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

Item 4

MEMORANDUM

To: Management, Operations, and Intelligent Transportation Systems (MOITS) Technical Subcommittee

From: Andrew J. Meese, AICP ajm
Systems Management Planning Director

Date: December 4, 2007

Subject: MOITS Components of the Draft Constrained Long Range Plan (CLRP)

Attached for the review of the Subcommittee are the draft Web pages related to MOITS from the new financially Constrained Long Range transportation Plan (CLRP) now under development. These pages and the rest of the draft Web site were distributed to the TPB Technical Committee for their review at their December 7 meeting. This will be an item of discussion at the December 4 MOITS meeting.

The pages included are:

- Top MOITS page (3)
- Transportation Emergency Preparedness page (with link to COG Emergency Preparedness Programs) (5)
- Regional ITS Architecture page (7)
- Traveler Information page (9)
- Regional Integrated Transportation Information System (RITIS) page (with link to the University of Maryland) (11)
- Traffic Signals page (13)
    - Transit Signal Priority sub-page (15)
- Metropolitan Area Transportation Operations Coordination (MATOC) Program page (17)
- What Is the Congestion Management Program? (19)
    - Operational Management Strategies (23)

Attachments

MANAGEMENT, OPERATIONS AND INTELLIGENT TRANSPORTATION SYSTEMS

Getting the most out of the existing transportation system is an important goal of the TPB, notably by means of actively managing the system. Nationally, efficient system "management and operations" (M&O) has been promoted by the U.S. Department of Transportation.

M&O encompasses the day-to-day actions and agency responses to the region's transportation system. Examples include routine activities such as reconstruction and maintenance, snow plowing and salting, providing real-time traveler information, and traffic signalization. Management of the transportation system in special circumstances is also important, such as traffic plans for special events, and also falls under the umbrella of M&O.

When events reach the level of a regional public safety emergency, such as severe weather, major disasters, terrorism, or other catastrophes, transportation becomes a support function to emergency management agencies and leadership. TPB coordinates with COG's **emergency preparedness programs**, where these major issues are addressed.

Advanced technologies are also key to M&O. Intelligent Transportation Systems (ITS) are defined in the transportation field as the application of current and evolving technology (particularly computer and communications technology) to transportation systems. Examples include up-to-the-minute traffic and transit information, traffic detection systems, and advanced technology traffic signals. Such technologies often show a particularly strong benefit-cost relationship and are good investments for the region.

By focusing on the evolving technology of ITS and the day-to-day activities of M&O, TPB and the region's transportation operators and planners have a greater opportunity of providing more efficient and effective solutions to the region's transportation problems. TPB's **Management, Operations and Intelligent Transportation Systems (MOITS) Policy Task Force and MOITS Technical Subcommittee** meet regularly to discuss coordination and ways in which transportation technology can improve congestion, safety, maintenance, and system efficiency. MOITS brings short-term

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operational needs into consideration as important input to the regional long-range transportation plan.

Key focuses in the MOITS program include:

- **The Regional ITS Architecture** provides a technical communications blueprint for systems engineering of transportation-related information systems.
- **Traveler information**, especially real-time information, is growing in importance for its role in managing transportation system demand.
- **Traffic signal operations** have an immediate impact on almost all residents and visitors.
- **Transportation safety** is also an important consideration overall in the region. MOITS programs are coordinated with the TPB's regional transportation safety activities and recently established **Transportation Safety Subcommittee**.
- Interagency coordination on transportation incidents that have multijurisdictional or regional impacts fostered creation of the **Metropolitan Area Transportation Operations Coordination (MATOC) Program**, which is being developed in close coordination with the MOITS program.

EMERGENCY PREPAREDNESS AND TRANSPORTATION SECURITY

Events in recent years have heightened awareness of regional emergency preparedness. In addition to the tragic attacks of September 11, 2001, the Washington region has experienced a series of sniper shootings, anthrax incidents, Hurricane Isabel, and other emergencies. With its world prominence and its many visible symbols of democracy, the Washington region remains a target for terrorism and other attacks. These events and circumstances serve as reminders the region must be as prepared as possible to respond to emergencies and disasters.

Transportation plays multifaceted roles in incidents and emergencies. Every day, transportation agencies handle incidents such as crashes and breakdowns on their systems. The need for coordination among transportation agencies during incidents having multi-jurisdictional or regional impacts fostered creation of the **Metropolitan Area Transportation Operations Coordination (MATOC) Program**. The MATOC Program aims to advise agencies as they respond to major incidents, through improved technological data sharing systems, coordinated operating and notification procedures, and better availablilty of transportation information for the public.

In declared emergencies and major disasters, transportation becomes one of a number of support functions to a public safety agency-led response. Regionally, public safety and emergency management planning are addressed under the auspices of the **Metropolitan Washington Council of Governments (COG) Board of Directors** and its group of **public safety programs** and committees. The COG Board is advised by the **National Capital Region Emergency Preparedness Council** on regional preparedness planning matters, as well as by a number of specialized public safety committees. The TPB and its programs maintain liaison with the COG programs, and provide technical transportation expertise as necessary.

In the wake of the 9/11 attacks, a new plan, the **Regional Emergency Coordination Plan**, was developed. The Regional Emergency Coordination Plan discusses how the numerous federal, state, and local agencies in the region should communicate and coordinate during emergencies. It builds from but

does not replace the emergency response plans that individual jurisdictions must develop. Sections of the Regional Emergency Coordination Plan are designated as Regional Emergency Support Functions (RESFs) 1 through 15, following the Federal Emergency Management Agency's (FEMA's) naming convention. Some of the functional areas included are emergency management, law enforcement, fire, health, public outreach, and, transportation; the emergency transportation function referred to as RESF-1. The dedicated **RESF-1 Transportation Chapter** in the Regional Emergency Coordination Plan addresses communication and coordination among regional jurisdictions and agencies concerning regional transportation issues and activities before, during and after a regional incident or emergency.

Specialized appendices called annexes were developed for certain issues in the Regional Emergency Coordination Plan. Associated with RESF-1 is the **Regional Emergency Evacuation Transportation Coordination (REETC) Annex**. The REETC Annex describes communication and coordination needs for transportation agencies during large-scale evacuation or shelter-in-place events, and identifies transportation management strategies that might be used. The REETC Annex notes the key consideration to manage demand, urging people not in danger to stay off roads and transit, keeping capacity available for those persons who are endangered (as well as for response personnel). An evacuation event is not purely a transportation issue – it is a multi-faceted occurrence involving public safety, emergency management, human services, and other agencies as necessary. Transportation will serve as one of many support functions under public safety and emergency management leadership of the event.

TPB coordinates with COG's **RESF-1 Emergency Transportation Committee** that, with police, fire, emergency management, and others, is a part of the COG structure of public safety committees and staff. The RESF-1 Committee plans for and addresses Transportation's role regarding emergency response, coordination, and recovery during and after a declared emergency or other major event.

For further information on COG's Homeland Security activities and a list of emergency preparedness resources, please visit **COG's Homeland Security pages**.

ITS ARCHITECTURE

The Metropolitan Washington Regional Intelligent Transportation Systems (ITS) Architecture is a technical document that serves as a framework for integrated transportation systems technologies. It describes ITS operations of regional significance, ensures conformity with applicable federal law and guidance, and helps project engineers follow appropriate systems engineering practices. The architecture aims to ensure a common technical understanding of ITS operations across the region, encouraging appropriate systems integration and enhanced technical systems interoperability.

The Regional ITS Architecture is maintained by TPB staff under the guidance of the TPB's MOITS Regional ITS Architecture Working Group. The architecture is maintained as a resource document for technical users on **COG/TPB's Web site.**

The architecture can help identify what information technology projects might be needed, what proposed projects need to be coordinated or integrated, and develops a common language by which interrelated projects are described. Based upon the structure of the official U.S. Department of Transportation's National ITS Architecture, it is intended to be a "living document" that is updated as necessary under the advice of the technical experts on the regional working group.

Major features of the architecture include:

- Operational Concepts - identify the roles and responsibilities of participating agencies and other stakeholders in the operation and implementation of a system included in the regional ITS architecture.
- Functional Requirements - identify the purposes of existing or planned technological systems.
- Interface Requirements - describe how various systems need to be connected together to exchange information.
- Standards - in the context of data and information exchange (not in transportation policy or

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operations areas).

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The Regional ITS Architecture is a source of input to the Regional Transportation Plan in that it provides the framework for potential future information technology components of the plan. ITS offers non-traditional solutions to transportation problems and provides an alternative to new infrastructure. Important topics include:

- Coordination of real-time information exchange among area stakeholders to facilitate freeway and arterial incident management practices. This is key component of **Management and Operations** and **Emergency Preparedness** aspects of the plan. Emergency vehicle priority at signalized intersections can also be addressed.
- **Traveler information systems** involve data collection, fusion, and dissemination aspects among multiple parties in both the public and private sectors. The regional architecture can provide the blueprint for how information can be exchanged.
- Bus vehicle priority at **signalized intersections**, intended to serve the policy goals of making transit more efficient and effective, depends upon interlinked technical systems among transit and traffic signal agencies in the architecture.
- Archiving transportation data, for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, research applications, and inputs into Federal, State, and local data reporting systems, comprises a vital part of the **Congestion Management Process** component of the plan.

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Bicycle and Pedestrian Plan

Congestion Management Process

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Emergency Preparedness and Transportation Security

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TRAVELER INFORMATION

Users of the transportation system benefit from knowing up-to-date system conditions. These may include the current speed of traffic on a particular roadway link, the location and severity of an accident along their route, how soon the next bus will arrive at a stop, or many other items. Benefits to users include being able to change the route, start time, or mode of a trip, or to decide not to take the trip at all. Transportation system managers also benefit from making this information available so the public can be encouraged to avoid problem areas or to consider alternatives such as transit.

Availability of traveler information depends on a three-stage approach. First is the collection (or entering of text into a system) of initial or raw data. Examples include traffic detection equipment on a roadway, global positioning system-based tracking systems for buses, or reports typed into a police or fire dispatch system. Second is the compilation or "fusion" of raw data into meaningful information. The final step is availability or delivery of information to users through a variety of means.

Traveler information can be available to the transportation system user through the traditional commercial radio and television broadcast media, through the Internet, and through emerging direct delivery technologies such as emails and text messages. Delivery of information traditionally has been the purview of the media and other private sector companies. The public sector role has been in gathering and verifying information such as traffic speeds and locations of accidents. These roles, however, are evolving; now private companies are placing monitoring devices along freeways to report speeds, and public agencies are maintaining informational Web sites.

Notable is the assignment of "511" as a nationally-designated telephone number for traveler information. State, regional, or local agencies around the country have been encouraged to develop traveler information systems available to the public by dialing 511. Virginia has developed a statewide 511 system. Through the **Metropolitan Area Transportation Operations Coordination Program**, development of a metropolitan Washington 511 system will be explored for future deployment.

A critical prerequisite for traveler information, however, is the accuracy and verification of information

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provided to the public. To improve data sharing and quality and to set the stage for enhanced traveler information availability, the region, in conjunction with the University of Maryland , has developed the **Regional Integrated Transportation Information System** (RITIS). RITIS is designed to be a system that can feed information from a variety of sources to a variety of outlets. Whether through existing media or transportation agencies sources, or through a future 511 system, RITIS will improve the quality and timeliness of information available to the region's traveling public.

REGIONAL INTEGRATED TRANSPORTATION INFORMATION SYSTEM

The Regional Integrated Transportation Information System (RITIS) was conceptualized in 2001 by the TPB's **Management, Operations, and Intelligent Transportation Systems (MOITS) Technical Task Force** (now the MOITS Technical Subcommittee), and has been developed on behalf of the region by **the University of Maryland Center for Advanced Transportation Technology**.

Numerous agencies operate portions of the region's transportation systems. In turn, these agencies utilize numerous separate computerized systems that detect traffic, measure speed on given roadway links, hold reports of crashes or other incidents, project when the next transit bus will arrive at a stop, and a host of other data. These data, however, generally have not been amalgamated regionally until now. Now RITIS will be a "data fusion engine" that puts together transportation systems condition information from these disparate sources, and makes it available back to the region's stakeholders in the systems and software they already use for their internal purposes.

Transportation personnel and the general public may never see or perceive the existence of RITIS; however, information they may have in their software system, see on a Web site, or hear in a radio traffic report, may have been gathered, cross-compared, error-checked, and filtered by RITIS. RITIS also will be critical to provide real-time information to the **Metropolitan Area Transportation Operations Coordination (MATOC) Program**. Improved real-time information is a keystone for effective management of the region's transportation system and the numerous incidents that occur upon it everyday.

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TRAFFIC SIGNAL OPERATIONS

Most of the region's residents and visitors, whether pedestrians, bicyclists, motor vehicle drivers, or transit riders, are impacted by traffic signals in their daily travels. There are about 5,000 signalized intersections in the Washington metropolitan area. These intersections range from simple and isolated to large and complex. Signals are maintained by numerous agencies and jurisdictions, with the goals of safety, efficiency, and meeting community needs. Interagency coordination, especially near jurisdictional boundaries is important. Efficient traffic signal operations are key for getting the most out of the region's transportation system.

Engineers speak of "traffic signal optimization", which is the science of determining how a traffic signal (or system of signals) can be timed to cause the least delay for most travelers, while still ensuring safety. Optimized timings are based on traffic data, numbers of pedestrians, travel time observations, consideration of intersection geometrics, and computer analysis. The result from the viewpoint of any one driver may not appear to be optimal due to high traffic loads, cross-traffic or other factors, but overall system delay should be reduced.

Optimization aims to reduce travel times, delays and the frequency of stops. Though variable, improvements are commonly seen in the range of five to twenty percent. An engineering rule of thumb recommends re-checking signal timing at least every three years as traffic patterns evolve. Analysis performed for the Maryland State Highway Administration estimated a benefit of about ten dollars in time and fuel savings for each dollar spent on optimization, at a cost of a few thousand dollars per intersection (just a fraction of roadway construction improvement costs).

The TPB increased its focus on the issue with a 2002-2005 traffic signal optimization "Transportation Emissions Reduction Measure" (TERM). The TERM called for an increase in the percentage of the region's signals optimized within the previous three years. Increasing the percentage of optimized signals in the region is beneficial for air quality. At the outset of the TERM in 2002, about 45 percent of the region's signals were classified as optimized. This had increased to 68 percent upon completion of the TERM in 2005. The TPB has called for maintaining and increasing this optimization in future years.

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Signal optimization occurs within a larger context of traffic engineering activities. On a routine basis, agencies perform systems monitoring and maintenance, respond to public inquiries and perform spot checks. Other notable activities around the region include use of **transit signal priority treatments for buses**, signal preemption devices for fire trucks and ambulances, red light running enforcement, pedestrian "countdown" signals, use of energy-efficient light-emitting diodes (LEDs) in place of old-fashioned incandescent bulbs, and installation of failure-resistant power backup systems.

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TRANSIT SIGNAL PRIORITY

Transit buses travel mostly mixed with regular traffic on our region's arterial roadways. Buses are subject to the congestion and delays that other traffic experiences. These buses are critical components of the region's transportation systems, providing an efficient, necessary travel option for residents and visitors; depending upon size and design, buses can carry 40 or more passengers, compared to the one-to-two persons in most private motor vehicles.

Advanced technologies now allow for buses, if equipped with the necessary technology, to receive special treatment at traffic signals, referred to as "transit signal priority" (TSP). For example, if a bus is running behind schedule, a signal might extend its green phase for a few extra seconds, long enough to ensure the bus does not get stopped at the light, and giving it a chance to get back on schedule. Another application of TSP is for "bus rapid transit" systems expediting bus movement in the corridors of heaviest demand for bus transit.

A number of the region's jurisdictions have been or will be undertaking deployments (some as prototypes) of transit signal priority for bus routes in their jurisdictions, following implementation of these technologies in cities across the country and around the world. There are a number of technical and policy questions to consider in these deployments. Technical considerations include the variety of TSP technologies commercially available (but not necessarily technically compatible with one another), the variety of traffic signal technologies already installed in the region (which will make it challenging to adopt a single TSP technology region-wide), and overall integration of bus and signal technical systems. Policy considerations include under what circumstances priority is to be given to buses, and what impact TSP might have on overall traffic flows. The deployments in the region and elsewhere will provide valuable information on the potential for further TSP in the region.

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METROPOLITAN AREA TRANSPORTATION OPERATIONS COORDINATION PROGRAM

A truck overturns on the Beltway. A building fire closes a major roadway. Service to a transit station is interrupted due to police activity. Such events occur frequently in the Washington region. The immediate scenes of these incidents are handled with skill by responsible police, fire, transportation, and other responder personnel. Following well-established incident command procedures, they work to clear the problem as quickly as possible while protecting safety and security. These occurrences, however, also can have impacts on the transportation system far from the incident scene, generating major traffic tie-ups or transit delays. On-scene responders often are too busy to spend significant time addressing these faraway secondary "ripple effects" affecting thousands of people. Historically, the region has addressed such ripple effects on a case-by-case basis without a single, designated regionwide entity responsible for coordination.

Following the experiences of the 9/11 attacks and other major incidents, TPB championed creation of the Metropolitan Area Transportation Operations Coordination (MATOC) Program (formerly known as the Regional Transportation Coordination Program or RTCP) partnering with the region's major transportation agencies. Development of the MATOC Program was identified as one of the TPB's priority emphasis areas for 2005. At the initiative of U.S. Congressman Jim Moran, a $1.6 million grant to jumpstart the MATOC Program was provided in the 2005 SAFETEA-LU federal transportation reauthorization legislation, enabling the region's transportation agencies with TPB to initiate the program.

"We need to coordinate construction schedules. We need to coordinate the way we address traffic incidents. And we certainly need to communicate better so that we can immediately figure out the most efficient way to deal with transportation crises as they arise," Congressman Moran told the TPB in April 2005.

MATOC Program development was also advised by experts at the U.S. Department of Transportation's Volpe Center research arm. Volpe indicated that the establishment of such a program would benefit

incident management work each transportation agency already does. The Center's researchers confirmed that there are capability shortfalls if there is no designated accountability for undertaking regional coordination activities. Volpe noted that the program does not have to be a bricks-and-mortar center, but it must be a committed cooperative effort among key agencies. Accomplishing MATOC Program goals will rely to the greatest extent possible on existing agency personnel and effective implementation of technology as it is implemented on an incremental basis over the years 2006 to 2010.

Goals for the MATOC Program include:

- Based upon improved standard operating procedures and notification practices, strengthen multi-agency coordination among transportation response agencies during incidents.
- Improve the technological systems by which transportation agencies can share data with each other to aid incident management.
- Improve the quality and timeliness of the information available through current sources (e.g., radio and television stations) on transportation systems conditions, especially during incidents.
- Coordinate with the University of Maryland on the separate but related **Regional Integrated Transportation Information System** (RITIS). RITIS is to provide real-time transportation data compiled from each of the region's transportation agencies, and will be the primary source of information used within the MATOC Program.
- Help ensure transportation systems condition information is provided to emergency management and public safety agencies to aid in their responses to declared emergencies or major disasters. In such incidents, **transportation emergency management** becomes one of a number of support functions to public safety agency leadership of the response.

WHAT IS THE CMP?

The Congestion Management Process (CMP) is a systematic process in Transportation Management Areas (TMAs) that provides for safe and effective integrated management and operation of the multimodal transportation system. The process is based on a cooperatively developed metropolitan-wide strategy of new and existing transportation facilities.

Congestion is the level at which transportation performance is no longer acceptable due to traffic interference resulting in decreased speeds and increased travel times. As our region continues to experience dynamic economic and demographic growth, congestion remains a primary focus of the TPB.

What Are the Major Components of and Considerations for the CMP?

The CMP requires a systematic approach. The TPB's CMP is part of the regional transportation plan and includes the following:

- Methods to monitor and evaluate system performance
- Objectives and performance measures
- Data collection and analysis
- Identification and evaluation of anticipated performance and expected benefits of Congestion Management strategies, including demand management, traffic operational improvements, public transportation improvements, ITS technologies, and additional system capacity, (where necessary)
- Assessment of the effectiveness of previously implemented strategies

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Proposed single-occupant vehicle (SOV) capacity-increasing projects must show that congestion management strategies have been considered. In addition, the regional transportation plan will consider the **results of the CMP**.

The Need for a CMP

Congestion Management as a Goal of the TPB

As the Washington region continues to grow, congestion management will remain a primary goal of the TPB. Over the years the TPB has implemented a number of demand and operational management strategies to address congestion. The TPB is committed to documenting these strategies in an enhanced structured process to get maximum benefit from new and existing transportation systems.

Federal Requirements

The Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU), enacted August 10, 2005, requires that metropolitan transportation planning processes include a CMP, similar to the Congestion Management System (CMS) requirements under previous federal transportation bills. In addition, the March 2006 Federal certification of the TPB process suggested that the region's CMP be enhanced. The TPB develops the CMP in concert with long-range transportation plan development.

The Transportation Planning Board (TPB) is committed to management of the existing and future transportation system through the use, where appropriate, of **demand management and operational management strategies**. These strategies, when taken as a whole, form a large portion of the CMP.

The CMP addresses the SAFETEA-LU requirements, as laid out in the February 14, 2007 federal regulations (Source: §450.320(a), Metropolitan Transportation Planning, Final Rule, Federal Register, February 14, 2007). These 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."

The CMP is important to the Washington region for many reasons. First, it provides for safe and effective integrated management and operation of the multimodal transportation system. Compiling information on congestion throughout the region can help determine priorities for regional transportation projects.

The CMP takes a metropolitan-wide, systematic approach, in that congestion is examined over the entire metropolitan region, and the process is integrated into the Long Range Transportation Plan.

Both new and existing transportation infrastructure is part of the CMP. This is important in determining what existing facilities could be improved upon to reduce congestion, and what congestion management strategies are appropriate for new facilities. Travel demand reduction strategies, such as alternative commute programs, growth management, and HOV facilities and value pricing, as well as operational management strategies such as identifying non-recurring congestion, ITS technologies, and capacity increases (where necessary), are potential strategies the CMP considers for new and existing facilities.

The CMP is important when considering single-occupant vehicle (SOV) capacity-increasing projects in the Long-Range Plan. Capacity increasing projects are sometimes necessary to eliminate bottlenecks, make safety improvements, and implement traffic operational improvements. However, in many instances, travel demand management or operational demand management strategies can be implemented in lieu of, or in conjunction with, capacity increase. Capacity-increasing projects are considered as a metropolitan-wide strategy, for new and existing transportation facilities.

The results of the CMP are important to the long-range planning process. The CMP, including the locations and extent of congestion, along with which strategies are most successful, helps guide decision makers to prioritize areas for current and future projects. The CMP is important to long-range planning to help determine priorities for implementation and funding.

OPERATIONAL MANAGEMENT STRATEGIES

The TPB's 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. The TPB is committed to a number of ongoing operational management strategies, such as:

Incident Management/Non-Recurring Congestion Strategies

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. The TPB minimizes 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.

- **DDOT's emergency incident plan** provides information on many incident management areas, including updating and protecting communication network, deployment of evacuation dynamic message signs, emergency public address system, evacuation plans, and deployment of CCTV cameras.
- **Maryland's Coordinated Highways Action Response Team (CHART) program** provides TPB with information such as distribution of incidents and disabled vehicles by location; number and type of incidents responded to; reduction in secondary incidents; percent of incidents occurring on weekdays versus weekends; and roadway segments with highest number of incidents.
- **VDOT's Smart Traffic Control Center in Northern Virginia** collects data from loop detectors and pavement sensors embedded in the roadways to prompt an automatic incident detection system which alerts the traffic control center when there is an accident, complete with speed and occupancy data. In addition, VDOT alerts drivers of unexpected conditions with variable message signs and an AM radio station, such as for the Springfield Interchange and Woodrow Wilson Bridge projects.

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

ITS Technologies and Systems Management

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

- **Advanced Traffic Signal Systems** apply computer and communications technologies to the operations of traffic signals in order to maximize safety and efficiency. Components of such systems include interconnection of groups of signals to facilitate timing and coordination among them, and countdown signals for pedestrians to bolster safety and walkability.
- **Electronic Payment Systems** use cards or transponders carried by the user that electronically communicate with devices maintained by a transportation agency to conduct and record payment transactions. Examples include WMATA's SmarTrip card, for uses on bus, rail, and WMATA parking lots, as well as the E-Z Pass toll system.
- **Service Patrols** involve specialized trucks or vans traveling the highways and rendering assistance where needed, such as pushing disabled vehicles off the road, providing gasoline, or changing tires.DDOT, MDOT, and VDOT all implement service patrols on roadways. Also, Montgomery County is the first local jurisdiction in the area to have patrols (since 2006), primarily on arterials.
- **Advanced Traveler Information Systems (ATIS)** are technology-based means of compiling and disseminating transportation system information on a real-time or near-real-time basis prior to or during tripmaking. Examples include the Virginia 511 system.
- **Transit Information Systems** provide information to riders after their trips have started, including arrival and departure times, information on transfers and connections, and related services like park and ride availability.Metrorail implements passenger information on platform displays, on the web, and via mobile phone.

Capacity Increases (Where Necessary)

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 .

- **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.