National Capital Region Transportation Planning Board
777 North Capitol Street, N.E., Suite 300, Washington, D.C. 20002-4290 (202) 962-3310 Fax: (202) 962-3202 TDD: (202) 962-3213

MEMORANDUM

TO: Travel Management Subcommittee

FROM: Andrew J. Meese, AICP
Systems Management Planning Director

DATE: May 21, 2008

SUBJECT: Revised Draft 2008 Congestion Management Process (CMP) Technical Report

---

Please find attached a revised draft of the 2008 Congestion Management Process (CMP) Technical Report. It is identical to the version distributed to the Commuter Connections Subcommittee for its May 20 meeting, excepting that for ease of your review, this version contains "track changes" markings comparing it to the version provided to you for the April 15 Travel Management Subcommittee meeting.

As noted previously the draft Technical Report represents the third of three major CMP activities for 2008:

1. The CMP components [www.mwcog.org/clrp/elements/cmp] of the 2007 Constrained Long-Range Plan (CLRP), adopted by the TPB in January 2008
2. Materials for Congestion Management Documentation for the upcoming 2008 CLRP and FY2009-2014 Transportation Improvement Program, accepted by the TPB Technical Committee at its April 4, 2008 meeting
3. [New] The Draft 2008 CMP Technical Report.

The CMP Technical Report provides detailed information on the various aspects of the CMP, including the extent of congestion and the demand management and operational management strategies considered and undertaken in the region to address congestion. It is positioned as a support document to the CMP as included in the 2007 CLRP (noted as component 1 above).

This draft report is being provided to the Travel Management Subcommittee for review and comment in conjunction with your May 27 meeting, along with review and comment that is taking place by the Commuter Connections Subcommittee, the Management, Operations, and Intelligent Transportation Systems (MOITS) Technical Subcommittee, and the TPB Technical Committee. A further revised draft report is to be provided to the TPB Technical Committee for review at its June 6 meeting and approval at its June 27 meeting (scheduled in lieu of a July Technical Committee meeting since the normal date would fall on July 4).

To meet the above schedule, please provide any comments you have to me **by May 28, 2008** by email to ameese@mwcog.org, by fax to (202) 962-3202, or by mail.

Thank you for your time and attention to this document.

2008
CONGESTION MANAGEMENT PROCESS (CMP)
TECHNICAL REPORT

PRELIMINARY DRAFT

(May 5, 2008)

Deleted: April 11

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS
NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

Draft – May 2008

Deleted: April

TABLE OF CONTENTS

Deleted: April

1. EXECUTIVE SUMMARY

Deleted: ¶

To be completed upon completion of report.

Deleted: April

2. INTRODUCTION

2.1 Need for a CMP Technical Report

This report presents a technical review of the Congestion Management Process (CMP), as addressed by the Transportation Planning Board (TPB) of the Metropolitan Washington Council of Governments (COG).

The Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requires that metropolitan transportation planning processes include a Congestion Management Process (CMP). The CMP is similar to the previous requirements for a Congestion Management System (CMS), except that the change in name and acronym of CMS to CMP is intended to place a greater emphasis on the planning process and environmental review process, while maintaining and developing effective management and operation strategies. Federal regulations state that Metropolitan transportation planning areas with a population of 200,000 or more, designated as a Transportation Management Area (TMA), are required to have a CMP, and that long-range transportation plans developed after July 1, 2007 must contain a CMP component. Also, in metropolitan planning areas classified as non-attainment for ozone and Carbon Monoxide (CO) under the Clean Air Act, no single occupant vehicle (SOV) capacity expanding project can receive federal funds unless it shows that the CMP has been considered.

Federal regulations state that:

"The transportation planning process shall address congestion management…

…through a process that provides for safe and effective integrated management and operation of the multimodal transportation system…

…based on a cooperatively developed and implemented metropolitan-wide strategy…

…of new and existing transportation facilities…

…through the use of travel demand reduction and operational management strategies."[1]

Additionally, the federal certification of the TPB planning process, dated March 2006, addressed CMS/CMP with the following recommendation:

[1] "Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule," *Federal Register*, Vol. 72, No. 30, February 14, 2007, § 450.320 (a) page 7274 – emphasis added.

Deleted: April

> *The TPB should develop a comprehensive description of a regional Congestion Management System to demonstrate its application at critical stages of the metropolitan planning process, including the development of the CLRP, TIP, and the development of major projects and policies. The description should be part of the next update to the CLRP or a stand-alone document that is completed in one year from the issuance of this report. The description can build on key elements in place, including monitoring and evaluating alternatives to new capacity (such as for the Mixing Bowl Springfield Exchange and the Woodrow Wilson Bridge) and the range of congestion related strategies (such as the Commuter Connections Program).*[2]

The Congestion Management Process is intended to operate within or in conjunction with the planning process, which is the focal point for consideration of other factors, such as Clean Air Act requirements, transit, funding, land use scenarios, and non-motorized alternatives. The planning process also leads to decisions on which projects are programmed and implemented. The CMP will provide better information to decision-makers, such as the TPB, who consider transportation planning in our region.

This report is a step in the CMP, which is an ongoing activity. Just as there are many causes of congestion, there are also many solutions. While this report documents the region’s recent CMP activities, the concept of addressing congestion and meeting regional goals will continue to be an integral part of the metropolitan planning process.

2.2 The Institutional Context of the CMP in the Washington Region

The federally designated Metropolitan Planning Organization (MPO) for the region is the National Capital Region Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments (MWCOG). The TPB is charged with producing long-range transportation plans and transportation improvement programs (TIPs) for the region, which includes the District of Columbia as well as portions of the States of Maryland and Virginia. The members of the TPB include representatives from state, county, local government agencies, as well as the Washington Metropolitan Area Transit Authority (WMATA), non-voting members of the Metropolitan Washington Airports Authority, and federal agencies.

The TPB is advised by a standing Technical Committee for transportation. The TPB technical committee oversees details of transportation planning and engineering studies and efforts required to support the region’s transportation decision-making process. The Technical Committee has a number of standing subcommittees that focus on particular aspects of the transportation planning process, such as aviation, bicycle and pedestrian planning, regional bus planning, travel forecasting, transportation safety, transportation scenarios, and travel management.

The TPB Technical Committee is the oversight committee for the CMP, as the committee that guides long-range plan activity and oversees interaction of the various subcommittees. The Technical Committee is also advised by a number of the standing subcommittees who have

---

[2] *Transportation Planning Certification Summary Report* (March 16, 2006). Prepared by Federal Highway Administration and Federal Transit Administration. Page 10.

Deleted: April

knowledge about particular aspects of the CMP (for example, MOITS, Commuter Connections, and Travel Management).

Previous CMS/CMP activities of the region were steered by a CMS Task Force, developed in the mid-1990s. Congestion Management System reports were developed in FY 1995 and FY 1996. However, a decision was then made to fully incorporate congestion management information into the CLRP rather than having a stand-alone document, in order to achieve continuity between the CMS and the CLRP. As such, over the past several years the CMS/CMP process has included data collection and analysis through compilation of information from implementing agencies associated with projects submitted to the CLRP and TIP, and through consideration of management and operations strategies under the Management, Operations, and Intelligent Transportation Systems (MOITS) Policy Task Force and MOITS Technical Subcommittee. This report represents a return to the practice of developing a separate Congestion Management document.

3. WHERE CONGESTION OCCURS OR WILL OCCUR IN THE WASHINGTON METROPOLITAN AREA

3.1 Congestion of the Metropolitan Area's Major Highways

The regional planning process currently has two approaches for congestion monitoring on major highways: an aerial survey approach for freeways and a travel time/speed monitoring system for arterial highways. Identifying congested locations on our major highways is important in providing a regional overview of where and why congestion is occurring.

3.1.1 Freeways

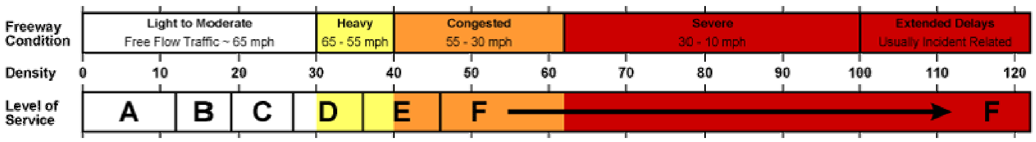
Freeways comprise the critical backbone of the region's roadway system, and provide the most important indicator of our overall system. Generally they are used for longer distance travel and/or people opting for the most direct route between two points. They are different from arterials in that they have fewer access points, no at-grade intersections, more lanes, and generally can accommodate higher speeds. Therefore, the congestion on freeways can be characterized different than that on arterials and should be measured differently.

The TPB's regional freeway monitoring program is based upon comprehensive aerial photography of the region's freeways. The TPB has contracted with Skycomp, Inc. to conduct a systematic aerial study of regional freeway congestion. Peak period congestion is monitored on a once-every-three-years cycle during the AM and PM peak periods, off-peak and weekend congestion is monitored once every five years, and there are periodic incident-related monitoring efforts.

The program and analysis provide a wealth of information on the region's freeways, including the overall conditions of freeways, specific congested locations, trends over time, and identification of factors associated with the congested conditions[3]. Level of Service (LOS) is

[3] *Traffic Quality on the Metropolitan Washington Area Freeway System*, Spring 2005 report. Prepared by: Skycomp, Inc. (Columbia, Maryland). http://www.mwcog.org/uploads/committee-documents/u1paXFg20060216110515.pdf

used to indicate the extent of congestion. LOS "A" reflects generally free-flow conditions, and levels "E" and "F" reflects the most severe congestion with extended delays, as illustrated in the following diagram.[4]



The information from the 2005 freeway monitoring program can provide insight into the reasons for this congestion, and on overall patterns of mobility in the Washington region.

The Overall Congestion Picture:

Figure 1 and Figure 2 below illustrate the freeway locations throughout the region with the most severe congestion in the morning and evening, respectively[5]. From these figures a few different things are evident in terms of morning and evening congestion during rush hours.

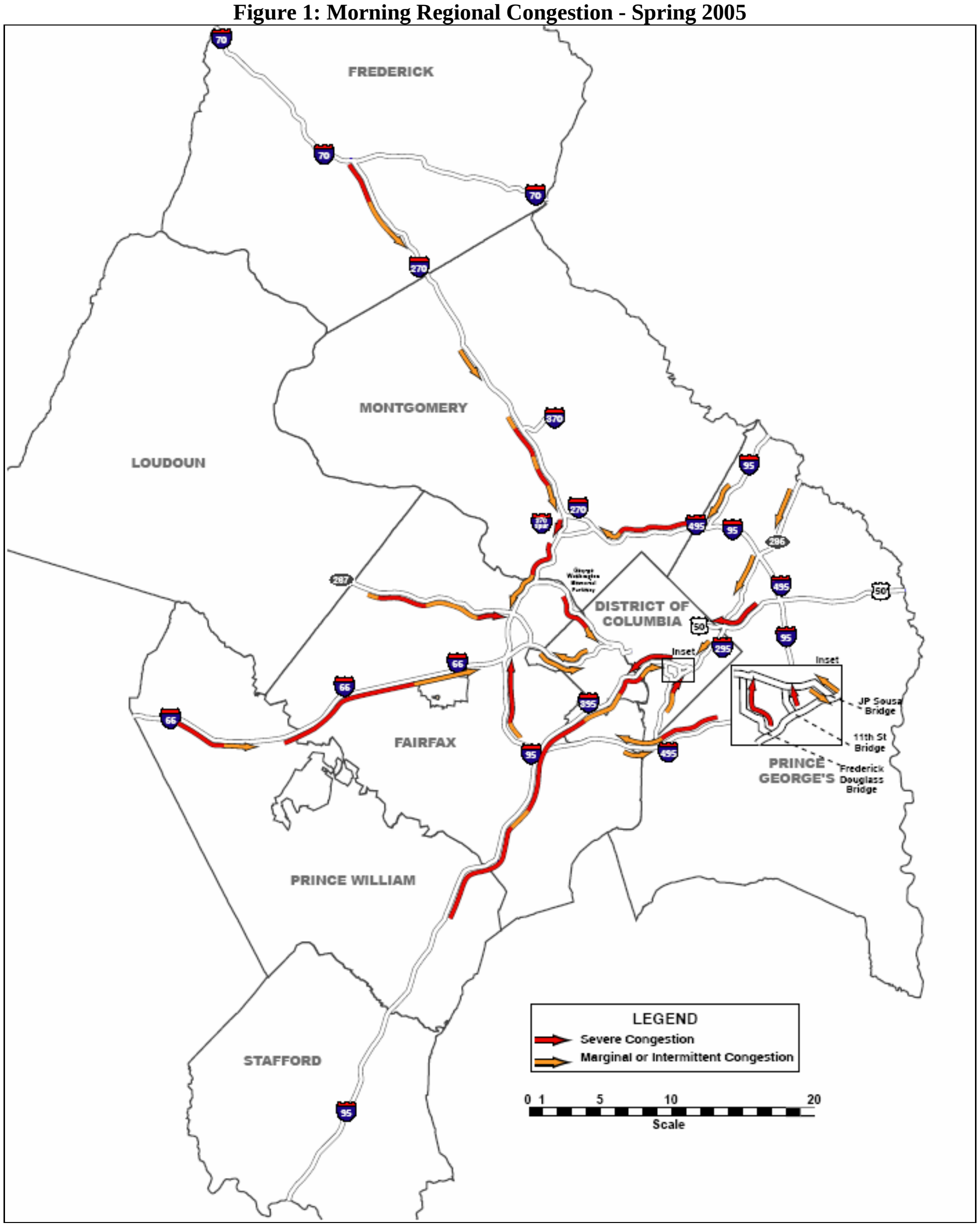
The Washington region is like many other urban areas in that the region continues to grow and more people are choosing to commute longer distances to their jobs in and around the Beltway, closer to the inner core. This is one cause of congestion on some segments of I-66, I-95, and VA 267 in Virginia, I-395 and I-295 in the District of Columbia, and I-270, I-95, and MD 295 in Maryland. The same segments experience congestion in the opposite direction during the evening. "Reverse" congestion (i.e. congestion occurring from traffic moving away from the city center during peak period travel) is also occurring.

In addition to the "in-out" movement there is also an "east-west" pattern of mobility. The Washington region is divided in terms of jobs and housing, with generally more job growth on the west. As a result, many people are commuting from the eastern Maryland suburbs, to the western Maryland suburbs or across District of Columbia to the Virginia suburbs for work. Using Figure 1 as an example, I-495 both north and south of the District of Columbia experiences west-bound congestion, in addition to I-95, MD/DC 295, and I-270 leading to the Capital Beltway. Figure 2 shows evening congestion occurring in the exact opposite direction, particularly on the I-495 Inner Loop; the cause of which could be attributed to commuters returning home.

[4] This is Level of Service (LOS) based on the *2000 Highway Capacity Manual*.
[5] The morning times of coverage were 6:00 – 9:00 AM outside the Capital Beltway and 6:30 – 9:30 AM inside the Capital Beltway. The evening times were 4:00 – 7:00 PM inside the Capital Beltway and 4:30 – 7:30 PM outside the Capital Beltway.

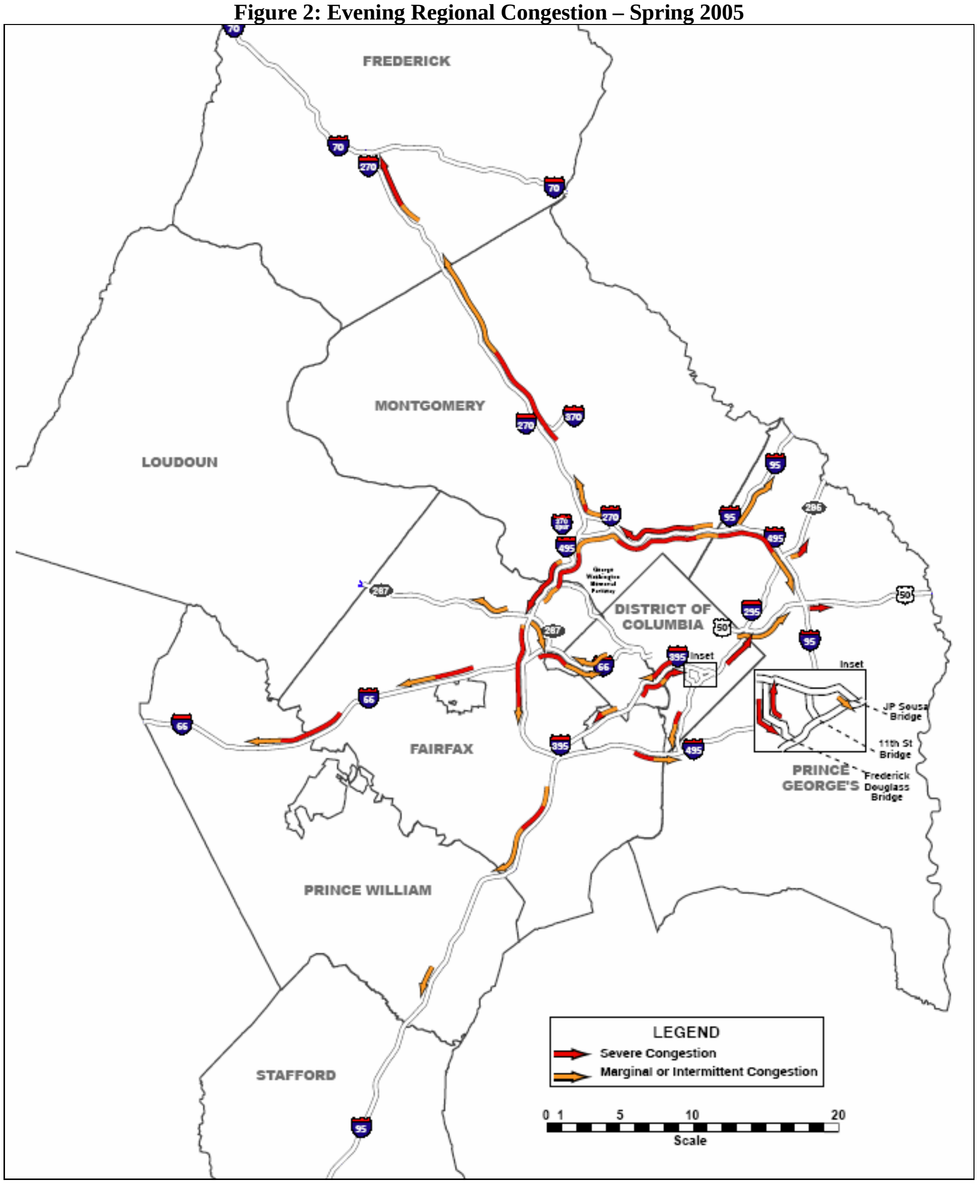
Deleted: April

Figure 1: Morning Regional Congestion - Spring 2005



Deleted: April

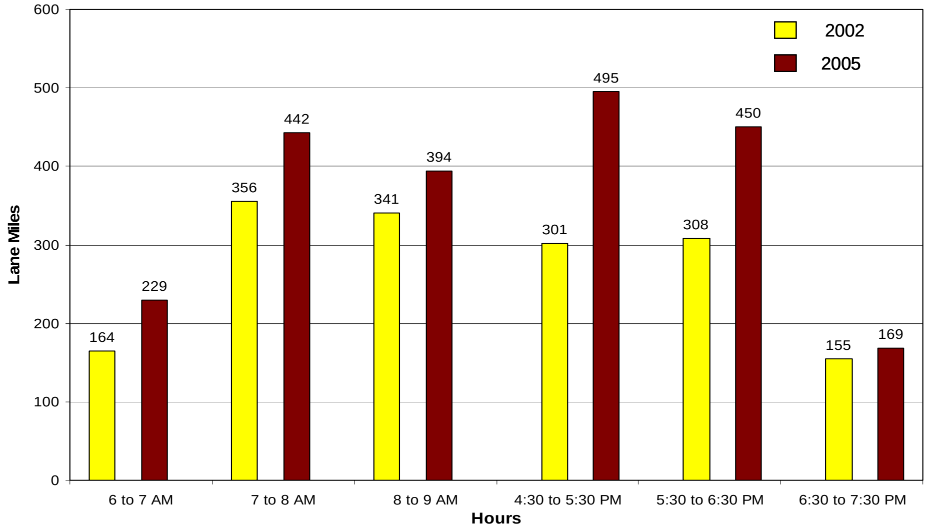
Figure 2: Evening Regional Congestion – Spring 2005



Deleted: April

There has been an increase in the lane miles found to be operating at LOS "F" over the past few years. When comparing the 2005 and 2002 surveys, it was found that lane miles with LOS "F" increased in every hour in the morning and evening peak periods. The largest increase from 2002 was in the PM peak hours, and, more specifically, during the 4:30 – 5:30 hour.

Figure 3: Lane Miles at LOS F - 2002 and 2005



(Density > 45 passenger cars per mile per lane with 2000 total lane miles)

The concept of "peak spreading" is also occurring in our region – when congestion occurs on the "shoulders" of peak congestion periods, thus resulting in longer periods of AM and PM congestion. Peak spreading can be passive in that there is a natural increase in the duration of peak period travel as congestion worsens, or it can be active, where travelers change their travel behavior (such as by telecommuting or flex scheduling) to avoid peak congestion periods.

Location-specific Congestion:

Congestion is often location specific in nature. It is caused by bottlenecks at specific places, exacerbated by road construction or changes in nearby land use, and thus can improve or worsen quickly. Congestion generally is worsening throughout the region. However, congestion is not getting worse at every location; there are areas that have shown improvement when compared to data of previous years. Comparing the most recent survey (2005) to the previous four surveys helps identify major trends or changes in traffic conditions at specific locations. In some cases, changes could be attributed to the absence or presence of construction, or a decline in level of service can be attributed to an increase in demand. In other cases, added capacity was the reason for improved traffic flow. Still, in other cases, no reason could be linked to why traffic

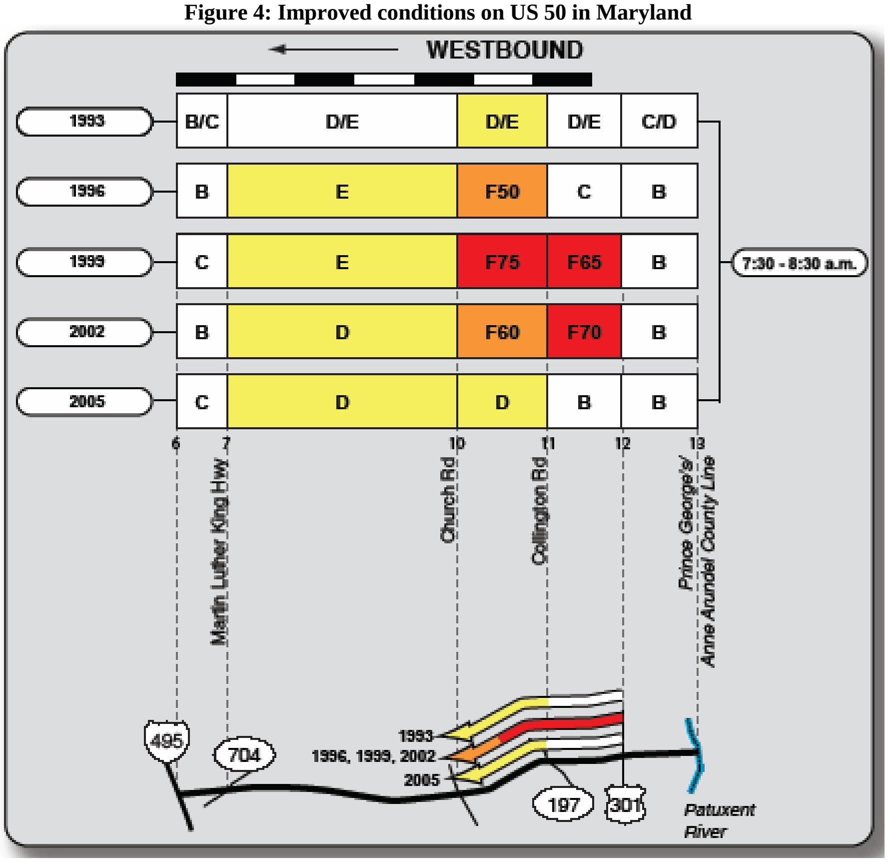
Deleted: April

conditions improved or declined from previous years. The following examples from the 2005 Report illustrate this:

Improved Conditions:

- ***US 50 in Maryland*** **-** between the Anne Arundel / Prince George's County Line and the Church Road overpass.
  - **Time period**: Morning (7:30 – 8:30 AM)
  - **Change in LOS:** The 1993 LOS data indicated mostly free-flow conditions, while the 1996 – 2002 data indicated mostly congested conditions in the vicinity of the interchanges at US 301 and MD 197. The roadway showed improvement in LOS after the 2005 survey.
  - **Cause of change:** Addition of added capacity, in the form of an HOV lane. Prior to the survey in 2005, an HOV lane was added to US 50 in each direction (Figure 4).

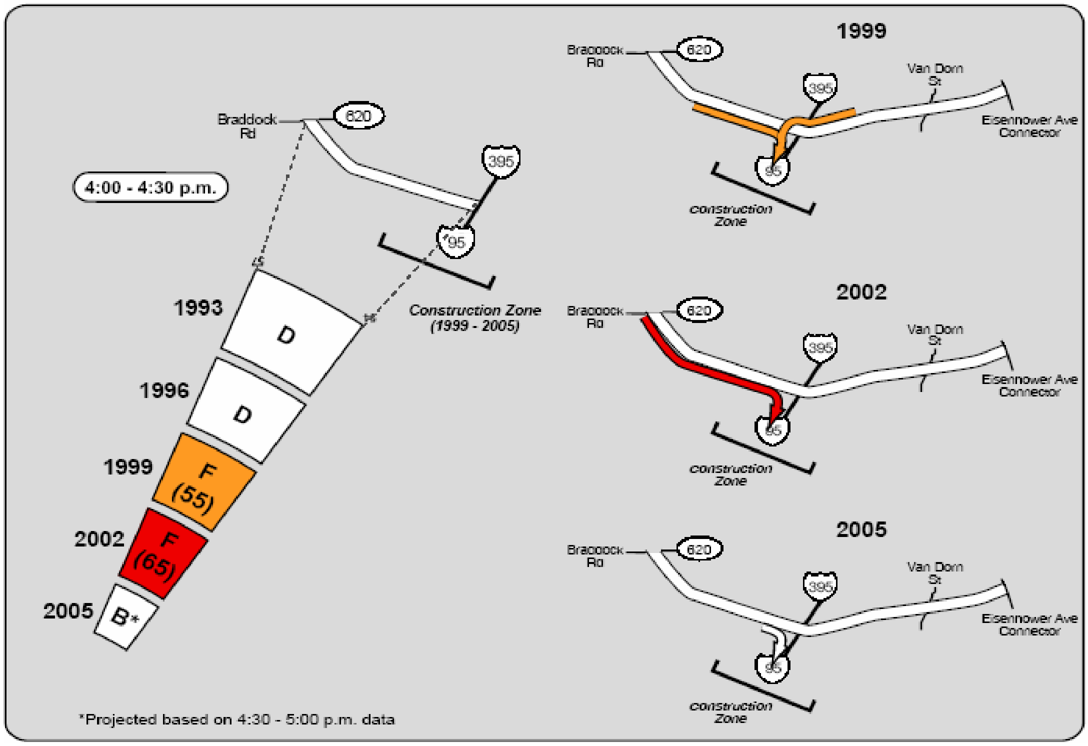
Figure 4: Improved conditions on US 50 in Maryland



Deleted: April

- ***I-495 (Capital Beltway) – Outer Loop*** – In Fairfax County, VA, along the eastbound and westbound approaches to I-95.
  - o **Time Period:** Evening
  - o **Change in LOS:** During the 1999 and 2002 surveys the portion of the beltway approaching I-95 was found to typically be congestion during the evening peak period. More specifically, congestion was primarily found where vehicles would be entering I-95 from the inner and outer loops. In 2002 the congestion was thought to be at its worst, extending back to the vicinity of Braddock Road on the outer loop (a distance of about 2.5 miles). However, between 1999 and 2005 this area called the Springfield Interchange underwent major reconstruction and over time improved much of the congestion in this area of I-495.
  - o **Cause of change:** The construction of new ramps on the Beltway approaches to I-95 (Figure 5).

Figure 5: Improved conditions on I-495 Outer Loop (Fairfax County)



Deleted: April

- ***I-495 Capital Beltway (Outer Loop)*** – Between I-270 Spur and I-66.
    - **Time Period:** Morning (8:00 AM – 9:00 AM) and Evening (5:30 – 6:30 PM).
    - **Change in LOS:** This section of the Beltway experienced severe congestion when surveyed in 1999 and 2005, especially between the I-270 spur and VA 193. After the 2005 spring survey flights had ended, VDOT opened a second lane on the off-ramp from Southbound I-495 to Westbound VA 267. Supplementary flights were conducted to quantify the benefits of this new construction.
    - **Cause of change:** Congestion was found to significantly improve as a result of the extra lane, both in the morning and evening. What used to take 15 to 20 minutes was shown to only take 6 to 8 minutes at the time of the survey (Figure 6 and Figure 7). The photograph in Figure 8 shows the difference in traffic flow before and after the extra lane. In Spring 2005/early 2006 traffic is moving more freely on the outer loop of I-495. This is an example of a low-cost solution to fix a problem of a major bottleneck.

Deleted: April

Figure 6: I-495 (Outer Loop) Improvement in Congestion (Morning)

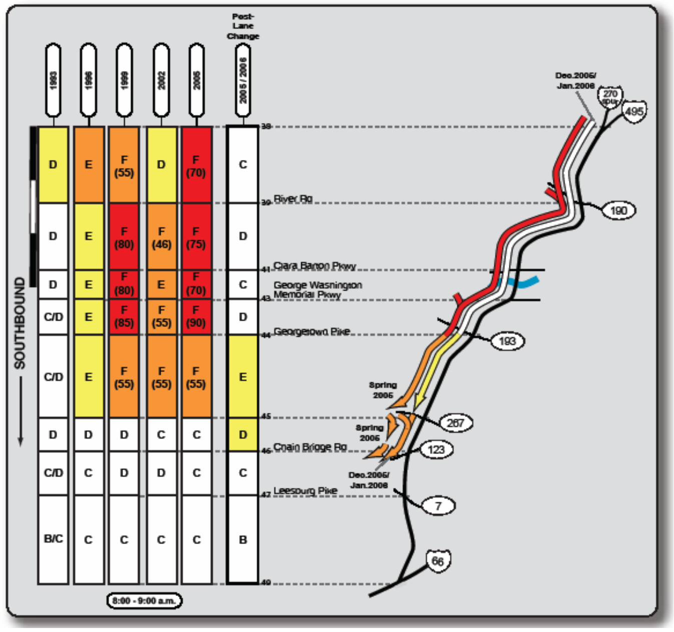
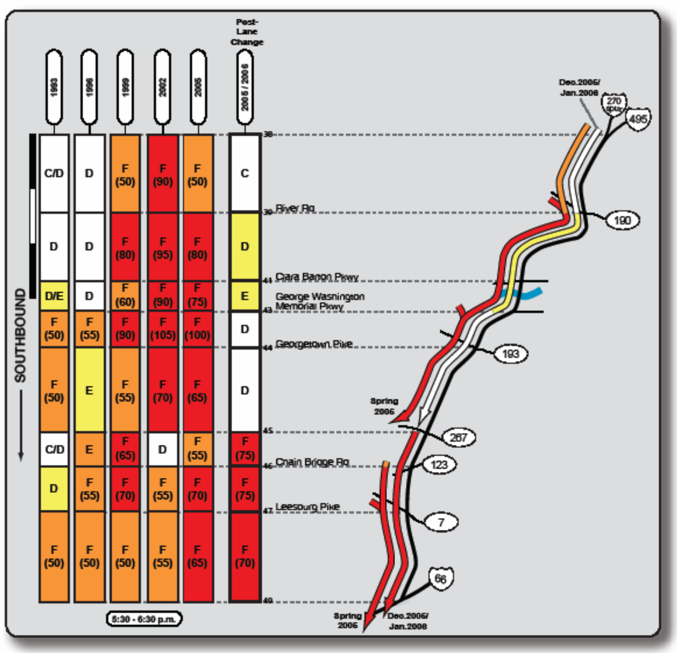
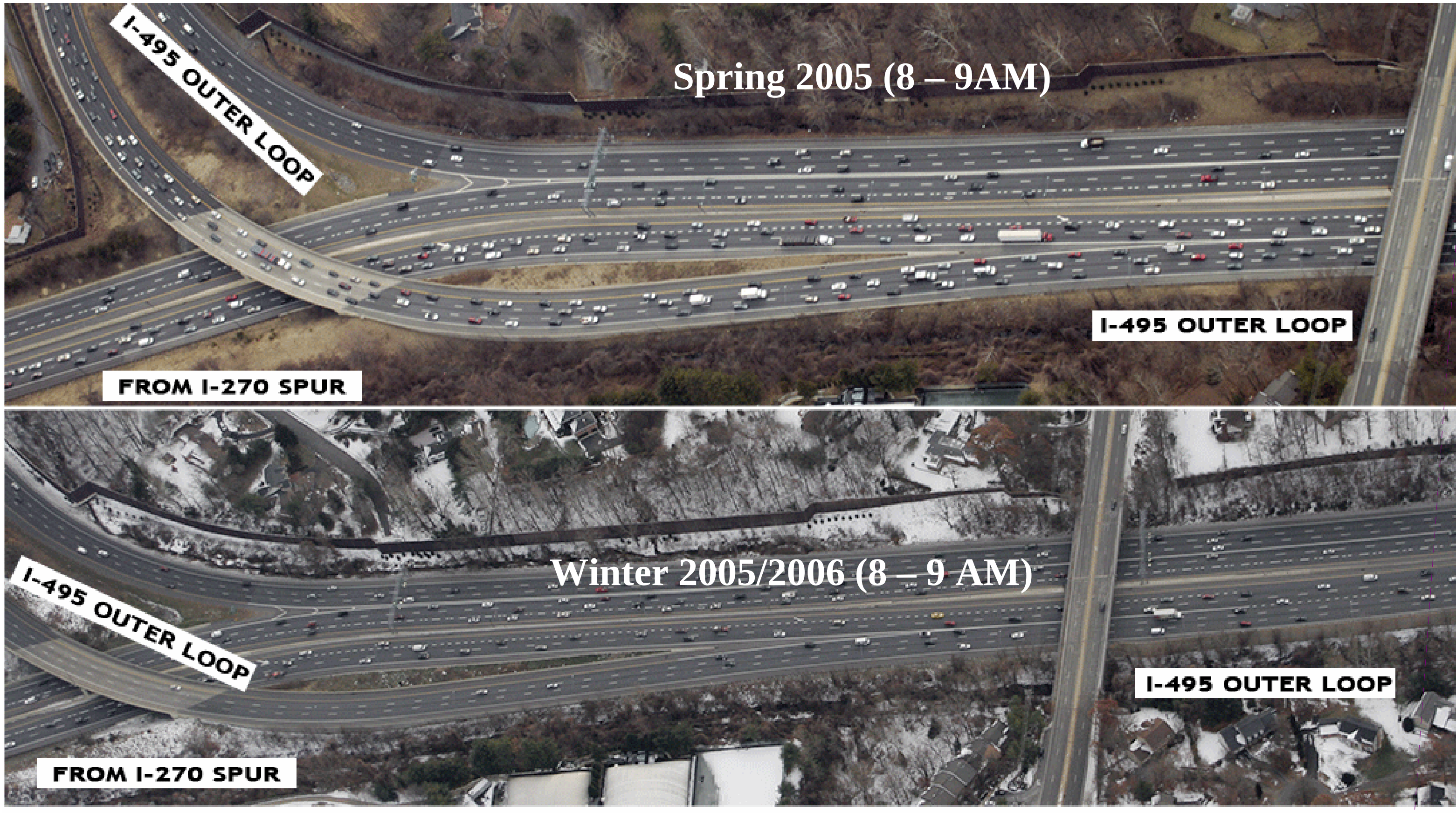


Figure 7: I-495 (Outer Loop) Improvement in Congestion (Evening)

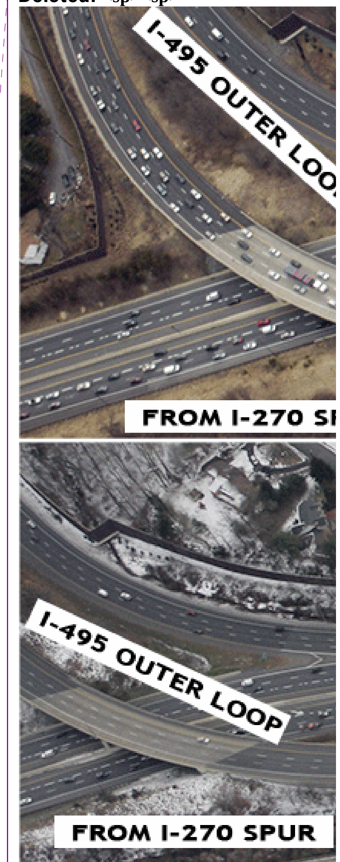


Deleted: April

Figure 8: Aerial Comparison of Congestion on I-495 Before and After Extra Lane



Deleted: <sp><sp>

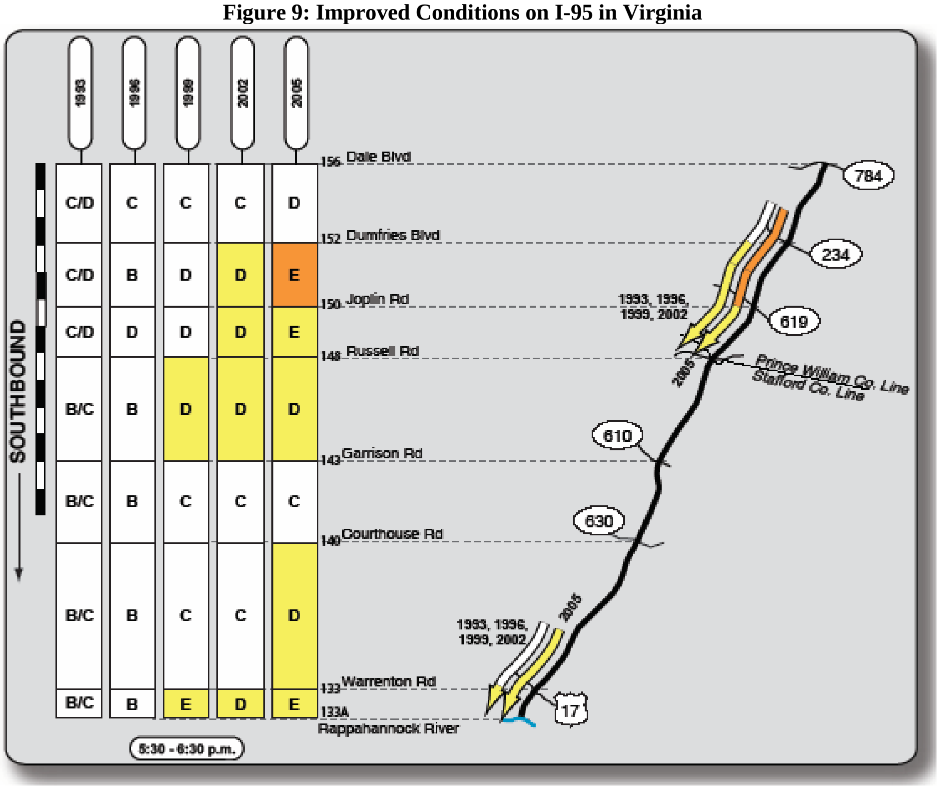


Deleted: April

Degraded Conditions:

- ***I-95 in Virginia*** – Southbound between Dale Boulevard and the Rappahannock River.
  - **Time period:** Evening
  - **Change in LOS:** The LOS on this section of roadway has gradually degraded since the first aerial survey in 1993 (Figure 9).
  - **Potential cause of trend:** Increased demand, especially toward the HOV lane merge.

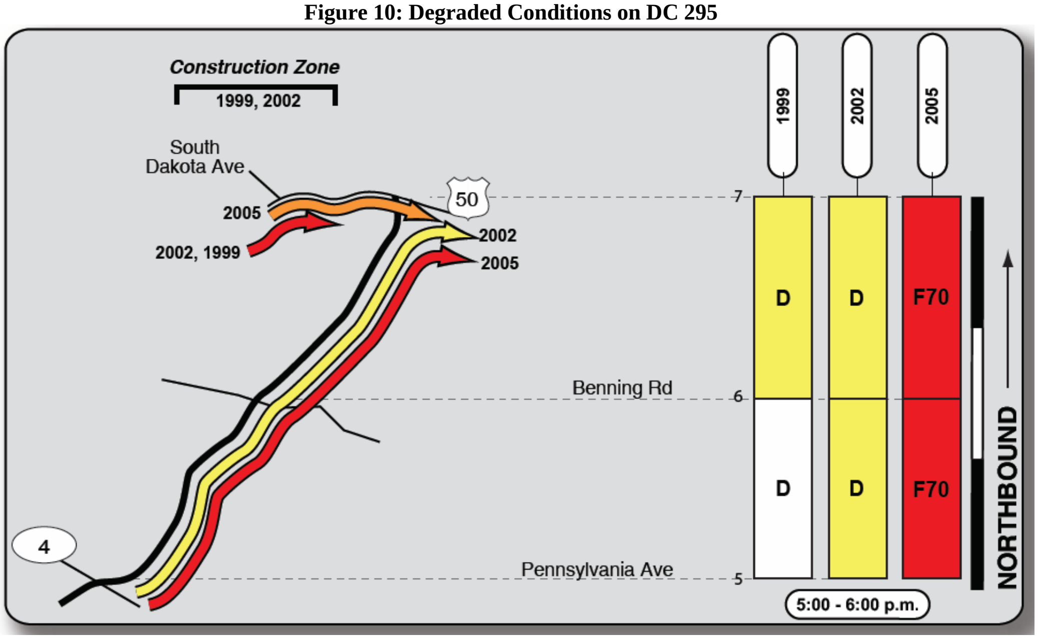
Figure 9: Improved Conditions on I-95 in Virginia



- ***D.C. 295 (Washington DC, Prince George's County)*** – Northbound between Pennsylvania Avenue and US 50.
  - **Time Period:** Evening
  - **Change in LOS:** From the graphic below (Figure 10) it is clear that LOS went down from a LOS of "D" in 2002 to LOS "F" in 2005 between Pennsylvania Ave. and US 50.
  - **Potential cause of trend:** Much of the congestion was found to be caused by vehicles on DC 295 exiting to eastbound US 50 which resulted in vehicles backing up on DC 295. During the 1999 and 2002 surveys there was a

construction zone at US 50 and South Dakota Ave. This construction may have allowed vehicles entering US 50 from DC 295 to merge without causing a congestion backup. The construction in a sense was "metering" the traffic. Thus, the absence of this construction during the 2005 survey could be attributed to the decline in LOS.

Figure 10: Degraded Conditions on DC 295



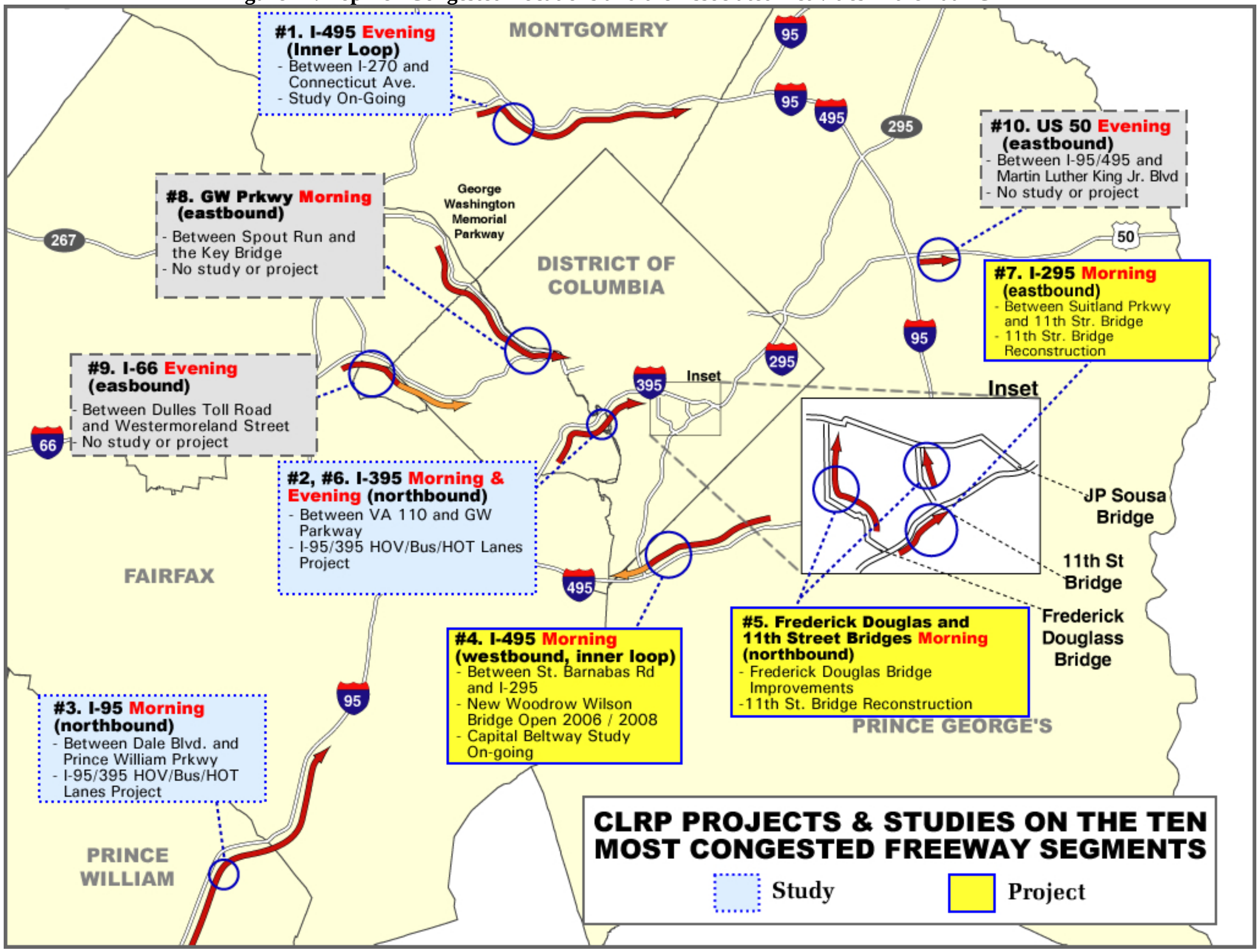
Top Congested Freeway Locations

Figure 11 shows the top ten congested freeway locations in the region, as concluded by the 2005 Freeway Monitoring Program[6]. Also indicated are planning and construction activities in the 2007 Financially Constrained Long-Range Transportation Plan (CLRP) at or near these locations. Among the many reasons for implementing these projects is to improve the flow of traffic on these highly-traveled corridors.

[6]The entire Skycomp 2005 Freeway Monitoring Report can be viewed at: http://www.mwcog.org/uploads/committee-documents/u1paXFg20060216110515.pdf

Deleted: April

Figure 11: Top Ten Congested Locations and the Associated Activities in the 2007 CLRP



Deleted: April

Outlook for Freeway Congestion in the Region

The region has and is anticipated to continue having a vibrant economy with significant employment and population growth. This will lead to continuing freeway congestion. There are few opportunities for significant freeway capacity expansion in the region. Therefore, it remains important to address congestion through management strategies.

Strategies include the use of transit and alternative commute programs, land use development that supports the use of public transportation, congestion pricing, and many other congestion management strategies outlined in this report.

Deleted: April

3.1.2 Arterial Highways

An arterial highway is defined as an urban interrupted flow roadway. Arterials are different than freeways in that they tend to have multiple ingress and egress points, intersections, fewer lanes, and lower speeds. Due to these characteristics, the congestion on arterials can be caused from reasons different than that of freeways.

Unlike for freeways, there is no comprehensive data set of roadway congestion for arterials in the region. There are a number of data sources that are informative, but data were collected different years, for different lengths of time, and using different methodologies. Therefore, for the purpose of identifying congestion on regional arterials, TPB has looked at these data sources plus has regularly undertaken specialized arterial data collection on a sample basis.

To identify the location, severity, and extent of congestion along selected National Highway System arterial highways in the region, an arterial highway performance monitoring study has been underway since FY 1999. Over the past several years staff has gathered data regarding travel time, speed, and data delay using Geographic Positioning System (GPS) technology, with data collection occurring in three-year cycles.[7] Several arterials were surveyed in the District of Columbia, Maryland, and Virginia, and level of service (LOS)[8] was used to characterize the extent of congestion during the PM peak hour and PM peak periods of travel[9].

Arterial monitoring shows some common themes and trends about general arterial congestion:

- There are competing demands of traveler mobility and accessibility to adjacent land uses affecting arterial operations.
- Growth and development can contribute to rapid worsening of congestion at specific locations.
- Intersections and driveways can cause slow-downs and backups along arterials.
- Arterials often experience spillover from freeways.
- Arterials tend to be heavily traveled in densely developed corridors.
- Traffic engineering improvements, such as extending a turn lane or traffic signal timing, can help soften the impacts of growth.
- By nature of design and other factors, arterials can be a mix of speeds, depending on things such as number of traffic signals, intersections, and lanes.
- Since the Washington region has a limited number of freeway lane miles, the region is especially dependent upon its arterial highways for mobility.
- Cars share the road with transit and delivery vehicles with frequent stops.

Although congestion occurs on arterials throughout the region, there are also common trends that are generally associated with the land uses and urban form surrounding the arterial. For the purposes of this report, we will classify these as metro core, inner suburban, and outer suburban

[7] Details on the data and methodology of the Arterial Highway System Performance study can be found in Chapter 7 – Data and Methodologies.
[8] There are generally six levels of service, A through F. Level of service "A" is the best, describing primarily free-flow conditions, while level of service "F" is the worst, describing flow as unstable and significant traffic delay.
[9] The study defines PM peak period travel as 4:00PM – 7:00PM and the PM peak hour between 5:00 – 6:00 PM.

Deleted: April

arterials. Conditions in general for these types of roadways will be reported, and illustrative examples provided.

Arterials in the Inner Core

The characteristics of the inner core of a region, by their urban nature, can greatly impact the flow of traffic on the core's arterials:

- Pedestrian and transit access to densely populated land uses are a major focus of inner core roadways. Traffic speeds must be at a level that ensures pedestrian safety.
- The flow of traffic is more frequently interrupted by a higher concentration of signaled intersections and driveways/alleyways in the inner core.
- Intersections tend to be close together. If traffic is stopped at an intersection, sometimes backups can occur through the intersection behind it. In addition, traffic blocking an intersection could impact the flow of traffic on the cross street.
- There are not always turn lanes present, so drivers may have to wait while a car in front of them makes a turn.
- On-street parking necessitates slower traffic speeds. In addition, some inner core arterials experience worse congestion in the off-peak period because two lanes of capacity are lost due to on-street parking during the day.
- In many older areas, a grid pattern of streets allows for multiple travel routes at moderate speeds.

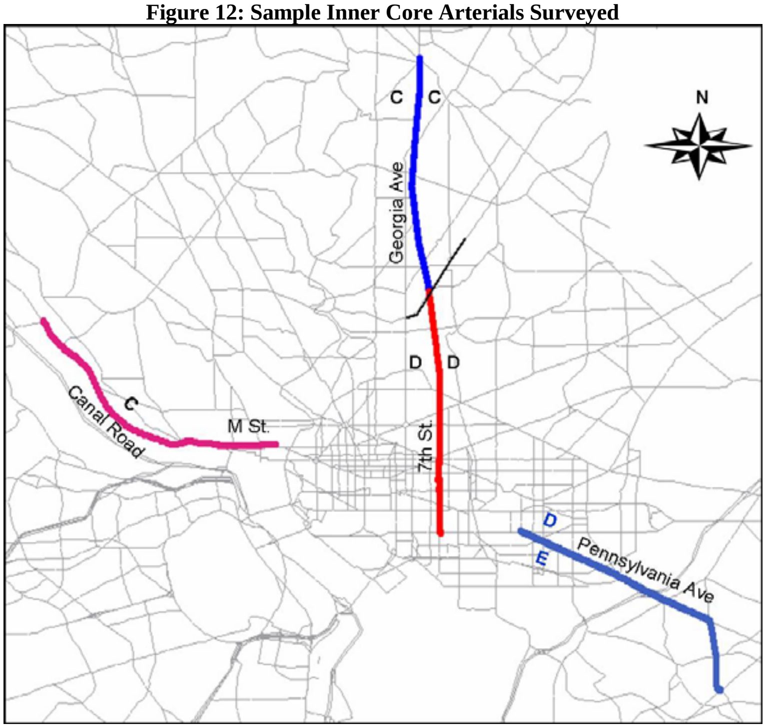
Deleted: ¶

For example, many of these inner core characteristics play a role in the congestion on M Street NW, between 30th Street and Chain Bridge Road (shown in Figure 12 in pink). When surveyed during the 2007 arterial monitoring study, the segment of this corridor with the lowest LOS during the PM peak hour was between Wisconsin Avenue and 35th Street NW. This segment of M street is a dense corridor of retail and commercial activity which attracts a large number of pedestrians and drivers searching for on-street parking. In addition, much of the traffic in this segment is approaching or spilling over from the Francis Scott Key Bridge, which connects to the George Washington Parkway and I-66 in Virginia.

Another example is 7th Street NW/Georgia Avenue, between Independence Avenue and New Hampshire Avenue (shown in Figure 12 in red). This arterial runs in a north-south direction through the busy Gallery Place/Chinatown neighborhood. Seventh Avenue likely experiences spillover from I-395 to the south and US 50/New York Avenue to the north. High pedestrian activity, on-street parking, and increasing construction zones over the past several years are all characteristics of this corridor. The 2007 arterial monitoring study concluded that increase in construction activities in the area was the cause of several bottlenecks from Chinatown south to Pennsylvania Avenue. While congestion is impacting traffic flow in this area, it is also evidence of the vibrancy of the neighborhood.

Deleted: April

Figure 12: Sample Inner Core Arterials Surveyed



Congestion management strategies that can help manage congestion on core arterials include operations management strategies such as optimized traffic signal timing and traffic engineering improvements. Relevant demand management strategies include robust transit services in these densely populated areas, employer outreach of alternative commute programs, as well as improved pedestrian and bicycle facilities.

Arterials in the Inner Suburbs

Arterials in the inner suburbs have characteristics combined from that of the inner core and outer suburban arterials.

- Signalized intersections, especially the intersections of major arterial roadways, have capacity limitations, especially when there are high percentages of turning movements at those intersections.
- Traffic from both nearby offices and residences can cause congestion.
- There can be spillover from adjacent congested freeways.
- Strip retail and other “destination” retail activities are often located along arterials. In the inner suburbs the density of these uses is likely higher than that of the outer suburbs, and ingress/egress points are closer together. This could cause disruptions in traffic flow during peak times.

Deleted: April

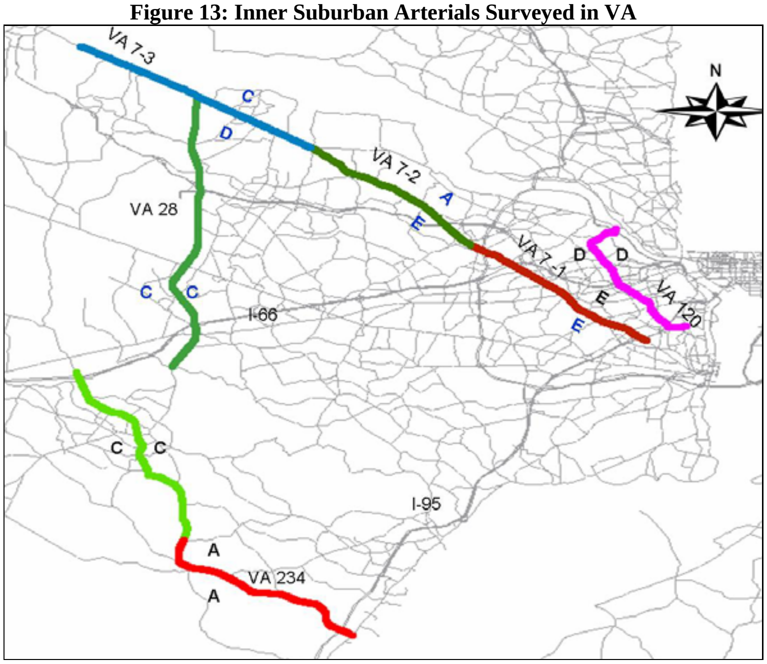
- Inner suburban areas have been experiencing welcome increases in pedestrians and transit usage in recent years, which must be considered in operations planning for arterials in these areas.

For example, these inner suburban arterial qualities are true of VA 7, which extends from Alexandria, VA to Leesburg, VA (shown in Figure 13). Different colors represent different segments of VA 7). The segment between Van Dorn Street in Alexandria and International Drive in McLean is lined with several strip retail areas. Tyson's Corner, at the north end of the segment near International Drive, contains a large amount of office and retail space, including two large shopping malls.

Deleted: 12.

VA 7 is also a major commuting route, and it provides access to the Dulles Toll Road to the north of International Drive. VA 7 experiences spillover from several major freeways in the vicinity, including I-66. The 2007 arterial monitoring study determined that the segment of VA 7 from Haycock Road to Washington Boulevard experienced the worst LOS in the corridor. This segment is just south of where I-66 and VA 267 meet.

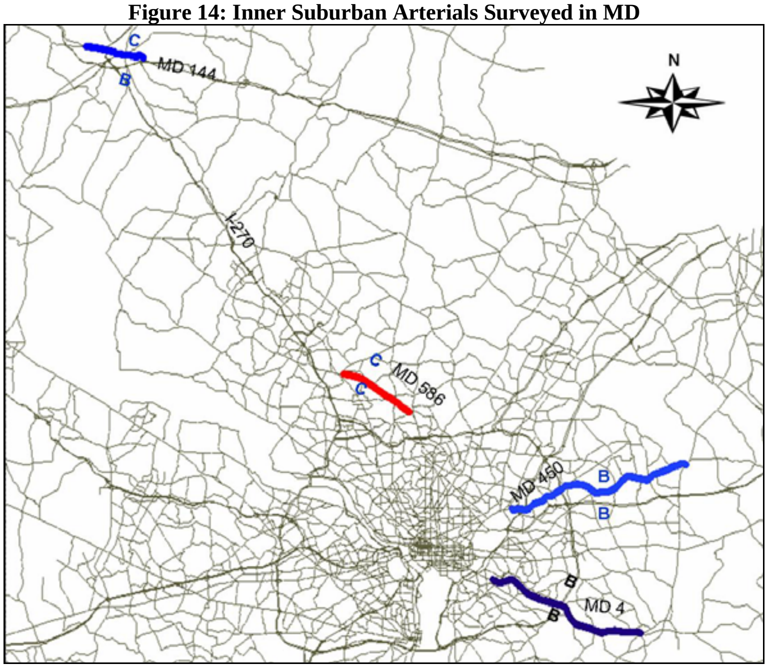
Figure 13: Inner Suburban Arterials Surveyed in VA



MD 450, between MD 202 and MD 3 also experiences situations typical of inner suburban arterials. MD 450 links the Bladensburg area to Bowie. Over the past several years there has been an increase in housing and suburban development along this segment. The western part of the corridor connects to I-495 and the Baltimore-Washington parkway, two primary travel routes. New roadway alignments and additional lanes have been implemented along this segment after the 2001 survey. Not every location in the segment experienced congested conditions when surveyed in 2007. During the peak hour the eastbound direction performed at a LOS "A-C."

Deleted: April

Figure 14: Inner Suburban Arterials Surveyed in MD



Congestion management strategies that can help inner suburban arterials include operational management strategies such as optimized traffic signals, operational management improvements on nearby freeways, and traffic engineering improvements. Often off-peak signal timing in inner suburban arterials can be worse than the peak hours, as a high number of people are moving in all directions and not with peak flow movement. Relevant demand management strategies include transit services, bus rapid transit, and Commuter Connections programs (especially employer-based programs).

Arterials in the Outer Suburbs

Arterials in the outer suburbs have their own unique characteristics:

- New development in the outer suburbs may quickly overwhelm the capacities of what were until recently lightly traveled rural roads.
- Because commute distances in the outer suburbs tend to be longer, peaking characteristics of traffic are much sharper.
- Transit services and pedestrian facilities are limited.
- Not unlike the inner suburbs, strip retail and other “destination” retail activities are likely to be located along outer suburban arterials. This could cause disruptions in traffic flow during peak times.
- Outer suburban arterials can also experience spillover from major freeways. This is especially expected during the morning and evening peak period when commuters drive to and from the inner core for work.

Deleted: April

For example, MD144 between Waverly Road and Monocacy Boulevard in Frederick County (Figure 14) experiences spillover from two major roadways that bypass in Frederick: I-70/I-270 and US 340/US 15 (Catoctin Mountain Highway).

The northern section of VA 7 between Georgetown Pike and VA 653 links Fairfax County to Leesburg (Figure 13). It is a major commuting route which connects to VA 28. The stretch of arterial from the Loudoun County line to Sterling has seen much commercial and retail development over the past several years.

Congestion management strategies that can help outer suburban arterials include operational management strategies such as bottleneck removal, dedicated turn lanes, and other traffic engineering improvements. Relevant demand management strategies include park-and-ride lots, commuter bus and rail services and Commuter Connections programs (especially employee-focused programs).

Improving Congestion on Arterials

Adding capacity on arterials to reduce congestion is seldom feasible, as many arterials are already built to capacity with development on either side. However, as noted above, there are demand management and operational management strategies that could offer solutions. The addition of express bus or other types of public transportation along an arterial could decrease the amount of cars on the road. Pedestrian and bicycle improvements, such as the implementation of a new bike facility along the arterial can provide an alternative option for travelers. Operational improvements can include the addition of turn lanes, to reduce the amount of back-ups at an intersection, or the creation of additional lanes. Traffic signal timing optimization is also important in ensuring the appropriate movement of vehicles at intersections.

3.2 Safety and Congestion

3.2.1 Overview

Transportation safety is a serious concern in the Washington region. There is shown to be a strong correlation between traffic safety and traffic congestion. Incidents, including those in work zones, are secondary incidents, involve adverse weather events, or bicycle and pedestrian incidents, all can contribute to non-recurring congestion. Sources indicate that approximately half of all congestion is caused by non-recurring congestion.[10] Raising awareness about such things as transportation safety can help address an issue at the root of incident management.

Engineering and operational management activities can help improve safety and therefore lessen the impact of crashes and other safety problems on congestion. Many transportation agencies in the region have active incident management programs that quickly respond to incidents, help reduce their duration, and lessen the likelihood of secondary accidents in traffic backups. Furthermore, transportation agencies look for ways to improve the safety of the physical roadway infrastructure, again to improve safety and therefore lessening its impacts on

[10] Source: Federal Highway Administration

Deleted: April

congestion. Such engineering improvements may include turn lanes, improvements of site lines, lighting, guardrails, and pedestrian enhancements.

The TPB is addressing transportation safety through a variety of programs and activities:

- Transportation safety is encouraged and tracked by TPB member agencies through the ***Transportation Improvement Program (TIP)***, which provides information on projects to be completed over the next six years. The TIP contains projects whose primary purpose is to enhance safety, and explains how other projects will support transportation safety.
- The ***TPB's transportation safety planning activities*** helps facilitate regional traffic data compilation, sharing this data among member agencies, and identifying regional safety problems.
- The ***Transportation Safety Subcommittee*** is a newly-formed subcommittee of the TPB Technical Committee. The Subcommittee will focuses on advising staff on the federally-required transportation safety portion of the long-range transportation plan. The diversity of the Subcommittee, which is comprised of stakeholders from the State Departments of Transportation Planning, planning staff of the TPB member agencies, law enforcement officials, and public health representatives, will be essential to providing a wide-range of safety perspectives. Another key objective of the Subcommittee will be exchanging information on ongoing safety activities and best practices.
- The ***Street Smart Pedestrian and Bicycle Safety*** campaign is an annual region-wide campaign to raise public awareness on pedestrian and bicycle safety.[11] The campaign, created by the TPB's Bicycle and Pedestrian Subcommittee in 2002, uses methods such as radio, newspaper, and transit advertising, public awareness efforts, and law enforcement with an overall goal of changing motorist and pedestrian behavior and reducing pedestrian and bicycle deaths and injuries.

Transportation Safety remains a key focus of transportation planning in the region. The TPB's transportation safety work program acts as a home for facilitating discussion of transportation safety issues in our region, and raising awareness about those issues. Continuing safety planning activities in the Washington region will continue to be important to the CMP.

3.2.2 COG Aerial Survey of Incidents

As a way of compiling information on non-recurring congestion, the TPB formerly used an aerial survey program. This program would use fixed-wing aircraft to monitor and track incidents and congestion related to construction on the area's roadways during the morning and evening peak travel periods.

The last Aerial Survey of Incidents and Construction was conducted in Spring of 1997.[12] The TPB no longer uses this method to collect non-recurring congestion information because it was found to not be as productive as the Freeway Monitoring Program method conducted by Skycomp, which is outlined in detail in Section 3.1.1. With the Freeway Monitoring Program,

[11] http://www.mwcog.org/streetsmart/about.asp
[12] *Incidents and Construction: An Examination of the Effects of Non-recurring Events on Traffic Quality*, Spring 1997.

Deleted: April

incident-related and construction-related congestion can be observed at the same time as recurring congestion, making it a more economical and viable means of collecting aerial data.

3.2.3 Traffic Safety Facts

The U.S. Department of Transportation and its National Highway Traffic Safety Administration (NHTSA) compile, summarize, and publish safety and other information about the nation's transportation system. Some of these traffic safety facts may help in illustrating the relationship of safety and congestion.[13]

- In 2005, 386 people were killed as a result of traffic incidents, and approximately 40,000 were injured;
- In 2005, 12% (5,212) of all the motor vehicle traffic fatalities reported involved large trucks (gross vehicle weight rating greater than 10,000 pounds);
- More than 6.1 million police-reported motor vehicle crashes occurred in the United States in 2005. Almost one-third of these crashes resulted in an injury, with less than 1 percent of total crashes (39,189) resulting in a death;
- Traffic fatalities increased by 1.4 percent from 2004 to 2005 for the nation as a whole. Twenty-six states and the District of Columbia showed increases, ranging from less than 1 percent to as much as 23 percent.

The above facts reveal that traffic safety is something that needs to be taken very seriously. The incident-related and non-recurring strategies our region undertakes not only manage congestion that commonly occurs after an incident happens, but these strategies can also prevent subsequent incidents from occurring. Our region's strategies aim at improving safety on our roadways, and ultimately contribute to making a nationwide difference.

(More to be provided)

Formatted: Justified, Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

Formatted: Font: Not Bold, Not Italic

3.2.4 Incident-Related and Non-Recurring Congestion

Fifty percent of congestion is said to be non-recurring, which is congestion due to incidents such as crashes, disabled vehicles, and traffic associated with special events.[14] There are 200 or more traffic related incidents on the region's roadways everyday, the most severe of which can disrupt traffic for hours, cause secondary incidents, and overall cause major disruptions to the transportation system. Heavily-trafficked areas and construction areas are especially prone to incidents. Nonrecurring events dramatically reduce the available capacity and reliability of the entire transportation system. Travelers and shippers are especially sensitive to the unanticipated disruptions to tightly scheduled personal activities and manufacturing distribution procedures.

[13] Source for Traffic Safety Facts: National Highway Traffic Safety Administration (NHTSA), Traffic Safety Facts 2005. www.nhtsa.gov
[14] Source: Federal Highway Administration

Deleted: April

The Federal Highway Administration breaks down non-recurring congestion into three primary causes: 1) incidents ranging from a flat tire to an overturned hazardous material truck (25%), work zones (10%), and weather (15%).[15]

A number of TPB's member agencies, including DDOT, MDOT, VDOT, and some local jurisdictions operate incident-management programs. These programs help minimize the impact these events have on the transportation network and traveler safety. If an incident disrupts traffic, it is important for congestion that normal flow resumes quickly. The TPB compiles and analyzes data associated with these incident management programs. See Section 4.3.6.1.

3.3 Congestion on the Metropolitan Area's Transit Systems

3.3.1 Impacts of Highway Congestion on Transit Systems

Often the region's highway congestion will have an impact on transit systems, such as rail and bus. To some extent, transit operations are concentrated in areas of high-density land uses, where traffic congestion may be expected. Bus schedules generally are designed to anticipate and accommodate highway congestion whenever possible. However, there are instances when congestion is unpredictable and can not only impact the timing of one bus, but of the entire bus system and other transit systems the bus connects to (such as commuter rail).

One way to analyze the performance of one mode's impact on another is to identify key linkages between one or more modes of transportation. In 2008 the TPB is conducting a Regional Bus Survey throughout our region. This survey will, among other things, collect information on origin-destination trip patterns for bus route planning and travel demand model validation. This can identify key linkages between transportation modes. More information on the results are anticipated to be reported in 2009.

3.3.2 Congestion Within Transit Facilities or Systems

Congestion can also be an issue within transit. If the demand for rail and buses is high and the capacity cannot keep up with that demand, then transit becomes too crowded. Just as incidents can cause non-recurring incidents on roadways, the same can occur on transit facilities. Even a minor bus or train incident can cause back-ups and delays.

In addition, certain transit facilities may experience more congestion that others. Union Station in the District of Columbia is a station that accommodates Metrorail, Metrobus, DC Circulator buses, Maryland Area Rail Commuter (MARC) trains, Virginia Railway Express (VRE) trains, and AMTRAK. With these various transit options, Union Station has become a primary connection point for commuters, and visitors. Congestion can not only result on the transit system itself, but on station platforms and around the station.

In 2007, an analysis was conducted by TransSystems to gauge the effect traffic congestion and passenger crowding has on WMATA bus operations.[16] The analysis found evidence that traffic

[15] Federal Highway Administration. http://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm

Deleted: April

congestion imposes a cost on WMATA, as the peak vehicle requirement needs to be increased to maintain a sufficient level of service on certain routes. In addition, growth in passenger demand has the same effect, since additional bus trips need to be added to certain routes to avoid overcrowding.

The Congestion Management Process (CMP) recognizes the growing concern of congestion within our regional transit stations. As more and more people are living in the outer suburbs and working far from their home, more commuters are looking to transit options instead of driving. While increase in transit use is overall a positive trend, it is important that the concern of transit congestion throughout the region be examined further.

3.4 Park-and-Ride Facilities

The Washington region has over 300 park-and-ride lots where commuters can conveniently join up with carpools, vanpools, or connect to public transit. Many of these lots are conveniently located for those that commute from the outer suburbs of Virginia or Maryland.

The following statistics provide an idea of why park-and-ride lots play such a popular role in the region's transportation system[17]:

- About one third of Park & Ride Lots have commuter bus service available.
- Approximately one third of the Park & Ride Lots have rail service available, including Metro, MARC, VRE and Baltimore Light Rail.
- Parking is free at 90% of the Park & Ride Lots.
- About 25% of the Park & Ride Lots have bicycle parking facilities.

In addition to the above statistics, Intelligent Transportation Systems (ITS) strategies such as traveler information systems and electronic payment systems can add to the convenience of park-and-ride lots. Commuter Connections also displays a park-and-ride map on their website, which provides users with the location of lots, transit stations in the vicinity, and the location of telework centers.

Due to the popularity of park-and-ride lots, some are experiencing overcrowding, where demand exceeds supply. This tends to happen at lots at or near Metrorail and commuter rail service. Maryland State Highway Administration (SHA) notes that once their park-and-ride lots fill to 80 percent capacity, locations for new lots are considered.

The most recent TPB study on the usage of park-and-ride lots was conducted in 1996. As the region continues to grow and the demand for park-and-ride lots increases, this is an area that may need to be examined more closely.

Deleted: by the TPB

Deleted:

WMATA is currently conducting a study of Metrorail station access and capacity which, when completed, could provide information on the capacity of Metrorail park-and-ride lots.

Deleted:

Deleted: ¶
¶

[16] Memo: Impact of Congestion on Metrobus Operations. March 12, 2007. http://www.mwcog.org/uploads/committee-documents/t1daVl020070509095750.pdf

[17] Source: Commuter Connections http://www.mwcog.org/commuter2/commuter/ridesharing/prlocations.html

Deleted: April

3.5 Airport Access

The transportation linkage between airports and local activities is a critical component of the transportation system. The Washington region has two major airports – Ronald Reagan Washington National Airport (DCA) in Arlington, VA, and Washington Dulles International Airport (IAD) in Loudoun County, VA. The region is also served by the nearby Baltimore/Washington International Thurgood Marshall Airport (BWI). The majority (95%) of those traveling to the region's airports does so via the highway network (i.e. personal cars, rental cars, taxis, buses)[18]. Therefore, understanding ground airport access is important to congestion management for two primary reasons:

- Choice of airport to use and even the decision to fly in general can be based on the quality, cost, and travel time associated with the ground journey to the airport. Traffic conditions can have an impact on these decisions.

- Understanding airport ground access provides a basis for understanding overall congestion on major roadways at peak travel times.
  - Studying airport ground access can provide information on traffic patterns that may have not otherwise been considered, in particular the relationship between travel times and distances. For example, a study can examine and compare trips across the region (e.g. from Maryland to IAD), or shorter trips where the origin and destination are close together.
  - Passengers using the airports may be non-residents of the Washington region, so this airport access information can give us information on trips originating elsewhere.

Conclusions of the most recent TPB study on airport ground access travel time[19] provide relevant information to congestion management:

- Overall, during the AM and PM peak periods there was a much higher percentage of roadway segments at LOS "D" or lower than the mid-day peak period. Furthermore, roadways with LOS "A" or "B" almost doubled in the mid-day period. This reflects the common pattern morning and evening commute congestion found when surveying freeways and arterials.
- Travel time from activity centers in the inner and outer suburbs to DCA during the AM and PM is important to congestion management studies, as it is similar to flow of commuters traveling to and from the inner core for employment. It was found in the 2003 study that generally travel times are increasing and LOS is decreasing from major activity centers to DCA in the AM.
  - From Tyson's Corner to DCA during the AM peak period, travel time almost doubled when compared to the previous 1995 study.
  - From Rockville to DCA in the AM travel time increased by nearly 50%.

---

[18] *2000 Washington-Baltimore Regional Air Passenger Survey Data*
[19] *Washington – Baltimore Regional Airport 2003 Ground Access Travel Time Study Update*, September 2004.

Deleted: April

- From downtown Washington, DC to DCA travel time increased only slightly, but LOS decreased, with levels "E" and "F" experienced along K Street, 4th Street, and George Washington Parkway.

- By the same token, travel times from some activity centers to IAD in the PM can provide an illustration of traffic conditions during the evening commuting period. Overall, when comparing the 2003 ground access travel time data to that of 1995, it seems that travel time is increasing slightly, but not as dramatically as was seen in the AM peak periods.

3.6 National Comparison of the Washington Region's Congestion

Regularly since 1982, the Texas Transportation Institute (TTI) releases an *Urban Mobility Report*[20], which outlines and compares urban congestion and mobility in 85 cities across the United States. The most recent report was released in 2007 and was based on 2005 data from the National Highway Performance Monitoring System (HPMS).

Several different performance measures are used in the report, which greatly impacts the rankings of cities. For example, the study concludes that the Washington region is ranked second (along with San Francisco and Atlanta) in terms of national congestion, the ranking of the report often cited in the local press. This particular ranking uses travel delay per person as the performance measure. In previous TTI reports, a different methodology, the Travel Time Index (the ratio of travel time in the peak period to travel time under free flow conditions), which effected the Washington region's ranking in previous years.

There are additional performance measures used throughout the 2007 study, such as percent of daily travel in congested conditions, travel speed, incident-related travel delay (non-recurring), person delay, travel time index, wasted fuel, and congestion cost that result in different rankings for the Washington region. Compared to other very large urban areas, the Washington area ranks 8th in travel delay, 8th in congestion cost, and 9th in excess fuel consumed.

There are some limitations to the TTI report. The TTI report provides average conditions across the region, not location-specific information that only a regional congestion monitoring program, such as that done for freeways and arterials in our region, can provide. In addition, even though the methodology has improved over time and attempts to include the impacts of transit, HOV lanes, demand management, and some operational improvements, it still cannot estimate performance on a specific corridor.

The primary value of the report is not in identifying rankings, but rather in studying how urban areas across the county are doing over time. The report states that the Washington region is not unique in dealing with congestion, stating that congestion is worsening in urban areas of all sizes. However, it also mentions the benefits of congestion management strategies that many cities, such as the Washington, DC area, are considering. Operational and demand management strategies, such as providing more travel options, adding capacity, managing the demand, increasing efficiency of the system, and managing construction and maintenance projects, all

---

[20] *The 2007 Urban Mobility Report*. Texas Transportation Institute (TTI) and the Texas A&M University System. September, 2007.

noted in the report, are all robust strategies that will continue to be pursued by TPB member agencies.

3.7 2007 Financially Constrained Long-Range Transportation Plan (CLRP) Performance and Forecasting Analysis

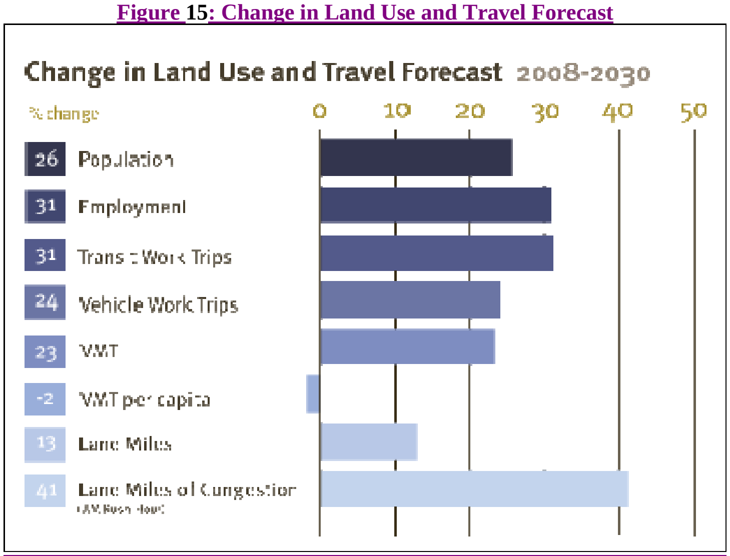
The CLRP includes all regionally significant transportation projects and programs planned in the Metropolitan Washington region over the next 25 years. Each year the CLRP is updated to include new projects and programs. TPB produces a performance analysis of every CLRP, which examines trends and assesses future levels of congestion and other performance measures. The 2007 CLRP Performance Analysis provides both an overall assessment of the anticipated impacts of the CLRP, as well as an indication of future levels of congestion relevant to the CMP. The 2007 CLRP Performance Analysis uses a base year of 2008 in the analysis, along with COG's Cooperative Forecasting (Round 7.1a) information (see Section 4.3.5), and the Travel Demand Model Version 2.2.

Plan performance analyzes the outlook for growth in the region. One of the cornerstones of plan performance is the forecasting of future congestion. The plan performance looks at where in the region congestion will occur in the future and compares current congestion to future congestion. It looks at criteria that may effect congestion, such as changes in population, employment, transit work trips, vehicle work trips, lane miles, and lane miles of congestion. The analysis also breaks down lane miles of congestion into core, inner suburbs, and outer suburbs, providing information on where, generally, the most lane miles of congestion can be found in 2008 compared to 2030.

Several factors are analyzed which are important to congestion management, such as changes in growth and travel demand from 2008 – 2030 (Figure 15). While the analysis shows a percentage increase in Vehicle Miles Traveled (VMT) and lane miles of congestion, there is also anticipated to be an increase in transit work trips. In addition, the analysis shows a small decline in VMT per capita.

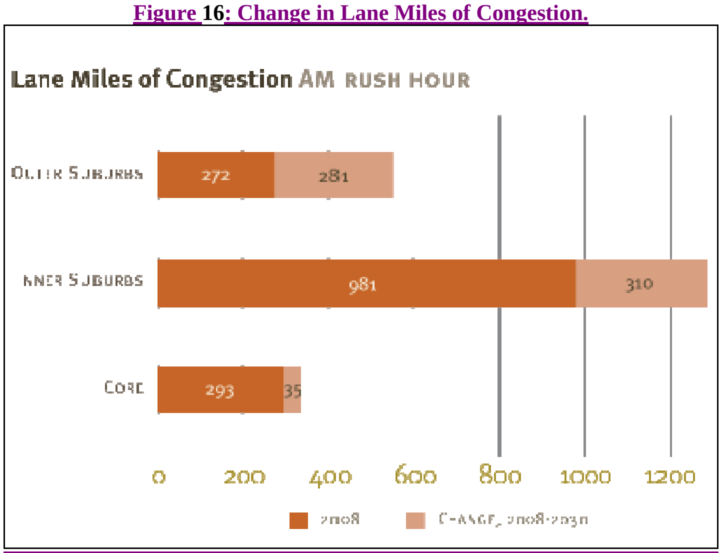
Deleted: April

Figure 15: Change in Land Use and Travel Forecast



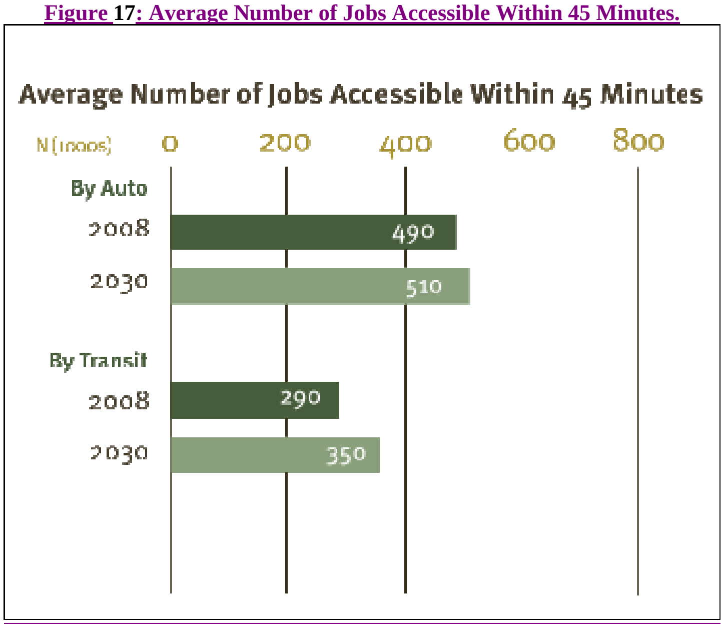
The region as a whole is growing steadily. However, growth is much faster in the outer jurisdictions. In terms of lane miles of congestion, the biggest increase will be found in the inner suburbs, followed by the outer suburbs and the inner core, respectively (Figure 16). In addition, the number of jobs accessible within 45 minutes will continue to grow, but the number will be greater for transit-accessible jobs in that category (Figure 17).

Figure 16: Change in Lane Miles of Congestion.



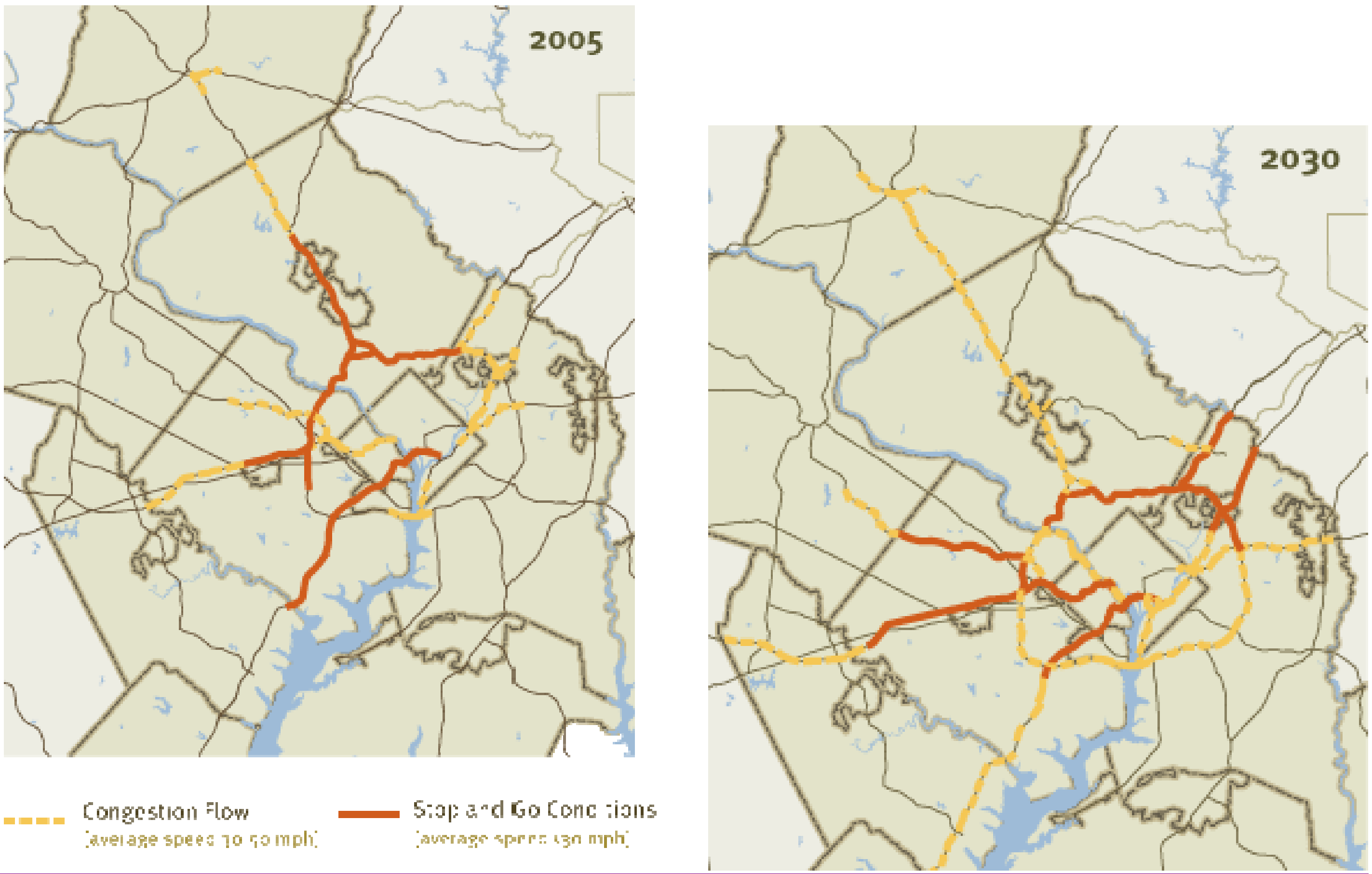
Deleted: April

Figure 17: Average Number of Jobs Accessible Within 45 Minutes.



Deleted: April

Figure 18: Congestion on Regional Highways. 2005 Compared to 2030.



Deleted: April

Figure 18 compares locations of moderate (yellow line) and severe (red line) congestion flow in 2008 compared to 2030. There is a large portion of I-495 in Maryland experiencing generally free-flow conditions in 2008 that will experience more moderate congestion in 2030. In addition, some areas with moderate congestion, such as on a portion of I-66 in Virginia and I-295 in Maryland, will experience severe congestion in the future.

While it is evident that congestion may be get worse in some areas by 2030, this is not true of all areas. Improvement is also evident, such as around the I-95 HOT lanes in Virginia.

Some overall conclusions of the plan performance analysis are:

- Population and employment growth are outpacing levels of transportation investment, resulting in worsening congestion.
- The rate of population and employment growth is much more rapid in outer jurisdictions.
- Transit trips are heavily focused in activity centers, but clusters are not growing any faster than the rest of the region.

4. IMPACTS OF PREVIOUSLY IMPLEMENTED CONGESTION MANAGEMENT STRATEGIES

4.1 Overview of Demand Management and Supply Management

Congestion Management Strategies generally can be divided into two types – Demand Management strategies and Operational, or Supply Management strategies.

Demand Management is aimed at reducing the demand for travel and influencing travelers behavior; either overall or by targeted modes. Demand Management strategies can include carpooling, vanpooling, telework programs that allow people to work from home to reduce the amount of cars on the road, and living near your work as a means of reducing commute travel.

Supply management, on the other hand, is managing and making better use of existing transportation modes in order to meet the region's transportation goals and ultimately improve congestion. Example supply management strategies are High-Occupancy Vehicle (HOV) lanes, variably priced lanes, transit systems, and nontraditional modes.

These strategies, and how they are implemented throughout the Washington region, are explained in further detail below. It should be noted that although strategies are divided into two categories, many times demand management and operational management strategies work together and are not stand-alone strategies.

4.2 Demand Management Strategies

4.2.1 Commuter Connections Program

Commuter Connections is a regional network, coordinated by COG/TPB, which provides commuter information and assistance services to those living and working in the Washington,

Deleted: April

DC region. The Commuter Connections program is designed to inform commuters of the availability and benefits of alternatives to driving alone, and to assist them in finding alternatives to fit their commuting needs. The program is funded by the District of Columbia, Maryland, and Virginia Departments of Transportation, as well as the U.S. Department of Transportation, and all services are provided free to the public and employers.

Transportation Emission Reduction Measures (TERMs) Evaluation:

The programs that Commuter Connections promote are important demand management strategies because they can influence traveler behavior and ultimately help to reduce congestion. They also are crucial to reducing vehicle emissions, which is why Commuter Connections, in concert with program partners, is responsible for implementing a number of Transportation Emission Reduction Measures (TERMs) to meet air quality conformity and federal clean air mandates. Commuter Connections sets goals on TERM programs that impact commute trips[21], and evaluates the TERMs to determine the impact they are having on reducing congestion and vehicle emissions. These TERMs include:

- ***Telework*** – Provides information and assistance to commuters and employers to further in-home and telecenter-based telework programs.
- ***Guaranteed Ride Home (GRH)*** – Eliminates a barrier to use of alternative modes by providing free rides home in the event of an unexpected personal emergency or unscheduled overtime to commuters who use alternative modes.
- ***Employer Outreach*** – Provides regional outreach to encourage large, private-sector employers voluntarily to implement commuter assistance strategies that will contribute to reducing vehicle trips to worksites, including the efforts of jurisdiction sales representatives to foster new and improved in-house trip reduction programs.
- ***Employer Outreach for Bicycling*** – Provides regional outreach to encourage employers to implement strategies that could increase employees' use of bicycling for commuting.
- ***Mass Marketing*** – Involves a large-scale, comprehensive media campaign to inform the region's commuters of services available from Commuter Connections as one way to address commuters' frustration about the commute.

Commuter Connections evaluates the impacts of these TERMs through the Commuter Connections Transportation Demand Management Evaluation Project.[22] The evaluation process allows for both on-going estimation of program effectiveness and for annual and triennial evaluations.

Both qualitative and quantitative types of performance measures are included in the evaluation process to assess effectiveness. First, measures reflecting commuters' and users' awareness, participation, utilization, and satisfaction with the program, and their attitudes related to transportation options are used to track recognition, output, and service quality.

---

[21] The region has adopted and implemented TERMs other than those in the Commuter Connections program. Some other TERMs, such as for Signal Timing Optimization, may also impact congestion. Others, such as for emissions control equipment on heavy-duty diesel vehicles, impact only emissions.

[22] *Transportation Emission Reduction Measure (TERM) Analysis Report FY 2003-2005*, January 17, 2006.

Deleted: April

Second, program impact measures are used to quantify six key outcome results, including:

- Vehicle trips reduced
- Vehicle miles of travel (VMT) reduced
- Emissions reduced: Volatile Organic Compounds (VOC), Oxides of Nitrogen (NOx), and Particulate Matter (PM2.5)
- Energy reduction (fuel saving)
- Consumer saving (commuting cost saving)
- Cost effectiveness, in terms of cost per benefit obtained (e.g., cost per trip reduced)

Particularly of interest to congestion management is the impact on vehicle trips reduced, vehicle miles of travel (VMT) reduced, and cost effectiveness. Appendix A shows the summary of results for individual terms (i.e., how many daily vehicle trips were reduced and the daily VMT reduced compared to the goals set by Commuter Connections).

Deleted: *(to be included later)*

Commuter Connections also operates the Commuter Operations Center (COC), providing direct commute assistance services, such as carpool and vanpool matching through telephone and internet assistance to commuters. The COC is not an "official" TERM, however, it supports all other TERMs.

In addition, several surveys are conducted by Commuter Connections to follow-up with program applicants and assess user satisfaction on TERMs. These surveys provide data used to estimate program impacts. Some of the surveys, such as the Applicant Placement survey and Guaranteed Ride Home (GRH) Survey, also provide information used by Commuter Connections staff to fine tune program operations and policies.

- ***Commuter Connections Applicant Placement Rate Survey*** – Since May 1997 Commuter Connections has conducted commuter applicant placement surveys to assess the effectiveness of the Commuter Operations Center and other program components. The surveys assess users' perceptions of and satisfaction with the services provided.

- ***GRH Applicant Survey*** – Commuters who register with the GRH program or use a one-time exception trip will be surveyed to establish how the availability and use of GRH influenced their decision to use an alternative mode and to maintain that mode. Satisfaction with GRH services also will be polled.

- ***State of the Commute Survey (SOC)*** – The SOC survey, a random sample survey of employed adults in the Washington metropolitan region, serves several purposes. First, it establishes trends in commuting behavior, such as commute mode and distance, and awareness and attitudes about commuting, and awareness and use of transportation services, such as HOV lanes and public transportation, available to commuters in the region.

- ***Employee Commute Surveys*** – Some employers conduct baseline surveys of employees' commute patterns, before they develop commuter assistance programs and follow-up surveys after the programs are in place.

Deleted: April

- ***Employer Telework Assistance Follow-up Survey*** – Sent to employers that received telework assistance from Commuter Connections to determine if and how they used the information they received.
- ***Bike-to-Work Day Participant Survey*** – A survey among registered participants in the Bike-to-Work Day event is undertaken to assess travel behavior before and after the Bike-to-Work Day, as well as commute distance and travel on non-bike days.

Both the TERM evaluation and associated surveys are key to assessing the impact these programs have on air quality and congestion management. Following is a more detailed analysis on the above TERMs and other Commuter Connections demand management strategies in our region.

Formatted: None

Deleted: ¶

4.2.1.1 Telework

Teleworking, or telecommuting, can be described as a means of using telecommunications and information technology to replace work-related travel. This can be done by working at one's home, or at a designated telework center one or more days a week. There are designated telework centers throughout the region, in the District, Maryland, and Virginia. Phones, fax machines, and computers make teleworking an easy alternative to getting in a car and driving long distances to an office. Teleworking has shown to boost the quality of life, have economic benefits, reduce air pollution, and ease traffic congestion.

Telework is a TERM evaluated by Commuter Connections. Telework Outreach is a resource service to help employers, commuters, and program partners initiate telework programs. In evaluating teleworking, several travel changes need to be assessed, including: trip reduction due to teleworking, the mode on non-telework days, and mode and travel distance to telework centers.

Telework impacts are primarily estimated from the State of the Commute survey and by surveys conducted of employers directly requesting information from Commuter Connections. The most recent SOC survey[23] concluded the following regarding teleworking:

- Teleworkers accounted for 18.7% of all regional commuters. That is, workers who travel to a main work location on non-telework days.[24]
- An additional 24% of commuters said they "would and could" telework, that is, they have job responsibilities that could be done while teleworking and would be interested in teleworking, if given the opportunity.
- More than half of those surveyed (56%) said they teleworked at least one day a week.

The *TERM Analysis Report for FY 2003-2005* estimated the impacts of teleworking. The following are some noteworthy statistics from that report:

---

[23] *Commuter Connections State of the Commute Survey 2007*. Prepared for Metropolitan Washington Council of Governments. Prepared by: LDA Consulting, Washington, DC. In conjunction with: CIC Research, San Diego, CA.
[24] Using this base of commuters excludes workers who are self-employed and for whom home is their only workplace.

Deleted: April

- In 2005, approximately 318,000 regional workers were telecommuting at least occasionally, about 12.8% of the total workforce. This number of teleworkers represents an increase of 210% over the 1996 baseline of 150,900 teleworkers.
- The Telework TERM reduced 11,129 daily vehicle trips and 226,913 VMT. Although these numbers were slightly below the goals set for the TERMs[25], it is still clear that the TRC had an impact on daily vehicle trip reduction and VMT.

Formatted: None, Indent: Left: 0.25"

4.2.1.2 Employer Outreach

Employer Outreach is aimed at increasing the number of private and non-profit employers implementing worksite commuter assistance programs, and is ultimately designed to encourage employees of client employers to shift from driving alone to alternative modes.

In this TERM, jurisdiction-based sales representatives contact employers, educate them about the benefits commuter assistance programs offer to employers, employees, and the region and assist them to develop, implement, and monitor worksite commuter assistance programs.

The *TERM Analysis Report for FY 2003-2005* estimated the impacts of employer outreach. The following are some noteworthy statistics from that report:

- Employers participating in Employer Outreach substantially exceeded the goal, with 876 participating employers compared to the goal of 251.
- The trip reduction and VMT reduction impacts for Employer Outreach were more than six times higher than the goals set. Employer Outreach reduced 60,683 daily vehicle trips, and there was 1,002,115 daily VMT reduced.

4.2.1.3 Live Near Your Work

Population and growth can be considered a wonderful thing for a region, but with it comes side effects of congestion. The trend of employees living further from their job is worsening, creating longer commutes. ‘Live Near Your Work’ is a program to help bridge the gap between the workplace and home. The program is primarily geared towards employers in an attempt to improve their employees’ work-life balance. In turn, the results of employees living closer to where they work can reduce the number of cars on the road, which ultimately can ease congestion and have positive environmental impacts.

Deleted: employees

To promote the ‘Live Near Your Work’ initiative, Commuter Connections provides housing information in an online Employer’s Resource Guide. The tool highlights various housing programs and resources available for the Washington area workforce and aims to assist employees with moving closer to where they work. This guide also provides a list of flexible commuter options available through Commuter Connections. Used in tandem, employers have a number of ways to provide the information workers need to make living near and getting to work

[25] The reason for these numbers being slightly below the TRC goals for these measures could be attributed to the calculation assuming a telecommute frequency higher than 1.29 days per week.

Deleted: April

a reality. Employers can work with their internal staff to find and execute the right fit for their employees, and ultimately help everyone feel "more connected." Employers can find that this can have a true impact on their bottom line.

4.2.1.4 Carpooling, Vanpooling, Ridesharing and other Commuter Resources

Commuter Connections provides information on carpooling, vanpooling, and Ridesharing. These alternative commute methods reduce the amount of single occupant vehicles (SOVs) on the road, which is important to congestion management.

- ***Carpooling*** is two or more people traveling together in one vehicle, on a continuing basis.

- ***Vanpooling*** is when a group of individuals (usually long-distance commuters) travel together by van, which is sometimes provided by employers. There are typically three kinds of vanpool arrangements:

    - *Owner-operated vans* — An individual leases or purchases a van and operates the van independently. Riders generally meet at a central location and pay the owner a set monthly fee.

    - *Third-party vans* — A vanpool "vendor" leases the vanpool vehicle for a monthly fee that includes the vehicle operating cost, insurance, and maintenance. The vendor can contract directly with one or more employees. The monthly lease fee is paid by the group of riders.

    - *Employer-provided vans* — The employer (or a group of employers) buys or leases vans for employees' commute use. The employer organizes the vanpool riders and insures and maintains the vehicles. The employer may charge a fee to ride in the van or subsidize the service.

- ***Ridematching Services*** enables commuters to find other individuals that share the same commute route and can carpool/vanpool together. This provides carpooling options for people who may not know of someone to carpool with, thus broadening the carpooling options

4.2.1.5 Bike To Work Day

Each May thousands of area commuters participate in Bike to Work Day, sponsored by Commuter Connections and the Washington Area Bicyclist Association.[26] The TPB has a Bike to Work Day Steering Committee which coordinates the event each year.

Bike to Work Day encourages commuters to try bicycling to work as an alternative to solo driving. The program has grown enormously attracting over 6,600 bicyclists in 2007.[27]

---

[26] Commuter Connections *Bike to Work Day 2007* final report.
[27] Source: www.commuterconnections.org

Deleted: April

Biking and other nontraditional modes are expanded upon in Section 4.3.4.

4.2.2 Local and Other Transportation Demand Management and Traffic Management Activities

Local agencies and organizations, such as local governments and Transportation Management Areas (TMAs) are doing their part to promote alternative commute methods and other demand management strategies. The following table provides detailed information on specific ongoing demand management strategies in the Washington region.

Deleted: in the region. ¶
¶
Appendix B ***(to be included later)***

Formatted: Font: Not Bold, Not Italic

Deleted: throughout the

Deleted: April

4.3 Supply Management Strategies

4.3.1 High-Occupancy Vehicle (HOV) Facilities

4.3.1.1 Overview

High Occupancy Vehicle (HOV) lanes are defined as roadways or roadway segments that are restricted to use by vehicles (cars, buses, vanpools) carrying the driver and one or more additional passengers.

HOV facilities offer several advantages over conventional lanes and roads. They increase the number of persons per motor vehicle using a highway over conventional (non-HOV) roadways, they preserve the person-moving capacity of a lane or roadway as demands for transportation capacity increase, and enhance bus transit operations. All of these advantages are important to effectively managing the operations of existing and new capacity on roadways.

However, HOV facilities can also be considered demand management strategies as well, providing predictable travel times even during peak periods of high demand for highway capacity. HOV lanes can help influence travelers' behavior and provide them with additional choices of how, or if, to travel a certain route.

Currently there are five HOV facilities in the Washington region on highways functionally classified as freeways:

- I-66 in the Northern Virginia counties of Prince William, Fairfax, and Arlington (this HOV system includes a section of the Dulles Connector in McLean, connecting to VA 267's HOV lanes – see below);

- Virginia Route 267 (Dulles Toll Road), where operation of concurrent-flow HOV lanes began in December 1998, connecting to I-66 via the Dulles Connector; and,

- I-95/I-395 (Shirley Highway) in the Northern Virginia counties of Prince William, Fairfax, and Arlington, and the City of Alexandria,

- I-270 and the I-270 spur in Montgomery County, Maryland;

- U.S. 50 (John Hanson Highway) in Prince George's County, Maryland.

COG/TPB staff typically studies the performance of HOV facilities every three or four years during the AM and PM peak periods. The most recent data collected and analyzed along these five HOV corridors was in Spring, 2004 and the results can be found in the *2004 Performance of Regional High Occupancy Vehicle Facilities on Freeways in the Washington Region*. The report concluded the following trends on the entire network of HOV facilities in the region:

Deleted: April

- All of the HOV lanes in Spring 2004 were observed to carry more persons per lane during the HOV-restricted periods than adjacent non-HOV lanes, with the exceptions of the concurrent-flow HOV lane on U.S. 50 John Hanson Highway, where per-lane person movements were found to be approximately the same in the HOV and non-HOV lanes, and the concurrent-flow HOV lane on I-270 at Md. 187 during the P.M. peak period.

- All of the HOV lanes provide savings in travel times when compared to non-HOV alternatives, especially the barrier-separated HOV lanes in the I-95/I-395 corridor in Northern Virginia.

- There generally has been a decline in average auto occupancy on the HOV facilities in Northern Virginia, particularly in the barrier-separated lanes, due in part to the hybrid vehicle exemption.

Separate analyses on Northern Virginia's I-66 corridor and the I-95/I-395 corridor were conducted in 2005 and 2006 respectively to analyze AM peak period travel only. These analyses were conducted at the request by Northern Virginia Transportation Commission (NVTC) and was sponsored by the Virginia Department of Transportation (VDOT). The studies analyzed both auto *and* transit data; that is, they were not done solely for the purposes of studying HOV facilities. However, the analyses provide some key statistics on the operation of the I-66 and I-95/I-395 HOV facilities.

Following is a breakdown of each HOV facility in detail, with some statistics provided from the above documents.

4.3.1.2 I-66

Interstate-66 was opened to traffic between the Capital Beltway (I-495) and Rosslyn, in Arlington County, in 1982. Initially the facility was restricted to HOV-4 traffic, meaning four occupants per vehicle. This was lowered to HOV-3 in late 1983 and to HOV-2 in March 1995. During the 1990s, I-66 outside the Beltway was expanded to include a concurrent-flow HOV lane to Virginia Route 234 (Business) in Prince William County just north of Manassas.

Currently the I-66 HOV corridor consists of two distinct sections. One section is between the Capitol Beltway (I-495) and Rosslyn. This segment of I-66 is restricted to HOV use only during the peak commute period of the peak direction, due to the large amount of traffic traveling inbound from Northern Virginia in the morning, and outbound from the District of Columbia in the evening. The other section, between Virginia Route 234 (Business) near Manassas and the Capitol Beltway, is a concurrent-flow lane HOV facility. The entire HOV corridor is about 27 miles in length, about 9 miles inside the Beltway and 18 miles outside the Beltway.

I-66 is a key commuting corridor, as it connects the District of Columbia with the suburbs of Virginia and beyond. Direct access to employment centers in Washington, D.C. is provided via the Theodore Roosevelt Bridge over the Potomac River. Along the I-66 corridor there are also several Metrorail stations that many commuters drive to everyday. Some of these stations contain Park-and-Ride facilities that allow commuters to drive and connect to other modes, such as rail

Deleted: April

or bus.

AM Peak Period HOV Travel in the I-66 Corridor:

An analysis conducted in mid-September, 2005 by COG/TPB, in conjunction with various member agencies and organizations, collected traffic and transit data along two screen lines of I-66: an outer area screen line just outside the Capital Beltway, and an inner area screen line just outside Glebe Road in Arlington County.

The analysis compared transit, HOV, and single-occupants trips. Some key results included:

- More than 6 out of 10 inbound AM peak period travelers in Northern Virginia's I-66 corridor are using transit or multiple occupant autos and vans for their travel to or through regional core area employment sites in Northern Virginia and the District of Columbia.

- Almost 17,000 persons traveling in passenger vehicles with two or more occupants (HOV2+) for their typical weekday[28] inbound AM peak period travel across the I-66 corridor inner area screen line.

- The greatest amount of HOV2+ person travel was seen on I-66. Use of I-66's inbound lanes between 6:30AM and 9:00AM is restricted to HOV2+ person vehicles and single occupant vehicles traveling from Dulles Airport.

- The effectiveness of the I-66 HOV lanes in encouraging the use of car and vanpooling and their efficiency in moving large numbers of people per lane of roadway is clearly seen in the count data collected in this study. During the 2.5-hour time period the I-66 use restrictions are in effect, the two inbound I-66 HOV lanes carry an average of 2,800 persons per lane per hour compared to an average of just 1,200 persons per lane per hour on the seven inbound nonrestricted general purpose lanes on the other roadway facilities crossing the Glebe Road screen line in this corridor.

Deleted: ¶

Formatted: None, Indent: Left: 0.25"

4.3.1.3 I-95/I-395 (Shirley Highway)

The Shirley Highway Corridor is one of the two corridors that provide direct access to the employment centers (the other is I-66). Therefore, understanding congestion on these corridors is crucial.

The HOV lanes in this corridor are entirely barrier-separated, and reversible, so they accommodate heavy AM peak period northbound traffic and operate southbound in the P.M. peak period. The HOV roadway is about 27 miles long, extending from Virginia Route 234 (Dumfries Road) near Dumfries, Prince William County to South Eads Street near the Pentagon

[28] Defined as a non-holiday Tuesday, Wednesday, or Thursday on which there were no special events or major traffic incidents that would affect typical traffic patterns on these days.

in Arlington County. Several HOV-only ramps provide direct access to the HOV lanes from park-and-ride facilities in Prince William County.

The corridor is also served by the Virginia Railway Express (VRE) Fredericksburg Line. The Metrorail Blue Line terminates in the corridor at Franconia-Springfield. Numerous bus lines serve the corridor, including Metrobus, the City of Alexandria's DASH, Fairfax Connector, PRTC OmniRide and private motor coach companies serving communities in Stafford and Spotsylvania Counties and the City of Fredericksburg.

AM Peak Period HOV Travel in the I-395/I-95 Corridor:

A recent COG/TPB analysis (similar to the analysis for the I-66 corridor above) was conducted on the AM peak period travel on the I-395 corridor. This study was conducted in mid-September and early October 2006, and collected traffic and transit data along an inner area screen line just outside Glebe Road.

The analysis compared transit, HOV, and single-occupants trips. Some key results included:

- Two out of every three inbound AM peak period travelers in Northern Virginia’s I-95/I-395 corridor are using transit or multiple occupant autos and vans for their travel to or through regional core area employment sites in Northern Virginia and the District of Columbia.

- The multi-modal Shirley Highway facility itself carries one out of every two of the inbound AM peak period travelers in this corridor, 24,500 of them in carpools and vanpools and 7,400 in buses and 16,500 in single occupant vehicles (SOV).

- It is particularly noteworthy that during the 6:00AM to 9:00AM time period, when the Shirley Highway HOV3+ use restrictions are in effect, the two Shirley HOV3+ lanes carry an average of 5,100 persons per lane per hour. This average is about 3 and one-half times greater than the average of 1,500 persons per lane per hour found on Shirley Highway’s four non-restricted general purpose lanes during this 3-hour time period.

4.3.1.4 Maryland HOV Systems

I-270 HOV Facilities:

In the southbound (A.M. peak) direction, the HOV concurrent-flow lane runs from I-370 near Gaithersburg south to the Rockville Pike/Capital Beltway interchange. There is also a concurrent flow HOV lane along the southbound lanes of the I-270 Spur. Together, the A.M. peak-flow direction lanes total about 11 miles in length. The Spur is just less than 2 miles long. In the northbound (P.M. peak) direction, concurrent-flow HOV lanes exist along the entire northbound I-270 Spur, and along I-270 from its southern terminus at I-495/Md. 355 to I-370 (the same sections of the corridor having HOV lanes southbound). Additionally, there are about 7.5 miles of HOV lane between I-370 and Maryland 121 near Clarksburg.

Deleted: April

The Metro Red Line serves the I-270 corridor from Shady Grove (I-370), continues south to Bethesda, and on to the downtown area of the District of Columbia. The Mass Transit Administration's (MTA) MARC Brunswick Line also serves several stops in this corridor, and continues south to Silver Spring and on to Union Station in the District of Columbia. Montgomery County Ride-On serves areas in the corridor north of I-370, and MTA coach service (between Hagerstown, Frederick and Shady Grove) use the HOV lanes. Express Metrobus service operates on the HOV lanes in the corridor between Bethesda and Gaithersburg.

US 50 HOV Facilities:

Concurrent-flow HOV lanes operate in the U.S. 50 (John Hanson Highway) Corridor from just west of the Md. 704 Martin Luther King Highway interchange to east of the U.S. 301/Md. 3 interchange in Bowie. Unlike all other HOV lanes in the region, these lanes are HOV-2 restricted at all times (24 hours, 7 days) in both directions.

Buses operated the Washington Metropolitan Area Transit Authority (WMATA) and the Maryland Transit Administration (MTA) run on the U.S. 50 HOV lanes. To the east, the buses serve the City of Bowie in Prince George's County, and the Annapolis and Crofton areas of Anne Arundel County. All WMATA buses terminate at the New Carrollton rail station. Some MTA buses serve the downtown area of the District of Columbia, others terminate at New Carrollton.

2004 Performance of HOV Facilities on Freeways study:

Most comparisons are made with results obtained from the previous Regional HOV Facilities Monitoring reports for 1997, 1998, and 1999. Trends and changes are emphasized for the HOV restricted periods inbound and outbound.

One of the ways to assess the performance of HOV facilities, and to compare these facilities, is to measure the travel time for HOV facilities versus non-HOV, and to determine the time savings. This is what was done for the 2004 study. The results are shown in Appendix B.

Deleted: C ***(to be included later)***.

From the results it came be concluded that all corridors HOV routes saved time and operated at higher average speeds than parallel non-HOV routes. The time savings ranged from a total of 37 minutes on I-95/I-395, to three minutes on US 50 in the AM peak direction.

HOV facilities are designed to provide faster travel times and more predictable speeds than parallel non-HOV facilities, which was something concluded in this study. It is clear that while HOV facilities aid in improving the operation of the region's roadways, they can also influence traveler behavior and manage the demand of single-occupant travel.

4.3.2 Outlook for Variably Priced Lanes/Systems

Variably Priced Lanes (VPLS), a demand management strategy, is the pricing of roadways to help reduce congestion and generate revenue for transportation projects. The TPB has had active

Deleted: April

interest in VPLs since June 2003 when the TPB, together with the Federal Highway Administration and the Maryland, Virginia, and District Department of Transportation, sponsored a successful one day conference on value pricing in the Washington region. After the conference, in Fall 2003, the TPB created a Task Force on Value Pricing to further examine and consider the subject.

There are currently three VPL projects in the region that are included in the Constrained Long Range Transportation Plan (CLRP):

- *The Intercounty Connector* – an 18-mile east-west highway in Montgomery County and Prince George's County Maryland that will run between I-270 and I-95/US 1. Six VPLs are planned with express bus service connecting to Metrorail. (construction began in 2008).
- *The Northern Virginia Capital Beltway High Occupancy Toll (HOT) lane project* – Four new HOT lanes are expected to be added to a 15-mile segment of I-495. These HOT lanes will be able to be used for free by vehicles with three or more occupants, as well as transit buses and emergency response vehicles. Other vehicles, such as single-occupant vehicles (SOV) will have to pay a fee to use the lanes. This fee will be according to the time of day. The project was added to the CLRP in 2005, and completion is expected by 2013.
- *I-95/I-395 HOT lane project in Northern Virginia* – HOV facilities between Eads Street in Arlington County and just south of Dumfries will be reconfigured to HOT lanes and the lanes will be extended from 2 – 3. Completion is expected in 2010.

Over the past several years, under a grant from the Federal Highway Administration's Value Pricing Program, the TPB Value Pricing Task Force has been evaluating a regional network of variably priced lanes in the region. The Value Pricing Pilot Program allowed extensive analysis of this large network, as well as the creation of other scenarios that apply variable pricing to some existing freeway and arterial lanes. A final report, essentially a "vision document" for the future of VPLs, was produced in February, 2008, which outlines the study of a regional network of variably priced lanes.[29]

The study involved the development and evaluation of the following VPL scenarios. These scenarios outline ways that VPLs could be used in the future:

- A "Maximum Capacity" network in which two VPLs were added to each direction of the region's freeways; one VPL was added to each direction of major arterials outside the Capital Beltway; existing High-Occupancy vehicle (HOV) lanes were converted to VPLs, and direct access/egress ramps were added at key interchanges in the VPL network.

- A "DC Restrained" scenario in which the new capacity from the "Maximum Capacity" scenario was removed from all of the bridges and other facilities in the District of

[29] *Evaluating a Network of Variably Priced Lanes for the Washington Metropolitan Region*, INSERT DATE OF FINAL REPORT

Deleted: April

Columbia, and replaced by variable pricing applied to existing freeway and selected arterial lanes.

- A "DC and Parkways Restrained" scenario in which the "DC Restrained" scenario was further restrained by applying variable pricing to the existing capacity on the region's parkways (Baltimore Washington, George Washington Memorial, Rock Creek, Clara Barton, and Suitland).

Comparison of scenarios, cost estimates, evaluation of potential land use impacts, and impacts of pricing scenarios on different populations were examined among the various scenarios. The report states that the next phase of the scenario study may identify a set of segments in these VPL networks which could be high priorities for expanding the VPL network in the region, beyond what is currently planned in the CLRP.

Value pricing is a concept that has been implemented in cities such as London, England and Stockholm, Sweden.

While the concept of value pricing is something that has yet to be implemented in our region, it will continue to be a strategy that is closely studied and considered well into the future to manage congestion.

4.3.3 Transit Systems

Transit systems can improve the operation of existing roadways and systems by carrying more passengers than a single-occupant vehicle. They can also be considered demand management strategies in that they can influence a person's traveling behavior and convince them to leave their car at home. Many of the transit systems in the region are operated by transit agencies or local government agencies, including:

- *Alexandria DASH*, a local bus service in Alexandria, Virginia
- *Arlington Rapid Transit (ART)*, a bus service in Arlington County, Virginia
- *Bethesda Circulator*, a downtown Bethesda bus service
- *CUE in City of Fairfax*, a bus service in City of Fairfax, Virginia
- *DC Circulator* bus, serving downtown District of Columbia
- *Fairfax Connector*, a bus service in Fairfax County, Virginia
- *Frederick County Transit*, a bus service in Frederick County, Maryland
- *GEORGE*, a bus serving Falls Church, Virginia
- *Greenbelt Connection*, bus serving Greenbelt upon request
- *Loudoun County Transit*, a bus service in Loudoun County, Virginia
- *Maryland Transit Administration (MTA) MARC* train commuter rail, serving District of Columbia and Maryland
- *Montgomery County Ride-On*, a local bus service in Montgomery County, Maryland
- *MTA Local Bus* service throughout Maryland
- *Potomac and Rappahannock Transportation Commission (PRTC)* OmniLink, a local bus service in Eastern Prince William County and Manassas

Deleted: April

- *Prince George's County Call-A-Bus*, serving those in Prince George's County not served by existing bus or rail
- *Prince George's County TheBus*, serving Prince George's County
- *Virginia Railway Express (VRE)* commuter rail serving Virginia and District of Columbia
- *Virginia Regional Transit* (in cooperation with Loudoun County Transit), a bus service in Loudoun County, Virginia
- *Washington Metropolitan Area Transit Authority (WMATA) Metrobus*, serving the entire Washington metropolitan area
- *Washington Metropolitan Area Transit Authority (WMATA) Metrorail*, serving the entire Washington metropolitan area

While these transit systems are individually very important strategies, it is important to note that they work together to form an entire transit network important to our congestion management system. They work well with other strategies as well, such as VPLs and HOV lanes. In addition, with the help of Intelligent Transportation System (ITS) technologies and Advanced Traveler Information Systems, transit can be even more appealing to travelers.

4.3.4 Pedestrian and Bicycle Transportation

Walking and bicycling is gaining more attention as having positive environmental and health benefits. As a part of the region's transportation network, these activities impact congestion management as well. There are a number of things the Washington region is doing to enhance the area of bicycle and pedestrian transportation to encourage non-motorized transportation.

- Most of the area's local governments have adopted bicycle, pedestrian, trail plans, and/or policies. Bicycle or pedestrian coordinators and trail planners are now found at most levels of government.
- The Washington Metropolitan Transit Authority (WMATA) has eliminated the requirement for bike-on-rail permits, expanded bicycle boarding hours, and added bike racks to its buses.
- In accordance with federal guidance and new state policies, pedestrian and bicycle facilities are increasingly being provided as part of larger transportation projects. A number of local jurisdictions have implemented transit oriented developments (TODs) and other walkable communities.
- Employers are investing in bike facilities at work sites, and developers are including paths in new construction.
- Specific bicycle/pedestrian campaigns are developing to encourage biking/walking, such as WALKArlington.[30]

Bicycle and pedestrian plans and projects are widespread throughout the Washington region. However, bicycling and walking could reach a greater potential. Many trips taken by automobile could potentially be taken by bicycle. This is especially true in areas such as Activity Centers and Activity Clusters, where a number of trips are more easily to be switched from motorized transportation to walking. Many people who live far from their jobs, but closer to transit or a

[30] http://www.walkarlington.com/

Deleted: April

carpool location could walk or bike to transit or the carpool instead of driving. When considering the following statistics, switching from a motor vehicle or bicycling or walking is feasible[31]:

- The average work trip length for all modes in the Washington Metropolitan Statistical Area is 16.2 miles.
- Seventeen percent of commute trips are less than five miles, a distance most people can cover by bicycle.
- The average trip distance to transit or carpool is only 3.1 miles.
- Only 15% of transit riders and carpoolers travel more than five miles to the transit or carpool location.

Supporting bicycle and pedestrian planning is important to congestion management. Each additional person walking or biking for a trip is one less person on the road, thus easing congestion. Pedestrian and bicycle facility planning is something that will continue to be considered in the realm of congestion management, not only as a stand-alone area, but in conjunction with transit projects and land use planning.

Deleted: *(To Be Completed)*¶

4.3.5 Recently Implemented Land Use Strategies in the Washington Region

The relationship of land use and transportation often have an important influence on a person's willingness to commute by transit, ridesharing, bicycling, or walking; modes other than driving alone. The TPB is undertaking projects that consider the relationship of land use and transportation, all of which are important components of the CMP. Concentrating activities near transportation facilities helps reduce the number and length of vehicle trips necessary by residents and workers. More trips can be made by walking. Densities can be sufficient to make provision of transit services cost effective.

Cooperative Forecasting

TPB coordinates with the regional Cooperative Forecasting process at COG.

Cooperative forecasting is a regional process that provides forecasts for demographic information that considers the potential impacts of future transportation facilities. The forecasts are based on national economic trends, local demographic factors, and are closely coordinated with regional travel forecasts.

Local jurisdictions develop independent projections of population, households, and employment based on pipeline development, market conditions, land use plans and zoning, and planned transportation improvements. These local forecasts are also compared and coordinated at the regional level to ensure compatibility. If there is a major change in planned transportation facilities (such as an addition or removal of a planned major facility) the cooperative forecasts are updated to reflect this change. Overall, Metropolitan Washington has strong, well-established processes to ensure transportation planning and land use planning are well-coordinated.

---

[31] *The Bicycle and Pedestrian Plan for the National Capital Region*: http://www.mwcog.org/uploads/committee-documents/v1ZfWl020070726155118.pdf

Deleted: April

Regional Activity Centers and Regional Activity Clusters:

The most recent round of cooperative forecasting projects increases in employment, population, and households by 2030, the end of the forecast period. Employment growth, population, and household growth is expected to increase more in the inner and outer suburbs than in the central jurisdictions. Much of this increase in employment and households is going to mean the development of new infrastructure and the expanding of already existing Regional Activity Centers and Regional Activity Clusters.

Regional Activity Centers and Regional Activity Clusters help coordinate transportation and land use planning in specific areas in the Washington region experiencing and anticipating growth. Focusing growth in Centers and Clusters is important to congestion management, where transportation options for those who live and work there can be provided. The concentration of activities and location near transportation facilities help reduce vehicle trips, as more trips can be made by walking. Transit services also become more cost effective.

The first map of Regional Activity Centers was created in 1999, and since that time it has been updated several times, based upon current local comprehensive plans and zoning. The most recent effort of updating the centers was Round 7.0, completed in June, 2007.[32]

The evaluation of Round 7.0 concluded that approximately 54 percent of the region's current employment and 55 percent of future jobs were located in the Activity Centers. In addition, the Activity Centers capture 58 percent of all new jobs between now and 2030. The Centers contain 13 percent of the region's existing households and nearly 16 percent of future households, a significant increase from the previous forecast. Although this number may not seem high, it is clear that Activity Centers are growing in many respects. It is important that transportation options continue to be considered for these Centers to accommodate the needs of people who live and work there.

Transportation-Land Use Connection (TLC) Program:

The Transportation-Land Use Connection (TLC) program provides support and assistance to local governments in the Washington region as they implement their own strategies to improve coordination between transportation and land use.

The program does this in two ways. First, it provides information via the Regional TLC Clearinghouse, which is a web-based source of information and transportation/land use coordination, experiences with transit-oriented development, and key strategies. Secondly, the TLC Technical Assistance Program provides consultant services to local jurisdictions working on projects land use and transportation projects.

Five projects were completed as part of the FY 2007 TLC program:

[32] *Metropolitan Washington Regional Activity Centers and Clusters report*, June, 2007.

Deleted: April

- *District of Columbia, Potomac Avenue Metro Station Area Scoping* – Assistance in developing a scope of work for a neighborhood plan near the Potomac Avenue Metro Station. The project's aim included revitalizing public space around the station, with a focus on increasing pedestrian enhancement around the neighborhood.

- *Montgomery / Prince George's Counties Langley Park / Takoma Park Pedestrian Study* – This study looked at enhancing pedestrian safety at the intersection of New Hampshire Avenue (MD 650), and University Boulevard (MD 193), the location of a future metro station along the proposed Purple Line.

- *St. Charles Urbanized Area, Urban Roads Standards* – Assistance in developing urban road standards, as the County's current road standards did not allow flexibility for compact, pedestrian-friendly road and streetscape design.

- *Fairfax County, Levels of Service around Transit Oriented Development* – This project looked at how best define an acceptable level of vehicular congestion around transit stations, which was important to Fairfax County in implementing a new locally-recognized definition on transit oriented development.

- *Prince William County, Scoping Assistance for Base Realignment and Closure (BRAC) impacts* – Examined how best to evaluate and address land use and transportation impacts of BRAC in the Potomac Communities are, located between two military bases.

The TLC program allows for flexibility to study a wide variety of transportation – land use issues. Some projects are more demand management focused, focusing on pedestrian improvements, growth management, and transit oriented development. Other projects address operational issues, including pedestrian safety improvements and roadway design. The goals among each may be different, but each project is applicable to congestion management.

Local Jurisdictional Land Use Planning Activities

There are also a number of activities going on at the local level that are important to congestion management. Activities range from having a strong comprehensive plan that guides local development, to the implementation of projects that include transportation options and pedestrian and bicycle facilities. Examples of local jurisdictional planning activities include:

- *Loudoun County's comprehensive plan* calls for higher densities in the eastern part of the County, generally along or near primary corridors such as Route 28 and the Dulles Toll Road, and near future planned rail stations. In addition, in 2007 a Plan Amendment called for achieving and maintaining acceptable levels of transportation along Route 50 by completing a planned road network and supporting alternative modes of transportation.

- The *Maryland-National Capital Park and Planning Commission's* plan for the Georgia Avenue corridor. Montgomery County planners are analyzing different development scenarios along the corridor, which extends from the District of Columbia north to the

Deleted: April

Maryland County line. Sector plans are also being considered for neighborhoods surrounding the Wheaton and Glenmont Metro Stations.

- *District of Columbia* has recently approved a number of mixed-use developments near the new baseball stadium, which will, among other things, facilitate pedestrian movement in a developing area. The projects contain a mix of office, hotel, retail, and residential all within easy access to the Navy Yard Metro station.

4.3.6 Traffic Management

The topic of Traffic Management, including Incident Management and Intelligent Transportation Systems (ITS) is considered under the Management, Operations, and Intelligent Transportation Systems (MOITS) Policy Task Force and MOITS Technical Subcommittee. MOITS advises the TPB on traffic management matters and provides a regional forum for coordination among TPB member agencies and other stakeholders on these topics.

Investments in operations-oriented strategies have time and again shown good benefit-cost ratios and best enable transportation agencies (for both highways and transit) to provide effective incident management and good customer service, through operations centers and staffs, motorist/safety service patrols, traffic signal optimization, and supporting technologies.

In addition, the Metropolitan Transportation Operations Coordination (MATOC) program, comprising DDOT, MDOT, VDOT, and WMATA, is a regional program to enhance the availability of real-time transportation information and strengthen coordination among transportation agencies.

4.3.6.1 Incident Management

According to the Federal Highway Administration, an estimated 50% of congestion is associated with incidents such as crashes, disabled vehicles, and traffic associated with special events. If an incident disrupts traffic, it is important for congestion that normal flow resumes quickly.

Many successful incident management activities are part of the robust activities undertaken by the Washington region’s transportation agencies. The region’s state DOTs all pursue strategies for managing their transportation systems, including operation of 24/7 traffic management centers, roadway surveillance, service patrols, and communications interconnections among personnel and systems. All three focus on getting timely word out to the media and public on incidents. Local-level agencies also play an important role in transportation management, particular on local roads and traffic signal optimization.

Deleted: ¶

Specific state-wide and regional incident management strategies include:

- ***Imaging / video for surveillance and detection*** – help detect incidents and allow emergency vehicles to arrive quickly. Also helps travelers negotiate around incidents.
    - Montgomery County operates an Advanced Transportation Management System (ATMS), with 200 surveillance cameras across the County;

Deleted: April

- The three state DOTs implement cameras for surveillance and detection.

- ***Service patrols*** – These specially equipped motor vehicles and trained staff help in clearing incidents off a roadway and navigating traffic safely around an incident.
  - MDOT and VDOT have deployed service patrols for a number of years. DDOT began deploying patrols in 2003.
  - Montgomery County became the region's first local jurisdiction to deploy patrols in 2006, concentrating on major arterials rather than freeways.

- ***Road Weather Management*** – Can take the forms of information dissemination, response and treatment, surveillance and monitoring, prediction, and traffic control.
  - All three state DOTs implement road weather management systems that disseminate information, treat roadways, and monitor conditions, especially during winter snow and ice events

.

- ***Traffic Management Centers (TMCs)*** – These centers collect and analyze traffic data, then disseminate data to the public. Data collection includes CCTVs, cameras, and loop detectors.
  - All three state DOTs have TMCs:
    - *VDOT's Smart Traffic Control Center in Northern Virginia* collects data from loop detectors and pavement sensors embedded in roadways to prompt and automatic incident detection which alerts the traffic control center.
    - *DDOT's Transportation Management Center* gathers and disseminates information to the public using a network of cameras and other devices.
    - *MDOT's Coordinated Highway Action Response Team (CHART)* collects traffic data, disseminates information to the public, and provides emergency motorist assistance.

- ***Curve Speed Warning Systems*** - use roadside detectors and electronic warning signs to warn drivers, typically those in commercial trucks and other heavy vehicles, of potentially dangerous speeds in approach to curves on highways, with the intention of preventing incidents.
  - Curve speed warning systems have been used on the Capital Beltway in Virginia and Maryland.

- ***Work zone management*** **-** uses traffic workers, signs, and temporary road blockers to direct and control traffic during construction activities.
  - All three state DOTs have work zone management programs to temporary implement traffic management and direct traffic. The goal is to reduce incidents by controlling the flow, speed, and direction of traffic.

- ***Automated truck rollover systems*** **-** detectors deployed on ramps to warn truck drivers if they are about to exceed their rollover threshold, thus helping to reduce incidents.
  - Automated truck rollover systems, similar to the curve speed warning systems, were implemented at the same locations on the Capital Beltway in Virginia and

Deleted: April

Maryland. This was in response to a high number of truck rollovers on the Beltway in the 1980's.

- ***Adaptive Signal Control*** – Coordinate management of traffic signals across a signal network, adjusting the lengths of signal phases based on prevailing traffic conditions automatically in response to traffic detected at a large number of detectors.
    - Arlington County's successful Adaptive Signal System allows traffic signals to be coordinated based on prevailing traffic conditions, which can be impacted by incidents.

Formatted: Indent: Left: 0.75"

Studies have shown the impact incident management activities have on reducing congestion, in particular reducing duration of incidents and reducing chances for secondary incidents. An example of this type of study is the yearly analysis of impacts of the Coordinated Highway Action Response Team (CHART) on incident management in Maryland. The focus of the report is to gauge effectiveness of CHART's availability to detect and manage incidents on major freeways and highways.

Deleted: of

Deleted: had an impact

Deleted: For

Deleted: , the 2007 evaluation

Deleted: concludes that…*(*

Formatted: Font: Not Bold, Not Italic

Deleted: ***be completed)***

Formatted: Font: Not Bold, Not Italic

Highlights of the 2006 CHART performance evaluation report includes:

- Distribution of incidents an disabled vehicles
    - By day and time
    - By road and location
    - By lane blockage type
    - By blockage duration
    - By nature of incident (vehicle fire, collision, etc.)
- Comparison of current year's data with that of previous years
- Benefits from CHART's incident management
    - Assistance to drivers
    - Potential reduction in secondary incidents
    - Estimated benefits due to efficient removal of stationary vehicles
    - Direct benefits to highway users

The CHART report includes specific statistics on the impact of CHART, including:

- When comparing clearance time of incidents and disabled vehicles with an without CHART, the assistance of CHART generally cut the duration of an incident or disabled vehicle in half:
    - In all cases with a clearance time less than or equal to 2 hours, the average duration of an incident or disabled vehicle was 11.89 minutes with CHART, compared to 24.94 minutes without CHART assistance.
- Response time was shortened with the help of SHA patrols, particularly when the incident blocked only the shoulder. The 2006 evaluation showed that with SHA patrol, incident response averaged 3.76 minutes, compared to 5.44 minutes without SHA patrol.
- Clearance time was also shortened with SHA patrol:
    - For incidents blocking only the shoulder, clearance time averaged 13.32 minutes, compared to 23.90 without SHA patrol.

Deleted: April

- For incidents blocking 1 lane, clearance time averaged 18.90 minutes, compared to 23.26 minutes without SHA patrol.
- For incidents greater than 4 lanes, clearance time averaged 47.33 minutes compared to 55.39 without SHA patrol.

- Incident duration also decreased with SHA patrol:
  - For incidents blocking shoulder only, duration averaged 17.16 minutes with SHA patrol, compared to 32.59 without.
  - For incidents blocking one lane, duration averaged 23.25 with SHA patrol, compared to 27.55 without.
  - For incidents blocking 4 lanes or more, duration lasted 49.38 minutes with SHA patrol, compared to 54.40 without.

Analysis and studies such as those conducted by CHART indicate that incident management activities do have a positive impact on congestion. Each minute of reduced duration of incidents, for example, reduces the chances of secondary incidents and has a concomitant reduction in the severity and duration of non-recurring congestion. Even a relatively simple activity such as a service patrol assisting a motorist with a flat tire, or who is out of gas, might prevent a congestion-inducing crash. Continuing enhancement and investment of incident management activities will support congestion management.

4.3.6.2 Intelligent Transportation Systems

The TPB works with the region's jurisdictions and local transportation agencies to implement various ITS technologies, from which the TPB compiles and analyzes operational management data.

ITS strategies can be defined as electronic technologies and communication devices aimed at monitoring traffic flow, detecting incidents, and providing information to the public and emergency systems on what is happening on our roadways and transit communities. Much of what is done with ITS helps in reducing non-recurring and incident-related congestion.

- ***Advanced Traveler Information Systems (ATIS)*** – A technology-based means of compiling and disseminating transportation systems information on a real-time or near-real-time basis prior to or during tripmaking.
  - Virginia operates under a statewide 511 system via telephone and the Internet.
  - The District of Columbia makes traffic information, including live traffic cameras, traffic alerts, and street closures, available on the DDOT website.
  - Maryland provides live traffic information on traffic and incidents via the CHART website.
  - WMATA provides real-time transit information on the web and on informational screens in the Metrorail stations.

- ***Advanced Traffic Signal Systems*** **-** The coordination of traffic signal operation in a jurisdiction, or between jurisdictions. This is important to congestion, as it reduces delay and improves travel times.

Deleted: April

- Arlington County has successfully deployed an adaptive signal system for a portion of its signal system.

- ***Electronic Payment Systems*** **-** These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor, and helps increase transit ridership and transfers among different transit modes.
  - SmarTrip cards are used for rail and bus fares (both WMATA and local buses) and for WMATA parking facilities.
  - The region's roadway toll agencies are part of the E-ZPass consortium electronic payment system.

- ***Freeway Ramp Metering*** **-** Traffic signals on freeway ramps that alternate between red and green to control the flow of vehicles entering the freeway. This prevents incidents that may occur from vehicles entering the freeway too quickly, and also prevents a backup of traffic on the on-ramp.
  - Ramp meters are used inside the Capital Beltway (I-495) in Virginia.

- ***Bus Priority Systems*** **-** Bus priority systems are sensors used to detect approaching transit vehicles an alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary. This is important because improved transit performance, including a more precisely predicted time for bus arrivals, makes public transit a more appealing option for travelers.
  - There have been three pilot deployments in the region: U.S. 1 (Fairfax County), Columbia Pike (Arlington County), and Georgia Avenue (DC). These are pilot projects intended to provide lessons learned for wider deployments.
  - Montgomery County has co-located traffic management and transit dispatch which enables adjustment of signals (by the centralized signal operations center) if deemed necessary for transit.

- ***Lane Management (e.g. Variable Speed Limits)*** **-** Variable Speed Limits are sensors used to monitor prevailing weather or traffic conditions, and message signs posting enforceable speed limits. These systems can promote the most effective use of available capacity during emergency evacuations, incidents, construction, and a variety of other traffic and/or weather conditions.
  - Lane management is used throughout the region by the three state DOTs.

- ***Automated Enforcement (e.g. red light cameras)*** **-** Still or video cameras that monitor things such as speed, ramp metering, and the running of red lights, to name a few. They are important to preventing non-recurring and incident related congestion.
  - In the Washington region, the legal ability to deploy these systems is in place in the District of Columbia and Maryland, and pending in Virginia.

Deleted: April

- ***Traffic Signal Timing* -** Traffic signal timing plans adjust traffic signals during an incident, during inclement weather, or to improve transit performance. The overall objective is to reduce backups at traffic signals and to increase the level of service.

- ***Reversible Lanes* -** Traffic sensors and lane control signs reverse the flow of traffic and allow travel in the peak direction during rush hours. This is important to alleviating congestion that may occur in one direction during a peak hour.

- ***Dynamic Routing/Scheduling* -** Public transportation routing and scheduling can automatically detect a vehicle's location, and dispatching and reservation technologies can facilitate the flexibility of routing/scheduling. This is can help increase the timeliness of public transportation, keep transit on schedule, which in turn increases ridership.

- ***Service Coordination and Fleet Management. (e.g. buses and trains sharing real-time information* -** Monitoring and communication technologies in a vehicle that facilitate the coordination of passenger transfers between vehicles or transit systems. This is important and appealing to passengers that use more than one type of transit.

- ***Probe Traffic Monitoring* -** Using individual vehicles in the traffic stream to measure the time it takes them to travel between two points and also to report abnormal traffic flow caused by incidents. Tracking could be done with the use of cellular phones, and in the future with the installation of a system in the vehicle which would send information to transportation operators. This is important to monitoring recurring and non-recurring congested locations, and travel time.
    - Probe traffic monitoring has been tested in the Baltimore region under the Maryland State Highway Administration and private sector partners.

- ***Variable Message Signs*** – Changeable electronic signs positioned along major highways that enable timely posting of warnings or other special messages.
    - All three state DOTs operate variable message signs. Posting travel times has been under study but not yet deployed. Temporary static signage has proved successful on projects such as the Woodrow Wilson Bridge construction.

4.4 Additional System Capacity

4.4.1 Documentation of Congestion Management for Additional System Capacity

Federal regulations state that any project proposing an increase in Single-Occupant Vehicle Capacity should show that congestion management strategies have been considered. The specific language from the Federal Rule states that Transportation Management Areas (TMAs) shall provide for:

"an appropriate analysis of reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in SOVs is proposed to be advanced with Federal Funds. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully

Deleted: April

satisfy the need for additional capacity in the corridor, and additional SOV capacity is warranted, then the congestion management process shall identify all reasonable strategies to managed the SOV facility safely and effectively."

In the Washington region, the TPB is ensuring that all proposed SOV capacity increasing projects (except those which are exempt) show that congestion management strategies have been considered to effectively manage the additional capacity. This is being done with agencies completing a "CMP Documentation Form" when submitting a proposal for projects in the long-range plan and Transportation Improvement Program (TIP).

Deleted: A blank sample CMP documentation form is provided for reference in Appendix D ***(to be provided later)***.

A sample CMP documentation form was developed to provide guidance to agencies completing these forms (Appendix C). Agencies completing these forms are able to cite various ongoing strategies in the region, local jurisdiction, and corridor in the vicinity of their project.

4.4.2 Where Additional System Capacity Is Needed and How the Additional System Capacity Will be Managed Efficiently

Deleted: 1

Deleted: ¶
¶
(to be completed)¶
¶
4.4.2

The CLRP, updated regularly, identifies where major roadway capacity expansions are planned. The TPB, through the CLRP, asks that congestion management strategies be considered for these capacity increases. In the Washington region, all proposed SOV capacity increasing projects (except those which are exempt), show that congestion management strategies have been considered to effectively manage the additional capacity. These types of strategies could be of demand or operational management, or both, as outlined in this report. Many of these strategies are considered before any capacity-increasing project is adopted.

Deleted: *(*

Formatted: Font: Not Bold, Not Italic

The CLRP, through the CMP, strongly encourages consideration and implementation of strategies such as the following to manage both existing and future additional roadway capacity:

- Transportation Demand Management (TDM) strategies, such as Commuter Connections programs.
- Traffic Operational Improvements
- Public Transportation Improvements
- Intelligent Transportation Systems technologies
- Combinations of the above strategies.

Roadway capacity increases may be needed in specific locations for a number of reasons including bottleneck removal, safety improvements, economic development, and other reasons. Managing this capacity through the CMP is key.

Formatted: Font: Not Bold, Not Italic

Deleted: ***completed)***

Formatted: Font color: Black

Formatted: Level 1

Deleted: April

5. RECENT STUDIES OF CONGESTION MANAGEMENT STRATEGIES

5.1 Project-Related Congestion Management

5.1.1 Woodrow Wilson Bridge

The Woodrow Wilson Bridge is a key connection point over the Potomac River between Alexandria, Virginia and Prince George's County, Maryland. The bridge carries the traffic of the I-95/I-495 corridor, a major highway in the Washington region. Traffic on the former bridge was one of the most significant bottlenecks and transportation issues in the Washington region. Replacing the original bridge was a primary concern, and consisted of building not one, but two parallel bridges.

The first of the two bridges opened in 2006. Congestion management strategies were implemented as programs and construction features to ensure that traffic ran smoothly on this major Washington corridor. Some of these strategies included:

- ***Bridge Bucks program* -** provides an incentive for commuters to give up driving alone and try transit or vanpooling as an alternative. Designed expressly for commuters who may be affected by construction along the 7.5-mile construction corridor, Bridge Bucks provided up to $50 per month in bus, rail or vanpool fare for one year. Bridge bucks could be used on Metrorail, local buses such as Metrobus, MTA local buses, and Fairfax Connector, and organized vanpools.
- ***Mission Possible initiative*** – The Mission Possible initiative was launched to provide information on alterative commute options, how travelers can help clear incidents, tips for drivers, and real-time traffic information.
- ***Updated Website Information*** – A Woodrow Wilson Bridge project website kept the public informed of project phases and news, a project scrapbook, a video, and more, to keep the public informed and included in the process.
- ***Bridge Construction Features***
    - Construction of the new bridge will accommodate pedestrians/bicyclists and metro rail.
    - The new drawbridge will be 20 feet higher than the old bridge with a 70 foot clearance. The increased clearance will allow for seventy-percent fewer bridge openings and traffic interruptions.
    - Currently, there are nearly 260 openings per year, which will be reduced to approximately 65 times per year.
    - The new bridge will have twelve lanes:
        - Eight general purpose lanes, matching the number of lanes on the Beltway which will unclog the existing bottleneck;
        - Two merge/divide lanes to allow safe acceleration and deceleration of vehicles traveling between the adjacent Maryland and Virginia interchanges;
        - An express/local configuration to balance through and local traffic;
        - HOV/Express Bus/rail transit lines (these lanes will not open for normal use until connecting systems are in place on both sides of the Potomac

Deleted: April

River, and will be used for incident management and traffic during construction).

5.1.2 I-95/I-495 Springfield Interchange

The Springfield Interchange is a heavily-traveled area where I-95, I-395, and I-495 come together. The Virginia Department of Transportation (VDOT) was especially concerned about the safety of the Springfield Interchange after a study revealed that this was the most dangerous spot on the 64-mile Capital Beltway.[33] During a two-year study the interchange logged 179 incidents. Thus, it was rebuilt for safer traveling. The Springfield Interchange project was completed in June, 2007.

VDOT created one of the nation's most ambitious Congestion Management Plans (CMP) to improve safety of the Springfield Interchange. The $28 million CMP pays for several programs to enhance commuter options during and after construction to keep traffic moving. Some CMP strategies were to:

- Improve alternative routes around the interchange;
- Provide fire and rescue equipment and staff for emergency services along with additional police services;
- A Springfield Interchange project website, to provide travelers with up-to-date information on the project status. In addition, the website provided information on alternative commute methods, traveler information systems (such as 511 Virginia), and news releases;
- Adding additional spaces to park-and-ride lots along I-95 over the course of a few years:
- Providing a shuttle for commuters from Prince William County to the District of Columbia to avoid driving in single-occupant vehicles through the construction;
- Providing informational kiosks at various business locations along the corridor;
- Providing bus passes for Metrobus;
- Funding vanpooling for commuters.

VDOT developed this CMP program by working with local governments and regional transit partners. VDOT continues to coordinate with its regional partners to monitor these services to adjust programs as necessary to meet commuter needs.

5.1.3. 11th Street Bridges

During the construction phases of the DDOT 11th Street Bridges project, several congestion management approaches were considered and the following will be implemented to mitigate congestion and keep traffic moving:

- Maintain three lanes of traffic in each direction across the river;
- Provide additional transit enhancements during peak traffic periods;

[33] Source: www.springfieldinterchange.com

Deleted: April

- Provide traveler information systems, including low power highway advisory radio, and Intelligent Transportation Systems, including real-time message signs with alternate route suggestions;
- Provide updated freeway guide signing within the immediate project area that reflects temporary access routes during the various phases of construction. Also provide way-finding signage for freeway access points on local roads in the project study area; and event management systems, such as roving tow services.

5.1.4 South Capitol Street Project

South Capitol Street is located near the Washington Nationals Ballpark and is anticipated to be crowded during the baseball season for Nationals games. The South Capitol Street project aims to reduce congestion in the area through implementing several congestion management features applicable for both stadium events and everyday traffic flow through the vicinity. The South Capitol Street Draft Environmental Impact Statement (DEIS) evaluates two Build Alternatives that improve safety, multimodal mobility, accessibility and support economic development in the corridor. Both alternatives include the following:

- Traffic signal optimization;
- Modifications to intersections to improve safety and reduce accident rates;
- Improved access to bus and rail transit in the project area;
- Reconstructed, widened, and/or new sidewalks and bicycle path.

Examples of the congestion management approaches considered include:

- Bicycle lanes, racks, stations, sharing lanes, and trails;
- Special events Transportation Systems Management (TSM) including a Transportation Demand Management (TDM) Web Site (godcgo.com). Citizens can use an interactive map feature on this Web Site to determine the best way to get to an event using transit (rail and bus); carpool/vanpool, bicycle, parking, and car sharing.
- *Bridge bucks* during the South Capitol Street bridge construction.

5.1.5 Northern Virginia Congestion Management Program During Construction

Deleted: ¶
¶

In 2007, the Virginia Department of Transportation (VDOT) began a new program of congestion management during roadway construction. This program has been developed to address potential increase congestion resulting from a number of simultaneous large-scale roadway construction projects. These projects include I-95/ I-395 High-Occupancy Toll (HOT) lanes project, the I-495 HOT lanes project, and the I-66 spot improvements project.

Deleted: To be

Deleted: .

Formatted: Font: Not Bold

Congestion management strategies considered for these future projects will be similar to those implemented for previous projects like the Woodrow Wilson Bridge and Springfield Interchange. Previous successful strategies included public outreach, additional transit services, park-and-ride facilities, and bolstering emergency services. New strategies to be considered include study and implementation of Variable Speed Limit (VPLs) to maintain mobility and minimize motorist delay, as well as additional traffic engineering analyses looking at construction related congestion.

Deleted: April

5.2 Analysis of Transportation Emissions Reduction Measures (TERMs)

5.2.1 Overview

Transportation Emission Reduction Measures (TERMs) are strategies or actions employed to offset increases in nitrogen oxide (NOx) and volatile organic compound (VOC) emissions from mobile sources. The TPB has been adopting TERMs since FY1995.

The Clean Air Act Amendments of 1990 (CAAA) and SAFETEA-LU requires metropolitan planning organizations and DOTs to perform air quality analyses, to ensure that the transportation plan and program conform to mobile emission budget established in the State Implementation Plans (SIP). Consequently MPOs and DOTs are required to identify TERMs that would provide emission-reduction benefits and other measures intended to modify motor vehicle use.

Deleted: MPO's

Selection of the TERMs requires quantitative as well as qualitative assessment. The quantitative assessment includes specific information on the benefits, costs, and expected air-quality benefits. Qualitative criteria includes ranking based on the subjective criteria's such as ease of implementation, how to implement, and synergy with other measures.

5.2.2 Findings and Applications to Congestion Management

Most TERMs are intended to reduce either the number of vehicle trips (VT), vehicle miles traveled (VMT), or both. These strategies may include ridesharing and telecommuting programs, improved transit and bicycling facilities, clean fuel vehicle programs or other possible actions. These TERMs are not only an important to offsetting increases in NOx and VOC, but may are important to the implications of congestion management as well.

The Washington region has adopted and implemented several TERMs with the sole aim of reducing emissions, such as the addition of clean diesel bus service, taxicabs with Compressed Natural Gas (CNG) cabs, and CNG buses. However, many TERMs also have an impact on congestion management. Examples of some of these congestion-mitigating TERMs that have been implemented include (the number after each TERM coincides with a number on the TERM tracking sheet):

Deleted: Following are some of the

Deleted: important to

- *Upgraded Signal Systems in Maryland*
  - MD 85 Executive Way to MD 355
  - MD 355, I-70 ramps to Grove Road
  - MD 410, 62nd Avenue to Riverdale Rd
- *Traffic Signal Optimization*
- *Alexandria Telecommuting Program*
- *Cherry Hill VRE access*
- *Bicycle facilities*
- *Additional park-and-ride lots*
  - Shady Grove West park-and-ride

Formatted: Bulleted + Level: 1 + Aligned at: 0.25" + Tab after: 0.5" + Indent at: 0.5"

Deleted: *(more to be completed)*

Formatted: Font: Italic

Deleted: April

  - White Oak park-and-ride
  - Tacketts Mill park-and-ride
  - Town of Leesburg park-and-ride
- *Pedestrian facilities to Metrorail*
- *Employer outreach/Guaranteed Ride Home*
- *District of Columbia Incident Response and Traffic Management System*
- *Carsharing program*

In addition, there are a number of potential TERMs that are being considered for the region that would impact congestion management. Some examples include:

- *Employer parking cash-out (M-07A)*
- *Improve pedestrian facilities near rail stations* (M-93)
- *Implement neighborhood circulator buses* (M -134)
- *Vanpool incentive program* (M-132)
- *WMATA bus information displays with maps* (M-148)
- *Enhanced commuter service (HOV facilities)* (M-150)
- *Parking impact fees* (M-144)

5.3 Regional Mobility and Accessibility Scenario Study

5.3.1 Introduction

As the National Capital Region Transportation Planning Board (TPB) voted to approve the 2000 fiscally Constrained Long-Range Transportation Plan (CLRP), members were dissatisfied to learn that congestion would continue to worsen over the next 25 years. The Regional Mobility and Accessibility Study grew out of this dissatisfaction. It sought to find creative new options to improve future congestion and performance of the region's transportation system. High rates of population and employment growth are projected for the region over the next 25 years. This will place future travel demands that may exceed projected revenues needed for new and expanded highway and transit network facilities. The Study's stated purpose was to "evaluate alternative options to improve mobility and accessibility between and among regional activity centers and the regional core."

Five alternative land use and transportation scenarios were analyzed. These alternatives analyzed different options to enable workers in the metropolitan Washington region to live closer to regional employment activity centers interconnected to each other through a greatly expanded regional transit network. The idea is to examine alternative transportation improvements together with potential future land use changes. If regional stakeholders ultimately agree on these options, the region could move forward in pursuing additional funding to implement the most promising of these transportation improvements and making the necessary changes in local land use plans.

The alternatives were developed by a Joint Technical Working Group (JTWG) composed of state and local jurisdiction staff serving in their role as members of the TPB Technical Committee, the Planning Directors' Technical Advisory Committee, and the Metropolitan Washington Air

Deleted: April

Quality Committee (MWAQC) Technical Advisory Committee. In addition, members of the TPB Citizen Advisory Committee and the Citizen Advisory Committees to MWAQC and the Council of Governments (COG) Metropolitan Development Policy Committee (MDPC) were also invited to participate in the meetings of the JTWG. The first phase of the study was completed in late 2006.

5.3.2 Strategies and Scenarios Analyzed

The following are the five strategies and scenarios analyzed:

1. *"Higher Households in Region" Scenario*: To reduce the estimate of forecast growth in the long distance commuting trips to the to the Washington region. This scenario assumed the development of more housing in the region than is currently planned for by 2030.

2. *"More Households in Inner Areas" Scenario*: To enable more workers to live closer to their jobs by assuming some shifts in future household growth from the outer suburbs of the region to the inner suburbs and core area jurisdictions.

3. *"More Jobs in Outer Areas" Scenario*: To examine the impacts of shifting some of the forecast job growth from core area jurisdictions to the outer suburbs.

4. *"Region Undivided Scenario"*: To look at the potential impacts of shifting some of the future household and job growth from the western portion of the region to the eastern portion.

5. *"Transit Oriented Development (TOD)" Scenario*: To examine the impacts of concentrating more of the region's future growth in areas that could be efficiently served by transit.

5.3.3 Key Findings

Each scenario was carefully analyzed. Key findings from the alternative analysis showed that concentrating more of the region's future housing growth in Regional Activity Clusters supported by an expanded regional transit network would increase transit use and daily walking and biking trips, while decreasing driving and congestion relative to current plans and growth trends. This scenario also had small, but favorable impacts on regional accessibility, land use, air quality and other measures of effectiveness evaluated in this study.

6. HOW RESULTS OF THE CMP ARE INTEGRATED INTO THE CLRP

The region compiles information on the congestion management strategies considered, implemented, or committed to in conjunction with roadway projects or studies. This provides an overall picture of congestion in the region, and helps set the stage for agencies to implement CMP strategies, including those integrated into capacity-increasing roadway projects.

Deleted: April

Each strategy is assessed in the post-implementation phase. This determines the success each strategy has at reducing congestion. Considering the impacts and results becomes especially important when updating the CMP and considering adding new strategies to the process.

For planned (CLRP) or programmed (TIP) projects, the locations of planned or programmed improvements on freeways are able to be noted with the locations of congestion. The level of correlation is shown between projects and congestion. This helps guide decision makers as to prioritize areas for current and future projects.

For the 2007 CLRP, the correlation between congested locations as shown in the CMP and planned or programmed projects was high. Most planned or programmed projects were in locations where significant congestion is being experienced[34].

6.1 Demand Management in the CLRP

Existing demand management strategies contribute to a more effective use and improved safety of existing and future transportation systems. The long-range plan takes a number of demand management strategies into consideration when planning for the region's transportation infrastructure. Such strategies include alternative commute programs, managed facilities (such as HOV facilities and variably priced lanes), public transportation improvements, pedestrian and bicycle facility improvements, and growth management (implementing transportation and land use activities). These strategies are outlined in detail in Section 4.2

Deleted: *(To be completed)*¶

6.2 Roadway and Systems Management in the CLRP

Part of the CMP effort focuses on defining the existing operational management strategies that contribute to the more effective use and improved safety of existing and future transportation systems. Such strategies include incident management programs, ITS Technologies, Advanced Traveler Information Systems, and traffic engineering improvements. These strategies are outlined in detail in Section 4.3.

Deleted: *(To be completed)*¶

6.3 Capacity Increases in the CLRP and Their CMP Components

Formatted: Font: Italic

Formatted: None

Federal law and regulations list capacity increases as another possible component of operational management strategies, for consideration in cases of:

- *Elimination of bottlenecks*, where a modest increase of capacity at a critical chokepoint can relieve congestion affecting a facility or facilities well beyond the chokepoint location. Widening the ramp from I-495 Capital Beltway Outer Loop to westbound VA 267 (Dulles Toll Road) relieved miles of regularly occurring backups on the Beltway and across the American Legion Bridge.

[34] Please refer back to Figure 11 in Section 3.1.1 – Freeways – for reference.

Deleted: April

- *Safety improvements*, where safety issues may be worsening congestion, such as at high-crash locations, mitigating the safety issues may help alleviate congestion associated with those locations.

- *Traffic operational improvements*, including adding or lengthening left turn, right turn, or merge lanes or reconfiguring the engineering design of intersections to aid traffic flow while maintaining safety.

Deleted: *(To be completed)*¶

7. DATA AND METHODOLOGIES

7.1. Definition and Description of the CMP Network

7.1.1 Coverage Area and Extent of the CMP

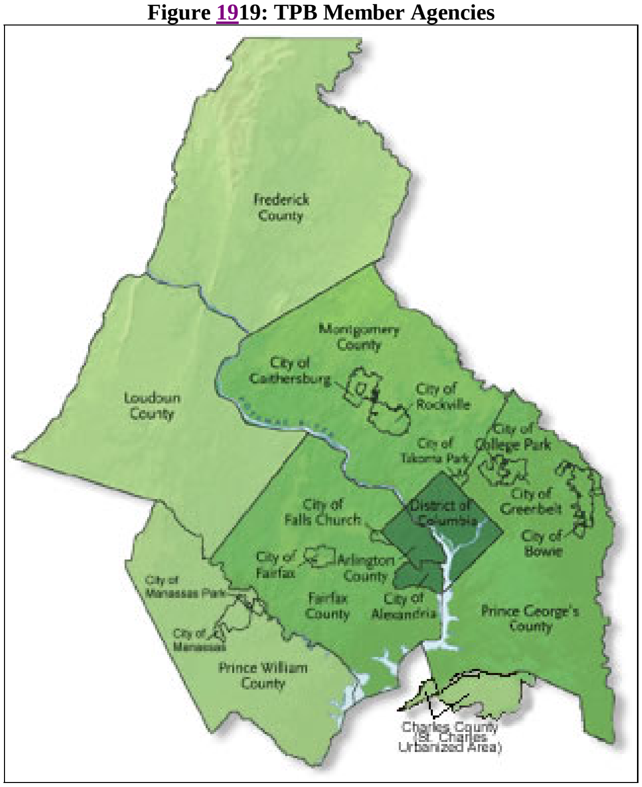
The Washington region CMP covers the TPB planning area (Figure 19).

Deleted: 2

The TPB's planning area covers the District of Columbia and surrounding jurisdictions. In Maryland these jurisdictions include Frederick County, Montgomery County, and Prince George's County and the St. Charles urbanized area of Charles County, plus the cities of Bowie, College Park, Gaithersburg, Greenbelt, Rockville, and Takoma Park. In Virginia, the planning area includes Alexandria, Arlington County, the City of Fairfax, Fairfax County, Falls Church, Loudoun County, Manassas, and Prince William County.

Deleted: April

Figure 1919: TPB Member Agencies



7.1.2 CMP Network

For the 2007-2008 CMP, the TPB's efforts were primarily focused on:

- *Documenting* ongoing congestion management *strategies* in the CMP network. There are a number of different strategies going on in the region, both in local jurisdictions and on a regional level, such as with Commuter Connections. This initial effort was focused on providing an analysis of what CMP strategies were already being done. Documenting existing strategies was also an important part of ensuring that the 2007 long-range plan had a CMP component.
- *Measuring and monitoring* congestion in the region with ongoing studies such as the Arterial Travel Time Study and Freeway Monitoring Program, as well as Travel Forecasting activities.

7.2 Performance Measures

7.2.1 Introduction to Performance Measures

Deleted: April

A performance measure, or indicator, is a means to gauge and understand the usage of a transportation facility, or the characteristics of particular travelers and their trips. The performance measure/indicator may refer to a particular location or "link" of the transportation system.

Performance measures can be either quantitative or qualitative. It may refer to the experience of a traveler on a trip between a particular origin and a particular destination. It may summarize all trips or trip makers between a particular origin and destination pair. Or, it may describe the operation of one mode of transportation versus another.

Federal regulations state that the CMP should include:

"Definition of congestion management objectives and performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods."

The fields of transportation planning have typically used mode-specific performance measures/indicators to gauge conditions on the system. These include motor-vehicle specific performance measures such as traffic volumes, capacities, and level-of-service.

7.2.2 How Performance Measures/Indicators Were Selected

Level of Service has generally been the most widely used performance measure in the Washington region, as can be seen in the Freeway Monitoring Program and Arterial Monitoring Program. However, there are other performance measures that are used, such as Volume/Capacity (V/C) ratio.

In 1996, the CMS Task Force undertook discussion of CMP performance measures/indicators because of the emphasis in federal CMP guidance on this issue. The efforts at the beginning of the process involved a literature search and brainstorming process. An array of possible performance measures were developed based on materials from an FHWA instructional course on CMP. The CMP Task Force worked with these draft lists, adding, deleting, and changing the performance measures to suit the needs of the Washington region. The result was a stratified list of CMP performance measures.

Early in the process, the CMS Task Force was already aware of the gap between the intermodal, locally focused performance measures/indicators available and the multi-modal, wide-area scope desired for congestion management. Other issues were raised, as well, which set the tone of the discussion. The following were taken into consideration:

- Can the particular performance measure/indicator (or the data needed to feed it) be forecast by known tools and capabilities?
- Traditional congestion indicators tended to be precise in scale, addressing a particular link or intersection on the transportation system, yet modeling or forecasting capabilities tended to be rough in scale, forecasting at best, a regional or sub-regional scale.

- The choice of performance measures may lead or bias the investigator toward only certain kinds of solutions, and eliminate others that may actually be worthy. This was a particular concern expressed by elected officials on the TPB.
- The CMP tries to have a vague, layman's term, "congestion" apply to a technical process. Congestion could be characterized by crowdedness, by delay, or by decreases in traffic speeds. Conversely, crowdedness, delay, and slowing are not all the same phenomenon not always experienced, and not always tantamount to congestion.
- Level of Service appeared to be the most promising alternative to using delay. It has been used frequently in the past, and there is a level of understanding and buy-in from regional decision makers and the public. Level-of service does have some drawbacks, including not being multi-modal. In addition, it is difficult to distinguish from the varying severities of Level of Service "F."

The solution proposed and adopted instead was to choose a whole list of indicators, and apply them where and when relevant. The CMS Task Force reviewed over 100 different performance measures in use or suggested for use by States and localities around the country. This list was then narrowed to a manageable few. Some of the major criteria used to rate the utility of prospective performance measures were the following:

- Had to be clear and understandable.
- Had to be sensitive to modes.
- Had to be sensitive to time.
- Based on readily available data.
- Can be forecast.
- Able to gauge the impact of one or more congestion management strategies.

7.2.3 Selected CMP Performance Measures

7.2.3.1 Summary List

Following is a list of performance measures selected:[35]

- *Data for Direct Assessment of Current (or future background) Conditions:*
  - Traffic volumes
  - Facility capacity
  - Speed
  - Vehicle density
  - Vehicle classification
  - Vehicle occupancy
  - Transit ridership

- *Calculated performance measures/indicators for congestion assessment:*
  - Volume-to-capacity (V/C) ratio
  - Level of Service

[35] As identified in the *CMS Work Plan for the Washington Region*, approved by the TPB on September 21, 1994.

Deleted: April

Deleted: *(to be completed)*¶

Formatted: Justified

Deleted: *(to be completed)*¶
¶

Deleted: 3.

Deleted: *(to be completed)*

Formatted: Font: Not Bold, Not Italic

Deleted: ¶
<#>**Descriptions of the Performance Measures**¶
¶
(to be completed)¶

Formatted: Justified, None

Formatted: Font: Not Bold

Formatted: Font: Not Bold, Italic

Formatted: Justified, None, Bulleted + Level: 1 + Aligned at: 0.25" + Tab after: 0.5" + Indent at: 0.5"

Deleted: Future) Background

Formatted: Font: Not Bold, Italic

Formatted: Font: Not Bold

Deleted: April

- Person miles of travel/vehicle miles of travel
- Truck hours of travel
- Person hours of delay/vehicle hours of delay
- Modal shares
- Safety considerations
- Vehicle trips
- Emissions reduction benefits

7.2.3.2 Descriptions of the Performance Measures

- *Traffic volumes* – number of vehicles crossing a certain point, usually expressed for an average weekday. This indicator would be applicable in corridors or spot locations, and of interest in the assessment of most CMP strategies.
- *Facility capacity* – Typically for highways, and expressed in terms of the number of passenger car equivalents that can pass over a certain point in an hour, given the geometric characteristics and environment of the highway.
- *Speed* – Defined as the average running speed of motor vehicles traversing a section of roadway. Speed as an indicator is applicable in corridors or spot locations, and is of interest in the assessment of most CMP strategies.
- *Vehicle density* – Described as passenger-car-equivalents per lane per mile. It is of interest for highway-oriented CMP strategies such as traffic operations and HOV facilities.
- *Vehicle classification* – Entails determining the proportion of traffic passing a given point. Can be passenger cars, trucks, buses, or other vehicle types. It is applicable to spot locations, and is of interest in the assessment of most CMP strategies.
- *Vehicle occupancy* – average number of persons per motor vehicle for a given location. It is applicable region-wide, or on a corridor or spot basis. Can be used in the comparison of corridors.
- *Transit ridership* – average daily volume of passengers on given transit lines or facilities. It is of interest in the assessment of the following CMP strategies: Transportation Demand Management (TDM), transit, congestion pricing, and growth management.
- *Volume-to-Capacity (V/C) Ratio* – ratio of demand flow rate at a given level of vehicle capacity for a roadway. Calculated from available highway data according to national standards in the Highway Capacity Manual. V/C Ratio was analyzed in the 2008-2030 Plan Performance evaluation.
- *Level of Service* – rating of the quality of service provided by a roadway under a given set of operating conditions. A roadway is classified with a letter “A” through “F” with “A” being the least congestion and “F” being the most congested. This performance measure is currently used in the Freeway Monitoring Program.
- *Person Miles of Travel/Vehicle Miles of Travel* – sum of all miles of travel by all vehicles for a given area or facility for a given period of time, factored by the vehicle occupancy to gauge person movement.
- *Modal Shares* – indicate the apportioning of person trips among possible transportation modes: single-occupant vehicle (SOV), high-occupancy vehicle (HOV), transit, non-motorized, or other modes of transportation.

Deleted: April

- *Safety Considerations* – include empirical or sketch planning evaluation of safety or hazard issues in a given congestion situation or in consideration of potential congestion management strategies.
- *Vehicle Trips* – number of motor vehicle trips from a given origin to a given destination, which may be stratified by mode purpose, time period, vehicle type, or other classifications.
- *Emissions Reductions Benefits* – reductions in pollution emissions based on reductions in vehicle miles of travel or vehicle trips. Currently, this performance measure is used when analyzing the TERMs for the region.

7.2.3.3 Performance Measures/Indicators Requiring Further Research Before Use in the CMP

There are a number of performance measures that would be beneficial to congestion management, but require more research before use in the CMP. Some of these include:

- *Bicycle usage and pedestrian counts*
    - Very little data on these have been collected in the region, but would be beneficial in areas such as bicycle and pedestrian planning and growth management.
- *Number of congested intersections*
    - Will give an indication of the extent and severity of congestion. Possible sources include traffic volumes, Data Clearinghouse information, and traffic operations models.
- *Hours per day of congestion*
    - Will directly address the need to gauge the extent of congestion on the transportation system. This indicator is dependent upon having travel volumes by time of day.
- *Percent person miles of travel by congestion level*
    - Will allow comparison of the extent of congestion among CMP locations.
- *Percent delay*
    - The total delay (in minutes) divided by the designated threshold (meaning expected, ideal, or free-flow) travel time. For example, a percent delay of 25% would mean that travel time on a certain segment of the transportation system is taking 25% longer than it would be expected to under non-congested conditions.
- *Number of average duration of incidents*
    - Could be incidents, special events, infrastructure or equipment failures, or other unusual circumstances that lead to a one-time-only or occasional increase in traveler delay.
- *Truck and freight movement involvement with congestion*
    - Impact of truck and freight movement on congestion. Currently the region does not have much data on hand in this area.
- *Percent of person miles of travel by transit load factor*
    - This is the transit analog of highway congestion as described by Level of Service. Load factor indicates the crowdedness of the transit vehicles, thus providing an overall indication of crowdedness on the portion of the transportation system.
- *Person volume-to-person capacity ratio*

Deleted: ¶
(to be completed)¶
¶
<#>**Calculated Performance Measures/Indicators for Congestion Assessment**¶
¶
(to be completed)¶
¶
<#>**Performance Measures/Indicators Requiring Further Research Before Use in the CMP**¶
¶
(to be completed)¶
¶
7.3.3.4 Congestion Thresholds¶
¶
(

Formatted: Font: Not Bold, Not Italic

Formatted: Justified, Bulleted + Level: 2 + Aligned at: 0.75" + Tab after: 1" + Indent at: 1"

Formatted: Font: Not Bold, Not Italic

Deleted: *completed)*

Formatted: Font: Italic

Deleted: April

- Used to develop a Level of Service for transportation corridors by taking the sum of automobile and transit capacities. Levels of service are then determined with reference to volume-to-capacity standards.

7.3 Detailed Review of Congestion Management Strategies

7.3.1 Introduction

Federal regulations state that the CMP should include:

> *"Identification and evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combinations of strategies, are some examples of what should be appropriately considered for each area:*
>
> *(i) Demand Management measures, including growth management and congestion pricing;*
> *(ii) Traffic operational improvements;*
> *(iii) Public transportation improvements;*
> *(iv) ITS technologies as related to the regional ITS architecture; and*
> *(v) Where, necessary, additional system capacity."*[36]

To address this point, strategy long lists have been developed as a way of categorizing congestion management strategies and characterizing the current impact, or potential impact, these strategies have throughout our region.

These lists are modeled after the longstanding Transportation Emission Reduction Measure (TERM) process for air quality in the region. The TERM list was formed as a way of developing additional plan and program elements which could be utilized to mitigate emission increases.

Similarly, lists have been developed for strategies under consideration for Congestion Management. At this time the effort is proposed to be qualitative, as the congestion information is not tied to one specific location. In addition, some strategies are regional while others are done at a more local level, and a qualitative effort better characterizes the impact they have on the region as a whole.

The following section contains background and summary information of how the Strategy Long Lists were developed.

---

[36] §450.320(c), Metropolitan Transportation Planning, Final Rule, Federal Register, February 14, 2007 – emphasis added.

Deleted: April

7.3.2 Descriptions of Strategies

7.3.2.1 General Characteristics

There are two strategy criteria lists; one for operational management strategies (those strategies contributing to a more effective use of existing systems) and one for demand management strategies (those that influence travel behavior). However, the qualitative criteria across the top of the lists, and the methodology used to categorize each strategy as “high”, “medium”, and “low” are the same for both lists. The separate lists are simply for the purpose of distinguishing between the two types of strategies.

Deleted: April

Following is an explanation of the lists and how they were developed:

Deleted: The lists are provided in Appendix E ***(to be included later)***, and should be referred to for reference.¶

Strategy Name and Number:

The strategies down the left-hand side of the lists were developed based on the types of strategies being pursued in the region and elsewhere, and could be considered for implementation in our region. Inclusion of any given strategy on the list does not imply endorsement, but rather is included on the list only for consideration and comparison purposes.

Each strategy has a number associated with it (C.1.0, C.1.1, etc.) to make it easier to find and discuss the strategies. The number is not in any way a ranking.

Those listed in bold italics are the strategy categories and underneath them are the specific strategies in that category.

A brief overview and definition of each category and strategy in the lists is provided in Section 7.3.2.2.

Qualitative Criteria:

The qualitative criteria listed across the top of the lists are used to show what kind of impact strategies have on various areas. The first three criteria listed are all impacts on congestion. However, there are several other criteria that could be looked at to determine if a strategy should be considered. The following is a definition of each criterion, and the questions we may want to ask when giving each strategy a "high," "medium," or "low" indicator:

- ***Reduces Overall Congestion***
  - How much of an impact does a strategy have in reducing overall traffic congestion?
- ***Reduces Incident-related Congestion***
  - How much of an impact does a strategy have in reducing incidents and incident-related congestion?
- ***Support/Promotes Multi-modal Transportation***
  - Does this strategy play a particular role in supporting multi-modal transportation, such as the use of bus, rail, bicycling, or pedestrian facilities?
- ***Regional Applicability***
  - Is this the type of strategy that would be easier to implement at the regional level (e.g. alternative commute programs across the region)?
- ***Local Applicability***
  - Is this the type of strategy that would be easier to implement at the local level (e.g. Automated Enforcement, which depends greatly on the local laws and law enforcement)?
- ***Existing Level of Deployment***
  - Is this strategy implemented anywhere in the region now, and if so, to what extent?
- ***Ease of Implementation***

Deleted: April

  - How easy is the strategy to implement? Not only in terms of complexity, but in also in terms of funding, and a local jurisdiction's unique programs and laws. Some strategies are more common and more promising, while others may be more difficult to implement.
- ***Cost***
  - How much does a strategy cost to implement?
- ***Cost Effectiveness***
  - How much does the value outweigh the cost (i.e. how high are the benefits)? This is different than the previous "cost" category. For example, carpooling may be indicated as low in terms of cost, because the cost is generally low to implement. However, carpooling may be indicated as high in terms of cost effectiveness, because the benefits and value gained in the region far outweigh the cost.
- ***Enhance Existing Programs***
  - How well does this strategy fit in with existing strategies in the region? Is it new and something that existing strategies would benefit from? This category, previously broken down into "DC," "MD," and "VA," was collapsed into one category. It was found that when trying to determine if a strategy enhanced existing programs, there was not much variation among the jurisdictions.

Low, Medium, and High Indicators:

Each strategy was given an indicator of "low," "medium," or "high," which was based on a similar nomenclature used in the TERM process. Each indicator was developed from the knowledge and research of what sorts of activities are going on in our region. By nature of various strategies, some will be evaluated with greater or lesser impacts (e.g. a strategy may be listed as "low" for regional applicability but "high" for local applicability"). That being said, some strategies that are "low" in some categories may be of interest for other reasons.

To further explain and clarify the reason for these indicators, let's walk through the indicators of one strategy, *C.8.1 – Improve Pedestrian Facilities*:

- Improving pedestrian facilities was thought to have a medium impact on reducing overall congestion in the region. Improving pedestrian facilities provides an alternative mode of transportation and takes some cars off the road.
- Its contribution to reducing incident-related congestion is limited; therefore it is indicated low in that category.
- Improving pedestrian facilities greatly support and promote multi-modal transportation, therefore indicated high.
- It is something that can be implemented region-wide, but is more likely to be applied more on a local level, given the unique programs and laws of jurisdictions (thus a medium indicator for regional applicability and a high indicator for local applicability).
- It has a fairly good existing level of deployment across the region (although given the high demand for pedestrian facilities in this region, some areas are lacking facilities).
- Ease of implementation for improving pedestrian facilities could be less expensive than building new roadways, and it could be easier to implement than ITS technologies.

Deleted: April

However, challenges such as local approval, and demand for these facilities, still remain. Indicator: medium.

- Cost is neither extremely low nor especially high, and it really depends on what type of pedestrian facility is being implemented. Cost effectiveness was indicated medium, as pedestrian facilities provide a good benefit for what it costs to implement them.
- Improvement of pedestrian facilities enhance existing programs. Pedestrian facilities support local growth management plans and provide access to transit options. Indicator: high.

Tying It All Together:

The strategy long lists are important to the regional CMP for several reasons:

- The lists outline various existing and potential strategies that could be considered for our region. As congestion is becoming and epidemic here and elsewhere, these strategies will serve as a point of reference to indicate what is being done in this region to address this.
- The "high," "medium," and "low" indicators characterize the impact strategies have. They provide a starting point for discussion show that there are various reasons why one may want to implement a strategy. While something may have a high cost, it may also have a high impact on reducing congestion and a high cost effectiveness.
- The lists address federal requirements, which state that the region should identify and evaluate anticipated performance and expected benefits of existing strategies.

As the region continues to grow these are just some of the strategies that could be considered for our region. Many strategies on these lists are ongoing and will continue to be implemented on a greater scale. For other strategies these lists may act as a starting point for future consideration. Regardless, congestion management strategies will be at the forefront of discussion as the Washington region continues to be a dynamic living and working environment.

7.3.2.2 Detailed Descriptions of Strategies

Following is a list of congestion management strategies listed in the Strategy Long Lists. The numbers correspond with the numbered strategies in the list.

Operational Management Strategies:

C.1.0 - Incident Management./Non-recurring - This category of strategies are aimed at reducing non-recurring congestion; congestion caused primarily by incidents and events. Many of these incident management systems are aimed at clearing an incident so that traffic can resume its normal flow.

- *C.1.1 – Imaging/Video for Surveillance and Detection*
  - Cameras throughout our transportation system, on roadways, at intersections, and at transit stations. Help detect incidents quickly, help emergency response units arrive quickly and help travelers safely negotiate around incidents.
- *C.1.2 – Service Patrols*

Deleted: April

- o Specially equipped motor vehicles and trained staff that help in clearing incidents off a roadway and navigating traffic safely around an incident.
- *C.1.3 – Emergency Management Systems (EMS)*
  - o EMS notify, dispatch, and guide emergency responders to an incident. Aid in detecting, tracking, and clearing incidents.
- *C. 1.4 – Emergency Vehicle Preemption*
  - o Signal preemption for emergency vehicles use sensors to detect and emergency vehicle and provide a green signal to the vehicle. This is important to incident management in that it allows for emergency vehicles to get to the scene of and incident and clear it so that traffic can resume its normal flow.
- *C.1.5 – Road Weather Management*
  - o Can take the forms of information dissemination, response and treatment, surveillance monitoring, and prediction, and traffic control. Helps prevent incidents due to inclement weather (snow, ice).
- *C.1.6 – Traffic Management Centers (TMCs)*
  - o Centers that collect and analyze traffic data and then disseminate data to the public. Data collection elements might include CCTVs, cameras, and loop detectors. Might relay information to the public through radio, TV, or the Internet. This is important to the public, as it allows them to get information about existing traffic conditions and plan their route and timing accordingly.
- *C.1.7 – Curve Speed Warning System*
  - o GPS and digital devices on a highway that assess and detect the threat of vehicles moving toward a curve too quickly. This is important in preventing incidents and thus preventing non-recurring congestion.
- *C.1.8 – Work Zone Management*
  - o Can take the form of traffic workers, signs, and temporary road blockers used to direct traffic during an incident or construction. The temporary implementation of traffic management or incident management capabilities can help direct the flow of traffic, keep traffic moving, and prevent additional incidents.
- *C.1.9 – Automated truck rollover systems*
  - o Detectors deployed on ramps to warn trucks if they are about to exceed their rollover threshold. If the data concludes a truck’s maximum safe speed is to be exceeded around a turn, then a message sign would flash, “TRUCKS REDUCE SPEED.” This is important in preventing incidents caused by large trucks, and thus preventing non-recurring congestion.

C.2.0 – ITS Technologies – This category of strategies can be defined as electronic technologies and communication devices aimed at monitoring traffic flow, detecting incidents, and providing information to the public and emergency systems on what is happening on our roadways and transit communities. Much of what is done with ITS helps in reducing non-recurring and incident-related congestion, and works hand-in-hand with those strategies listed in the above category (C.1.0).

C.2.1 – Advanced Traffic Signal Systems

Deleted: April

- The coordination of traffic signal operation in a jurisdiction, or between jurisdictions. This is important to congestion, as it reduces delay and improves travel times.

- *C.2.2 – Electronic Payment Systems*
  - These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor, and helps increase transit ridership and transfers among different transit modes.
- *C.2.3 – Freeway Ramp Metering*
  - Traffic signals on freeway ramps that alternate between red and green to control the flow of vehicles entering the freeway. This prevents incidents that may occur from vehicles entering the freeway too quickly, and also prevents a backup of traffic on the on-ramp.
- *C.2.4 – Bus Priority Systems*
  - Bus priority systems are sensors used to detect approaching transit vehicles an alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary. This is important because improved transit performance, including a more precisely predicted time for bus arrivals, makes public transit a more appealing option for travelers.
- *C.2.5 – Lane Management (e.g. Variable Speed Limits)*
  - Variable Speed Limits are sensors used to monitor prevailing weather or traffic conditions, and message signs posting enforceable speed limits. These systems can promote the most effective use of available capacity during emergency evacuations, incidents, construction, and a variety of other traffic and/or weather conditions.
- *C.2.6 – Automated Enforcement (e.g. red light cameras)*
  - Still or video cameras that monitor things such as speed, ramp metering, and the running of red lights, to name a few. They are important to preventing non-recurring and incident related congestion.
- *C.2.7 – Traffic Signal Timing*
  - Traffic signal timing plans adjust traffic signals during an incident, during inclement weather, or to improve transit performance. The overall objective is to reduce backups at traffic signals and to increase the level of service.
- *C.2.8 – Reversible Lanes*
  - Traffic sensors and lane control signs reverse the flow of traffic and allow travel in the peak direction during rush hours. This is important to alleviating congestion that may occur in one direction during a peak hour.
- *C.2.9 – Dynamic Routing/Scheduling*
  - Public transportation routing and scheduling can automatically detect a vehicle's location, and dispatching and reservation technologies can facilitate the flexibility of routing/scheduling. This is can help increase the timeliness of public transportation, keep transit on schedule, which in turn increases ridership.
- *C.2.11 – Service Coordination and Fleet Management (e.g. buses and trains sharing real-time information*

Deleted: April

  - Monitoring and communication technologies in a vehicle that facilitate the coordination of passenger transfers between vehicles or transit systems. This is important and appealing to passengers that use more than one type of transit.
- *C.2.12 – Probe Traffic Monitoring*
  - Using individual vehicles in the traffic stream to measure the time it takes them to travel between two points and also to report abnormal traffic flow caused by incidents. Tracking could be done with the use of cellular phones, and in the future with the installation of a system in the vehicle which would send information to transportation operators. This is important to monitoring recurring and non-recurring congested locations, and travel time.

C.3.0 – Advanced Traveler Information Systems – Provide information to travelers which allow them to adjust the timing of their travels or the route that they take to avoid any incidents, construction, or weather problems.

- *C.3.1 – 511*
  - A variety of applications for travelers to use either before their trip or en-route, such as 511 telephone systems, internet websites, pagers, cell phones, and radio, to obtain up-to-date traveler information. This helps travelers plan their timing and routes accordingly.
- *C.3.2 – Variable Message Signs (VMS)*
  - One way ITS operators can share traffic information with travelers is through a Variable Message Sign (VMS) along the roadway. Such signs could provide information on road closures, emergency messages, weather message, and construction. This helps travelers plan their timing and routes accordingly. These signs can also prevent incidents from occurring as they provide warnings about speed, weather, construction, etc.

Deleted: is

- *C.3.3 – Highway Advisory Radio (HAR)*
  - Another way ITS operators can share traffic information with travelers is through Highway Advisory Radio (HAR). The radio can provide information on road closures, emergency messages, weather, and construction (such as the Woodrow Wilson Bridge Project). Travelers can plan their timing and route accordingly.
- *C.3.4 – Transit Information Systems*
  - Can provide up-to-date transit information, such as arrival times for bus and rail. The WMATA Metrorail display signs depicting arrival times for trains are examples of this. Having this type of information available can increase transit ridership, and can also allow riders to make decisions on what type of transit to use based on up-to-date information.

C.4.0 – Traffic Engineering Improvements – Improvements implemented on roadways where congestion problems have occurred in the past or are anticipated to occur in the future. Some of these engineering improvements can be aimed at reducing incidents on a particularly dangerous section of roadway, while others may be attempting to relieve a choke-point or bottleneck.

- *C.4.1 – Safety Improvements*
  - Improvements done to increase safety and reduce incident-related congestion. Examples of some improvements include traffic calming devices, speed bumps, widening or narrowing a roadway, and textured pavement. These safety

improvements can prevent incidents and non-recurring congestion resulting from incidents.

- *C.4.2 – Turn lanes*
    - Might be implemented to reduce the queuing of cars waiting to make a right or left turn at an intersection, thus reducing congestion.
- *C.4.3 – Roundabouts*
    - Barriers placed in the middle of an intersection, creating a circle, and thus directing vehicles in the same direction. This can help reduce congestion by slowing the speed of cars on a street and/or preventing thru traffic on a neighborhood street.

Demand Management Strategies:

C.5.0 – Alternative Commute Programs – Provides travelers with options other than the single-occupant vehicle. These programs are aimed in reducing the amount of single-occupant vehicles are on our roadways.

- *C.5.1 – Carpooling*
    - Two or more people traveling together in one vehicle. This reduces the amount of vehicles on the road.
- *C.5.2 – Ridematching Services*
    - Enables commuters to find other individuals that share the same commute route and can carpool/vanpool together. This provides carpooling options for people who may not know of someone to carpool with, thus broadening the carpooling option.
- *C.5.3 – Vanpooling*
    - When a group of individuals (usually long-distance commuters) travel together by van, which is sometimes provided by employers. This reduces the amount of vehicles on the road, which is especially important for long-distance transportation modes.
- *C.5.4 – Telecommuting*
    - Workers either work from home or from a regional telecommute center for one or more days of the week. This reduces the amount of vehicles on the road, especially during rush hour when many commuters are going to work at once.
- *C.5.5 – Promote Alternate Modes*
    - Programs, such as Commuter Connections, or regional Transportation Management Areas (TMAs) provide information to the public on alternative commute programs. This gets the word out about commute options in the region, many who may not have considered alternative commute programs as an option before.
- *C.5.6 – Compressed/flexible workweeks*
    - Employees compressing their work week into a shorter number of days, which allows them to avoid commuting one or more days a week. This reduces the amount of vehicles on the road.
- *C.5.7 – Employer outreach/mass marketing*
    - Organizations, such as Commuter Connections, providing information to employers on the benefits of alternative commute programs for their employees.

Deleted: April

This allows employers to see the benefits that alternative commute programs can have in their organization.

- *C.5.8 – Parking cash-out*
  - Employees essentially pay their employees not to park at work. The employees receive compensation for the parking space they would have otherwise used if they did not walk, bike, take transit, etc. This encourages more people to leave their car at home in favor of another mode of transportation.
- *C.5.9 – Alternative Commute Subsidy Program*
  - Employees provide a transit subsidy to their employees, which encourages them to use public transit instead of driving to work. This reduces the amount of vehicles on the road.

C.6.0 – Managed Facilities – These facilities have restrictions for use of the roadways. In some cases, only those other than single-occupant vehicles can use the lane or roadway. In other cases, a fee is implemented for single-occupant vehicles. Still, in other case, a fee might be implemented for every car on the roadway entering a city. They all have a common goal of reducing the amount of single-occupant vehicles on the roadways and promoting other forms of transportation.

- *C.6.1* - *HOV*
  - High Occupancy Vehicle (HOV) are lanes reserved for vehicles with a driver and one or more passengers. This promotes the use of carpools, which can use a less-congested lane on the highway.
- *C.6.2- Variably Priced Lanes (VPL)*
  - Lanes which are typically used by carpoolers for free, while solo drivers pay tolls that change according to varying congestion levels. This encourages the use of carpooling, but also raises revenue for additional transportation projects that would reduce congestion.
- *C.6.3 – Cordon Pricing*
  - Cordon area congestion pricing is a fee paid by users to enter a restricted area in the city center. This is a way of promoting other alternative modes of transportation, while raising revenue for other transportation projects that would reduce congestion.
- *C.6.4 – Bridge Tolling*
  - Tolling over a bridge, in either one or both directions. This may decrease congestion on a bridge, as people may find an alternative route in lieu of paying the fee. Also, it raises revenue for transportation projects that would help in reducing congestion.

C.7.0 – Public Transportation Improvements – These improvements are done to the region's public transportation to ensure that it remains a safe and viable mode for travelers. Improvements can maintain the amount of users and attract new ones who never considered public transit as an option before.

- *C.7.1 – Electronic Payment Systems*

Deleted: April

- These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor, and helps increase transit ridership and ridership between different transit modes.

- *C.7.2 – Improvements/added capacity to regional rail and bus transit*
  - Added capacity and improvements to rail and bus to help keep up with increasing demand on public transportation. This is important in keeping with the growing demand on public transportation as an alternative mode.
- *C.7.3 – Improving accessibility to multi-modal options*
  - Ensuring that connections are provided to multi-modal options, such as bus, rail, and pedestrian and bicycle facilities. More connections makes it easier for people to access multi-modal options, thus increasing use.
- *C.7.4 – Park-and-Ride Lot Improvements*
  - Improvements to park-and-ride lots to keep up with increasing demand and growth in the region. Park-and-Ride lots allow people to access public transportation, who may not be able to access it from their home. Improvements to these lots can ensure that this growing need is met and that people can continue to have transit access.
- *C.7.5 – Carsharing Programs*
  - A convenient and cost-effective mobility option for those that typically do not have a need to own a car. This reduces the amount of cars on the road because generally the car is only used when needed, and public transportation or other modes are used most of the time.

C.8.0 – Pedestrian, Bicycle, and Multi-modal Improvements – Maintaining and creating new pedestrian, bicycle, and multi-modal facilities is improvement in that it improves accessibility. If something is accessible by a walk or bike path, people are more likely to leave their car at home.

- *C.8.1- Improve Pedestrian Facilities*
  - Improvement and addition of new pedestrian and bicycle facilities to keep up with a growing demand and ensure safety for users. This ensures that those using these facilities will continue to do so, and that potential users will find pedestrian facilities more appealing and accessible.
- *C.8.2 – Creation of new bicycle and pedestrian lanes and facilities*
  - Addition of new lanes to keep up with a growing demand and created new connections throughout the region. This will extend the option of bicycle and pedestrian lanes to those that may not already have access to it, as well as provide increased access to employment, recreation, retail, and housing in the region.
- *C.8.3 – Addition of bicycle racks at public transit stations/stops*
  - Allows people who bike to connect to other forms of transportation. This gives people another option for traveling other than a single-occupant vehicle.

C.9.0 – Growth Management – Growth Management is the term used in the Federal Rule, but really this term pertains to ensuring the coordination of transportation and land use. In terms of Growth Management we are talking about making sure that everyone has the option to public transportation and alternative modes no matter where they live or work in the region.

- *C.9.1 – Coordination of Regional Activity Centers*

    - Help coordinate transportation and land use planning in specific areas in the Washington region experiencing and anticipating growth. Focusing growth in Regional Activity Centers is important to congestion management, where transportation options for those who live and work there can be provided.
- *C.9.2 – Implementation of TLC program (i.e. coordination of transportation and land use with local governments).*
    - Provides support and assistance to local governments in the Washington region as they implement their own strategies to improve coordination between transportation and land use. The idea is to provide public transit options to everyone in the region.
- *C.9.3 – "Live Near Your Work" program*
    - Supporting the idea that locating jobs and housing closer together can provide alternative commuting options that may not have been options otherwise.

7.4 Monitoring Activities

7.4.1 History and Background, and Objectives of Regional Data Management and the Travel Monitoring Program

The Travel Monitoring Program has been a longstanding element of the TPB's annual Unified Planning Work Program (UPWP). The purpose of this program is to collect and compile usage information for the region's transportation network.

The TPB Travel Forecasting Subcommittee (TFS) was formed in 1991 to provide oversight in the effort of model development activities. The work activities in the FY 2008 Unified Planning Work Program (UPWP) for which the TFS maintains oversight are:

- Network Development
- Models Development
- Cordon Counts
- Congestion Monitoring and Analysis
- Travel Surveys and Analysis
- Regional Transportation Data Clearinghouse

7.4.2 Summary of Recent Travel Monitoring Activities

Deleted: ¶

7.4.2.1 Congestion Monitoring and Travel Time Studies

The TFS monitors congestion on the region's roadways two ways: with the Arterial Travel Time Study and with the Freeway Monitoring Program.

Deleted: April

Arterial Travel Time Study:

An arterial highway performance monitoring study has been underway since FY 1999 to identify the location, severity, and extent of congestion along selected arterial highways in the region.[37]

Over the past several years staff has gathered data regarding travel time, speed, and data delay using Geographic Positioning System (GPS) technology, with data collection occurring in three-year cycles. Several arterials were surveyed in the District of Columbia, Maryland, and Virginia, and level of service (LOS) was used to characterize the extent of congestion during the PM peak hour and PM peak periods of travel.

Freeway Monitoring Program:

The TFS's regional freeway monitoring program is based upon comprehensive aerial photography of the region's freeways. The TPB has contracted with Skycomp, Inc. to conduct a systematic aerial study of regional freeway congestion[38]. Peak period congestion is monitored on a once-every-three-years cycle during the am and pm peak periods, and off-peak congestion is monitored once every five years during weekday mid-day and weekend mid-day. It provides a comprehensive data set of the region's freeway conditions and congestion.

The program and analysis provide a wealth of information on the region's freeways, including the overall conditions of the freeways, specific congested locations, trends over time, and identification of factors associated with the congested conditions.

7.4.2.2 Cordon Counts

The cordon count program originated from the desire to asses the impact of the construction of the region's Metrorail system stating in the late 1960's. Thus, a cordon line around the Central Business District (the "core") was determined by the inbound point at which there were more destinations (alighting from transit buses) than origins (loadings onto transit buses). In later years, two additional cordon counts were added to the program, which the TPB has performed on a three-year cycle.

- In the first year, vehicle counts, classification, and occupancy were taken on facilities that cross the region's center core cordon.
- In year two, the cordon line used has been the Capital Beltway (I-495), which circles the region.
- In year three, the TPB collected information for persons and vehicles going into or coming out of a designated set of suburban employment sites.

---

[37] An overview of the Arterial Travel Time Study can be found here: http://www.mwcog.org/uploads/committee-documents/kl5fXVtZ20080118112816.ppt#296

[38] *Traffic Quality on the Metropolitan Washington Area Freeway System*, Spring 2005 report. Prepared by: Skycomp, Inc. (Columbia, Maryland). http://www.mwcog.org/uploads/committee-documents/u1paXFg20060216110515.pdf

Deleted: April

These cordon counts help calibrate regional travel forecasting computer models and provide an opportunity for trend analysis.

The most recent cordon count studies and findings include:

2003 District of Columbia City Line Cordon Count of Peak Period Vehicular and Passenger Volumes

This study analyzed peak period vehicle and passenger volumes entering the District of Columbia in the mornings, and leaving the District of Columbia in the evenings. Traffic count and most transit count data were collected in Spring, 2003.

Data were collected from 5 A.M. to 10 A.M. inbound and 3 P.M. to 8 P.M. outbound across the cordon line. On most streets and highways crossing the cordon line along the D.C./Maryland border, the counts were taken at a point just outside of the District of Columbia border. On the bridges crossing the Potomac River, counts were taken of traffic as it crossed the river.

Results were compared against the previous D.C. City Line Cordon Count conducted in Spring 1998. Key findings of the study concluded:

- During the three hour inbound A.M. peak period (6:30 to 9:30), person trips by all modes increased from 395,000 in 1998 to 406,000 in 2003, an increase of about 11,000. Trips on transit in this period increased by about 23,000.
- Trips by SOVs showed little change between 1998 and 2003. Similarly, inbound motor vehicle traffic during this period showed little change.
- For the full five hour A.M. inbound monitoring period (5 A.M. to10 A.M.), person trips by all modes increased from 492,000 in 1998 to almost 524,000 in 2003. Transit increased by about 32,000 trips, and the modal share of transit increased from 28 percent in 1998 to 32 percent in 2003.
- Vehicles crossing the D.C. City Line Cordon inbound between 5 A.M. and 10 A.M. with exactly four wheels were classified as to state of registration. For the full cordon, the following percentages and volumes were observed:
    - District of Columbia: 6% (17,000)
    - Maryland: 50% (176,000)
    - Virginia: 27% (79,000)
    - All other jurisdictions (includes all other states, territories and Canadian provinces, federal government and diplomatic registration): 8% (23,000).
- In the three-hour P.M. outbound peak period (3:30 to 6:30 P.M.), the total number of person trips was statistically unchanged between 1998 and 2003. However, there were changes in modal shares that were significant. Transit trips increased by almost 24,000 trips (and an increase of 17,500 trips on Metrorail made up the bulk of the increase), while trips in vehicles with more than once person decreased by about 13,000 trips.

Deleted: April

Deleted: F *(to be included later)*

Appendix D shows a comparison of inbound park period trips by mode, comparing results from 1990, 1998, and 2003. A similar chart shows outbound peak trips.[39]

2001 Count of Radial Transportation Facilities Crossing the Capital Beltway:

This study analyzed peak period vehicular and passenger volumes crossing the Capital Beltway in Maryland and Virginia.

Data were collected in the peak direction during the five peak commute hours in both the morning and afternoon: from 5:00 A.M. to 10:00 A.M. for inbound traffic; and, 3:00 P.M. to 8:00 P.M. for outbound traffic. Most analysis of data is for the peak periods within these hours, 6:30 to 9:30 A.M. inbound and 3:30 to 6:30 P.M. outbound. The inner loop of the Beltway defined the cordon, and counts were taken at points just inside this boundary. Data collection for this project was conducted between March and June 2001. The report includes an analysis of trends and changes in travel patterns between 1998 and 2001.

Some of the trends in person travel, vehicle travel, and automobile occupancy concluded from the 2001 study were:

- The total number of persons traveling inbound across the Beltway during the A.M. peak period is nearly unchanged from 1998 at about 513,000 trips, even though this is the largest number of trips observed in the history of the Beltway cordon monitoring program.
- The share of total person trips crossing the Beltway in autos remained about the same at 440,000 trips in 2001. Autos made up about 86% of observed movements, down from 88% in 1998. Trips by single-occupant autos remained essentially unchanged, and represented about 63% of all person movements in 1998 and 2001.
- The total number of persons traveling outbound across the Beltway during the P.M. peak period in 2001 increased from 1998 by about 25,000 trips, to 560,000 persons.
- The imbalance between A.M. peak period (6:30 - 9:30 A.M.) trips inbound and P.M. peak period (3:30 - 6:30 P.M.) trips outbound persists. During the A.M. peak period, about 513,000 trips were observed inbound, but there were about 560,000 trips counted in the P.M. outbound direction.
- An imbalance was also observed in the full five-hour monitoring periods (5:00 - 10:00 A.M. inbound and 3:00 - 8:00 P.M. outbound). In the A.M. inbound direction, over the full five hour period, about 669,000 trips were observed, while there were about 822,000 trips counted during the 5 outbound P.M. hours.

Appendix E shows a comparison from 1981 to 2001 of the type of inbound trips crossing the Capital Beltway. A similar comparison is shown from 1992 to 2001 for outbound trips.[40]

Deleted: G *(to be included later)*

Formatted: Font: Not Bold, Not Italic

[39] *2003 District of Columbia City Line Cordon Count of Peak Period Vehicular and Passenger Volumes*, February 2006.
[40] *2001 Count of Radial Transportation Facilities Crossing the Capital Beltway*, July 2002.

Deleted: April

Cordon count studies such as this one allow one to view trips and travel trends across a certain line, in this case, the Capital Beltway. This is important to congestion management as we continue to monitor how many trips (especially in SOVs) are being made from the outer suburbs into the central core of the region.

2006 Central Employment Core Cordon Count of Vehicular and Passenger Volumes:

This study analyzed peak period vehicle and passenger volumes entering the downtown employment area of the District of Columbia and Arlington County, Virginia[41]. The data was collected during the months of March, April, May and June 2006.

Data were collected from 5 A.M. to 10 A.M. inbound and 3 P.M. to 8 P.M. outbound across the cordon line. Supplemental two-way counts of vehicle and person movements in both monitoring periods across four central Potomac River bridges between the District of Columbia and Arlington County were also performed.

Some of the key findings from the study include:

- Total inbound travel declined in the A.M. peak period from 467,100 person trips in 2002 to 443,000 in 2006.
- In the P.M. peak period, total outbound person travel declined from about 436,400 persons in 2002 to 427,600 in 2006
- Transit's modal share of inbound peak period trips increased from approximately 40% (about 186,200 trips) in 2002 to 43% (about 191,500 trips) in 2006. By far the largest share of transit trips were served by Metrorail, approximately 32% (about 143,100 trips).
- Transit's modal share of peak-period outbound trips increased from about 39% (171,400 trips) in 2002 to about 41% (177,000 trips) in 2006. Trips on Metrorail represented about 31% (131,500) of outbound transit trips in 2006.
- In spite of gains in transit's modal share, trips by single-occupant vehicles did not decrease in modal share or absolute terms that were of statistical significance.
- The number of person trips entering the Central Employment Core by private automobiles during the A.M. peak period in 2006 has declined from 2002, and, the decline in person trips by multiple-occupant accounts for nearly that entire decline.
- Travel crossing the Arlington, Virginia sectors of the cordon line showed little change in total, but there was a decline of over 10,000 person trips by multiple-occupant vehicles.

Appendix F contains two graphs, which depict the modal share trends from 1996 to 2006, in the inbound and outbound peak periods.

Deleted: H *(to be included later)*

Formatted: Font: Not Bold, Not Italic

7.4.2.3 Household Travel Surveys

The Household Travel Survey is a survey of 10,000 households in the Washington region and adjacent areas to gather updated information on area wide travel patterns. The survey provides

---

[41] The full report can be found here: http://www.mwcog.org/uploads/committee-documents/u1daXFs20070501081323.pdf

Deleted: April

information on such important determinants of travel as household demographics, income, employment destinations, and number of vehicles available. This data helps guide future transportation planning as the area continues to grow.

A Household Travel Survey was being conducted by TPB staff in 2007-2008, updating the last such survey which was undertaken in 1994. Data is being collected from households across the region. The survey is in two parts:

- First, to recruit respondents, an advance letter with a mail-back household questionnaire was sent, in addition to reminder postcards. A telephone interview was also conducted, to obtain household, person, and vehicle data.
- Second, a travel diary is being used to capture the daily trips and activities of households. Each household selected for the study was asked to record daily travel and activities for a 24-hour period. A short telephone survey and retrieval of additional personal and travel diary data was also conducted.

The Household Travel Survey is anticipated to be completed in late 2008.

7.4.2.4 Special Surveys and Studies

The TPB and its member agencies undertake special studies or data collection efforts, on both one-time and recurring bases. Examples include compiling data to form a regional travel trends report, as well as monitoring of high-occupancy vehicle (HOV) systems, transit usage, and cordon counts of traffic on specified areas of the region.

Regional Travel Trends Report:

The Regional Travel Trends report summarizes major travel trends in the metropolitan region from 2000 – 2006[42]. The rate and spatial pattern of population growth are key to the underlying changes in travel trends. The metropolitan Washington region has seen a fast increase in growth over the last several decades, and with that come major changes in how and why people travel. This is important to congestion management, in that it is important in understanding why congestion may be occurring in particular areas. In addition, travel trends can help predict, and prepare for, future congestion.

The data for the Regional Travel Trends report is not compiled from just one survey or study. Rather, the data is drawn from a variety of different sources. These sources include:

- Population and worker characteristic data from the 2000 Decennial Census and the new American Communities Survey (ACS)
- Population, group quarter, and housing unit estimates from the Federal State Cooperative Program for Population Estimates (FSCPE)
- Employment and labor force data from the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW)

---

[42] *DRAFT Regional Travel Trends Report*, December 28, 2007

Deleted: April

- Local Area Unemployment Statistics (LAUS) program
- Highway Performance Monitoring System (HPMS)
- Travel monitoring data from:
  - DDOT
  - MDOT
  - VDOT
  - TPB Regional Transportation Data Clearinghouse
- Transit ridership statistics from the Washington Metropolitan Area Transit Authority (WMATA)
- Northern Virginia Transportation Commission (NVTC)
- Montgomery County
- Prince George's County

The Travel Trends report looks at the 2000 – 2006 trends and compares that to the trends of the previous decade, from 1990 – 2000. During the 1990s, the outer suburbs experienced the greatest population changes, with Loudoun County having the largest population increase at 97%. However, both Fairfax County and Montgomery County added more population in absolute terms than Loudoun. During the 1990's there was virtually no net increase in population in the region's Center Area jurisdictions.

Some key findings of the regional travel trends during the 2000 – 2006 time period include:

- The outer suburbs continue to grow. The greatest amount of population increase in this decade so far have been in the Outer Suburban jurisdictions of Loudoun, Prince William, and Stafford Counties in Virginia, and in Frederick, Charles, and Calvert Counties in Maryland. Loudoun and Prince William counties have already added more population in the first six years of this decade than they did in the entire ten years of the previous decade.
- If the annual growth rates observed in the Outer Suburbs from 2000 – 2006 continue, they will have added almost 500,000 people between 2000 and 2010. This would be significantly more than the 340,000 added in the Inner Suburbs between 1990 and 2000.
- A significant turnaround in the District of Columbia's population growth was seen from 2000 – 2006. Whereas the District lost population between 1990 and 2000, the city experienced a net gain of more than 10,000 residents between 2000 and 2006.
- Similar to the gain in population growth, the Outer Suburbs also experienced the greatest increase in civilian labor force between 2000 and 2006.
- The latest statistics show household vehicle availability growing at the same rate as total population increase. This is different from the 1990's statistics, which show that at that time the number of household vehicles was increasing faster than the total population.
- Weekday Vehicle Miles of Travel (VMT) in the region grew by an average annual rate of 2.4% between 2000 and 2006. This is faster than the increase in population, employment, and vehicle availability.

Formatted: Justified

Deleted: April

Local Studies:

Sometimes member state and local jurisdictions will conduct studies to analyze and evaluate their own programs, and these studies can be important to congestion management.

An example of one such project is a Maryland State Highway Administration (SHA) Congestion Relief Study (CRS) to evaluate the effectiveness reconstructing intersections had on improving congestion in 2003[43]. Twelve of the fourteen intersections that were reconstructed were analyzed for "before" and "after" improvements. The study asked two questions: 1)

- Did the program meet its goal of reducing congestion? And;
- Was the program justifiable from an economic standpoint (i.e. did the benefits of the program exceed the cost?)

Overall, the study concluded that the reconstruction program was a success.

- Congestion levels were reduced at each intersection during the AM and PM peak periods. The time the average motorist waits at a traffic signal in the program was reduced by 1 minute each day.
- For the intersections in the program, average delays were reduced by 30% in the AM and 40% in the PM peak hour, compared to a no-build condition.
- Reductions in stopped time translate into travel time savings for motorists. This study shows that the CRS program saved Maryland motorists approximately 350,000 hours of waiting at traffic signals in 2003.
- In terms of economic benefits, the program is found to have an increase in $11 Million dollars of wages and productivity (based on the average hourly income of $18.04 in Maryland in 2002 and an average price of $1.65 per gallon of gasoline).

Studies such as this allow agencies to evaluate the economic and other benefits of a project. This can be important to stakeholders and local decision makers to identify what projects work best where, and deciding how to make the most of transportation funds.

7.4.3 The Regional Transportation Data Clearinghouse

TPB compiles roadway usage data as available, collected from the region's agencies and jurisdictions. These data may come from jurisdictions' regular traffic counting efforts, special studies, permanent count stations, or other sources.

The Regional Transportation Data Clearinghouse program transforms these data into a format associated with the region's travel demand forecasting model. Compiled data are also associated with the estimated capacity of links on the region's roadway network, providing the opportunity to calculate estimated volume-to-capacity (V/C) ratios, a widely-used performance measure.

[43] *Congestion Relief Study – Category I Program Evaluation*. Maryland Department of Transportation (MDOT) State Highway Administration (SHA)

Deleted: April

The goal of the Clearinghouse is to make traffic volume data more accessible, more accurate, and more meaningful. It provides for easy access to a wide variety of traffic volume data for many links in the regional transportation network.

An updated version of the Clearinghouse is anticipated to be completed in 2008.

7.5 The Location, Existence, and Extent of Highway Congestion (Regional Scan of Congestion)

7.5.1 Freeways

Formatted: Font: Not Bold

Formatted: Justified, None

The TPB's regional freeway monitoring program is based upon comprehensive aerial photography of the region's freeways. The TPB has contracted with Skycomp, Inc. to conduct a systematic aerial study of regional freeway congestion[44]. Chapter 3 outlined some of the results of the Skycomp analysis, painting a picture of where congestion is occurring on the region's major freeways. The purpose of this section is to provide more detail on the data and methodologies behind this analysis.

Skycomp measures peak period congestion during the AM and PM peak periods on a once-every-three-years cycle since 1993. Fixed-wing aircraft follow designated flight patterns along the region's primary highways, including:

- *US 50 (Maryland)*
- *I-66 (inside beltway)*
- *I-66 (outside beltway)*
- *I-66 (outside beltway) HOV*
- *I-70*
- *I-95 (north of beltway in Maryland)*
- *I-95 (south of Dale City in Virginia)*
- *VA 267 (Dulles Greenway)*
- *VA 267 (Dulles Toll Road)*
- *VA 267 (Dulles Toll Road) HOV*
- *VA 267 (Airport Access Road)*
- *I-270*
- *I-270 HOV*
- *I-270 (local lanes)*
- *I-295 / BW Parkway Corridor (including Anacostia Freeway)*
- *I-370*
- *I-395 / I-95 Corridor North of Dale City*
- *I-395 / I-95 Corridor North of Dale City (HOV)*
- *I-495 / I-95 (Capital Beltway)*
- *George Washington Parkway*

[44] *Traffic Quality on the Metropolitan Washington Area Freeway System*, Spring 2005 report. Prepared by Skycomp, Columbia, MD. http://www.mwcog.org/uploads/committee-documents/u1paXFg20060216110515.pdf

Deleted: April

- *Anacostia River Bridges*

Each highway segment is photographed a total of 24 times during peak commuter hours. Survey flights were conducted on weekdays, excluding Monday mornings, Friday evenings, and mornings after holidays, during the following time periods:

- *Morning surveying times:*
  - 6:00 AM – 9:00 AM outside the Capital Beltway;
  - 6:30 AM – 9:30 AM inside the Capital Beltway.
- *Evening surveying times:*
  - 4:00 – 7:00 PM inside the Capital Beltway
  - 4:30 – 7:30 PM outside the Capital Beltway

Data was then extracted from the aerial photographs to measure average traffic conditions by link and by time period, and this information is compiled for the Skycomp report. There are two major parts of this report:

- *Part one* contains a comparison of traffic conditions for locations on the highway system where major trends and changes were found between the most recent and past surveys.

- *Part two* presents performance ratings on highway segments by direction and time period. Level of Service (LOS) is used to indicate the extent of congestion on the segments, with LOS "A" indicating generally free-flow conditions, and LOS "F" indicating severe congestion and delays.

The program and analysis provide a wealth of information on the region's freeways, including the overall conditions of freeways, specific congested locations, trends over time, and identification of factors associated with the congested conditions.

Deleted: *(to be completed)*¶

7.5.2 Arterial Highways

Unlike for freeways, there is no comprehensive data set of roadway congestion for arterials in the region.

To identify the location, severity, and extent of congestion along selected National Highway System arterial highways in the region, an arterial highway performance monitoring study has been underway since FY 1999. Over the past several years staff has gathered data regarding travel time, speed, and data delay using Geographic Positioning System (GPS) technology, with data collection occurring in three-year cycles.[45] Several arterials were surveyed in the District of Columbia, Maryland, and Virginia, and level of service (LOS)[46] was used to characterize the extent of congestion during the PM peak hour and PM peak periods of travel[47].

[45] Details on the data and methodology of the Arterial Highway System Performance study can be found in Chapter 7 – Data and Methodologies.
[46] There are generally six levels of service, A through F. Level of service "A" is the best, describing primarily free-flow conditions, while level of service "F" is the worst, describing flow as unstable and significant traffic delay.
[47] The study defines PM peak period travel as 4:00PM – 7:00PM and the PM peak hour between 5:00 – 6:00 PM.

Deleted: April

Each of the study routes proposed to be studied in FY 2007 was driven by staff with the intent of verifying that the reference points were signalized intersections, and whether there were any turning movement restrictions at the beginning or end of each tour. The length of each segment and tour were verified. This was critical to assure the accuracy of the travel speeds that would be arrived at during the data analysis phase.

Deleted: (

Formatted: Font: Not Bold, Not Italic

Another motivation was to determine if the pre-designed tours could be driven within a 20-minute period or less. This condition would determine the number of complete bi-directional runs that could be completed in an hour. In the analysis phase, the number of runs per hour would determine if the data were statistically significant. During the verification phase, changes were made to the beginning and end of each tour, and reference points were modified as needed.

Formatted: Justified

Formatted: Font: Not Bold, Not Italic

Deleted:)

Formatted: Font: Not Bold, Not Italic

A tour is a section of a roadway, approximately 5 to 6 miles long, which can be driven in 20 minutes, but tours vary in length depending on location and travel accessibility. Staff assembled tours from the selected corridors. A segment is a section of a tour approximately a mile long, with similar operating characteristics, and with the limits made up of major intersecting roadways used to specify data collection operations within each tour.

The travel time data collected in the field were used in validating the tours and the segments. Changes were made to tours and segments where necessary. This enabled us to obtain 3 to 4 travel speed measurements during an hour using two data collection vehicles. Some corridors such as Virginia Route 7, Virginia Route 234, and 7th Street/Georgia Avenue were broken into multiple tours. Speed data were collected at the segment level, enabling us to identify potential bottlenecks along a tour.

Main Conclusions of 2007 Arterial Monitoring Study:

Based on ideal conditions under which the data were collected, out of 250.7 miles of arterial highways surveyed, 82.6% of the system operated at LOS "D" or better during the PM Peak Hour in FY 07 compared to 87% in FY 2004 and 86% in FY 01. Even though the mileage varied from state to state the percentage of highways operating at LOS "D" or better was 90% in Maryland, 81% in Virginia, and 77 % in the District of Columbia. The District of Columbia routes experienced the worst congestion during the peak hour (22%), peak period (13%).

7.6 Park-and-Ride Facility Usage

The Washington region has over 300 park-and-ride lots where commuters can conveniently join up with carpools, vanpools, or connect to public transit. Many of these lots are conveniently located for those that commute from the outer suburbs of Virginia or Maryland.

The following statistics provide an idea of why park-and-ride lots play such a popular role in the region's transportation system[48]:

- About one third of Park & Ride Lots have commuter bus service available.

[48] Source: Commuter Connections http://www.mwcog.org/commuter2/commuter/ridesharing/prlocations.html

Deleted: April

- Approximately one third of the Park & Ride Lots have rail service available, including Metro, MARC, VRE and Baltimore Light Rail.
- Parking is free at 90% of the Park & Ride Lots.
- About 25% of the Park & Ride Lots have bicycle parking facilities.

In addition to the above statistics, Intelligent Transportation Systems (ITS) strategies such as traveler information systems and electronic payment systems can add to the convenience of park-and-ride lots. Commuter Connections also displays a park-and-ride map on their website, which provides users with the location of lots, transit stations in the vicinity, and the location of telework centers.

Due to the popularity of park-and-ride lots, some are experiencing overcrowding, where demand exceeds supply. This tends to happen at lots at or near Metrorail and commuter rail service.

Over the past several years, SHA has taken inventory of the SHA owned and maintained ridesharing facilities in the state (Appendix G). Inventory was taken in Spring 2001, and again in 2005, 2006, and 2007. Average use has been gradually increasing over the years, with approximately 51% in 2001, 55% in 2005, and 57% in 2006 and 2007. Maryland State Highway Administration (SHA) notes that once their park-and-ride lots fill to 80 percent capacity, locations for new lots are considered.

The most recent TPB study on the usage of park-and-ride lots was conducted in 1996. As the region continues to grow and the demand for park-and-ride lots increases, this is an area that may need to be examined more closely. WMATA is currently conducting a study of Metrorail station access and capacity which, when completed, could provide information on the capacity of Metrorail park-and-ride lots.

Formatted: Justified

Deleted: (

Formatted: Font: Not Bold, Not Italic

Formatted: Font: Not Bold, Not Italic

Deleted:)

Formatted: Font: Not Bold, Not Italic

Deleted: April

APPENDICES

Deleted: (All Appendices will be provided at a later date.)