



## Congestion Management Process

# CMP Toolbox

Technical  
Memorandum  
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## **Congestion Management Process CMP Toolbox**

One of the components of the Congestion Management Process for the Capital Area MPO 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 through-lane capacity projects. As the CMP is implemented local municipalities and agencies will use this toolbox as a starting point when considering alternative solutions to be evaluated.

We envision that when cities and agencies find themselves considering roadway capacity projects, that they would use the toolbox like a checklist. 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 model and applicable post-processing methods. If a tool does not make sense, a brief explanation of why it is not appropriate would be provided.

The CMP toolbox of strategies is presented using the following categories:

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

For each of the projects and strategies we have identified 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, inter-jurisdictional 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, Inc.

In identifying analysis methods we identified the tools needed to evaluate the congestion reduction potential of each strategy or project. The methods include the TDM Evaluation Model, the ITS Deployment Analysis Process (IDAS), and the Triangle Regional Model which form the analytical foundation for the CAPITAL AREA MPO CMP.

## **Highway Projects**

Table 1 presents the potential highway infrastructure projects that may be applicable for the Capital Area 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 Capital Area MPO. These projects tend to reduce systemwide VMT in relatively small increments but do improve corridor and systemwide accessibility, improve roadway travel times, and decrease congestion on the roadway system.

## **Bicycle and Pedestrian Projects**

Non-motorized modes of transportation, such as biking and walking, are often overlooked by transportation professionals. Investments in these modes 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 Capital Area MPO with relatively little cost, but tend to have local rather than systemwide 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 Capital Area MPO. These strategies can potentially build upon current ITS initiatives being implemented in the Capital Area MPO such as the Triangle Transit 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 Capital

Area MPO. The strategies identified in Table 5 can build upon current ITS initiatives such as the ATMS system and the various traffic signal coordination systems.

### **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 Capital Area MPO, 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 Capital Area MPO.

### **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 Capital Area MPO are presented in Table 8.

**Table 1. Potential Highway Strategies for the CMP Toolbox**

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and other Impacts	Implementation Timeframe	Analysis Method
<p><i>1b. Geometric Design Improvements</i> This includes widening to provide <i>shoulders</i>, additional turn lanes at intersections, improved sight lines, auxiliary lanes to improve merging and diverging.</p>	<ul style="list-style-type: none"> <li>• Increase mobility</li> <li>• Reduce congestion by improving bottlenecks</li> <li>• Increase traffic flow and improve safety</li> </ul>	<ul style="list-style-type: none"> <li>• Costs vary by type of design</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> </ul>
<p><i>1c. HOV Lanes</i> This increase 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.</p>	<ul style="list-style-type: none"> <li>• Reduce Regional VMT</li> <li>• Reduce regional trips</li> <li>• Increase vehicle occupancy</li> <li>• Improve travel times</li> <li>• Increase transit use and improve bus travel times</li> </ul>	<ul style="list-style-type: none"> <li>• HOV, separate ROW costs</li> <li>• HOV, barrier separated costs</li> <li>• HOV, contraflow costs</li> <li>• Annual operations and enforcement</li> <li>• Can create environmental and community impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years</li> <li>• (includes planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> <li>• IDAS</li> </ul>
<p><i>1d. Super Street Arterials</i> This involves converting existing major arterials with signalized intersections into “super streets” based on North Carolina design standards.</p>	<ul style="list-style-type: none"> <li>• Increase capacity</li> <li>• Improve mobility</li> </ul>	<ul style="list-style-type: none"> <li>• Construction and engineering substantial for grade separation</li> <li>• Maintenance variable based on area</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years</li> <li>• (includes planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> </ul>
<p><i>1e. Highway Widening by Adding Lanes</i> This is the traditional way to deal with congestion</p>	<ul style="list-style-type: none"> <li>• Increase capacity, reducing congestion in the short term</li> <li>• Long-term effects on congestion depend on local conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Costs vary by type of highway constructed; in dense urban areas can be very expensive</li> <li>• Can create environmental and community impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years (includes planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> </ul>

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviation Traffic Congestion.

**Table 2. Potential Transit Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>2a. Reducing Transit Fares</i> This encourages additional transit use, to the extent that high fares are a real barrier to transit.</p>	<ul style="list-style-type: none"> <li>• Reduce daily VMT</li> <li>• Reduce congestion</li> <li>• Increase ridership</li> </ul>	<ul style="list-style-type: none"> <li>• Lost in revenue per rider</li> <li>• Capital costs per passenger trip</li> <li>• Operating costs per passenger trip</li> <li>• Operating subsidies needed to replace lost fare revenue</li> <li>• Alternative financial arrangements need to be negotiated with donor agencies</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: Less than one year</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> </ul>
<p><i>2b. Increasing Bus Route Coverage or frequencies</i> This provides better accessibility to transit to a greater share of the population. Increasing frequency makes transit more attractive to use.</p>	<ul style="list-style-type: none"> <li>• Increase transit ridership</li> <li>• Decrease travel time</li> <li>• Reduce daily VMT</li> </ul>	<ul style="list-style-type: none"> <li>• Capital costs per passenger trip</li> <li>• Operating costs per trip</li> <li>• New bus purchases likely</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (includes planning, engineering, and construction)</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>
<p><i>2c. Implementing Park-and-Ride Lots</i> These can be used in conjunction with HOV lanes and/or express bus services. They are particularly helpful for encouraging HOV use for longer distance commute trips.</p>	<ul style="list-style-type: none"> <li>• Reduce Regional VMT (up to 0.1 percent)</li> <li>• Increase mobility and transit efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Structure costs for transit stations</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years (includes planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>
<p><i>2d. Implementing Rail Transit</i> This best serves dense urban centers where travelers can walk to their destinations. Rail transit from suburban areas can sometimes be enhanced by providing park-and-ride lots.</p>	<ul style="list-style-type: none"> <li>• Reduce daily VMT</li> </ul>	<ul style="list-style-type: none"> <li>• Capital costs per passenger</li> <li>• 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.</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years (includes planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 3. Potential Bicycle and Pedestrian Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>3a. New Sidewalks and Designated Bicycle Lanes on Local Streets</i></p> <p>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.</p>	<ul style="list-style-type: none"> <li>• Increase mobility and access</li> <li>• Increase non-motorized mode shares</li> <li>• Separate slow-moving bicycles from motorized vehicles</li> <li>• Reduce incidents</li> </ul>	<ul style="list-style-type: none"> <li>• Design and construction costs for paving, striping, signals, and signing</li> <li>• ROW costs if widening necessary</li> <li>• Bicycle lanes may require improvements to roadway shoulders to ensure acceptable pavement quality</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (includes planning, engineering, and construction)</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> </ul>
<p><i>3b. Improved Bicycle Facilities at Transit Stations and Other Trip Destinations.</i></p> <p>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 for using bicycles.</p>	<ul style="list-style-type: none"> <li>• Increase bicycle mode share</li> <li>• Reduce motorized vehicle congestion and access routes</li> </ul>	<ul style="list-style-type: none"> <li>• Capital and maintenance costs for bicycle racks and lockers, locker rooms</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (includes planning, engineering, and construction)</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> </ul>
<p><i>3c. Design Guidelines for Pedestrian-Oriented Development</i></p> <p>Maximum block lengths, building setback restrictions, and streetscape enhancements are examples of design guidelines that can be codified in zoning ordinance to encourage pedestrian activity.</p>	<ul style="list-style-type: none"> <li>• Increase pedestrian mode share</li> <li>• Discourage motor vehicle use for short trips</li> <li>• Reduce VMT emissions</li> </ul>	<ul style="list-style-type: none"> <li>• Capital costs largely borne by private sector; developer incentives may be necessary</li> <li>• Public sector may be responsible for some capital and/or maintenance costs associated with right-of-way improvements</li> <li>• Ordinance development and enforcement costs</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>
<p><i>3d. Improved Safety of Existing Bicycle and Pedestrian Facilities.</i></p> <p>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.</p>	<ul style="list-style-type: none"> <li>• Increase non-motorized mode share</li> <li>• Reduce incidents</li> </ul>	<ul style="list-style-type: none"> <li>• Increased monitoring and maintenance costs</li> <li>• Capital costs of sidewalk improvements and additional traffic control devices</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>

**Table 3 (cont'd). Potential Bicycle and Pedestrian Strategies for the CMP Toolbox (continued)**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>3e. Exclusive Non-Motorized Rights-of-Way</i> Abandoned rail rights-of-way and existing parkland can be used for medium-to-long distance bike trails, improving safety and reducing travel times.</p>	<ul style="list-style-type: none"> <li>• Increase mobility</li> <li>• Increase non-motorized mode shares</li> <li>• Reduce congestion on nearby roads</li> <li>• separate slow-moving bicycles from motorized vehicles</li> <li>• Reduce incidents</li> </ul>	<ul style="list-style-type: none"> <li>• ROW costs</li> <li>• Construction and Engineering Costs</li> <li>• Maintenance Costs</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years (includes planning, engineering, and construction)</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 4. Potential TDM Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>4a. Alternative Work Hours</i> 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.</p>	<ul style="list-style-type: none"> <li>• Reduce peak-period VMT</li> <li>• Improve travel time among participants</li> </ul>	<ul style="list-style-type: none"> <li>• No capital costs</li> <li>• Agency costs for outreach and publicity</li> <li>• Employer costs associated with accommodating alternative work schedules</li> </ul>	<ul style="list-style-type: none"> <li>• Employer-based Short-term: 1 to 5 year</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>
<p><i>4b. Telecommuting</i> This involves employees to work at home or regional telecommute center instead of going into the office. They might do this all the time, or only one or more days per week.</p>	<ul style="list-style-type: none"> <li>• Reduce VMT</li> <li>• Reduce SOV trips</li> </ul>	<ul style="list-style-type: none"> <li>• First-year implementation costs for private-sector (per employee for equipment)</li> <li>• Second-year costs tend to decline</li> </ul>	<ul style="list-style-type: none"> <li>• Employer-based Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>
<p><i>4c. Ridesharing</i> This typically arranged/encouraged through employers or transportation management agencies (TMA), which provides ride-matching services.</p>	<ul style="list-style-type: none"> <li>• Reduce VMT</li> <li>• Reduce SOV trips</li> </ul>	<ul style="list-style-type: none"> <li>• First-year implementation costs for private-sector (per employee for equipment)</li> <li>• Second-year costs tend to decline</li> </ul>	<ul style="list-style-type: none"> <li>• Employer-based Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> <li>• Regional Travel Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 5. Potential ITS and TSM Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>5a. Traffic Signal Coordination</i></p> <p>This improves traffic flow and reduces emissions by minimizing stops on arterial streets</p>	<ul style="list-style-type: none"> <li>• Improve travel time</li> <li>• Reduce the number of stops</li> <li>• Reduce daily VMT by vehicle miles per day, depending on program</li> </ul>	<ul style="list-style-type: none"> <li>• O&amp;M costs per signal</li> <li>• Signalized intersections per mile costs variable</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> </ul>
<p><i>5b. Freeway Incident Detection and Management Process</i></p> <p>This is an effective way to alleviate non-recurring congestion. Systems typically include video monitoring, dispatch systems, and sometimes roving service patrol vehicles.</p>	<ul style="list-style-type: none"> <li>• Reduce accident delay</li> <li>• Reduce travel time</li> </ul>	<ul style="list-style-type: none"> <li>• Capital costs variable and substantial</li> <li>• Annual operating and maintenance costs</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-to Long-term: likely 10 years or more</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> </ul>
<p><i>5c. Ramp Metering</i></p> <p>This allows freeways to operate at their optimal flow rates, thereby speeding travel and reducing collisions.</p>	<ul style="list-style-type: none"> <li>• Decrease travel time</li> <li>• Decrease accidents</li> <li>• Improve traffic flow on major facilities</li> </ul>	<ul style="list-style-type: none"> <li>• O&amp;M costs</li> <li>• Significant costs associated with enhancements to centralized control system</li> <li>• Capital costs</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> </ul>
<p><i>5d. Highway/ Advanced Traveler Information Systems</i></p> <p>These systems provide travelers with real-time information that can be used to make trip and route choice decisions. ATIS 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.</p>	<ul style="list-style-type: none"> <li>• Reduce travel times and delay</li> <li>• Some peak period travel shift</li> </ul>	<ul style="list-style-type: none"> <li>• Design and implementation costs variable</li> <li>• Operation and maintenance costs variable</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 6. Potential Access Management Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>6a. Left Turn Restrictions; Curb Cut and Driveway Restrictions</i></p> <p>Turning vehicles can impede traffic flow and are more likely to be involved in crashes.</p>	<ul style="list-style-type: none"> <li>• Increased capacity, efficiency on arterials</li> <li>• Improved mobility on facility</li> <li>• Improved travel times and reduced delay for through traffic</li> <li>• Fewer incidents</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation and maintenance costs vary; range from new signage and striping to more costly permanent median barriers and curbs.</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Localized Analysis</li> </ul>
<p><i>6b. Turn lanes and New or Relocated Driveways and Exit Ramps</i></p> <p>In some situations, increasing or modifying access to a property can be more beneficial than reducing access.</p>	<ul style="list-style-type: none"> <li>• Increase capacity efficiency</li> <li>• Improved mobility and safety on facility</li> <li>• Improved travel times and reduced delay for all traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Additional right-of-way costs</li> <li>• Design, construction, and maintenance costs</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Localized Analysis</li> </ul>
<p><i>6c. Interchange Modifications</i></p> <p>Conversion of a full cloverleaf interchange to a partial cloverleaf, for example, reduces weaving sections on a freeway.</p>	<ul style="list-style-type: none"> <li>• See 6b</li> <li>• Fewer incidents due to fewer conflict points</li> </ul>	<ul style="list-style-type: none"> <li>• Design and construction costs</li> </ul>	<ul style="list-style-type: none"> <li>• Short term: 1 to 5 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> <li>• Would need to code ramps</li> </ul>
<p><i>6d. Minimum Intersection/ Interchange Spacing</i></p> <p>Reduces number of conflict points and merging areas, which in turn reduces incidents and delay.</p>	<ul style="list-style-type: none"> <li>• See 6c</li> </ul>	<ul style="list-style-type: none"> <li>• Part of design costs for new facilities and reconstruction projects</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• Local</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 6 (cont'd). Potential Access Management Strategies for the CMP Toolbox**

<p><i>6e. Frontage Roads and Collector-Distributor Roads</i> 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.</p>	<ul style="list-style-type: none"> <li>• See 6c</li> </ul>	<ul style="list-style-type: none"> <li>• Additional right-of-way costs</li> <li>• Design, construction, and maintenance costs</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-term: 5 to 10 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> <li>• Would need more network detail</li> </ul>
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Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 7. Potential Land Use Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	• Implementation Timeframe	Analysis Method
<p><i>7a. Mixed-Use Development</i> This allows many trips to be made without automobiles. People can walk to restaurants and services rather than use their vehicles.</p>	<ul style="list-style-type: none"> <li>• Increase walk trips</li> <li>• Decrease SOV trips</li> <li>• Decrease in VMT</li> <li>• Decrease vehicle hours of travel</li> </ul>	<ul style="list-style-type: none"> <li>• Public costs to set up and monitor appropriate ordinances</li> <li>• Economic incentives used to encourage developer buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> </ul>
<p><i>7b. Infill and Densification</i> This takes advantage of infrastructure that already exists, rather than building new infrastructure on the fringes of the urban area.</p>	<ul style="list-style-type: none"> <li>• Decrease SOV</li> <li>• Increase transit, walk, and bicycle</li> <li>• Doubling density decreases VMT per household</li> <li>• Medium/high vehicle trip reductions</li> </ul>	<ul style="list-style-type: none"> <li>• Public costs to set up and monitor appropriate ordinances</li> <li>• Economic incentives used to encourage developer buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> </ul>
<p><i>7c. Transit-Oriented Development</i> This clusters housing units and/or businesses near transit stations in walkable communities.</p>	<ul style="list-style-type: none"> <li>• Decrease SOV share</li> <li>• Shift carpool to transit</li> <li>• Increase transit trips</li> <li>• Decrease VMT</li> <li>• Decrease in vehicle trips</li> </ul>	<ul style="list-style-type: none"> <li>• Public costs to set up and monitor appropriate ordinances</li> <li>• Economic incentives used to encourage developer buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> </ul>
<p><i>7d. Transportation Impact Analysis</i> This is an evaluation tool for proposed developments, and assists planners in making major land use decisions.</p>	<ul style="list-style-type: none"> <li>• Increase bicycle, pedestrian, and transit trips</li> <li>• Decrease SOV Trips</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Public costs to set up and monitor appropriate ordinances</li> <li>• Economic incentives used to encourage developer buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Varies</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.

**Table 8. Potential Parking Management Strategies for the CMP Toolbox**

Strategies/Projects	Congestion Impacts	Implementation Costs	Implementation Timeframe	Analysis Method
<p><i>8a. On-Street Parking and Standing Restrictions</i></p> <p>Enforcement of existing regulations can substantially improve traffic flow in urban areas. Peak-period parking prohibitions can free up extra general purpose travel lanes or special bus or HOV “diamond” lanes.</p>	<ul style="list-style-type: none"> <li>• Increase peak-period capacity</li> <li>• Reduce travel time and congestion on arterials</li> <li>• Increase HOV and bus mode shares</li> </ul>	<ul style="list-style-type: none"> <li>• Design, construction, and maintenance costs for signage and striping</li> <li>• Rigid enforcement of parking restrictions</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term: 1 to 5 years (including planning, engineering, and implementation)</li> </ul>	<ul style="list-style-type: none"> <li>• IDAS</li> <li>• Regional Travel Model</li> </ul>
<p><i>8b. Employer/Landlord Parking Agreements</i></p> <p>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.</p>	<ul style="list-style-type: none"> <li>• Reduce work VMT</li> <li>• Increase non-auto mode shares</li> </ul>	<ul style="list-style-type: none"> <li>• Economic incentives used to encourage employer and landlord buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Metropolitan and Employer-based</li> <li>• Short-term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TDM Evaluation Model</li> </ul>
<p><i>8c. Preferential or Free Parking for HOVs</i></p> <p>This provides an incentive for workers to carpool.</p>	<ul style="list-style-type: none"> <li>• Reduce work VMT</li> <li>• Increase vehicle Occupancy</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively low costs, primarily borne by the private sector, include signing, striping, and administrative costs</li> </ul>	<ul style="list-style-type: none"> <li>• Metropolitan and Employer-based</li> <li>• Short term: 1 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• TCM Evaluation Model</li> </ul>
<p><i>8d. Location-Specific Parking Ordinances</i></p> <p>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.</p>	<ul style="list-style-type: none"> <li>• Reduce VMT</li> <li>• Increase transit and non-motorized mode shares</li> </ul>	<ul style="list-style-type: none"> <li>• Economic incentives used to encourage developer buy-in</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term: 10 or more years</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Travel Model</li> <li>• TDM Evaluation Model</li> </ul>

Sources: Cambridge Systematics, Inc. and ITE, a Toolbox for Alleviating Traffic Congestion.