Richmond Area MPO Congestion Management System

CMS Toolbox

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Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox*, December 2001.

Richmond Area MPO Congestion Management System

CMS Toolbox

One of the components of the Congestion Management System for the Richmond Area Metropolitan Planning Organization (RAMPO) will be a toolbox of potential congestion reduction and mobility strategies. The idea behind this toolbox is to encourage ways to deal with congestion and mobility problems beyond traditional roadway widening projects. As Step 3 (Strategy Evaluation) of the CMS is implemented, local governments, agencies, and VDOT will give consideration to the various strategies identified in this toolbox as a starting point for alternative solutions to address possible congestion areas. They would consider each item in the toolbox in turn, and determine whether a tool had a reasonable potential for providing benefit to the corridor or study area in question. If a tool shows promise, it can be evaluated in detail using the regional travel demand forecasting model and other applicable post-processing methods, if available. If a tool does not make sense, a brief explanation of why it is not appropriate would be provided.

For each of the projects and strategies, the toolbox identifies their potential for congestion reduction, implementation cost and schedule, and analysis method. The congestion reduction impacts are defined by indicators such as the potential reduction of single occupant vehicles (SOV), improved travel times, and reduced delay. The implementation costs and schedules consider design and maintenance costs, interjurisdictional agreements, and implementation timing over short-term (one to five years), medium-term (five to 10 years), and long-term (over 10 years). The implementation costs and schedules presented in each section are based on information prepared by the Institute of Transportation Engineers (ITE) and Cambridge Systematics for other projects and, therefore, will vary for specific implementation in the Richmond area. Some of the analysis methods have been modified based on comments by VDOT travel demand model staff. Specific costs are specified where data were available.

Toolbox Strategy Categories:

1. ***Highway Projects***
2. ***Transit Projects***
3. ***Bicycle and Pedestrian Projects***
4. ***Transportation Demand Management (TDM) Strategies***
5. ***Intelligent Transportation System (ITS) and Transportation System Management (TSM) Strategies***
6. ***Access Management Strategies***
7. ***Land Development Strategies***
8. ***Parking Management Strategies***

In identifying analysis methods, the toolbox indicates the tools needed to evaluate the congestion reduction potential of each strategy or project. In addition to the regional travel demand forecasting model, other analytical methods considered include:

- Transportation Demand Management (TDM) Evaluation Model: The TDM Evaluation Model is a software program that analyzes the vehicle-trip reduction effects of a wide range of travel demand management strategies. Strategies addressed - improved transit; bicycle/pedestrian facilities; HOV lanes; carpooling and vanpooling promotion; telecommute and work hour strategies; pricing and subsidies.
- Intelligent Transportation System (ITS) Deployment Analysis System (IDAS): IDAS is a modeling tool that enables the user to conduct systematic assessments and quantitative evaluations of the relative benefits and costs of more than 60 types of ITS investments, in combination or in isolation. Strategies Addressed - Improved transit; HOV lanes; traveler information; traffic flow improvements; incident management.

Highway Projects

Table 1 presents the potential highway infrastructure projects that may be applicable for the MPO. The regional travel model will be the primary analysis tool to assess the transportation impacts. The TDM Evaluation Model and IDAS can also be applied to evaluate HOV lanes.

Transit Projects

Transit services and infrastructure projects have traditionally been implemented in regions to provide an alternative to automobile travel potentially reducing peak-period congestion and improving mobility and accessibility for commuters. Table 2 presents the transit projects that may be applicable for the Richmond Area MPO. These projects tend to reduce system wide VMT in relatively small increments but do improve corridor and system wide accessibility, improve roadway travel times, and decrease congestion on the roadway system.

Bicycle and Pedestrian Projects

Investments in non-motorized modes of transportation, such as biking and walking can increase safety and mobility in a cost-efficient manner, while providing a zero-emission alternative to motorized modes. The strategies listed in Table 3 can be implemented in the MPO with relatively little cost, but tend to have local rather than system wide impacts. The effectiveness of an investment in non-motorized travel depends heavily on coordination with local land use policies and connections with other modes, such as transit, for longer distance travel. Safety and aesthetics should also be emphasized in the design of bicycle and pedestrian facilities in order to increase their attractiveness.

TDM Strategies

Transportation demand management (TDM) strategies are used to reduce travel during the peak, commute period. They are also used to help agencies meet air quality conformity standards, and are intended to provide ways to provide congestion relief/mobility improvements without high cost infrastructure projects. Table 4 presents the TDM strategies that may be applicable for the Richmond area. These strategies can potentially build upon current TDM initiatives being implemented in the MPO such as the area's Rideshare program.

ITS and TSM Strategies

Intelligent transportation system (ITS) and transportation system management (TSM) strategies have traditionally focused on improving the operation of the transportation system without major capital investment and cost. While ITS strategies may be costly compared to more traditional TSM strategies, their relative congestion-reduction impacts can be significant. Table 5 presents the ITS and TSM strategies that may be applicable for the Richmond region. The strategies identified in Table 5 can build upon current ITS initiatives in the Richmond area such as VDOT's Richmond Area Smart Traffic Center.

Access Management Strategies

Access management is a broad concept that can include everything from curb cut restrictions on local arterials to minimum interchange spacing on freeways. Restricting turning movements on local arterials can reduce accidents and prevent turning vehicles from impeding traffic flow. Similarly, eliminating merge points and weaving sections at freeway interchanges increases the capacity of the facility. The access management strategies listed in Table 6 are applicable to the Richmond area, and can be used in either the modification or original design of a facility.

Land Development Strategies

Land development strategies have been used in some areas to manage transportation demand on the system, and to help agencies meet air quality conformity standards. Land development strategies can include limits on the amount and location of development until certain service standards are met, or policies that encourage development patterns better served by public transportation and non-motorized modes. Table 7 presents the land development strategies that may be applicable for the Richmond area.

Parking Management Strategies

Parking management is most often used to decrease automobile trips for both work and non-work purposes, although in the context of enforcement it may also be used to improve traffic flow. Often, policies implemented by local governments and directed towards the private sector must be accompanied by incentives in order to ensure their effectiveness. Several strategies applicable to the Richmond area are presented in Table 8.

Table 1: Potential Highway Strategies for the CMS Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
1a. Increasing Number of Lanes without Highway Widening This takes advantage of "excess" width in the highway cross section used for breakdown lanes or median.	• Increase capacity	• Construction and engineering • Maintenance	• Short-term: 1 to 5 years (includes planning, engineering, and implementation)	• Regional Travel Model • IDAS
1b. Geometric Design Improvements This includes widening to provide shoulders, additional turn lanes at intersections, improved sight lines, auxiliary lanes to improve merging and diverging.	• Increase Mobility • Reduce congestion by improving bottlenecks • Increase traffic flow and improve safety	• Costs vary by type of design	• Short-term: 1 to 5 years	• Microsimulation
1c. HOV Lanes This increases corridor capacity while at the same time provides an incentive for single occupant drivers to shift to ridesharing. These lanes are most effective as part of a comprehensive effort to encourage HOVs, including publicity, outreach, park-and-ride lots and rideshare matching services.	• Reduce Regional VMT • Reduce Regional trips • Increase vehicle occupancy • Improve travel times • Increase transit use and improve bus travel times	• HOV, separate ROW costs • HOV, barrier separated costs • HOV, contraflow costs • Annual operations and enforcement • Can create environmental and community impacts	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • TDM Evaluation Model • IDAS
1d. Super Street Arterials This involves converting existing major arterials with signalized intersections into "super streets" that feature grade-separated intersections.	• Increase capacity • Improve mobility	• Construction and engineering substantial grade separation • Maintenance variable based area	• Medium-term: • 5 to 10 years (includes planning, engineering, and implementation)	• Microsimulation
1e. Highway Widening by Adding Lanes This is the traditional way to deal with congestion.	• Increase capacity, reducing congestion in the short term • Long-term effects on congestion depend on local conditions	• Costs vary by type of highway constructed; in dense urban areas can be very expensive • Can create environmental and community impacts	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Microsimulation • Regional Travel Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.

Table 2: Potential Transit Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
2a. Reducing Travel Fares This encourages additional transit use, to the extent that high fares are a real barrier to transit.	• Reduce daily VMT • Reduce congestion • Increase Ridership	• Lost in revenue per rider • Capital costs per passenger trip • Operating costs per passenger trip • Operating subsidies needed to replace lost fare revenue • Alternate financial arrangements need to be negotiated with donor agencies	• Short-term: Less than one year	• Regional Travel Model • TDM Evaluation Model
2b. Increasing Bus Route Coverage or frequencies This provides better accessibility to transit to a greater share of the population. Increasing frequency makes transit more attractive to use.	• Increase transit ridership • Decrease travel time • Reduce daily VMT	• Capital cost per passenger trip • Operating costs per trip • New bus purchases likely	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• TDM Evaluation Model • Regional Travel Model
2c Implementing Park-and-Ride Lots These can be uses in conjunction with HOV lanes and / or express bus services. They are particularly helpful for encouraging HOV use for longer distance commute trips.	• Reduce regional VMT (up to 0.1 percent)	• Structure costs for transit stations	• Medium-term: 5 to 10 years (including planning, engineering, and construction)	• TDM Evaluation Model • Regional Travel Model
2d. Implementing Rail Transit This best serves dense urban centers where travelers can walk to their destinations. Rail transit from suburban areas can be sometimes be enhanced by providing park-and-ride lots.	• Reduce daily VMT	• Capital cost per passenger • New systems require large upfront capital outlays and ongoing sources of operating subsidies, in addition to funds that may be obtained from federal sources, under increasingly tight competition.	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.

Table 3: Potential Bicycle and Pedestrian Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
3a. New sidewalks and Designated Bicycle Lanes on Local Streets. Enhancing the visibility of bicycle and pedestrian facilities increases the perception of safety. In many cases, bike lanes can be added to existing roadways through restriping.	• Increase mobility and access • Increase non-motorized mode shares • Separate slow-moving bicycles from motorized vehicles • Reduce incidents	• Design and construction costs for paving, striping, signals, and signing • ROW costs if widening necessary • Bicycle lanes may require improvements to roadway shoulders to ensure acceptable pavement quality	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• TDM Evaluation Model
3b. Improved Bicycle Facilities at Transit Stations and Other Trip Destinations. Bicycle racks and bike lockers at transit stations and other trip destinations increase security. Additional amenities such as locker rooms with showers at workplaces provide further incentives fro using bicycles.	• Increase bicycle mode share • Reduce motorized vehicle congestion on access routes	• Capital and maintenance costs for bicycle racks and lockers, and locker rooms	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• TDM Evaluation Model
3c. Design Guidelines for Pedestrian-Oriented Development. Maximum block lengths, building setback restrictions, and streetscape enhancements are examples of design guidelines that can be codified in zoning ordinances to encourage pedestrian activity.	• Increase pedestrian mode share • Discourage motor vehicle use for short trips • Reduce VMT, emissions	• Capital costs largely borne by private sector; developer incentives may be necessary • Public sector my be responsible for some capital and / or maintenance costs associated with right-of-way improvements • Ordinance development and enforcement costs	• Short-term: 1 to 5 years	• TDM Evaluation Model • Localized Analysis
3d. Improved Safety of Existing Bicycle and Pedestrian Facilities. Maintaining lighting, signage, striping, traffic control devices, and pavement quality, and installing curb cuts, curb extensions, median refuges, and raised crosswalks can increase bicycle and pedestrian safety.	• Increase non-motorized mode share • Reduce incidents	• Increased monitoring and maintenance costs • Capital costs of sidewalk improvements and additional traffic control devices	• Short-term: 1 to 5 years	• TDM Evaluation Model

Table 3: Potential Bicycle and Pedestrian Strategies for the CMS Toolbox (continued)

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
3e. Exclusive Non-motorized Rights-of-way. Abandoned rail rights-of-way and existing parkland can be used for medium- to long- distance bike trails, improving safety and reducing travel times.	• Increase mobility • Increase non-motorized mode shares • Reduce congestion on nearby roads • Separate slow-moving bicycles from motorized vehicles • Reduce incidents	• ROW costs • Construction and Engineering Costs • Maintenance Costs	• Medium-term: 5 to 10 years (including planning, engineering, and construction)	• TDM Evaluation Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox*, December 2001.

Table 4: Potential TDM Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
4a. Alternative Work Hours. This allows workers to arrive and leave work outside of the traditional commute period. It can be on a scheduled basis or a true flex-time arrangement.	• Reduce peak-period VMT • Improve travel time among participants	• No capital costs • Agency costs for outreach and publicity • Employer costs associated with accommodating alternative work schedules	• Employer based • Short-term: 1 to 5 years	• TDM Evaluation Model • Regional Travel Model
4b. Telecommuting This involves employees to work at home or regional telecommute center instead of going into the office. They might do all this all of the time, or only one or more days per week.	• Reduce VMT • Reduce SOV trips	• First year implementation costs for private sector (per employee for equipment) • Second-year costs tend to decline	• Employer based • Short-term: 1 to 5 years	• TDM Evaluation Model
4c. Ridesharing This is typically arranged/ encouraged through employers or transportation management agencies (TMA), which provides ride-matching services.	• Reduce work VMT • Reduce SOV trips	• Savings per carpool and vanpool riders • Costs per year per free parking space provided • Administrative costs	• Employer based • Short-term: 1 to 5 years	• TDM Evaluation Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.

Table 5: Potential ITS and TSM Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
5a. Traffic Signal Coordination This improves traffic flow and reduces emissions by minimizing stops on arterial streets.	• Improve travel time • Reduce the number of stops • Reduce VMT by vehicle miles per day, depending on program	• O & M costs per signal • Signalized intersections per mile costs variable	• Short-term: 1 to 5 years	• IDAS • Microsimulation
5b. Reversible Traffic Lanes These are appropriate where traffic flow is highly directional.	• Increase peak direction capacity • Reduce peak travel times • Improve mobility	• Barrier separated costs per mile • Operation costs per mile • Maintenance costs variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
5c. Freeway Incident Detection and Management Systems This is an effective way to alleviate non-recurring congestion. Systems typically include video monitoring, dispatch systems, and sometimes roving service patrol vehicles.	• Reduce accident delay • Reduce Travel Time	• Capital costs variable and substantial • Annual operating and maintenance costs	• Medium- to Long-term: likely 10 years or more	• IDAS
5d. Ramp Metering This allows freeways to operate at their optimal flow rates, thereby speeding travel and reducing collisions.	• Decrease travel time • Decrease accidents • Improve traffic flow on major facilities	• O & M costs • Significant costs associated with enhancements to centralized control system • Capital costs	• Medium term: 5 to 10 years	• IDAS
5e. Highway Information Systems These systems provide travelers with real-time information that can be used to make trip and route choice decisions.	• Reduce travel times and delay • Some peak-period travel shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium-term: 5 to 10 years	• IDAS
5f. Advanced Traveler Information Systems This provides an extensive amount of data to travelers, such as real time speed estimates on the web or over wireless devices, and transit vehicle schedule progress.	• Reduce travel times and delay • Some peak-period travel and mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium-term: 5 to 10 years	• IDAS

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.

Table 6: Potential Access Management Strategies for the CMS Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
6a. Left Turn Restrictions; Curb Cut and Driveway Restrictions Turning vehicles can impede traffic flow and are more likely to be involved in crashes.	• Increased capacity, efficiency on arterials • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer accidents	• Implementation and maintenance costs vary; range from new signage and striping to more costly permanent median barriers and curbs.	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• Localized Analysis
6b. Turn Lanes and New or Relocated Driveways and Exit Ramps In some situations, increasing or modifying access to a property can be more beneficial than reducing access.	• Increased capacity, efficiency • Improved mobility and safety on facility • Improved travel times and reduced delay for all traffic	• Additional right-of-way costs • Design, construction, and maintenance costs	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• Localized Analysis
6c. Interchange Modifications Conversion of a full cloverleaf interchange to a partial cloverleaf, for example, reduces weaving sections on a freeway.	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents due to fewer conflict pints	• Design and construction costs	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• IDAS • Regional Travel Model • Would need to code ramps
6d. Minimum Intersection/Interchange Spacing Reduces number of conflict points and merging areas, which in turn reduces incidents and delays.	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents	• Part of design costs for new facilities and reconstruction projects	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Local
6e. Frontage Roads and Collector-Distributor Roads Frontage roads can be used to direct local traffic to major intersections on both super arterials and freeways. Collector-distributor roads are used to separate exiting, merging, and weaving traffic from through traffic at closely-spaced interchanges.	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents due to fewer conflict points	• Additional right-of-way costs • Design, construction, and maintenance costs	• Medium-term; 5 to 10 years (including planning, engineering, and construction)	• IDAS • Regional Travel Model • Would need more network detail

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox***,** December 2001.

Table 7: Potential Land Use Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
7a. Mixed-Use Development This allows many trips to be made without automobiles. People can walk to restaurants and services rather than use their vehicles.	• Increase walk trips • Decrease SOV trips • Decrease in VMT • Decrease vehicle hours of travel	• Public costs to set and monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• TDM Evaluation Model • Policy Analysis
7b. *Infill and Densification* This takes advantage of infrastructure that already exists, rather than building new infrastructure on the fringes of the urban area.	• Decrease SOV • Increase transit, walk, and bicycle • Doubling density decreases VMT per household • Medium / high vehicle trip reductions	• Public costs to set up and monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• TDM Evaluation Model
7c. Transit-Oriented Development This clusters housing units and / or businesses near transit stations in walkable communities.	• Decrease SOV share • Shirt carpool to transit • Increase transit trips • Decrease VMT • Decrease in vehicle trips	• Public costs to set up and monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• TDM Evaluation Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.

Table 8: Potential Parking Management Strategies for the CMS Toolbox

STRATEGIES/PROJECTS	CONGESTION AND MOBILITY BENEFITS	IMPLEMENTATION COSTS AND OTHER IMPACTS	IMPLEMENTATION TIMEFRAME	ANALYSIS METHOD
8a. On-Street Parking and Standing Restrictions Enforcement of existing regulations can substantially improve traffic flow in urban areas. Peak-period parking prohibitions can free up to extra general purpose travel lanes or special bus or HOV "diamond" lanes.	• Increase peak-period capacity • Reduce travel time and congestion on arterials • Increase HOV and bus mode shares	• Design, construction, and maintenance costs for signage and striping • Rigid enforcement or parking restrictions	• Short-term: 1 to 5 years (includes planning, engineering, and implementation)	• IDAS • Regional Travel Mode
8b. Employer / Landlord Parking Agreements Employers can negotiate leases so that they pay only for the number of spaces used by employees. In turn, employers can pass along parking savings by purchasing transit passes or reimbursing non-driving employees with the cash equivalent of a parking space.	• Reduce the VMT • Increase non-auto mode shares	• Economic incentives used to encourage employer and landlord buy-in	• Metropolitan and employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model
8c. Preferential or Free Parking for HOVs This provides an incentive for workers to carpool.	• Reduce work VMT • Increase vehicle occupancy	• Relatively low costs, primarily borne by the private sector, include signing, striping, and administrative costs	• Metropolitan and Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model
8d. Location-Specific Parking Ordinances Parking requirements can be adjusted for factors such as availability of transit, a mix of land uses, or pedestrian-oriented development that may reduce the need for on-site parking. This encourages transit-oriented and mixed-use development.	• Reduce VMT • Increase transit and non-motorized mode shares	• Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• TDM Evaluation Model

Source: Cambridge Systematics, Inc. *Mid-America Regional Council Enhanced Congestion Management System, Technical Memorandum, CMS Toolbox,* December 2001.