7.0 Preservation & Enhancement of Strategic Roadway Corridors

7.1 The Cost of Aging & Congested Infrastructure

Each year, hundreds of people die on dangerous sections of roadways throughout Tennessee. In urban areas, drivers waste time waiting to get through congested intersections, pedestrians and cyclists are injured or killed by motorized vehicles, and public transportation is not a viable choice for the majority of commuters. To meet the multitude of challenges in balancing transportation needs with quality of life goals, the region must invest in a diverse strategy that not only seeks to build new infrastructure, but one that first seeks to fix what we have and make it better.

Because the vast majority of money for major transportation projects built to serve the metropolitan area, or "capital" projects, historically came from federal tax dollars, it is far too easy to perceive these projects as "free." The truth is that capital funding for mega-projects comes at the expense of other long-awaited improvements to the existing transportation system. Additionally, federal funding for transportation projects is in decline due to the ongoing depletion of the Highway Trust Fund which provides states and MPOs with federal money from taxes on transportation fuels such as gasoline.

Once transportation infrastructure is built, state and local governments must keep roads, bridges, sidewalks, and trails maintained and public transportation operated and maintained. Over time, as our region – like other areas around the nation – has continued to build new bridges and roadway infrastructure, the challenge to keep it safe and efficient has grown substantially.

The American Society of Civil Engineers (ASCE) estimates that $1.6 trillion is needed over the next five-years to bring the nation's infrastructure to a state of good condition. Establishing a long-term development and maintenance plan must become a national priority as poor road conditions cost U.S. motorists $67 billion a year in repairs and operating costs – $333 per motorist.

Moreover, Americans spend 4.2 billion hours a year stuck in traffic, at a cost of $78.2 billion a year to the economy. At the same time, transit ridership has grown at a faster pace than highway use. Total federal spending of approximately $60 billion annually is well below the $155.5 billion needed annually to improve surface transportation infrastructure conditions nationally. Between 2003 and 2007, the percentage of the nation's 599,893 bridges rated structurally deficient or functionally obsolete decreased slightly from 27 percent to 26 percent.

- Thirty-two percent (32%) of Tennessee's major urban roads are congested.
- Vehicle travel on Tennessee's highways increased 48% from 1990 to 2003. Tennessee's population grew 20% between 1990 and 2003.
- Driving on roads in need of repair costs Tennessee motorists $636 million a year in extra vehicle repairs and operating costs --- $152 per motorist.
- Congestion in the Nashville area costs commuters $730 per person per year in excess fuel and lost time

For those reasons and more, the Nashville Area MPO has adopted as one of its three major policy initiatives an emphasis on preserving and enhancing existing roadway corridors. The following sections describe some of the more significant strategies for turning an aging and increasingly congested urban roadway system into one that is modern, safer, more efficient, and built to address the needs of a variety of users and modes of travel.

7.2 Complete Streets for Purpose and Function

As most communities' largest collection of public space, streets need to reflect the values of the community and reinforce a unique 'sense of place' to be enjoyed by citizens – whether in urban, suburban, or rural contexts. This is especially true for a collector street system that serves as the backbone for local mobility, property access, and non-vehicular transportation modes. "Complete Streets" is a term used nationally to describe the transformation of vehicle-dominated thoroughfares in urban and suburban areas into community-oriented streets that safely and conveniently accommodate all modes of travel, not just motorists.

Recently, municipalities across the country have started implementing Complete Streets as one way to transform their transportation corridors from vehicle-dominated roadways into community-oriented streets that safely and efficiently accommodate all modes of travel – not just motor vehicles. The Complete Streets movement as described later in this chapter does not advocate for one size fits all — solutions for an urban area may look quite different from those in a more rural area. However, both facilities are designed to balance mobility, safety, and aesthetics for everyone using the travel corridor. Furthermore, design considerations supportive of Complete Streets include elements in both the traditional travel corridor (i.e., the public realm) as well as adjacent land uses (i.e., the private realm) for reinforcing the desired 'sense of place.'

Complete Streets policies and enabling legislation should be reflected in important policy documents including:

- City or County Comprehensive Plans;
- City or County Comprehensive Transportation Plans;
- Area Plans (for the applicable area served by the Complete Street);
- Park Master Plans (if adjacent to the corridor);
- Economic Revitalization/Development Strategies.

Implementing Complete Streets

Transforming major arterials into Complete Streets is complicated, requiring a diverse range of skill sets and broad support from the community. Fortunately, other metropolitan areas have demonstrated success stories that have been translated into guiding documents. The most detailed guidance comes from a joint effort of the Institute of Transportation Engineers and Congress for the New Urbanism. With funding from the U.S. Department of Transportation and the U.S. Environmental Protection Agency, best practices have been published as "Context-Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities."

Successful Complete Street transformations require community support and leadership, as well as coordination between various disciplines. In particular, support must include economic revitalization, business retention and expansion, property owner involvement, urban planning, urban design, landscape architecture, roadway design, utility coordination, traffic engineering, transportation planning, transit planners, architects, graphic artists, and developers.

Complete Streets Principles

The following principles embody the most important aspects of a successful Complete Streets program:

- Achieve community objectives.
- Blend street design with the character of the area served.

- Capitalize on a public investment by working diligently with property owners, developers, economic development experts, and others to spur private investment in the area. A minimum return-on-investment of $3 private for every $1 of public investment should be expected. Often in more densely populated areas, the ratio is 10:1 or more.
- Design in balance so that traffic demands do not overshadow the need to walk, bicycle, and ride transit safely, efficiently, and comfortably. The design should encourage people to walk.
- Empower citizens to create their own sense of ownership in the success of the street and its myriad characters.

Realms of Complete Street

As described below, Complete Streets can be viewed in terms of four basic zones or realms: the context realm, pedestrian realm, travelway realm, and intersection realm. Together these street designs ensure the needs of all users are accommodated.

Context Realm

The context realm of a Complete Street is defined by the buildings that frame the major roadway. Identifying distinct qualities of the context realm requires focusing on four areas: building form and massing, architectural elements, transit integration, and site design.

Building Form and Massing: To enhance an already high-quality street design and help create a complete street, buildings should be located close enough to the street that they are able to frame the public space enjoyed by pedestrians. In more urban areas, these buildings should be located directly behind the sidewalk. Buildings with stairs, stoops, or awnings may even encroach into the pedestrian realm to provide visual interest and access to the public space. Suburban environments that must incorporate setbacks for adjacent buildings should limit this distance to 20 feet or less and avoid off-street parking between buildings and the pedestrian realm.

Larger setbacks in these suburban areas will diminish the sense of enclosure afforded to the pedestrian and move access to the buildings farther away from the street. In both environments, building heights should measure at least 25 percent of the corridor width. For example, a 100-foot wide roadway right-of-way should be framed by buildings that are at least 25 feet high (a typical two-story building) on both sides with facades that are at most 20 feet from the edge of right-of-way.

Architectural Elements: Careful placement and design of buildings adjacent to the major roadway offer opportunities for meaningful interaction between those traveling along the corridor and those using the corridor for other purposes. These opportunities are greatly enhanced when restaurants, small shops and boutiques, residential units, and offices are located adjacent to the street. Building scale and design details incorporated into individual buildings foster a comfortable, engaging environment focused on the pedestrian. Common building design treatments generally favored in a pedestrian environment include awnings, porches, balconies, stairs, stoops, windows, appropriate lighting, promenades, and opaque windows.

Transit Integration: Areas that are targeted for high-quality transit service must be supported through land use and zoning policies that support transit-oriented development and reflect the benefits of increased access to alternative modes of travel. Policy examples include appropriate densities and intensities for supporting transit use, parking ratios that reflect reduced reliance on the automobile, and setback and design guidelines that result in pedestrian-supportive urban design. In addition, potential transit service identified for transportation corridors within the community should take into consideration the land use, density/intensity, and urban design

characteristics of the surrounding environment before selecting proposed technologies or finalizing service plans.

Site Design: The Complete Street truly is integrated into the surrounding environment when the interface between the site and the street is complementary to the pedestrian environment created along the entire corridor. Access to the site should be controlled through a comprehensive access management program to minimize excessive driveways that create undesirable conflicts for traveling pedestrians. Building orientation, further defined by landscape and architectural elements incorporated into the site should reinforce the public space protected between the buildings. Public paths through sites should be provided to shorten blocks longer than 600 feet.

Pedestrian Realm

The pedestrian realm of a Complete Street extends between the outside edge of sidewalk and the face-of-curb located along the street. Safety and mobility for pedestrians within this realm is predicated upon the presence of continuous sidewalks along both sides of the street built to a sufficient width for accommodating the street's needs as defined by the environment. For example, suburban settings will require different widths than downtown settings. The quality of the pedestrian realm also is greatly enhanced by the presence of high-quality buffers between pedestrians and moving traffic, safe and convenient opportunities to cross the street, and consideration for shade and lighting needs.

The pedestrian realm may consist of up to four distinct functional zones: frontage zone, throughway zone, furnishing zone, and edge zone. The frontage zone is located near the back of the sidewalk and varies in width to accommodate potential window shoppers, stairs, stoops, planters, marquees, outdoor displays, awnings, or café tables. The throughway zone provides clear space for pedestrians to move between destinations and varies between 5 and 16 feet wide, based on the anticipated demand for unimpeded walking area. The furnishing zone provides a key buffering between pedestrians and moving traffic. It generally measures at least 4 to 6 feet wide to accommodate street trees, planting strips, street furniture, utility poles, sign poles, signal and electrical cabinets, phone booths, fire hydrants, bicycle racks, or retail kiosks targeted for the pedestrian realm. The edge zone is incorporated into the pedestrian realm concurrent with the presence of on-street parking to allow sufficient room for opening car doors.

Incorporation of one or more of these function zones in the pedestrian realm of a street generally is based upon the context of the surrounding built environment. For example, a more urban, downtown environment will include all four zones in the pedestrian realm and could measure up to 24 feet wide. An equally important link to the pedestrian network that is located in a more suburban setting may omit one or more of the function zones listed above, resulting in an overall minimum width of 11 feet.

Recommended design elements for promoting a healthy pedestrian realm generally focus on one of four areas of concentration: pedestrian mobility, quality buffers, vertical elements, and public open space. Together, these best practices can be implemented in both urban and suburban environments, to varying degrees, for promoting healthy pedestrian environments.

Pedestrian Mobility: The presence of a comprehensive, continuous pedestrian network serves as the foundation for fostering a walkable community that supports active transportation and mode choice. Sidewalks generally provide clear zones of 6 to 8 feet wide to accommodate pedestrian travel. In more urban environments, amenities in the frontage zone and furniture zone will greatly increase the overall width of the corridor when compared with more suburban settings. Mid-block pedestrian crosswalks should be incorporated into the urban fabric as needed to make sure that convenient crossing opportunities are provided approximately every 300 feet

for maximizing efficiency and safety within the pedestrian system. As a general rule, mid-block crossings should be considered on two-lane streets when the block length is greater than 500 feet and the posted speed limit for the travel lanes does not exceed 40 miles per hour.

Quality Buffers: Providing separation between pedestrians and moving traffic greatly enhances the character of the pedestrian realm. The amount of separation incorporated into the pedestrian realm may vary between corridors based on the context of the surrounding built environment or on streets with different travel speed and/or traffic volume characteristics. In downtown areas, parallel or angled on-street parking provides sufficient distance (8 to 18 feet) for separating pedestrian and vehicle traffic. Likewise, landscape planting areas (typically 6 feet wide) incorporated into either urban or suburban environments provide adequate lateral separation for pedestrians. In urban areas, street trees may be placed in tree wells within an overall hardscaping surface instead of using suburban-style grass areas.

Vertical Elements: Vertical elements traditionally incorporated into the pedestrian realm include street trees, pedestrian-scale street lighting, and utilities. Street trees provide necessary shade to pedestrians and soften the character of the surrounding built environment. They should be spaced between 15 and 30 feet apart, be adapted to the local environment, and fit the scale and character of the surrounding area. Pedestrian-scale street lighting incorporated into the pedestrian realm should use metal halide fixtures mounted between 12 and 20 feet high. Utilities should not interfere with pedestrian circulation or block entrances to buildings, curb cuts, or interfere with sight distance triangles. In some cases, burying utilities underground avoids conflicts and clutter caused by utility poles and overhead wires. Relocation of overhead utilities to tall poles on just one side of the roadway, however, can be a cost-effective aesthetic alternative to burial of utilities in a duct bank under the road.

Public Open Space: The pedestrian realm serves a dual purpose within the built environment, acting as both a transportation corridor and a public open space accessible to the entire community. As a result, specific design elements incorporated into the pedestrian environment should reinforce this area as a public space. Properly planned, these design elements could provide opportunities for visitors to enjoy the unique character of the corridor in both formal and informal seating areas. Public art and/or specialized surfaces and materials introduced into the pedestrian realm are appreciated by slower moving pedestrians. In more urban areas, street furniture and/or outdoor cafes provide opportunities that foster community ownership in the pedestrian realm, such as “people watching.” Furthermore, building encroachments in downtown areas, such as stairs and stoops, provide for interesting points of access to the pedestrian realm. Lastly, awnings and canopy trees provide shade which is helpful in the temperate climate of the region.

Travelway Realm

The travelway realm of a street is defined by the edge of pavement or curb line (in more urban areas) that traditionally accommodates the travel or parking lanes needed to provide mobility for bicycles, transit, and automobiles sharing the transportation corridor. This area also separates the pedestrian and context realms and may provide carefully-designed crossing opportunities between intersections. Recommended design elements incorporated into the travelway realm serve to achieve greater balance between travel modes sharing the corridor and favor design solutions that promote human scale for the street and minimize pedestrian crossing distance. Recommendations for the travelway realm in a Complete Street focus on two areas of consideration: modes of travel and medians.

Multi-modal Corridors: Balance between travel modes within the same transportation corridor fosters an environment of choice for mobility that could lead to reduced congestion on major roadways and a healthier citizenry. On a Complete Street, safe and convenient access to the transportation network for bicycles, transit,

and automobiles is afforded within the travelway realm. Travel lanes for automobiles and transit vehicles should measure between 10 and 11 feet wide, depending on the target speed, to manage travel speeds and reinforce the intended character of the street. Parking lanes incorporated into the travelway realm should not exceed 8 feet in width (including the gutter pan) and may be protected by bulb-outs evenly spaced throughout the corridor.

Bus stops located along the corridor should be well-designed to include shelters, as well as benches that comfort patrons while waiting for transit service. On-street bicycle lanes (typically 4 to 6 feet wide) should be considered when vehicle speeds range from 30 to 40 miles per hour. Wide outside lanes may be preferred on streets with higher speeds. To avoid situations where citizens with only basic bicycle skills may be attracted to a corridor, designated bicycle routes on parallel corridors may be the best option when speeds on the major street exceed 40 mph. According to state law, bicyclists are considered vehicles and are permitted on all corridors except freeways and access-controlled highways.

Median Treatments: Medians often are incorporated into the travelway realm to provide dedicated left-turn lanes, landscaping, and pedestrian refuge at crossings. They generally vary between 7 and 18 feet wide, depending on their intended application and the limitations of the surrounding built environment. Medians also reinforce other access management solutions provided within the travelway to reduce the number of conflict points and maintain the human scale intended for the Complete Street.

In addition to center medians, other access management solutions incorporated into the travelway realm should limit the number of individual driveways along the corridor and avoid the use of right-turn deceleration lanes. Together, these improvements will reduce the overall pedestrian crossing distance for the travelway and maximize the safety for pedestrians traveling inside the pedestrian realm.

Intersection Realm

Evaluating potential changes for the intersection realm of a street requires careful consideration for the concerns of multiple travel modes that could meet at major intersections within the transportation system. Recommendations for improving the multi-modal environment in and around these major intersections focus on two areas of the facility: operations and geometric design.

Geometric Design: Geometric design of an intersection should reinforce the operational characteristics of a traffic signal or roundabout. With traffic signals, this includes the introduction of curb extensions, or bulb-outs, to shorten pedestrian crossing distance and protect on-street parking near the intersection. Curb return radii designed for signalized intersections should be 15 to 30 feet to control turning speed around corners. At roundabouts, special consideration should be given to entry and exit speeds, pedestrian refuge in the splitter islands, and assigning predictability to the intersection for pedestrians, bicycles, and vehicles. Both intersection treatments may consider special pavement markings to distinguish pedestrian areas or bicycle lanes, although these surfaces need to be stable, firm, and slip resistant. Additional consideration should be given to maintaining adequate sight triangles in the intersection, addressing the treatment of bicycle lanes through the intersection, and compliance with federal requirements per the American with Disabilities Act for crosswalk and curb ramp design.

Operations: In terms of operations, traffic signals or roundabouts are the two most appropriate applications for traffic control devices that also could maintain the pedestrian scale of the street reinforced in the context, pedestrian, and travelway realms. The merits of a traffic signal rather than a roundabout for intersection control should be determined on a case-by-case basis after taking into consideration key issues such as desired traffic

speed, availability of right-of-way, anticipated traffic patterns, and the context of the built environment surrounding the intersection.

7.3 Congestion Management Strategies

Managing congestion requires an understanding of congestion and a definition of what constitutes congestion. Long-term solutions to congestion involve more that just the development of new roadway capacity, particularly in urban areas where major arterials cannot be widened without severely impacting the businesses that have grown up around those corridors.

While the traditional response to congestion has been to add capacity - either by building new roads or widening existing roads, there are other ways to improve mobility including the expansion of alternative transportation choices like transit, walking, or bicycling, or the use of technology to help better manage the follow of traffic on the transportation system. The following presents several strategies that will be deployed in the Nashville area to manage congestion.

Increased Multi-Modal Transportation Choices

Transit Service

One of the most significant alternatives to roadway construction is to improve transportation capacity in the deficient corridor(s) with better transit options. This might include more frequent service, the extension of existing routes, new routes, giving transit priority on conventional roadways, or providing a separate transit guideway. The foundation of any transit network is bus service, which is flexible and thorough, and requires relatively modest infrastructure investment. Bus Rapid Transit (BRT) is an expansion of standard bus service into a system that emulates rail. BRT systems have similar right-of-way characteristics, stations, and capabilities as rail transit systems yet tend to cost substantially less than fixed guideway systems such as Light-rail. Light-rail transit (LRT or streetcars) is suitable for transporting high volumes of passengers with frequent service, while commuter rail typically serves remote suburb-to-downtown commuters only during peak-hours.

Transit's ability to compete with the car depends on a large number of factors, the most important of which are speed, cost, and the frequency and reliability of service. As the region addresses the transportation challenges ahead of us, the implementation of a high-capacity transit system must be considered.

Bicycling and Pedestrian Facilities

When people first think about transportation, most people think about cars, buses, trains, and trucks. Bicycling and walking are often considered forms of recreation, and in fact, many people will put their bikes on their cars and drive to a good location for cycling. As we consider our transportation future through the 2035 Regional Transportation Plan, it is important that we develop a balanced system that provides choices for mobility. By providing bicycle facilities such as bike lanes, bike routes, or greenways, travelers are allowed to choose the most appropriate type of transportation for their trip. Data from the National Personal Transportation Survey indicate that about 40 percent of all trips are shorter than two miles. This is a very reasonable distance for bicycling when appropriate bicycle facilities exist.

The primary facilities available to cyclists are greenways, bike lanes, bike routes, and of course roadways. Greenways, also known as multi-use paths, are designed to be accessed by all types of users. They are separated from motor vehicle traffic by an open space or barrier and can be located within the roadway right-of-way (ROW) or they may have an independent ROW. While greenways can serve a transportation function, they are typically not designed to provide the most direct route and do not tend to have the high-level of connectivity

that a roadway-based network can provide. They are often located around parks and are used by walkers, runner, skaters, and cyclists.

Bike lanes can be built on new or existing roadways and are located at the edges of the pavement. These facilities are special lanes that have been striped to provide a travel way reserved for cyclists. The minimum width of a bicycle lane is 4 feet. Bike lanes must be well marked so that automobile drivers do not encroach into the cycling space and are aware of their use by cyclists. Bike lanes have a positive impact on both drivers and cyclists by making drivers more alert to the presence of cyclists due to the special lanes and roadway markings provided. This results in better safety for both the cars and cyclists. Bike lanes have several advantages that include: using a single ROW to provide multi-modal transportation opportunities; provide the most direct route and optimal connectivity for cyclists; they encourage cyclists to obey traffic laws as they are recognized as an on-road vehicle; and they make drivers aware of the legal use of roadways by cyclists.

Bicycle Routes are simply "shared roadways" that have been designated as bike routes by signage. Cyclists and pedestrians are legal users of all roadways unless they are specifically prohibited. Providing Bicycle Route signage on certain roadways can provide continuity by connecting other bicycle facilities, such as bike lanes or greenways, or by helping to identify preferred cycling routes through high-demand travel corridors. Like Bike Lanes, Bike Route signage helps to alert drivers to keep a look out for cyclists.

Roadway Construction

Building new roads or widening existing roads can help alleviate some of the anticipated congestion by providing increased capacity for all types of motorized vehicles. The reduction in congestion may not be proportional to the additional capacity. This is because the shorter travel times on the improved roadways can attract additional trips from vehicles that may have otherwise used other roads, traveled during off-peak times, or not made the trip at all. When roadways must be widened or built to alleviate congestion, the effort should focus on addressing bottlenecks and/or include multi-modal accommodations to increase the overall capacity of the facility – not just vehicular capacity.

Technology & Intelligent Transportation Systems

The term Intelligent Transportation Systems (ITS) refers to the use of technology to manage the transportation system more effectively, improve its efficiency, and make it easier to use. A wide variety of ITS techniques are under development or are being used in various parts of the country. In the Nashville area, the Tennessee Department of Transportation has recently installed dozens of dynamic message signs along interstates to provide important traffic-related messages to motorists. Similarly, radar detectors and video cameras have been installed on the interstates to alert transportation officials to a slow-down that could indicate that an incident has occurred. Faster response and clearance of these incidents reduces traffic congestion and helps prevent "secondary" incidents from occurring when motorists slow down to look or swerve to avoid a stopped vehicle.

Local jurisdictions are using ITS technology to achieve better signal coordination along important arterial routes, and to establish traffic management centers where data is collected and analyzed. Over the long term, the local and state efforts are coordinated through a plan known as the ITS Regional Architecture. This plan spells out what types of data are being collected by each agency, what will be shared, and the compatibility needs for equipment. The regional architecture is continuously updated.

The Nashville Area has undertaken several deployments of ITS programs throughout the Region. These programs have come from multiple agencies and cover multiple transportation modes as well. Some multi-

agency participation has been present on some of these ITS initiatives. The following are some of the larger ITS initiatives underway or existing within the Nashville Area:

- **TDOT SmartWay Program** – TDOT's SmartWay Program includes freeway closed circuit television (CCTV) cameras, dynamic message signs (DMS), vehicle detectors, and a traffic management center (TMC) that operates 7 days per week. A majority of the urban freeway systems is currently covered or will be covered in the future by the SmartWay system. The SmartWay Program is active in providing incident management and traveler information throughout the Region and coordinates with other TDOT SmartWay TMCs in Memphis, Chattanooga, and Knoxville to share traffic information that may have an impact on operations outside of the Region.
- **Municipal Traffic Management Centers and ITS Deployments** – Several cities within the Region have deployed ITS, to assist with arterial traffic management. These include Metro Nashville and the Cities of Franklin, Brentwood and Murfreesboro, which all have active traffic operations centers (TOCs) used for monitoring their traffic signal systems. Franklin, Brentwood and Murfreesboro also have CCTV cameras deployed within their cities that can be monitored from the TOC.
- **511 Traveler Information Number** – TDOT currently operates a statewide traveler information number that provides real-time traveler information throughout the state. Information is put into 511 through the TDOT SmartWay Information System (TSIS), which is updated by the TDOT SmartWay TMC operators and the Tennessee Highway Patrol (THP) dispatchers. 511 information can also be accessed through a 511 website and several social media sites such as Twitter and Facebook.

Coordination with Land Use and Urban Design

The primary purpose of a transportation system is to move people and goods from one place to another, but transportation systems also affect community character, the natural and human environment, and economic development patterns. A transportation system can improve the economy, shape development patterns, and influence quality of life and the natural environment.

Land use and transportation are symbiotic: development density and location influence regional travel patterns, and, in turn, the degree of access provided by the transportation system can influence land use and development trends. Urban or community design can facilitate alternative travel modes. For example, a connected system of streets with higher residential densities and a mix of land uses can facilitate travel by foot, bicycle, and public transportation, in addition to automobile. Conversely, dispersed land development patterns may facilitate vehicular travel and reduce the viability of other travel modes.

Studies have repeatedly shown that the most important factors in the feasibility of various transportation modes is land use mix, development intensity, and design. Focusing land development in corridors and nodes will do more to enhance transit in this region than any capital investment.

Walking plays a key role in any effort to reduce traffic. This is partly true because walking can substitute for short car trips, but more importantly, because almost any use of transit will involve walking to the transit line and then from the transit line to one's final destination. Willingness to walk is related to the safety of the route, the aesthetic appeal of the route, and the efficiency in which developments are connected. As such, the best way to maximize the convenience of transit - without adding new route miles, is to increase neighborhood connectivity for pedestrians.

Well designed developments also address how parking is arranged. Activities and buildings placed in the middle of large parking lots undermine walking and transit options. Instead, good design places parking at the side or

rear of a building, and emphasizes on-street parking. Parking garages also promote many objectives of pedestrian-friendly design, since they reduce the amount of surface land consumed by parking, allowing buildings to be closer together.

In Metro Nashville, benefits of such land-use patterns have begun to be realized. Hillsboro Village is an area which these components already are largely in place, whereas Green Hills has the density and mix of uses but is still in the planning stages for critical design improvements. Other jurisdictions have taken this concept to various levels, especially county seats such as Franklin and Murfreesboro that have historic downtown cores. These traditional models indicate the elements of good design that can be used to create new pedestrian-oriented developments in other parts of the region centered on transit stations and other public uses.

Employer-Based Transportation Demand Management Strategies

Transportation Demand Management or TDM refers most commonly to a collection of efforts that seek to reduce or manage the number of personal trips made by the private automobile using low-cost strategies aimed at travel behavior modification. The most common TDM objective is to encourage commuters to share rides so that more people can move through a segment with the same amount of vehicles; this is the aim of rideshare matching or carpool incentive programs. Both the Metropolitan Transit Authority (MTA) and the Regional Transportation Authority (RTA) have rideshare programs that target major employers and growth areas. The TMA Group in Franklin is a private non-profit organization which has forged a strong partnership with the business community to promote rideshare options.

Other TDM solutions more specifically target involvement by major employers and include strategies such as staggered work hours, flexible scheduling, transit subsidies, on-site bicycle parking, on-site showers, work site parking management, etc.

Incident Response & Management

Incident management is gaining national attention as a means to improve highway congestion problems as well as safety. An incident such as a traffic accident, an overturned truck, an abandoned vehicle on the shoulder, or debris on the highway can cause major problems on the highway system and eventually to the supporting network of local streets. Often these events lead to secondary crashes. Reportedly, approximately 20 percent of all freeway crashes are secondary.

The Nashville Regional Incident Management Taskforce was established in late 2006. The taskforce is comprised of the TDOT, Metro Police Department, EMS-911, Tennessee Highway Patrol, the Nashville Area MPO, and other incident management related agencies. This taskforce is intended to bring the stakeholders together to explore new initiatives and increase the efficiency in Incident Management. Incident Management encompasses all of the activities undertaken to assist involved motorists, protect public health and safety, conduct necessary investigations, minimize travel disruptions and delays, remove the damaged vehicles or cargo, and restore the roadway to normal conditions.

The TDOT HELP program provides motorist assistance throughout the Region on assigned routes throughout the Nashville Area. The HELP program trucks assist motorists with minor repairs such as flat tire changes, fuel, and push services to move disabled vehicles out of the through lanes. HELP operators also assist with traffic control and detours during major incidents and may be requested to assist with traffic management for special events.

Managed Lanes & Congestion Pricing

The distinction between managed lanes and other traditional forms of freeway lane management is the operating philosophy of "active management." Under this philosophy, the operating agency proactively

manages demand and available capacity on the facility by applying new strategies or modifying existing strategies. The agency defines the operating objectives for the managed lanes and the kinds of actions that will be taken once pre-defined performance thresholds are met.

High-Occupancy Vehicle (HOV): HOV facilities serve to increase the total number of people moved through a congested corridor by offering two kinds of travel incentives: a substantial savings in travel time, along with a reliable and predictable travel time. Because HOV lanes carry vehicles with a higher number of occupants, they move significantly more people during congested periods, even if the number of vehicles that use the HOV lane is lower than on the adjoining general purpose lanes. In general, carpoolers, vanpoolers, and bus patrons are the primary beneficiaries of HOV lanes by allowing them to move through congestion.

High-Occupancy Tolls (HOT): HOT lane facilities are limited-access, normally barrier-separated highway lanes that provide free or reduced cost access to qualifying HOVs, and also provide access to other paying vehicles not meeting passenger occupancy requirements. By using price and occupancy restrictions to manage the number of vehicles traveling on them, HOT lanes maintain volumes consistent with free flow levels of service even during peak travel periods.

Most HOT lanes are created within existing general-purpose highway facilities and offer potential users the choice of using general-purpose lanes or paying for premium conditions on the HOT lanes. HOT lanes utilize sophisticated electronic toll collection and traffic information systems that also make variable, real-time toll pricing of non-HOV vehicles possible. Information on price levels and travel conditions is normally communicated to motorists via variable message signs, providing potential users with the facts they need in order to decide whether or not to utilize the HOT lanes or the parallel general-purpose lanes that may be congested during peak periods.

HOT lanes may be created through new capacity construction or conversion of existing lanes. Conversion of existing HOV lanes to HOT operation is the most common approach.

Exclusive Transit Lanes: Exclusive, or dedicated, lanes for transit can be implemented in a variety of ways. In some cases, HOV lanes, or specific HOV access ramps, can be operated to allow buses preferential or exclusive use. In other cases, permanent exclusive transit lanes are built within the right-of-way of an existing roadway facility or in an entirely new alignment – which is more common with rail transit than bus service.

Truck-Only Lanes: Truck-only lanes are lanes designated for the use of trucks. The purpose of truck-only lanes is to separate trucks from other mixed-flow traffic to enhance safety and/or stabilize traffic flow. In some cases, tolls have been applied to truck-only lanes to help manage truck traffic during peak travel periods, or to help offset the cost to build and maintain the truck facility.

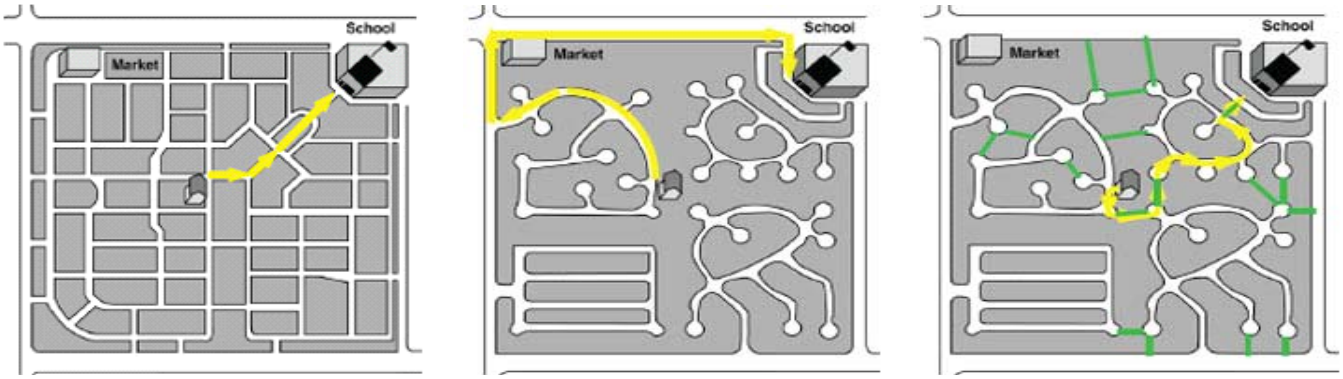
Collector Street Connectivity

Collector streets are an important component of the transportation system because they can reduce congestion on principle and arterial roadways. Many American cities and towns were originally developed utilizing a grid system of streets. This interconnectivity gives motorists several options to arrive at a destination; thereby, traffic is diverted through the interconnected street system.

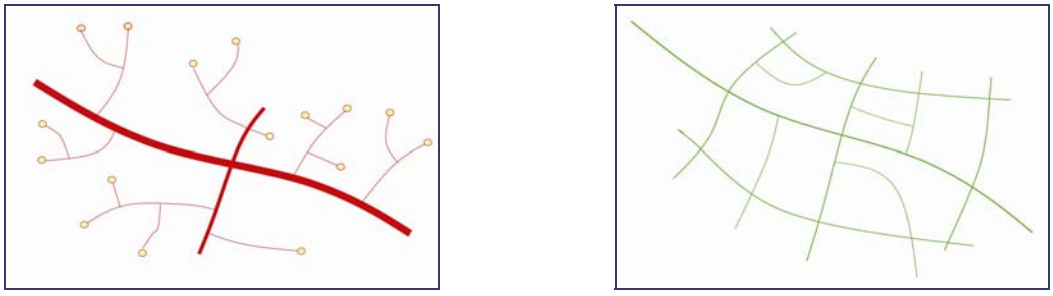
Since the modern suburb was built, streets began to be constructed in a curvilinear pattern with dead-ends. This type of street network development actually increases traffic congestion on principle and arterial streets by diverting traffic to only a few roadways. Many of the region's residential developments have been built along arterials, but they have not been connected to one another. Connecting the internal street system is one way of addressing congestion on the area's arterials. The following figure shows the grid system, curvilinear system,

and how to connect street networks. These connections can also be made with non-motorized infrastructure such as shared use trails or sidewalks.

Figure 50. Examples of Street Networks



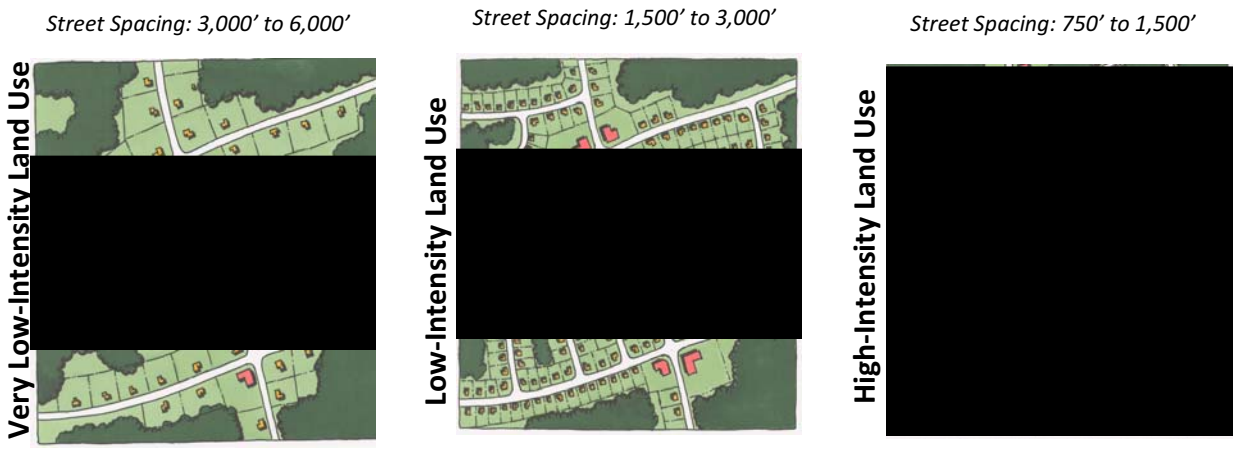
The role of a collector street in a balanced transportation system is to collect traffic from neighborhood and local streets and distribute it to the network of arterials. As such, these streets provide relatively less mobility but higher overall accessibility compared to higher level streets. The lower design speeds and multi-modal amenities make these streets attractive for bicyclists and pedestrians. Proper design and spacing of collector streets is critical to ensuring a balanced transportation network.



Limited connectivity resulting in heavy reliance on arterial system (left) versus well-connected system of streets (right).

The design of a collector street network must respect present and future conditions, the public's vision for the future, and how the network can best balance the natural environment, connectivity, access, mobility, and safety. Local geography creates a network of lakes, creeks, and floodplains that impact land use and transportation decisions. These features affect how the community develops, where streets can be constructed and maintained, and where connections between streets can be made. Collector streets, as part of the development process, must respect the natural environment.

Local officials also must consider street spacing guidelines to promote the efficient development of an expanding transportation system. Ultimately, these street spacing guidelines could be used as "rules of thumb" during the development review process.



Different spacing standards are necessary for different development types and intensities. The figure below and the table on the following page show the desired collector street spacing for different intensities. In addition, individual driveway access to collector streets should be limited to local streets when possible.

Table 32. Land Use Intensity and Collector Street Spacing

Land Use/Type of Collector Street	Intensity (dwelling units per acre)	Access Function	Approximate Street Spacing
Very Low Intensity Residential	Less than 2	High	3,000 to 6,000 ft
Low Intensity Residential	2 to 4	High	1,500 to 3,000 ft
Medium and High Intensity Residential	More than 4	High	750 to 1,500 ft
Activity Center	Mixed-use	Medium	750 to 1,500 ft

Access Management

Access management allows local decision-makers to do more with less. As the region's most traveled corridors continue to attract commercial development, protecting the through capacity becomes essential for the efficiency of the transportation system and continued economic growth. Access management balances the needs of motorists using a roadway with the needs of adjacent property owners dependent upon access to the roadway. In an environment with limited funds for transportation projects and competing agendas, access management is not just good policy but crucial to the health of the entire transportation network.

The Federal Highway Administration (FHWA) defines access management as "the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding system in terms of safety, capacity, and speed." According to the Access Management Manual, access management results from a cooperative effort between state and local agencies and private land owners to systematically control the "location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway." Access management requires cooperation between government agencies and private land owners.

Symptoms and Benefits of Access Management

Poor access management directly affects the livability and economic vitality of commercial corridors, ultimately discouraging potential customers from entering the area. A corridor with poor access management lengthens commute times, creates unsafe conditions, lowers fuel efficiency, and increases vehicle emissions. Signs of a corridor with poor access management include:

- Increased crashes between motorists, pedestrians, and cyclists,

- Worsening efficiency of the roadway,
- Congestion outpacing growth in traffic,
- Spillover cut-through traffic on adjacent residential streets,
- Limited sustainability of commercial development.

Without access management, the function and character of major roadway corridors can deteriorate rapidly and adjacent properties can suffer from declining property values and high turnover. Access management has wide-ranging benefits to a variety of users as shown in the table below.

Benefits of Corridor Access Management

User	Benefit
Motorists	• Fewer delays and reduced travel times • Safer traveling conditions
Bicydists	• Safer traveling conditions
	• More predictable motorist movements
	• More options in a connected street network
Pedestrians	• Fewer access points and more median refuges increases safety • More pleasant walking environment
Transit Users	• Fewer delays and reduced travel times
	• Safer, more convenient trips to and from transit stops in a connected street and sidewalk network
Freight	• Fewer delays and reduced travel times lower cost of delivering goods and services
Business Owners	• More efficient roadway system serves local and regional customers
	• More pleasant roadway corridor attracts customers
	• Improved corridor aesthetics
	• Stable property values
Government Agencies	• Lower costs to achieve transportation goals and objectives • Protection of long-term investment in transportation infrastructure
Communities	• More attractive, efficient roadways without the need for constant road widening

Access Management Tools

Access management is not a "one size fits all" solution to corridor congestion. Successful strategies differ throughout a region and even along the same road. The Access Management Strategy Toolkit provides a general overview of the various strategies available to mitigate congestion and its effects. A comprehensive access management program includes evaluation methods and supports the efficient and safe use of the corridors for all transportation modes. The purpose of the toolkit is to provide local engineering and planning officials with access management strategies as well as an overview of their application, use, and, in some cases, unit cost.

Site Access Treatments: Improvements that reduce the total number of vehicle conflicts should be a key consideration during the approval of redeveloped sites along corridors identified for access management programs. Site Access Treatments include the following:

- Improved on-site traffic circulation,
- Number of driveways;
- Driveway placement/relocation; and
- Cross access.

Improved On-Site Traffic Circulation: One way to reduce traffic congestion is to promote on-site traffic circulation. Pushing back the throat of an entrance, as shown in the figures below, helps avoid spillback onto the arterial. This action improves both the safety and efficiency of the roadway. A minimum separation of 100 feet should be provided to prevent internal site operations from affecting an adjacent public street, ultimately causing spillback problems. Approximate construction cost varies and usually is the responsibility of private development.

Number of Driveways: Only the minimum number of connections necessary to provide reasonable access should be permitted. For those situations where outparcels are under separate ownership, easements for shared access can be used to reduce the number of necessary connections. Reducing the number of access points also decreases the number of conflict points, making the arterial safer and more efficient. Approximate construction cost varies and usually is the responsibility of private development.

Driveway Placement/ Relocation: Driveways located close to intersections create and contribute to operational and safety issues. These issues include intersection and driveway blockages, increased points of conflict, frequent/unexpected stops in the through travel lanes, and driver confusion as to where vehicles are turning. Driveways close to intersections should be relocated or closed, as appropriate. As a best planning practice, no driveway should be allowed within 100 feet of the nearest intersection.

Frontage Roads/ Cross Access: Cross access is a service drive or secondary roadway that provides vehicular access between two or more continuous properties. Such access prevents the driver from having to enter the public street system to travel between adjacent uses. Cross access can be a function of good internal traffic circulation at large developments with substantial frontage along a major roadway. Similarly, backdoor access occurs when a parcel has access to a parallel street behind buildings and away from the main line. When combined with a median treatment, cross access and backdoor access ensure that all parcels have access to a median opening or traffic signal for left-turn movements.

Median Treatments: Segments of a corridor with sufficient cross access, backdoor access, and on-site circulation may be candidates for median treatments. A median-divided roadway improves traffic flow, reduces congestion, and increases traffic safety — all important goals of access management. While medians restrict some left-turn movements, overall traffic delays are reduced by removing conflicting vehicles from the mainline. Landscaping and gateway features incorporated into median treatments improve the aesthetics of the corridor, in turn encouraging investment in the area. Median Treatments include the following:

- *Non-Traversable Median* - These features are raised or depressed barriers that physically separate opposing traffic flows. Inclusion in a new cross-section or retrofit of an existing cross-section should be considered for multi-lane roadways with high pedestrian volumes or collision rates as well as in locations where aesthetics are a priority. A non-traversable median requires sufficient cross and backdoor access. As these treatments are considered, sufficient spacing and locations for U- and left-turn bays must be identified.
- *Directional Cross (Left-Over Crossing)* - When a median exists on a corridor, special attention must be given to locations where left turns are necessary. A left-over is a type of directional crossover that prohibits drivers on the cross road (side street) from proceeding straight through the intersection with the main road, but allows vehicles on the mainline to turn left onto the cross road. Such designs are appropriate in areas with high traffic volumes on the major road and lower volumes of through traffic on the cross road, particularly where traffic needs to make left turns from the main line onto the minor street. A properly implemented left-over crossing reduces delay for through-traffic and diverts some

left-turn maneuvers from intersections. By reducing the number of conflict points for vehicles along the corridor, these treatments improve safety.

- *Left-Turn Storage Bays* - Where necessary, exclusive left-turn lanes/bays should be constructed to provide adequate storage space exclusive of through traffic for turning vehicles. The provision of these bays reduces vehicle delay related to waiting for vehicles to turn and also may decrease the frequency of collisions attributable to lane blockages. In some cases, turn lanes/bays can be constructed within an existing median. Where additional right-of-way is required, construction may be more costly.
- *Offset Left-Turn Treatment* - Exclusive left-turn lanes at intersections generally are configured to the right of one another, which causes opposing left-turning vehicles to block one another's forward visibility. An offset left-turn treatment shifts the left-turn lanes to the left, adjacent to the innermost lane of oncoming through traffic. In cases where permissive left-turn phasing is used, this treatment can improve efficiency by reducing crossing and exposure time and distance for left-turning vehicles. In addition, the positive offset improves sight distance and may improve gap recognition. In locations with sufficient median width, this treatment can be easily retrofitted. Where insufficient right-of-way width exists, the construction of this treatment can be difficult and costly. As a result, approximate construction costs vary.

Intersection and Minor Street Treatments: The operation of signalized intersections can be improved by reducing driver confusion, establishing proper curb radii, and ensuring adequate laneage of minor street approaches. Intersection and Minor Street Treatments include the following:

- *Skip Marks (Dotted Line Markings)* - These pavement markings can reduce driver confusion and increase safety by guiding drivers through complex intersections. Intersections that benefit from these lane markings include offset, skewed, or multi-legged intersections. Skip marks are also useful at intersections with multiple turn lanes. The dotted line markings extend the line markings of approaching roadways through the intersection. The markings should be designed to avoid confusing drivers in adjacent or opposing lanes.
- *Intersection and Driveway Curb Radii* - Locations with inadequate curb radii may cause turning vehicles to use opposing travel lanes to complete their turning movement. Inadequate curb radii may cause vehicles to "mount the curb" as they turn a corner and cause damage to the curb and gutter, sidewalk, and any fixed objects located on the corner. This maneuver also can endanger pedestrians standing on the corner. Curb radii should be adequately sized for area context and likely vehicular usage.
- *Minor Street Approach Improvements* - At signalized intersections, minor street vehicular volumes and associated delays may require that a disproportionate amount of green time be allocated to the minor street, contributing to higher-than-desired main street delay. With laneage improvements to the minor street approaches, such as an additional left-turn lane or right-turn lane, signal timing often can be re-allocated and optimized.

Signalization: The volume of traffic attracted to some side streets or site driveways is more than can be accommodated acceptably under an unsignalized condition. Delays for minor street movements as well as left-turn movements on the main street may create or contribute to undue delays on the major roadway and numerous safety issues. The installation of a traffic signal at appropriate locations can mitigate these types of issues without adversely affecting the operation of the major roadway provided they are spaced appropriately. Approximate construction cost is $50,000 to $60,000 per signal.

Progressive-Controlled Signal System: A progressive-controlled signal system coordinates the traffic signals along a corridor to allow vehicles to move through multiple signals without stopping. Traffic signals are spaced appropriately and synchronized so when a vehicle is released from one intersection the signal at the next intersection will be green by the time the vehicle reaches it.

Likewise, adaptive signal control involves continuously collecting automated intersection traffic volumes and using the volumes to alter signal timing and phasing to best accommodate actual—real-time—traffic volumes. Adaptive signal control can increase isolated intersection capacity as well as improve overall corridor mobility by up to 20 percent during off-peak periods and 10% during peak periods. Approximate construction cost is $250,000 per system and $10,000 per intersection in addition to 25% of capital costs in training, etc.

Emergency Vehicle Preemption: This strategy involves an oncoming emergency or other suitably equipped vehicle changing the indication of a traffic signal to green to favor the direction of desired travel. Preemption improves emergency vehicle response time, reduces vehicular lane and roadway blockages, and improves the safety of the responders by stopping conflicting movements. Approximate construction cost is $5,000-$7,000 per intersection plus $2,000 per equipped vehicle.

7.4 Keep Heavy Trucks Moving

The trucking industry hauls over 10 billion tons of goods annually, representing 70 percent of the value of all US commercial freight activity and serves as the final mode for many finished products. The nation relies on trucks to serve regional economies, yet truck congestion has caused many urban areas to consider alternate ways to manage and mitigate truck traffic. In urban areas, where infrastructure is often constrained and dense populations reside, the impact of truck traffic adds to overall congestion, poor air quality, and increased safety risks.

Many of the congestion mitigation strategies focus on identifying truck routes, utilizing technology for cleaner fuel and ITS, providing alternative routes for trucks, establishing truck restrictions and in some places fines, and adjustments to delivery and receiving patterns. While there is not a perfect strategy, a combination of strategies should be considered for truck congestion mitigation in the Nashville region. Following is a list of recommended strategies to further explore:

- Establish a network of recommended truck routes;
- Establish a truck route signage plan to help designate the recommended truck routes;
- Further develop the existing ITS program and infrastructure to include arterial signal timing adjustments, more dynamic message signs, and up to date information on arterials and designated truck routes through the existing 511 system. In general, expand the ITS program further into the region to provide for adequate alternative route identification for trucks;
- Consider the use of truck only lanes to alleviate truck congestion along I-40;
- Consider expanding the soon to be completed State Route 840 to the north thus completing a full bypass for all Interstates. The northern loop of SR 840 has been in the MPO Long Range Transportation Plan in the past but is not currently in the plan. As truck traffic continues to increase, the project should be reconsidered as part of the upcoming RTP;
- Conduct a complete inventory of railroad crossings on heavy truck routes to determine if improvements are needed.

Ongoing Freight Planning Efforts

The Nashville Area MPO has completed an effort to identify and plan for long-term freight needs in the Nashville region. The *Freight & Goods Movement Study: Phase II* provides the needed technical tools to help regional partners:

- Predict future freight traffic volumes through the year 2035;
- Identify areas likely to see future capacity constraints and infrastructure deficiencies;
- Identify possible traffic bottlenecks and safety concerns;
- Evaluate the costs and benefits of potential improvements;

The study also will be used to develop specific transportation projects, identify potential funding sources for those projects, and evaluate policy-based solutions to accommodate future levels of freight on our regional transportation system while protecting the mobility and safety of the traveling public. Key recommendations of the study will include:

- Identification of a freight routing system;
- Increased coordination of industrial development and land use planning;
- Development of urban design standards for freight infrastructure;
- Incorporation of heavy truck vehicles into transportation facility design.

TDOT Efforts

The Interstate 40/Interstate 81 (I-40/I-81) Corridor from Bristol to Memphis was identified through the statewide planning effort (Plan *Go*) as a strategic statewide corridor. The study identifies solutions to a variety of transportation challenges and provide a list of projects that can be considered by TDOT for the department's ten-year transportation improvement program. Projects will encompass capacity, roadway operations and maintenance, safety, freight movement, inter-modal connections, and economic access opportunities along I-40/I-81. The study area for the I-40/I-81 corridor extends from Bristol to Memphis, a distance of about 550 miles and traverses 27 of Tennessee's 95 counties, within 9 of the 12 Rural Planning Organization (RPO) boundaries and 8 of the 11 Metropolitan Planning Organization (MPO) / Transportation Planning Organization (TPO) areas.

The I-40/I-81 corridor travels east/west through the state of Tennessee and provides direct access to and from the Nashville region. The heavily traveled corridor carries a large amount of freight and deals with a variety of capacity and volume issues. The I-40/I-81 study looked at the corridor's deficiencies to develop corridor level multi-modal solutions that will improve freight and commuter transport throughout Nashville and surrounding regions. Existing data and forecasts of auto and truck delays from the study indicate the need for capacity improvements as well as ITS and other solutions to divert traffic from the facility.

Specifically the greater Nashville area faces many challenges in developing lane solutions along the corridor. Physical attributes of I-40 in the Nashville area reflect deficient interchange spacing, substandard acceleration, deceleration and weave areas, frequently spaced major interchanges, and limited right-of-way. An example of a short-term recommendation is to modify the current HOV lanes on I-40 east to HOT lanes, allowing use by single-occupant vehicles willing to pay a toll through the use of electronic transponders. In the longer term, two parallel managed lane strategies should be considered and studied further. Solutions such as these, along with new interchanges or interchange improvements identified to increase access to areas along the study corridor are recommended in the region.

National Efforts

In 2010, the American Association of State Highway and Transportation Officials (AASHTO) released a report on the nation's freight system. The *Unlocking Freight* report identifies key projects in 30 states, including Tennessee, Mississippi and Arkansas, which would improve freight delivery and dependability. According to the report, dramatic increases in freight demand finds the nation's highways, railroads, ports, waterways, and airports require investments well beyond the current levels to maintain – much less improve – their performance. Recommendations of this report include:

- Expand the capacity of the Interstate Highway System.
- Add 32,000 lane-miles to the current Interstate system.
- Upgrade 14,000 lane-miles of the current National Highway System to Interstate standards.
- Add 14,000 lane-miles to NAFTA corridors.
- Add 8,000 lane-miles of truck-only toll facilities.
- Add 400 lane-miles to provide access to key port and intermodal facilities
- Create and fund a national freight program that could include multi-state freight corridor organizations at the state, regional, and multi-state level.
- Develop a National Multimodal Strategic Freight Plan.
- Apportion approximately $3 billion annually of a proposed $375 billion highway program to the states for freight investment from the Highway Trust Fund, and add another $7 billion annually through freight fees outside the Highway Trust Fund.
- Invest in Intermodal Connector Improvements.
- Ensure funding eligibility for intermodal connectors—usually local roads in older industrial and residential neighborhoods used by truckers to travel between major highways and the nation's ports, rail terminals, and air cargo hubs.
- Support increased collaboration between states and railroads on public-private partnerships and federal investment tax credits to finance growing needs on the freight rail network.
- Use the existing surplus from the federal Harbor Maintenance Trust Fund for critical seaport dredging projects. Additionally, direct the Federal Inland Waterway Trust Fund to complete needed lock and dam construction and maintenance projects.

7.5 Planning for Safety & Security

The Nashville Area MPO promotes "safety conscious planning" in all of its planning and programming activities. "Safety conscious planning" is proactive planning for preventing crashes and unsafe conditions. Often safety improvements are reactive, spearheading strategies such as "hot spot" improvements and educational and behavioral programs. In essence, safety conscious planning involves a shift of focus from driver behavior initiatives to strategies that make it more difficult for the driver to have a crash. One way to look at integrating safety conscious planning into long range planning is considering that crashes are a function of exposure. In long range transportation planning, the MPO has the capability of minimizing exposure (via an efficient intermodal network), minimizing risk (via functional network), and minimizing consequences (via efficient emergency management system).

To be most effective, safety conscious planning must extend across all planning activities. The Institute of Transportation Engineers (ITE) identified several levels of planning processes and decisions which safety conscious planning must effectively address, namely:

- Regional- growth strategies, major network strategies, etc.;
- City/County- community plans, zoning and subdivision regulations, transportation plans, etc.;
- Small area plans- sector/neighborhood plans, area transportation strategies, corridor and access management strategies, pedestrian and bicycle facilities development, etc.; and
- Site- site plan review, site impact studies, etc.

Safety conscious planning is needed in land use planning decisions and processes to influence policies that shape the direction of land uses to the specifics of urban form, mix, and density of use. Safety conscious planning is also an integral part of transportation planning for all modes of travel in order to shape the amount of travel as well as the mix of transportation modes.

Challenges in Planning for Safety

Some of the challenges involved in planning for safety include creating an innovative region-wide and/or state-wide system for collecting, analyzing, and sharing important information like crash data and integrating safety conscious planning into long range planning and short-term programs.

Some other issues surrounding incorporating safety and security in the regional transportation plan are as follows:

- Recognizing regional safety needs and local isolated problems;
- Building stakeholder partnerships;
- Continuing multi-agency coordination and communication;
- Developing or obtaining modeling software tools for predicting potential hazards;
- Disseminating important real-time incident information to motorists;
- Implementing design factors in new infrastructure that enhances the safety and extends the life of structures, minimizing construction zone periods;
- Improving interconnectivity of the transportation system, across and between modes, for people and goods such as at modal transfer points, bikeways that share and cross the roadways, intersections with crosswalks, and railroad crossings;
- Improving the accessibility and safety of transit stops and transfer points;
- Continuing efforts to promote truck safety such as restricted lanes, speed limits, and proper loading to prevent turnovers;
- Implementing ITS technologies on transit and emergency vehicles; and
- Finding financial resources to fund safety and security improvements.

Tennessee Strategic Highway Safety Plan

The Tennessee Strategic Highway Safety Plan, revised in 2009, defines a system, organization, and process for managing the attributes of the road, the driver, and the vehicle to achieve the highest level of highway safety by

integrating the work of disciplines and agencies involved. These disciplines include the planning, design, construction, operation, and maintenance of the roadway infrastructure (engineering); injury prevention and control (law enforcement and emergency response services), health education; those disciplines involved in modifying road user behaviors (education, enforcement), and the design and maintenance of vehicles.

Developed through a partnership among the Federal Highway Administration, Tennessee Department of Transportation, Tennessee Department of Safety, the Governor's Highway Safety Office, the Federal Motor Carrier Safety Administration, MPOs, RPOs, the Federal Highway Administration, and others, the plan's mission is to reduce the number of crashes that result in fatalities, injuries, and related economic losses on Tennessee's roadways through coordination of education, enforcement, engineering, and emergency response initiatives.

The 2009 revision of the Tennessee Strategic Highway Safety Plan included the first language addressing the safety of bicycle and pedestrian travel. The inclusion of the language for bicyclists and pedestrians in the plan allows the state to spend safety dollars, such as 402 Safety Funds from the National Highway Traffic and Safety Administration and Highway Safety Improvement Program funds from the Federal Highway Administration, on bicycle and pedestrian safety improvement projects. Approximately 8 to 10 percent of the annual fatalities on Tennessee roadways are bicyclists and pedestrians. As urban areas expand and more people use these travel modes, the fatalities for these modes are likely to increase, especially as the percentages for other roadway fatalities decline in response to safety infrastructure and programming for motorized modes.

The plan sets a goal to ensure no more than 900 fatalities occur annually on Tennessee roadways by the end of calendar year 2012 by focusing efforts on eight individual emphasis areas:

- Improve Crash Data**,**
- Reduce Lane Departures,
- Improve Intersection Safety,
- Improve Work Zone Safety,
- Improve Motor Carrier Safety,
- Improve Driver Behavior,
- Strengthen Legislation, and
- Enhance Educational and Awareness Programs.

Improve Crash Data

A critical challenge facing Tennessee's state and local transportation safety professionals is optimizing the use of information technology. Knowing the specifics relating to traffic crashes is the foundation of a comprehensive traffic safety analysis system. Proactive decisions can be made and effective safety policies and projects implemented by improving the availability of crash, traffic, citation, medical, judiciary, criminal, and driver records. To facilitate this, a central point of contact for statistical data information has been established in the Department of Safety.

Appropriate use of integrated traffic records to plan and assess safety programs, and leverage critical resources, is needed to protect public safety. The systems utilized to collect, store, and analyze traffic safety information require continuous assessment. This promotes the open exchange of techniques and ideas to improve the availability of information used by the highway safety community.

A complete traffic records program is necessary for problem identification, planning, operational management or control, and evaluation of a state's highway safety activities. Each state, in cooperation with its political subdivisions, should establish and implement a traffic records program to collect and provide information for the entire state. This type of program is basic to the implementation of all highway safety countermeasures and is the key ingredient to their effective and efficient management. The Highway Safety Improvement Program (HSIP) is driven by data on fatal and serious injury crashes.

The state has developed the Tennessee Integrated Traffic Analysis Network (TITAN) to improve the accuracy and storage of crash records. TITAN is a multi-stage project consisting of a core system housing multiple functional components of highway safety and law enforcement data. TITAN will expand based on the availability of funding, resources and technical support. The first phases of TITAN address the availability of crash and citation data in Tennessee and are identified as TITAN E-Crash, TITAN Paper-Crash, and TITAN E-Citation. Additional TITAN applications will address criminal activity, arrests, and other traffic safety related reporting.

Strategies:

- Improve timeliness and accuracy of data collection, analysis processes, and traffic safety data systems including the linkage of crash, roadway, driver, medical, enforcement, conviction, criminal, and homeland security data.
- Improve and expand the storage and accessibility of safety data. Expansion will include additional data from local roads which is currently limited.
- Continually update data definitions defined by Model Minimum Uniform Crash Criteria and D-20.
- Maintain the Traffic Records Coordinating Committee (TRCC) and include stakeholders who require traffic safety information.
- Promote and expand the implementation of electronic data collection systems for traffic safety information.
- Improve safety and access to resources by expanding local partner agencies' participation in the collection and use of traffic information.
- Provide training to State and local partner agencies on data collection, submission, analysis, definitions, importance, and appropriate uses for traffic safety data.
- Improve access to highway improvement and traffic safety information by communicating to the media and general public via the Internet.
- Independently verify data validity.
- Develop standard methodologies for the state-wide analysis of Work Zone Crash Data consistent with the requirements of the Work Zone Safety and Mobility Rule.

The Nashville Area MPO has been assisting the Tennessee Departments of Transportation and Safety by helping to geocode crash data for crashes involving bicyclists, pedestrians and heavy trucks from 2003-2008. Having this geocoded data will enable the MPO to prioritize infrastructure and behavioral safety projects to increase safety of these modes, and will assist the state in having this data available.

Reduce Lane Departures

In 2008 lane departure related crashes accounted for 545 fatalities, approximately 52 percent of all the fatalities statewide. This is the first year since 2002 that this percentage has been below 65 percent. For example, a

head-on collision, one of the most serious crash types, occurs when a driver departs the travel lane and collides with an oncoming vehicle. Another type of lane departure crash is the run-off-road crash that occurs when the driver loses control and the vehicle either collides with a fixed object or overturns. The primary objective of this section is to identify cost effective strategies that reduce unintentional lane departure as well as alert the driver should a departure occur. The secondary objective is to assist the driver in returning to the travel lane safely and minimize the consequences of departure by creating clear zones along the roadside. A lane departure action plan was devised in 2006 and is being updated in the fall of 2010.

Strategies:

- Continue implementation of Lane Departure Action Plan.
- Identify locations with significant crash history or the potential for drivers to unintentionally leave their travel lane and develop and implement a comprehensive and coordinated initiative of Engineering, Education, Enforcement, and Emergency Response.
- Identify corridors and locations with a disproportionately large number of actual and/or potential for run-off-road and head-on crashes.
- Develop standard operating procedures for the implementation of roadway safety system-wide improvements.
- Apply the concepts of forgiving roadway design.
- Achieve increased safety through the implementation of the latest designs and technology.
- Investigate improved lighting at rural interchanges based on 2006 TDOT Customer Satisfaction Survey findings.
- Removal of hazardous obstacles in the clear zone on right-of-way.
- Encourage safer mailbox structures.
- Consider motorcycle travel when designing strategies for preventing lane departures.

When developing lane departure plans, it is important that a safety countermeasure that may improve the safety on one mode not decrease the safety of another mode. An example is the installation of a traditional rumble strip, which may increase the safety for a motor vehicle but may decrease the safety for a bicyclist.

Improve Intersection Safety

Intersection-related crashes accounted for 186 fatalities within Tennessee in 2008. Rural intersections accounted for 71 fatalities, of which 7 were at signalized intersections, and 64 were at unsignalized intersections. Urban intersections accounted for 115 fatalities, of which 51 were at signalized intersections, and 64 were at unsignalized intersections. Intersection related crashes accounted for 18 percent of Tennessee's fatalities compared to 22 percent nationally. Fatalities and serious injuries at highway/railroad intersections, while spectacular, account for a small percentage statistically of this particular emphasis area. According to NHTSA, two-thirds of all motor cycle vs. motor vehicle crashes occur at intersections. Tennessee will improve the focus for all modes of transportation at intersections.

Strategies:

- Identify intersections that qualify for the Highway Safety Improvement Program based on severity due to the number of fatal and serious injury crashes on the State and local systems.

- Implement cost effective intersection safety improvements that address project specific fatal and serious injury crash data.
- Achieve increased safety through the implementation of the latest designs and technology.
- Provide appropriate warnings at all highway-rail grade crossings.
- Increase enforcement at intersections and highway-rail grade crossings.
- Provide public information on the importance of compliance with traffic control devices.
- Inventory and bring up to MUTCD standards all signs on Tennessee roadways (state and county).

Improve Work Zone Safety

Most road construction projects or utility work along Tennessee's Highways involve lane closures or restricted lanes at times. Each year, there are hundreds of work zones which present dangers to workers and drivers alike. Typically, 85 percent of those killed in a work zone are drivers or occupants and rear-end crashes (running into the rear of a slowing or stopping vehicle) are the most common kind of work zone crash. Increased public awareness is a key factor in improving work zone safety. In order to comply with the Work Zone Safety and Mobility Rule, the Tennessee Department of Transportation developed the Tennessee Work Zone Safety and Mobility Manual to maintain safety and mobility within Tennessee's roadway work zones. Its purpose is to serve as a record of compliance with the Final Rule by promoting safety and mobility within work zones; define the process by which major aspects of applicable work zones shall be established; promote coordination between all organizations involved in work zone development; and provide guidance for the required completion of the work zone process by providing detailed instruction for completion of Traffic Management Plans.

Strategies:

- Provide work zone training and information for public agencies and industry personnel.
- Ensure appropriate work zone traffic control including pavement marking and signing.
- Implement the updated work zone temporary striping policy.
- Prepare and air Public Service Announcements on work zone safety.
- Continue "Between the Barrels" teenage driver work zone training program instituted in 2006.
- Provide practices and policies to improve the safe travel of motor carriers in work zones.
- Achieve increased safety through the implementation of innovative designs and technology.
- Provide incident management training for all responders to highway incidents.
- Publish work zone booklet.
- Provide funding to state and local law enforcement to help control speeding in major work zones.
- Use "Merge Left" lane drops wherever practical.
- Use the 511 system to relay important work zone information to the public.
- Expand use of coordinated incident management (including HELP Program) in work zones to minimize effects on traffic flow and decrease secondary incidents.
- Implement Quick Clearance on all highway incidents and in work zones as a means of minimizing effects of secondary incidents.

- Conduct comprehensive review of current procedures as required by TDOT's Work Zone Safety and Mobility Manual.
- Implement state-wide standardized inspection procedures for work zones.
- Provide Emergency Reference Markers on urban Interstates and other controlled access highways to improve emergency response and crash data.

Improve Motor Carrier Safety

According to the Federal Motor Carrier Administration, Tennessee's crash data shows over representation of crashes in metropolitan areas along the interstates, due to congestion and high amounts of through CMV traffic. Department of Safety data shows 2003 had 117 fatal crashes with 124 fatalities, 2004 had 148 fatal crashes with 165 fatalities, 2005 had 153 fatal crashes with 166 fatalities, 2006 had 151 fatal crashes with 157 fatalities and 2007 had 152 fatal crashes with 155 fatalities. For overall crashes, Motor Carrier Management Information System shows 3,452 in 2003 – 3,339 in 2004 – 4,698 in 2005 – 4,488 in 2006 - and 3,915 in 2007. During the year 2007 approximately 61 percent of all CMV fatalities reported occurred in rural locations, with approximately 79 percent of crashes identified as occurring on either undivided two way traffic ways, or divided traffic ways without a barrier. This information was taken from FMCSA Analysis and Information Online (A&I) and TDOS data.

Strategies:

- Combine Safety Education efforts;
- Improve the effectiveness and reporting of CMV violation citations;
- Restrict trucks to right two lanes in urban areas and outside city limits;
- Identify and manage problem drivers more effectively in high crash counties;
- Develop and implement targeted enforcement initiatives;
- Provide technological infrastructure and solutions;
- Continue to implement National and State Specific Program Elements:
- Driver/Vehicle Inspections
- Compliance Reviews and New Entrant Safety Audits,
- Traffic Enforcement,
- Public Education and Awareness,
- Data Collection,
- School Bus Program (State Specific),
- Drug and Alcohol Interdiction (State Specific),
- Hazardous Materials (State Specific),
- Motor Coach Program (State Specific),
- CMV Seat Belt Usage.

Improve Driver Behavior

Addressing driver behavior is a critical factor in reducing fatal and serious injury crashes. In 2008, of the 1,043 fatalities, 404 were alcohol related, 243 involved driving too fast or exceeding the speed limit, and 467 were not wearing safety restraint devices. The statistics also show that a large number of fatal crashes are due to the drivers' impaired condition or errors. A driver's lack of knowledge for the needs and rights of other road users leads to fatal crashes. Therefore, enforcement and education should be emphasized in the corresponding strategies.

Strengthen Legislation

Legislation that was passed in 2004 by the Tennessee General Assembly included a new Primary Seat Belt law that went into effect July 1, 2004. In addition to primary enforcement, this bill added the following definitions to the seat belt law: prohibits any passenger from riding anywhere in a motor vehicle other than in a passenger seat position; requires all passengers, and not just front seat passengers, to wear safety belts; directs $20.00 of the proceeds of the fines from violations, rather than full amount, to the division of vocational rehabilitation; mandates that violators receive points on driving record; and adds to the list of circumstances excluded from the act.

In 2007, the Jeff Roth and Brian Brown Act was passed by the Tennessee General Assembly requiring all motorists to provide at least three feet of distance between a motor vehicle and a bicyclist on a roadway, making roads safer for both motorized and non-motorized modes of transportation. Multiple testing of impaired drivers was passed in 2005. In fall of 2006 a task force appointed by the Governor reported on proposed changes and reorganization of DWI laws. These will be proposed in a future legislative session. Booster seat legislation was passed by the Tennessee General Assembly in 2003 that also went into effect July 1, 2004. A booster seat is now required for children aged 4 years through 8 years and less than 5 feet tall. In 2006, the *Move Over for Emergency Vehicles* law was strengthened. The maximum fine was raised from $50.00 to $500.00. A law prohibiting texting while driving was passed during the 2009 session. Also legislation allowing Department operated cameras in work zones for enforcing or monitoring traffic violations when workers are present was passed in 2009.

Enhance Educational and Awareness Programs

The Tennessee Law Enforcement Training Academy, as well as the four metropolitan area law enforcement academies, is overwhelmed with requests from law enforcement agencies for specialized traffic crash training courses. The need exceeds the resources. Due to overcrowded schedules as well as local agency funding resources, courses are unavailable on a regularly scheduled basis, the availability of specialized training within a geographic region is lacking in scope.

Also, due to emerging technologies and processes, additional safety training in intersection safety improvements, roadside safety design, safety data analysis and new approaches to highway safety design will be needed for State and local engineers, technicians, and highway personnel.

In 2006 a Safety Circuit Rider Program was instituted to train local officials on road safety audits and low cost safety improvements. Counties that were over represented in fatal crashes were first targeted. In 2009 this will be replaced by a Local Roads Safety Initiative to perform Road Safety Audits and let to bid safety improvement contracts on non-state routes. Priority will be given to items that do not require a local match of funds such as guardrail, signing, marking, lighting, etc.

Strategies:

- Conduct a needs assessment survey for municipal and county law enforcement agencies to determine specialized highway safety and traffic enforcement training courses.
- Offer more regional based highway safety and traffic courses to meet the demand for specialized traffic enforcement training.
- Conduct training for local and State engineering forces on integration of safety into the project development process (planning, design, construction, maintenance and operations) of the highway system.
- Implement a Local Roads Safety Initiative.
- Provide training to representatives of Metropolitan Planning Organizations and Rural Planning Organizations for Road Safety Audit Reviews.
- Continue to bring in Federal Highway Administration sponsored safety training.
- Continue "Between the Barrels" teenage driver work zone training.
- Provide law enforcement training for work zones and incident management.
- Continue training for law enforcement, prosecutors and judges for impaired driver enforcement. Collaborate with other agencies and organizations to establish standardization of traffic schools in Tennessee, i.e. licensing, curriculum, minimum hours, and qualification of instructors.
- Provide law enforcement agencies training about the laws that apply to bicyclists and sharing the road with bicyclists.
- Continue to promote and fund Safe Routes to School programs to enable communities to educate schools, law enforcement, parents, students and motorists about the benefits of walking and bicycling to school for reduction of traffic congestion and promotions of student health and environmental health.
- Continue utilization of driver awareness messages and programs aimed at reminding drivers to watch for motorcycles while on the road as a venue for reducing avoidable accidents from occurring.
- Partner with the Motorcycle Awareness Foundation to educate local and state law and emergency officials to train in the proper techniques for handling a motorcycle accident and motorcycle victims.

Safety on Public Transit

Local transit agencies have always placed an emphasis on providing a safe, secure, and reliable service for its passengers and employees. These efforts are continuing and are an integral part of providing transit service. While transit must be concerned about safety and security as it relates to the provision of service, transit itself can be a valuable resource to a community in providing rescue or evacuation services. Local transit providers participate as part of the larger community emergency preparedness efforts.

Transportation System Security

With increased emphasis placed on transportation system security as a result of recent national natural disasters and the ever present fear of an act of crime or terrorism against the public or public infrastructure, the metropolitan planning process has been improved to provide a more in-depth discussion of security. All projects

listed in this plan have been reviewed to determine their potential to improve the security of the transportation system.

Though the MPO is not involved in specific security or emergency planning activities, the Organization does communicate with the Tennessee Department of Transportation, Tennessee Department of Safety, Tennessee Emergency Management Agency, Tennessee Highway Patrol, local emergency management and law enforcement agencies, local engineering officials, and emergency personnel on major transportation plans and projects with the intention of developing a transportation system that is as secure as possible.

Intelligent Transportation Systems

Intelligent Transportation System (ITS) cameras allow officials at the Transportation Management Center (TMC) to monitor activity along Interstates within the region. Law enforcement and/or emergency personnel can be dispatched by the TMC if an emergency is spotted.

Dynamic Message Boards located along interstates and major highways throughout Davidson County and at some rural locations are capable of displaying emergency information such as weather or other natural incidents or warnings, hazardous spill information, Amber alerts, or evacuation orders.

The TDOT HELP trucks provide incident response services along area interstates and routine surveillance of bridges and overpasses, keeping a look out for suspicious activity or disabled vehicles. HELP truck operators are able to contact law enforcement or emergency personnel if needed.

Public Transportation

Since the terrorist attacks of September 11th, 2001, the efforts with regards to safety and security have reached a new level of importance. The Federal Transit Administration has undertaken a series of major steps to help local transit providers prepare against a variety of threats. It is critical to integrate security throughout every aspect of transit programs. This commitment must be demonstrated by the continual emphasis on security from the procurement or new systems and equipment, through the hiring and training of employees, to the management of the agency, and through the provision of service. The security function must be supported by an effective capability for emergency response, both to support resolution of those incidents that occur on transit property and those events that affect the surrounding community serviced by the agency.

Although local transit providers have made great strides to strengthen security and emergency preparedness, there remains much more to do. Local transit providers are a critical, high risk, and high consequence asset. Every day, transit provides mobility to thousands of our region's citizens. An appealing aspect of transit is its open and easy access. This aspect also makes it vulnerable.

At the basic level, local transit agencies are assessing their vulnerability, developing security and emergency response plans, training drivers and supervisors, coordinating with local emergency management services, and, if possible, accelerating technology development. Security is being considered proactively in all plans or projects being developed rather than added as an afterthought.

Basic goals of transit agencies in regards to safety and security include:

- Being prepared for and well-protected against attacks;
- Being able to respond rapidly and effectively to natural and human-caused threats and disasters;
- Being able to appropriately support the needs of emergency management and public safety agencies; and

- Being able to quickly and efficiently be restored to full capability.

While local transit agencies have embraced the need to update safety and security throughout their systems, there are relatively few funds to help pay for these programs. Capital expenses can slowly be absorbed through the regular improvement plans. As older vehicles are replaced, the fleet can be upgraded to include new security features, however, it would take years to turn over the entire fleet with some additional financial assistance.

Freight Movement

Trucking: The Transportation Security Administration (TSA) administers the Hazmat Threat Assessment Program which obtains background and security checks on drivers of commercial vehicles transporting hazardous materials. In addition, the Federal Motor Carrier Safety Administration (FMCSA) has initiated several programs aimed at protecting against terrorists using commercial trucks as weapons or targets. Their top priority is dealing with trucks that carry hazardous materials.

Rail: The TSA has developed a series of voluntary freight rail security action items that should be considered when security plans are developed. The action items address system security, access control, and en-route security.

CSX routinely monitors railroads for both safety and security purposes. CSX spends $1 billion annually on track maintenance and upgrades.

Air: The TSA has new air cargo regulations in place that includes canine teams, site and on-board inspections, and physical screening of cargo as well as security and background checks of pilots, employees, and air cargo carriers. The TSA is also responsible for air passenger security.

Barge: The U.S. Army Corps of Engineers in responsible for monitoring all the locks along the Cumberland River and ensuring that they are operating safely and efficiently.

Security Planning Progress

The Strategic Plan for Highway Incident Management in Tennessee was adopted in August 2003 and "establishes the framework for a systematic, statewide, multi-agency effort to improve the management of highway incidents- crashes, disabled and abandoned vehicles, debris in the roadway, work zones, adverse weather, and other events and emergencies that impact the transportation system."

The Department of Homeland Security administers the Targeted Infrastructure Protection Program which in 2005 allocated $365 million to rail, port, and inter-city bus security, and highway watch and buffer zone protection programs.

In April 2003, the State of Tennessee formally formed the Tennessee Department of Homeland Security with the intention of coordinating emergency services and investigative agencies.

The DHS has also provided $250 million to state and local governments and owners of transit security systems and $141 million to owners and operators of rail systems.

MPO-Interagency Consultation & Project Prioritization

The primary objective of the goals related to safety and security is to work with state and local agencies and transportation providers to identify needs and facilitate improvements. Building partnerships with stakeholders is important in the following areas:

- Developing and implementing short term strategies that enhance the safety and security for all users of the transportation system;
- Creating policies and design practices that are consistent with an efficient and safe Intermodal Transportation Network;
- Developing an information system for compiling, accessing, and analyzing crash data; and
- Establishing a long term vision that enhances the safety and security of all citizens.

The MPO coordinates with the Nashville Regional Incident Management Committee which includes members of TDOT, TEMA, THP, local governmental officials, law enforcement, emergency personnel, and wrecker services to discuss challenges and solutions related to safety and security.

Projects benefiting the safety and security of the region are given heightened consideration for inclusion in the Plan. The MPO requires that all parties pursuing projects funded with federal funds show how the project meets the goals and objectives of this plan, including safety and security.

7.6 Roadway & Intersection Needs through 2035

The following map represents more than $6 billion dollars (today's dollars) in needed improvements to the region's major roadway network over the next 25-years, as identified by MPO member jurisdictions or the Tennessee Department of Transportation. With the MPO's increased emphasis of system preservation and enhancement, the bulk of the identified roadway needs contain provisions for the implementation of many of the strategies included in this chapter including complete streets, access management, safety improvements, and multi-modal improvements. With funding levels expected to fall well below the revenue needed to pay for these improvements, the MPO is tasked with developing a strategic approach to prioritizing projects so that limited financial resources are used in a way that most efficiently and effectively advances the region's goals and objectives. The following chapter presents and overview of that process.

Figure 51. Strategic Roadway & Intersection Needs