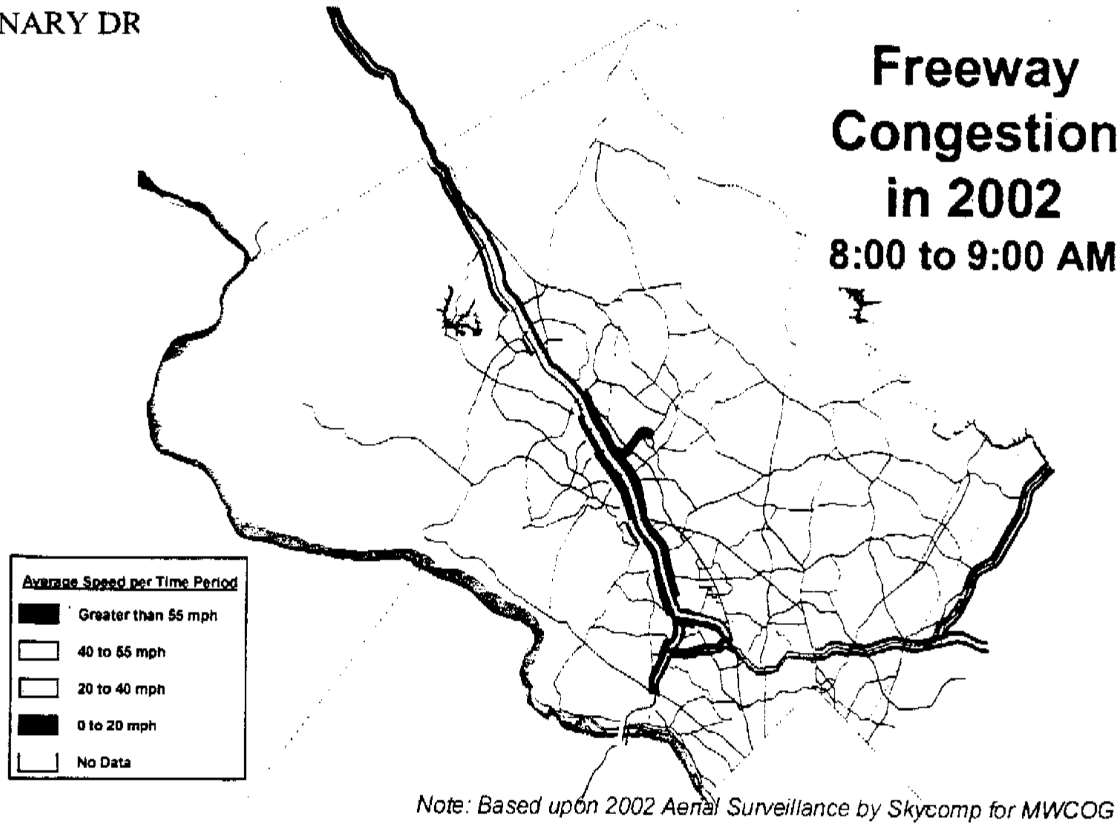


Figure 5.19: Example of Peak Morning Congestion from Average Freeway Speed Data

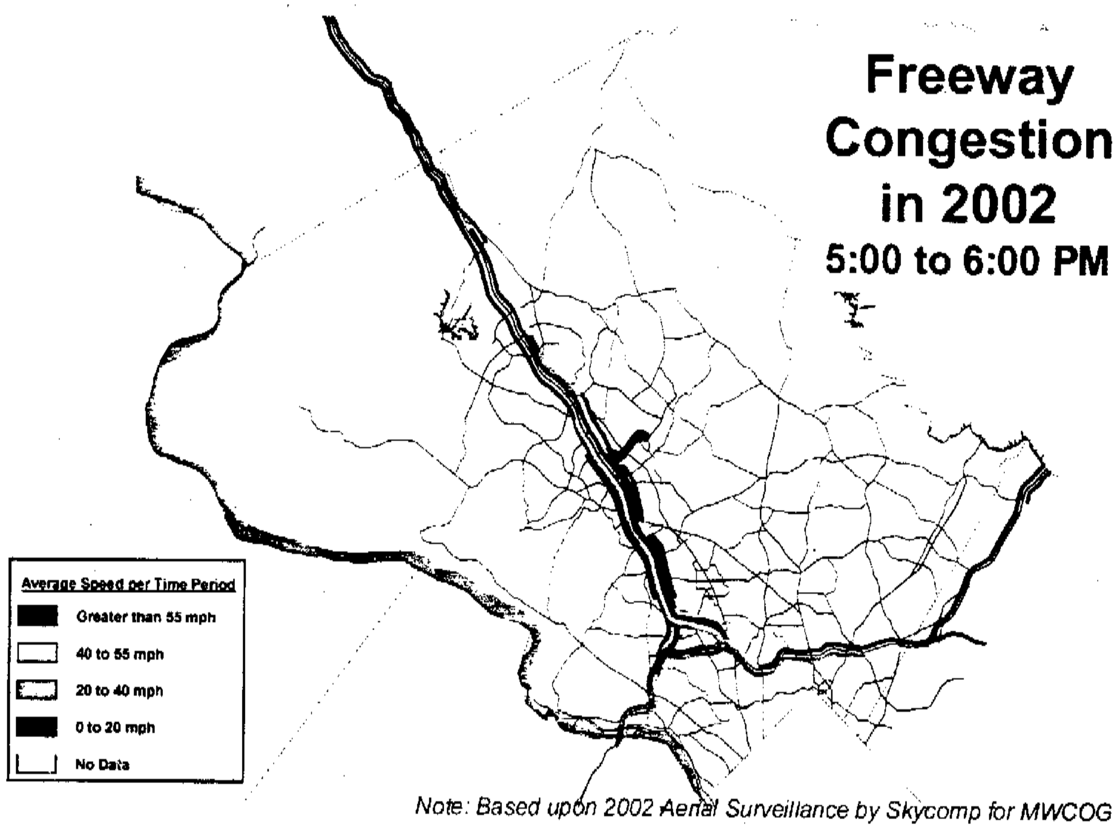


Figure 5.20: Example of Peak Morning Congestion from Average Freeway Speed Data

Route-Specific Arterial Speeds and Travel Times

The previously described performance measures of traffic congestion have each been based upon sampling particular transportation facilities or component parts of them, such as an intersection. Those are measures that have been developed mainly from the perspective of the system providers. For example, it has been relatively easy but still difficult for transportation agencies to count turning traffic at intersections and to use that to calculate CLVs. In these days of increasing concern for the customer perspective on services, other measures such as route specific speeds and travel times may be more in tune with the perspective of transportation system users. Users understand if there average morning peak period travel time from Clarksburg to Bethesda is 40 minutes, or if the average speed on a section of northbound Connecticut Avenue (MD 185) inside the Beltway at 5:15 PM is 18 miles/hour.

While it has been harder for transportation and planning agencies to collect, analyze, and summarize such data and information in the past, innovations in technology are beginning to make that less difficult. In the past the collection of data on route specific speed and travel time has been labor intensive requiring one person to drive a probe vehicle and another to use a stop watch, to periodically record the data by hand at main crossing points, or to operate a distance measuring device. Further, the analysis, summary, and display of the data was even more labor intensive. As part of this ADAC Report extensive experimentation has been carried out on the use of Global Positioning System (GPS) devices that record the second-by-second path, or route of the probe vehicle.

When the probe is driven at the general speed of the surrounding traffic then the recorded data is representative of the congestion at those places and times. Only having a driver and not another person acting as a recorder is a key feature of this method that significantly reduces the amount of labor intensiveness. The GPS technology provides reasonably accurate enough second-by-second location (latitude and longitude) of probe vehicles for these purposes. The GPS devices also uses a time stamp for each data record that is given in Greenwich Mean Time thus resulting in full synchronization when more than one probe is being used. Further, The electronic file of the sequential path of the probe can then be relatively easily analyzed to get information such as the incremental spot speed along a route and cumulative travel time for the whole route or any of its sections.

One challenge with using this new technology is that the amount of data potentially available for analysis can become overwhelming unless proper and effective data management tools and techniques are available. One of these tools is the use of a GIS based database management system that can keep track of the many different data files that each represents travel along a particular route at a particular time. It is necessary for the system to know what where the locations and time periods that were sampled, and then to be able to analysis, summarize, and display the resulting information in appropriate groupings or combinations of the individual travel time and speed samples. The GIS-based database management system used by Motion Maps provides such functionalities.

Three main sources of samples of GPS travel time and speed runs were available for use in the ADAC Report, in total consisting of over 1,500 separate route-specific files. These include files form MWCOG, files specifically collected for the ADAC Report, and a collection of files previously collected by Motion Maps as part of their research and development. The particulars of these sources are given next as well as other future potential sources.

- **MWCOG GPS Data Files**: Since 2000 MWCOG has used GPS tracking devices to periodically sample a selected but limited set of arterials throughout the region, which has included several in Montgomery County for sections of: MD 28 (Norbeck Road), MD 117 (Clopper Road), MD 193 (University Boulevard), MD 198 (Spencerville Road), MD 355 (Wisconsin Ave/Rockville Pike/ Frederick Road), MD 586 (Veirs Mill Rd), and Randolph Road. That sampling has been relatively intensive with a probe traveling in each direction at once every twenty minutes between the hours of about 1:00 and 8:00 PM. The sampling has generally occurred over two to four separate days. The overall sampling plan has each of these routes being surveyed once every three years and as such a few of them have had their second sampling. Upon request and with some funding support from MDOT/SHA, MWCOG has made these data files available for use by the ADAC Report.

- **ADAC Report Data Files**: A supplemental sampling was to the MWCOG sampled routes was performed for a larger number of state and county routes as well as to get AM conditions for some of the routes sampled by MWCOG. The sampling was less frequent and for a shorter duration – about once every 30 minutes between the hours of 6 to 9 AM and 4 to 7 PM.

- **Ad Hoc Sampling by Motion Maps**: Over the past three years Motion Maps has been using a GPS device to record travel during business and personal trips, which constitutes an ad hoc sample of different routes of interest to the ADAC Report. In addition, one-shot samples were made of particular routes as part of this project to get a broader geographic coverage and to cover gaps from the other two samples.

- **Other Potential Data Sources**: MWCOG has also performed GPS travel time runs in Montgomery County for other activities, in particular an access study to the regional airports and for the monitoring of HOV use in the I-270 corridor. Work is beginning to be carried out for MCDPWT and MDOT/SHA as part of traffic signal retiming activities that is using GPS tracking devices to study before and after conditions. These and other similar data sources may be available for future summaries.

Figure 5.21 is an example that shows the particular extent and intensity of congestion on I-270 for a set of AM and PM samples for the section of I-270 between MD 109 (Old Hundred Road in Hyattstown) and the Democracy Boulevard or Rockledge interchanges, which is approximately a 20.1 mile distance. In this example the speed shown is the average speed every 1/10th of a mile. While the congested southbound travel time starting at about 7:19 AM was about 45 minutes and finished at about 8:04, the actual second of the start and end times are available if they are needed for improved understanding. The northbound, un-congested travel time was about 18 minutes. The average congested southbound speed was about 27.1 mph. The corresponding afternoon travel time runs showed that it took about 48 minutes to go northbound starting at about 4:38 PM. A thunderstorm made the last part of that run go even slower and slowed the return southbound trip by about 5 minutes to a travel time of about 23 minutes.

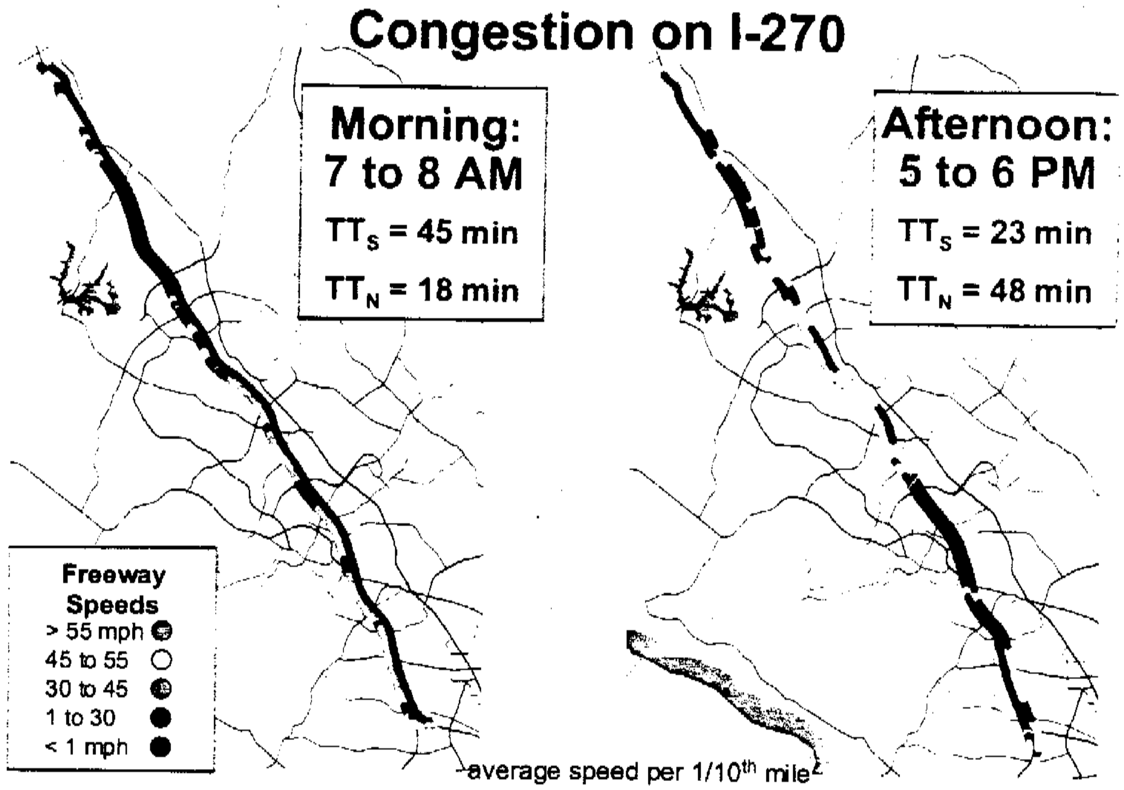


Figure 5.21: Example of the Extent and Intensity of Congestion for I-270

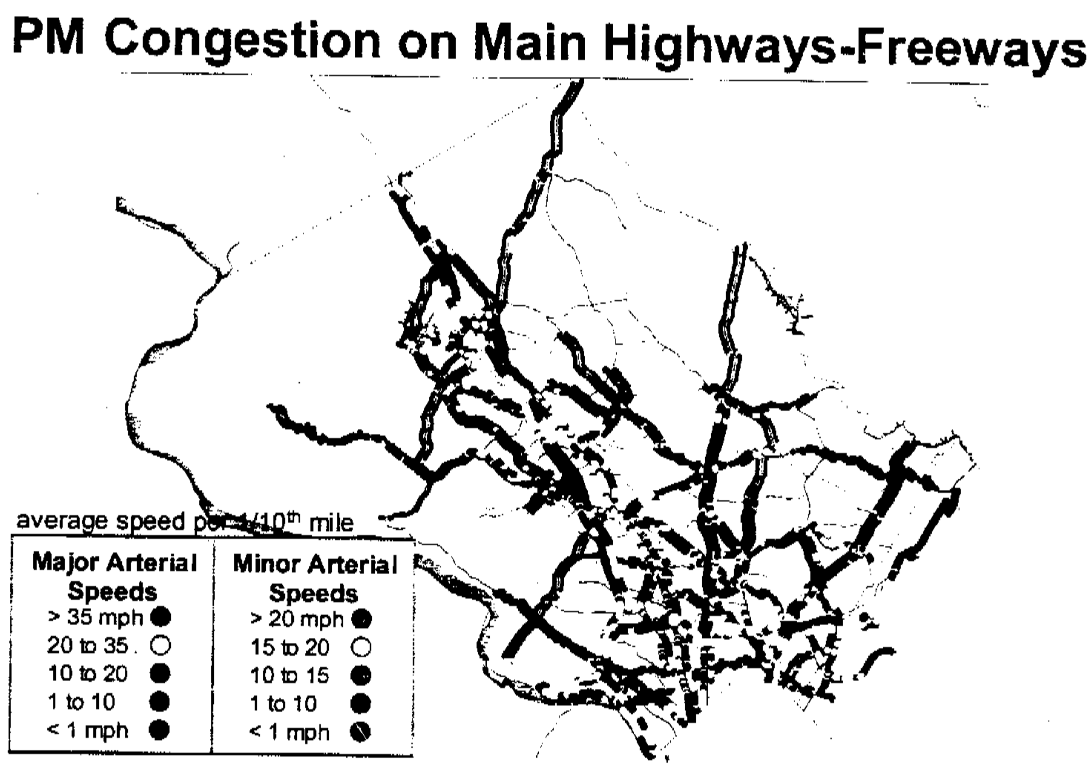


Figure 5.22: Example of the Extent and Intensity of PM Congestion Countywide

Figure 5.22 is an example display that shows the general extent and intensity of PM congestion on main highways and freeways in the county. When compared to a similar display for the AM (not shown here) the PM conditions are more congested in that the geographic extent of the slower speeds is greater and the operational intensity in many places is slower or more congested. Figure 5.22 also has many more routes that had observations as more sampling was done during the PM. However, not all of these routes shown were for times during the PM peak period. That is because due to the one-shot sampling some of those routes were only surveyed in the mid-day or early afternoon time period. They are shown here nevertheless in order to give an indication of possible coverage. There are some lines shown either as a brown or teal that indicates those are ones that only had sampling done in the morning and not at all during the PM.

Figures 5.23 and 5.24 are examples in which the geographic scale and coverage is a zoom-in on the same basic data files from Figure 5.22. Figure 5.23 shows the sub-area in the vicinity of Shady Grove, Rockville and Gaithersburg while Figure 5.24 shows the sub-area in the vicinity of Silver Spring, Takoma Park, Kensington, and White Oak. In both of these figures the level of detail has also been sharpened so as to show average speeds per $1/20^{th}$ of a mile. That distance is 264 feet or about ten to eleven car lengths. Such displays really hone in on where the congestion occurs as well as clearly shows the extent of queues. For example, in Figure 5.23 northwest bound along MD 117, Clopper Road, where the road narrows after passing Long Draft Road. An observation that is worthwhile to note is that the "congestion" associated with an intersection may not actually be located at the intersection per se but rather in queues upstream of the intersection. This can be seen in Figure 5.24 for the northbound approach along MD 97, Georgia Avenue at the intersection with Randolph Road. In these two figures there is also a set of "circles" which indicates those locations for which there are CLV calculations available.

There are two other basic types of summary displays that can readily be prepared on a selective basis for a particular route. They are (a) overall route travel time variation by time of day, and (b) what we are terming a travel time versus distance profile. Samples for northbound MD 185, Connecticut Avenue from Western Avenue at the boundary line with the District of Columbia to MD 97, Georgia Avenue in Aspen Hill, a distance of some 8.3 miles is used as an example. Figure 5.25 shows the former and 5.26 shows the latter. In total for the project 11 northbound and 11 southbound travel time runs were performed. The fastest northbound run of about 12.8 minutes was for a run that started at about 7:14 AM while the slowest was about 30.7 minutes for a run that started about 5:10 PM. Thus the observed slowest time was about 2.4 times slower than the fastest run. This is a very high peak "Travel Time Ratio" when compared to many other corridors, which may have values of 1.5 to 2.0. However, such a comprehensive tabulation and evaluation has not yet been performed. The Travel Time Ratio for the southbound observed trips was about 1.7. Other examples of this variation in route travel time by time of day are being prepared.

Figure 5.26 presents a subset of that same basic data in a different manner to focus on where along the corridor the congestion or slowness was observed to take place. In this figure the total travel time (expressed in hours) is the Y-axis and the distance in miles from Western Avenue is the X-axis. The fastest and slowest travel time runs of the previous figure are shown

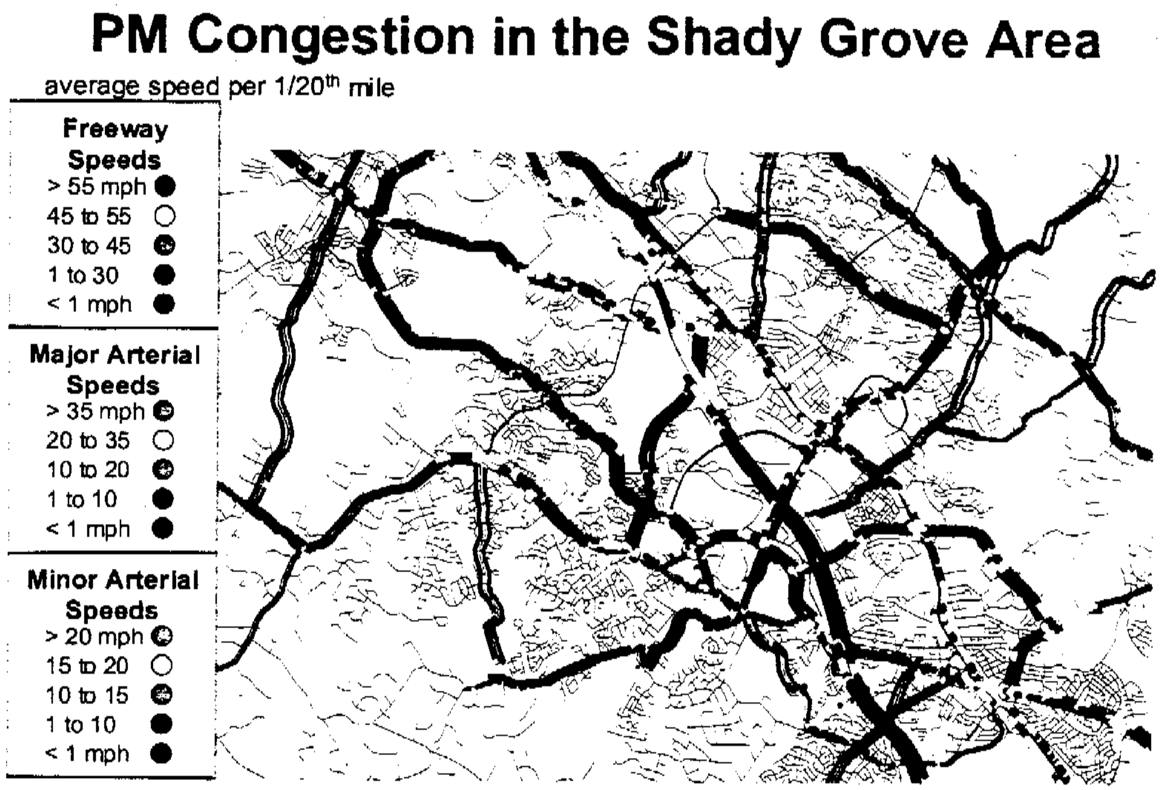


Figure 5.23: Example of Localized PM Congestion for the Shady Grove Area

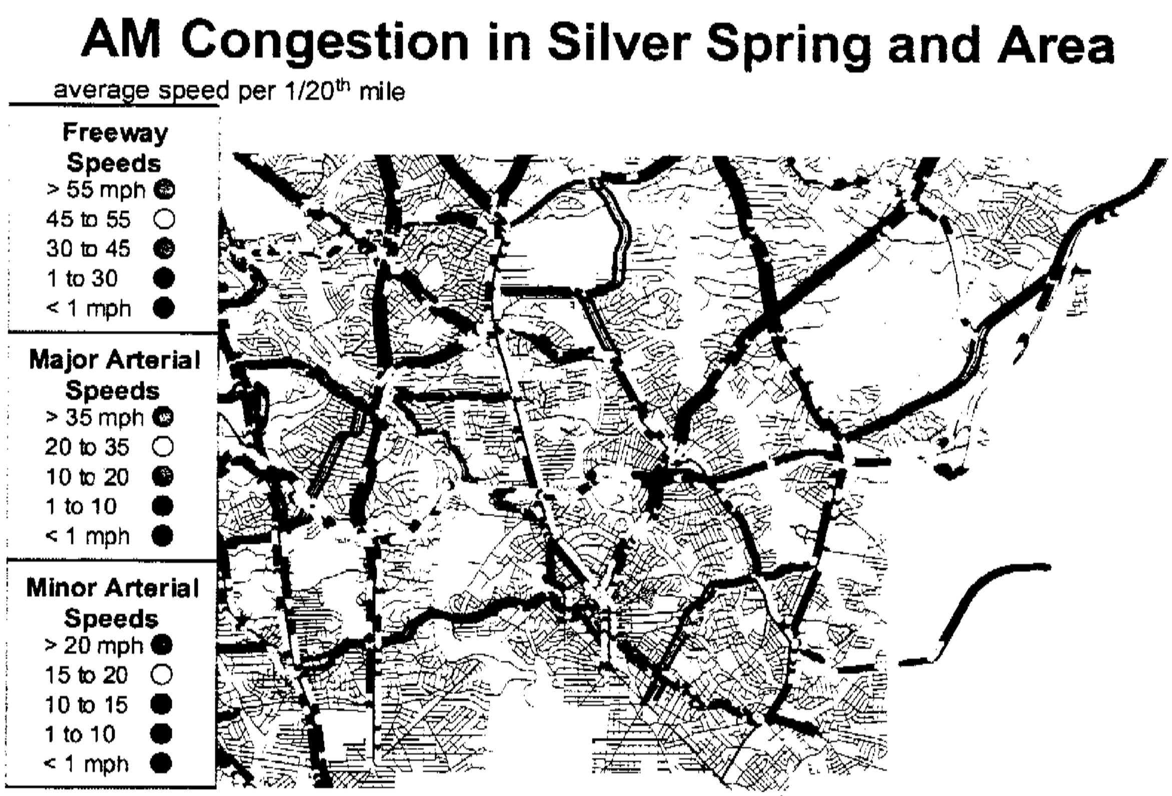


Figure 5.24: Example of Localized PM Congestion for the Silver Spring Area

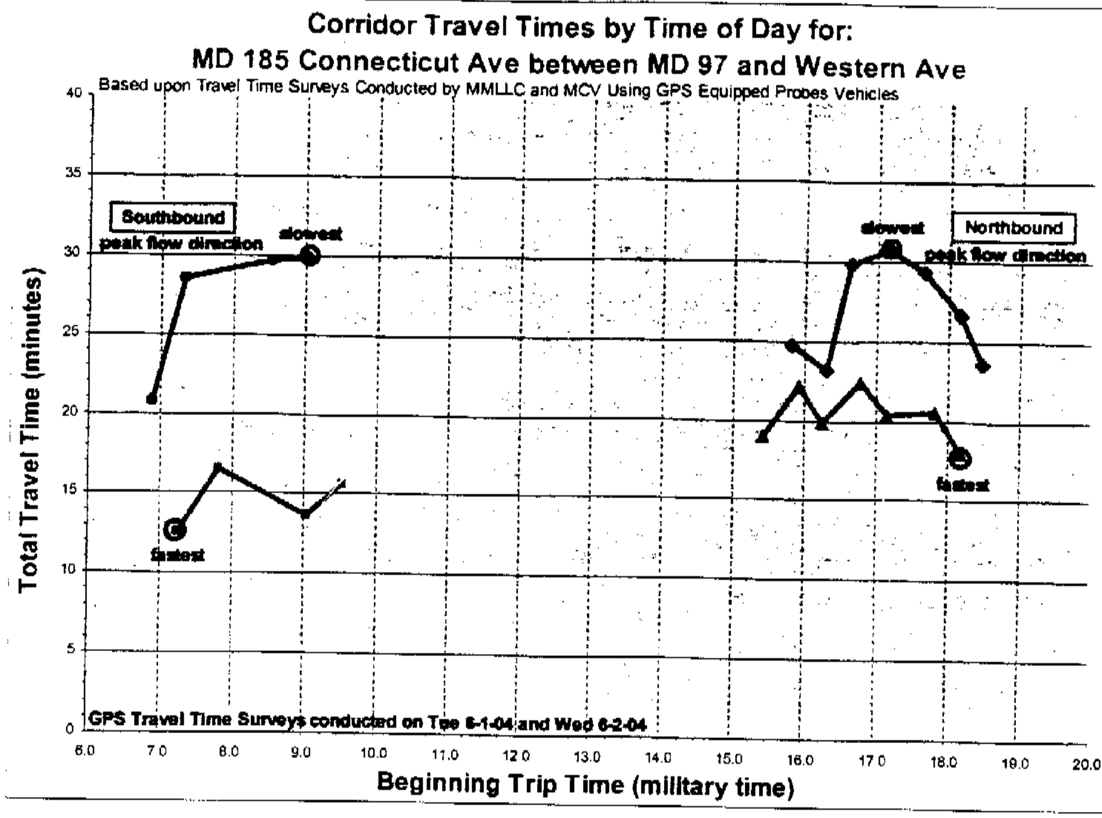


Figure 5.25: Example of Route Travel Time Variation by Time of Day

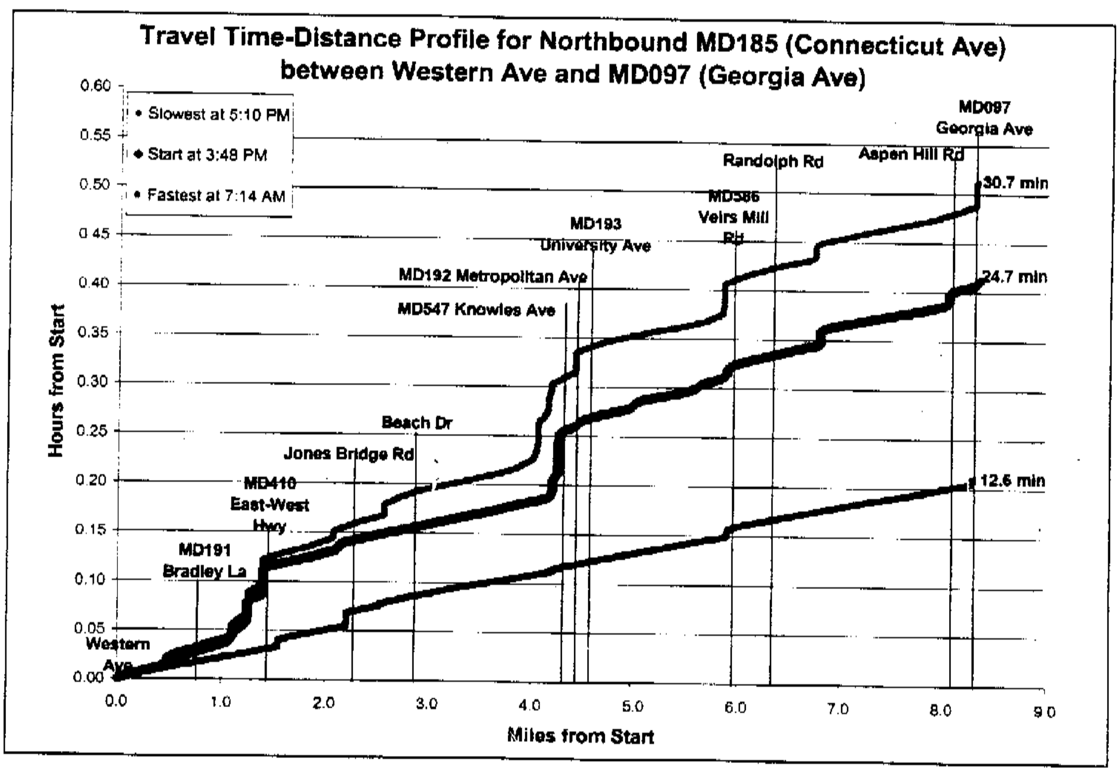


Figure 5.25: Example of Travel Time versus Distance Profile for MD 185

as well that for the first northbound PM run that started about 3:48 and took about 24.7 minutes. The shapes or "profiles" of these lines indicate the relative congestion experienced by the traveler along the route. The fast time, the green line has a more gentle and uniform slope with few jumps up. The travel distance of 8.3 miles divided by the travel time of .21 hours results in an average speed of about 39.5 mph for the fastest run. The relative uniformity of the slope of the line also indicates a rather uniform speed. This is especially noticeable in contrast to the two other lies for the slowest and the first run of the afternoon. Those lines have several steep slopes that indicate that the traveler experienced significant time with little forward movement – congestion. There are also many short jumps, which are associated with stopping for traffic signals but necessarily being delayed for too long at any one. Long queues of traffic can also be discerned in this figure, particularly on the approach to East-West Highway (MD 410) and to Knowles Avenue (MD 547).

There are numerous and basically an unlimited number of summary displays that can be prepared that are of interest to different people and groups. The availability of this new source of GPS based travel time and speed data will present many opportunities for staff to develop even more informed analyses regarding the spatial extent, operational intensity, temporal duration, concurrent variability over time and space, and the basic causes of the particular observed congestion – whether recurrent or non-recurrent. Non-recurrent congestion, which is associated with incidents and events of many kinds are all too often becoming more of an everyday occurrence. A significant proportion of the congestion that travelers experience is associated with such incident and event conditions, even though they may not be aware of it being so. For example, a major incident on one of the freeways may be reported on the radio newscasts and as a result many travelers change either their route and/or their time of departure resulting in abnormally high congestion of other nearby routes. Some other travelers may not hear the news and not be aware of why their usually normal traffic is so congested that day.

Monitored Freeway Speeds from CHART Traffic Flow Detectors

For nearly ten years the MDOT/SHA has operated a statewide traffic management center called CHART, which stands for Coordinated Highways Action Response Team. CHART has several key missions that include incident management, traffic management, traveler information, and traffic and roadway monitoring. As part of these interdependent missions they have a program of monitoring of traffic flows over a wide area throughout Maryland, including freeway locations in Montgomery and nearby in adjacent counties. This monitoring occurs in the jargon of traffic management centers at "24x7x365" – in other words day-in and day-out all of the time. While the temporal coverage is very complete, the spatial coverage is presently much more limited.

There are several ways in which the monitoring occurs: (a) the use of strategically placed closed circuit television (CCTV) cameras, (b) traffic flow detectors, and (c) through personal observations by the CHART service patrols, maintenance personnel, and the State Police and other emergency service personnel. Over the years various technologies have been used for the traffic flow detectors and maintaining their effective operation and of the necessary communications systems has been a significant challenge. Higher priority has been given to effective functioning the CCTV cameras and to the Variable Message Signs that span many freeways. There are traffic flow detectors located near several of the main freeway gateways to the county, along I-270 in Frederick County, along the Beltway at I-95 in Prince George's

County, and along I-95 itself. However, there are also limitations – the functioning CHART detectors on I-270 currently only extend as far down as I-370, and there are significant gaps along the I-495, the Capital Beltway in those sections that typically are frequently congested. A list of current CHART detector locations may be found in Appendix L.

There are plans to deploy such "missing" detectors to give better geographic coverage but funding continues to be tight. Proposals from private sector companies to install privately provided detectors for them to use in traveler information systems have been under consideration in the Baltimore and Washington regions. That may result in a more extensive deployment of such detectors in the near-term future.

The CHART traffic flow detectors currently collect data on: (1) traffic volume, (2) average speed, and (3) "lane occupancy", a measure of the density of use of the roadway during the monitoring time period. The monitoring time period for CHART is one minute. Originally, and for many years that minute-by-minute monitoring data on speed and volume was routinely being discarded after its immediate use by the CHART program. However, in recent years an Archived Data Management System has been incorporated into the mission of CHART, which has resulted in this data being saved for analysis by CHART staff and for secondary uses by others – such as in the ADAC Report. The Center for Advanced Transportation Technology (CATT) at the University of Maryland has been assigned the responsibility under contract to set up and maintain the data archive for the CHART detector data. CATT and CHART staff has been cooperating in providing samples of the archived detector data for evaluation in this ADAC Report. The time period for the archive currently aggregates the data to five-minute intervals although plans are underway this summer to switch that to be to a one-minute aggregation level.

The most unique and interesting aspect of this potential new data source is the concurrency of the data – the same type of data is being collected at many places at the same time for the same time-period. Except for the DASH data from the traffic signal system all of the other data sources being used in the ADAC Report depend upon a sampling of traffic conditions at different places at different times. Thus while the CHART detector data may be limited in spatial coverage only to certain places along the freeways, it never-the-less can be analyzed to show concurrent variability of traffic flows and congestion in time and space, as illustrated in the subsequent example figures. As such this type of data source has the potential of being a very good source for periodically tracking congestion conditions by sampling data from the Archived Data Management System rather than by conducting field studies.

Figures 5.26 and 5.27 respectively show AM southbound and PM northbound congestion on I-270 using a sample of the CHART archived detector data. Experience with studying similar detector data from other traffic management centers has shown that when (a) the speeds per time period per detector can be sorted and arrayed by (b) increasing time, and (c) direction of flow from detector-to-detector, that displays like these two result. These figures show the concurrent temporal duration and spatial extent of the congestion on parts of I-270 where the direction of traffic flow is from left to right. Figure 5.ii shows for example, that for the right-most column for the detector at I-370 that the time period of about 7:50 to 8:15 AM was the most congested while congestion was heavy for the 15 minutes before and ten minutes after that. The upstream congestion at the next working detector at MD 118 in Germantown shows less intense but longer duration congestion that occurs earlier – mainly from about 6:30 to 8:00 AM. Information of the effect on I-270 congestion from the traffic flows entering from MD 124 and MD 117 is missing.

Figure 5.27 shows similar information for the following afternoon where the direction of traffic flow is from right to left. However, due to the more continuous and evenly space series of detectors up into Frederick County (the four right most columns), a pattern of a shock-wave of congestion moving against the direction of flow emerges, as illustrated by the shaded arrow. It shows that the intense half-hour of congestion north of the county line in Frederick County between about 4:00 to 4:30 PM appears to result in a backward cascading of congestion in time and space back into Montgomery County during the subsequent half hour to forty-five minutes such that the effects are felt by travelers between Shady Grove and Germantown (the two left most columns) between about 5:00 and 5:20.PM.

I-270 Southbound for AM Peak Period

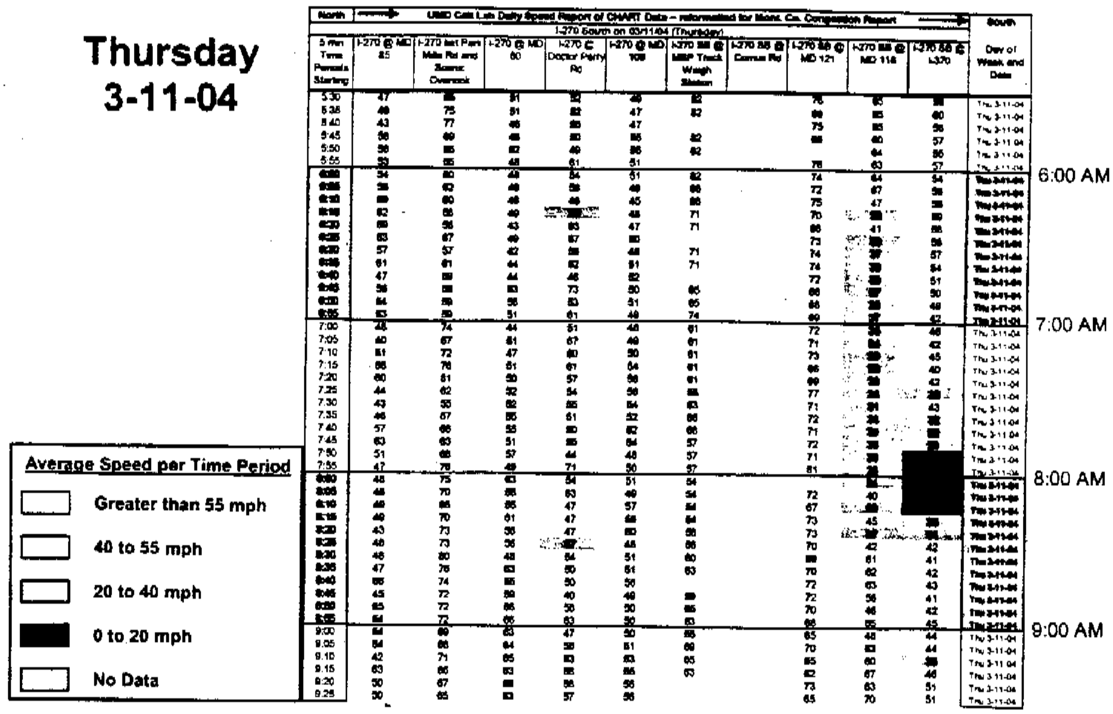


Figure 5.26: Example of AM Congestion Duration based upon CHART Traffic Flow Detectors

I-270 Northbound for PM Peak Period

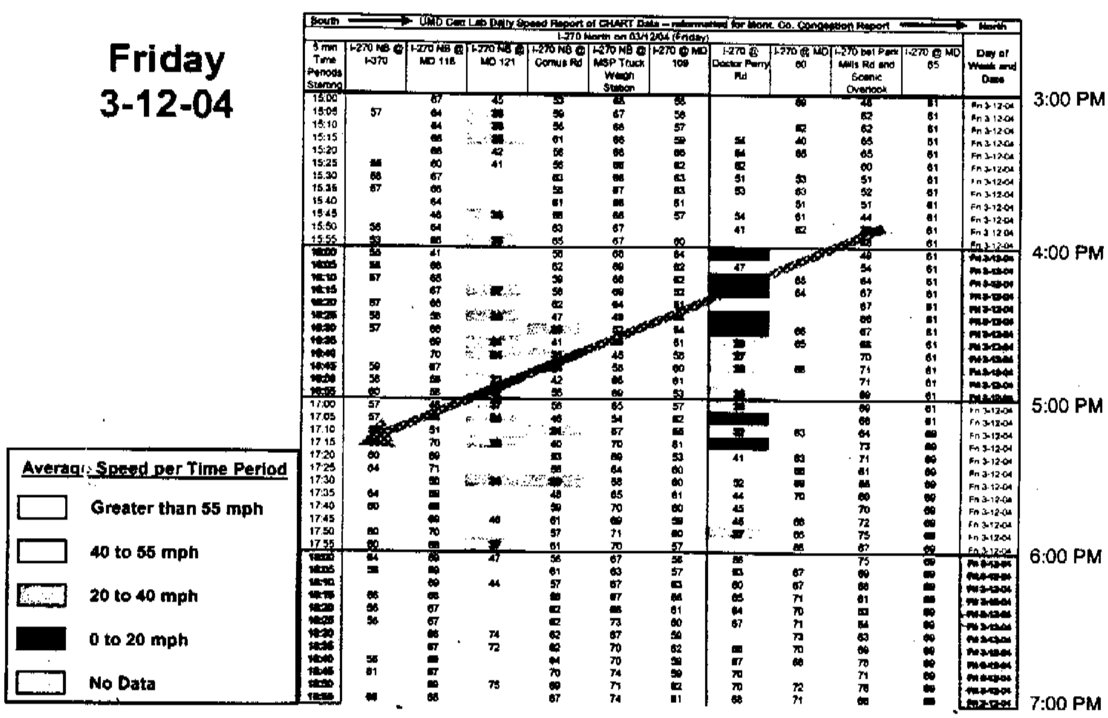


Figure 5.27: Example of PM Congestion Duration based upon CHART Traffic Flow Detectors

6. **Projected Congestion (Forecast Data)**

Short-Range Forecasted (year 2010) V/C ratio and average speeds

A modeling run was performed using the Department's TRAVEL/2 model.[6] This run used the Round 6.3 Cooperative Forecasts for land use, and a base transportation network for the year 2010 consisting of projects contained in the region's Constrained Long Range Plan (CLRP) that are anticipated to be completed by 2010. All data arc for the PM peak hour.

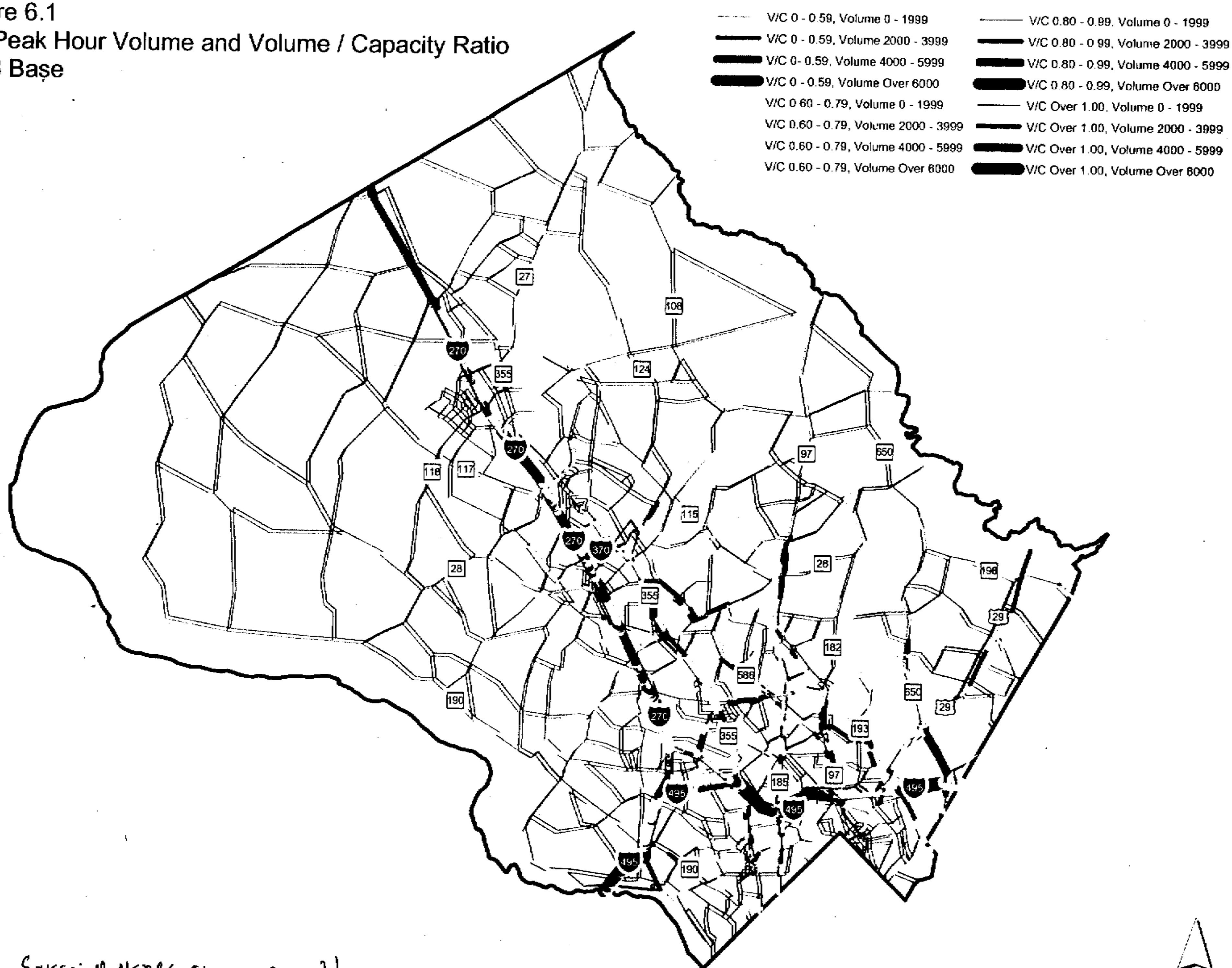
Table 6.1: Countywide Results From 2010 Model Run

	Base (1998 Validation)	2010 CLRP	Chg From Base	% Chg From Base
Total Lane-Miles	2,474	2,633	159	6%
Vehicle-Miles Traveled (000)	1495.2	1778.8	283.6	19%
Vehicle-Hours Traveled (000)	55.0	74.8	19.8	36%
Average Speed (mph)	27.2	23.8	-3.4	-13%
Average V/C Ratio	0.61	0.65	0.04	7%
Lane Miles With V/C 0 to 0.59	1668.7	1521.8	-146.9	-9%
Percent	67%	58%		
Lane Miles With V/C 0.60 to 0.79	597.0	758.1	161.1	27%
Percent	24%	29%		
Lane Miles With V/C 0.80 to 0.99	204.2	337.7	133.5	65%
Percent	8%	13%		
Lane Miles With V/C 1.00 and up	4.3	15.7	11.5	268%
Percent	0.2%	0.6%		

Figures 6.1 and 6.2 show the link volumes and V/C ratios for the base case and the 2010 scenario. Figure 6.3 shows the difference in link volumes between the 2010 scenario and the basc casc. Increases in volume of 750 or more vehicles during the 2010 scenario occur on most of the new or widened roads contained in the scenario, including Midcounty Hwy, Woodfield Rd (MD 124), Great Seneca Hwy (MD 119), and MD 28 / MD 198; however, most of the new or widened roads have V/C ratios below 0.8 over a majority of their length, so they are having little difficulty accommodating the new traffic. Many roads that have no capacity improvements built by the year 2010 have significant congestion, with V/C ratios over several successive links approaching or exceeding 1.0. Included in this group of roads are sections of Randolph Rd,

[6] The Department is in the process of moving to the TRAVEL/3 model, which applies the COG model to a more detailed network for Montgomery County. It is anticipated that next year's report will use forecasts from TRAVEL/3.

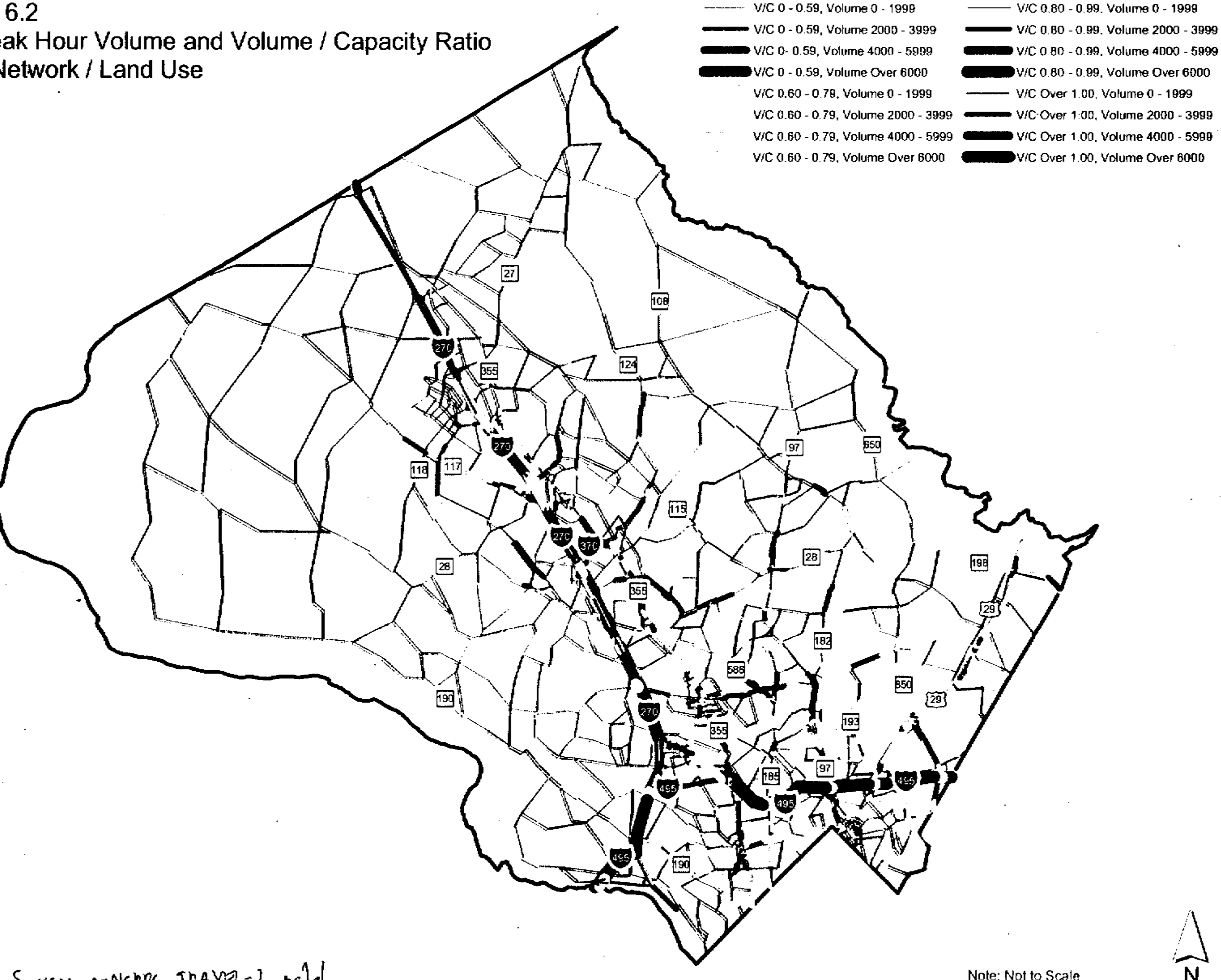
Figure 6.1
PM Peak Hour Volume and Volume / Capacity Ratio
1998 Base



Source: M-NCPPC TRAVEL-2 Model

Note: Not to Scale

Figure 6.2
PM Peak Hour Volume and Volume / Capacity Ratio
2010 Network / Land Use

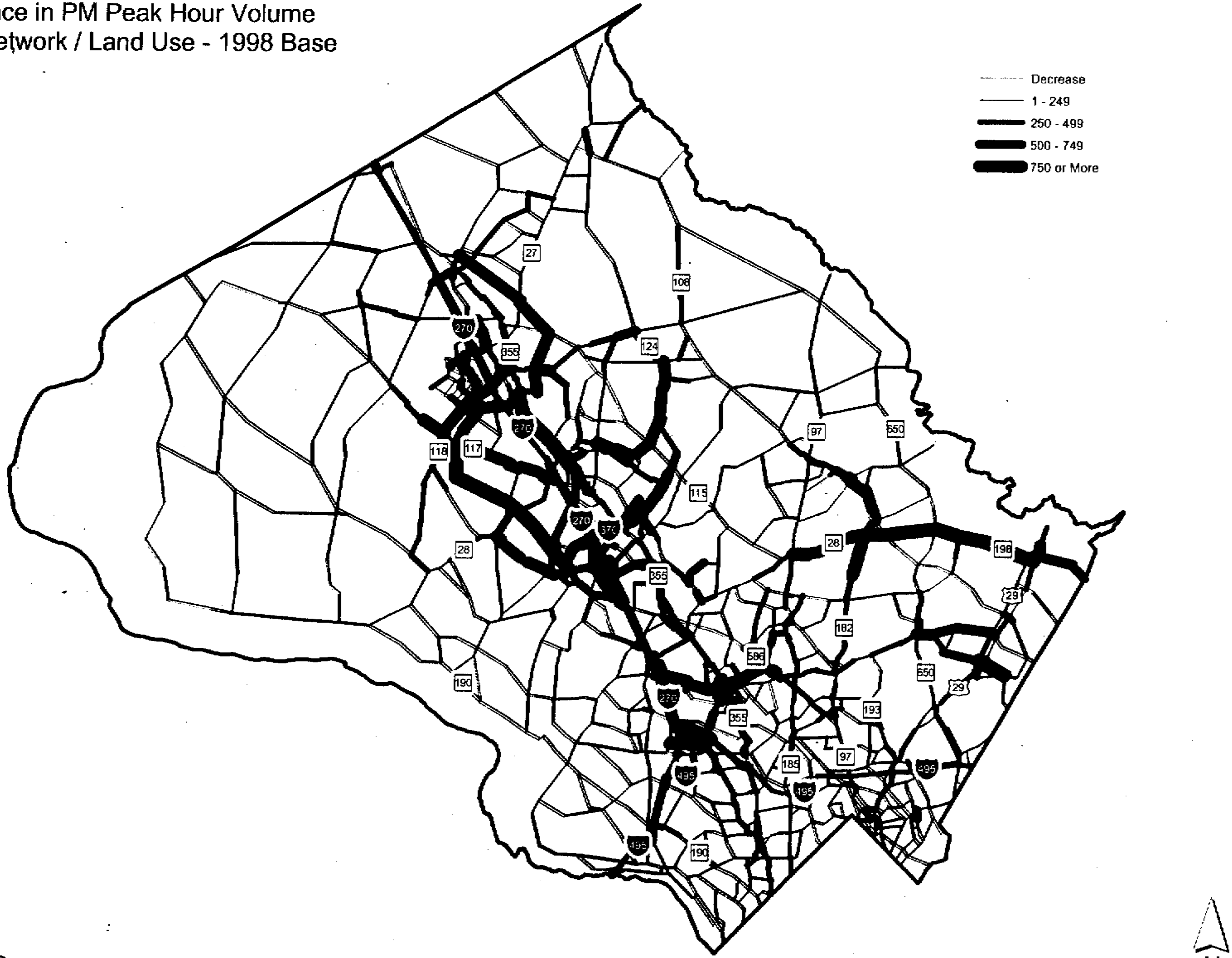


Source: M-NCPPC TRAVEL-2 model

Note: Not to Scale

48

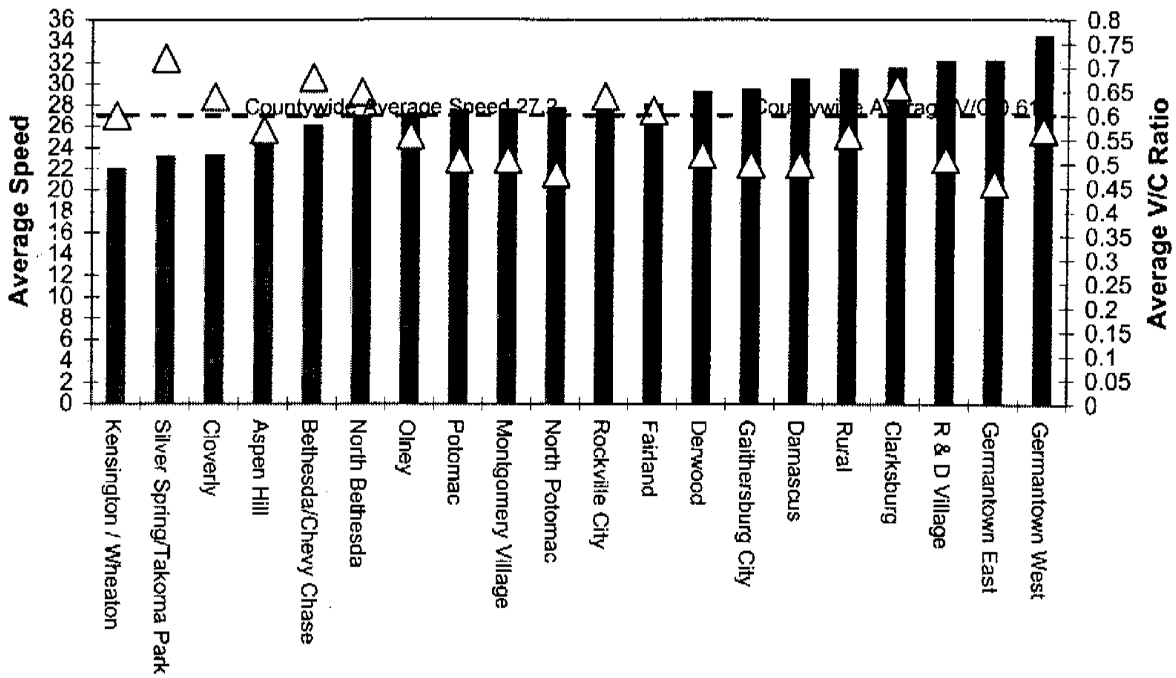
Figure 6.3
Difference in PM Peak Hour Volume
2010 Network / Land Use - 1998 Base



Source: M-NCPPC TRAVEL-2 Model

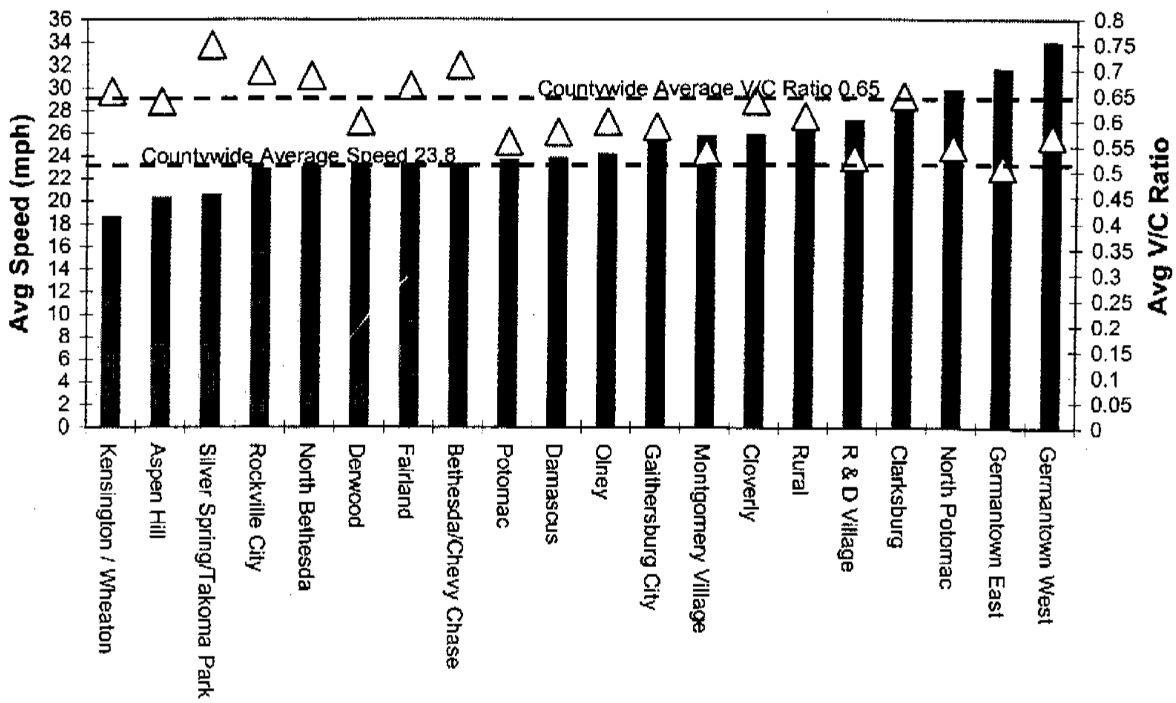
Norbeck Rd (MD 28), Connecticut Ave (MD 185), MD 355, and Georgia Ave (MD 97), and others.

Figure 6.4: Policy Areas Ranked By Average Speed -- Base Case



Figures 6.4 and 6.5 show average speed (bars) and average V/C ratio (points) by policy area. The policy areas are ranked by average speed, so the policy area with the lowest average speed (i.e., where traffic is moving most slowly) is shown to the left of the graph – in the base case, the Kensington / Wheaton policy area.

Figure 6.5: Policy Area Ranked by Average Speed -- 2010 Scenario



The Fairland / White Oak policy area, where grade-separations along US 29 are operating during the year 2010 scenario, experiences a decrease in average speed relative to the base case, but has higher speeds when compared with the rest of the county. The central location of the Kensington / Wheaton Policy Area causes it to receive a significant amount of both north-south and east-west traffic. This factor, along with the relatively small number of improvements in the year 2010 scenario and a lack of freeway mileage, contributes to still having the slowest average speeds of the policy areas. The complete list of forecasting results by policy area may be found in Appendix M.

7. Transportation Improvement Priorities

The project priorities are broken into the following categories:

- Projects of Regional and Statewide Significance
- State Project Priority List
- County Project Priority List

The projects of regional and statewide significance are not ranked. The remaining projects are ranked based on the following methodology:

- Retain the previous year's rankings unless there are *new and significant* observed data on current congestion patterns, current development approvals, or forecast congestion patterns that cause projects to be ranked differently.

- Review and analyze available current observed data on congestion
  - CLVs, AADTs, DASH data, other link volumes, travel time / speed GPS data

- Review and analyze available current data on development approvals
  - Pipeline report, Hansen queries

- Review and analyze recent travel forecasting data
  - Link V/C Ratios, Average Speeds

- Review project progress reports
  - Projects that are further along in facility planning will be ranked higher compared with similar projects

- Based on review of data, recommend changes to project rankings, if applicable

- Based on review of data, recommend new projects for consideration

Projects of regional and statewide significance (not ranked)

Intercounty Connector
I-270 improvements (extension of HOV lanes, managed lanes concept)*
I-495 improvements (managed lanes concept)*

*The County's 12/5/2003 letter to the State ranked HOV on I-270 and I-495 as priorities #11 and 12 for road improvements, respectively. Given the emergence of the managed lanes/HOT concept, it is best to consider them again as major regional unranked projects.

State Project Priority List (last year's ranking in parens)*

Construction Program

1. Rockville Pike (MD 355)/Montrose Parkway (Phase 1): build grade-separated interchange (1)
2. Georgia Avenue (MD 97)/Randolph Road: build grade-separated interchange (2)
3. Woodfield Road (MD 124): widen to 6 lanes from Midcounty Highway to Fieldcrest Road (3)
4. Clopper Road (MD 117): improve intersections from I-270 to Seneca Creek State Park (4)
5. Georgia Avenue (MD 97)/Norbeck Road (MD 28): build grade-separated interchange (5)
6. Georgia Avenue (MD 97): build 2-lane bypass around Brookeville (6)
7. MD 198: widen to 4 lanes from Old Columbia Pike to US 29 (7)
8. Rockville Pike (MD 355)/Montrose Parkway (Phase 2): build bridge over CSX Railroad (8)
9. I-270/Watkins Mill Road Extended (Phase 1): build grade-separated interchange (9)
10. US 29/Fairland Road/Musgrove Road: build grade-separated interchange (10)
11. Woodfield Road (MD 124): widen from Fieldcrest Road to Warfield Road (13)
12. MD 28/198: widen to 4 lanes from MD 97 to Old Columbia Pike (14)
13. Veirs Mill Road (MD 586)/First Street (MD 28): build grade-separated interchange (15)

Development and Evaluation Program (Project Planning)

1. US 29 / Stewart Lane / Milestone Drive: complete facility planning for grade-separated interchange and fund for construction (**)
2. Georgia Ave (MD 97) reconstruction in Montgomery Hills: add to Development and Evaluation Program (1)
3. Veirs Mill Road (MD 586) widening from Twinbrook Pkwy to Randolph Rd: add to Development and Evaluation Program (2a)***
4. Rockville Pike (MD 355)/Cedar Lane grade-separated interchange: add to Development and Evaluation Program (6)
5. Frederick Rd (MD 355)/Gude Drive grade separated interchange: add to Development and Evaluation Program (4)
6. Great Seneca Hwy (MD 119) flyover at Sam Eig Hwy: add to Development and Evaluation Program (2)
7. Rockville Pike (MD 355)/Nicholson Ln grade-separated interchange: add to Development and Evaluation Program (5)
8. River Rd (MD 190) widening from I-495 to DC Line: add to Development and Evaluation Program (**)
9. Ridge Rd (MD 27) from Brink Rd to Damascus Main St (MD 108): add to Development and Evaluation Program (**)
10. Veirs Mill Rd (MD 586)/Randolph Rd grade-separated interchange: add to Development and Evaluation Program (**)
11. I-270/Newcut Rd Extended grade-separated interchange: add to Development and Evaluation Program (**)
12. Frederick Rd (MD 355) widening from 2000 feet south of Brink Rd to future Old Frederick Rd / Clarksburg Bypass: add to Development and Evaluation Program (**)
13. Rockville Pike (MD 355) at Jones Bridge Rd / Center Dr intersection improvements: add to Development and Evaluation Program(**)
14. Frederick Rd (MD 355) reconstruction in Olde Towne Gaithersburg: add to Development and Evaluation Program (3)

*The County's 12/5/2003 letter to the State ranked HOV on I-270 and I-495 as priorities # 7 and 8 for road improvements, respectively. Given the emergence of the managed lanes/HOT concept, it is best to consider them again as major regional unranked projects.
**Project did not appear on previous list.
***The road widening was requested as part of the Bus Rapid Transit study.

County Project Priority List (not previously ranked)

1. Montrose Parkway East: new road from Parklawn Dr to Veirs Mill Rd (MD 586): complete facility planning and fund for construction
2. Chapman Ave, extend road between Randolph Rd and Maple Ave: complete facility planning and fund for construction
3. Midcounty Hwy / Middlebrook Rd, from Montgomery Village Ave to Ridge Rd (MD 27) and from east of Frederick Rd (MD 355) to Midcounty Hwy: complete facility planning and fund for construction
4. Observation Dr, extend road from 800 feet north of Dorsey Mill Rd to Frederick Rd (MD 355): complete facility planning and fund for construction
5. Watkins Mill Rd, extend road from 1400 feet north of Clopper Rd (MD 117) to Frederick Rd (MD 355): complete facility planning and fund for construction
6. Longdraft Rd, widen from 2 to 4 lanes between Quince Orchard Rd (MD 124) and Clopper Rd (MD 117): complete facility planning and fund for construction
7. Goshen Rd South – widen road from Oden'hal Ave to Warfield Rd: complete facility planning and fund for construction
8. Deer Park Dr – replace bridge over CSX and construct master-planned realignment of Oakmont Ave: complete facility planning and fund for construction
9. Ripley District Improvements, build new circulation streets in Silver Spring CBD: complete facility planning and fund for construction
10. Randolph Rd, improvements between Parklawn Dr and Veirs Mill Rd (MD 586): complete facility planning and fund for construction

11. Stringtown Rd East (Section II), build new road 400 feet east of MD 355 to Midcounty Hwy (A-305): add to facility planning candidate list
12. Midcounty Hwy (M-83), study options between Shady Grove Rd and ICC, including grade-separation of Midcounty Hwy / Shady Grove Rd intersection: add to facility planning candidate list
13. Snouffer School Rd from Centerway Rd to Flower Hill Dr – widen to 4 lanes: add to facility planning candidate list
14. Seminary Rd / Seminary Pl / Second Ave / Brookville Rd / Linden Ln intersection safety improvements: add to facility planning candidate list

Analysis / Rationale for Priority Project Lists

State Project Priority List

The rankings for the State construction list are unchanged from last year, except for moving I-270 and I-495 into the unranked regional projects list and promoting the Woodfield Rd widening, MD 28/MD 198 widening, and Rockville Town Center grade-separation to fill in the remaining spaces on the list. The rationale behind the ranking of the projects on the State construction list is well documented and has been determined through a series of discussions among the various county decision-makers. Staff sees little value in reopening debate on these projects when a set of unified county priorities is already on record with MDOT, the delegation, and the Governor.

However, there are changes in the rankings for the State project planning list, which are discussed project by project below in the order in which they appear / are ranked on the list:

Columbia Pike (US 29) @ Stewart / Milestone

The Fairland Master Plan recommends the following construction priority for the interchanges along US 29:

- MD 198/Dustin Rd
- Briggs Chaney Rd
- Randolph Rd
- Tech Rd / Industrial Pkwy
- Stewart Ln
- Musgrove Rd / Fairland Rd
- Blackburn Rd / Greencastle Rd

The Plan also provides the following guidance:

> Monitor the net effects of completing each grade-separation for adverse impacts on upstream and downstream intersections as well as for east-west circulation as compared to the expected operational improvements. Monitoring may change the priorities, the cost-effectiveness of the improvements, or whether other grade-separations should be constructed at all.

The interchanges at MD 198, Briggs Chaney Rd, and Randolph Rd are all currently under construction, with the MD 198 interchange to be completed in spring 2005. The Fairland / Musgrove interchange has its own facility planning study and is the next one to be funded for construction, subject to the results of monitoring of effects of the completed interchanges. The remaining interchanges, Stewart, Tech / Industrial, and Blackburn / Greencastle (now broken into two separate projects) are the combined subject of another facility planning study. Of those four, Greencastle at 40% design has proceed the furthest, in part because some of the design was completed during the facility planning for the MD 198 interchange before the Greencastle interchange was broken off as a separate project.

While a recent turning movement count was not available for the existing intersection with Greencastle Rd, the existing intersection at Stewart / Milestone has the highest CLV of the remaining planned interchange locations and ranked #14 on the list of most congested intersections with CLVs of 1890 AM and 1849 PM. Even though a determination on the necessity of constructing the remaining interchanges along US 29 has not yet been made, the available congestion data indicate that planning for the Stewart Ln interchange should be accelerated. Breaking the project out into a separate facility planning study will ensure that work is completed in time to receive construction funding when it becomes available and if it is determined that the interchanges need to be built.

Georgia Ave (MD 97) Montgomery Hills reconstruct

With an average annual daily traffic (AADT) volume ranging between 80,000 and 90,000 over the past decade, the section of MD 97 between 16th St (MD 390) and I-495 ranks among the highest traffic volumes on an arterial highway *in the State of Maryland.* Redesigning this section of MD 97 to restore the median and allow more peak period turns is a recommendation of the 2000 North and West Silver Spring Master Plan. Signalized intersections along this section of roadway – MD97 @ Seminary Pl, MD 97 @ Seminary Rd / Columbia Blvd, and MD 97 @ MD 390, ranked #48, #32, and #196 on the list of most congested intersections, respectively.

Veirs Mill Rd (MD 586) Widening -- Twinbrook Pkwy to Randolph Rd

This project, which would widen MD 586 to 6 lanes, was not included by the Board but was ranked #2 by both Council staff and the Executive on last year's priority list of State highway projects to move into project planning. The project was included in the final letter of transmittal to the State delegation but was envisioned as part a larger study of Bus Rapid Transit (BRT) in the MD 586 corridor. The 2003 AADT along MD 586 south of Norbeck Rd (MD 28) was 37,000 vehicles. This section of MD 586 is forecast to experience congestion during the year 2010, with the section between the Montrose Parkway and Randolph Rd is forecast to operate at LOS F in both directions. Volumes on the surrounding network are also forecast to increase.

Rockville Pike (MD 355) @ Cedar Ln / W Cedar Ln

This intersection has the highest CLV of the 320 sampled for the report – 2131 AM / 2391 PM, and is consistently among the most congested intersections in the county. The congestion at this location inhibits access to the National Institutes of Health (NIH) and National

Naval Medical Center (NNMC) campuses, as well as the Bethesda CBD and Friendship Heights CBD located further south on MD 355. The 1990 Bethesda / Chevy Chase Master Plan reported at that time that the intersection was operating at LOS F, and recommended a grade-separated interchange "be retained as a possible long-range project."

Frederick Rd (MD 355) @ Gude Drive

This intersection ranked eighth on the list of most congested intersections, with a CLV of 2028 AM / 2017 PM. In the 2001 City of Rockville Master Plan, it ranked fourth in the top ten most congested intersections in the city, operating at 98% of capacity. The Rockville Master Plan recommends a grade separation for this location, which will become part of the main east-west route through the City after the MD 28 designation is moved to Gude Drive in the future.

Great Seneca Hwy (MD 119) Flyover at Sam Eig Hwy

Recent 2004 turning movement counts were recently received for this location and have not yet been loaded into the digital intersection database, but the CLV of 1839 PM (1166 AM) would rank this location in the top 25 on the list of most congested intersections once loaded into the database. In the evening, most traffic coming from I-370 and I-270 down Sam Eig goes onto northbound MD 119, and the proposed westbound to northbound and southbound to eastbound flyover ramp would take this critical movement out of the intersection and address the congestion problem. The flyover ramp is recommended in the 1990 Shady Grove Study Area Master Plan.

Rockville Pike (MD 355) @ Nicholson Ln

This intersection had an AM CLV of 1069 and a PM CLV of 1582, ranking it number 66 on the list of most congested intersections. Even though the CLV is still within the White Flint policy area standard of 1800, 12% of the remaining non-residential pipeline and 6% of the remaining residential pipeline will be constructed in White Flint or the surrounding North Bethesda policy area, and the intersection will not be able to efficiently handle the resulting traffic.

River Rd (MD 190) widening from 4 to 6 lanes, I-495 to DC Line

The 1990 Bethesda / Chevy Chase Master Plan and the 1982 Westbard Sector Plan recommend that River Road in this section ultimately have 4 to 6 lanes. The entire length is currently built at 4 lanes and experiences congested conditions. The section between the Beltway and Goldsboro Rd (MD 614) had a 2003 AADT of just under 60,000; between MD 614 and the District of Columbia line the AADT decreases to 40,000 as people use Goldsboro to access the Bethesda CBD and to travel on Massachusetts Ave (MD 396) into Washington (some of those travelers also cut-through on Little Falls Parkway. The intersections at the Holton Arms School, Beechtree / Nevis, Wilson Ln (MD 188), and Whittier Blvd all have morning peak hour CLVs that exceed their LATR standard; the intersection with MD 188 ranks #28 on the list of most congested intersections. Those intersections have evening peak hour CLVs that are within

80% of the LATR standard, and several other intersections down to the District line are approaching the LATR standard as well.

Ridge Rd (MD 27) – Midcounty Hwy to Damascus Town Center

The forthcoming draft of the Damascus Master Plan recommends keeping this stretch of Ridge Rd at 2 lanes but also investigating additional turn lanes and operational improvements to address current congestion levels on the roadway. The intersection of Ridge Rd and Bethesda Church Rd ranked #43 on the list of most congested intersections with CLVs of 1565 AM and 1667 PM, both of which exceed the policy area standard of 1450. The intersection of Ridge Rd and Kings Valley Rd ranked #65 on the list of most congested intersections with CLVs of 1599 AM and 1322 PM. The intersection of Ridge Rd and Sweepstakes Rd ranked #124 on the list of most congested intersections with CLVs of 1301 AM and 1369 PM, both of which are within 90% of the policy area standard. The 2010 forecasts show most of the links along this section of roadway operating with V/C ratios between 0.80 and 0.99, and traffic volumes along Ridge Rd will increase as more development is added in Clarksburg.

Veirs Mill Rd (MD 586) @ Randolph Rd

This interchange, which was recently added to the Kensington / Wheaton Master Plan through an Amendment to the Master Plan of Highways (Transportation), is needed in conjunction with the widening of Veirs Mill Rd (MD 586) from Twinbrook Pkwy to Randolph Rd to address current congestion at the intersection and future traffic growth. The intersection currently ranks #61 on the list of most congested intersections, with CLVs of 1613 AM and 1380 PM. The recent Master Plan of Highways amendment states:

> SHA has not yet identified the type of interchange and amount of right-of-way that would be needed. Given the high density of land uses around that intersection, every effort should be made to make the interchange as compact as possible.

Beginning a facility planning study now would also these issues to be sufficiently resolved in time to move toward construction while keeping schedule with both Montrose Parkway East and widening of MD 586.

I-270 @ Newcut Rd Extended

This new interchange in Clarksburg is part of the menu of highway improvements under consideration in the I-270 / US 15 DEIS. Originally the developer of the Cabin Branch project was slated to fund this project to meet staging ceiling requirements under Policy Area Transportation Review. Since the recent revisions to the AGP removed the PATR test, the developer is no longer required to fund this project to move forward, and the project must be funded through other means. The interchange is crucial to east-west circulation in Clarksburg and not overburdening the existing interchange at Clarksburg Rd (MD 121) and the surrounding local street network once the residential pipeline development (23% of the remaining county total) The intersection at MD 121 and MD 355 currently ranks #71 on the list of most congested intersections, with a CLV of 1569 AM and 1525 PM (both of which exceed the congestion standard of 1450). This project should be broken out from the ongoing I-270 study and have its own facility planning study.

MD 355 @ Jones Bridge / Center

This intersection, while not recommended for a grade-separation in the current master plan, merits special consideration because of its high congestion levels. It is the second most congested intersection on the list in the report, with CLVs of 1497 AM and 2299 PM. DPWT recently completed a series of spot improvements at this location in March 2004 a more recent traffic count would illustrate the effects of that work; however, the DPWT project envisioned a second phase of improvements that have been put on hold pending changes in local circulation patterns to be implemented by NIH. Future improvements cannot proceed until NIH determines their circulation, since the intensity of traffic flow on the Center Dr leg serving NIH will impact the optimal configuration and operation of the intersection. Nonetheless, improvements need to be completed as soon as possible to address the existing congestion levels, and state funding may facilitate this process.

County Project Priority List (not previously ranked)

Montrose Parkway East

This project is the new eastern gateway to the North Bethesda and White Flint policy areas, both of which are slated to receive significant amounts of future development. It will provide relief to Randolph Rd, which showed congested conditions during GPS travel time runs and operates with V/C ratios approaching 1.0 in the model run for the base case. The intersection of Randolph Rd and Gaynor Rd ranked #15 on the list of most congested intersections, with CLVs of 1259 AM and 1885 PM. The intersection of Randolph Rd and Lauderdale Dr ranked #41 on the list of most congested intersections with CLVs of 1388 AM and 1663 PM.

Midcounty Hwy (M-83) Phase I – Montgomery Village Ave to MD 27

The Clarksburg Policy Area contains 23% of the remaining residential pipeline. When those residents travel to destinations in the I-270 corridor, they will add to the already congested facilities crossing Seneca Creek: I-270 and Frederick Rd (MD 355), which showed significant congestion in the GPS-based travel time and speed data. The master-planned Midcounty Hwy on the east side of I-270 provides a parallel facility similar to Great Seneca Hwy (MD 119) on the west side of I-270.

Observation Drive extension

This facility provides a north-south alternative to I-270 and Frederick Rd (MD 355) between Germantown and Clarksburg, where both facilities currently experience congested conditions and both residential and non-residential growth will continue. 23% of the remaining residential pipeline development is located in Clarksburg. 7% of the remaining non-residential pipeline development is located in the Germantown East Policy Area. The intersections of MD 355 at

Clarksburg Rd (MD 121), MD 355 at Ridge Rd (MD 27), MD 355 at Darnestown-Germantown Rd (MD 118), and MD 355 at Middlebrook Rd ranked #68, #81, #167, and #34 respectively on the list of most congested intersections.

Chapman Ave (Randolph to Maple)

This project is needed complete the master-planned grid street network in North Bethesda and White Flint to disperse traffic and divert trips from Rockville Pike (MD 355) in anticipation future development: 10% of the remaining residential pipeline and 12% of the remaining non-residential pipeline is located in the North Bethesda and White Flint Policy Areas. Most of the nearby intersections along MD 355 and Montrose and Randolph Rds in the area have current CLVs that are within 60 to 80% of their congestion standards or worse.

Watkins Mill Road extended

This project works in conjunction with the State's project to build a grade-separated interchange at Watkins Mill Rd and I-270 to provide a new access route to and across I-270 and provide relief to both Montgomery Village Ave and Clopper Rd (MD 117), the main access routes to I-270 in the area. The 2003 AADT along Montgomery Village Ave between I-270 and Frederick Rd (MD 355) was 81,000 vehicles. Both existing routes currently experience congestion, as shown in the GPS travel time and speed data, and are forecast to have V/C ratios approaching 1.0 in the year 2010.

Longdraft Rd Widening (Quince Orchard to Clopper)

This project will provide parallel capacity to relieve Quince Orchard Rd (MD 124), where current CLVs at the intersection of Bank St / North Rd and the intersection of Great Seneca Hwy were between 80% and 100% of the congestion standard.

Snouffer School Rd Widening (Centerway Rd to Flower Hill Way)

Snouffer School Rd has 4 through lanes from Woodfield Rd north to Flower Hill Way. The developer of the Airpark North project will widen Snouffer School Rd to 4 through lanes as a condition of their plan, which was approved when Policy Area Transportation Review was still in effect. Moving this small project into the facility planning candidate list will obviate the creation of an artificial bottleneck in the road when the developer-funded widening moves forward. The upstream intersection of Snouffer School and Centerway Rd ranked #94 on the list of most congested intersections, with CLVs of 1483 AM and 844 PM

Goshen Road South (Oden'hal to Warfield)

This project provides improved access to Gaithersburg and an alternative to Woodfield Rd. The intersection of Goshen Rd and Midcounty Hwy ranked #151 on the list of most congested intersections and has CLVs exceeding 80% of the congestion standard. The intersection of Goshen Rd and Centerway Rd ranked #169 on the list of most congested intersections and also CLVs exceeding 80% of the congestion standard.

West Deer Park Rd Bridge (including Oakmont Ave realignment)

This project provides an important safety improvement and improves connectivity between Shady Grove and Gaithersburg, but since it provides little to no congestion relief it is ranked lower relative to other projects that are already in facility planning

Ripley District Improvements (SS CBD)

This project provides local circulation improvements in the Silver Spring CBD and facilitates growth in the County's downtown area by allowing redevelopment of an area that previously had limited access due to a lack of a street grid. However, it also provides little to no congestion relief to an area that is relatively uncongested to begin with; therefore it also moves down in the rankings.

Randolph Road Improvements Phase I (Parklawn to Viers Mill)

The improvements under study do not add any capacity; thus the project has been ranked lower.

Stringtown Rd East (Section II), 400' east of Frederick Rd (MD 355) to Midcounty Hwy (A-305)

This project was bumped from the facility planning candidate list during the last CIP update. It is needed for east-west circulation in Clarksburg and to provide access to the town center. Because much of the development planned for Clarksburg is just starting to be constructed, most of the available observed data does not show congested conditions. However, the intersection of Frederick Rd (MD 355) and Ridge Rd (MD 27) ranks #68 on the list of most congested intersections, with CLVs of 1569 AM and 1525 PM, both of which exceed the policy area standard. 27% of the remaining residential pipeline development is located in Clarksburg.

MD 355 widening Brink to Clarksburg Bypass (old Frederick Rd)

This project is also needed to support the pipeline development and traffic growth in Clarksburg, but it is for north-south circulation, as opposed to Stringtown Rd, which is needed for east-west circulation.

Midcounty Hwy (M-83) from Shady Grove Rd to ICC, including study of grade-separated interchange at the intersection of Midcounty Hwy and Shady Grove Rd

The existing intersection of Midcounty Hwy and Shady Grove Rd ranks #10 on the list of most congested intersections, with CLVs of 1961 AM and 1242 PM. The intersection will become more congested once the additional traffic from a fourth (westbound) leg is added if the extension of Midcounty to the ICC is constructed. The CLV in the existing configuration merits study on its own, but studying the entire corridor to determine the best option given the uncertainties regarding the ICC and the northern extension of Midcounty Hwy constitutes the most prudent course of analysis and was recommended in the recent draft of the Shady Grove Study Area Master Plan.

Seminary Rd/Seminary Place/Second Ave/Brookville Rd/Linden Ln -- Intersection Improvement

This is primarily a safety improvement that does not provide direct congestion relief and therefore is ranked lower.

8. Items to Add in Next Report

This report is by no means exhaustive. Rather, it is the first in a series of annual reports that will transition the Board and Council into a new role: congestion tracking. However, there is a balancing act between collecting data to meet the regulatory requirements of the APFO and collecting data for effective congestion monitoring. Congestion monitoring by its very nature is extremely data intensive. The ability to report on congestion and development approvals is primarily a function of data availability, which is in turn a function of resource availability and data collection policies. Besides widely expanding the spatial and temporal extent of the existing datasets presented in this ADAC report, other data and potential measures under consideration by staff for next year's ADAC report include:

- Including the transit system and in the investigation and analysis of congestion
- Examining safety measures and the relationship of safety to congestion
- Expanding use of the State's database of average annual daily traffic (AADT)

Staff looks forward to discussing and receiving guidance from the Board and Council on ways to enhance and improve the ADAC report for next year.