Identification and Assessment of Strategies

Based on monitoring and performance outcomes, CMP staff recommends the funding of certain studies in the UPWP to analyze existing conditions and needs in detail and recommend improvement strategies for implementation. Subsequently, recommendations are considered for funding during development of the MPO's LRTP, TIP, and Clean Air and Mobility Program. For the Boston metropolitan region, appropriate congestion management strategies fall into seven categories.

CONGESTION MANAGEMENT STRATEGIES

- **Travel Demand Management (TDM)** – Encouraging land use and travel patterns that reduce congestion (such as parking management, flexible work hours, carpooling, vanpooling, ridesharing, car sharing, telecommuting, and flexible work schedules).

- **Promote the Use of Nonmotorized Modes** – Focusing on infrastructure improvements to promote the efficiency of bicycling and walking. This category also includes considering principles of livability and "complete streets."[1]

- **Incident Management** – Responding to causes of nonrecurring congestion, such as roadway crashes, special events, bad weather, and certain categories of construction.

- **Intelligent Transportation Systems (ITS) –** Using technology to make the CMP network function more efficiently. Some examples of ITS strategies are signal timing and transit signal prioritization.

- **Traffic Management and Operations** – Operating the system more efficiently with the existing capacity (such as by optimizing traffic signals, metering traffic on freeways, and making geometric improvements).

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[1] "Complete streets" is a design concept for designing or retrofitting roadways for multimodal use to promote quality of life, mobility, and safety for all users.

- **Public Transportation** – Increasing the efficiency, reliability, and mode share of public transportation. The focus is on the modernization of the public transit system.

- **Road Capacity** –Targeted capacity additions such as turning lanes or extended acceleration lanes can increase traffic throughput at an intersection and reduce congestion.

The following section lists, for each category above, potential specific congestion management strategies that may be in the interest of this region to implement. Each strategy is accompanied by a description of the strategy and a discussion of its advantages, disadvantages, and current status, and the performance measures that should be used for evaluating a strategy's effectiveness after the strategy has been implemented.

List of Specific Strategies

Travel Demand Management

Programs to Encourage Ridesharing, Transit Use, Bicycling, and Walking

Description

Programs for encouraging modes of transportation other than single-occupant-vehicle travel, such as ridesharing, transit, bicycling, and walking. These programs usually involve public outreach efforts focused on encouraging a single mode. Methods include providing information to the public (for example, maps and schedules to encourage transit use, and "rules of the road" brochures to encourage legal bicycle use) and, in the case of ridesharing, matching people who have similar commuting patterns so that they can travel together.

Pros

These programs can be effective in reducing single-occupant-vehicle travel. Increasing the number of people who bicycle and walk also has benefits for public health due to the associated increase in daily exercise.

Cons

Some programs, if not effectively planned or managed, may not achieve their goals and may not have a significant impact on commuting patterns.

Status

There are currently several TDM programs in the Boston Region MPO area.

- MassRIDES (www.commute.com) operates a statewide travel-options program that encourages people to carpool, vanpool, telecommute, use public transit, bike, and walk, and assists them in changing their travel patterns. MassRIDES also provides consultation to companies that analyze worksite conditions and map workers' home locations and travel patterns to see where there are opportunities for expanding on-site travel demand programs.

- MassBike (www.massbike.org) and other advocacy groups promote bicycling as a means of transportation in the region.

- WalkBoston (www.walkboston.org) is a nonprofit organization dedicated to improving the walking environment in the Boston region.

- The MBTA (www.mbta.com) has many resources for facilitating transit use, such as smartphone apps (software applications) that provide traveler information.

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- Transportation Management Areas (TMAs), with the main objective of influencing transportation policies, creating programs and encouraging the use of alternative modes of transportation.[2] Examples of TMAs that operate within the MPO area include the ABC TMA in downtown Boston, the Charles River TMA in Cambridge, the Seaport TMA in the South Boston Waterfront, TransCom at BU Medical Center, and Commute Works at MASCO.

- Safe Routes to School is a program that improves the health and mobility of children and their parents by promoting alternative travel modes. There are several Safe Routes to School projects in the federal fiscal years (FFYs) 2012–15 TIP.

Evaluation Metrics

Mode shares (percent of commuters walking, bicycling, using transit, or ridesharing)

Programs that Encourage Flextime, Telecommuting, Staggered Work Hours, and Remote Work Centers

Description

Alterations of employees' work hours and/or locations so that an employee does not have to commute during peak periods. These strategies would move some peak-period work trips into the off-peak period. Telecommuting eliminates some work trips altogether. Remote work centers can shorten a worker's commute by having the worker commute to the work center closer to home rather than to an office that is farther from home.

Pros

These programs would eliminate demand on the roadways and therefore have an impact on peak-period congestion.

Cons

There no cons with these strategies. In this MPO region, they are important for employers to implement with the assistance of MassRIDES.

Status

The Transportation Management Associations work together to implement and promote these strategies.

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[2] MassRides, Employers-TMA, available online at
  http://www.commute.com/employers/tma (accessed October 26, 2011).

Evaluation Metrics

The metrics used are the percent of commuters who enroll in programs that implement flextime, telecommuting, and staggered work hours and that have access to remote workstations.

Improving Infrastructure for Nonmotorized Modes

Pedestrian and Bicycle Infrastructure Improvements – "Complete Streets"

Description

Improvements to pedestrian and bicycle infrastructure can help to encourage a higher proportion of people to walk or bike for their transportation needs, thus reducing automobile congestion.

Improvements to pedestrian infrastructure may include:

- Installing new sidewalks where none previously existed

- Repairing or widening existing sidewalks

- Removing obstacles, such as improperly placed street furniture or utility infrastructure, from sidewalks

- Installing pedestrian signals or improvements to existing signals (for example, optimizing signal timing to reduce jaywalking rates, or replacing antiquated signals with modern pedestrian countdown signals)

- Installing new, improved, or repainted crosswalks and associated signs

- Constructing sidewalk buffer areas (to provide some distance between pedestrians and cars)

- Reducing speed limits and increasing the use of traffic calming measures

Improvements to bicycle infrastructure may include

- Adding bicycle lanes

- Creating shared-use paths (also beneficial to pedestrians)

- Installing bicycle parking amenities

"Complete Streets" Programs:

- Requiring new roadway projects to accommodate users of all travel modes

- Implementing "road diets" – reducing the number of travel lanes and/or the effective width of lanes

Pros

Improvements in the quality of life.

Cons

There are no cons for "complete streets," although many may feel differently due to fiscal reasons. "Complete streets" concepts deal with roadway design improvements for all users in roadway design and should be implemented where feasible.

Status

The Boston region has a complex and varied network of pedestrian and bicycle facilities. An assessment of current facilities and needs for improvement is available in the MPO's Long-Range Transportation Plan, *Paths to a Sustainable Region.*[3] A "complete streets" approach (www.completestreets.org), already being implemented in parts of the Boston region, is designed to provide safe access to all users, including pedestrians, bicyclists, motorists, and transit riders.[4]

Evaluation Metrics

Mode shares (percent of commuters walking or bicycling to work), number and rate of crashes that involve pedestrians or bicyclists.

Incident Management

Traffic Incident

Description

Surveillance, response, and clearance of traffic incidents, including developing and managing plans for the diversion of traffic from roads affected by the incident.

Pros

Having a well-defined and well-managed multidisciplinary incident management program to respond to incidents can alleviate congestion and prevent secondary crashes or incidents.

Cons

Funding must be secured.

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[3] The Boston Region MPO's Long-Range Transportation Plan, *Paths to a Sustainable Region,* September 22, 2012.

[4] For information on "complete streets," see www.completestreets.org.

Status

Massachusetts State Police, MassDOT, all MPO transportation agencies, and municipal police and fire departments participate in existing programs.

Evaluation Metrics

Detection time, response time, clearance time, hours of congestion, and person-hours of delay related to incidents.

Improved Response to Weather and Road Surface Problems

Description

Improved, faster response to road problems caused by weather (for example, snowfall) and to road surface problems such as potholes.

Pros

Makes roads safer (for example, by reducing crashes) and reduces congestion related to road problems.

Cons

Funding must be secured.

Status

MassDOT, police and fire departments, and utility services have response programs.

Evaluation Metrics

Pavement conditions, case-by-case reporting.

Intelligent Transportation Systems

Real-Time Traffic Monitoring and Management Systems (including incident management and work zone management)

Description

Intelligent transportation systems that monitor traffic remotely and respond to traffic patterns, events, and incidents by adjusting factors such as utilizing signal-timing and variable-message signs.

Pros

A technological solution with high potential for reducing congestion by adjusting traffic flows.

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Cons

Regionwide traffic monitoring requires cooperation among multiple jurisdictions, which can be a challenge.

Status

Several traffic monitoring and management systems are in place in the Boston region, and interagency communication is in need of improvement.

Evaluation Metrics

Travel speed, speed index, delay, traffic volume, volume-to-capacity ratio, level of service, hours of congestion, and number of incident-related crashes.

Integration of the Payment System for Tolls, Park-and-Ride Lots, and Transit

Description

This strategy involves integrating the payment methods for transit fares, parking fees at park-and-ride lots, and roadway tolls into a single system, so that users of the transportation system could pay all of these fees with a single electronic card or other device, similar to the CharlieCard system currently in operation for MBTA rapid transit and bus service.

Pros

Facilitates travel, especially intermodal travel (for example, car-to-train commuting) by making payment faster and easier.

Cons

Would require the implementation of a regionwide payment system; much cooperation among agencies would be required, and the cost would be substantial.

Status

Not yet implemented.

Evaluation Metrics

The metric used is the mode share (for transit), park-and-ride lot utilization, toll revenues.

Provide and Market Regionwide Real-Time Information on Travel Conditions, Alternate Routes, and Alternate Modes

Description

Through various avenues, real-time travel information would be provided to travelers using all modes; outreach would be conducted to ensure that the information reaches as many people as possible. Avenues may include variable message signs, audible announcements, mobile phone apps, and Internet applications.

Pros

Has the potential to make travel more efficient for many people by assisting with travel planning, including planning alternative routes; likely to reduce congestion.

Cons

If the effort to provide real-time information is concentrated in high-tech avenues such as smartphone apps, lower-income and less technologically inclined populations may not benefit.

Status

Real-time information is already available—for example, MassDOT's 511 system and variable message signs are operated on major roadways.

Evaluation Metrics

Hours of congestion, travel speed, and person-hours of delay before and after the implementation of a regionwide comprehensive traveler information system.

Optimization of Traffic Signal Timing

Description

Modify traffic signal timing so that traffic flows as smoothly as possible. Typically applied on a corridor basis (along an arterial).

Pros

Reduces delay at traffic signals. May reduce the number of crashes.

Cons

May increase delay at cross streets due to longer green lights on the main corridor. May increase delay for pedestrians trying to cross the main corridor.

Status

There are proposals to study signal timing at several locations throughout the region on a corridor basis.

Evaluation Metrics

Level of service, intersection delay, crash rate.

Traffic Management and Operations

Reversible Commuter Lanes and Movable Median Barriers for Arterials or Highways

Description

A strategy for increasing capacity on a roadway in one direction by borrowing underutilized capacity from travel lanes that normally go in the opposite direction. Typically, a lane that is normally outbound is rededicated to inbound traffic during the AM peak period; a lane that is normally inbound is rededicated to outbound traffic in the PM peak period. This may be accomplished by traffic signals (a large red X indicates that a lane is closed to approaching traffic, while a green arrow indicates the lane is open) or by movable median barriers.

Pros

May reduce congestion and improve travel times. Requires less space than adding two permanent lanes.

Cons

Reversible commuter lanes without median barriers may present a safety hazard in some cases (for example, if motorists do not notice the traffic signals).

Status

A reversible HOV lane, separated by a movable median barrier, is in operation on I-93 south of downtown Boston.

Evaluation Metrics

Travel speed, speed index, delay, traffic volume, volume-to-capacity ratio, hours of congestion.

Access Management

Description

A set of techniques to control access to roadways. May include access spacing (increasing the distance between access points, including driveways on non-limited-access roads), separated turning lanes, and median treatments.

Pros

Reduces congestion and travel times. Improves safety. These strategies often relieve a bottleneck without the need of roadway expansion.

Cons

Relatively expensive. On commercial arterials, removal of access driveways may be met with opposition by business owners.

Status

Currently being implemented by MassDOT and communities as part of project implementation.

Evaluation Metrics

Travel speed, speed index, delay, traffic volume, volume-to-capacity ratio, hours of congestion, level of service.

HOV Lanes

Description

Lanes restricted to vehicles occupied by two or more persons and motorcyclists.

Pros

May improve road capacity by reducing the total number of vehicles on the road. Benefits ridesharing commuters by allowing them to bypass congested single-occupant-vehicle traffic.

Cons

Generally expensive. Requires concerted enforcement efforts to discourage violations. Will require either extra space for new lanes or the conversion of existing lanes to HOV lanes.

Status

Currently, the only HOV lanes in the region are on I-93 and I-90. However, there is a possibility of adding new HOV lanes in the future.

Evaluation Metrics

Travel speed, speed index, delay, traffic volume, volume-to-capacity ratio, hours of congestion, vehicle occupancy (number of persons per vehicle).

Geometric Improvements to Roads and Intersections

Description

Modifications to roads and intersections, such as restriping of paint lines, modification of signage, improvement of sight lines, and traffic-calming measures.

Pros

Reduces crashes, can reduce congestion, and can make roads and intersections friendlier to all users.

Cons

Impacts on congestion can vary.

Status

Many current TIP projects involve geometric improvements to roads and intersections.

Evaluation Metrics

Level of service, intersection delay, crash rate.

Public Transportation

Adjust Transit Schedule by Time of Day

Description

This strategy can shift capacity to a different time of day, which would reduce the frequency of service during off-peak times and provide more frequent service during the peak when passenger loads are higher.

Pros

Minimal cost, and can fix passenger load problems for many transit lines.

Cons

Not generally effective on transit lines where the passenger loads are excessive throughout the day. This could cause the quality of service to drop during off-peak hours.

Status

The MBTA is constantly adjusting the schedules of all of its transit lines.

Evaluation Metrics

Passenger load factor.

Increase Transit Frequency and Span

Description

Increase the frequency with which transit vehicles run and the span (the number of hours throughout each day) that transit service operates.

Pros

Reduces wait time for transit, making it a more attractive option for people who would otherwise drive; therefore reduces traffic congestion. Also alleviates crowding on transit vehicles.

Cons

Requires additional funding, if new equipment is required.

Status

Current focus is on maintenance and modernization.

Evaluation Metrics

Change in transit route frequency; change in transit route span; change in transit ridership, passenger load factor.

Transit Signal Prioritization

Description

A system in which transit vehicles on a shared roadway (buses and sometimes light rail trolleys, such as the Green Line) have the ability to send electronic requests to a traffic management system that can extend the green phase of a signal cycle, or make a traffic signal turn green sooner than it otherwise would, as the transit vehicle approaches.

Pros

Has the potential to improve transit vehicle efficiency and travel speeds.

Cons

May cause traffic congestion on cross streets along a transit corridor— something to watch for and avoid implementing strategy in those cases.

Status

Transit signal prioritization is used for Silver Line buses on the SL1 and SL2 routes and is also considered for other roads where MBTA buses operate.

Evaluation Metrics

On-time performance of transit vehicles, the number of crashes involving transit vehicles.

Bus Rapid Transit

Description

Provides service similar to bus service, but with a variety of modifications to traditional bus transit that improve speed and efficiency, approaching the service quality of rail transit. Methods include signal prioritization, expedited fare collection, stop consolidation, and separate busways that eliminate competition from other traffic modes.

Pros

Increases the efficiency of bus transit. Marketing efforts may make BRT attractive to populations who would otherwise only want to use rail transit, not bus transit.

Cons

May sometimes require additional right-of-way for infrastructure. There may be challenges in establishing coordination between municipalities for the implementation of features such as signal prioritization.

Status

The MBTA's Silver Line routes (SL1, SL2, SL4, and SL5) are considered a form of BRT.

Evaluation Metrics

On-time performance of transit vehicles, seating capacity.

Provide Transit Users with Real-Time Transit Arrival Information

Description

Facilitates travel by making transit use easier and more efficient for users. Examples: Many rapid transit systems provide transit arrival times on variable message screens at platforms or via applications for mobile devices. A pilot program in San Francisco has extended this technology to predict bus arrivals at certain bus stops (variable message signs are powered by solar power).

Pros

Encourages more people to use transit; makes it more convenient; may reduce roadway congestion.

Cons

Accuracy is important; therefore, systems that predict transit arrival inaccurately may reduce the credibility of the transit provider and lead the public to consider the system a waste of resources.

Status

On the bus system, Silver Line 4 and 5 buses have real-time variable-message signs. There are also variable-message signs for buses at Ruggles, Back Bay, and Bellingham Square in Chelsea, and there are plans to install them at the Dudley and Forest Hills stations. For heavy rail, variable-message signs were recently installed at South Station, and there are plans to install variable-message signs on the rest of the heavy rail system by the end of 2012. The MBTA has partnered with Next Bus to provide AVL data available for smartphones.

Evaluation Metrics

Transit mode share.

Provisions for Bicycles at Transit Stops and on Transit Vehicles

Description

Bicycles take up a relatively small amount of space, but provide the opportunity to travel much faster than on foot. Therefore, the linking of bicycle use to transit use has a great deal of potential to improve travel efficiency for many users of the system. The two main strategies involved are providing bicycle parking at transit stations (typically facilitating bike-transit-walk trips) and allowing bicycles on transit vehicles (typically facilitating bike-transit-bike trips).

Pros

Encourages transit use and bicycle use for those inclined to use transit and bikes; may provide a convenient option for a large number of commuters.

Cons

Loading bicycles onto the front bike racks on buses may cause delays at bus stops and negatively affect on-time performance. Bikes on trains may cause an obstruction and a safety hazard, if the transit operator has not made specific accommodations for them.

Status

There are several provisions for linking bicycle and transit use in the MBTA system:

- "Pedal & Park" facilities, which are enclosed, access-controlled, and video-monitored bicycle parking, had been installed, as of May 2012, at two rapid transit stations (Alewife and Forest Hills). The Pedal & Park facilities are in various stages of procurement and construction and will be completed incrementally between the fall of 2011 and the summer of 2012. The MBTA has installed 16 of the planned 50 BikePorts (covered bike shelters) at subway and commuter rail stations, and had planned to complete the remainder by the spring of 2012.

- Non-enclosed bike racks are available at most train stations. Some stations have covered parking.

- Bike racks are mounted on more than 70% of MBTA buses, covering 72 bus routes.[5]

- Outside of peak commuting hours, bikes can be taken on heavy rail trains (the Blue, Red, and Orange lines) and on commuter trains.

- Folding bikes are allowed on all trains at all times.

- Currently, non-folding bikes cannot be carried on light rail vehicles in the MBTA system (the Green Line and Mattapan High-Speed Line). Some transit systems (for example, the TRIMET system in Portland, Oregon) provide hooks for hanging bikes on the inside of designated light rail vehicles.[6]

Evaluation Metrics

On-time performance of transit vehicles, transit mode share, bicycle mode share, number of linked bicycle-transit trips.

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[5] MBTA, "Bikes and the T," available on the MBTA's website, www.mbta.com (accessed June 6, 2012)

[6] TRIMET, "How to Load Your Bike on MAX," http://trimet.org/howtoride/bikes/bikesonmax.htm (accessed July 28, 2011).

Improvements to Bicycle and Pedestrian Routes that Lead to Transit Stops

Description

Focus investments on bicycle and pedestrian infrastructure on routes that lead to transit stops, in order to encourage more bike-transit and walk-transit linked trips.

Pros

Increases multimodal travel.

Cons

Such investments are fairly expensive if constructing new bike paths would be required.

Status

Many TIP projects include bicycle and pedestrian improvements around transit stations.

Evaluation Metrics

Number of linked trips combining transit with biking or walking,[7] overall increase in transit ridership.

Infrastructure Modernization

Description

Updating signal equipment and other transportation infrastructure to increase the efficiency of the transit network.

Pros

May have a significant impact on on-time performance.

Cons

Can be expensive, with some projects costing over $100 million. May sometimes be a temporary solution rather than a permanent one, depending on the situation. For example, repairing railway ties, ballasts, and rail line can be a short-term solution versus replacing the railway entirely.

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[7] Number of linked trips is measured by composite impedance from the transportation model. Common factors are considered for each trip, including travel time, travel distance, and cost per trip. This analysis is done by Traffic Analysis Zone.

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Status

There are several projects in the region that are implementing this strategy, including many references in the Boston Region MPO's Fiscal Year 2013–16 TIP. This includes plans to modernize the commuter rail and subway right-of-way, the modernization of railyards where railway cars are repaired, the renovation of Blue Line stations to make six-car train service possible, and improvements to the Government Center, Copley and Arlington Green Line stations.[8]

Evaluation Metrics

On-time performance.

Solicitation of Private Operators to Provide Shuttle Bus Service to Transit Stations

Description

Implement this service in areas that are determined to have a market for shuttle bus ridership. Employers or transportation management associations can be solicited to introduce a for-profit or nonprofit bus service to shuttle commuters to a transit stop. This strategy is recommended for operation by a private company because the MBTA is currently focusing on efficiency and maintenance, not service expansion.

Pros

Will provide transit service to commuters that otherwise might not receive it. Minimal cost to local governments, as this service would be run and paid for by private entities.

Cons

Privatized services' prices and quality can depend on the private entities' interests. This strategy would also be dependent on companies' assuming responsibility for implementing and running the new service.

Status

There are several employers and transportation management associations that already offer this type of service in the Boston metropolitan area.

Evaluation Metrics

Shuttle ridership.

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[8] Boston Region Metropolitan Planning Organization, Transportation Improvement Program and Air Quality Conformity Determination: Federal Fiscal Years 2013–2016, Transit Element (accessed October 26, 2012).

Expansion of Roadway Capacity

Description

Adding lanes, or building new roads, to increase capacity.

Pros

May reduce congestion.

Cons

May have impacts on land takings or the environment.

Status

Several expansion projects are currently underway in the Boston region.

Evaluation Metrics

Travel speed, speed index, delay, traffic volume, volume-to-capacity ratio, hours of congestion.

Range of Strategies for Addressing Example Problems

Table 6-1 was developed in order to provide some examples of types of congestion, mobility, and safety problems and indicate how they could be addressed by applying one or more of the identified strategies above.

TABLE 6-1
Congestion, Mobility, and Safety Problems and Potential Strategies

Problem	Strategy
Congested limited-access or partially limited-access roadways	Reversible commuter lanes and movable median barriers
	New HOV lanes
	Expansion, when no other solution is possible
	Real-time traffic monitoring and management systems (including incident management and work zone management)
	Provide and market real-time information on travel conditions, alternate routes, and alternate modes
Congested interchanges	Real-time traffic monitoring and management systems
	Geometric improvements
	Provide and market real-time information on travel conditions, alternate routes, and alternate modes
	Optimization of traffic signal timing
	Courtesy patrol programs
Congested arterials	Access management
	Optimization of traffic signal timing
	Provide and market real-time information on travel conditions, alternate routes, and alternate modes
	Geometric improvements to roads and intersections
Congested intersections	Optimization of traffic signal timing
	Geometric improvements to roads and intersections
	Provide and market real-time information on travel conditions, alternate routes, and alternate modes

(cont.)

TABLE 6-1 (Cont.)
Congestion, Mobility, and Safety Problems and Potential Strategies

Problem	Strategy
Decreasing travel time savings in HOV lanes	HOV lane expansion
	Change the occupancy requirements of the HOV lanes
Low vehicle occupancies	Programs to encourage ridesharing, transit use, bicycling, and walking
Congestion at toll booth approaches	Integration of the payment system for tolls, park-and-ride lots, and transit
	Provide and market real-time information on travel conditions, alternate routes, and alternate modes
Congestion approaching a transit station	Integration of the payment system for tolls, park-and-ride lots, and transit
	Provisions for bicycles at transit stops and on transit vehicles
	Improvements to bicycle and pedestrian routes that lead to transit stops
Transit routes with high levels of passenger crowding	Increase transit frequency and span, and improve on-time performance
Transit routes with poor on-time performance	Transit signal prioritization, modernization of infrastructure
	Integration of the payment system for tolls, park-and-ride lots, and transit
	Improve accessibility to the transportation system for individuals with disabilities
	Bus rapid transit
Park-and-ride lots that fill before the last peak-period transit vehicle leaves	Provisions for bicycles at transit stops and on transit vehicles
	Improvements to bicycle and pedestrian routes that lead to transit stops

(cont.)

TABLE 6-1 (Cont.)
Congestion, Mobility, and Safety Problems and Potential Strategies

Problem	Strategy
Park-and-ride lots that fill before the last peak-period transit vehicle leaves *(cont.)*	Implementation of suburban shuttle buses
	Expansion of parking areas
High crash rates	Geometric improvements to roads and intersections
	Optimization of traffic signal timing
	Real-time traffic monitoring and management systems
	Weather-related diversion plans