Operational efficiency is important to maintaining a reliable and safe transportation system that supports an improved quality of life for the traveling public. There are multiple strategies employed to promote efficiency of the transportation system by managing and reducing congestion. These strategies include addressing Travel Demand Management, Transportation System Management, Intelligent Transportation Systems, and Sustainable Development.

**Mobility 2040 Supported Goals**

- Improve the availability of transportation options for people and goods.
- Support travel efficiency measures and system enhancements targeted at congestion reduction and management.
- Assure all communities are provided access to the regional transportation system and the planning process.
- Preserve and enhance the natural environment, improve air quality, and promote active lifestyles.
- Ensure adequate maintenance and enhance the safety and reliability of the existing transportation system.
- Develop cost-effective projects and programs aimed at reducing the costs associated with constructing, operating, and maintaining the regional transportation system.

**Operational Efficiency Strategies**

The need to operate the regional transportation system as efficiently as possible is a top priority to provide a reliable and safe transportation system that will enhance the livability of North Central Texas. The Dallas-Fort Worth area is classified as a Transportation Management Area (urbanized areas with a population over 200,000) and is required by federal law to develop a Congestion Management process. The Congestion Management process is a systematic process for managing traffic congestion that provides information

**Operational Efficiency at a Glance:**

Mobility 2040 supports an efficient, safe, and secure transportation system that contributes to a high quality of life for the traveling public. Several initiatives improve operational efficiency of transportation systems, ranging from the use of technology to improving the connections and coordination between land use and transportation systems.

By 2040, the region is expected to see a 48 percent increase in population. With this increase, the demands on the transportation system to carry people and goods will become greater. With the existing financial climate, the reality is that the Dallas-Fort Worth region will not be able to build enough roads and rail lines to satisfy the demands and needs of this growing population.

The operational efficiency strategies discussed in this chapter provide alternatives to building higher-cost infrastructure to reduce congestion.

**In This Chapter:**

- Travel Demand Management
- Transportation System Management and Operations
- Transportation System Safety
- Transportation System Security
- Sustainable Development
Operational efficiency strategies addressed in this chapter are part of the multifaceted Congestion Management process. These strategies include Travel Demand Management, Transportation System Management, and Intelligent Transportation Systems. They are cost effective, quick implementation projects and programs that encourage the use of alternative travel modes and improve the efficiency of the transportation system. The Dallas-Fort Worth Congestion Management Process complements the strategies outlined in Mobility 2040.1

Additionally, transportation system safety and security is a concern in a region with millions of people. Monitoring and evaluating the safety and security of the transportation system is a key priority.

Mobility 2040 Policies

Effective and comprehensive policies are an important element in the planning and implementation of programs and projects. Mobility 2040 promotes the following Congestion Management policies:

MO3-001: Ensure the efficient operation of the existing multimodal transportation system by evaluating and/or implementing maintenance, rehabilitation, enhancement, and/or operational type projects in order to maintain safe, efficient travel conditions.

MO3-002: Ensure the existing multimodal transportation system operates efficiently by constructing bridge replacements with approaches, new bridges, overpasses or underpasses for railroads, bicycle/pedestrian facilities, off-system roads, and non-regionally significant facilities.

1 DFW CMP, http://www.nctcog.org/trans/cmp/, NCTCOG.
Traffic moves more efficiently along a roadway when fewer vehicles are on the road, especially during peak travel periods. Travel Demand Management (TDM) strategies reduce the number of vehicles that travel on roadways by promoting alternatives to driving alone. These alternatives include rail and bus transit, ridesharing options like carpools and vanpools, and active transportation options like bicycling and walking. Higher-occupancy travel modes such as rail transit, lanes for high-occupancy vehicles (HOV), and managed lanes do more than reduce demand by single-occupant vehicles; they also have the capacity to transport a larger number of people. TDM programs improve mobility, accessibility, and air quality within the North Central Texas region.

The TDM strategies described and recommended in this chapter are relatively low-cost, quick-implementation programs and projects that encourage alternatives to driving alone. The higher cost and more complex TDM projects such as transit systems, HOV/managed lanes, and bicycle routes are described in the Mobility Options chapter.

TDM activities can improve air quality by reducing the number of vehicles on the roads or by shifting drive-alone travel to off-peak periods. TDM strategies that reduce peak-period travel include flexible work hours, compressed work weeks, and telecommuting.

TDM strategies that support high-occupancy modes and active transportation options such as walking and bicycling play a role in Sustainable Development. In turn, sustainable land use and development can encourage commuters to utilize TDM options. Employers help reduce the demand on roadways when they locate their businesses in areas supported by transit and/or they allow employees to reduce the number of times they must travel to work or allow them to travel outside of peak travel hours.

Travel Demand Management Policies and Programs

Mobility 2040 supports the following policies associated with Travel Demand Management:

**TDM3-001**: Support the Congestion Management process, which includes explicit consideration and appropriate implementation of Travel Demand Management, Transportation System Management, and Intelligent Transportation Systems strategies during all stages of corridor development and operations.

**TDM3-002**: Support an integrated planning process that maximizes existing transportation system capacity before considering major capital infrastructure investment in the multimodal system.

**TDM3-003**: Request local agency staff and North Central Texas Council of Governments staff to meet with all major employers (defined as employers of 250 or more employees) to discuss and encourage the implementation of voluntary employer trip reduction programs.

Mobility 2040 supports the following Travel Demand Management programs:

**TDM2-100**: Employer Trip Reduction Program

**TDM2-200**: Regional Vanpool Program

**TDM2-300**: Park-and-Ride Facilities

**TDM2-400**: Transportation Management Associations

Mobility 2040 also recommends the following TDM-related strategies to manage congestion:
Employer Trip Reduction Program

The Employer Trip Reduction (ETR) Program is a cooperative educational program that seeks to reduce vehicle trips by employees working for large employers (defined as employers with 250 or more employees) in the region. Implemented by the North Central Texas Council of Governments (NCTCOG), the ETR Program markets and implements rideshare programs, telecommuting and flexible work schedule programs, and transit, and it encourages the use of bicycling, walking, and similar strategies to reduce vehicle trips. Dallas Area Rapid Transit (DART), the Fort Worth Transportation Authority (the T), Denton County Transportation Authority (DCTA), and other public- and private-sector organizations are historical partners in this effort.

An essential tool used within the ETR Program is TryParkingIt.com, the regional commuter tracking and ride-match system. The Website enables commuters to locate carpool and vanpool ride matches along with transit and bicycle buddy matches. When commuters enter information about telecommuting or the trips they made using these alternative means, the Website generates a summary of miles saved, trips reduced, and harmful emissions reduced. TryParkingIt.com also helps regional planners develop and evaluate the regional transportation system, allowing them to calculate the mobility and air quality benefits of strategies to reduce vehicle trips.

Employer Trip Reduction Program Policy Guidance

The ETR Program requires strong public support, promotion, and participation to ensure success. Public support is needed to recruit and retain employers, establish Transportation Management Associations, help employers implement programs to reduce trips, and train on-site employee transportation coordinators. The public sector also must collect and maintain data to determine how well the program performs. Leaders in the public sector must develop aggressive programs to reduce trips for their own employees. These programs can provide a model for private industry if they establish targets that go beyond average efforts to reduce trips and monitor effectiveness.

Employers should develop policies that give employees incentives to use carpooling, vanpooling, or transit. For example, if parking management and pricing policies save employers money, they could provide employees with subsidized transit passes or guaranteed ride home programs. Employers should seek to reduce employees’ trips by vehicle by a minimum of 20 percent. Employers can achieve these goals by using policies that change the hours that employees work and provide incentives to use alternative travel modes. Policy TDM3-003 further strengthens these recommendations for employers along the region’s most congested corridors by encouraging large employers to establish and implement an ETR Program. NCTCOG has developed toolkits to help employers develop and implement programs.

Rideshare Programs (Carpooling and Vanpooling)

Ridesharing programs, such as carpooling and vanpooling, are essential TDM strategies. TryParkingIt.com and DFWConnectARide.com help commuters locate carpool matches in the region. TryParkingIt.com is designed for commuters who need to carpool or vanpool regularly. The Website matches commuters who have similar travel routes, travel times, and commute frequency. DFWConnectARide.com is designed for commuters with occasional carpooling needs. It provides real-time ridesharing options to quickly match commuters with others in the area.

While vanpooling and carpooling both seek to increase the number of travelers per vehicle during peak travel periods, carpools usually include 2 to 5 people traveling in a private vehicle, while vanpools consist of 6 to 15 commuters and are typically aimed at commutes of 25 miles or more. The Regional Vanpool Program is currently operated by DART, the DCTA, and the T. By the end of Fiscal Year 2016, nearly 530 vans are expected to be operating as part of this program.

Federal funds for operating costs can help employers and employees participate in vanpools, but these funds should not exceed 50 percent of the operating costs. In recent years, NCTCOG and transportation/transit authorities have contributed funds needed to subsidize vanpool operating costs. The balance of the funds can come from employer subsidies, vanpool rider fares, private grants, advertisers, and other commercial sponsors. Although the Regional Vanpool Program is operated by local transit agencies, opportunities exist for employers, private interest groups, Transportation Management Associations, and commuter groups to organize, fund, and operate vanpools without federal subsidy assistance. Representatives from NCTCOG, local transportation/transit authorities, and private vanpool providers can assist employers and commuters in setting up privately funded vanpool programs.

Vanpool Program Policy Guidance

Public- and private-sector vanpool programs must coordinate to ensure their programs are not overlapping and are operating efficiently. To protect the
region’s air quality, vanpools that use fuel-efficient or low-emitting vehicles or operate in the region’s ozone nonattainment area should be encouraged. Regular performance reporting ensures that subsidies are standardized and service is provided in the appropriate areas.

According to DART, the T, and DCTA, the program can serve nearly 13,245 riders per day and eliminate more than 25,607 vehicle trips per day if it couples marketing and public subsidies for vanpool riders and start-up programs.

**Park-and-Ride Facilities**

Park-and-ride facilities serve as collection areas for commuters transferring to higher-occupancy vehicles. They are often located and designed to serve bus or rail transit, but many are also used by carpoolers and vanpoolers. Park-and-ride facilities can be located near a central business district to serve areas with public transit and pedestrians or in suburban areas to collect riders near the origin of their trips. Combined with HOV/managed lanes, park-and-ride facilities can be an effective incentive for increasing vehicle occupancy, thus reducing congestion and vehicle emissions.

Existing, planned, and candidate park-and-ride facilities are provided in Exhibit 5-1. While many park-and-ride facilities exist in areas served by transit, other facilities are planned for counties in the nonattainment area that are not currently served by transit authorities. Federal and local funding has been identified for several projects occurring outside of areas served by transit. The development of park-and-ride facilities in Hood, Hunt, and Wise counties may also be evaluated.

Even after considering the impact of new rail and roadway facilities expected to be constructed by 2040, the region will need 46 park-and-ride facilities in addition to the existing sites. These additional park-and-ride sites would serve 17,850 commuters. Technical studies, forecasted congestion levels, transit service planning and simulations, and local government initiatives are the main tools used to identify candidate park-and-ride facilities. Inventories and costs associated with the existing, planned, and candidate park-and-ride facilities are provided in Appendix D.

**Transportation Management Associations**

Transportation Management Associations (TMA), also known as Transportation Management Organizations, are private and public-private organizations that implement strategies to mitigate congestion and work together on local transportation issues. Many are incorporated non-profit organizations. They frequently are membership organizations composed of employers, developers, building owners, and local government representatives. Most TMAs are located in areas of dense employment and focus on the TDM programs of public and private employers.

The principal role of a TMA is to involve the business community in transportation planning and to provide a forum for the private sector to impact strategy development and implementation. TMAs can be involved in the following activities:

- Advocacy on transit, roadway, bicycle, pedestrian, land use, and air quality issues
• Transit pass subsidy or voucher programs
• Shuttles or vanpools for employees, customers, or both
• Ride-matching services and support for carpools and vanpools
• Parking management programs
• Guaranteed or emergency ride home programs
• Telecommuting/teleconferencing center(s) operation
• Employee transportation coordinator training
• Promotional programs and incentives for alternative travel modes
• Educational programs

TMAs seeking to increase their influence on mobility and accessibility can take advantage of future rail and roadway options and partner with transportation or transit authorities and agencies. Two TMAs currently operate within North Central Texas. The Central Dallas Association operates a TMA in the Dallas central business district, and Downtown Fort Worth, Inc. functions as the TMA for the Fort Worth central business district. A proposed third TMA has been funded in conjunction with the Greater Irving/Las Colinas Chamber of Commerce. Candidate TMA locations have also been recommended through corridor and feasibility studies. These locations have been identified based on employment densities in future years and the location and magnitude of traffic congestion. Candidate locations can be further evaluated during the environmental process. Existing and candidate TMA service areas are listed in Appendix D.

Transportation Management Associations Policy Guidance

Transportation Management Associations requesting start-up funds from the Regional Transportation Council must provide a written business plan to access funding for two years. After the first two years, only primary and secondary transportation services are eligible for funding. Primary services reduce drive-alone or peak-period travel by either providing Travel Demand Management services directly or by promoting the use of alternative travel modes. Secondary transportation services provide information on TDM program options and advocate for alternative travel modes.

Environmental Justice

Environmental Justice is taken into account in TDM strategies. Many park-and-ride facilities are located in and around areas that have large populations of people in protected classes and that provide the public with alternatives to driving alone. DART, the T, and DCTA operate regional vanpool programs that offer vanpool services in Environmental Justice protected class areas.

Summary

Travelers affect mobility, accessibility, and air quality by choosing when and how they travel. The importance of TDM strategies cannot be overstated. By reducing the number of people driving alone (demand), the capacity of the transportation system (supply) is more efficiently utilized. Mobility 2040 recommends a set of low-cost, quick-implementation options that complement the transportation system recommendations.

Changes in technology, the workplace, business travel, and personal travel will improve the effectiveness of TDM strategies. Future updates to the Metropolitan Transportation Plan will revise existing strategies and add new and innovative approaches.

All Travel Demand Management policies, programs, projects, and maps are provided in Appendix D.
TRANSPORTATION SYSTEM MANAGEMENT

Transportation System Management strategies, also known as Transportation System Management and Operations (TSMO), seek to identify and implement cost-effective strategies to mitigate congestion and improve traffic flow, safety, system reliability, and capacity. Compared with major improvements to capacity and infrastructure, management and operational projects are usually low-cost improvements that can be implemented or constructed quickly with minimal physical changes to the transportation network.

TSMO projects should be recommended and implemented during the planning, engineering, construction, and operation of corridors. Corridor studies help refine transportation recommendations by providing detailed analyses of travel characteristics and inventories of transportation infrastructure. Corridor studies offer an excellent opportunity to study the feasibility and implementation of TSMO projects in a transportation corridor. TSMO projects should be recommended as part of a comprehensive strategy to improve transportation infrastructure in a corridor and improve traffic flow on arterials and local streets. No corridor study should be approved without the proper consideration of TSMO and TDM strategies. Agencies that implement such projects should seek applicable funding sources for the recommended projects and programs.

TSMO strategies also include Intelligent Transportation Systems strategies, which seek to integrate advanced communications technologies, transportation infrastructure, and vehicles. Intelligent Transportation Systems covers a broad range of wireless, wire line, and electronics technologies to improve travel conditions and the reliability of the transportation system. North Central Texas is exploring new strategies that employ cutting-edge technology and innovative operating concepts that expand TSMO capabilities. One of the strategies is to implement Connected Vehicle capabilities in the region. The core of the Connected Vehicle platform is the communications network which addresses safety, traffic management, and traveler information by enabling vehicle-to-infrastructure and vehicle-to-vehicle communication.

Mobility 2040 supports the following Transportation System Management and Operations strategies to reduce recurring and nonrecurring congestion in North Central Texas:

- Capacity Investments Program
- Technology Investments Program
- Emerging Technology Investments Program

Implementing capacity and technology investment projects improves safety and decreases travel time. This reduces emissions from vehicles and improves air quality. Identifying and eliminating bottleneck locations along the roadway system also reduces congestion. Managing incidents effectively reduces incident clearance time, which improves system reliability. Data from these types of projects will be aggregated and analyzed to develop performance measures to prioritize project investments at the regional level.

Transportation System Management and Operations Policies and Programs

Mobility 2040 supports the following Transportation System Management and Operations policies:

- **TSMO3-001**: Installation of pedestrian facilities by local agencies as part of intersection improvement and traffic signal improvement programs shall provide access to usable walkways or sidewalks.

- **TSMO3-002**: Require regional partners to coordinate during major special events or planned events to ensure minimal impact on the transportation system for individuals traveling to an event or through an event zone.
TSMO3-003: Require regional partners to coordinate with the US Department of Transportation on Connected Vehicle development and identify new Transportation System Management and Operations technologies that can be considered for deployment.

TSMO3-004: Priority funding consideration will be given to projects that meet the regional Intelligent Transportation Systems deployment initiatives as outlined in the Dallas-Fort Worth Regional Intelligent Transportation Systems Architecture.

TSMO3-005: Intelligent Transportation Systems projects must be consistent with the architecture and standards described in the Dallas-Fort Worth Regional Intelligent Transportation Systems Architecture.

TSMO3-006: Encourage, evaluate, and deploy new energy-efficient, low-cost technologies for Intelligent Transportation Systems and Transportation System Management projects.

TSMO3-007: Integrate all traffic operations systems between public sector entities, including sharing of data and videos.

TSMO3-008: Coordinate and share best practices to prevent copper wire theft supporting the operations and illumination of transportation infrastructure.

Mobility 2040 supports the following Transportation System Management and Operations programs:

TSMO2-001: Intersection Improvement Program
TSMO2-002: Signal Improvement Program
TSMO2-003: Bottleneck Improvement Program
TSMO2-004: Special Events Management Program
TSMO2-005: Bottleneck Program for Regional Corridors
TSMO2-006: Intelligent Transportation Systems Implementation Program
TSMO2-007: Regional Intelligent Transportation Systems Architecture Program
TSMO2-008: Advanced Traveler Information System Implementation Program

TSMO2-009: Advanced Traffic Management System Implementation Program
TSMO2-0010: Advanced Public Transportation System Implementation Program
TSMO2-0011: Intelligent Transportation Systems Interoperability Program

**Capacity Investments Program**

The Capacity Investments Program strategically expands the transportation system’s capacity at bottlenecks and intersections, reducing or eliminating the need for new and expensive transportation infrastructure. Examples of projects that fall under this program are restriping, roundabouts, grade separation, and the addition of turning lanes. The following capacity investment strategies have been implemented in North Central Texas to reduce recurring and nonrecurring congestion:

- Intersection improvements
- Freeway and arterial bottleneck improvements
- Shoulder utilization during peak period

**Intersection Improvements**

Arterials provide the link between local streets and major roadways, in addition to providing access to a variety of destinations. On an arterial system, intersections are points of traffic conflict between drivers, pedestrians, and bicyclists. Infrastructure improvements such as turning lanes, grade separations, pavement striping, signage and lighting, bus turnouts, and channelization of traffic can greatly improve traffic flow on arterials. Ramps that comply with the Americans with Disabilities Act provide access to useable walkways. Local agencies can install these ramps during projects to improve intersections.

More than 80 intersection projects are funded under the 2015-2018 Transportation Improvement Program. These projects include the installation of traffic control devices, construction of roundabouts, traffic channelization, grade separations, and the addition of turning lanes. The cost of implementing these improvements through 2040 is estimated to be $1.8 billion.
Freeway and Arterial Bottleneck Removal

Strategies to remove bottlenecks are low-cost, quick-implementation solutions to improve locations of isolated congestion. These types of strategies include:

- Adding travel lanes
- Restriping merging or diverging areas
- Reducing lane or shoulder widths to add a travel and/or auxiliary lane
- Providing bypass routes
- Modifying weave patterns
- Metering or closing entrance ramps
- Improving traffic signal timing on arterials
- Implementing HOV/managed lanes

Regional transportation providers coordinate with local governments to identify and mitigate bottlenecks. Corridor studies and subregional traffic management teams are forums to identify potential bottleneck locations and recommend improvements. The Roadway section in the Mobility Options chapter further discusses the Bottleneck Improvement Program on roadways.

In addition to these strategies, ways to innovatively manage traffic are being pursued in the region to alleviate bottlenecks. These approaches may include:

- Temporary use of shoulder lanes during peak periods to add additional capacity.
- Extending smooth traffic flow and the duration of efficient travel.
- Queue warning to inform drivers of the reason for slower speeds.
- Employ a series of advance signs that would be activated to advise drivers to use both lanes to the merge point when congestion is detected to prevent conflicts at merge point.

While these approaches, coupled with TDM strategies, can maximize person throughput on the transportation system, larger-scale projects may be required to address bottlenecks that result from roadway design that decreases travel speed and increases the potential for traffic accidents. The Bottleneck Improvement Program can improve travel conditions and safety by identifying and eliminating problems in roadway design such as insufficient acceleration and deceleration lanes and ramps, sharp horizontal and vertical curves, or narrow lanes and shoulders.

While corridors are undergoing reconstruction, the design phase of each project needs to address the identified bottlenecks. Additional bottleneck locations will be considered as corridors are reconstructed to provide better transitions from current to future projects and to allow for early implementation of larger corridor projects. Work to improve the corridor will be monitored to identify congestion points at the corridor limits. All projects to remove bottlenecks will incorporate or transition into the larger permanent facility to reduce overall cost. This approach will help minimize the number of congestion points or bottlenecks in the short term and support the long-term build out of the transportation system.

The Bottleneck Improvement Program is estimated to cost $300 million through 2040. Additional funding to support the bottleneck program will be available as part of the roadway infrastructure budget. These programs will improve the level of service on roadways and parallel arterials.

Shoulder Utilization during Peak Period

Allowing non-emergency vehicles to use shoulders for travel during peak periods is a strategy to manage congestion that is typically deployed in conjunction with complementary strategies. These may include variable speed limits and ramp metering to address capacity bottlenecks on segments of the freeway network. Shoulder utilization provides additional capacity at critical locations during times of recurrent congestion and reduced speeds without constructing additional pavement. Traffic signs indicate to drivers when they may drive on shoulders, and signs or overhead lane messages display the speed limit. Temporary use of shoulders is generally only permitted when vehicles are traveling below posted speeds.

Commercial Vehicle Operations

TSMO improves the efficiency and safety of freight operations. Please refer to the Freight section of the Mobility Options chapter for additional information.

Source: www.NCPA.org
Technology Investments Program

Automated systems and other technological strategies are used to optimize the free flow of traffic. Signal optimization, a technological strategy, improves the operation, maintenance, timing, and locations of traffic signals to promote smoother traffic flow. Ramp metering is a congestion mitigation method that controls the rate of vehicles entering freeways, reducing mainlane congestion near entrance ramps, and discouraging short trips on freeways in congested locations. Technology investment strategies implemented in North Central Texas to reduce recurring and nonrecurring congestion include:

- Regional Intelligent Transportation Systems Architecture and Strategic Intelligent Transportation Systems Deployment Plan
- 511 and traveler information
- Arterial management
- Freeway management
- Transit management
- Other management solutions

Regional Intelligent Transportation Systems Architecture and Strategic Intelligent Transportation Systems Deployment Plan

The Regional Intelligent Transportation Systems (ITS) Architecture guides the use of ITS and builds regional consensus for integrating the systems of multiple agencies in the Metropolitan Planning Area. ITS projects funded through the Highway Trust Fund must be consistent with the National/Regional ITS Architecture and applicable standards, and they must incorporate the systems engineering process. Regional ITS Architecture must include the following:

- A description of the region
- Identification of participating agencies and stakeholders
- Identification of the roles and responsibilities of participating agencies and stakeholders
- New and existing agreements required for operations affecting ITS project interoperability, utilization of ITS-related standards, and the operation of the projects identified in the Regional ITS Architecture
- System functional requirements
- System interface requirements
- Identification of ITS standards supporting regional and national interoperability
- A sequence of projects, or Strategic ITS Deployment Plan

The Regional ITS Architecture was developed based on the corresponding transportation services identified by the regional stakeholders. The North Texas Regional ITS Architecture (http://www.nctcog.org/trans/its/RegITSArch/index.asp) expands upon the efforts associated with the use of Intelligent Transportation Systems in North Central Texas.

Subregional ITS plans also have been developed to identify projects, corridors, and systems where the use of ITS is a priority. The criteria for developing subregional ITS include:

- Filling gaps in the existing ITS communications infrastructure by completing critical system linkages.
- Leveraging transportation resources by targeting investment, where possible, to facilities undergoing reconstruction.
- Leveraging transportation resources by creating or enhancing public-private partnerships that will provide communications infrastructure for Regional ITS Architecture.

511 and Traveler Information

The US 75 Integrated Corridor Management project has deployed the first 511 system in Texas. As part of the cooperation between North Central Texas agencies led by DART, the 511DFW system utilizes the 511 dial code in the region’s counties that are in air quality nonattainment. The 511DFW system’s public Website (511dfw.org) provides personalized travel information via the My511 link and the Transit Trip Planner link. Users who have created an account online also can access 511DFW by phone.

Many public and private sources in the region contribute information to 511DFW. Traffic and Transportation Management Centers monitor and provide
information on traffic conditions. Staff at these centers receive information on highway conditions from police and transportation officials, motorist assistance patrol drivers, 911 calls, construction crews, traffic cameras, and roadway sensors.

A related project may provide improved information via radio on weather conditions, road closures, or construction on key highways.

**Arterial Management**

Traffic signals at intersections are an effective means to control the movement of traffic, bicycles, and pedestrians on arterial streets. Older traffic signals and traffic signal plans become outdated if they cannot be adapted to changes in vehicular, bicycle, and pedestrian traffic or cannot accommodate more sophisticated traffic signal plans.

Advances in communication and information technology over the past decade have provided tools for traffic engineers to manage signal systems more efficiently and effectively. Improved signal timing plans and computerized traffic signals that allow signals to communicate with other intersections can enhance traffic flow on arterial streets. Traffic operations engineers located at a Traffic Management Center can respond in real time when signals are connected to a centralized control center.

Such coordinated systems have several advantages over signals with fixed-time systems. They can monitor traffic conditions and implement timing plans that best serve current traffic needs. They can respond to recurring congestion and to nonrecurring congestion caused by accidents, weather conditions, special events, or fluctuating traffic volumes.

Wireless communication between multiple vehicles and between vehicles and transportation infrastructure may have broad implications for how traffic signals are controlled in the future. Known as Dedicated Short Range Communications, this new strategy to control traffic signals would be able to use data from in-vehicle diagnostic sensors instead of relying on methods that detect traffic in static locations, such as video and in-pavement loop detectors. The new wireless system would provide a more complete picture of traffic situations, adding data on vehicle speeds, positions, arrival rates, rates of acceleration and deceleration, queue lengths, and stopped time. The Federal Highway Administration has established a goal for 25 percent of signals to be connected via Dedicated Short Range Communications by 2025 and 80 percent by 2040.

More than 1,000 improvements to traffic signals are currently funded in the 2015-2018 Transportation Improvement Program. These projects include signal timing optimization, signal equipment upgrades, system interconnection, and adaptive systems. Additionally, the Transportation Improvement Program requires the use of light-emitting diode lamps in all new and replacement traffic signal projects. The cost of implementing these traffic signal improvements by the year 2040 is estimated to be $800 million. As advances in technology are made, ITS technology can increasingly be incorporated into traffic signal improvements, further decreasing travel times. ITS also should reduce vehicle emissions because improved traffic signal operation reduces delays, braking and acceleration, and idling vehicles at intersections.

**Freeway Management**

Freeway management systems use strategies and technologies to monitor, control, and manage freeway traffic, providing more efficient operations. Available strategies and technologies include:

- Incident management
- Transportation management during construction
- Surveillance and detection (vehicle speed and count detectors, weather and environmental detection, over-height vehicle detection, automatic truck warning system, closed circuit television
- Traveler information systems (dynamic message signs, lane-use control signals, highway advisory radio, telephone, in-vehicle systems) and other communications (television, radio, other media, and social media)
- Ramp and lane control (ramp metering, ramp closure), freeway mainline metering, freeway-to-freeway ramp metering, reversible lane control,
variable speed control, and priority control for high-occupancy vehicles (priority access control, HOV facilities)

Freeway management typically links a freeway or Transportation Management Center to other ITS components in the region. Freeways in North Central Texas are operated by two Texas Department of Transportation Freeway Management Centers and multiple toll road operators. The Freeway Management Centers coordinate with several local jurisdictions to manage congestion on mainlanes, frontage roads, and arterials. Personnel electronically monitor traffic conditions using closed-circuit television and vehicle sensors. They also receive information from emergency responders and drivers using cell phones or social media. Personnel coordinate responses with intra-agency and interagency resources, including those that respond to emergencies.

Transit Management

Transit Management Centers will serve as communications hubs for the T, DART, and the DCTA, and the centers will be integrated with others operated by state and local governments. Security systems and technology that automatically locates vehicles, collects fares, and prioritizes traffic signals will provide better service and safety for transit users. A more personalized public transportation system will allow for flexible routing and service that responds to user demand. More advanced technology will allow transit operators to monitor traffic conditions for multiple modes of travel, including supporting special events and the operation of managed facilities.

Mobility 2040 recommends the region develop an Advanced Public Transportation System that would improve the operation, convenience, and safety of the public transit system. The region should consider emerging technologies such as wireless detection systems and Connected Vehicle. The region will invest in the following systems:

- Tools that enable bus and rail operators to maximize resources
- Technology that allows public transit operators to automatically track and dispatch vehicles through a Global Positioning System
- Automated safety controls, such as Positive Train Control, for heavy rail services
- Critical safety systems for light rail

Other Management Solutions

Work Zone Management

Construction disrupts travel patterns, frequently affecting roadway capacity. Work zones are more likely than other locations to be the site of traffic accidents. Strategies to manage traffic in work zones should be based on the project constraints, construction phasing/staging plan, type of work zone, and anticipated impacts of the work zone. To ensure they effectively mitigate impacts, strategies need to be consistently monitored and coordinated. Strategies that mitigate the impact construction has on capacity include improving alternate routes of travel, providing temporary facilities, staging work to occur during off-peak hours, and providing additional enforcement and advance information to travelers. Proper signage, safety devices, and lighting are necessary to ensure the safety of travelers and work crews.

Special Events Management

North Central Texas is home to major professional, collegiate, and amateur sporting teams and events. The region also hosts cultural and social activities such as street festivals, fairs, celebrations, and parades. Several major recreational facilities in urban and rural parts of the region host multiple events each year. These events present special challenges to surrounding transportation systems and services. Inclement weather magnifies the impact of these events.

Work groups plan for the traffic created by these events; applicable transit options also are used.
Several factors affect how the transportation system performs during special events:

- Time and duration of the event
- Transportation system capacity
- Availability of parking
- Number of participants and spectators
- Transportation mode options
- Weather conditions
- Surface conditions
- Amount and type of event information available to drivers

Regional coordination during special events can increase the efficiency of transportation systems, mitigating the effect of the event. A detailed inventory of special events is maintained and identifies primary and secondary transportation impacts, including their magnitude and duration. Following special events, their impact on transportation and the success of efforts to mitigate those impacts should be documented.

Several strategies can minimize traffic disruption caused by special events and enhance mobility. Managing traffic through the use of advanced traffic management systems, parking and lane assignment controls, and customized signal timing plans is essential. In addition, three special event practices are recommended:

- Coordination between regional partners during major events to ensure minimal impact on the transportation system.
- Input from regional partners within the event zone to ensure agencies don’t schedule construction during major events.
- HOV/managed lanes paid for by organizers of major events.

Other strategies can improve travel during special events, including information provided to travelers before and during their trips, transit and other high-occupancy modes that reduce demand on the transportation system, and advanced planning to manage incidents. The latter is important because an incident that occurs when demand on the transportation system is already near or exceeding capacity has a far greater impact than one that occurs during low traffic volumes. See the Transportation System Safety section in this document for more information on freeway incident management.

### Copper Theft

Copper theft has become an increasingly expensive issue for the past several years. The removal of copper wiring from the roadside damages devices and fiber-optic cabling in the process. This reduces nighttime visibility and causes device and communication failure, resulting in significant costs to replace equipment. Various strategies are being considered to protect the resources and prevent recurrence of theft and vandalism.

### Emerging Technology Investment Program

The region is evaluating innovative transportation technologies that could reduce costs and traffic congestion, enhance safety, and increase economic productivity. Emerging technologies have the potential to limit the frequency and severity of crashes and to enhance mobility for North Central Texas residents while spurring economic growth. They also can reduce fuel wasted when commuters drive on congested roadways.

These technologies include Connected Vehicle, autonomous vehicles, in-vehicle signage and warnings, open-road tolling, cloud computing, and crowdsourcing.

### Connected Vehicle

Connected Vehicle technologies use wireless communication to connect vehicles with one another and the surrounding infrastructure, such as cell towers or roadside communication equipment. This connectivity is classified into three types: 1) vehicle-to-vehicle, 2) vehicle-to-infrastructure, and 3) vehicle-to-others (including personal devices, bicyclists, and pedestrians). Connected Vehicle technologies allow secure, interoperable, networked wireless communications between vehicles, the roadway infrastructure, and personal communication devices. The devices collect and share data about important safety and mobility information such as vehicle position, speed, size, traffic signal information, and weather conditions. Connected Vehicle technologies create a collective intelligence that could enable
safety, mobility, and environmental solutions to help save lives, prevent injuries, reduce traffic congestion, and decrease emissions.

**Autonomous Vehicle**

Autonomous vehicles use radar, Global Positioning System, image recognition, or computer vision to navigate their environment with limited to no input from humans. This technology could improve reliability and reaction time, reducing traffic collisions; lead to smarter and greener driving and navigation; require less urban land for parking due to autonomous parking capabilities; and increase access to travel by occupants who face obstacles due to age or physical impairment.

**Cloud Computing/Crowdsourcing**

Cloud computing and crowdsourcing can be combined to enhance data services for transportation. Cloud computing makes information technology, infrastructure, platforms, and software available on the Internet and allows end users to remotely access high-powered computing resources through broadband connections. Crowdsourcing allows for rapid automatic collection of information from users of the system. Advanced data analytics using these instruments could improve system management, organizational efficiency, and public communication.

**In-Vehicle Signage and Warnings**

Roadside units mounted on traffic signs at key points along the roadway send messages to approaching vehicles, informing drivers about potentially dangerous conditions.

**Open-Road Tolling**

In an open-road tolling system, the toll operator collects tolls without using booths. Instead, drivers equip their cars with transponders or other readable devices connected to a credit card or payment account. Open-road systems also can use license plate recognition technology to invoice those without readable devices. By eliminating the need to stop to pay tolls, open-road tolling leads to better traffic flow, faster travel times, reduced congestion, and lower emissions.

**Environmental Justice**

Environmental Justice was considered while evaluating improvements to traffic signals and intersections and the use of ITS. The analysis reviewed TSMO projects in areas determined to have a high concentration of protected class populations. The analysis compared the total number of centerline miles with TSMO to the total number of centerline miles adjacent to a protected class population. In addition to safety, mobility, and air quality, Environmental Justice will be a criteria when TSMO projects are selected in the future.

**Summary**

Capital costs for Intelligent Transportation Systems and Transportation System Management and Operations strategies are estimated at $2 billion and $1 billion, respectively. Operating costs for ITS are anticipated to be $700,000 per year when the system is fully implemented. TSMO and ITS should reduce recurrent traffic congestion by approximately 59,000 and 460,107 person hours per day regionally, respectively. The strategies should reduce non-recurrent traffic congestion by approximately 794,098 person hours per day regionally. ITS and TSMO also will reduce air pollution, the amount of fuel used, and the cost of maintaining the transportation system. They also will create safer streets and highways.
The Transportation System Safety Program focuses on improving traffic safety throughout the region for all users by supporting and coordinating planning efforts to develop safety policies, programs, and projects. The four Es of transportation safety – engineering, enforcement, education, and emergency response – continue to be integral components to improving the safety of the regional transportation system:

- **Engineering**: Highway design, traffic, maintenance, operations, and planning professionals
- **Enforcement**: State and local law enforcement agencies
- **Education**: Prevention specialists, communication professionals, educators, and citizen advocacy groups
- **Emergency Response**: First responders, paramedics, fire, and rescue

The safety program also supports the Toward Zero Deaths (TZD) vision, a national strategy on highway safety that provides a framework for traffic safety planning efforts. The vision focuses on eliminating fatalities and serious injuries across all modes of travel; in essence, even one death on the transportation system is unacceptable. TZD emphasizes areas for improvement and utilizes proven countermeasures that integrate the four Es of Transportation Safety. The state of Texas also supports the TZD strategy and aims to achieve a consistent reduction in fatalities from year to year until the goal is reached. As highlighted in the 2014 Texas Strategic Highway Safety Plan, when an increase occurs, the goal is for the increase to be less than or equal to two percent, or to be better than the national percent change in fatalities.

Because safety planning is a multidisciplinary effort and human behavior is a major factor in traffic safety, improvements that reduce roadway crashes, fatalities, and injuries include a diverse set of activities implemented by a variety of stakeholders, including transportation professionals, enforcement agencies, educators, and the emergency response community. The Transportation System Safety Program involves these stakeholders and regional partners in creating a safer transportation system through three core concepts:

- Data analysis and information system development
- Safety planning and implementation efforts
- Safety education and training efforts

**Transportation System Safety Policies and Programs**

The safety policies that Mobility 2040 supports include:

- **TSSF3-001**: Require implementation of safety strategies in work zones consistent with industry best practices.
- **TSSF3-002**: Develop safety information partnerships with the Texas Department of Transportation, local governments, local police departments, and other organizations to encourage the sharing of regional/jurisdictional safety data (including, but not limited to, crash data, red light camera data, and incident response and clearance time data).
- **TSSF3-003**: Implementation of programs, projects, and policies that assist in reducing fatalities across all modes of travel toward zero deaths. (Toward Zero Deaths – no fatalities across all modes of travel)
- **TSSF3-004**: Implementation of roadway improvement strategies that assist in reducing wrong-way driving incidents consistent with regional and/or industry best practices.
- **TSSF3-005**: Implementation of low-cost, systemic intersection safety countermeasures that assist in reducing severe intersection crashes consistent with strategies outlined in the *Intersection Safety Implementation Plan for North Central Texas*.
- **TSSF3-006**: Mandatory passage of a jurisdictional incident management policy that is modeled after *Regional Transportation Council Resolution R08-10*, which
is a resolution supporting a comprehensive, coordinated, interagency approach to freeway incident management in the North Central Texas region.

Mobility 2040 supports the following Transportation System Safety programs:

TSSF2-001: Freeway Incident Management Program
TSSF2-002: Regional Mobility Assistance Patrol Program
TSSF2-003: Regional Safety Information System
TSSF2-004: Safety Education and Training Program
TSSF2-005: Crash Causal Road Factors Program

All safety policies, programs, projects, and maps are provided in Appendix D.

Data Analysis and Information System Development

Problem identification is the first step in effective transportation safety planning. As a result, identifying, collecting, and analyzing crash, fatality, and other safety data is important to improving transportation safety in North Central Texas. The safety program coordinates with the Texas Department of Transportation, local governments, local police departments, the Texas A&M Transportation Institute, and other organizations to collect and analyze the data needed throughout the safety planning process.

The safety program utilizes crash data to:
- Identify high-crash locations, intersections, or hot spots
- Determine types and severity of crashes
- Identify contributing factors for serious injury and fatality crashes
- Develop county, regional, and corridor-level crash rates for limited-access facilities

Regional Safety Information System

The Regional Safety Information System (RSIS) is a centralized database for traffic crash information in the North Central Texas region. Data from the Texas Department of Transportation’s Crash Record Information System, the National Highway Traffic Safety Administration Fatality Analysis Reporting System, and the National Response Center are used by NCTCOG to analyze, map, and report performance measures through RSIS. Information from RSIS is used to identify locations with high crash occurrences, analyze crash rates, and evaluate analyses of factors that contribute to regional crashes. RSIS also provides the ability to determine the most prevalent types of fatal, injury, and non-injury crashes by type of roadway and to identify locations with above-average crash histories. RSIS is used to analyze crashes for the three main categories of regional transportation system users: 1) motor vehicles, 2) freight carriers, and 3) active transportation users.

Motor Vehicle Crash Analysis

In 2014, the NCTCOG Metropolitan Planning Area experienced 104,289 crashes; 16,548 resulted in serious injuries and 543 resulted in a fatality. Through RSIS, NCTCOG calculates regional- and county-level crash rates on limited-access facilities. Maps that compare county-level crash rates to the regional crash rate are developed annually. Exhibit 5-2 shows the county-level crash rates for North Central Texas in 2014. Counties that have a crash rate higher than the regional rate are shown in red, while counties with a rate below the regional rate are shown in green.

Freight Carriers Crash Analysis – Hazardous Materials

North Central Texas represents one of the nation’s largest inland ports that transports freight to destinations across the state and around the world. The region experiences traffic associated not just with moving commercial products and goods, but also with trucks associated with the natural gas industry. As a result, safety issues are one of the most significant truck transportation issues within the region. RSIS also is used to evaluate and map hazardous material spills on regional limited-access facilities utilizing data from the National Response Center. This analysis helps identify possible roadway segments that are especially affected by hazardous materials carriers. The HazMat Mobile Incident Locations Map for 2011 to 2014 is included in Appendix D.

Active Transportation Crash Analysis

Active transportation users, or bicyclists and pedestrians, are a growing segment of the regional transportation system. Over the past decade, the Federal Highway Administration (FHWA) has worked to aggressively reduce pedestrian deaths by focusing extra resources on the states and cities with the highest pedestrian fatalities and/or fatality rates. FHWA has designated Texas, Dallas, and Fort Worth as areas with a high number of pedestrian fatalities resulting from crashes with motor vehicles, and the agency has called on these areas to emphasize
pedestrian safety efforts. Cities receive the Focus Cities designation if they are among the top 20 cities for number of bicycle and pedestrian fatalities or if their bicycle and pedestrian fatality rate per population is greater than the average of the top 50 cities. Focus Cities are provided with additional training and educational resources to improve safety for both pedestrians and bicyclists.

**Exhibit 5-2: 2014 County-Level Crash Rate Map**

Between 2010 and 2014, 5,997 pedestrian crashes; 2,426 bicycle crashes; and 528 bicycle and pedestrian fatalities were reported in North Central Texas. **Exhibit 5-3** identifies the density of pedestrian and bicycle crashes within the region.

Bicycle and pedestrian crashes in the region are generally clustered near central business districts, along major arterial roadways, and near other business or employment centers. Twenty-four percent of all bicycle and pedestrian crashes in the region occurred on state highways (on-system roadways) and represented 61 percent of all bicycle and pedestrian fatalities. **Exhibit 5-4** identifies the number of reported crashes and fatalities by county and identifies whether they occurred on on-system or off-system roadways.
Exhibit 5-4: 2010 to 2014 Pedestrian and Bicycle Crashes and Fatalities in the 12-County North Central Texas Region

<table>
<thead>
<tr>
<th>County</th>
<th>Roadway</th>
<th>Number of crashes</th>
<th>Number of fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collin</td>
<td>Off-System</td>
<td>534</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>95</td>
<td>12</td>
</tr>
<tr>
<td>Dallas</td>
<td>Off-System</td>
<td>3318</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>1011</td>
<td>162</td>
</tr>
<tr>
<td>Denton</td>
<td>Off-System</td>
<td>431</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>Ellis</td>
<td>Off-System</td>
<td>48</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>42</td>
<td>9</td>
</tr>
<tr>
<td>Hood</td>
<td>Off-System</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Hunt</td>
<td>Off-System</td>
<td>29</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>Johnson</td>
<td>Off-System</td>
<td>66</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>Kaufman</td>
<td>Off-System</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Parker</td>
<td>Off-System</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Rockwall</td>
<td>Off-System</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Tarrant</td>
<td>Off-System</td>
<td>1797</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>616</td>
<td>94</td>
</tr>
<tr>
<td>Wise</td>
<td>Off-System</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>All Counties</td>
<td>Off-System</td>
<td>6,310 (76%)</td>
<td>202 (39%)</td>
</tr>
<tr>
<td></td>
<td>On-System</td>
<td>1,978 (24%)</td>
<td>317 (61%)</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td><strong>8,288 (100%)</strong></td>
<td><strong>519 (100%)</strong></td>
</tr>
</tbody>
</table>

Safety Planning and Implementation Efforts

Safety planning efforts include advancing initiatives to preserve, maintain, and improve transportation safety in North Central Texas and developing region-appropriate countermeasures that address crash types and locations. Mobility 2040 includes safety policies and programs that directly impact the safety of the transportation system for all users, encourage the implementation of safety countermeasures and strategies that reduce wrong-way driving incidents, and decrease the number of severe injuries and fatalities on the transportation system. Many of these strategies can be incorporated into roadway improvements as a standard practice.

To garner input and feedback from regional partners, NCTCOG hosts and coordinates safety-related committees and working groups. The Regional Safety Advisory Committee helps develop regional safety policies, programs, procedures, projects, and activities that improve traffic safety throughout the region. The Regional Safety Advisory Committee also provides technical expertise and public outreach support, and the committee reviews regional safety planning and helps select safety projects funded by the Regional Transportation Council and NCTCOG’s Executive Board. Exhibit 5-5 is a summary of safety-related committees and working groups hosted and coordinated by NCTCOG.

NCTCOG and its safety partners have developed three strategies to improve systemic safety at intersections, address safety in work zones, and reduce wrong-way driving occurrences. More information on each strategy is included in Exhibit 5-6.
Exhibit 5-5: Regional Safety Committees and Working Groups

<table>
<thead>
<tr>
<th>Safety Group</th>
<th>Members</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Safety Advisory Committee</td>
<td>Transportation professionals, Texas Department of Transportation, law enforcement agencies, researchers</td>
<td>Help develop regional safety policies, programs, projects, and activities.</td>
</tr>
<tr>
<td>Work Zone Safety</td>
<td>Transportation professionals</td>
<td>Investigate the use and effectiveness of strategies to reduce the number of fatalities and injuries in work zones; implement effective strategies to improve work zone safety; and integrate safety into the construction process.</td>
</tr>
<tr>
<td>Wrong Way Driving</td>
<td>Transportation professionals, researchers</td>
<td>Investigate and recommend strategies that assist in reducing wrong-way driving incidents.</td>
</tr>
<tr>
<td>Mobility Assistance Patrols</td>
<td>Transportation professionals, North Texas Tollway Authority, Texas Department of Transportation, police, mobility assistance patrol representatives</td>
<td>Evaluate progress and effectiveness of program and maintain/develop routes.</td>
</tr>
<tr>
<td>Incident Management Performance</td>
<td>Transportation professionals, emergency responders</td>
<td>Develop consistent definitions for incident management performance measures; participate in annual Traffic Incident Management Self-Assessment.</td>
</tr>
<tr>
<td>Commercial Vehicle Enforcement</td>
<td>Transportation professionals, law enforcement agencies</td>
<td>Develop equipment and training programs that assist in effective commercial vehicle enforcement and create a data exchange system that allows enforcement agencies to view violations between agencies.</td>
</tr>
</tbody>
</table>

Exhibit 5-6: Regional Safety Committees and Working Groups Strategies

<table>
<thead>
<tr>
<th>Improvement Strategy</th>
<th>Development Partners</th>
<th>Final Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCTCOG Intersection Safety Implementation Plan</td>
<td>Regional Safety Advisory Committee, FHWA</td>
<td>List of low-cost, systemic intersection safety countermeasures for urban signalized intersections.</td>
</tr>
<tr>
<td>Work Zone Safety Toolbox</td>
<td>Transportation professionals</td>
<td>List of strategies that can assist in reducing the number of fatalities and injuries in work zones, including the strategies' effectiveness and the contributing factors they affect.</td>
</tr>
<tr>
<td>Wrong-Way Driving Mitigation Plan</td>
<td>Transportation professionals, researchers</td>
<td>Systemic improvements and design plan for diamond interchanges that help reduce wrong-way driving incidents.</td>
</tr>
</tbody>
</table>

FHWA Guidance to Promote Safety Countermeasures

In 2012, FHWA issued the *Guidance Memorandum on Promoting the Implementation of Proven Safety Countermeasures* to reduce fatalities and serious injuries on the nation’s highways. The guidance promotes the latest research to advance countermeasures that have been highly effective in improving safety. Mobility 2040 recommends that the 2012 guidance and future FHWA guidance be considered for federal, state, and local projects in the region.
Intersection Safety Implementation Plan

In 2012, the North Central Texas Council of Governments partnered with the Regional Safety Advisory Committee and FHWA to develop an Intersection Safety Implementation Plan (ISIP) for North Central Texas. The goals of ISIP were to identify intersections with high crash rates and to recommend low-cost, systemic countermeasures that may reduce intersection fatalities. Crash data from 2006 through 2010 was analyzed to locate these intersections. During the five-year analysis period, it was determined that 215,043 out of 510,692 crashes occurred at intersections. Analyzing the top ten percent of intersections with severe crashes revealed that urban signalized intersections were the site of the greatest number of severe crashes. Of the 15,008 intersections analyzed, 1,522 intersections had five or more severe crashes during the five-year period. Exhibit 5-7 highlights the cities with ten or more intersections identified in ISIP.

Exhibit 5-7: Cities with 10 or More Intersections Identified in the Intersection Safety Implementation Plan

<table>
<thead>
<tr>
<th>City</th>
<th>Number of Intersections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallas</td>
<td>346</td>
</tr>
<tr>
<td>Fort Worth</td>
<td>167</td>
</tr>
<tr>
<td>Arlington</td>
<td>116</td>
</tr>
<tr>
<td>Plano</td>
<td>106</td>
</tr>
<tr>
<td>Garland</td>
<td>59</td>
</tr>
<tr>
<td>Richardson</td>
<td>42</td>
</tr>
<tr>
<td>Denton</td>
<td>35</td>
</tr>
<tr>
<td>Grand Prairie</td>
<td>32</td>
</tr>
<tr>
<td>Lewisville</td>
<td>27</td>
</tr>
<tr>
<td>Irving</td>
<td>24</td>
</tr>
<tr>
<td>Mesquite</td>
<td>22</td>
</tr>
<tr>
<td>Frisco</td>
<td>16</td>
</tr>
<tr>
<td>Mansfield</td>
<td>12</td>
</tr>
<tr>
<td>North Richland Hills</td>
<td>12</td>
</tr>
<tr>
<td>Hurst</td>
<td>11</td>
</tr>
<tr>
<td>Grapevine</td>
<td>10</td>
</tr>
<tr>
<td>McKinney</td>
<td>10</td>
</tr>
</tbody>
</table>

ISIP recommended five systemic countermeasures that could assist in reducing severe crashes at these urban signalized intersections:
- Re-time traffic signals for better coordination and for proper red and amber.
- Install one signal head per approach.
- Change permitted and protected/permitted left-turn phasing to protected.
- Improve basic pavement marking and signs.
- Install advanced signs that warn of a signal ahead.

In 2015, the state of Texas partnered with FHWA to develop a statewide ISIP. NCTCOG is also participating in this effort.

Regional Pedestrian Safety Strategic Plan

While mapping bicycle and pedestrian crash locations can reveal hot spots or clusters in the region, it doesn’t identify what actions led to those crashes. Officers who arrive at the crash scene produce reports containing narratives and diagrams that can provide the information needed to determine the actions that led to a crash. FHWA and the Pedestrian and Bicycle Information Center have produced a list of common bicycle and pedestrian crash types with their accompanying diagrams. By coding this information, trends in the causes of crashes can be analyzed.

Mobility 2040 active transportation programs will continue to collect and analyze pedestrian and bicycle crash data, using crash density maps to relate trends in unsafe actions to their physical locations. This will provide a more comprehensive view of the safety issues that need to be addressed. The development of a Regional Pedestrian and Bicycle Safety Strategic Plan will help guide appropriate strategies to reduce the number of crashes and fatalities across the region. The plan also will guide the strategic implementation of proven countermeasures to improve pedestrian and bicycle conditions on all roadways.

Wrong-Way Driving Mitigation Planning

The National Transportation Safety Board identifies wrong-way driving crashes on high-speed divided highways as the most serious type of highway collision. Although wrong-way driving collisions occur less frequently than other crashes, they are more likely to result in fatal and serious injuries than other types of
Operational Efficiency

Exhibit 5-8 summarizes the wrong-way crashes that occurred in the region from 2010 to 2014.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>Wrong-Way Driving Crashes</td>
<td>Wrong-Way Driving Crashes</td>
<td>Wrong-Way Driving Crashes</td>
<td>Wrong-Way Driving Crashes</td>
<td>Wrong-Way Driving Crashes</td>
<td>2010-2014</td>
</tr>
<tr>
<td>Collin</td>
<td>12</td>
<td>19</td>
<td>28</td>
<td>25</td>
<td>28</td>
<td>112</td>
</tr>
<tr>
<td>Dallas</td>
<td>162</td>
<td>166</td>
<td>211</td>
<td>238</td>
<td>253</td>
<td>1030</td>
</tr>
<tr>
<td>Denton</td>
<td>10</td>
<td>21</td>
<td>31</td>
<td>33</td>
<td>45</td>
<td>140</td>
</tr>
<tr>
<td>Ellis</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>10</td>
<td>17</td>
<td>51</td>
</tr>
<tr>
<td>Hood</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>Hunt</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td>Johnson</td>
<td>4</td>
<td>5</td>
<td>16</td>
<td>10</td>
<td>10</td>
<td>51</td>
</tr>
<tr>
<td>Kaufman</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>20</td>
<td>51</td>
</tr>
<tr>
<td>Parker</td>
<td>8</td>
<td>2</td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>57</td>
</tr>
<tr>
<td>Rockwall</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Tarrant</td>
<td>38</td>
<td>65</td>
<td>117</td>
<td>105</td>
<td>116</td>
<td>441</td>
</tr>
<tr>
<td>Wise</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>Totals</td>
<td>257</td>
<td>297</td>
<td>465</td>
<td>473</td>
<td>532</td>
<td>2024</td>
</tr>
</tbody>
</table>

In 2012, NCTCOG began working with the Texas Department of Transportation and local jurisdictions in Dallas County to implement a Wrong-Way Driving Pilot Project. The goal was to prevent wrong-way driving along regional corridors by improving intersections, signage, and/or other countermeasures. The project focused on 350 diamond interchanges which connect streets and highways throughout Dallas County. The pilot project recommended eliminating conflicting lane assignment signs and pavement markings; placing straight arrow markings in extended bays; modifying signage message, size, and location; and making minor traffic signal enhancements such as installing light-emitting diode bulbs and utilizing vertical green arrows instead of the traditional green balls. Work began on many of these intersections in 2014 and is expected to be completed in 2016.

The cities included in this Wrong-Way Driving Pilot Project in Dallas County are listed in Exhibit 5-9.

<table>
<thead>
<tr>
<th>City/Agency</th>
<th>Total Number of Intersections</th>
<th>City/Agency</th>
<th>Total Number of Intersections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrollton</td>
<td>12</td>
<td>Dallas</td>
<td>194</td>
</tr>
<tr>
<td>Farmers Branch</td>
<td>2</td>
<td>Garland</td>
<td>15</td>
</tr>
<tr>
<td>Grand Prairie</td>
<td>25</td>
<td>Irving</td>
<td>38</td>
</tr>
<tr>
<td>Mesquite</td>
<td>16</td>
<td>Richardson</td>
<td>7</td>
</tr>
<tr>
<td>Rowlett</td>
<td>4</td>
<td>TxDOT</td>
<td>37</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>350</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

2 Source: National Transportation Safety Board. 2012. Wrong-Way Driving. Highway Special Investigation Report NTSB/SIR-12/01
Planning efforts for Phase 2 of the pilot project began in 2015. Phase 2 will be implemented in Tarrant County and will focus on 54.2 miles along seven priority corridors in Arlington and Fort Worth as shown in Exhibit 5-10. Phase 2 will concentrate on limited-access facilities, and countermeasures may include wrong-way pavement markings in the travel lanes, enhanced signage with active detection units, modified sign placement, and use of technology for wrong-way driving incident notifications.

Exhibit 5-10: Seven Priority Corridors for Wrong-Way Driving Countermeasure Deployment in Tarrant County

<table>
<thead>
<tr>
<th>Priority</th>
<th>Corridor-Area</th>
<th>From</th>
<th>To</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IH 30 West Freeway</td>
<td>University Drive</td>
<td>Bridgewood Drive</td>
<td>6.2</td>
</tr>
<tr>
<td>2</td>
<td>North Downtown Fort Worth</td>
<td>Spur 280</td>
<td>Yucca Avenue/Northside Drive</td>
<td>2.4</td>
</tr>
<tr>
<td>3</td>
<td>SH 360</td>
<td>Spur 303/Pioneer Parkway</td>
<td>Trinity Blvd.</td>
<td>7.9</td>
</tr>
<tr>
<td>4</td>
<td>SH 199/Jacksboro Highway</td>
<td>IH 820</td>
<td>FM 730</td>
<td>11.0</td>
</tr>
<tr>
<td>5</td>
<td>IH 820 West Loop</td>
<td>Old Decatur Road</td>
<td>Winscott Road</td>
<td>14.0</td>
</tr>
<tr>
<td>6</td>
<td>IH 820 East Loop</td>
<td>Trinity Blvd.</td>
<td>IH 20/Business 287/Mansfield Highway</td>
<td>8.2</td>
</tr>
<tr>
<td>7</td>
<td>IH 30 Entertainment District</td>
<td>Fielder Road</td>
<td>SH 360</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Mobility Assistance Patrol Program

The Mobility Assistance Patrol Program (MAPP) is an essential element of the region’s safety program and incident management operations. Goals of MAPP are to improve roadway safety and alleviate congestion on area freeways and tollways. MAPP coverage area includes congested roadway systems in Dallas and Tarrant counties and portions of Collin and Denton counties. MAPP provides free assistance to stalled and stranded motorists by helping them to move disabled vehicles from the main lanes; assisting with flat tires, stalled vehicles, and minor accidents; and ultimately getting the vehicles operating or off the facility. The program also assists law enforcement with traffic control when deemed necessary or when requested by law enforcement.

MAPP is currently being operated by the Dallas County Sheriff’s Office, Tarrant County Sheriff’s Office, and the North Texas Tollway Authority. Portions of operations in Dallas and Tarrant counties are currently patrolled by private-sector partner agencies who serve the LBJ, DFW Connector, and North Tarrant Express TEXPress corridors. More information on MAPP is included in Appendix D.

Safety Education and Training Efforts

Educating stakeholders and increasing public awareness about safety issues is important to promoting safety in the region. NCTCOG was the first agency in the nation to formalize training in traffic incident management for all responders, including police, fire, emergency medical services, towing, and transportation agencies. The training is designed to increase awareness of safety issues for responders and motorists, improve multi-agency coordination, reduce response and clearance times for traffic incidents, and reduce on-scene confusion over responder roles, responsibilities, and jurisdictional line. To emphasize the importance and need to coordinate incident management, the Regional Transportation Council adopted Resolution R08-10: Resolution Supporting a Comprehensive, Coordinated, Interagency Approach to Freeway Incident Management. Policy TSSF3-006 requires the adoption of a jurisdictional policy modeled after this resolution. More information on the NCTCOG Traffic Incident Management Training Program and Resolution R08-10 is included in Appendix D.

Examples of regional safety education and training efforts are shown in Exhibit 5-11.
**Exhibit 5-11: NCTCOG-Supported Regional Safety Education and Training Opportunities**

<table>
<thead>
<tr>
<th>Training Goal</th>
<th>Training Outcomes</th>
<th>Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traffic Incident Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiate common, coordinated response to traffic incidents that builds partnerships, enhances safety for emergency responders, reduces upstream traffic accidents, improves system efficiency, and improves air quality.</td>
<td>Improves safety by notifying motorists of incidents, reducing rear-end collisions due to vehicle queue, and improves the safety of responders and commuters at the scene.</td>
<td>First responders, managers, executive-level policy makers</td>
</tr>
<tr>
<td><strong>Photogrammetry Training</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complements Traffic Incident Management training, accident reconstruction and forensic measurements.</td>
<td>Uses image-based 3D system to calculate measurements from photographs and digital camera images.</td>
<td>Traffic incident responders</td>
</tr>
<tr>
<td><strong>ITE Web Seminars</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide safety training opportunities for regional professionals.</td>
<td>Varied based on topic.</td>
<td>Varied</td>
</tr>
<tr>
<td><strong>Driver Safety Initiatives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teens in the Driver Seat educational program to improve safety for teen drivers.</td>
<td>Focuses on driving at night, distractions, speeding, failure to wear safety belts, and drinking and driving.</td>
<td>Texas schools</td>
</tr>
<tr>
<td>Distracted driving educational awareness outreach.</td>
<td>Raise public awareness, reduce distractions within the vehicle, avoid crashes caused by distractions, and improving driver behavior.</td>
<td>All drivers</td>
</tr>
<tr>
<td><strong>Work Zone Safety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work zone traffic control/qualified flagger, planning work zone traffic control, night road work planning and implementation, installation and maintenance of signs and pavement markings.</td>
<td>Varied based on topic.</td>
<td>City, county, Texas Department of Transportation, North Texas Tollway staff</td>
</tr>
</tbody>
</table>

Mobility 2040 supports additional NCTCOG programs that improve safety and quality of life for all residents in the region, as summarized in **Exhibit 5-12**.
## Exhibit 5-12: Additional Safety-Related Programs

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Outcome</th>
<th>Safety Component</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional Traffic Signal Retiming Program</strong></td>
<td>Maximize existing roadway system capacity by implementing low-cost capital improvements on selected thoroughfares.</td>
<td>Audit thoroughfares, assess operational characteristics, estimate air quality benefits, implement recommendations.</td>
</tr>
<tr>
<td><strong>Intelligent Transportation Systems</strong></td>
<td>Integrate traffic monitoring, incident detection systems, and traveler information systems.</td>
<td>Reduce congestion on regional roadways.</td>
</tr>
<tr>
<td><strong>Traffic Signal/Intersection Improvement Program</strong></td>
<td>Improve traffic flow operation on arterials and intersections.</td>
<td>Improve Infrastructure and traffic signals.</td>
</tr>
<tr>
<td><strong>Active Transportation (Bicycle/Pedestrian) Education, Outreach, and Campaigns</strong></td>
<td>Increase bicycle and pedestrian mobility and safety.</td>
<td>Collect safety data and conduct pedestrian and bicycle safety education.</td>
</tr>
<tr>
<td><strong>Regional Railroad Crossing Banking</strong></td>
<td>Reduce number of at-grade crossings and amount of infrastructure.</td>
<td>Marketplace to collect credits for at-grade crossings that are eliminated.</td>
</tr>
<tr>
<td><strong>Railroad Crossing Reliability Partnership</strong></td>
<td>Improve 2,000 at-grade railroad crossings.</td>
<td>Upgrade passive warning devices at railroad crossings.</td>
</tr>
<tr>
<td><strong>Railroad Safety Education</strong></td>
<td>Improve safety at rail crossings.</td>
<td>Educate children, driver-education instructors, first responders.</td>
</tr>
<tr>
<td><strong>Truck Lane Planning</strong></td>
<td>Evaluate needs for truck traffic flow, identify probable truck-only lane corridors.</td>
<td>Remove trucks from the left lane of highways.</td>
</tr>
<tr>
<td><strong>Freight System Plan</strong></td>
<td>Review of all freight facilities and long-term freight needs.</td>
<td>Freight System Plan</td>
</tr>
<tr>
<td><strong>Hazardous Materials Routing</strong></td>
<td>Ensure hazardous materials are not routed through high population/high traffic areas.</td>
<td>Reduce risk associated with hazardous material transport.</td>
</tr>
<tr>
<td><strong>Regional General Aviation and Heliport Plan</strong></td>
<td>Plan for and develop Regional Aviation System.</td>
<td>Develop aviation data, management system, forecasting model.</td>
</tr>
<tr>
<td><strong>Emerging Technology Investment Programs</strong></td>
<td>Evaluate new technology including Connected Vehicle, in-vehicle signage and warnings, and open road tolling.</td>
<td>Reduce the impact of incidents for occasions during which transportation system demand is already near or exceeding capacity.</td>
</tr>
</tbody>
</table>
Summary

The goal of the Transportation System Safety Program is to improve safety for all users of the transportation system by supporting and coordinating planning efforts to develop safety policies, programs, and projects. Because safety planning is a multidisciplinary effort and human behavior is a major factor in traffic safety, effective safety improvements must involve input by stakeholders from the engineering, enforcement, education, and emergency response communities. As the North Central Texas population continues to grow, implementing and funding safety initiatives that include training, data collection, and various regional safety programs is essential to save lives and to improve the reliability, efficiency, and maintenance of the transportation system.
The security of the transportation system is a national and regional priority. The goal of Transportation System Security is to support ongoing local, state, and federal initiatives to address security and emergency preparedness planning in North Central Texas. Local governments, transportation providers, and emergency responders in the region are working to coordinate response plans, response capabilities, and emergency medical services in the event of a major incident or catastrophic event. In addition, these partners are identifying critical transportation infrastructure so they can increase surveillance of these systems. The partners are developing approaches for sharing and disseminating information about severe weather, including timely information for tornadic activity, flooding, and other emergencies.

Vehicles that communicate and help drivers make life-saving decisions have been highly anticipated and are now available. Segments of private industry, including manufacturers and information providers, are working with government agencies to optimize the benefits of these new technologies. A Connected Vehicle network can improve the transportation system’s safety, security, mobility, and impact on the environment. Safety and security are the highest priorities for North Central Texas. The potential for vehicle-to-vehicle and vehicle-to-infrastructure communication systems to revolutionize roadway safety is imminent. Future challenges include testing new secure applications and deploying effective technology to ensure the system is secure and reliable.

**Transportation System Security Policies**

Mobility 2040 supports the following Transportation System Security policies:

**TSSC3-001**: Support the Regional Transportation Emergency Responders Uniform Communication System.

**TSSC3-002**: Transportation System Security should be considered and mitigation strategies put in place during planning, engineering, construction, and operation stages of corridor implementation for roadway and transit operations, with emphasis on identified critical infrastructure or key resources.

**TSSC3-003**: Participate in the identification and development of a security plan for the top ten regionally identified transportation infrastructure components.

Mobility 2040 supports the following Transportation System Security programs:

**TSSC2-001**: Transportation System Security Improvements, Expansions, Management, and Operations

**TSSC2-502**: Transportation and Emergency Responder Uniform Communication System

**TSSC2-504**: Transportation Security Education and Training

**TSSC2-506**: Regional Response Plan Development

The region’s ITS infrastructure is an integral part of the Transportation System Security Program. Current and future Transportation and Transit Management Center ITS components improve the transportation system’s security by monitoring traffic, detecting incidents, and responding to problems.

**Transportation Resource Support for Mass Evacuation Events**

NCTCOG and partner agencies in the region are establishing procedures to use transportation resources during mass evacuations. The partner agencies are assessing the use of land, air, rail, or other resources to facilitate effective and efficient emergency response or assistance operations.

The Texas Homeland Security Strategic Plan 2012-2016 is a high-level roadmap for all homeland security efforts across the state. A regional goal stemming from the plan is to develop the capability to provide an overwhelming response to any catastrophic incident that poses a significant threat to communities within Texas. To focus on North Central Texas, regional partners are working closely together to develop a Multi-Agency Coordination Plan. This plan will address topics such as regional emergency management, comprehensive resource
planning, readiness and response levels, regional coordination centers, situation awareness, pre-positioning of resources, and evacuations.

One need related to regional readiness is the potential to accommodate hurricane evacuees. The region continues to prepare for possible evacuees from the Gulf Coast by participating in hurricane exercise projects. The region’s roles include:

- Coordinating with local jurisdictions and state operations centers through shelter hubs to manage shelters in accordance with priorities established in state and local plans and procedures.
- Managing evacuation in accordance with state and local traffic management plans to ensure desired outcomes.

The regional ITS infrastructure is an integral part of the evacuation planning toolkit. Such tools include contra-flow, traveler information sources, signal timing for emergency conditions, ramp closures, supply of heavy equipment and barriers, and ITS components such as closed-circuit television and vehicle detection. While it is critical to obtain information about the status of the regional transportation facilities, it is equally important to provide a mechanism to distribute information to the public. Several potential methods of disseminating information include dynamic message signs, Websites, a 511 system, and highway advisory radio.

The Centers for Disease Control and Prevention, the Texas Department of State Health Services, and NCTCOG work with local jurisdictions to prepare to make full and effective use of the Strategic National Stockpile in the event of a possible biological terrorist attack. The Strategic National Stockpile is the Centers for Disease Control and Prevention’s collection of medicine and medical supplies available to communities that run out of such supplies during an emergency.³

The region is evaluating and planning transportation options for distributing Strategic National Stockpile items within 48 hours of an attack. These planning efforts include evaluating traffic and transit conditions and analyzing usage.

The region is also planning for major incidents that require emergency response efforts. This planning includes traffic conditions analysis, transit system usage analysis, and analysis of various conditions.

**Transportation Critical Infrastructure**

NCTCOG and regional transportation partners annually assess transportation and other components for nomination to the inventory of critical infrastructure and key resources. The US Department of Homeland Security establishes the inventory’s criteria, which are subject to change based on the latest security and intelligence information. The confidential inventory is used to develop security measures for surveillance and protection of the identified regional assets.

**Transportation and Emergency Responders Uniform Communication System**

The Transportation and Emergency Responders Uniform Communication System (TERUCS) enables network communication between Emergency Operations Centers (EOC) and Traffic Management Centers (TMC) in North Central Texas. TERUCS evolved from the 2007 Emergency Responder Uniform Communication System study, which assessed the benefits of a regional data and video communication network to exchange information between TMCs and EOCs.

By utilizing the existing fiber-optic infrastructure deployed by partner agencies, TERUCS provides a wide area network for communication and video data exchange, allowing stakeholders to share resources and leverage funding. TERUCS also provides a template for the flow of data and video across vertical (local, state, federal) and horizontal (local EOC, police, fire, transportation) hierarchies. TERUCS allows diverse TMCs and regional partners to share traffic-
related information across a common protocol. With TERUCS in place, emergency management staff will have access to live transportation data and video to improve incident response and clearance times, as well as to make better operational decisions when EOCs are activated.

The jurisdictions participating in TERUCS have identified communication via secured video teleconferencing as the current primary EOC function. Teleconferencing would enable region-wide briefings during regionally significant catastrophic events and other major special events.

**Memorandum of Understanding**

NCTCOG is developing a draft Memorandum of Understanding that would lead to a regional agreement for ITS partner agencies to share fiber and data with each other, the Texas Department of Transportation, and NCTCOG. The Memorandum of Understanding will outline the roles and responsibilities of each party.

Methods to share security-related messages with the public are being developed. Dynamic message signs and 511DFW are among the mechanisms that could be used to share information about security issues such as severe weather, flooding, infrastructure failure, and other potential emergencies. Connected Vehicle systems may also be instrumental by using dashboard displays and warnings.

**Summary**

The primary goal of Transportation System Security is to support ongoing local, state, and federal initiatives that address emergency preparedness and the security of the transportation system. The policies and programs discussed in this section are intended to achieve this goal in North Central Texas. All security policies, programs, and projects are provided in Appendix D.
Regional Growth Trends and Forecasts

From 2000 to 2010, the Dallas-Fort Worth Metropolitan Statistical Area had the second-largest population increase in the nation after the Houston Metropolitan Statistical Area. The population of the Dallas-Fort Worth area grew by 23.4 percent during this period. According to NCTCOG’s demographic forecasts, the total population of the Metropolitan Planning Area is projected to increase 57 percent from 2015 (6,812,020 people) to 2040 (10,676,844 people). Accommodating this growth with an efficient and effective transportation system is important to maintaining a high quality of life. However, considering the financial realities associated with funding additional capacity for the transportation system, development patterns and the location choices that existing and new residents make are critical pieces of future transportation recommendations.

From 2000 to 2010, 52 percent of growth in the region was in eight cities. These cities and their respective percentage growth are shown in Exhibit 5-13.

Exhibit 5-13: Regional Growth Percentage

<table>
<thead>
<tr>
<th>City</th>
<th>Growth Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Worth</td>
<td>17</td>
</tr>
<tr>
<td>Dallas</td>
<td>10</td>
</tr>
<tr>
<td>Frisco</td>
<td>6</td>
</tr>
<tr>
<td>McKinney</td>
<td>6</td>
</tr>
<tr>
<td>Plano</td>
<td>4</td>
</tr>
<tr>
<td>Allen</td>
<td>3</td>
</tr>
<tr>
<td>Arlington</td>
<td>3</td>
</tr>
<tr>
<td>Grand Prairie</td>
<td>3</td>
</tr>
</tbody>
</table>

Regional forecasts indicate that population density (people per square mile) for the 12-county Metropolitan Planning Area will increase by 57 percent between 2015 and 2040; from 718 people per square mile to 1,130 people per square mile. Regional forecasts indicate that the largest share of population growth will occur in Collin, Dallas, Denton, and Tarrant counties, the four core North Central Texas counties. The increased population density that results from population growth in these core counties should support more sustainable development patterns and investments. These growth trends can support increases in infill development and improve the feasibility of transit options. The four core counties are forecasted to experience less greenfield development, less agricultural land converted to urban development, fewer vehicle miles traveled per person, and improved safety and air quality. Mobility 2040 emphasizes multimodal mobility options and policies, programs, and projects that support Sustainable Development and transportation. These strategies are integral to facilitating the movement of 10.7 million people in 2040. Additional discussion of regional demographic and growth trends is included in the Social Considerations chapter.

Three Es of Sustainability

Sustainable Development can be defined as “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.” Within Mobility 2040, an overall theme or commitment to Sustainable Development encompasses a holistic approach to growth by combining economic development, environmental protection, and social equity. These concepts are known as the three Es: economic, environmental, and equity.

---

5 NCTCOG, 2015 Population Estimates
6 NCTCOG, 2040 Demographic Forecast

Economic Development: Transportation policies often drive the maintenance and construction of transportation systems, which impact economic development. Transportation systems can impact the economy, consumer expenditures, employment, resource consumption, productivity, property values, affordability, and wealth accumulation. Economic sustainability focuses on issues related to the jobs/housing balance, regional economic development and revitalization, and research on innovative financial tools and mechanisms that promote economic revitalization.

Environmental Protection: Transportation systems range from sidewalks to major highways. The type and location of such infrastructure and the process by which transportation systems are built impact environmental resources including air quality, open space, and watersheds. Mobility 2040 aims to improve transportation systems without causing a heavy burden on the environment. A high level of vehicle miles traveled typically results in a greater negative impact on air quality, more maintenance needs on roadways, and increased levels of pollutants in roadway runoff that must be mitigated.

Encouraging development near existing transportation and utility infrastructure not only reduces vehicle miles traveled, it preserves open space. Environmental sustainability focuses on a number of development strategies, including location efficiency, reduction in vehicle miles traveled, green development and construction codes, land use-transportation connections, multimodal transportation connections, context-sensitive solutions, transit-oriented developments, brownfield redevelopment, habitat/land/water conservation, and the implementation of the ecosystem approach to mitigation.

Social Equity: Transportation systems need to accommodate commuters who travel to jobs, education, and other needed services. Social equity is impacted when a variety of transportation systems, such as transit, sidewalks, and bike lanes, allow people to travel without the need for personal vehicles. Social sustainability focuses on creating affordable housing, Environmental Justice, fair housing choice, infill housing, revitalization, redevelopment, compliance with the Americans with Disabilities Act, improved health, and local food options.

The goal of sustainable transportation is not just moving people and goods, but meeting people’s mobility needs in a way that is the most sustainable and does not create negative impacts. Because transportation is linked to components of the three Es, it is critical for planners implementing Sustainable Development projects to involve and coordinate with responsible agencies from multiple disciplines.

Complete Streets: Complete Streets are defined as those designed and operated to enable safe access and travel for all users. This design allows pedestrians, bicyclists, motorists, transit users, and travelers of all ages and abilities to move along the street network safely. According to the National Complete Streets Coalition, elements typically included in Complete Streets are sidewalks, bicycle lanes (or wide, paved shoulders), shared-use paths, designated bus lanes, safe and accessible transit stops, and frequent and safe crossings for pedestrians, including median islands, accessible pedestrian signals, and curb extensions.

The design for a Complete Street in rural areas of the region will look different from one in urban or suburban areas. For example, Complete Streets in rural areas could provide wide shoulders, where those in suburban areas may include a separate multi-use path and sidewalks, and those in urban areas may also include marked or separated bicycle lanes, transit accommodations, and on-street parking. Not all roadways in suburban and urban areas will have each of these characteristics in their design. The common denominator is balancing all users’ safety and convenience in the context of the road’s adjoining land uses and its location in the region. Mobility 2040 endorses the development of local Complete Streets policies and the implementation of Complete Streets infrastructure that safely accommodates all users throughout the region.

Mobility 2040 also endorses context-sensitive solutions to ensure that streets are indeed "complete" and are also designed and function appropriately based on the character of the area where the streets lie. As defined by FHWA and the American Association of State Highway and Transportation Officials, context-sensitive solutions is a collaborative, interdisciplinary approach that involves all stakeholders in providing a transportation facility that fits its setting. Applying context-sensitive solutions as projects are developed and delivered will preserve and enhance scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions.
Mobility 2040 Supported Goals

- Encourage livable communities which support sustainability and economic vitality.
- In an effort to maximize limited resources, infrastructure in transportation will be prioritized to support sustainable land uses (offering more than one land use choice or within a connected two-mile proximity to other land uses) within the urban core and to support similar nodes of development investment in more rural areas.
- Preserve and enhance the natural environment, improve air quality, and promote active lifestyles.
- Improve the availability of transportation options for people and goods.

Sustainable Development is an important tool that can be used to increase mobility and improve air quality in North Central Texas. Sustainable Development, as it relates to transportation, can be defined more specifically as:

- Land use and transportation practices that promote economic development while using limited resources in an efficient manner.
- Transportation decision-making based on impacts on land use, congestion, vehicle miles traveled, and the viability of alternative transportation modes.
- Planning efforts that seek to balance access, finance, mobility, affordability, community cohesion, environmental quality, and community health.

Sustainable Development is not:

- Connected to the Agenda 21 movement
- An avenue to promote United Nations policies
- A challenge to or restriction of property rights of land owners

Sustainable Development Policies

The foundation of the Sustainable Development policies listed below are Livability Principles provided by the US Department of Housing and Urban Development-Department of Transportation-Environmental Protection Agency Interagency Partnership, NCTCOG’s Mobility 2040 Goals, the 12 Principles of Development Excellence, and the North Texas 2050 guidebook developed by the Vision North Texas process. More details on these principles are located in Appendix D. To promote Sustainable Development and transportation in the region, Mobility 2040 supports the following Sustainable Development policies:

SD3-001: Support mixed-use, infill, and transit-oriented developments that utilize system capacity, reduce vehicle miles of travel, and improve air quality through improved rail mobility and access management as shown in Exhibit 5-14.

SD3-002: Promote transit-oriented development for all station types that improves the jobs/housing balance, “last mile” connections, and appropriate land-use density to encourage diverse transportation mode choices.

SD3-003: Plan for land use-transportation connections, including a variety of land uses from natural areas to the urban core connected by multimodal transportation options through strategies such as smart zoning codes, green infrastructure, affordable housing, preservation of agricultural land, healthy communities, economic development tools, and innovative financing, etc.

SD3-004: Support Independent School Districts and local governments through various programs and projects as supported by Regional Transportation Council Policy Supporting School Districts.

Implementing Sustainable Development

As the region grows and demand for housing and transportation options change, Sustainable Development principles that promote density and diversity and
improve the economic, social, and environmental vitality of communities will become more important.

Implementing Sustainable Development strategies in North Central Texas is important to demonstrating the outcomes of investing in new approaches to living and traveling in the region. Mobility 2040 Sustainable Development policies are supported by the following initiatives:

- Respond to local initiatives for town centers, mixed-use growth centers, transit-oriented developments, infill/brownfield developments, and pedestrian-oriented projects.
- Complement rail investments with coordinated investments in park-and-ride and bicycle and pedestrian facilities.
- Encourage local government regulations that promote mixed-use, infill, and transit-oriented developments.
- Promote interaction between planning and zoning officials, development communities, and transportation interests.
- Coordinate with transit agencies and the development community to incorporate access to facilities early in the design process.
- Incorporate livable and healthy communities factors as criteria in funding programs.
- Encourage multimodal transportation options including transit, bicycle, and pedestrian activities and programs.
- Encourage elements that reduce traffic congestion and pollution and offer traffic calming impacts, which result in safer environments for pedestrians.
- Encourage mixed-use zoning and form-based codes including Smart Growth and New Urbanism Principles.

In addition to increasing mobility and improving air quality, Sustainable Development can promote healthy communities. In 2015, the US Surgeon General released a Call to Action promoting walking and walkable communities as a powerful public health strategy. Community design can support walking by locating residences within short distances of employment, retail, schools, and public transportation, and by building well-connected and safe sidewalks and paths between destinations. Context-sensitive street design can also encourage walking and make walking safer through measures that improve street lighting, reduce traffic speed, and increase the number of safe pedestrian crossings. Additional discussion on healthy communities is included in the Environmental Considerations chapter.

Mobility 2040 supports the following Sustainable Development programs:

SD2-001: Land Use-Transportation Connections Program
SD2-002: Community Schools and Transportation Program
SD2-003: Transit-Oriented Development Program
SD2-004: Sustainable Development Funding Program

**SD2-001: Land Use-Transportation Connections Program**

As land uses impose demands on the transportation system and transportation provides connections, both systems need to be planned in conjunction with each other. Land uses, when sustainably integrated, can affect air quality and the number of trips commuters make because when different land uses are clustered in close proximity, commuters have less need to take automobiles to access other land uses. The effects are amplified if the cluster of land uses includes a residential area. This type of development usually qualifies as a mixed-use development. Because most people make trips that originate at their homes, vehicle miles traveled can be reduced when single- or multi-family residential areas are within walking or biking distance of locations that provide employment, retail, restaurants, and entertainment. This produces fewer emissions and benefits air quality. When viable housing choices exist in urban mixed-use centers, fewer residential units must be constructed in greenfield suburban areas, thus reducing the overall mileage traveled from suburban areas to employment locations in the central city.

Some of the strategies and projects addressing land use-transportation connections include:

---

• Promoting smart zoning ordinances and building codes that allow varying densities, layouts, and heights.
• Creating a jobs-housing balance through promoting developments and creating strategic transportation connections.
• Integrating green infrastructure components into transportation projects to improve air quality, mitigate urban heat effects, and control stormwater runoff.
• Utilizing parking management strategies and innovative parking technologies.
• Developing workforce, mixed-income, and affordable housing options for diverse demographic groups.
• Preserving agricultural land in rural areas to allow for compact development in infill areas.
• Utilizing economic development tools and providing financial incentives to promote sustainable developments.
• Planning for healthy communities to promote active lifestyles, improving access to stores with healthy food, and improving air quality.
• Coordinating with various agencies through data collection, best practices, and planning to look at land use and transportation connections and improvements.

SD2-002: Community Schools and Transportation Program
The Regional Transportation Council approved a school policy in 2013 to promote coordination between the municipalities and school districts located within the Metropolitan Planning Area. Like local governments, school districts are also members of the North Central Texas Council of Governments, and this policy, P13-02, recognizes the independence of the school districts and contains innovative and multidisciplinary strategies for collaboration. This policy addresses candidate areas of interest between school districts, local governments, and the Regional Transportation Council. The policy includes a variety of topics and projects described in Exhibit 5-15.

By 2040, the number of school children under the legal driving age (aged 5 to 15 years) will increase by 545,000, or roughly 50 percent (assuming this age group’s share of the population remains constant). The region will need to accommodate 50 percent more trips to and from schools. Hundreds of schools will need to be built or renovated. By addressing current school siting and transportation issues, the Community Schools and Transportation Program is intended to be a holistic approach to mitigating and improving traffic congestion, air pollution, and safety around our region’s most vulnerable population group. Additional descriptions and specific program activities are outlined in Appendix D.

Exhibit 5-15: Regional Transportation Council Policy Supporting School Districts

SD2-003: Transit-Oriented Development Program
Transit-Oriented Development (TOD) is a style of planning and development that encourages pedestrian activity by mixing higher density employment, housing, and commercial land uses within a half-mile walking distance of a passenger rail station. TOD encourages commuters to bike or walk in combination with using transit. It accomplishes this through a well-designed, accessible built environment and a network that connects bike and pedestrian facilities, thus reducing automobile dependence. TOD is evolving to include development within a half-mile around stations for bus rapid transit, street cars, and people movers.

In order to maintain North Central Texas’s regional transportation network as the region continues to grow, it is increasingly important to offer transit that links a greater choice of places to live, work, and play. Through the Sustainable Development Funding Program, NCTCOG has prioritized TOD for funding, planning, infrastructure, and land banking projects around rail transit stations (see Exhibit D-5 in Appendix D). The region has seen success in attracting development around rail transit stations, with approximately $5 billion of private investment in existing and planned commercial and residential development.
around the DART light rail system since its opening in 1996.\footnote{11} However, in the Metropolitan Planning Area, only marginally more than one percent of workers use transit to commute to work, while over 81 percent drive alone.\footnote{12} Expanding transit use requires a continued regional commitment to TOD.

The Transit-Oriented Development Program will focus on the following key initiatives:

- Provide technical assistance and research best practices to plan and implement transit-oriented development.
- Foster regional coordination and data sharing through working group and training events to encourage transit-oriented development.
- Lead and conduct regional transit-oriented development data collection efforts to create a robust and reliable source of information that improves decision-making and facilitates transit-oriented development.
- Improve the job-housing balance with transit access by increasing density of development in station areas.
- Support the location of higher density, mixed income, and affordable housing options around transit stations that leads to increased ridership.
- Support parking management for transit-oriented development.

Additional description and specific program activities are outlined in Appendix D.

**SD2-004: Sustainable Development Funding Program**

NCTCOG’s Sustainable Development Funding Program is one of the best examples of regional programs that support livability principles in the region, state, and country. The program was created by the Regional Transportation Council to encourage public-private partnerships that positively address existing transportation system capacity, rail access, air quality concerns, and/or mixed land uses. Three calls for projects have been conducted since 2001; they have resulted in many projects that support livability principles, Mobility 2040 Sustainable Development policies, and other regional and national goals (see Exhibit 5-15).

<table>
<thead>
<tr>
<th>Program Year</th>
<th>Sustainable Development Project Type</th>
<th>Program Funding*</th>
<th>Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Infrastructure and Planning</td>
<td>$45 Million</td>
<td>Congestion Mitigation &amp; Air Quality/Surface Transportation-Metropolitan Mobility</td>
</tr>
<tr>
<td>2006</td>
<td>Infrastructure, Landbanking, and Planning</td>
<td>$45 Million</td>
<td>Regional Transportation Council Local</td>
</tr>
<tr>
<td>2011</td>
<td>Infrastructure and Planning</td>
<td>$54 Million</td>
<td>Regional Transportation Council/Congestion Mitigation &amp; Air Quality/Surface Transportation-Metropolitan Mobility/Regional Transportation Council Local</td>
</tr>
</tbody>
</table>

*Net funding includes matching funds from local governments

By allocating transportation funds in the next 25 years to alternative modes of transportation that connect mixed land uses and pedestrian-scale projects, regional partners will work toward reducing automobile use and traffic congestion, and toward improving air quality and quality of life. This funding program will promote projects that are located within walking distance to existing or potential rail stations; that create infill in locations with a concentration of unemployed people, high-emitting vehicles, or low-income households; and/or are located in historic downtowns with pedestrian-oriented developments on the frontages of multiple contiguous street blocks. Exhibit D-5 in Appendix D shows the location of projects funded through the Sustainable Development Funding Program and shows the areas of interest for Sustainable Development within the region.

**Summary**

As the North Central Texas region becomes home to millions more people and jobs by 2040, the demand placed on the transportation system will continue to grow. Encouraging and implementing sustainable growth patterns will be important to supporting and maintaining a high quality of life for the region’s residents.

\footnote{11} Terry Clower, Michael Bomba, Owen Wilson-Chavez, Matthew Gray, Development Impacts of the Dallas Area Rapid Transit Light Rail System, UNT Center for Economic Development Research, January 2014

\footnote{12} US Census Bureau, 2009-2013 5-Year American Community Survey, Table B08301, 12 Counties of Metropolitan Planning Area
residents. Mobility 2040 supports Sustainable Development and the land use-transportation connection as key initiatives to create an efficient transportation system that supports a livable and sustainable region.

NCTCOG, in coordination with federal, state, and local government partners, the development community, and other stakeholders, will strive to improve the economic, environmental, and social equity of development by offering sustainable transportation and promoting connections between land use and transportation. Providing the tools to create livable communities in the region is the goal and vision for the future.

All Sustainable Development policies, programs, projects, and maps are provided in Appendix D.