A. CMP Toolbox Strategies

Table A.1 Transportation Demand Management Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
ALTERNATIVE COMMUTE PROGRAMS			
1a. Compressed Work Week/Flexible Work Schedules 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.	• Decrease 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 (including collaborative technologies)	Employer-based Short-term: 1 to 5 years
1b. Telecommuting Policies Allows employees to work at home or in a regional telecommute center instead of traveling to the worksite. They might do this all the time, or only one or more days per week.	• Decrease work VMT • Decrease SOV trips	• First-year implementation costs for private-sector (per employee for equipment and collaborative technologies) • Second-year costs tend to decline	Employer-based Short-term: 1 to 5 years
1c. Ridesharing Programs Includes carpooling, vanpooling, and ride-matching services; typically arranged/encouraged through employers or transportation management agencies (TMA). The Vanpool Sponsorship Program offers financial incentives for vanpooling in areas where public transportation is not readily available or feasible.	• Decrease work VMT • Decrease SOV trips	• Savings per carpool and vanpool riders • Costs per year per free parking space provided • Administrative costs • Agency costs for outreach and publicity	Employer-based Short-term: 1 to 5 years
1d. Guaranteed Ride Home Policies Provides a guaranteed ride home at no cost to the employee in the event an employee or a member of their immediate family becomes ill or injured, requiring the employee to leave work	• Decrease work VMT • Decrease SOV trips	• Requires administrative support from employers • Potential to be costly	Employer-based Short-term: 1 to 5 years
PRICING/MANAGED FACILITIES			
1e. Road Pricing Involves pricing facilities to encourage off-peak or HOV travel, and includes time-variable congestions pricing and cordon (area) tolls, high-occupancy/ toll (HOT) lanes, and vehicle-use fees.	• Decrease peak period VMT • Decrease SOV trips	• First-year implementation costs for public-sector	Short-term: 1 to 5 years

Table A.2 Transportation System Management and Operations Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
HIGHWAY/FREEWAY OPERATIONS			
2a. Reversible Traffic Lanes Appropriate where traffic flow is highly directional.	• Increase peak direction capacity • Decrease peak travel times • Improve mobility	• Barrier separated costs per mile • Operation costs per mile • Maintenance costs variable	Short-term: 1 to 5 years
2b. Ramp Metering Regulates the rate and spacing of traffic entering the freeway, allowing freeways to operate at their optimal flow rates.	• Decrease travel time • Decrease accidents • Improve traffic flow on major facilities	• O&M costs • High costs associated with enhancements to centralized control system • Capital costs for meters, sensors, and communication equipment	Medium-term: 5 to 10 years
2c. Freeway Incident Detection and Management Systems Typically includes video monitoring, incident detection, dispatch systems, and emergency response to alleviate nonrecurring congestion.	• Decrease accident delay • Decrease travel time • Decrease VHT and PHT	• Capital costs variable and substantial • Annual operating and maintenance costs	Medium- to long-term: 10 years or more
2d. Service Patrols Service vehicles patrol heavily traveled segments and congested sections of the freeways that are prone to incidents to provide faster and anticipatory responses to traffic incidents and disabled vehicles.	• Reduce incident duration time • Restore full freeway capacity • Reduce the risks of secondary accidents to motorists	• Costs vary based on the number of vehicles used by the patrol, number of routes that the patrol operates, and the population of the area in which the program operates	Short-term: 1 to 5 years
ARTERIAL AND LOCAL ROADS OPERATIONS			
2e. Traffic Signal Coordination Optimizes traffic flow and reduces emissions by minimizing stops on arterial streets.	• Improve travel time • Decrease the number of stops • Decrease VMT, VHD and PHT 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 (includes planning, engineering, and implementation)
ARTERIAL AND LOCAL ROADS OPERATIONS (continued)			
2f. Restricting Turns at Key Intersections Limits turning vehicles, which can impede traffic flow and are more likely to be involved in crashes.	• Increase capacity, efficiency on arterials • Improve mobility on facility • Improve travel times and decrease delay for through traffic • Decrease incidents	• 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 implementation)

Table A.2 Transportation System Management and Operations Strategies (continued)

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
2g. Converting Streets to One-Way Operations Establishes pairs of one-way streets in place of two-way operations. Most effective in downtown or very heavily congested areas.	• Increase traffic flow	• Conversion costs include adjustments to traffic signals, striping, signing and parking meters • May create some confusion, especially for nonlocal residents	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
OTHER OPERATIONS STRATEGIES			
2h. Traveler Information Systems Provides travelers with real-time information, such as incidents, speed and travel time estimates, that can be used to make trip and route choice decisions; Information accessible on the web, dynamic message signs, 511 systems, Highway Advisory Radio (HAR), or handheld wireless devices.	• Decrease 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
2i. Targeted and Sustained Enforcement of Traffic Regulations Improves traffic flow by reducing violations that cause delays; Includes automated enforcement (e.g., red light cameras).	• Improve travel time • Decrease the number of stops	• Increased labor costs per officer	Short-term: 1 to 5 years
OTHER OPERATIONS STRATEGIES (continued)			
2j. Special Events and Work Zone Management Includes a suite of strategies, including temporary traffic control, public awareness and motorist information, and traffic operations.	• Minimize traffic delays • Improve mobility • Maintain access for businesses and residents	• Design and implementation costs variable	Short-term: 1 to 5 years
2k. Road Weather Management Identifying weather and road surface problems and rapidly targeting responses, including advisory information, control measures, and treatment strategies.	• Improve safety due to reduced crash risk • Increased mobility due to restored capacity, delay reductions, and more uniform traffic flow	• Design and implementation costs variable • Operating and maintenance costs variable	Short-term: 1 to 5 years

Table A.2 Transportation System Management and Operations Strategies (continued)

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
2l. Traffic Surveillance, Control Systems, and Active Traffic Management Often housed within a Traffic Management Center (TMC), monitors volume and flow of traffic by a system of sensors, and further analyzes traffic conditions to flag developing problems, and implement adjustments to traffic signal timing sequences, in order to optimize traffic flow estimating traffic parameters in real-time. Currently, the dominant technology traffic surveillance is that of magnetic loop detectors, which are buried underneath roadways and count automobiles passing over them. Video monitoring systems for traffic surveillance may provide vehicle classifications, travel times, lane changes, rapid accelerations or decelerations, and length queues at urban intersections, in addition to vehicle counts and speeds.	• Decrease travel times and delay • Some peak-period travel and mode shift	• Design and implementation costs variable • Installation of video surveillance cameras may be less expensive than magnetic loop detectors, which require disruption and digging of the road surface	Medium-term: 5 to 10 years

Table A.3 Transit Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
FARE STRATEGIES			
3a. Reducing Transit Fares Encourages additional transit use.	• Decrease daily VMT • Decrease congestion • Increase ridership	• Loss in revenue per rider • Capital costs per passenger trip • Operating costs per passenger trip • Operating subsidies needed to replace lost fare revenue • Alternative financial arrangements need to be negotiated with donor agencies	Short-term: Less than 1 year
3b. Employer Incentive Programs Encourages additional transit use through transit subsidies of mass transit fares provided by employers.	• Increase transit ridership • Decrease travel time • Decrease daily VMT	• Cost of incentives to employers offering employee benefits for transit use	Short-term: 1 to 5 years
3c. Electronic Payment Systems and Universal Farecards Interchangeable smartcard payment system (including RFID) that can be used as a fare payment method for multiple transit agencies throughout the region.	• Increase transit ridership • Decrease travel time	• Considerably high, but expected to decrease • Implementation costs vary based on system design and functionality	Short-term: 1 to 5 years
OPERATIONS STRATEGIES			
3d. Realigned Transit Service Schedules and Stop Locations Service adjustments to better align transit service with ridership markets.	• Increase transit ridership • Decrease daily VMT	• Operating costs per trip	Short-term: 1 to 5 years
3e. Intelligent Transit Stops Ranges from kiosks, which show static transit schedules, to real-time information on schedules, locations of transit vehicles, arrival time of the vehicle, and alternative routes and modes.	• Decrease daily VMT • Decrease congestion • Increase ridership	• Capital costs per passenger	Medium-term: 5 to 10 years (includes planning, engineering, and construction
OPERATIONS STRATEGIES (continued)			
3f. Transit Signal Priority Often combined with dedicated rights-of-way for transit and/or bus rapid transit routes.	• Decrease travel time	• Implementation costs vary based on system design and functionality and type of equipment	Short-term: 1 to 5 years (includes planning, engineering, and construction)
3g. Enhanced Transit Amenities Includes vehicle replacement/upgrade, which furthers the benefits of increased transit use.	• Decrease daily VMT • Decrease congestion • Increase ridership	• Capital costs • Addition of clean fuel bus fleets may be incorporated as part of regular vehicle replacement programs	Short-term: 1 to 5 years (includes planning, engineering, and construction)

Table A.3 Transit Strategies (continued)

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
CAPACITY STRATEGIES			
3h. Increasing Transit Frequencies or Hours of Service Increased frequency makes transit more attractive to use.	• Increase transit ridership • Decrease travel time • Decrease daily VMT	• Operating costs per trip • New bus purchases likely	Short-term: 1 to 5 year (includes planning, engineering, and construction)
3i. Expanding Bus Route Coverage Provides better transit accessibility to a greater share of the population.	• Increase transit ridership • Decrease daily VMT	• Capital costs per passenger trip • Operating costs per trip • New bus purchases likely	Short-term: 1 to 5 year (includes planning, engineering, and construction)
3j. Expanding Rail Service Rail transit serves dense urban centers where travelers can walk to their destinations; Can be enhanced from suburban areas by providing park-and-ride lots.	• Increase transit ridership • Decrease daily VMT	• Capital costs per passenger • New systems require large up-front 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)
3k. Dedicated Rights-of-Way for Transit Reserved travel lanes or rights-of-way for transit operations, including use of shoulders during peak periods.	• Increase transit ridership • Decrease travel time	• Costs vary by type of design	Medium-term: 5 to 10 years (includes planning, engineering, and construction)
ACCESSIBILITY STRATEGIES			
3l. Implementing Park-and-Ride Lots Encourages HOV use for longer distance commute trips.	• Decrease congestion by increasing vehicle occupancy rate • Increase mobility and transit efficiency	• Structure costs for transit stations	Medium-term: 5 to 10 years (includes planning, engineering, and construction)
3m. Improved Bicycle and Pedestrian Facilities at Transit Stations Includes improvements to facilities that provide access to transit stops as well as provisions for bicycles on transit vehicles and at transit stops (bicycle racks and lockers).	• Increase bicycle mode share • Decrease motorized vehicle congestion on access routes	• Capital and maintenance costs for bicycle racks and lockers	Short-term: 1 to 5 years (includes planning, engineering, and construction)

Table A.4 Bicycle and Pedestrian Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
4a. New Sidewalks and Designated Bicycle Lanes on Local Streets Enhances the visibility of bicycle and pedestrian facilities; increases the perception of safety.	• Increase mobility and access • Increase nonmotorized mode shares • Separate slow-moving bicycles from motorized vehicles • Decrease incidents	• Design and construction costs for paving, striping, signals, and signing • ROW costs if widening needed • Bicycle lanes may require improvements to roadway shoulders to ensure acceptable pavement quality	Short-term: 1 to 5 years (includes planning, engineering, and construction)
4b. Improved Bicycle Facilities at Transit Stations and Other Trip Destinations Increases safety with the addition of bicycle racks and bike lockers at transit stations and other trip destinations; Additional amenities such as locker rooms with showers at workplaces provide further incentives for using bicycles.	• Increase bicycle mode share • Decrease motorized vehicle congestion on access routes	• Capital and maintenance costs for bicycle racks and lockers, locker rooms	Short-term: 1 to 5 years (includes planning, engineering, and construction)
4c. Design Guidelines for Pedestrian-Oriented Development Encourages pedestrian activity through the use of design guidelines (i.e., maximum block lengths, building setback restrictions, and streetscape enhancements).	• Increase pedestrian mode share • Discourage motor vehicle use for short trips • Decrease VMT • Decrease emissions	• Capital costs largely borne by private sector; developer incentives may be needed • Public sector may 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
4d. Improved Safety of Existing Bicycle and Pedestrian Facilities Increases safety by maintaining lighting, signage, striping, traffic control devices, pavement quality; installing curb cuts and extensions, median refuges, and raised crosswalks.	• Increase nonmotorized mode share • Decrease incidents • Increase monitoring and maintenance costs	• Capital costs of sidewalk improvements and additional traffic control devices	Short-term: 1 to 5 years

Table A.4 Bicycle and Pedestrian Strategies (continued)

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
4e. Exclusive Non-Motorized Rights-of-Way Use abandoned rail rights-of-way and existing parkland for medium- to long-distance bike trails, improving safety and reducing travel times.	• Increase mobility • Increase nonmotorized modes • Decrease congestion on nearby roads • Separate slow-moving bicycles from motorized vehicles • Decrease incidents	• Right-of-way costs • Construction and engineering costs • Maintenance costs	Medium-term: 5 to 10 years (includes planning, engineering, and construction)
4f. Bike Sharing Programs Short-term bicycle rental program supported by a network of automated rental stations.	• Increase nonmotorized mode share • Discourage motor vehicle use for short trips • Decrease VMT	• Capital and maintenance costs for bicycles and rental stations	Short-term: 1 to 5 years

Table A.5 Access Management Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
5a. Curb Cut and Driveway Restrictions Limits turning vehicles, which can impede traffic flow and are more likely to be involved in crashes.	• Increase capacity, efficiency on arterials • Improve mobility on facility • Improve travel times and decrease delay for through traffic • Decrease incidents	• 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 implementation)
5b. Turn Lanes and New, Shared, or Relocated Driveways and Exit Ramps In some situations, increasing or modifying access to a property can be more beneficial than reducing access.	• Increase capacity, efficiency • Improve mobility and safety on facility • Improve travel times and decreased delay for all traffic	• Additional right-of way costs • Design, construction, and maintenance costs	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
5c. Minimum Intersection/Interchange Spacing Decreases number of conflict points and merging areas, which in turn decreases incidents and delays.	• Increase capacity, efficiency • Improve mobility on facility • Improve travel times and decrease delay for through traffic • Decrease incidents	• Part of design costs for new facilities and reconstruction projects	Medium-term: 5 to 10 years (includes planning, engineering, and implementation)
5d. Frontage Roads and Collector-Distributor Roads Directs local traffic to major intersections on both super arterials and freeways (parallel frontage roads); Separate exiting, merging, and weaving traffic from through traffic at closely spaced interchanges (collector-distributor).	• Increase capacity, efficiency • Improve mobility on facility • Improve travel times and decreased delay for through traffic • Decrease incidents due to fewer conflict points	• Additional right-of way costs • Design, construction, and maintenance costs	Medium-term: 5 to 10 years (includes planning, engineering, and implementation)
5e. Roadway Restrictions Closes access during rush hours (AM and PM peak hours) and aids in the increase of safety levels through the prevention of accidents at problem intersections; This measure may be effective along mainline segments of a highway, which operate at poor service levels.	• Increase capacity, efficiency on arterials • Improve mobility on facility • Improve travel times and decrease delay for through traffic • Decrease incidents	• Implementation and maintenance costs vary	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
5f. Access Control to Available Development Sites Coordination of access points to available development sites allows for less interference in traffic flow during construction and/or operation of new developments.	• Increase capacity, efficiency on arterials • Improve mobility on facility • Improve travel times and decrease delay for through traffic • Decrease incidents	• Implementation and maintenance costs vary	Short-term: 1 to 5 years (includes planning, engineering, and implementation)

Table A.6 Land Use Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
6a. Mixed-Use Development 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 up and monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	Long-term: 10 or more years
6b. Infill and Densification 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
6c. Transit-Oriented Development Clusters housing units and/or businesses near transit stations in walkable communities.	• Decrease SOV share • Shift 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

Table A.7 Parking Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
7a. 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 extra general purpose travel lanes or special bus or HOV "diamond" lanes.	• Increase peak-period capacity • Decrease travel time and congestion on arterials • Increase HOV and bus mode shares	• Design, construction, and maintenance costs for signage and striping • Rigid enforcement of parking restrictions	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
7b. Employer/Landlord Parking Agreements Employers can negotiate leases so that they pay only for the number of spaces used by employees; Alternatively, employers can provide cash-out options for employees not utilizing subsidized parking spaces.	• Decrease work VMT • Increase nonauto mode shares	• Economic incentives used to encourage employer and landlord buy-in	Short-term: 1 to 5 years
7c. Parking Management and Pricing Strategies include reducing the availability of free parking spaces, particularly in congested areas, or providing preferential or free parking for HOVs; Provides an incentive for workers to carpool.	• Decrease work VMT • Increase vehicle occupancy	• Relatively low costs, primarily for the private sector, include signing, striping, and administrative costs	Short-term: 1 to 5 years
7d. Location-Specific Parking Ordinances Encourages transit oriented and mixed-use development 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.	• Decrease VMT • Increase transit and nonmotorized mode shares	• Economic incentives used to encourage developer buy-in	Long-term: 10 or more years
7e. Park and Ride Lots Park-and-Ride lots provide parking in areas that are convenient to other modes of transportation, and are commonly located adjacent to train stations, bus lines, or HOV lane facilities.	• Increase transit use and ridesharing • Decrease VMT	• Land acquisition, construction and maintenance are necessary for park-and-ride lots.	Medium-term: 5 to 10 years
7f. Advanced Parking Systems Helps drivers find or reserve parking using real-time information about the status of parking availability.	• Decrease congestion on local streets • Some peak-period travel and mode shift	• Costs vary based on system complexity	Short-term: 1 to 5 years

Table A.8 Regulatory Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
8a. Trip Reduction Ordinance Draws commuters to use other ways to travel to work besides driving alone.	• Improve air quality • Decrease traffic congestion • Minimize energy consumption	• Requires employers to promote commute alternatives	Medium-term: 5 to 10 years
8b. Congestion Pricing Controls peak-period use of transportation facilities by charging more for peak-period use than for off-peak.	• Decrease VMT • Increase transit and nonmotorized mode shares	• Implementation and maintenance costs vary	Medium-term: 5 to 10 years
8c. Auto Restriction Zones (Pedestrian Malls) Allows for a more equitable community, where all residents have an equal access to services within the area. Provides commercial access for pedestrians and noncar users. The most common form of an auto-restriction zone (pedestrian zones) in large cities is the pedestrian mall. Pedestrian malls generally consist of a storefront-lined street that is closed off to most automobile traffic. Emergency vehicles would have access at all times, while delivery vehicles may be restricted to limited delivery hours or entrances on adjacent back streets.	• Increase capacity • Decrease travel times • Increase safety • Improve bicycle and pedestrian-friendly roadways	• Design, construction, and maintenance costs	Medium-term: 5 to 10 years
8d. Truck Restrictions Aims to separate trucks from passenger vehicles and pedestrians. Prohibits trucks from traveling on certain roadways, and may call for weight restrictions on certain bridges.	• Increase capacity • Decrease travel times • Increase safety • Improve bicycle and pedestrian-friendly roadways	• Implementation and maintenance costs vary	Medium-term: 5 to 10 years
8e. Arterial Access Management Involves the application of local and state planning, and regulatory tools in efforts to preserve and/or enhance the transportation functions of roadways. Includes land use ordinances and techniques, corridor preservation, transportation improvements, and techniques in finance.	• Increase capacity • Decrease travel times • Increase safety • Improve bicycle and pedestrian-friendly roadways	• Requires government legislation • Implementation and maintenance costs vary	Medium-term: 5 to 10 years

Table A.9 Road Capacity Strategies

Strategies/Projects	Congestion and Mobility Benefits	Costs and Impacts	Implementation Timeframe
9a. Increasing Number of Lanes within Existing Cross Section Takes advantage of excess width in the highway cross section used for break-down lanes or median.	• Increase capacity	• Construction and engineering • Maintenance	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
9b. Geometric Design and Bottleneck Improvements Includes a range of improvements such as widening to provide shoulders, additional turn lanes at intersections, realignment of intersecting streets, auxiliary lanes to improve merging and diverging at entrance/exit ramps, and interchange modifications to decrease weaving sections on a freeway.	• Increase mobility • Decrease congestion by improving bottlenecks • Increase traffic flow • Decrease incidents due to fewer conflict points	• Design, implementation, operations and maintenance (O&M) costs vary by type of design	Short-term: 1 to 5 years (includes planning, engineering, and implementation)
9c. High-Occupancy Vehicle (HOV) Lanes Increases corridor capacity while at the same time providing an incentive for single-occupancy drivers to shift to rideshares. Most effective as part of a comprehensive effort to encourage HOVs, including publicity, outreach, park-and-ride lots, and rideshare matching services.	• Decrease congestion by reducing VMT • Increase vehicle occupancy • Decrease regional trips • Improve travel times • Increase transit use and improve bus travel times	• HOV, separate ROW costs • HOV, barrier separated costs • HOV, contra flow costs • Annual operations and enforcement • Can create environmental and community impacts	Medium-term: 5 to 10 years (includes planning, engineering, and construction)
9d. Super Street Arterials Involves converting existing major arterials with signalized intersections into "super streets" that feature grade-separated intersections.	• Increase capacity • Improve mobility	• Construction and engineering substantial for grade separation • Maintenance varies based on area	Medium-term: 5 to 10 years (includes planning, engineering, and implementation)
9e. Highway Widening by Adding Lanes Adds new highway lanes (including truck climbing lanes on grades); traditional way to deal with congestion.	• Increase capacity • Improve mobility	• Costs vary by type of highway constructed • Can create environmental and community impacts	Medium-term: 10 or more years (includes planning, engineering, and construction)

Table A.10 Major Transportation Systems Management Projects/Operations in the NYMTC Planning Area

Name	Description	Planned Future Expansion	TSM Category	Related NYMTC/Regional ITS Architecture Strategy
Traffic signal priority (TSP) for buses	To create a 100% wireless centrally-controlled TSP system which could be deployed anywhere in NYC. Within several years 100% of traffic signals will have state-of-the-art controllers connected through a wireless network to the central NYC traffic computer. The MTA will initially equip 200 buses to communicate with the central NYC traffic computer.	Initially 200 buses; ultimately the entire bus fleet	Active Traffic and Transit Management	Advanced Traffic Management and Advanced Public Transportation Systems
Bus Security Cameras	Bus security camera systems are currently being installed in MTA buses. The purpose of these cameras is to serve as a deterrent to criminal activity, thereby improving the efficiency and safety of the bus system. In the event of an incident, the video recorded on the cameras can help to explain what transpired and serve as evidence.		Active Transit Management	Advanced Public Transportation
Bus lane enforcement cameras	This automated enforcement project will record the license plate number of vehicles that violate bus lane regulations, and send a summons which is not a moving violation to the owner. The cameras do not capture an image of the people in the vehicle, only the license plate number.	All SBS bus operations	Active Transit Management	Advanced Public Transportation
Rail Control Center (RCC) and Automatic Train Supervision (ATS)	Automatic Train Supervision to monitor service and route subway trains to the right tracks. The RCC also centralizes the management of subway maintenance disciplines and customer information systems in stations. Future infrastructure is intended through the installation of advanced signal systems like Communications-Based Train Control or through adoption of new service monitoring technologies.	In the coming years, NYCT is looking to expand ATS-like capabilities to additional subway lines (lettered lines and the 7)	Active Transit Management	Advanced Public Transportation
Communications-Based Train Control (CBTC)	The computer-based Communications-Based Train Control allows subway trains to safely operate closer together and at higher speeds, resulting in an increase in maximum track capacity by approximately ten percent.	CBTC is now under construction on the 7 and planned for additional lines as they come due for signal modernization	Active Transit Management	Advanced Public Transportation
Bus Time	Bus Time is a real-time bus information system for customers. The system can provide next bus information by bus stop or bus route, using computer, handheld or text message. It has the capability to be expanded to offer fixed displays at bus stops. Today the system informs customers where the next bus is (i.e. two stops away);currently there is no predictive algorithm to inform that a bus is three minutes away.	To be expanded system wide by the end of 2013. Also in development would be an expansion of the Bus Time system to offer customers on board a bus both a variable message sign and audio announcement of the next bus stop.	Automatic Vehicle location (AVL) and Traveler Information	Advanced Public Transportation

Table A.10 Major Transportation Systems Management Projects/Operations in the NYMTC Planning Area (continued)

Name	Description	Planned Future Expansion	TSM Category	Related NYMTC/Regional ITS Architecture Strategy
Automatic Train Supervision (ATS)	This system transmits train location information to the Central Rail Control Center. The ability to see where all trains in the system are located assists train dispatchers with identifying delays and managing incidents that impede train service.	the B-Division (lettered) subway lines and the 7 line.	Incident Management	Advanced Public Transportation and Emergency Management Systems
Public Address/ Customer Information Screens (PACIS)	Building upon its ATS and CBTC systems, these are variable message signs which provide real-time train-arrival information to passengers waiting on station platforms and mezzanines.	PA/CIS will be installed on other segments of the system as they are outfitted with ATS, CBTC, or other technologies enabling real-time information.	Traveler Information	Advanced Traveler Information Systems
Advanced Solid State Traffic Controllers	The new controllers support complex intersections with phase skipping and real-time traffic responsive operation. The new controllers are able to adapt to the variety of communication media and protocols (fiber, coaxial, twist pairs and wireless) in order to support federal NTCIP standards. The ASTC is capable of being computerized, controlled by the TMC and implementing all of the central system timing patterns, scheduled by time of day and as holiday's event. The new ASTC's are also capable of implementing various traffic patterns for different traffic situations.	Expansion to include all NYC 12580 traffic signals. NYSDOT has also a program to replace old traffic controllers.	Active Traffic Management	Advanced Traffic Management Systems
Midtown in Motion	This system optimizes traffic mobility in midtown Manhattan via a set of field sensors and software equipment, which communicate wirelessly (via NYCWiN) with the joint traffic managements center (JTMC) and adjust signal timing appropriately in real time. The system utilizes ASTC controllers and includes 100 microwave sensors, 32 traffic video cameras and E-Z Pass readers at 23 intersections to measure traffic volumes, congestion, and travel times.	If necessary, future expansion of this system could include other areas in NYC.	Active Traffic Management	Advanced Traffic Management Systems
Regional Signal Timing and Coordination	This corridor based traffic signal retiming project improves traffic mobility and safety. It optimizes arterial traffic flow capacity, discourages speeding, and increases pedestrian walk times at crosswalks.	If necessary, it could be expanded to other arterials in the future.	Active Traffic Management	Advanced Traffic Management Systems
Smart Lights (Adaptive Control System)	This pilot project has been implemented at the entrance to the Staten Island College at Victory Blvd. This is a good signal timing option for improving traffic flow on limited size local areas, where traffic patterns are inconsistent and unpredictable. Smart lights are connected with field sensors to monitor changes in traffic flow and via wireless communication receive signal timing changes from the JTMC almost immediately.		Active Traffic Management	Advanced Traffic Management Systems

Table A.10 Major Transportation Systems Management Projects/Operations in the NYMTC Planning Area (continued)

Name	Description	Planned Future Expansion	TSM Category	Related NYMTC/Regional ITS Architecture Strategy
Highway Intelligent Transportation System (ITS)	This system uses traffic cameras and electronic message boards to monitor and improve traffic flows, as well as to inform drivers. The deployment includes fiber and wireless communication to support video traffic cameras, variable message signs (VMS), radio (RFID) readers and travel time signs. All NYC major construction projects require Mobil ITS deployment to support maintenance and protection of traffic management. Current implementation includes the Korean Veteran Parkway, Belt Parkway, FDR Dr., and the East River bridges. Construction projects using ITS deployment included all East River Bridges and the 2nd Avenue Subway and Lower Manhattan projects.	Future expansion could include other NYC areas.	Active traffic Management	Advanced Traffic Management Systems and Maintenance and Construction Operations
Freight Weight-In-Motion (WIM)	The goal of this research project is to quantify the damage and the corresponding cost to NYC's infrastructure caused by heavy vehicles, utilizing WIM sensors placed at strategic locations. The project also obtains data on existing axle weights of heavy vehicles and quantifies the annual damage caused by overweight vehicles using PaveDAT, a FHWA software. The project also examines using WIM and License Place Reader (LPR) technologies along with overview cameras for enforcement.	One permanent WIM site will be installed on the Alexander Hamilton Bridge. Three other temporary WIM sites will be established at selected locations on NYC through-truck routes.	Active traffic Management	Advanced Traffic Management Systems and Commercial Vehicle Operations Systems
INFORM (Information FOR Motorists)	The system is one of the nation's largest and most advanced transportation management systems, and consists of electronic monitoring, communications, signing and control components, providing motorist information for warning and route diversion, ramp control, and signal control. All operations are monitored and controlled by the TMC in Hauppauge. It includes more than 4000 vehicle detectors, 206 overhead and 48 portable variable message signs, 1080 traffic signals (500 under central control), 91 ramp meters, 228 closed circuit television cameras, managed lanes, and other ITS features.	The Region intends on eventually having approximately 360 centerline miles of instrumented roadway. (see Figure 4-1.)	Active Traffic Management	Advanced Traffic Management Systems
511NY	This system is available via phone by dialing 511 or via the web. It provides information via text and maps for current traffic and transit conditions, transit route trip planning, rideshare and other services. http://www.511ny.org.	The system would include additional travel information elements	Traveler Information	Advanced Traveler Information Systems
Highway Emergency Local Patrol (HELP)	Patrol Vehicles/Trucks on major roadways provide motorist assistance as necessary. They also communicate with local TMC to coordinate the response for roadway incidents.	The system would be expanded as necessary to include additional roadways	Incident Management	Emergency Management Systems

Table A.10 Major Transportation Systems Management Projects/Operations in the NYMTC Planning Area (continued)

Name	Description	Planned Future Expansion	TSM Category	Related NYMTC/Regional ITS Architecture Strategy
NYSDOT R-11, Regional ITS Deployment	The ITS deployment covers all interstate highways in NYC, including partial coverage along many of the City's Parkways. It includes an extensive electronic monitoring and communications network that provides motorist information about traffic incidents, road construction, travel time, and other traffic conditions. It includes 76 variables message signs, 260 closed circuit television cameras, more than 600 vehicular detectors, 8 highway advisory radio frequencies, managed lanes, and other components.	The system would be expanded in Eastern Queens, Manhattan and southern Brooklyn. Improvements would also include integration via new technologies (i.e., cross-agency via TMCs and vehicle-infrastructure communications).	Active Traffic Management	Advanced Traffic Management Systems
E-ZPass Customer Service Center	This system includes several Customer Service Centers (CSC) linked with various Toll Collection subsystems. The centers manage toll transactions and interface with a Financial Institution.	The system could be expanded as necessary	Active Traffic Management	Advanced Traffic Management Systems
Long Island Municipal/County Local Traffic Operation Center (TOC)	The center monitors, analyzes and stores traffic data and controls traffic conditions. The center exchanges highway-rail intersection information with rail operations centers. Its operations include regional traffic management, wide area alerts, and work zone management and coordination.	The system could be expanded as necessary	Active Traffic Management, Incident Management	Advanced Traffic Management and Emergency Management Systems Maintenance and Construction Operations
Mid Hudson South Municipal/County Local TMC (Hudson Valley TMC)	The TMC operations include incident dispatch, coordination and communication, and multimodal coordination, including signal coordination along a particular transit route.	The system could be expanded as necessary. Future ITS instrumentation would cover the 1-84 from Route 17 in Middletown to 1-684	Active Traffic Management, Incident Management	Advanced Traffic Management and Emergency Management Systems Maintenance and Construction Operations
MTA Bridges and Tunnels Facility Operation Centers	The center operations include traffic surveillance, commercial vehicle operations, emergency management, regional traffic management, environmental information management, work zone operations, etc.	The system could be expanded as necessary	Active Traffic and Transit Management, and Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems Maintenance and Construction Operations
MTA LIRR Operations Center Systems	The center operations include rail and bus dispatch operations, vehicle tracking and scheduling systems and emergency management.	The system could be expanded as necessary	Active Transit Management and Incident Management	Advanced Public Transportation and Emergency Management Systems Maintenance and Construction Operations
MTA Metro-North Operations Center Systems	The center operations include rail and bus dispatch operations, vehicle tracking and scheduling systems and emergency management.	The system could be expanded as necessary	Active Transit Management and Incident Management	Advanced Public Transportation and Emergency Management Systems Maintenance and Construction

Operations

Table A.10 Major Transportation Systems Management Projects/Operations in the NYMTC Planning Area (continued)

Name	Description	Planned Future Expansion	TSM Category	Related NYMTC/Regional ITS Architecture Strategy
New York City Joint Transportation Management center (JTMC)	The center operations include traffic and transit network control and monitoring, emergency management, emissions management, and maintenance and construction management.	The system could be expanded as necessary	Active Traffic, Transit Management, and Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems Maintenance and Construction Operations
NYC Office of Emergency Management (OEM) Watch Command Center	This is the emergency operations center for the City of New York. The command center is responsible for coordinating responses between the various agencies operating within New York City during major incidents and events.	The system could be expanded as necessary	Incident Management	Emergency Management Systems
PANYNJ Airports Communication desk/operations center	This includes central operations for coordination and communication systems as well as facility- based ITS servers. The functional areas include traffic surveillance, incident management, traffic and transit information services, multi-modal coordination, transit center security, work zone management, etc.	The system could be expanded as necessary	Active traffic and transit management, and Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems Maintenance and Construction Operations
TRANSCOM OpenReach Servers	The TRANSCOM regional architecture is a program. It coordinates the collection and redistribution of traffic flow, origin-destination, incident, construction, equipment status and special event information data between transportation management centers running the TRANSCOM regional architecture.	The system could be expanded as necessary	Active traffic and transit management, Incident Management, and traveler information	Advanced Traffic Management, Public Transportation, Emergency Management and Traveler information Systems Maintenance and Construction Operations

Source: Plan 2040: NYMTC Regional Transportation Plan, Chapter 4.

Table A.11 Major Transportation Demand Management Projects and Operations in the NYMTC Planning Area

Name	Description/Aim	TOM Category	Website
Access-A-Ride	Special mobility services: adapted vehicles provide demand-response transportation for passengers with special needs such as the disabled and the elderly.	Para transit	http://www.mta.info/nyct/paratran/
Guaranteed Ride Home	Non-driving employees are provided with a transportation back-up option in case they need to leave work outside of regular hours in areas served by MetroNorth. This program is funded by NYSDOT-Region 8 and is offered via 511 NY Rideshare for usage for up to four times in a year.	Employer Program Vehicle Sharing	http://www.mta.info/mnr/html/guaranteed/guaranteed.htm
MTA Transit Oriented Development Office	"To promote and coordinate TOD initiatives among its operating agencies, to work closely with local land use jurisdictions and to support initiatives at the regional scale to coordinate land use and transportation planning."	Bike/Pedestrian Enhancement	http://www.mta.info/sustainability/pdf/MTA%20Smart%20Growth-TOD%2010%2029%2008.pdf
Employer Preferred Parking	Several employers in Long Island, Westchester and Putnam counties provide parking benefits for their stuff.	Employer Programs	
Westchester SMART Commute Program	This program informs commuters and employers of various strategies to increase the use of transit alternatives in order to reduce congestion and improve air quality.	Marketing/Employer Programs	http://transportation.westchestergov.com/commuter-services/smart-commute
PARK Smart Pilot	Performance-based parking pricing (pilot project). Parking prices have been increased. The goal is to optimize parking availability, increase turnover rates, and reduce "cruising" in order to reduce traffic volumes. Currently in 2-3 NYC neighborhoods.	Parking Management	http://www.nyc.gov/html/dot/html/motorist/parksmart.shtml
Parking Availability Technology Pilot	Sensors embedded into parking space enables wireless real-time transmission of information on parking availability, rates, and rules. 177 parking spots on Arthur Avenue and East 187th Street in the Bronx.	Parking Management	http://www.nyc.gov/html/dot/html/motorist/prkintro.shtml
Ancillary Park&Ride Lots	In Putnam County, Temple Beth Elohim and Carmel Bowl&Temple Beth Shalom lease parking spaces to supplement parking supply near existing Park&Ride lots.	Parking Management	
511NY Rideshare	Outreach program to demonstrate the benefits of rideshares and promote alternative travel choices. Outreach to promote and educate employers about pre-tax commuter benefit options	Paratransit/Marketing/ Employer Programs	www.511nyridesha re.org
Regional Commuter Choice Program (RCCP)	A program that delivers benefits to travelers who use TDM services in the NYMTC planning area.	Paratransit	
Bicycle Racks	Bike racks exist throughout the NYMTC planning area, including train stations, business centers, and areas with significant share of bicycle use	Bike/ped enhancement	http://www.mta.info/ http://www.nyc.gov/html/dot/html/bicyclists/cityrack-suggest.shtml

Table A.11 Major Transportation Demand Management Projects and Operations in the NYMTC Planning Area (continued)

Name	Description/Aim	TOM Category	Website
Bicycle Locker Program	Provision of secure bicycle lockers. Currently at 20 LIRR stations in Long Island, SUNY Stony Brook, Suffolk State Office Building in Brookhaven, Riverhead Town Hall. Seven locations administered by NYSDOT, seventeen are municipally owned. Bike lockers also exist at selected Metro-North stations.	Bike/ped enhancement	http://www.511ny.org/rideshare/ridesharesub.aspx?contentID=238 http://www.mta.info/bike/
Vanpool and shuttle services	511NY Rideshare TDM team coordinates with targeted employers to facilitate and establish rideshare services for employees. NYSDOT-Region 8 coordinates with Rockland and Westchester counties to facilitate rideshare and other transportation services for employees. Over 20 Metro-North station shuttles are supported by employers in Westchester County. Several employers in Long Island and Westchester provide employer paid vanpools and shuttles to LIRR and Metro- North stations. SUNY Purchase, Hofstra University and Bard and Marist & Vassar colleges offer ridesharing programs.	Paratransit/Marketing/Vehicle Sharing/Employer programs	
Telework	Many employers across the NYMTC planning area offer forma l and informal telework programs. Some of the large programs include IBM in Westchester and Putnam counties and Empire Blue Cross & Blue Shield, CA Technologies, and Aer Lingus in Long Island.	Employer Programs	
Other employer related financial incentives	The New York City Commute Enhancement Grant (NYCCE) is available to organizations in NYC to help fund work site transportation related projects designed to reduce congestion and improve air quality. The Long Island Region Improving Commuting Grant (LIRIC) is a public service to help employers in LI to promote commuting alternatives to driving alone, including carpooling, teleworking, etc.	Employer Programs	
Toll Pricing	The Port Authority of New York and New Jersey offers E-ZPass toll discounts for carpools on its bridges and tunnels. Off- peak toll discounts are also offered for vehicles with two axles and single rear wheels. Tappan Zee Bridge tolls provide discounts for carpool commuters and certain types of hybrid vehicles. The toll is higher for commercial vehicles during the morning peak period and for cash paying customers.	Marketing/Vehicle Sharing	
Complete Streets Legislation	To “accommodate and facilitate safe travel by pedestrians, bicyclists, and motorists of all ages and abilities and allow pedestrian and motor traffic to easily coexist.”	Bike/Pedestrian Enhancement	http://www.nysenate.gov/press-release/senate-passes-complete-streets-legislation
Commuter Tax Benefit	Many employers across the NYMTC planning area provide various financial incentives or tax-free transportation benefits to their employees to encourage the use of more efficient travel modes to and from work.	Employer Program Incentives	

Table A.11 Major Transportation Demand Management Projects and Operations in the NYMTC Planning Area (continued)

Name	Description/Aim	TOM Category	Website
Bike Share Programs	Bicycles are made available for shared use to individuals on a short term basis in to supplement public transit and automobile transport. CitiBike, the New York City Bike Share program, launched in May of 2013 with 6,000 bikes at 330 locations throughout the city. On Long Island, the City of Long Beach and SUNY Stony Brook have already launched bike share programs.	Bike/Pedestrian Enhancement	http://decobikelbny.com/http://www.stonybrook.edu/sustainability/greenmap/details/bike-shareprogram.shtml http://www.citibikenyc.com/
Ferry services to Metro North stations	Region 8 and Metro North finance ferry companies that provide ferry services to Ossining and Beacon Metro North stations.	Paratransit	
Suburban Express Bus	Region 8 Express Bus routes include OWL (Middletown- White Plains), Tappan Zee Express, Poughkeepsie- White Plains Express, IBus (Stamford- White Plains), Route 77 (Putnam- White Plains).		
Railroad Station Shuttles	Danbury Brewster, Fairfield CT-Katonah, Mahopac-Croton Falls, White Plains-Westchester avenue, Newburgh- Beacon.		

Source: Plan 2040: NYMTC Regional Transportation Plan, Chapter 4.

Table A.12 System Enhancement Projects (estimated costs in billions of year of expenditure (YOE) dollars)

Plan #/PIN #	Category/Item	Total Programmed Dollars
	Minor projects	**$ 2.728**
	Major Projects (itemized)	
PIN: G609/01/AA 09	MTA LIRR East Side Access Project	$ 1.020
PIN: X82266	Moynihan Station Phase 1	$ 0.067
PIN: X77047	Goethals Bridge Replacement	$ 1.500
PIN: L603/04/ TX 03	MTA LIRR Ronkonkoma Branch Second Track	$ 0.129
PIN: X76416; PLAN: NYCMB247C	Manhattan Bridge Cables & Suspenders	$ 0.388
PIN: X09629	Bayonne Bridge Clearance Project	$ 1.000
PIN: 005418, 005409, OT2155, 005410, OT2156, 005412, OT2493, 005411, OT2305; PLAN: NSSC646C; NSSC647C: NSSC649C: NSSC650C	NY 347 Safety, Mobility, and Environmental Enhancements	$ 0.855
PHASE 2 PIN: X72977: PLAN: NYCMB569C; NYCMB571C	Kosciuszko Bridge Replacement Project	$ 0.290
PIN: X77283: PLAN: NYCQ1686C	Ed Koch Queensboro Bridge Seismic Retrofit	$ 0.150
PIN: G610-01AA	MTA NYCT Second Avenue Subway Phase 1	$ 0.804
PLAN: NYCM2013V	MTA NYCT Second Avenue Subway Phases 2-4	$12.776
PIN: 8TZ101; PLAN: MHSMC1590C	Tappan Zee Hudson River Crossing Project	$ 3.900
	Transportation Demand Management	$ 0.286
PLAN: NYCMB584C	Bus Rapid Transit Routes in New York City	$ 0.180
	TOTALS	$**26.073**