Strategies to Address Congestion

This section presents a list of congestion management strategies designed to mitigate congestion depending on the cause of the problems and other factors. Each strategy includes a brief description; situations where it should be applied and is likely to be a benefit; general costs and time frame requirements; the benefits that could be realized; and any important considerations that should be accounted for when planning strategies. The strategies are broken down into three groups: those strategies that impact roadway operations and management, strategies that are considered travel demand management (TDM) and alternative travel mode, and strategies that improve roadway capacity.

Strategies that impact **roadway operations and management** cover intelligent transportation systems (ITS) and other operational controls such as traffic signals. These improvements typically do not consist of physical construction involving the roadway itself. Improvements such as traffic signal optimization, vehicle detection, dynamic message systems, and traffic management centers are some examples of projects that address roadway operations and management.

Travel demand management (TDM) and alternative travel mode strategies attempt to get drivers to alter travel behaviors or the mode in which they travel. These strategies can range from offering incentives to carpool or travel during off-peak times to providing new commuter bus service along a corridor. The goal of these strategies is to reduce the number of single occupant vehicles on the roadway as well as the number of vehicles traveling during peak travel periods.

Strategies that improve **roadway capacity** involve construction of new facilities or additions to existing roadway facilities. These strategies create more usable capacity for vehicles, improving travel times by allowing more vehicles to move through a specific point or segment. Often roadway capacity projects have constraints to the available capacity that can be added due to right-of-way limitations or budgets. Construction projects are typically the most costly improvements and take the longest to implement.

The following strategies are arranged based on each of these three strategy groups.

Roadway Operations and Management

Access Management

What:

- The location, spacing, design of entrances, street intersections, median openings, traffic signal impacts, congestion and traffic incidents through the management of conflict points
- Solutions can include medians, turn lanes, access roads, shared entrances to developments, and land use policies

When to use:

- High-volume corridors that have a large number of commercial developments, multiple curb cuts and driveways

Cost: Low to High

- Costs are variable with access management strategies. They can be dependent on the extent of the problem/solution as well as whether the construction will occur as part of new development or as a retrofit

Time: Short- to Medium-term

- Some strategies can be implemented faster when working with cooperative property owners
- Longer term solutions occur when major design changes are required due to planning, design, and implementation associated with potential right-of-way acquisition and construction

Benefits:

- Reduction in vehicle collisions
- Improved vehicle throughput
- Decreased travel times
- Increase roadway capacity without the addition of through lanes

Considerations:

- When consolidating development access points, consideration should be given to the design and capacity of parking lots
- Opposition from the public or commercial developments may occur when reducing access points

Traveler Information

What:

- Dynamic Message Signs (DMS) are electronic signs that publicize travel information about congestion, accidents, roadworks, or other incidents
- Other services such as Internet, telephone hotlines (511), and other media provide travel information that can be personalized based on location and roadway

When to use:

- Heavily traveled interstates and arterials that experience frequent or recurrent delays from congestion or other incidents
- Locations prior to major interchanges/intersections that allow drivers to make alternative route decisions based on travel information

Cost: Moderate

- Costs are dependent on the existing communications systems and technologies being used

Time: Short- to Medium-term

- Information can be distributed if the infrastructure is available or when it becomes available
- Time frame can be longer if capital investment, infrastructure, and communication networks need to be expanded or built

Benefits:

- Improvements in travel time and reductions in congestion associated with travelers having the ability to choose alternative routes based on information
- Allows drivers to become more informed during and prior to traveling and making informed decisions about travel times or routes

Considerations:

- The growth of in-vehicle and fee-for-service traveler information services should be tapped to expand traveler information services

Ramp Metering

What:

- Use of traffic signals to control the rate that vehicles enter a highway, reducing delays associated with oversaturation of the mainline

When to use:

- Highway corridors that have existing congestion associated with high volumes
- Locations where entrance ramps have high volumes of traffic that enter the highway at once

Cost: Low to Moderate

- Traffic signals and control costs are relatively low
- Costs associated with ramp expansion will be greater

Time: Medium-term

- Planning and engineering associated with implementation are most time intensive aspects

Benefits:

- Can increase mainline throughput 8% - 22%
- Reduction in crashes in merge zones 15% - 50%

Considerations:

- Ramps where metering is used may allow a bypass for buses or other high-occupancy vehicles
- Locations with high volumes and heavy queuing may require additional of lanes to avoid spillback
- Public opposition

Variable Speed Limits

What:

- Adjusting speed limits along a highway corridor and alerting drivers to regulate their speed based on travel conditions
- Decreasing speed prior to the location of a queue will extend the current LOS and allow the queue to improve
- Speed limits are typically conveyed using digital message signs

When to use:

- Highway corridors that have recurrent periods of congestion or areas with frequent traffic incidents that cause traffic queues

Cost: Low to Moderate

- Costs are dependent on the existing communications systems and technologies being used
- Costs are additive. As corridor of application gets longer, more message signs are required (1 every ½ mile)
- Approximate cost $400,000 per mile

Time: Short- to Medium-term

- Information can be distributed if the infrastructure is available once it is available
- Time frame can be longer if capital investment, infrastructure, and communication networks need to be expanded or built

Benefits:

- Decreased travel times by 8%
- Extension of more favorable LOS periods
- Slower travel speeds allow drivers to react to abrupt traffic changes
- Ability to respond to traffic incidents more quickly

Considerations:

- Requires diligent enforcement to ensure speed limits are being followed and benefits are being realized

Signal Optimization

What:

- Timing and coordination improvements that improve traffic flows by decreasing vehicle stops
- Optimization can be passive, through changes in timing based on collected data, or active where the system adapts to changing patterns in traffic through data collected by sensors and cameras

When to use:

- Heavily traveled corridors
- Areas with a high number of signalized intersections
- Corridors where signal timing is outdated based on changes in traffic patterns

Cost: Low to Moderate

- Estimated cost is $2,400 per intersection
- Route 610 – Garrisonville Road signal optimization cost $63,376 for 22 signalized intersections (≈ $2,880 per intersection)

Time: Short-term

- Immediate timing changes can be made on an intersection by intersection basis
- Signal optimization requires data collection, existing conditions analysis, timing plan, implementation, and results analysis. Typically takes between six and twelve months.

Benefits:

- Reduction in travel delays (Route 610 showed 12% ↓ in eastbound travel time)
- Improvements in fuel consumption (Route 610 showed a 5% ↓ during the weekday)
- Reductions in emissions (Route 610 showed a emissions reduction of 21, 201.8 kg of pollutants annually)
- Increased road capacity
- Cost savings (Route 610 signal optimization resulted in $3,257,339 in savings for a year)

Considerations:

- Preemption and signal priority treatments may impact signal optimization efforts
- Cooperation along corridors that travel through multiple jurisdictions is necessary to realize improvements throughout

Traffic Management Center

What:

- Hub that collects information about traffic operations, incidents, and other variables from a multitude of sources before synthesizing the information and crafting a response

When to use:

- Areas with a high number of incidents that results in responses from a multitude of agencies and requires inputs and management decisions from different agencies

Cost: Moderate

- Capital costs for developing the center and purchasing the necessary equipment can be approximately $1 million
- Operational costs will include maintenance and upgrades of equipment as well as personnel costs

Time: Medium- to Long-term

- Organization of resources, agencies, and operational agreements will need to be addressed and an agreement reached between all participating agencies

Benefits:

- Increased safety through fast detection and response to incidents
- Improved use and allocation of already limited resources
- Improved coordination across jurisdictional boundaries

Considerations:

- All parties involved need to be willing to cooperate in order for the center to work effectively

Traffic Signal Preemption

What:

- Ability of emergency vehicles to request absolute signal right-of-way by advancing or extending the green. All signals are changed to red and will not advance until the emergency vehicle has passed through the intersection

When to use:

- Mainline roads with a high number of signals and heavy traffic volumes
- Areas where emergency vehicles are delayed during responses

Cost: Low to Moderate

- Most new signals are installed and equipped with the equipment to accommodate signal preemption
- Costs increase if signals require retrofitting
- Small costs are associated with the optical or radio emitter the emergency vehicle requires for activation of the signal preemption

Time: Short- to Medium-term

- Equipment installation will require the most time if retrofitting is required

Benefits:

- Decreases response time of emergency vehicles to incidents
- Improves safety by removing the confusion of which direction an emergency vehicle is traveling from and clearly showing who has to yield the right-of-way at a signalized intersection

Considerations:

- Coordination between signal operations and emergency services may be required to ensure that as signals are upgraded, vehicles have emitters installed if not existing

Travel Demand Management / Alternative Travel Modes

Marketing and Education

What:

- Increase awareness and knowledge about alternative transportation options
- Explains the benefits of using alternative transportation programs

When to use:

- Areas with a large number of alternative transportation options (transit, vanpool, and carpool)

Cost: Low

- Costs for marketing and education programs can often be smaller than construction of transportation projects

Time: Short-term

- Marketing and education programs can be planned, organized, and distributed in a short amount of time (less than 1 year)

Benefits:

- Increase program participation as a result of understanding the benefits (monetary, environmental, congestion) of different alternative programs
- Marketing plans can be opportunities for partnerships within the local and regional community. This can allow for cost sharing as well as access to targeted markets.

Considerations:

- Timing of education campaigns should be coordinated with the start of new transit or travel demand programs

Telecommuting, Flexible Schedules, and Incentives

What:

- Employer program or policies that allow employees to work from home or telework centers
- Policies that allow for a condensed work week, allowing employees to work longer hours and take a day or two off from the traditional work week
- Employer programs that provide encouragement to take public transit, carpool/vanpool, or other alternative forms of transportation

When to use:

- Workplaces that perform tasks that can be completed offsite as well as the equipment and logistics to accommodate working outside the office
- Companies that have limited parking availability or costly parking expenses

Cost: Low to Moderate

- Startup costs are minimal for telecommuting and flex scheduling
- The size and funding available for incentive programs will determine the cost of these programs. Many programs can provide tax breaks to companies or employees

Time: Short-term

- Through TeleworkVA, a program administered by the Virginia Department of Rail and Public Transportation (DRPT), employers can get assistance in setting up telework programs, training staff, as well as financial incentives to help setup a program.

Benefits:

- Reduces the number of drivers on the road during morning and evening commutes
- Reduces vehicle miles traveled because employees work from home or commute to work fewer days of the week or through alternative transportation modes
- Reductions in overhead costs, office space requirements, parking requirements. Increases in employee productivity and recruitment/retention

Considerations:

- Requires sufficient information technology hardware/software for employees to work from home
- Requires frequency communication as well as accountability monitoring to ensure success

Expansion of Public Transportation

What:

- Creation of new routes or services
- Expansion of existing routes and services
- Improvements to overall transit operations (longer service hours, shorter headways, added amenities)

When to use:

- Areas that are expanding (residential or commercial/office) to levels that are suitable to support transit
- Existing transit routes that are operating at or near capacity

Cost: Low to Moderate

- Improving system efficiencies through route and service restructuring can provide a low cost means to improve service in key locations
- The creation of new routes or expansion of existing service can be more costly due to the need to add vehicles and staff

Time: Short-term

- Most transit improvements can be made short-term. The creation of new bus routes may require a couple of years to account for planning and implementation. Rail transit expansion or creation would be very time intensive unless the existing infrastructure and funding were already in place

Benefits:

- Reduce the number of drivers on the road because of a switch in travel mode
- Existing riders will benefit from additional/expanded service as well as improved system reliability

Considerations:

- Expansion of transit services may require expanded facility requirements in addition to increased maintenance requirements
- New services will require marketing to ensure success

Transit Queue Jump with Transit Signal Priority

What:

- Addition of a travel lane at a signalized intersection that allows buses to proceed through the intersection prior to general traffic with the assistance of transit signal priority
- Right-turn only lanes can be used as queue jump lanes in conjunction with right-turn only signal phases

When to use:

- Intersection with heavy congestion or bottlenecks
- Queue jumps can be considered at intersections that have a level of service (LOS) of D or worse[1]

Cost: Low to Moderate

- Cost is dependent on the existing intersection design. If an additional lane is not needed, costs can be low considering the installation and operation of signal equipment
- Costs can increase if the addition of a special lane is required

Time: Short-term

- Improvements that don't require lane construction can be done reasonably within a year's time frame. If construction of an additional lane is require, a longer time frame will be needed

Benefits:

- Reduction in bus travel delays associated with traffic signals or traffic congestion
- Can be a cost-effective solution to improving transit operations and efficiencies without requiring a bus-only lane for an entire corridor
- Improvements can result in increase transit ridership

Considerations:

- Construction of new lanes may require purchase of additional right-of-way
- Proper enforcement of the lane restrictions is important to ensuring safety as well as transit time savings

[1] Source: Texas Transportation Institute. *TCRP Report 19: Guidelines for the Location and Design of Bus Stops*. Washington, D.C.: National Academy Press, 1996.

Electronic Fare Collection

What:

- Use of special fare collection equipment that allows users to pay with credit, debit, or magnetic stripe cards

When to use:

- Typically used in situations where a transit agency is seeking to improve travel delays associated with traditional fare collection methods (cash, tickets, or tokens)

Cost: Moderate to High

- The type of fare collection equipment used and the size of the fleet to be outfitted with the new equipment are major factors in determining overall cost
- Additional costs associated with maintenance and repair of more complex fare collection equipment will be a recurring cost associated with implementation

Time: Medium-term

- Dependent on budgetary restrictions and fleet size, deployment of an electronic fare collection system can require up to five years

Benefits:

- Benefits can vary depending on the fare medium used (credit, debit, magnetic swipe, or smart card)
- Improved operational efficiencies
- Improvements can result in increased transit ridership
- Increases in the availability and type of ridership data available for planning purposes
- Increased revenue collection through a reduction in fare evasion and improvements in accountability

Considerations:

- Regions that have multiple transit agencies should consider interoperability of fare media
- Decisions about whether traditional fare media will be continued are required
- Electronic fare media may "mask" the fare structure to the user

Parking Facility Management

What:

- Signage that notifies travelers of the availability of parking at a parking lot
- Signage can also direct travelers to lots that have available parking

When to use:

- Parking lots that are frequently used at or near capacity
- Areas with a number of different parking lots (e.g. Downtown)

Cost: Low to Moderate

- The cost of a parking management system is dependent on the complexity of the system ($20,000 - $250,000)

Time: Short- to Medium-term

- Time to implement a system is dependent on the complexity of the system being designed. Can take from one to three years

Benefits:

- Decreases time that can be wasted searching for a parking space
- Reduces the frustration of searching through a parking lot that is already full

Considerations:

- Parking lots that are rarely at capacity are not good candidates for this technology
- Verification of equipment or methods used in determining parking lot capacity are required periodically
- Creation of a system that tracks multiple parking lot capacities and presents the information to travelers through signage or web-based applications may be valuable

Efficient Land Use Practices / Smart Growth

What:

- Region-wide land-use policies and strategies that drive development patterns that result in more efficient transportation systems
- Local planning efforts, zoning regulations, and site review processes that result in developments that improve transportation efficiency

When to use:

- Development of vacant or previously undeveloped sites
- Redevelopment of older developments
- Locations with proximity to existing or planning transit stations

Cost: Low to Moderate

- Costs are difficult to assign a dollar value because they are shared by various "partners" (local government, development corporations, property owners, local businesses, and customers)

Time: Short - to Long-term

- Time frames are dependent on the scale of the project in question. Retrofit of a single property can be done in a relatively short time frame. Development of zoning ordinances or local/regional land-use policies can be done in a short time frame as well. Implementation of policy changes on a region-wide scale can take decades.

Benefits:

- Less motor vehicle use through development patterns that encourage the use of public transportation, walking, and bicycling as transportation modes
- Reduction in overall carbon emission and improved health benefiting from more active lifestyles
- Reduction in costs associated with large and expensive roadway projects

Considerations:

- Many different parties must be "on-board" for these practices to become realized. Political, economic, and social aspects must be addressed and considered when developing policies.

Bicycle and Pedestrian Facilities

What:

- Off-street facilities designed for non-auto users such as pedestrians and bicyclists
- Inclusion of sidewalks in the construction of new road facilities or when roads are redesigned
- Addition of special areas on streets that are designed for use by bicyclists. These facilities are typically delineated through special striping or signage

When to use:

- Locations that provide access to popular destinations
- Locations that provide access to facilities such as transit stations and schools
- Locations that are part of a regional transportation network or a regional bicycle route

Cost: Low to Moderate

- Costs are dependent on existing road design and availability of right-of-way. Locations that can be restriped are cheaper alternatives to the creation of newly paved trails.

Time: Short - to Medium-term

- New road striping is typically a short-term project. Projects that require the acquisition of additional right-of-way and construction of a new facility will require more time.

Benefits:

- Spaces that create a more comfortable environment for walking, bicycling and improved safety
- Reduction in the number of vehicles on the roadway by providing a means for alternative modes of travel
- Improved health benefits associated with more physically active modes of travel

Considerations:

- Major conflict points between vehicles and pedestrians/bicyclists should receive special attention
- Locations where roadway geometries (width) changes should receive special signage or warning
- Locations that are perceived as major destinations should ensure appropriate facilities for storage of bicycles

HOV / HOT Lanes

What:

- New or existing lanes that have restrictions allowing use by buses, high-occupancy vehicles (HOV), and in certain cases specially approved vehicles such as motorcycles, hybrid vehicles, and toll paying vehicles (HOT)
- Can be temporal or directionally oriented to account for changes in congestion

When to use:

- Roads with extensive congestion problems
- Corridors with a high volume of transit service

Cost: Moderate to High

- Conversion of existing lanes is a lower cost alternative when compared with the construction of new lanes

Time: Medium- to Long-term

- These types of solutions require proper planning to formulate design, regulations, and possible construction
- When new construction is involved, additional time will be needed for the necessary regulatory compliance (i.e., environmental)
- Lane regulations may require changes to state or local law, which would include time for legislation to be drafted and ratified

Benefits:

- Improvements in transit schedule adherence and in some instance shortened travel times by reducing congestion and associated delays
- Lanes can increase the use of carpool and vanpool programs when drivers see a reduction in travel delays when compared to general traffic lanes

Considerations:

- HOV/HOT lane traffic flows must remain better than general traffic lanes to ensure continued use
- Decision on whether the lanes should have a physical barrier separating them from general traffic is important from an access/egress standpoint as well as operations. Lanes without a barrier and entry and exit points can operate at slower speeds because of vehicles being able to merge in and out at any time. Without a physical barrier the lane often neighbors a general traffic lane and can slow when general traffic speeds slow. Construction costs associated with separated lanes (ROW, barrier, entrance/exit ramps or gates) can be much higher.
- Enforcement of the lane regulations
- Ingress and egress for emergency vehicles

Ridesharing

What:

- Programs that promote or assist two or more riders sharing a vehicle
- These programs can be organized and operated by a public agency (GW Ride Connect), private companies, or single companies

When to use:

- Areas where there are high concentrations of commuters traveling to a similar destination
- Residential communities that have a large number of long-range commuters

Cost: Low to Moderate

- Ridesharing programs typically have low startup and maintenance costs
- Vanpool programs or car sharing programs have higher costs associated with vehicle purchasing and maintenance

Time: Short-term

- Programs can be set up and operating in a short timeframe

Benefits:

- Reduction in the number of single-occupant vehicles on the road results in decreased levels of congestion

Considerations:

- Promotion of these programs along with implementation of HOV/HOT lanes can increase participants
- Programs can be marketed or connected to workplace incentives to reduce parking needs or promote other trip reduction programs
- Programs should consider offering "Guaranteed Ride Home" programs that provide an emergency ride home for individuals who carpool or vanpool

Transit Rider Information

What:

- Use of communications structure (electronic message boards, media, and Internet), geographic positioning systems (GPS), and automatic vehicle location (AVL) systems that provide arrival times and system information of transit vehicles to the public

When to use:

- Locations such a major transfer locations or transit centers
- Areas with significant congestion problems that impact transit operations on a regular basis

Cost: Moderate

- Costs are dependent the existing communications systems, transit vehicle technologies, and fleet size

Time: Medium-term

- Time is dependent on the size of the program to be implemented and the availability of funding. Some level of planning and program design is required prior to implementation

Benefits:

- Customer satisfaction associated with increased information about system operations and vehicle schedules
- Systems also provide increased data to the transit agency about on-time performance and recurrent schedule problems, resulting in improved system operations

Considerations:

- Implementation of these systems can often be incorporated with the construction of new transit centers or major transit projects
- Combining transit information with other commuter information programs can provide a more robust and complete commuter information network, allowing for better decision making

Roadway Capacity

Road Widening

What:

- Addition of new travel lanes to an existing roadway

When to use:

- Roads that are severely congested and have an issue with capacity
- Roads that do not have sufficient alternative routes for diversion

Cost: High

- Costs for road widening will vary depending on the amount of right-of-way that needs to be acquired and any difficulties in construction that may need to be overcome

Time: Mid- to Long-term

- Completion of projects involving expansion can take between 5 and 20 years to complete. This includes planning, engineering, environmental, and construction phases

Benefits:

- Increased capacity results in reduced congestion and improved travel times for existing traffic
- Reductions in traffic on parallel roads as traffic diverts to less congested roadway

Considerations:

- Nearby property owners may have property taken as right-of-way for expansion
- Construction impacts to nearby property owners and roadways
- Creation of new bottlenecks if the expansion does not include enough of the corridor

New Roadways

What:

- The addition of new roads that provide a bypass of existing congested roadways for travelers moving through an area
- The extension of existing roads that do not currently connect to create new paths for travelers

When to use:

- Areas that have shown severe congestion in an area that travelers must pass through in order to reach their destination
- Previously developed areas that have numerous dead end streets. These streets can be connected to form a traditional grid street network, which provides numerous connections and pathways

Cost: High

- Costs for new roads will vary depending on the amount of right-of-way that needs to be acquired and any difficulties in construction that may need to be overcome

Time: Mid- to Long-term

- Completion of projects involving new construction can take between 5 and 20 years to complete. This includes planning, engineering, environmental, and construction phases

Benefits:

- New roads create additional capacity for the regional road network that results in reduced congestion and improved travel times for existing traffic
- Reductions in traffic on parallel roads as traffic diverts to less congested roadways or new paths created

Considerations:

- Nearby property owners may have property taken as right-of-way for expansion
- Construction impacts to nearby property owners and roadways
- Creation of new bottlenecks or problem areas as a result of the diversion of traffic

Shoulder Use as Travel Lane

What:

- Use of highway shoulders as a travel lane during assigned periods to allow for added capacity without the construction of new travel lanes

When to use:

- Highway corridors with heavy congestion and capacity issues
- Traffic volumes associated with congestion are temporal and can be addressed for short periods with brief periods of an expansion of capacity

Cost: Moderate to High

- Signage and lane control signs are required to communicate when lanes are in service
- Costs can range from $0.5 - $1.5 million per mile
- Costs will be higher if the shoulders are not structurally suitable for use as travel lane

Time: Medium-term

- Planning and engineering associated with implementation are most time intensive aspects

Benefits:

- Increases peak period mainline capacity
- Improves merge/diverge LOS

Considerations:

- Loss of the shoulder as an emergency pull-off lane can create safety issues. Will require construction of emergency pull-off areas

Interchange Improvements

What:

- Changes in interchange geometry
- Extension and expansion of acceleration and deceleration lanes

When to use:

- Interchanges where traffic spillback occurs onto mainline roads
- Interchanges where severe bottlenecks occur

Cost: Moderate to High

- Costs are variable based on the scale and size of the redesign

Time: Medium- to Long-term

- Planning and engineering associated with implementation are most time intensive aspects

Benefits:

- Improvements in LOS
- Reduction in spillback onto mainline
- Reduction in vehicle collisions
- Increased road capacity

Considerations:

- Acquisition of available right-of-way will be important to any expansion or change in intersection geometry
- Impacts of construction on neighboring property owners

Roundabout Intersections

What:

- Circular junction where traffic travels in one direction, yielding right-of-way to traffic within the circle. Traffic enters and exits the circle via separate lanes allowing for continuous movement through the intersection
- Does not require the use of traffic signals or stop sign control

When to use:

- Intersections with high crash frequency and/or severity
- Intersections with high percentage of turning volumes and/or moderate traffic on minor roadway
- Multi-legged intersections

Cost: Moderate to High

- Costs for building roundabouts depends on the size of the roundabout and aesthetic elements weaved into the construction
- Costs are also dependent on the need to acquire additional right-of-way, especially in urban settings

Time: Short-term

- Completion of projects typically take 3 months to an year depending on the level of complexity

Benefits:

- Improve safety
- Reduce congestion
- Reduce pollution and fuel consumption
- Less expensive than traditional intersections

Considerations:

- Acquisition of available right-of-way will be important to any expansion or change in intersection geometry
- Impacts of construction on neighboring property owners
- More challenging for visually impaired pedestrians to navigate

Grade-Separation

What:

- Construction of an overpass or underpass to eliminate two roads intersecting at-grade

When to use:

- Intersections with high traffic volumes or major congestion problems
- Intersections where at-grade expansion is a challenge
- Intersection with a high number of side impact vehicle collision

Cost: High

- Costs dependent on the need for additional right-of-way and scale of construction

Time: Medium- to Long-term

- Planning, engineering, environmental analysis, and construction are time intensive and collectively can take up to 15 years to complete

Benefits:

- Increased capacity
- Removes the need to stop at the intersection
- Improves safety by removing turning movement and eliminating conflicts

Considerations:

- Facilities for pedestrians and cyclists need to be considered when changing intersection design

Addition of Turn Lanes

What:

- Addition of left- or right-turn lanes, removing turning traffic from through lanes

When to use:

- Intersections with a high volume of turning traffic

Cost: Low to Moderate

- Compared to other roadway construction projects, turn lanes are relatively low in cost. Right-of-way needs will be the major determining factor for increasing costs

Time: Medium-term

- Planning, engineering, right-of-way activities, and construction are key aspects

Benefits:

- Improvements in safety resulting from fewer rear-end crashes
- Improves intersections capacity and results in more vehicles being able to travel through the intersection

Considerations:

- Facilities for pedestrians and cyclists need to be considered when changing intersection design