

## Section 11: Transportation Strategies Toolbox

A transportation strategies toolbox was developed to provide a systematic approach to identify potential strategies that address corridor transportation needs. This section describes a summary of potential transportation strategies that were considered for the 5-County region. The full toolbox can be found in the appendices.

### 5-COUNTY REGIONAL TRANSPORTATION STUDY PHASE 1

The Phase 1 report of the 5-County Regional Transportation Study outlined the following conclusions:

1. Traffic generation is anticipated to increase as a number of large land development projects are underway or are planned that will significantly impact the transportation system;
2. Billions of dollars in transportation needs have previously been identified.
3. Even more transportation needs will be identified as traffic impacts of many of the planned new large developments are determined.
4. Funding for transportation needs is not anticipated to increase significantly.

The Phase 1 report organized a general approach to evaluating the potential impacts of transportation investments to consider how each project not only improved travel mobility but also affected the economy, environment and society—the triple bottom line.

The consensus from the Phase 1 study was that:

- Transportation funds will not be available to address many of the corridor needs through a road construction program alone.
- Solely focusing on mobility without considering economic, environmental or societal impacts could lead to inefficient transportation investment choices.

The 5-County Study is focused on the portion of the transportation system that includes the major interstates, US highways, state routes and major arterial routes. It also includes the five transit systems – Lawrence Transit, KU on Wheels, Unified Government Transit, Kansas City Area Transportation Authority, and Johnson County Transit. Associated with these systems are supportive sidewalk and trail facilities and efforts to coordinate land use/development projects as they relate to the transportation system.

The strategies in the Toolbox have been grouped to address:

- Enhanced Management of the Existing Transportation System
- Reduced Travel Demand
- Increased Transportation System Capacity

### CONGESTION MANAGEMENT PLAN PROCESS

The approach to managing the transportation system, including efforts to reduce transportation demand, was initiated in a large scale following the energy price increases and economic downturn experienced in the late 1970s and early 1980s. In the 1990s, federal transportation legislation required larger Metropolitan

Planning Organizations (MPOs) to develop Congestion Management Plans (CMP). An overall objective of CMPs has been to maximize the efficiency of existing transportation systems and facilities before considering strategies that increase capacity. This 5-County planning process followed the general CMP approach and includes defining congestion management objectives, developing performance measures, and identifying and evaluating strategies.

While the transportation system serving the 5-County region is auto-oriented, recent experience with energy price increases reinforced the need for alternative transportation modes such as carpooling, public transit, bicycling, and walking to offset higher energy prices.

### STRATEGY DESCRIPTION

In analyzing potential corridor strategies, three factors were considered: the scale of the strategy, how well it addressed the 9 Desired Outcomes developed by the Stakeholder Advisory Panel, and the ease of implementation.

**Scale:** A specific strategy can be applied at the intersection or point level, along a corridor, or area-wide.

**Desired Outcomes:** While each desired outcome can include consideration of a number of evaluation criteria, the evaluation of strategies as described here focuses on a simplified number of criteria or factors related to the general evaluation of the overall strategy as discussed below:

- **Mobility:** Degree to which the strategy supports the movement of vehicles and goods and improves travel time and reduces delay.

- **Safety:** Degree to which the strategy would lead to reduced crash rates.
- **Regional Prosperity:** The degree to which the strategy would have economic impacts.
- **Efficient Use of Financial Resources:** This represents general level of anticipated cost.
- **Choice:** Degree to which the strategy provides for choice of auto and non-auto modes of transportation or provides information on choice of travel route or time of travel.
- **Environment:** For this evaluation, this outcome is reflected in the anticipated impact to reduce Vehicle Miles Traveled (VMT) or vehicle emissions.
- **Public Health:** Degree to which the strategy supports healthy lifestyles by providing opportunities for exercise as part of travel.
- **Social Equity:** Degree to which the strategy provides for travel opportunities to persons without access or unable to use a private vehicle.
- **Livability:** Degree to which the strategy would be consistent with a development scale that enables mixed land use and would not create barriers across a community.

**Ease of Implementation:** This includes political considerations, public perception, reaction of transportation system managers, or environmental considerations.

Table 11-1 provides a summary of the types of transportation strategies that can be considered. A more detailed discussion of these strategies can be found in Appendix C.

Table 11-1: Types of Transportation Strategies

Category/Strategy	Definition
<b>System Management</b>	This set of strategies emphasizes the management and operation of existing transportation facilities.
Traffic Signal Timing/Optimization	Upgrading traffic signal equipment and timings.
Freeway & Arterial Bottleneck Removal	Minor roadway geometric or traffic control improvements.
Ramp Metering	Traffic signals on ramps control vehicles entering freeways.
Access Management	Careful planning of access points along roadways.
Variable Speed Limits	Speed limits are changed based upon traffic conditions.
Congestion Pricing	Variable toll pricing based upon peak or off-peak periods.
ITS Technology	ITS applications that address travel mobility.
Traffic Incident Management	Planned process to detect and respond to traffic incidents.
Travel Information	Provides information to drivers regarding traffic conditions.
Parking Management	Providing information regarding parking.
<b>Travel Demand</b>	This set of strategies addresses transportation needs by reducing the number of trips during peak periods.
Ridesharing	Includes both carpooling and vanpooling.
Public Transportation	Includes fixed route bus service and paratransit service.
Bicycle and Pedestrian Travel	Bicycle and pedestrian facilities.
Alternate Work Hours	Varying work schedules to avoid peak travel times.
Telework	Promoting telework to reduce the number of commuters.
Land Use Management	Guide development to lessen traffic impacts.
Park & Ride Facilities	Promotes carpooling, vanpooling, and transit use.
<b>Increasing Capacity</b>	This set of strategies refers to traditional capacity improvements such as adding lanes or new roadways.
Add Travel Lanes	Widening existing roadways to add travel lanes.
Modify or Add Interchange	Adding capacity to existing interchanges or adding new interchanges to system.
Construct New Highways or Arterials	Constructing new roadways on new alignments.
Intersection Capacity Improvements	Includes adding turn lanes and roundabouts.
Transit Capacity	Includes added transit service and facilities such as Park & Ride lots.
HOV/HOT and Managed Lanes	A set of lanes where operational strategies respond to changing conditions. Includes high occupancy vehicle lanes.
Bicycle and Pedestrian Facilities	Construct bicycle and pedestrian facilities.
Freight Rail Track Improvements	Track related projects or grade separations.

### APPLYING THE TOOLBOX

The transportation toolbox presents a range of transportation strategies that can potentially address transportation issues within a corridor or an area within the 5-County region. This approach provides organization to determining which strategies could be used. The following steps are suggested:

1. Identify the Desired Outcomes most pertinent to area, corridor or point being considered.
2. Examine Toolbox strategies, using the hierarchy of system management, demand reduction, and then capacity.
3. Within this hierarchy, identify strategies that best respond to each outcome for each transportation corridor.

4. Evaluate the selected strategies using the travel demand model, highway capacity model, simulation model or manual techniques as appropriate.
5. Following implementation, review the effectiveness of the strategies in meeting the toolbox criteria.

### TOOLBOX STRATEGIES

The transportation toolbox strategies are described in the following sections. Table 11-2 lists those strategies that would be considered to best address each desired outcome. While the impact of a given strategy will vary given the characteristics of the area where it is applied, this table provides a starting point to discuss how a set of transportation strategies can be applied to address this range of desired outcomes. A full comparison of strategies related to desired outcomes is provided in the Appendices.

Table 11-2: Toolbox Strategies

Mobility	Safety	Regional Prosperity	Financial Resources	Choice	Environment	Public Health	Social Equality	Livability
Bottleneck Removal	Signal Timing	Add Travel Lanes	Signal Timing	Ridesharing	Signal Timing	Bicycle/Ped	Public Transportation	Land Use Management
Congestion Pricing	Bottleneck Removal	Modify/Add Interchanges	Bottleneck Removal	Public Trans	Bottleneck Removal	Bike Ped Facilities	Ridesharing	Bicycle/Ped
Access Management	Ramp Metering	Freight Rail	Ramp Metering	Bicycle/Ped	Ramp Metering	Land Use Management		
Ramp Metering	Access Management	Access Management	Access Management	Transit Capacity	Intersection Capacity		*others will vary by location of projects	*other projects can include livability elements
Add Travel Lanes	Variable Speed Limits	Intersection Capacity	Variable Speed Limits	HOV/HOT Lanes	Public Trans			
Modify/Add Interchanges		Transit Capacity	Ridesharing	Managed Lanes	Bicycle/Ped			
Intersection Capacity	*other projects may have safety benefits if addresses design criteria		Telework	Bike/Ped Facilities	Transit Capacity			
Transit Capacity			Parking Management	Freight Rail	Bike Ped Facilities			
HOV/HOT Lanes			Land use Management					
Managed Lanes			Alternative Work Hours					
			*Projects with operations or higher capital costs vary by project					

## TRANSPORTATION SYSTEM MANAGEMENT (TSM) STRATEGIES

TSM strategies seek to enhance capacity through better management and operation of the existing transportation facilities. These techniques are designed to improve traffic flow, air quality, and movement of vehicles and goods, as well as improve system reliability and safety.

Transportation management strategies are typically low cost when compared with capacity projects. The objective of these strategies is to provide for improved traffic and transit operation often reflected by moderate improvements in travel mobility and reduced vehicle emissions. These strategies are applicable to both highway and transit operations. Many of the management strategies contribute indirectly to public health, regional prosperity, social equity and livability.

### Traffic Signal Timing/Optimization

Upgrading traffic signal equipment and implementing more efficient traffic signal timing and communication are ways to improve traffic movement along travel corridors. Traffic signal timing provides an opportunity to reduce vehicle delay on arterial streets by up to 15 percent, with as much as 30 percent during peak hours<sup>1</sup>.

### Freeway and Arterial Bottleneck Removal

This is a location specific strategy targeting congestion that occurs due to a geometric feature of the roadway. Bottleneck removal can provide significant benefits to travel mobility. This strategy consists of identifying congested locations and improving elements including:

- Insufficient acceleration/deceleration lanes and ramps
- Improving weaving sections
- Addressing narrow lanes and shoulders
- Providing adequate signage and pavement striping
- Addressing other geometric features that may exist

Compared to larger capacity projects, these projects can provide a very efficient use of financial resources by providing benefits with modest costs.

### Ramp Metering

Ramp metering is the use of traffic signals on a ramp to control the rate at which vehicles enter a freeway facility. By controlling the rate at which vehicles are allowed to enter a freeway, the flow of traffic onto the freeway facility becomes more consistent, smoothing the flow of traffic on the mainline and allowing more efficient use of existing freeway capacity. Ramp metering can be an effective tool to address congestion and safety concerns that occur at a specific point or along a section of freeway. It is being used on a small section of I-435 east of Metcalf Avenue to manage a difficult weaving section.

### Access Management

Access Management is a process used to maintain the mobility function of arterial routes by managing vehicular access points between land parcels and roadways. This practice is already in use by KDOT and many local governments. Access management can include increasing the spacing of access points of both driveways and streets, providing turn lanes, providing medians and right-of-way preservation for future streets.

### Variable Speed Limits

Variable speed limits moderate freeway traffic flow in response to traffic congestion, weather, and construction. Variable speed limits can be advisory or regulatory. The speed limit is varied based on downstream conditions that drivers are heading towards, not necessarily conditions at the site where speed limits are changed. The intent of variable speed limits is to slow traffic speeds prior to reaching a congested area to improve safety and to allow the traffic in the congested area to disperse more quickly.

### Active Lane Use Control

Active Lane Use Control is one element of active traffic management which seeks to dynamically manage recurrent and non-recurrent congestion based on prevailing traffic conditions<sup>2</sup>. Active traffic lane use control is method of

Figure 11-1:  
Advisory Speed  
Limit Sign  
Source: Missouri  
Department of  
Transportation



increasing peak capacity and smoothing traffic flows on busy major highways.

Techniques include variable speed limits, hard-shoulder running and High-Occupancy Vehicle/High-Occupancy Toll lanes controlled by overhead lane-specific variable message signs.

Hard shoulder running involves converting the hard shoulder into a travel lane during periods of high traffic flow to expand the capacity of the road and may reduce the need to widen roadways

Active transportation strategies have been used effectively in Europe. Active lane use control strategies are typically those that can be used on freeways to manage traffic flow and safety.

Figure 11-2: Example of Active Lane Use Control  
Source: WSDOT



### Truck Restrictions

Truck restrictions such as designated truck-only lanes or lane restrictions are implemented in a corridor to better segregate vehicles when implementing lane management strategies listed above that may not allow for safe operation in particular lanes.

### Congestion Pricing

Congestion pricing implements variable price tolling between peak and off-peak times in toll areas on bridge and roadway facilities, tollways, zones, or High-Occupancy Toll (HOT) lanes. The price differences induce drivers of less critical or more discretionary trips to shift their highway travel to off-peak periods or other modes.

Figure 11-3: Example of Congestion Pricing in Chicago

Vehicles with	4am-8pm	8pm-4am
2 Axles	\$2.50	\$2.50
3 Axles	\$5.10	\$3.60
4 Axles	\$6.80	\$4.80
5 Axles	\$8.40	\$6.00
6 Axles	\$10.10	\$7.20
7 Axles +	\$11.80	\$8.40

## Intelligent Transportation Systems Arterial and Freeway Applications

Intelligent Transportation Systems (ITS) focuses on intelligent vehicles, intelligent infrastructure and the creation of an intelligent transportation system. ITS encompasses many areas of transportation and are part of many of the strategies included in this toolbox. This strategy includes those ITS actions that address travel mobility on freeway routes and the supportive arterial street network.

The types of ITS activities that support freeway and arterial operations include:

- Traffic surveillance systems
- Traffic control measures on freeway entrance ramps, such as ramp meters.
- Lane management applications that address the effective capacity of freeways and promote the use of high-occupancy commute modes.
- Special event transportation management systems.
- Advanced communications to improve the dissemination of information to the traveling public.
- Arterial management systems to manage traffic along arterial roadways.

The largest ITS application in the 5-County region is the Kansas City Scout freeway management system led by

<sup>1</sup> FHWA, Olsson Associates

<sup>2</sup> FHWA-PL-07-012 Active Traffic Management: The Next Step in Congestion Management, March 2007.

the Kansas and Missouri Departments of Transportation. The Scout system manages traffic on more than 100 miles of freeways in the Kansas City metropolitan area. Scout provides real time information to dynamic message signs, and cameras showing traffic conditions provided through the internet.

### Traffic Incident Management

Traffic incident management is a planned and coordinated process to detect, respond to, and remove traffic incidents and restore normal traffic flow as safely and quickly as possible.

### Travel Information

This strategy involves providing information to users of the transportation system about congestion or other problems on their typical route to enable them the option to modify the trip.

Figure 11-4: Kansas City Scout Website



### Parking Management

Parking management strategies include minimizing parking requirements and providing information about parking availability. Allowing coordinated parking between complementary daytime/nighttime or weekday/ weekend land-uses potentially reduces the number of spaces necessary for a development. Displaying real-time information of available parking spaces reduces the amount of both vehicle dwell in parking lots and circulation in the surrounding street network.

## TRAVEL DEMAND MANAGEMENT (TDM) STRATEGIES

These demand-side strategies are often referred to as Travel Demand Management (TDM). These types of strategies address transportation needs by reducing the number of trips taken during peak travel periods. This set of toolbox strategies have a lesser impact on mobility and traffic safety, but instead address the “desired outcome” to provide travel options, particularly for persons without access to private vehicles. Many of the travel demand strategies contribute to supporting public health, regional prosperity, social equity and livability.

### Ridesharing

Ridesharing includes both carpooling and vanpooling. A carpool is where two or more people share a ride in a private vehicle. Carpools generally have two or more passengers who live in the same neighborhood, or along the same route, using a private vehicle to travel to common or nearby destinations. A vanpool is where a larger group of people share a ride in a prearranged vehicle.

### Public Transportation

The two primary types of public transportation service include fixed route and paratransit. Fixed route transit provides designated public transportation that is operated along a prescribed route according to a fixed schedule. Paratransit transit service does not follow fixed routes or schedules, and provides service to customers unable to access fixed route service. Paratransit service often entails providing on-demand door-to-door service from any origin to any destination in a service area.

Figure 11-5: K-10 Connector at KU Edwards Campus  
Source: Olsson Associates



### Park & Ride Facilities

Park & Ride facilities include parking lots and parking structures that allow commuters and other people headed to city centers to leave their vehicles and transfer to a bus, rail system (rapid transit, light rail, or commuter rail), or carpool for the remainder of the journey. Park & Rides are generally located in the suburbs of metropolitan areas or on the outer edges of large cities.

Park & Ride facilities allow commuters to avoid the stress of driving a congested part of their journey and facing scarce, expensive city-center parking. They are meant to reduce congestion by encouraging people to use public transportation or carpool as opposed to their own personal (single-occupant) vehicles. They offer the flexibility for travelers to use personal vehicles for errands either before or after their workday commute.

### Bicycle and Pedestrian Travel

Many of the bicycle and pedestrian considerations are contained within the concept known as “complete streets”. This policy approach includes a focus on the design and operation of an entire right-of-way to enable pedestrians, bicyclists, motorists, and transit riders of all ages and abilities to move safely along and across a street or highway.

Bicycle and pedestrian improvement strategies address objectives related to transportation choice, livability, and public health.

### Alternate Work Hours (Shift in Time of Trip)

This strategy, often called “flextime,” involves varying work schedules to shift work-trip departure times away from peak congestion times, rather than maintaining traditional arrangements requiring employees to work a standard 8:00 AM to 5:00 PM day. This strategy helps reduce travel during the highest periods of travel.

### Telework

Teleworking is defined as working full- or part-time at home or another off-site location. Teleworking is increasingly used by employers to reduce the demand for office space and parking. While beneficial, this strategy is considered a complementary strategy with other strategies to address corridor needs. Promoting telework supports

a transportation choice for workers to avoid making the commute.

### Land Use Management

The type, intensity and site planning associated with land development can influence transportation conditions. These are regulatory strategies involving changes in land-use plans, zoning codes, subdivision ordinances and other development policies which can be used to collectively guide development in a way to lessen traffic impacts and provide a greater balance between travel modes.

## INCREASED CAPACITY STRATEGIES

Increasing capacity refers to traditional transportation supply strategies such as adding travel lanes, modifying interchanges to accommodate higher traffic volumes, and constructing new highways or urban arterials. It can also involve major capacity increases for public transportation.

While capacity projects typically address traffic congestion in the short term, adding capacity can support a long term cycle of congestion. This occurs when the added capacity induces new demand, which causes congestion to return. Other long term impacts of focusing resources on roadway capacity solutions include enabling growth to occur outward resulting in lower overall densities and disinvestment in older more established areas.

### Add Travel Lanes

This strategy includes projects to widen existing highways and arterial streets by adding through travel lanes. These projects are typically targeted to congested locations and provide a direct impact of reducing traffic congestion and travel time by adding vehicle capacity. The projects typically involve a relatively high project cost.

### Modify or Add Interchanges

This strategy includes adding capacity to existing interchanges by modifying the ramp configuration, widening ramps, or adding collector/distributor roads. It also includes building new interchanges on existing freeways. The principal purpose of new interchange projects is to provide access to land adjacent to freeways. The exception is with system-to-system interchanges where the primary objective is to improve mobility on the freeway system.

### Construct New Highways or Arterials

This strategy involves constructing new roadways on new alignments. In recent years, issues related to implementation such as right-of-way acquisition, project cost and environmental impacts have limited the construction of highways or arterials on new alignments.

Constructing new highways or arterials addresses the objective to improve or maintain mobility. Often a new roadway will provide a more direct connection between points or relieve an existing route which may be congested. The projects typically involve a high project cost. The potential outer loop that was evaluated during the study is an example of this type of strategy.

### Intersection Capacity Projects

This strategy involves adding turn lanes or constructing roundabout intersections. The capacity and traffic flow related to an arterial route is often dictated by the operation of its intersections. The primary objective of an intersection capacity project is to improve travel times by reducing vehicle delay at an intersection.

### Transit Capacity

A number of activities are underway to improve transit service in order to attract new riders and improve the experience for existing riders. These include construction of transit amenities such as bus shelters, improving existing or constructing new Park & Ride lots and providing real time information on bus arrival times. Service improvements are also being planned to increase service frequency and reduce the transit travel times.

The following lists options under consideration in the 5-County region that provide an increasing level of transit capacity and service characteristics:

Enhanced Transit involves providing a bus route that can include features such as additional passenger amenities at transit stops, improved transit stations or bus shelters, improved Park & Ride lots, real time schedule displays, and Transit Signal Priority (TSP) strategies to modify traffic signals with extended green time to optimize and reduce transit travel time and improve transit system reliability.

Bus Rapid Transit (BRT) provided in mixed traffic lanes combines station/shelter enhancement, unique vehicles, increased service frequency, and Intelligent Transportation Systems (ITS) elements. BRT systems can be described in two categories – BRT systems with dedicated guideways and BRT systems that operate predominately on regular travel lanes in mixed traffic.

Guideways can be constructed to provide exclusive transit right-of-way. It may include track improvements for commuter rail or exclusive transit lanes to operate BRT service.

Bus on Shoulder is oriented toward serving longer distance transit trips where buses could bypass freeway congestion by using the travel shoulder.

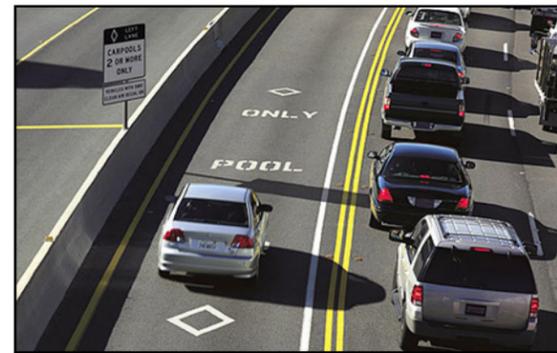
### High-Occupancy Vehicle (HOV) and Managed Lanes

HOV lanes are exclusive roadways or lanes designated for high-occupancy vehicles, such as buses, vanpools, and carpools. New HOV lanes can be constructed or an existing lane can be converted for HOV use. A new lane would be a capacity project, while conversion would be a management strategy.

The facilities may operate as HOV lanes full time or only during the peak periods. HOV lanes typically require minimum vehicle occupancy of two or more persons.

Managed Lanes are a set of lanes where operational strategies respond to changing conditions such as congestion levels, travel speeds, or downstream incidents.

*Figure 11-6: Example of HOV lanes Source: Metropolitan Washington Council of Governments*



Managed lanes often combine tolling and vehicle occupancy elements. High-Occupancy Toll lanes, or HOT lanes, allow single-occupant vehicles to utilize HOV lanes for a fee.

### Bicycle and Pedestrian Facilities

Bicycle and pedestrian facilities can include sidewalks, bicycle lanes, wider street accommodation for bicycles, and trails.

### Freight Rail Track Improvements

In some cases public funds are used for track related projects or grade separations that reduce rail-vehicle conflicts; in situations where improving the flow of freight also reduces trucking demand on highways; or where the rail project results in economic development.

## CONCLUSIONS

The transportation toolbox provides the mechanism to evaluate how potential transportation strategies meet a wider set of transportation objectives. Specifically, it provides a way to be able to see how a wide range of possible transportation strategies can lead to achieving a greater number of the desired outcomes identified in the 5-County Study. To better achieve these desired outcomes, a number of toolbox strategies will need to be combined. For example, many of the strategies that reduce transportation demand could be implemented together to achieve a stronger impact. In other cases, the time frame in which strategies produce benefits may also vary. For example, land use management could be implemented along a newly developing corridor. The benefits of this approach may be incrementally achieved over a period of years, rather than immediately observed.

The toolbox process also highlights how focusing on one type of strategy may not achieve all of the desired outcomes. The toolbox highlights how some strategies may be more effective at addressing congestion but may not address other desired outcomes, not serve all travel markets, or be costly or difficult to implement.

