

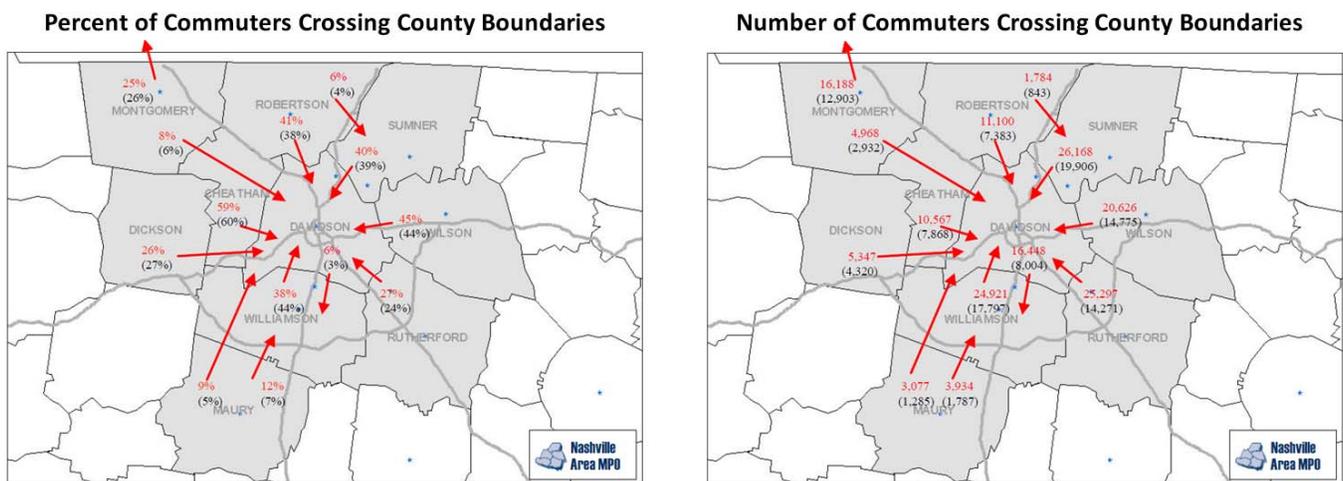
# 4.0 Evaluating the Existing Transportation System

## 4.1 Regional Travel Behaviors

Our transportation system, with its vast network of roads, bus routes, rail lines, sidewalks, and bicycle lanes, is the backbone of our region. Coordinated planning of that system is critical to the continued growth of our local and regional economies. Planning also is important to ensure that as the system grows to manage the traffic congestion that we know is coming as a result of our economic growth and development, and that it grows in a way that is sensitive to our region's valuable natural and community resources.

Understanding how, when, and where people need to move throughout our region plays an important role in determining future transportation needs. One of the most significant influences on travel behavior is the geographic relationship between where people live and work. The commuting workforce is by far the most pronounced part of area traffic congestion, particularly during peak travel periods which typically occur on weekday mornings, from 6 AM to 8 AM, and evenings, from 4 PM and 6 PM.

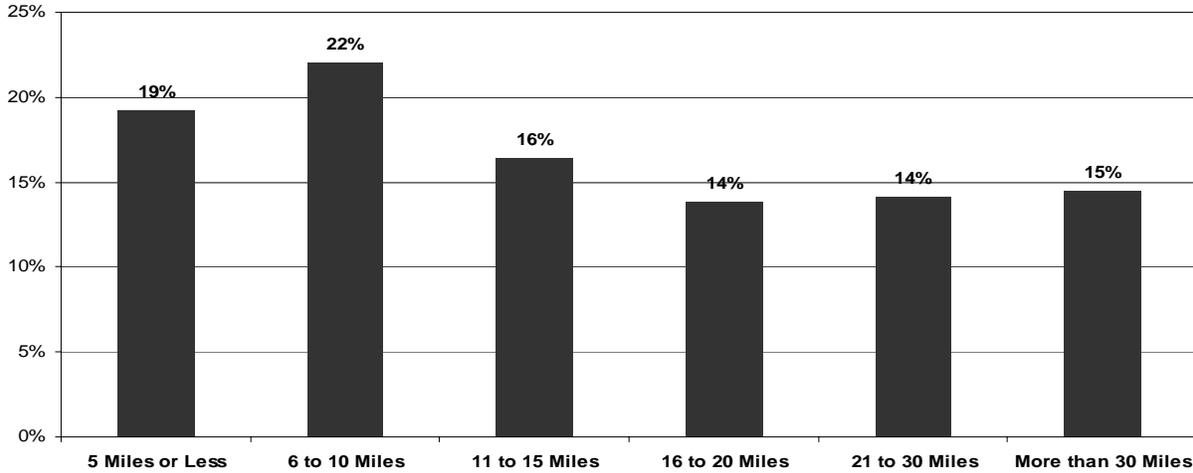
**Figure 16. Inter-County Commuting Patterns, 1990 and 2000**



Source: U.S. Census Bureau Journey to Work Data: 2000 (1990)

The U.S. Census is the most prominently used resource for understanding commuter characteristics. Unfortunately, the last decennial Census was published about 10 years ago. To augment its understanding of travel behaviors, the MPO conducted a random sample telephone survey in 2010. According to that survey, a little more than four out of ten (43 percent) commuters travel more than fifteen miles to get to work. One in five (19 percent) residents reported traveling five miles or less to get to work.

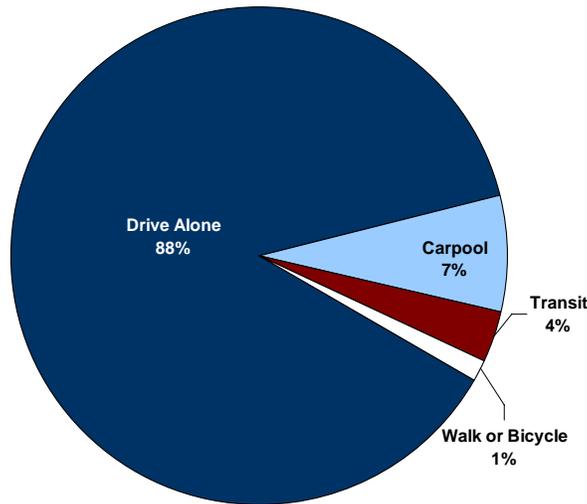
**Figure 17. Average Commute Distance**



Source: Nashville Area MPO, 2010 Transportation Survey.

When asked to indicate the travel mode most typically used to travel to and from destinations, including work, eighty-eight percent of respondents reported that they typically drive alone. Carpooling, or driving or riding in a car with someone else, was the second most reported typical way to travel, while transit (4 percent), and walking and bicycling (1 percent) was reported by about five percent of respondents.

**Figure 18. Typical Mode of Travel**

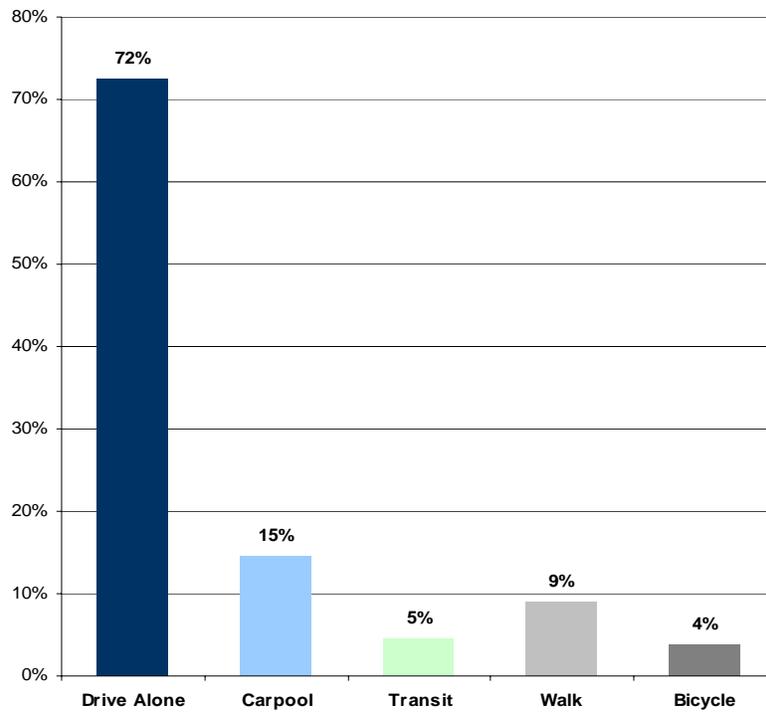


Source: Nashville Area MPO, 2010 Transportation Survey.

Since the Nashville Area MPO is concerned with developing a greater understanding of the full scope of how people choose to travel throughout the area, the survey also asked respondents to report how they have traveled within the last 90 days. Such a question allows the MPO to have a more complete understanding of the types of modes used in daily travel than what asking only for the “typical” travel mode would provide. As anticipated, the responses to that question provided a greater variation in the types of travel modes used by residents across the region. Walking, bicycling and transit made up almost 20% of the modes used within the last ninety days at the time the responses were provided. Moreover, when asked specifically if *any* member of the household had used transit within the past 90 days, fourteen percent reported, “yes.” When asked if *any* member in the household had walked or bicycled somewhere for purposes other than for recreation or exercise,

twenty percent reported “yes.” Such responses indicate that the percentage of households that have members with experience using transit or non-motorized modes of transportation is far greater than the percentage of respondents answering the survey.

**Figure 19. Travel Modes Used within Last 90 Days**



*Source: Nashville Area MPO, 2010 Transportation Survey.*

## 4.2 Roadways & Bridges

Roadways are the most visible and productive component of our national, state, and regional transportation infrastructure. The greater Nashville region benefits from easy access to three major U.S. Interstates. However, those facilities demand constant monitoring, maintenance, and management to ensure an acceptable level of service for a growing region.

In general, there are four general classifications of roadways in the Nashville area:



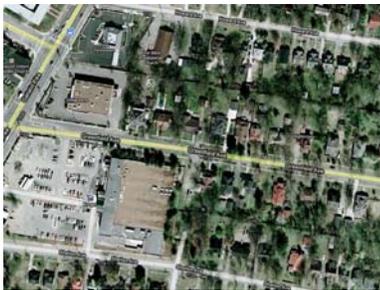
**Freeways** - A divided highway having two or more lanes for the exclusive use of traffic in each direction and full control of access. The freeway is the only type of highway intended to provide complete "uninterrupted" flow.

Examples: Interstates 24, 40, and 65, State Route 155-Briley Parkway, State Route 6-Ellington Parkway, State Route 386- Vietnam Veterans Parkway, 440 Parkway, State Route 840, etc.

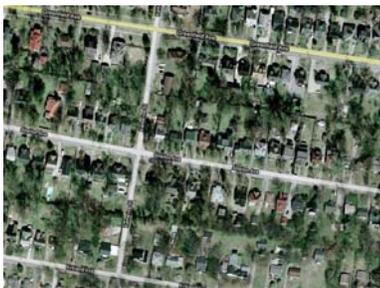


**Arterials:** A major thoroughfare that is vital for moving people and goods: feeds into the interstate and freeway systems.

Examples: Gallatin Pike, West End Avenue, Dickerson Pike, Hillsboro Pike, Nolensville Pike, Lebanon Road, State Route 109, State Route 96, etc.



**Collectors Streets:** Intended to balance access and mobility considerations by serving through movement as well as access to land. Collectors connect traffic on highways and arterials to local streets and adjacent land.



**Local Streets:** All other streets are generally considered to be local. Local streets typically support direct access to homes and are generally designed for slow speeds to safely allow for other neighborhood activities like walking and biking.

There are more than 8,000 lane miles of major roadways throughout the MPO planning area, of which more than 6,700 lane miles are eligible for federal funding made available through the MPO. Generally speaking, major roadways classified as collectors, arterials, and freeways in urban areas are eligible for federal-aid. In rural areas, major collectors, arterials, and freeways are eligible for federal aid. Some exceptions are made to allow federal funds to be used for improvements to bridges on local roads, or projects that improve the safety of local roadways for the non-motorized modes of transportation (e.g., sidewalks, bicycle lanes, etc).

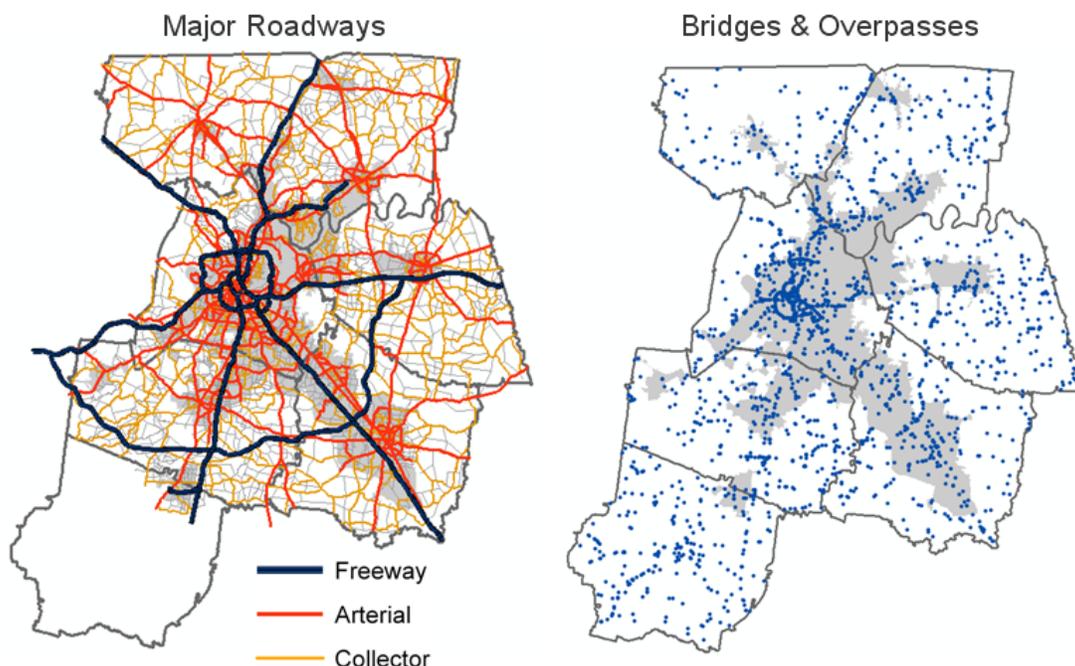
**Table 6. Roadway Lane Miles by Functional Class and County**

Functional Classification	Davidson	Maury	Robertson	Rutherford	Sumner	Williamson	Wilson	Total	Percent
Rural Interstate	47	20	91	30	-	47	32	267	3%
Rural Principal Arterial	2	-	-	129	74	64	60	329	4%
Rural Freeway	-	-	-	-	-	-	-	-	0%
Rural Minor Arterial	120	-	199	65	72	102	90	648	8%
Rural Major Collector	25	7	124	128	104	109	132	629	8%
Rural Minor Collector	117	14	218	222	271	294	404	1,540	19%
National Park Service Road	2	-	-	-	-	43	-	45	1%
Urban Interstate	537	-	16	170	24	88	92	927	11%
Urban Other Freeway / Expressway	159	19	-	19	52	1	2	252	3%
Urban Other Principal Arterial	576	19	73	199	158	108	125	1,258	15%
Urban Minor Arterial	745	-	66	254	83	126	103	1,377	17%
Urban Collector	322	21	50	231	190	144	92	1,050	13%
<b>Total All Road Miles</b>	<b>2,652</b>	<b>100</b>	<b>837</b>	<b>1,447</b>	<b>1,028</b>	<b>1,126</b>	<b>1,132</b>	<b>8,322</b>	<b>100%</b>
Percent	31.9%	1.2%	10.1%	17.4%	12.4%	13.5%	13.6%	100%	
<b>Total Federal Aid Lane Miles</b>	<b>2,535</b>	<b>86</b>	<b>619</b>	<b>1,225</b>	<b>757</b>	<b>832</b>	<b>728</b>	<b>6,782</b>	
Percent	37.4%	1.3%	9.1%	18.1%	11.2%	12.3%	10.7%	100%	

Source: Tennessee Department of Transportation

The maps in the following figure provide a graphical representation of the existing major roadways and the more than 2,000 bridges and overpasses located throughout the MPO planning area and includes existing roadways, as well as those with funding already committed to construction within the next couple of years. A list of current roadway projects contributing to the existing plus committed network is provided in Appendix A.

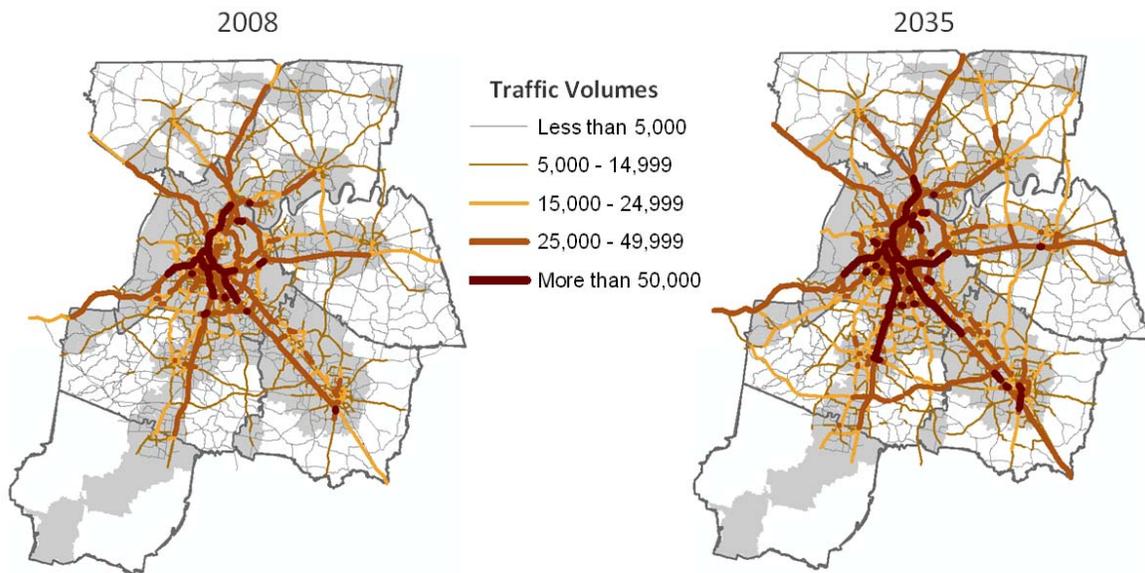
**Figure 20. MPO Major Roadways & Bridges (Existing plus Committed)**



## Future Roadway Travel Demand

Working in partnership with the Tennessee Department of Transportation and local governments, the MPO must be able to track the traffic volumes of existing roads and predict how those volumes will grow in the future in order to appropriately plan for future investment in roadway infrastructure. Between now and 2035, the traffic volume, as expressed in terms of vehicle miles traveled, is expected to increase by 45 percent. The following figure provides a comparison between existing and future vehicle volumes for major roadways throughout the region.

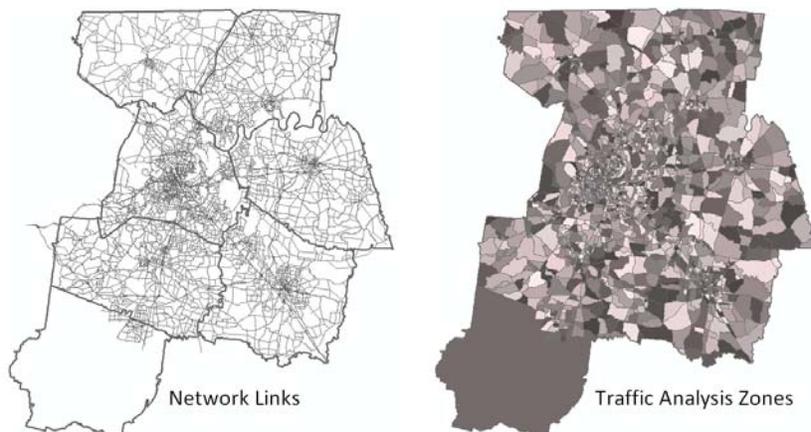
**Figure 21. Relative Vehicle Flows on Major Roadways, 2008 vs. 2035**



### *Predicting Future Traffic Volumes*

In urban areas of the state, MPOs take a lead role in predicting future traffic volumes for major roadways within their respective planning areas. In most cases, the primary tool used in developing traffic forecasts is a regional travel demand model. The travel demand model consists of two types of geographies -- a network of *links* (representing regionally-significant roads) and *nodes* (representing the Traffic Analysis Zones (TAZs) - there are over 2,100 TAZs in the Plan area).

**Figure 22. Travel Demand Model – Network Links and Traffic Analysis Zones**



Each TAZ is coded with the employment and demographic data (discussed in the Population & Employment Projections section) for the required years of the Plan (2008 base year, 2015, 2025 and 2035). At the same time, the links are coded with roadway characteristics that are used to determine the peak hour and daily 'capacity' of each road network segment. Network characteristics used to estimate capacity include facility type (e.g. arterial, freeway, collector or local), area type (e.g. rural, suburban, exurban), number of lanes, and speed under free-flow conditions.

Before future model years are run, tests are made with a base year network that represents the most current year for which 'on the ground' traffic counts are available. This is done to ensure, as closely as possible, that the model can reasonably represent traffic volumes for the forecast years. If the result of this initial run is far off, the model is *calibrated* until the modeled traffic volumes are within the threshold of error compared to observed traffic counts, or validated.

A common practice in assessing future demand is to assume no additional improvements to the existing transportation system will occur beyond what is currently being funded or currently under construction. This system is often referred to as an *existing plus committed network (E+C)*, or a "no-build" network. This is essentially a test of how a roadway network, consisting of existing and currently funded future roads, could withstand the demand of projected population and employment growth.

- **Trip Generation** - This is the first step of the four-step travel demand modeling process. The model is rooted in synthetic equations derived from local travel survey data - in this case the 1998 Nashville Area Travel Behavior Study - to create trip rates (i.e. trips per household). The trips rates are organized by trip purpose (i.e. home-based work) and then converted to total trips. The sum of these trips becomes the region's trip productions.
- **Trip Distribution** - Next, the model needs to determine where these trips are going. This is where the employment data comes in. These will attract the trips, so they can be distributed from zone to zone (example zone 163 to zone 420). Note that at this stage the model has not yet determined which actual paths - or roads - will be used. Trips are established between zones based upon the shortest travel time or lowest cost between all zones in the network. The model uses an accessibility-based algorithm to estimate the optimal distribution of trips within the region. Once completed, this portion of the model is calibrated against 'real-world' data obtained from the household survey.
- **Modal Split** - Modal Split is the process of splitting person trips, (i.e. the total trips a person will take each day), into all available modes of transportation, (e.g. auto, transit, bike, etc.). The process of determining how many trips to transfer can vary depending on the level of sophistication of the region's travel demand model. It can range from taking a set percentage of trips, to a mathematical mode-choice model. This type of model requires a substantial data collection and work effort, as a detailed origin-destination transit survey needs to be done, in addition to coding a full transit network in the model. If combined with various future forecast runs that emulate different land-use scenarios (i.e. transit-oriented development versus sprawl), the model can serve as a powerful tool to evaluate transportation and land-use policy options and how they affect the transportation system.

As part of the current Northeast Corridor Mobility Study, the Nashville Area MPO is piloting a regional mode-choice model capable of assigning a percentage of trips to transit alternatives as part. As an interim step toward the adoption of a regional mode-choice model, mode split for the region is based on the average vehicle occupancy of each trip purpose. Validation of the travel demand model supports this assumption - and for reference, the criteria used to validate the travel demand model are presented in the technical documentation for the regional model.

- **Trip Assignment** - Finally, the model assigns trips to the links in the network. The final output of the model shows the estimated volumes and average speed for each link in the network.
- **Model Calibration/ Validation** - Before the model can be used as a planning tool, the base year (2008) network is adjusted, or calibrated until the modeled results are within the established allowable error, (i.e. validated), when compared to actual base year traffic data.

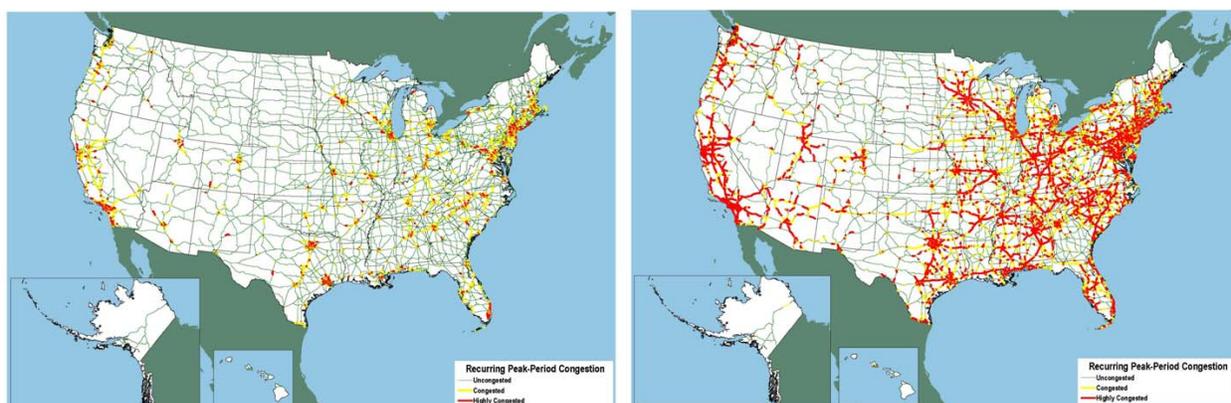
Projected average route speed on major arterials and interstates indicate how well a segment or route is expected to accommodate future travel demand. Even though some segments and routes may be operating efficiently at current levels, they may not be able to handle anticipated future traffic volumes. Conversely, the segments and routes which are currently experiencing poor operating conditions may be improved to acceptable average route speeds as a result of certain travel demand and supply strategies and/or infrastructure improvements.

More information about the MPO’s Regional Travel Demand Model is included in Appendix E.

### 4.3 Roadway Congestion

Demand for highway travel by Americans continues to grow as population increases, particularly in metropolitan areas. Construction of new highway capacity to accommodate this growth in travel has not kept pace. Despite the recent blip in traffic volumes due to the economic recession, traffic volumes are projected to continue growing. The volume of freight movement alone is forecast to nearly double by 2020. Congestion is largely thought of as a big city problem, but delays are becoming increasingly common in small cities and some rural areas as well.

**Figure 23. U.S. Daily Recurring Peak Period Congestion, 2002 and 2035**



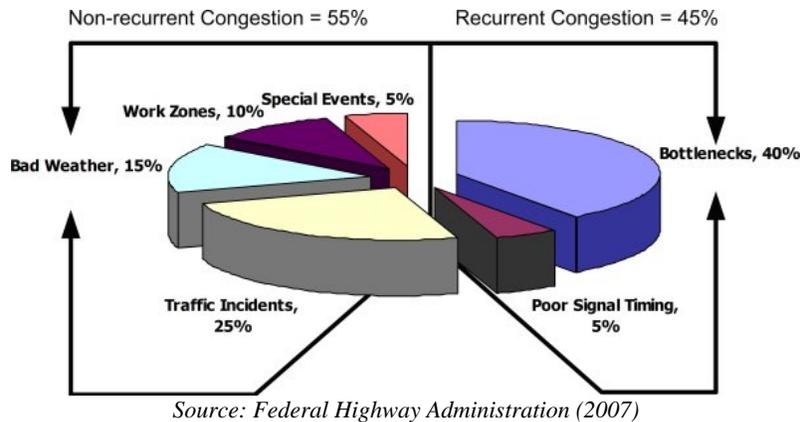
*Source: U.S. Department of Transportation Federal Highway Administration*

### Causes of Congestion

Transportation planners and engineers monitor two types of congestion, recurring and non-recurring. Recurring congestion results when traffic demand approaches or exceeds the available capacity of a facility as determined by the physical limitations of a roadway and/ or the operation of the facility (e.g., signalization or other traffic control devices). Recurring congestion is somewhat reliably predictable based on analysis of growth in demand and the supply of roadway capacity. Non-recurring congestion, on the other hand, is much more difficult to predict -- as it depends largely on factors beyond a transportation planner’s control including weather, driver behavior and/or impairment, accidents, and special events.

Across the U.S., less than half (45 percent) of all congestion is considered recurring and caused by bottlenecks or poor signal timing. That portion of congestion can be treated or managed through transportation improvements that add capacity to the network in the form of additional roadway lanes, transit service, sidewalks, and bicycle lanes or through more efficient traffic control measures (e.g., improved traffic signal timing). The remaining congestion, about 55 percent, is considered non-recurrent – or beyond the direct control of transportation planners or engineers. Still, DOTs and MPOs are seeking ways to minimize delays caused by bad weather, special events, work zones, or traffic accidents by employing more effective traffic incident techniques and targeting funding at improving the safety of high crash locations.

**Figure 24. Causes of Congestion in the U.S.**



### Current and Future Levels of Congestion

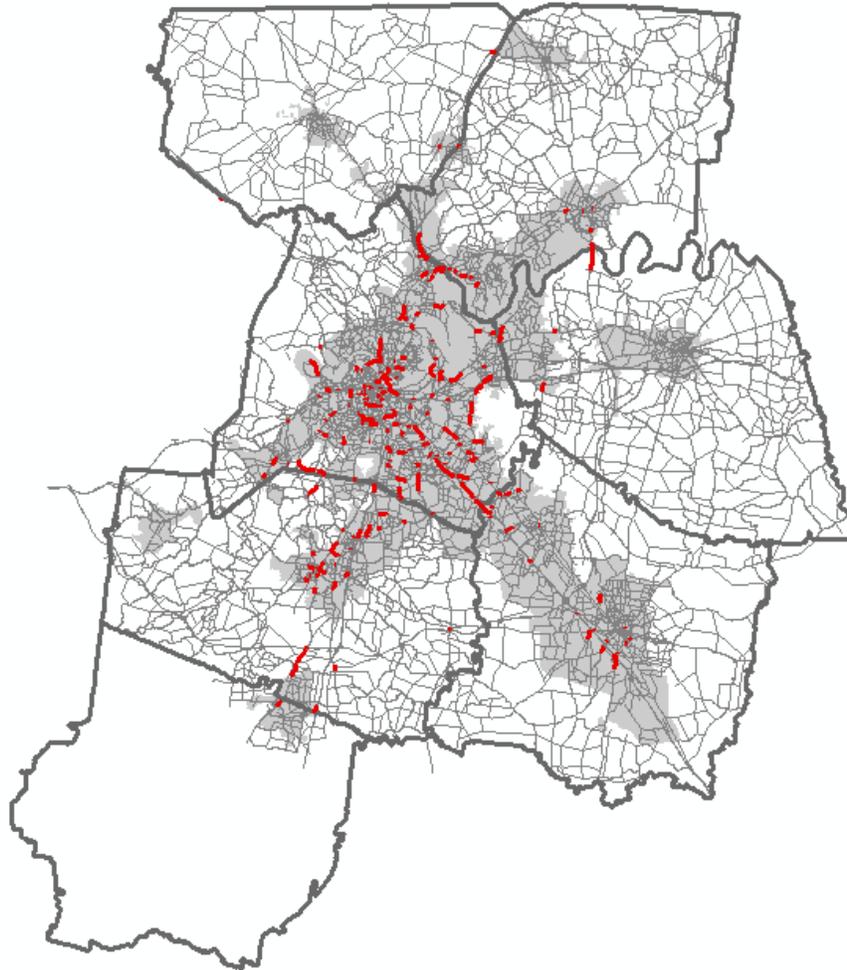
The Nashville region is well served by a complex system of roads ranging from the interstates and other freeways to city streets and rural local roads. Travel on these roads has been steadily increasing as the region has grown, causing congestion levels to rise. Congestion occurs regularly on certain roads and freeways as traffic approaches and exceeds the roadway’s operating capacity. Historically, congestion has been associated with radial commuting patterns leading in and out of downtown central business districts. Over the past thirty to forty years, large suburban retailers located along these arterial routes to take advantage of regular commuter traffic. The resulting commercial clusters (also called Regional Activity Centers) are now the location of frequent congestion.

Many communities are experiencing conflicts between the desire to use arterial roads as commercial destinations, versus the routes’ original role of carrying thru-traffic at relatively high speeds. As a result of arterial roads being congested with shoppers, the region’s interstates have been carrying an increasing proportion of local traffic. This in turn leads to congestion on the interstates, as commuting traffic mingles with heavy trucks and other vehicles who simply want to travel through the area.

In more recent years, the establishment of strong employment centers in suburban locations (such as Cool Springs in Williamson County and Indian Lake Village in Sumner County) has led to increased travel on circumferential routes around cities throughout the region. With the growth of suburban development in the region, congestion now occurs with regularity on circumferential as well as radial routes.

The following figure represents the MPO’s analysis of recurring congestion on major roadways throughout the region based on the land development patterns and population and job characteristics of 2008, which serves as the base year for the 2035 RTP. In determining congestion, the MPO defines any segment of roadway with a modeled travel speed of seventy percent or less of the expected free flow speed as being congested.

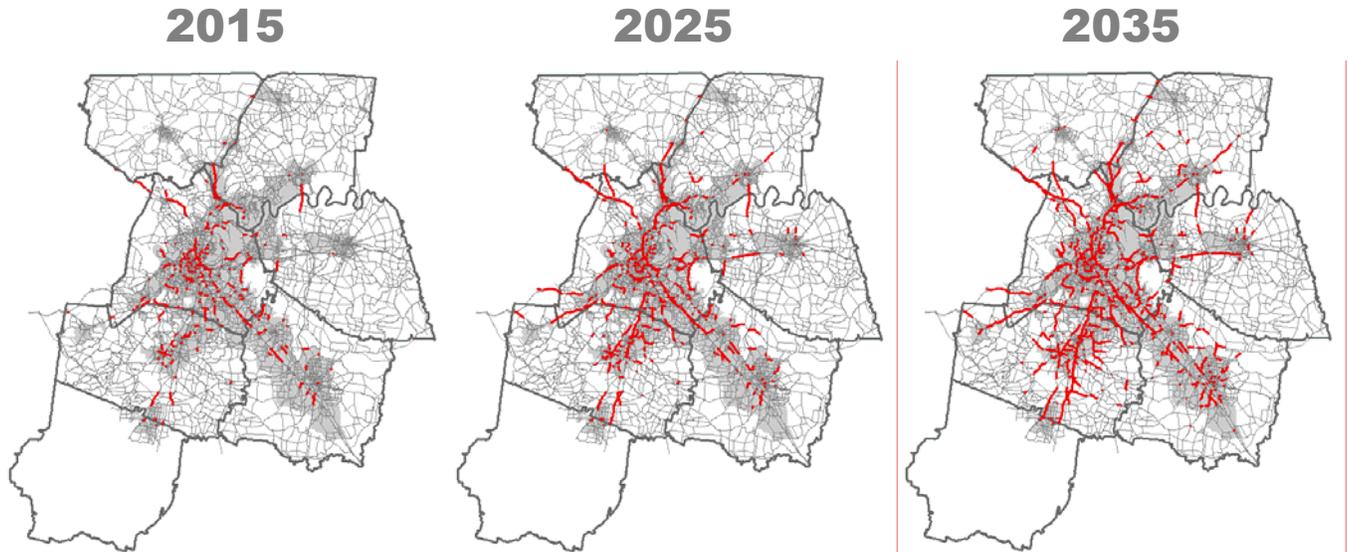
**Figure 25. MPO Daily Recurring Congestion, 2008**



*Source: Nashville Area MPO, Regional Travel Demand Model*

In predicting future congestion for the purposes of identifying the deficiencies of the existing roadway network, the MPO first uses a land use model (described in Section 3.2) to predict where people will live and work in the future. Once the land use model has determined the distribution of households and jobs, the travel demand model predicts how and where people will travel using the existing roadway network – assuming no improvements are made beyond those already underway. Using the same definition of congestion used for the base year (speeds at 70 percent or less of expected free flow), the MPO identifies congested routes for each of the plan’s horizon years. The following figure presents the results of the MPO’s congestion forecast for the short-term (2015), mid-term (2025), and long-term (2035) horizon years.

**Figure 26. MPO Congestion Forecasts by Horizon Year**



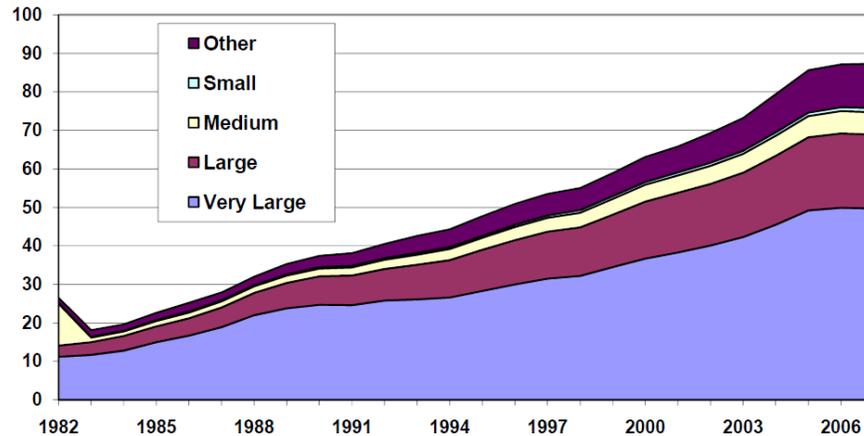
*Source: Nashville Area MPO, Regional Travel Demand Model*

### **Cost of Congestion**

While it is difficult to know for sure the true cost of congestion, the Texas Transportation Institute (TTI) at Texas A&M University has gained a solid reputation as being the leading authority for publishing congestion-related data for urban areas across the nation. Every two years, TTI releases their highly anticipated and highly publicized, “Urban Mobility Report,” which provides an overview of congestion in more than 439 urban areas across the nation including estimates of the cost of that congestion. According to TTI, congestion has several costs for travelers, businesses, agencies and cities. Two significant elements are the value of the time spent in traffic and the fuel wasted in that congestion. The following are highlights from the *2009 Urban Mobility Report* which includes data through the year 2007.

- In 2007, congestion (based on wasted time and fuel) cost about \$87.2 billion in the 439 urban areas, compared to \$87.1 billion (in constant dollars) in 2006.
- 2.8 billion gallons of fuel were wasted in the 439 urban areas. This amount of fuel would fill 56 super-tankers or 370,000 gasoline tank trucks.
- The urban areas with populations greater than 3 million accounted for 1.6 billion gallons (almost two-thirds of the national estimate) of wasted fuel.

**Figure 27. Annual Cost of Congestion for U.S. Urban Areas, 1982-2007**



Source: TTI Urban Mobility Report (2009)

For the Nashville-Davidson Urbanized Area (UZA), which includes only a portion of the Nashville Area MPO planning area, TTI estimates the average annual cost of congestion to be about \$426 million. Assuming that figure to remain constant over the life of the 2035 Regional Transportation Plan, the Nashville-Davidson UZA portion of the MPO's region would incur roughly \$10.6 billion (2007 dollars) in lost time and wasted fuel as a result of congestion. By comparison, the total federal revenues for transportation projects between 2010 and 2035 is estimated at about \$5 billion (in year of expenditure dollars). As the 44<sup>th</sup> most populous urban area of the 439 included in the report, the Nashville-Davidson UZA ranks 34<sup>th</sup> most costly in terms of congestion.

Additional costs of congestion include impacts to personal and environmental health. A study conducted in Atlanta during the 1996 Olympics found a significant decrease in hospital admissions related to asthma during the two-week period when the ADT on the regional roadways was down significantly. Studies such as this one provide insight into health concerns that may be related to air quality. New research indicates that severity of damage due to heart disease worsens as air quality deteriorates. The environmental impact of congestion is another area that is just starting to be understood. The MPO is aware that these hidden costs of congestion exist, and that congestion has significant impacts on health in addition to fuel consumption and time lost.

## 4.4 Roadway Safety

Incorporating safety in transportation planning helps identify, analyze and develop solutions to transportation hazards – and is an effective congestion management tool considering that 25 percent of traffic congestion is caused by accidents/ incidents. For safety conscious planning to appropriately address the movement of passengers and goods across all modes of transportation, it is necessary for many agencies (MPO, TDOT, local governments, public safety personnel, emergency services personnel and trucking companies) and the public to communicate consistently with one another. While the primary focus of transportation safety planning efforts is on reducing injuries and loss of life, improving safety can also decrease economic losses and significant transportation system disruptions that result from crashes.

National, State and regional statistics are given below to provide a realistic view of the challenges regarding safety problems for varying modes of transportation. Although there have been improvements and the rates of fatalities and injuries have declined on the national level over the years, there are still obviously needed improvements.

The following table presents a summary of crash data for a four-year period from 2005-2008 for the United States, Tennessee, and the Nashville region. In all cases, the frequency of total crashes and crashes involving a fatality or injury has declined over the past four years.

**Table 7. National, State, and Regional Crash Statistics, 2005-2008**

Year	All Crashes	Fatal Crashes	Injury Crashes
<b>2005</b>			
Nashville Area MPO Region	42,689	196	13,338
Tennessee	177,638	1,161	51,626
United States	6,159,000	39,252	1,816,000
<b>2006</b>			
Nashville Area MPO Region	44,507	187	13,676
Tennessee	179,168	1,161	51,487
United States	5,973,000	38,648	1,746,000
<b>2007</b>			
Nashville Area MPO Region	43,511	186	13,156
Tennessee	172,127	1,111	49,353
United States	6,024,000	37,435	1,711,000
<b>2008</b>			
Nashville Area MPO Region	39,321	181	11,922
Tennessee	158,731	950	45,474
United States	5,811,000	34,017	1,630,000

*Source: Tennessee Department of Safety, NHTSA Fatality Analysis Reporting System, Nashville Area MPO*

Because raw crash figures can be difficult to understand when comparing different locations, the Tennessee DOT and the MPO both rely on the use of crash rates in order to interpret useful information from the data. A crash rate represents the number of crashes per 1,000 licensed drivers for any given area (county, region, state, etc.). The following table presents the ranking of each MPO county (out of 95 Tennessee counties) for crash rates of various types of crashes. Overall the MPO region ranks fairly well when compared with other counties, statewide. Only two MPO counties are ranked in the bottom 10 for any one category. Davidson County has the highest overall crash rate, highest injury crash rate, and highest young-driver related crash rate in the state, and ranks 3<sup>rd</sup> worst for speed-related crashes, 4<sup>th</sup> worst for senior adult-related crashes, and 10<sup>th</sup> worst for motorcycle-related crashes. Rutherford County ranks 6<sup>th</sup> worst overall and 6<sup>th</sup> worst for injury crashes, young-driver related crashes, and senior-adult related crashes.

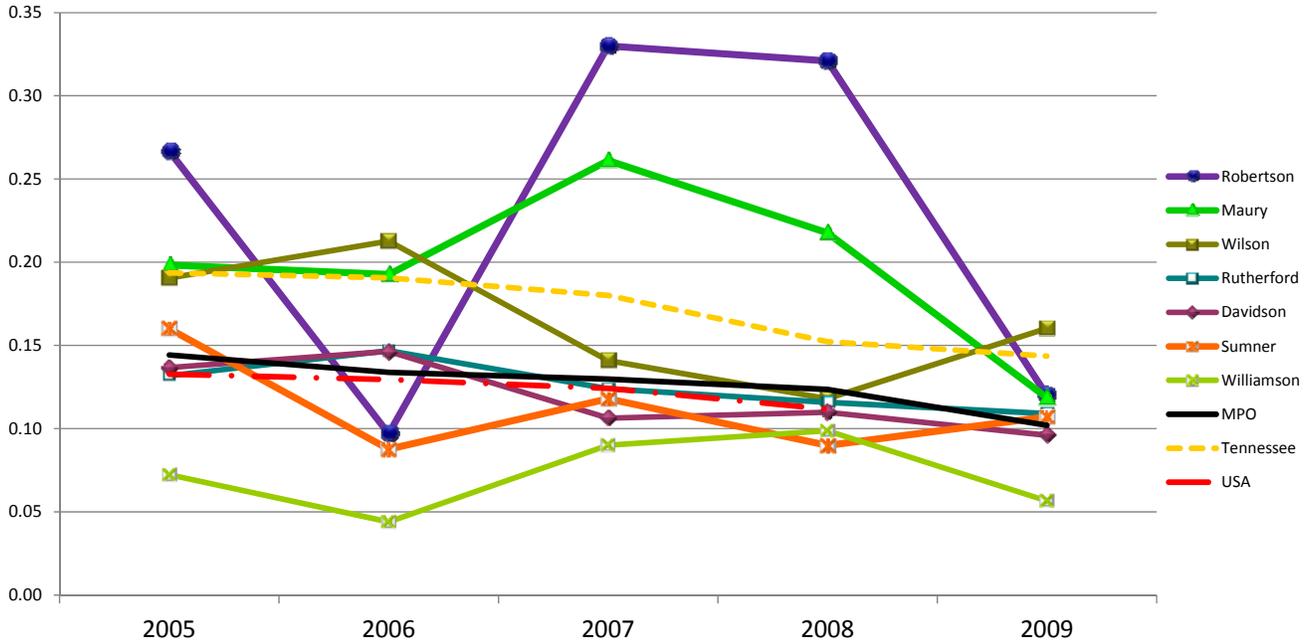
**Table 8. Statewide Crash Rate Rankings for MPO Counties, 2005-2009**

County	Licensed Drivers	All Crashes	Fatal Crashes	Injury Crashes	Motorcycle Crashes	Alcohol Related	Speed Related	Young Driver	Senior Driver
Davidson	2	1	90	1	10	20	3	1	4
Maury	16	23	67	17	67	26	39	29	27
Robertson	20	44	53	60	86	32	66	50	36
Rutherford	5	6	89	6	26	24	38	6	6
Sumner	8	49	94	72	68	62	30	39	35
Williamson	6	67	95	81	82	90	70	69	50
Wilson	12	52	79	52	57	53	31	44	37

*Source: Tennessee Department of Safety, Nashville Area MPO*

Within the MPO region, fatality crash rates tend to be the highest in the less populated, or more rural counties. Robertson and Maury consistently see the highest number of fatal crashes per 1,000 licensed drivers. The MPO performs worse than the national average, but significantly better than the state. The following figure presents the fatal crash rates by MPO county for the last five years, 2005 to 2009.

**Figure 28. Fatal Crash Rates by County, 2005 to 2009**



Source: Tennessee Department of Safety, NHTSA Fatality Analysis Reporting System, Nashville Area MPO

## Crash Locations

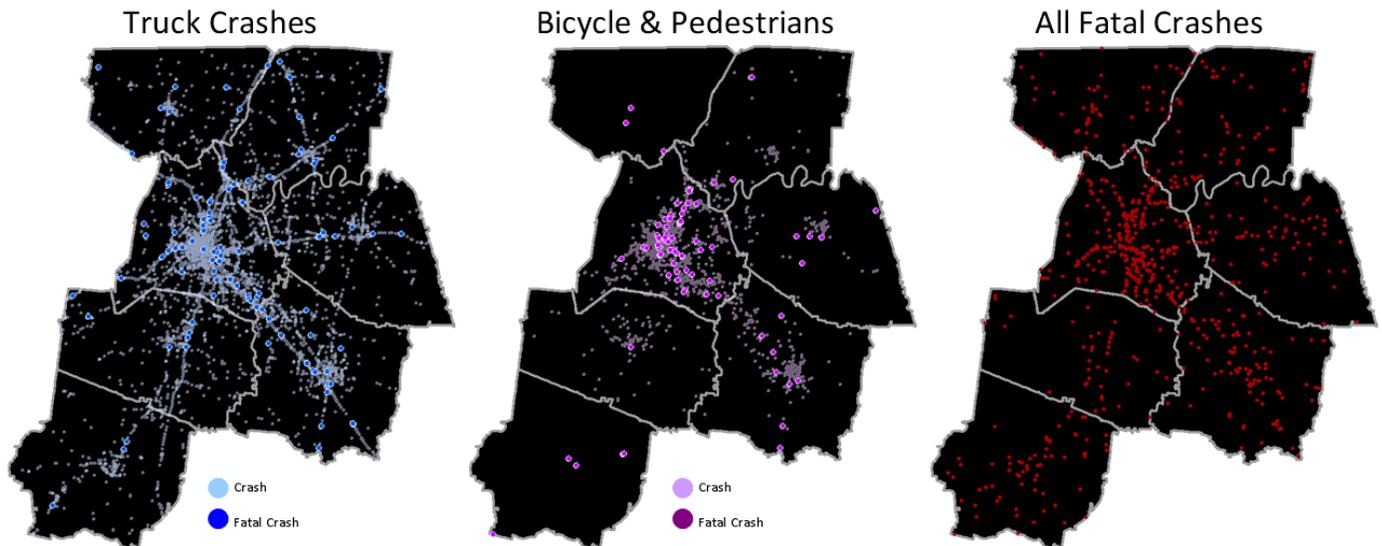
The MPO compiled information from a variety of sources to identify high crash locations on major roadways in the region. Although data were not analyzed by MPO staff in order to determine the specific causes of crashes at particular locations, the following observations were made:

- Most of the high crash locations listed were located at isolated spots or intersections rather than on longer segments of roadways; and
- More high crash locations occurred on uncontrolled access roadways than on controlled access roadways such as interstates.

Since the MPO is involved in a regional-level planning analysis, it is not practical to address all of the individual spot crash locations. That task is left to the state and local jurisdictions as specific improvements are proposed and implemented. The more appropriate means for the MPO to address high crash locations is to reward candidate projects proposing to make safety improvements at known high crash locations with additional consideration for funding, and to advocate safety conscious design principles into roadway improvement projects that are planned in order to promote safe transportation facilities for all modes of travel.

The following figure presents the locations of crashes across the region for the last five years, from 2005 to 2009.

**Figure 29. Regional Crash Locations, 2005-2009**



*Source: Tennessee Department of Safety, NHTSA Fatality Analysis Reporting System, Nashville Area MPO*

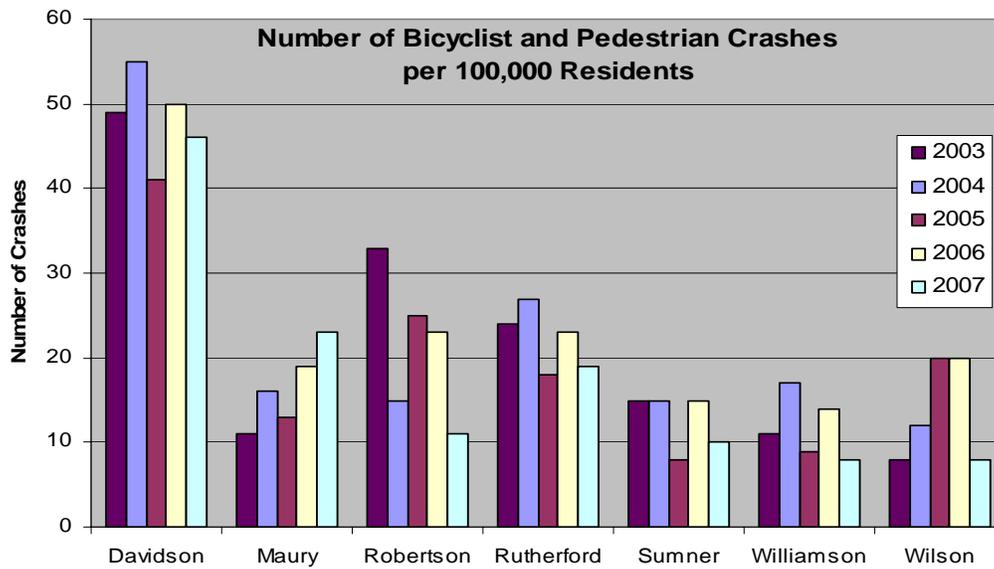
### **Bicycle & Pedestrian Safety**

Increasing bicycle and pedestrian safety is one of the goals of this plan along with evaluating the existing levels of service and facility needs. In order to increase safety for bicyclists and pedestrians, the locations and characteristics of crashes need to be determined and analyzed so that specific facility improvements where necessary can be identified. Pedestrian and bicycle crashes are generally a function of exposure. Pedestrian and bicycle crashes occur more frequently in urban areas where traffic volumes and pedestrian facility use is higher than in rural areas. However, according to the Federal Highway Administration (FHWA), 65 percent of pedestrian crashes occur at non-intersections. Nationally, about half of bicyclist crashes with motor vehicles occur at or near intersections.

A bicycle and pedestrian crash analysis was undertaken as part of the MPO's recently completed Regional Bicycle and Pedestrian Study (2009). The study evaluated crashes involving bicyclist and pedestrians in the MPO area on state routes based on data provided by TDOT. The data were evaluated to determine areas and corridors in the MPO that need improvements to increase safety for bicyclist and pedestrians. This information can be utilized to help prioritize facility improvements. The data spanned the five-year time period between 2003 and 2007. According to the data, 2,076 reported crashes involving a pedestrian or bicyclist occurred within the MPO during this time period, 107 of which resulted in a fatality.

In the figure below, the number of bicycle and pedestrian crashes per 100,000 people for each year between 2003 and 2007 by each of the MPO counties are shown. The figure shows that Davidson County consistently has the highest number of crashes per 100,000 people, which is expected based on exposure and greater use within Davidson County compared to the outlying counties. The figure also identifies a reduction in bicyclist and pedestrian crashes in six of the seven counties since 2003. Any number of factors could contribute to such a trend, but the most likely factor is increased education and awareness for both motorists and non-motorists coupled with improved bicycle and pedestrian facilities.

**Figure 30. Bicyclist & Pedestrian Crashes per 100,000 Residents by County, 2003-2007**



Furthermore, the crash data were evaluated geographically on a corridor level for a three-year period (2003-2005). This analysis is limited to state routes and interstates within the MPO. Crashes that occurred on local routes have been excluded. The following roadway segments in the MPO were identified as high-crash roadway segments, with ten or more pedestrian crashes and five or more bicyclist crashes. As shown, seven segments in Davidson County had ten or more pedestrian crashes within the three-year analysis period, and one segment in Rutherford County had five or more bicycle crashes.

**Table 9. High-Crash Bicycle and Pedestrian Roadway Segments, 2003-2005**

Route	Street Name	Segment (between)	# Ped Crashes	# Ped Fatalities	# Bike Crashes	# Bike Fatalities
<i>Davidson County</i>						
SR 1	West End Ave	15 <sup>th</sup> Ave & Cherokee Rd	13	0	4	0
SR 1	Lafayette St	Broadway & Fairfield Ave	11	0	0	0
SR 1	Murfreesboro Pk	Fairfield Ave & McGavock Pk	13	1	1	0
SR 11	Nolensville Pk	I-440 & Old Hickory Blvd	27	1	3	0
SR 11	Dickerson Pk	Jefferson St & I-65	21	3	3	0
SR 24	Charlotte Pk	I-40/65 & White Bridge Pk	14	2	2	0
SR 106	Hillsboro Pk, 21 <sup>st</sup> Ave, Broadway	16 <sup>th</sup> Ave & Abbott Martin Rd	11	0	3	0
<i>Rutherford County</i>						
SR 10	Memorial Blvd	W Thompson Ln & New Nashville Hwy	6	1	6	0

*Source: Tennessee Department of Transportation. These data were for planning purposes only and are protected by USC 409.*

In order to determine some overarching causes of pedestrian and bicycle crashes and deficiencies in non-motorized facilities, an analysis of crash characteristics was conducted. This analysis, which included all the crashes in the MPO between 2003 and 2005, determined that approximately 86 percent of all crashes involving bicyclists or pedestrians occurred with no adverse weather conditions. Approximately 48 percent of the crashes occurred in the evening after 5pm and 35 percent occurred when it was dark outside. Approximately half of the crashes occurred at intersections and half occurred at non-intersections or on roadway segments.

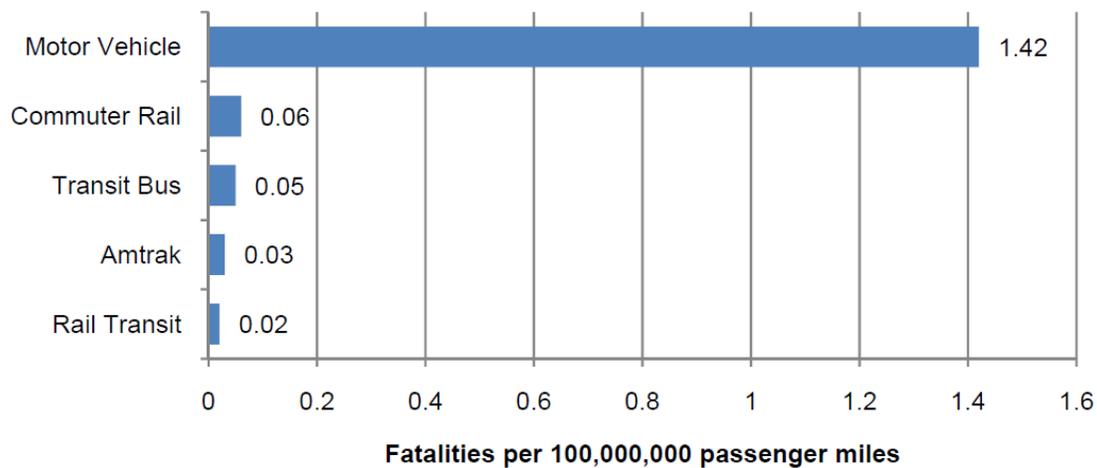
The MPO is working with the Tennessee Departments of Transportation and Safety to analyze bicycle and pedestrian crashes on local and regional roadways to find trends in crash causes such as behavior, time of day and weather conditions. Analyzing crashes by attributes will help MPO staff determine how to mitigate safety issues for bicycle and pedestrian modes. The MPO is also reviewing new reports that demonstrate pedestrian

safety increases with the presence of bicycle lanes (New York, NY) and safety for all modes increases with the presence of transit (Charlotte, NC). Understanding the causes of bicycle and pedestrian crashes and how safety for modes interrelate will help the MPO to make safety recommendations that will increase safety for all modes.

### Safety on Public Transportation

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 and mirror the national observations for the overall safety of public transportation, especially as compared with the fatality rates of the automobile.

**Figure 31. National Fatality Rates by Travel Mode, 2003-2008**



Source: Federal Transit Administration (2009)

## 4.5 Freight Movement

The Nashville region occupies a strategic location within North America. It is within 650 miles of half the U.S. population and sits at the nexus of major highways and rail routes. This location has made the region a transportation hub for many industries, which have produced enormous benefits to the many communities throughout the area. However, this position as a crossroads also brings the region a set of challenges associated with various aspects of transportation, particularly highway congestion and air quality, as the major sources of those problems originate outside the area. The need to influence the overhead flow of through traffic becomes a clear priority for a metropolitan area wishing to control its own development destiny.

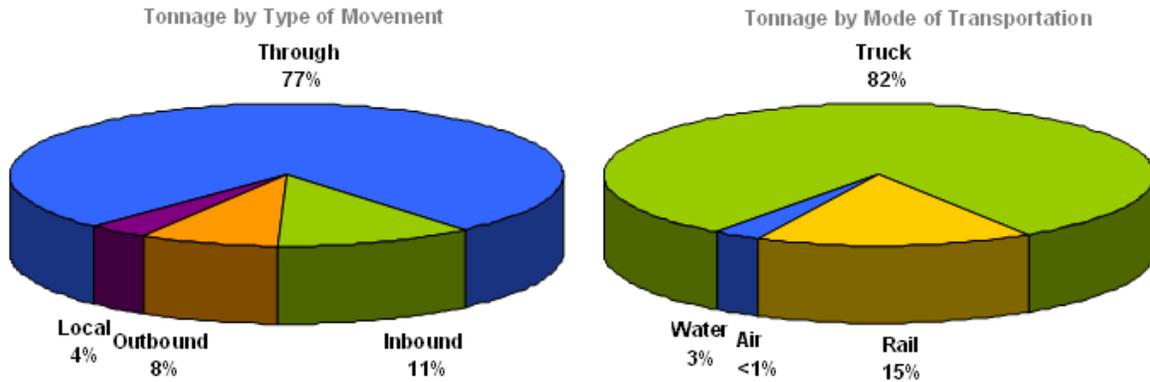
Through its freight planning efforts, the Nashville Area MPO is committed to developing a regional investment strategy that optimizes transportation infrastructure for the freight industry, while conforming to the Nashville region's overall goals for mobility, air quality, and economic development.

### Existing Freight Flows

Nashville has an excellent distribution network at hand with highway, rail, air, and barge facilities all readily available. Three major U.S. interstate highways intersect in Nashville: I-40, I-65, and I-24. The area is served by numerous freight carriers with terminal locations throughout the metropolitan area and beyond. The Cumberland River provides full river barge access to the Gulf of Mexico. CSX Transportation serves Nashville with a major classification yard as well as container, automotive, and bulk terminals. Companies who arrange freight transportation on behalf of local businesses are also active in the Region.

Nashville’s freight infrastructure carries significant tonnage of traffic through the year. The total volume is just short of 300 million tons. While all four modes of transport – truck, rail, water, and air - are represented, trucking far surpasses others in volume. Of the total tonnage moving in the Nashville Region, 87 percent is moving by truck. Rail service moves a substantially smaller volume at 11 percent of the total, and water and air have lesser volumes. Individual Profiles show the breakdown of tonnage by mode.

**Figure 32. Travel Behavior of Freight (2007)**



A substantial portion of the total freight traffic traversing the Nashville Region is “through traffic” with no origin or destination in the area. Nearly 80 percent of truck and rail tonnage combined is through traffic. Looking just at tonnage based in the area (excluding through traffic), Nashville is a medium sized freight market with a typically heavy reliance on the truck mode: 81 percent of area-based tonnage moves by truck, which is slightly above the 79 percent national average. The rail share of this volume is half the U.S. average, but that is common in markets where the water mode also is active.

***Truck Freight Overview***

The Nashville Area supports over 47,000 trucks per day. The majority of trucks by unit count are classified as through traffic – just over 34,000. The smaller inbound and outbound volumes are fairly well matched - in the neighborhood of 11 percent. Truck movement is an integral segment of any freight transportation system as highly evidenced in the Nashville region. While all four modes of transport – truck, rail, water, and air – are represented, trucking accounts for the majority of freight volumes carried inbound, outbound, locally, and through the area. Of the 298,171,394 tons of freight handled in 2007, 82% was transported by truck.

Davidson County accounts for the majority of inbound and outbound traffic in the Nashville region. This is to be expected given the fact that Davidson County is the “hub” of the region in terms of population, employment, and the cross-roads point of the Interstate system. This does not necessarily translate to greater efficiency of trips because the variety of commodities, in conjunction with the diverse type and number of motor carriers in the region, generates empty trips by trucks.

Like inbound and outbound freight, local movements, where trips originate and terminate within the region, mostly occur within Davidson County. Local movements mostly occur on collector and local roads and typically employ a greater number of drivers with knowledge of area roadways. Travel along local and collector roadways may be an attempt to reduce mileage or travel time between stops, increase productivity, or result as an alternative to a delay occurring on the arterial or interstate systems.

Traditional highway assets supporting truck movement are under increasing pressures to identify alternative infrastructural systems that will specifically expand truck capacity. Coalitions across the country are actively

reviewing structural implementations such as dedicated truck lanes (DTL), increased length and weight regulations, and private sector equipment design programs. These capacity enhancements have the potential to reduce trip miles and load counts.

### **On Road Freight Facilities**

The Nashville Region has about 1,200 lane miles of Interstate and about 8,300 total lane miles. This provides access either for long-haul or “final mile” of an intermodal shipment.

The recently completed *Freight & Goods Movement Study: Phase II* determined a network of preferred routes currently utilized to fulfill the needs of freight generators. This system of preferred routes is categorized based on the intended use or functional classification of the roadways in conjunction with the volume of truck traffic. The Primary Freight Highway System (PFHS) consists of interstates and US highways that are observed with an aggregated volume illustration compiled from all four directions. The PFHS may include arterials that exhibit truck volumes consistent with interstate and US highways. The Secondary Freight Highway System (SFHS) consists of arterials and collectors where larger truck volumes are present, as in the Primary System. This system should further reflect roadways that contribute to the overall mobility of the two systems. A third category, Connector Freight Highway System (CFHS), are those roadways similar to the Secondary Freight Highway System, but appear to supply access to a specific geographical area and thus do not contribute to overall mobility of the region’s freight transportation system.

### ***Air Freight Overview***

Increasing fuel and security costs have driven overall operating costs up substantially for the air industry. However, domestic cargo competition for goods that might be moved by air has grown due to carrier consolidation and trucking market-share gains. E-commerce, globalization, and increased competition are driving demand for just-in-time shipments, along with new technological advances and increased efficiencies.

The Airport and Airway Trust Fund (AATF), created by the Airport and Airway Revenue Act of 1970, provides funding for the federal commitment to the nation’s aviation system through several aviation-related excise taxes. Funding currently comes from collections related to passenger tickets, passenger flight segments, international arrivals/departures, cargo waybills, aviation fuels, and frequent flyer mile awards from non-airline sources like credit cards. The Tennessee Department of Transportation Aeronautics Division administers Federal and State funding to assist in the location, design, construction and maintenance of Tennessee's diverse public aviation system.

Of the nearly 20,000 airports in the U.S., there were about 106 qualifying cargo airports in 2009, according to Airports Council International. Nashville International Airport (BNA) is the only airport in the Nashville region to make this list. Total air cargo tonnage equaled 69,499 tons in 2007 with the majority of air freight moving outbound (66 percent). Overall, the airport has experienced a 14 percent average annual growth rate in the last 12 years. In 2007, approximately 55% of the cargo tonnage at the Airport was domestic air freight and about 45% was international air cargo. The major commodities transported by carriers at the airport are comprised mostly of small mixed shipments. Other key commodities are machinery, fabricated metal parts, printed material, and transportation equipment specifically motor vehicle parts and accessories.

Air cargo tonnage at the airport has increased steadily since 1997 after experiencing a dip in activity in the years following 9/11. Air cargo traffic fell precipitously in the United States in 2008 and 2009 as a result of the global recession, a decline that was nearly twice as much as that experienced in 2001 from the 9/11 attacks. The severity of the air freight slump is partially driven by manufacturers seeking to correct large inventory “overhangs” that emerged in late 2008. The lingering decline in air freight is also the result of international

shippers switching to maritime containerized shipping. While this mode is a much slower transport alternative, the cost savings are considerable. More importantly, it is unclear if this shift to container shipping will reverse as the economy rebounds.

For the past decade, rising fuel costs and more cost conscious shippers have created a shift in focus from overnight express to time-definite service. Coupled with financial and cost-saving measures, air cargo shippers are increasing the use of trucks on longer routes that were traditionally served by aircraft. This modal shift is particularly pronounced within the integrated express carrier community. In addition, less-than-truckload (LTL) companies have become major competitors to air freight. These trucking companies enjoy a significant cost advantage over air cargo carriers because of lower capital costs for equipment and lower wage scales. These trends do impact interstate highways such as I-40 as integrated express companies rely more on trucking to airports from distant markets. Integrated express truck operations face the same traffic congestion issues other trucking firms face. Most congestion issues for integrated express carriers occur in metropolitan areas, near major bridges and, to a degree, in the vicinity of airports. This is critical since integrated express companies' measure on-time performance in one-minute increments as opposed to 15- or even 60-minute increments utilized by some trucking companies.

Air transport can impact the local highway network when dealing with delivery of those goods between the airports and their origin or destination within the region. However, in comparison to the freight truck flows on the roadways, air freight contributes very little congestion to the region. However, an over-dependence on highway transportation leads to traffic congestion and lost time, which will, in turn, negatively impact economic growth. This combination of factors has driven efforts to promote intermodal transportation development that incorporates aviation.

### **Air Freight Facilities**

Within Nashville Area MPO area there are three airports that have facilities capable of shipping and receiving goods by air:

**International Airport (BNA):** The largest and most active airport is the Nashville International Airport (BNA), with almost 70 thousand tons of freight annually in 2007. According to Airports Council International, BNA ranked 61 in total air cargo tonnage handled in North America in 2008. The Nashville International Airport is second busiest passenger airport in the state following Memphis International. The Nashville Airport covers more than 4,460 acres and is served by 16 scheduled air carriers.

The Nashville Air Cargo Link all-cargo complex is located across the airfield from the passenger facility. The Air Cargo Link complex helps meet the high speed goods movement needs of area industries. Automotive manufacturers and health care facilities in particular rely on air cargo to keep their assembly lines moving and health care facilities supplied. FedEx operates a regional sort center at the airport. UPS used to operate aircraft at this facility but, within the last two years, switched to trucking air cargo to their global hub at Louisville Sanford International Airport (SDF). Until 2009, the airport received freighter flights on China Airlines 747 aircraft six days per week. This China Airlines flight supported Dell Computer's nearby assembly and distribution facility. This flight now arrives in Birmingham and Dell products are trucked to their Nashville facility. Air cargo, at BNA, dropped considerably in 2009 as a result of the China Airlines flight relocating to Atlanta or Birmingham. The US Postal Service maintains an air transfer station at the airport to expedite the shipment of mail via belly cargo on passenger airlines. Additionally, there is an array of transfer agents, freight forwarders, ground trucking companies, and contracted cargo carriers that rely on the airport to conduct business. The east side of the airport accommodates the freight services of the airlines – belly freight. The west side is the Air Cargo Link,

where Dell has two facilities. Trucks servicing the Air Cargo Link, on the west side, use Briley Parkway for access. Trucks servicing the freight needs (belly freight) for commercial airlines, on the east side, use I-40 for access.

**John C. Tune Airport (JWN):** John C. Tune Airport (JWN) is located on the west side of Nashville off Briley Parkway, and is owned and managed by the Metropolitan Nashville Airport Authority. It serves an important niche in Nashville's metropolitan economy by catering to corporate and personal aircraft users. The airport is capable of accommodating freight shipments, but it does not offer scheduled air cargo services.

**Smyrna/Rutherford County Airport (MQY):** Located twelve nautical miles south of Nashville, Smyrna/Rutherford County Airport (MQY) is the "reliever" airport for Nashville. With more than 1,700 acres, MQY is the third largest airport in Tennessee and the busiest general aviation airport in Tennessee and has an 8,000 foot runway which can handle up to 747's. The airport is within ten miles access to rail and three interstate systems which bisect Middle Tennessee. MQY handles corporate aviation, cargo, and aviation maintenance. Cargo is currently limited, but is use they contemplate expanding upon.

### ***Waterborne Freight Overview***

The U.S. Army Corps of Engineers (USACE) is responsible for 12,000 miles (19000 km) of the waterways. This figure includes the Intracoastal Waterways. Most of the commercially important inland waterways are maintained by the USACE, including 11,000 miles of fuel taxed waterways. Commercial operators on these designated waterways pay a fuel tax, deposited in the Inland Waterways Trust Fund, which funds half the cost of new construction and major rehabilitation of the inland waterways infrastructure. The U.S. Army Corps of Engineers maintains lock and dam structures at Hickory Lock and Dam upstream between Nashville and Gallatin and Cheatham Lock and Dam located downstream. Should the waterway become victim to neglect, the primary goods it supplies to the Nashville Area must continue to move. If they cannot go to the at-capacity rail network, they will add many slow and heavy trucks to the road system, affecting congestion, air quality, and highway maintenance budgets.

Water borne cargo is typically associated with bulk commodity movement on barges in either short or long haul environments. With limited interest and success, conversion of water barge service to a container on barge (COB) or trailer on barge (TOB) operation is occurring. One of the prominent efforts is occurring in Alabama and Mississippi with expansion of dockside service at the Port of Mobile, extending through to the Tennessee-Tombigbee waterway. The successful implementation of both COB and TOB service on this line may prompt introduction and diversion of this service in other parts of the country, where applicable. Though no readily identified efforts exist, adoption of this modal variant has the capacity to divert a percentage of highway and rail traffic in the Nashville market.

Substantial changes in traffic volumes are not anticipated, so current capabilities should remain sufficient, and allow the river to continue as a low-cost method of supplying basic and heavy bulk goods to the Nashville Area community and industry. Access to and from the water is still considered adequate with sufficient roadway access and multiple interstate highways paralleling, crossing, and radiating from the Cumberland River.

### **Waterborne Freight Facilities**

Nashville lies on the banks of the Cumberland River, an important waterway in the Southeastern United States that provides full river barge access to the Gulf of Mexico via the Ohio River. The waterway flows through southern Kentucky, looping through northern Tennessee before returning north to join the Ohio River after a course of 687 miles. Most of the river below Lake Cumberland's Wolf Creek Dam is navigable because of several locks and dams. Dams at various locations of the Cumberland River have created large reservoirs for recreation such as Lake Barkley, Lake Cumberland, Cordell Hull, Old Hickory, and Cheatham Lake. Laurel Lake, the Dale

Hollow Reservoir, and Percy Priest Lake are each created by dams located just upstream from their respective confluences with the Cumberland River.

The majority of water transport is mostly inbound. Most of the freight is delivered by truck to nearby locations – usually terminating within twenty to thirty miles of the riverside. Steel for automotive plants, for example, is supplied in part by water and trucked south from Nashville. Aggregates like sand and gravel are the chief form of outbound traffic, and primarily originate at locations adjacent to the riverbank. Water carries approximately 3 percent of the total tons of freight in the Nashville region. 96 percent of the total tons of water freight are inbound to Nashville and Gallatin. Water freight transport is very limited by the available docking and inland waterways available for cargo shipments.

For water freight, the two largest commodities are coal and nonmetallic minerals, accounting for 85 percent of the total water freight in the Nashville region. It is very common for these two commodities (coal and nonmetallic minerals) to be the largest commodities carried by barge due to the fact that heavy, non-perishable goods are most compatible with water movement. Most of the coal is delivered to the Gallatin power plant. Almost all the nonmetallic minerals (typically gravel and sand) traveling by water are going to Nashville. Ingram Barge Company is the primary provider of water related goods movement.

### ***Rail Freight Overview***

Approximately 650 railroads operate about 150,000 route miles infrastructure in the United States. Class I railroads are the primary freight haulers for most of the country. There are seven National (Class I) railroads in the U.S. and Canada. They are fed by Regional (Class II) and Short-line (Class III) railroads. Most railroads are privately owned and operated. For this reason, improvements in capacity are generally part of a rail carrier's capital program with little input from the public sector.

Rail diversion has gained increased support in the past decade, though this has equal detractors citing rail infrastructural capacity constraints, in light of proposed increased presence of passenger rail and desired business models by the Class I and Short line operators. This mode is due to be significantly influenced by the development of numerous projects, to provide service from the east coast ports to the Midwest by Class I carriers. Continued development of capacities to provide continental transit, independent of Nashville oriented routes, may lessen the impact of through volumes.

In the past several years, the rail industry has embarked on a number of "public-private partnerships" designed to secure public funding for capital investments that increase rail capacity in designated high volume freight corridors such as The Heartland Corridor by Norfolk Southern and the National Gateway project by CSX Corporation. One of these initiatives, the \$2 billion Crescent Corridor, has been developed by Norfolk Southern Railroad (NS) in conjunction with federal, state and local governments. The proposed route runs in a crescent shape along the railroad's southeast rail line paralleling Interstate 81, a key congested highway route connecting markets in the Northeast, Mid-Atlantic, and Southeast United States.

The corridor is 1,400 miles long and 28 new trains daily would be expected to go into service along with improvements to rail yards along the corridor. Construction on the first phase began in 2008. The Crescent Corridor's public benefits include improved roadway safety and air quality, stemming from the projected reduction of trucks on highways.

The Crescent Corridor would expand the entire NS network from the Northeast to the Southeast with implications for the Nashville Region's traffic congestion, air quality, and access to the Memphis freight network. The Corridor has the potential to significantly improve rail access between Memphis, Knoxville, and major northeast metropolitan areas served by NS, including Washington, D.C., Philadelphia, and New York. A Memphis



regional terminal will be an anchor for the Crescent Corridor, and the new facility will help make possible truck-competitive freight transportation between the Nashville Region and major Northeast markets. The Crescent Corridor and the Memphis intermodal terminal will expand the role of freight rail in the Nashville Region with recently approved TIGER funds.

The Crescent Corridor is anticipated to absorb more than one million truckloads of freight from the highways to the rails annually, saving the U.S. more than 170 million gallons of fuel per year. This will not only relieve traffic congestion throughout the region but also help the environment by removing trucks from long-haul transport. While focusing primarily on domestic traffic, the Corridor will also improve transit time to the Port of Norfolk as well.

### **Rail Freight Facilities**

Nashville is a crossroads for rail as it is for the highway. The Nashville area is served by the following Class I and two short line railroads:

**CSX Transportation:** Nashville Area's single Class I railroad, CSX Transportation (CSXT) operates 22,000 route miles in 22 eastern and Midwest states, the District of Columbia, and two Canadian provinces. Its network stretches from Chicago, East St. Louis, Memphis, and New Orleans to the eastern Great Lakes, Boston, New York, Philadelphia, and Baltimore on the east and down the Atlantic coast to Tampa and Miami.

CSXT's Tennessee Operating Division Headquarters are located in Nashville. They manage 1,377 track miles, two major rail yards, and nine terminals. The Nashville Area facilities include a major classification yard (Radnor), intermodal terminal (Nashville), TRANSFLO terminal (Nashville), and three TDSI automotive distribution terminals (Nashville, Smyrna, Spring Hill). Radnor Yard is a key hub in the CSX system. Sixty trains per day are routed through the Nashville Area toward five key cities: Atlanta, Birmingham, Chicago, Louisville, and Memphis. Forty of these trains simply pass through; the rest are "hubbed" in a classification yard, with the majority of railcars sent out again on a different train set.

The orientation of CSX lines in Tennessee is chiefly north-south, with a spur west from Nashville to Memphis, but none eastward. A second Class I railroad, the Norfolk Southern (NS), has a network orientation running northeast-southwest. The NS has a curving east-west line between Memphis and Knoxville via Huntsville and Chattanooga, skirting Nashville and lying over 100 miles to the south.

**Nashville & Eastern Railroad (NERR):** Nashville & Eastern Railroad runs 110 miles from Nashville east to Monterey, TN. NERR is a short-line railroad that has worked collaboratively with the Tennessee Department of Transportation (TDOT) and the Nashville and Eastern Railroad Authority (NERA). NERR does not offer intermodal services and are somewhat limited in their abilities to expand, however they carry important goods from Nashville to east Tennessee. They serve about 40 industries and are responsible for moving about 9,000 carloads a year.

**Nashville & Western Railroad (NWR):** As a sister railroad to NERR, NWR runs 18 miles from Nashville west to Ashland City, TN. NWR is a short-line railroad that has worked collaboratively with the Tennessee Department of Transportation (TDOT) and the Cheatham County Railroad Authority. NWR does not offer intermodal services and are somewhat limited in their abilities to expand, however they carry important goods from Nashville to Cheatham County. They serve about 7 industries and are responsible for moving about 600 carloads a year.

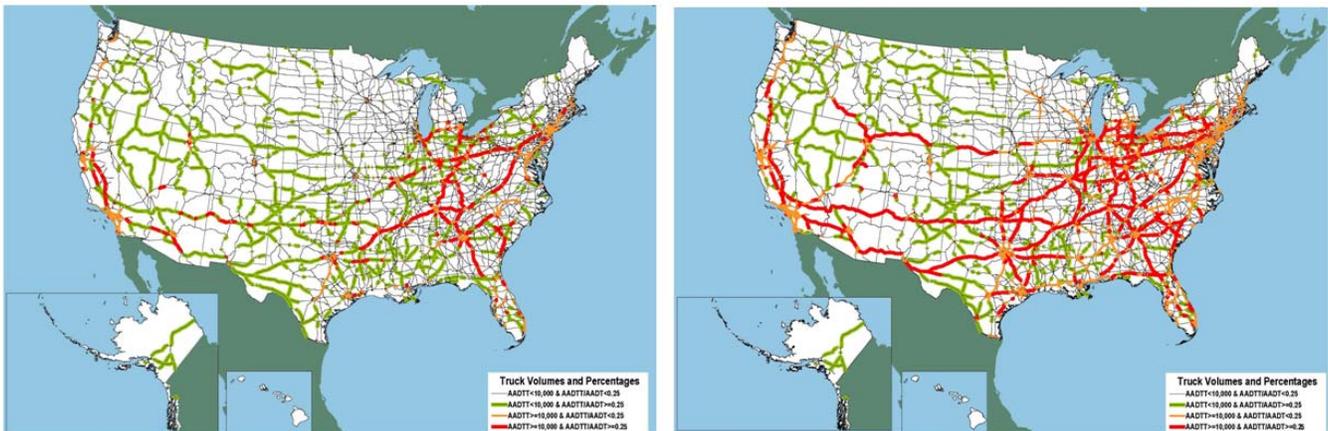
### **Freight Flow Forecasts**

Nashville's freight infrastructure is projected to carry around 400 million tons of freight in 2035 compared to 2007 volumes of around 300 million tons. The Nashville region is currently serviced by all modes of goods

movement including highway, rail, air, and barge facilities. Nashville is situated at the convergence of three major U.S. interstate highways: I-40, I-65, and I-24. With a central location in the East-Central United States, it can be expected that freight traffic volumes in the Nashville region will continue to grow. According to the Transearch dataset, freight tonnages impacting the Nashville region are anticipated to increase 35 percent between 2007 and 2035. This compares to a 124 percent expected growth for the combined Richmond and Tri-Cities MPO's in Virginia (from 2004 to 2035) and a 78 percent projected growth for the Atlanta Regional Commission (ARC) MPO (from 2004 to 2030). In today's global economy, improving freight mobility in metropolitan transport networks can result in substantial cost savings to regional business and ultimately increase the Nashville region's economic competitiveness.

Future growth is closely related to economic development and quality of life issues that deal with the externalities associated with increasing goods movement demands. The Nashville region's status as a crossroads in the transportation networks of the Eastern U.S. makes freight transportation a key component of current and future economic health. Transportation and material moving occupations employ almost 9 percent, ranking third, of those employed across all occupations within the Nashville MSA. Though geography heavily influences the dominance of this industry and employment sector, increasing levels of delay and reliability concerns pose a threat to corridor usage through the region. Alternative routings, where currently not selected due to circuitous miles, become viable as transit times deteriorate.

**Figure 33. Major Truck Flows on the National Highway System, 2002 and 2035**

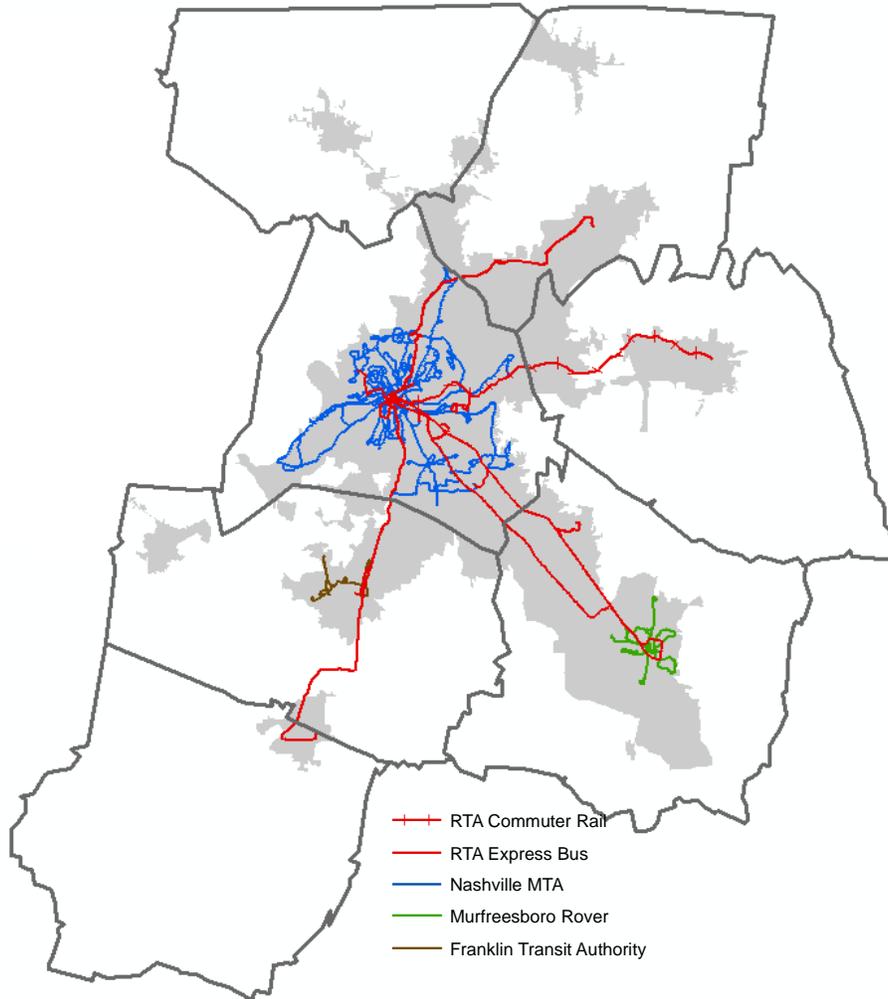


Source: US DOT Federal Highway Administration (2007)

## 4.6 Public Transportation

The Nashville area is served by multiple transit agencies that provide a variety of services to Middle Tennesseans ranging from rural demand response service to vanpool services to commuter rail services. The following figure presents an overview of the existing urban fixed route services offered by the Regional Transportation Authority, the Nashville MTA, the Franklin Transit Authority, and the Murfreesboro Rover. A description of each of the Nashville area's transit agencies, and the services they offer follows.

**Figure 34. Existing Urban Fixed-Route Transit Service**



### ***Regional Transportation Authority***

The Regional Transportation Authority (RTA) is a nine county authority created by state statute in 1988 to encourage transportation alternatives and develop a regional mass transit system. RTA oversees the operation of a variety of regional transit services that including the area’s first commuter rail line. RTA also offers the following services:

- Commuter rail service in the East Corridor to Mt. Juliet and Lebanon,
- Express commuter bus services in the South Corridor to Franklin,
- Express commuter bus services in the Southeast Corridor to Murfreesboro,
- Express commuter bus services in the Northeast Corridor to Hendersonville and Gallatin,
- Guaranteed Ride Home Program, which provides regular customers a taxi ride home in case of an emergency,
- RIDE, a commuter rideshare matching program,
- Employer-based promotions to encourage carpools, vanpools, and transit ridership,
- Development of park-and-ride lots.

### ***Nashville Metropolitan Transit Authority***

The Metropolitan Transit Authority (MTA) was formed in 1973 for the purpose of stabilizing existing public transportation services and meeting other transportation needs of the citizens within Davidson County and visitors who visit the city and local areas.

The Nashville MTA provides public transportation services, local and express routes, to citizens and visitors within the Metropolitan Nashville area and is a component unit of the Metropolitan Government of Nashville & Davidson County. MTA operates 36 bus routes throughout Metro-Davidson County and now provides more trips than at any other time in recent decades. Nashville MTA reached a milestone in ridership by providing our community with 9.4 million rides in fiscal year 2008. This is nearly an 11 percent increase over the previous fiscal period and almost 1 million additional trips when compared to the previous year. Average rides per weekday are 30,000. Nashville also has contracts with the Regional Transportation Authority (RTA) to provide management services for the RTA and to run bus service to Murfreesboro and the Music City Star bus shuttles. In addition, the Nashville MTA provides special door-to-door paratransit services (AccessRide) for seniors and people with disabilities that are unable to ride the larger buses on the fixed routes.

MTA has formed several unique EasyRide transit partnerships with organizations which pay for their employees transit commute to and from work and school. Metro Government has recently joined others such as Vanderbilt University and Medical Center, Belmont University, the State of Tennessee, Bass, Berry & Sims, LP Building Products, the U.S. Corps of Engineers, U.S. Bankruptcy Court, U. S. Probation Dept., and area hotels such as Holiday Inn Select Vanderbilt, Renaissance Hotel, Hilton Hotel and Hampton Inn in participating in the Easy Ride program.

In October 2008, MTA opened Music City Central (MCC) Station which is a multi-level indoor transfer facility in the heart of downtown Nashville. This indoor facility has customer waiting rooms, a ticketing and information booth, and a coffee shop. A new state-of-the-art 800 MHz radio and data transmission system for all buses is also being implemented in phases over the next year. Once completed, this system will give customers access to “real time” bus arrival and departure information via digital signage around town, at the MCC, and in the future, via the internet.

Nashville MTA currently has 137 fixed route buses, 63 AccessRide buses and 475 employees. A five-member Board of Directors, appointed by the Mayor and approved by the City Council, governs the Nashville MTA. A management team, headed by a Chief Executive Officer (CEO), oversees the day-to day operations. Nashville MTA receives funding from federal, state, and local governments to supplement its operating revenue.

### ***Franklin Transit Authority***

On May 14<sup>th</sup>, 2003, the City of Franklin held its new trolley service dedication with a ribbon cutting where over 200 area residents and city/state officials attended the event. Preview rides on the vintage trolleys were provided and Daily trolley service started officially on May 15, with four daily routes. The FTA, which is operated under contract by The TMA Group, offers a unique Flexible service. Anyone who needs to be picked up or dropped off within three-quarters of a mile of the standard trolley route can call and make a reservation for pickup. The trolleys are all wheelchair accessible. FTA also provides *Transit On DemandD* (TODD), a pre-arranged curb-to-curb pick-up and drop-off service as well as all-day, same-day access to the Franklin Trolleys. Use of TODD requires reservations and the fares are based on a zone-based.

In March 2010 FTA implemented service changes that included the following:

- Expanded service hours on fixed route from 6:00 am to 6:00 pm (was 9:00 am to 6:00 pm);



- The Gold route was eliminated and replaced with the new 30 minute TODD Service;
- The Red and Green routes were be combined;
- Provided better service to Embassy Suites, Corporate Centre Buildings, Nissan Corporation, Marriott, Meridian complex and Gillespie Drive – Alara Farms;
- Increased transit accessibility to work force of Cool Springs during lunch hours;
- The 2-bus system takes in the majority of the area that riders are traveling.

### ***Murfreesboro Rover***

The City of Murfreesboro Public Transportation Department is responsible for the administration and operation of public transportation service (Rover) within the City of Murfreesboro. Service is provided from 6 AM to 6 PM along eight fixed-routes. Each bus in the Rover fleet is lift-equipped, which means that all buses are accessible to passengers who use wheelchairs. If a disability prevents a customer from using the regular Rover service, paratransit services also are available through Mid-Cumberland Regional Transit System (MCRTS).

Rover began service to the public in April of 2007, providing comfortable and convenient bus transportation for the citizens of Murfreesboro along eight routes throughout the city. To find a name for the new service, the City of Murfreesboro held a city-wide contest to find a name for its public transportation system, offering a prizes including a free year's pass to ride the system's buses and the honor of being the first person to ride the new transportation system. The purpose of the contest was to involve the community and create some excitement and energy around public transportation in Murfreesboro.

A panel of citizen judges reviewed hundreds of entries based on the criteria of creativity, uniqueness, applicability to Murfreesboro, ability to create visual interest and overall viability as a name. They chose the name "Rover," submitted by 4-year old Savannah Leigh Bowen, because they liked the double entendre aspect as applying to movement as well as to the visual aspects of being able to use canine attributes like a friendly puppy or paw prints as icons.

### ***Mid-Cumberland Human Resource Agency Rural Paratransit Service***

Enhancing access to Tennessee’s non-urbanized areas and connecting thousands of people to jobs, schools and other destinations, the Mid-Cumberland Human Resource Agency (MCHRA) Public Transit serves as a vital function in meeting the mobility needs of thousands of people. As a mass public transportation service, it provides a basic level of rural mobility to those who depend on some form of public transportation.

MCHRA Public Transit provides rural mass public transportation service to 12 counties including Cheatham, Dickson, Houston, Humphreys, Montgomery, Robertson, Rutherford, Stewart, Sumner, Trousdale, Williamson, and Wilson counties using a fleet of vehicles that are accessible for the physically disabled.

Originally, MCHRA Public Transit was the Senior Citizens Transit System, serving people age 60 or older. Today, it is a full-fledged mass public transit system with a strong commitment to senior citizens and people with disabilities. MCHRA is proud to have a 72 percent accessible fleet.

### ***Tennessee Department of Transportation Intercity Bus Service***

Until the late 1970s, Greyhound bus and other urban transit services provided connections to rural Tennessee that knitted communities together, spurred economic development and enhanced community life. As automobile ownership became economically feasible for more families, citizens bought cars and much of the transit network, along with the social connections it created, quickly disappeared.

The Amish community was one of the hardest hit by the discontinuation of bus service. Unable to drive cars, the Amish must find alternative means for traveling 80 miles or more to Nashville to access medical care, shopping, and other goods and services. Moreover, the lack of bus service diminished tourism revenue, stunting the growth of an important industry.

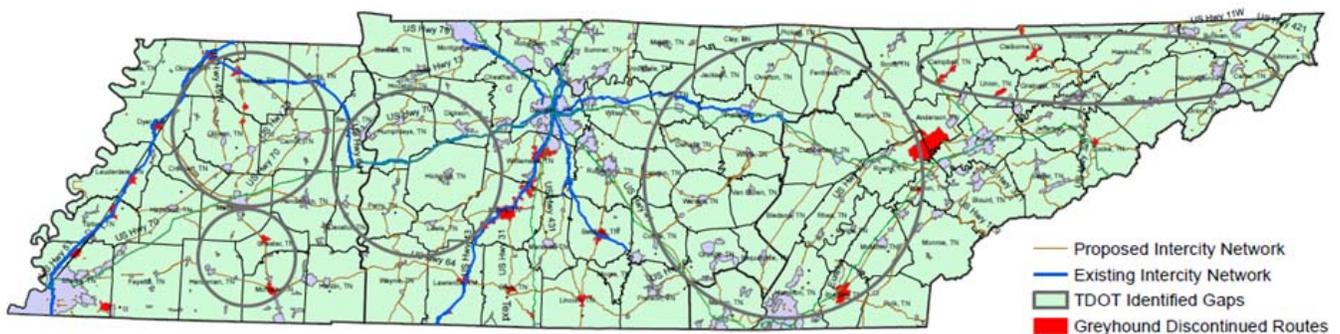
In response to growing public demand, the State of Tennessee implemented the Tennessee Intercity Bus Demonstration Program in 2008. Designed and managed at the state level, the program responds to local needs and provides residents and visitors the opportunity to choose public transportation to meet their mobility needs. Since the onset of the project, the State of Tennessee Division of Multimodal Transportation Resources has distributed \$3.6 million in Intercity Bus funds to seven transportation providers. This year, newly available ARRA funds will allow for an additional investment of \$3.2 million. Combined with Tennessee’s share, this reinvestment will allow the program to cover up to 98 percent of the State by the end of the program.



The Federal Transit Administration (FTA) and TDOT provided funds to Anchor Trailways Tours for the purchase of four new buses which offer service seven days a week to Nashville MTA and RTA train stations, and the Nashville Greyhound station. In addition to transporting Amish residents, the new buses and routes foster economic growth by expanding tourism and enabling visitors to “take a step back in time”.

The Tennessee effort exemplifies rural livability. Coordination had to be achieved between many stakeholders including the Nashville Area MPO and local city and county officials throughout fifteen counties. The end result provides the Amish community, and others, an affordable, efficient way to access urban areas and enjoy greater independence.

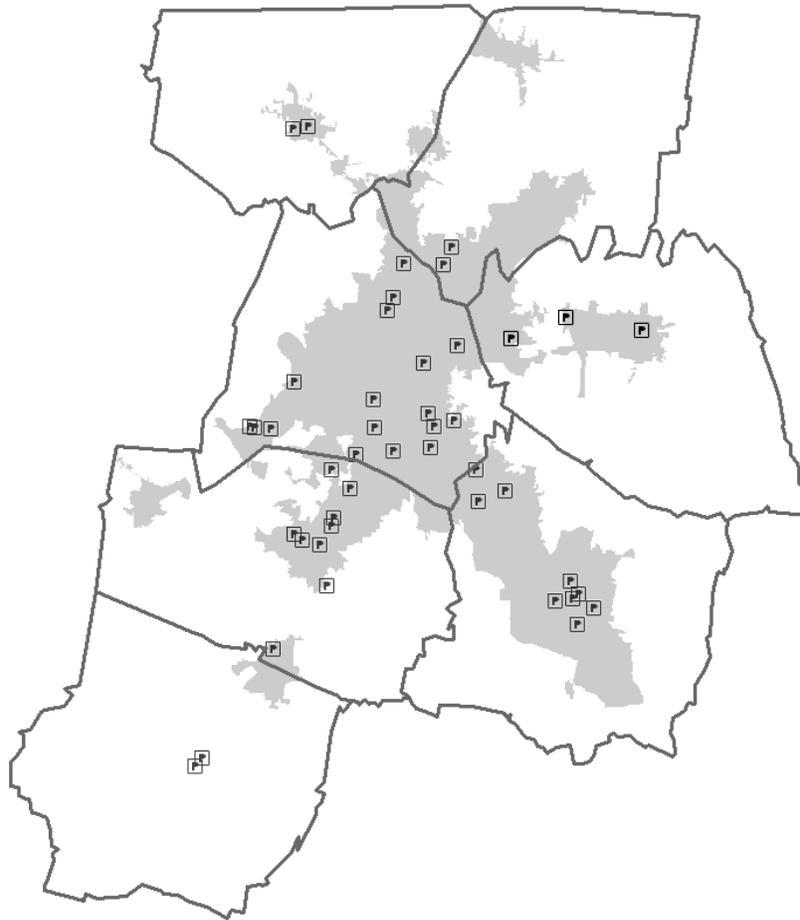
**Figure 35. Tennessee Intercity Bus Service**



***Regional Park & Ride Lots***

The greater Nashville region has many Park & Ride lots. Of the official lots, some have been built exclusively as Park & Ride, but most have been developed with agreements with churches or shopping areas. In addition to the official lots, there are many unofficial lots that are used by commuters who are carpooling or vanpooling. The following figure shows Park & Ride lots in the MPO planning area.

**Figure 36. Existing Park & Ride Lots**



The following table presents a listing of area-wide Park & Ride lots. As shown, most of those are shared lots with churches or shopping areas. This has the advantage of being low cost for the transit agencies providing bus service and also bringing potential customers to malls in days when the lots are likely to have plenty of parking. On the other hand, these lots are not as visible as lots located along a highway might be—and that additional visibility can help to draw potential customers for express bus service or ridesharing.

**Table 10. Regional Park & Ride Lot Locations**

County	Location/Description	Spaces Occupied
Davidson	Long Hollow Pike - K-Mart Goodlettsville (serves MTA Route 35X Rivergate Express)	60
Davidson	Rivergate Mall (serves MTA Route 35X Rivergate Express)	128
Davidson	Madison Square Shopping Center (serves MTA Route 26 Gallatin)	38
Davidson	K-Mart – Madison (serves MTA Routes 26 Gallatin, 56 BRT and 34X Opry Mills Express)	70
Davidson	Temple Church - Kings Lane (serves MTA Route 22 Bordeaux)	16
Davidson	M.T.A. Bellevue Park & Ride (serves MTA Routes 3 West End and 24X Bellevue Express)	88
Davidson	Staples - Bellevue - Park & Ride (serves MTA Routes 3 West End and 24X Bellevue Express)	69
Davidson	Bellevue Plaza (serves MTA Routes 3 West End and 24X Bellevue Express)	20
Davidson	Dollar General - Hickory Plaza (serves MTA Routes 12 Nolensville Road, 37X Tusculum/McMurray Express)	38
Davidson	Hickory Hollow Mall (serves MTA Route 15 Murfreesboro Road and 33X Hickory Hollow Mall/Old Hickory Express)	237
Davidson	Smith Springs Church of Christ (serves MTA Route 38X Antioch Express)	155

County	Location/Description	Spaces Occupied
Davidson	Una Church of Christ (serves MTA Route 15 Murfreesboro Road)	51
Davidson	Southminster Presbyterian Church (serves MTA Route 12 Nolensville Road)	49
Davidson	Crieve Hall Church of Christ (serves MTA Route 12 Nolensville Road)	20
Davidson	Music City Star - Donelson Station, 2705 Lebanon Pike, north of the intersection of Donelson Pike and Bluefield Ave. (also serves MTA Route 6 Lebanon Road and 34 Opry Mills Local via Donelson)	230
Davidson	Music City Star - Hermitage Station at 4121 Andrew Jackson Pkwy. (also MTA Route 6 Lebanon Rd)	280
Wilson	22 East Division St, Mt. Juliet with direct access from Division Street (parking for Music City Star)	220
Wilson	65 Martha Circle (State Rte 109 and Powell Grove Road) in Lebanon (parking for Music City Star)	75
Wilson	334 West Baddour Parkway, Lebanon (parking for Music City Star)	140
Sumner	Gallatin Wal Mart (Serves RTA Route 92X Gallatin, Hendersonville Express)	36
Sumner	Hendersonville Kohl's (Serves RTA Route 92X Gallatin, Hendersonville Express)	23
Sumner	Oak Street and Park Street, Westmoreland	N/A
Rutherford	Mercury Plaza (Serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	12
Rutherford	Tennessee-Rehabilitation Center (Serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	0
Rutherford	Smyrna – K-Mart (Serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	28
Rutherford	I24 and Waldron Road, LaVergne	N/A
Rutherford	I24 and Sam Ridley Parkway	N/A
Rutherford	SR 840 & US 41-US 70S (Murfreesboro Road)	N/A
Rutherford	Edge-O-Lake Park & Ride (serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	N/A
Rutherford	Agricultural Center SR 99 (off SR 96 near I-24)	N/A
Rutherford	LaVergne – Kroger (Serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	24
Rutherford	Bell Road & Murfreesboro Road (Serves RTA Route 96X Nashville/Murfreesboro Relax and Ride)	4
Davidson	Donelson Plaza and Cliffdale Road (south of Old Lebanon Pike)	N/A
Wilson	I40 and Mt. Juliet Road off Belinda Parkway	N/A
Wilson	I40 and SR109 off Safari Campground Road	N/A
Wilson	Valley Center on Mt. Juliet Road	N/A
Williamson	I40 and Highway 96	N/A
Williamson	Brentwood Civilian Ballpark (parking for RTA Route 91X Franklin/Brentwood Express)	N/A
Williamson	Cool Springs Lowes (parking for RTA Route 91X Franklin/Brentwood Express)	N/A
Williamson	Williamson Square Shopping Center (parking for RTA Route 91X Franklin/Brentwood Express)	N/A
Williamson	Thomson's Station Baptist Church (parking for RTA Route 95X Spring Hill Express)	N/A
Williamson	Spring Hill Kroger on Port Royal 9 (parking for RTA Route 95X Spring Hill Express)	N/A

Source: MPO Counts (Summer 2008)

## Regional Transit Ridership Trends

Nationally, public transportation ridership grew 36 percent from 1995 through 2008, almost three times the growth rate of the U.S. population (14 percent) and substantially more than the growth for vehicle miles of travel (VMT) on our nation's streets and highways (21 percent) over the same period. In 2008, Americans took more than 10.7 billion trips on public transportation, or 35 million trips each weekday.

Regionally, after a long period of declines during the 1980's and 1990's, ridership in the first decade of the 21<sup>st</sup> century is expanding in the greater Nashville area. The largest component of this expansion is the Nashville MTA which makes up the largest portion of transit service and transit ridership in the region. But other transit organizations are also increasing transit offerings outside of Davidson County. Several new agencies have been created in the past ten to fifteen years to provide service in the region, including the Franklin Transit Authority, Murfreesboro Public Transportation (Rover), and the RTA. As can be seen in the following table, nearly all of the



agencies have increased ridership since 2001 or since they were first created. Most of the transit providers in the Nashville Area MPO region provide bicycle racks on transit vehicles. The racks help to facilitate the use of bicycling to and from transit.

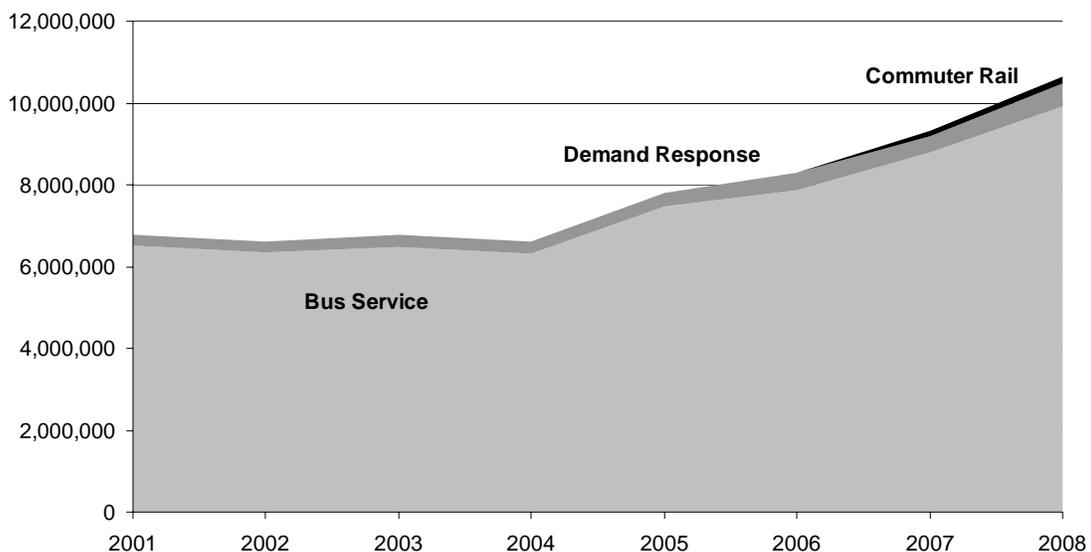
**Table 11. MPO Area Transit Ridership by Agency and Type of Service, 2001 to 2008**

Fiscal Year	Regional Transportation Authority			Nashville MTA		Franklin Transit Authority		Murfreesboro Rover	Mid-Cumberland HRA
	Bus	Vanpool/Rideshare	Rail	Bus	Access Ride	Flex Trolley	Demand Responsive	Bus	Demand Responsive
2001	0	0	0	6,527,926	118,121	0	0	0	129,735
2002	3,807	0	0	6,347,743	112,631	0	0	0	149,422
2003	3,825	51,000	0	6,473,724	120,771	3,307	0	0	167,363
2004	3,825	76,500	0	6,268,926	141,907	28,200	0	0	165,602
2005	41,110	<i>incl in bus</i>	0	7,372,388	170,214	45,895	0	0	165,663
2006	52,960	<i>incl in bus</i>	0	7,752,809	261,652	51,330	0	0	172,078
2007	68,208	23,400	104,785	8,644,456	211,268	51,177	2,167	15,331	212,848
2008	81,402	127,008	166,750	9,701,697	315,188	43,484	13,036	106,793	217,660

*Source: Local Agencies, FTA National Transit Database*

During the growth in ridership seen in the early part of the decade, the Nashville MTA began to expand service to reach more customers throughout Davidson County. Though the expansion required additional funding from the various sources that support operations, the service has been effective at increasing the number of passengers served per hour of service. In addition to the MTA, other transit organizations in the region were in a pattern of increasing transit offerings. Though new types of services have been introduced in recent years, traditional bus service remains the most prominent. The recent downturn in the economy and increases in fuel expenses required MTA and other operators to consider a reduction in service and an increase fares in FY 2008.

**Figure 37. MPO Ridership Trends by Transit Mode, 2001 to 2008**



## 4.7 Walking & Bicycling Facilities

Historically, bicycle and pedestrian facilities have not been given significant consideration in urban development throughout the region. Over the past several years, however, MPO communities have realized the importance of non-motorized modes of transportation such as walking and bicycling, as well as the need for crosswalks and traffic control features. These facilities are crucial for safe, convenient, and attractive access to transit, as well

as activities along major streets. They also provide connections between neighborhoods, schools, regional activity centers, community centers, parks, and greenways. The MPO has been placing an increasing amount of emphasis on projects that support or provide alternatives to the automobile. Moreover, federal funding opportunities offered under SAFETEA-LU– along with a growing interest in health, the environment, and energy conservation – have helped to promote a greater interest in non-motorized modes of transportation.

## Types of Facilities

A critical component of understanding walking and bicycling conditions in the region is to first understand the existing environment and provision of accommodations for non-motorized users. As part of the Regional Bicycle and Pedestrian Study, the MPO conducted a comprehensive inventory of existing and currently proposed on and off-road bicycle and pedestrian facilities within the region.

**Figure 38. Types of Facilities for Walking or Bicycling**



### Bicycle Lanes

A bike lane is a portion of the roadway that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes can be located on either side of the road, but both sides is typically preferred so that bicyclists move in the same direction as adjacent motor vehicle traffic.



### Paved Shoulder

A paved shoulder refers to the part of the highway that is adjacent to the regularly traveled portion of the roadway and is on the same grade as the roadway.



### Signed Bicycle Route

Signed shared roadways are a commonly used bike facility using signs to designate a travel lane as being shared by vehicles and bicycles – no separate bicycle lane exists.



### Sidewalk

Sidewalks and walkways are “pedestrian facilities” that provide people with space to travel within the public right-of-way that is separated from roadway vehicles. Pedestrian signals, ramps, and marked crosswalks are components of a pedestrian facility.



### Shared Used Path/ Greenway/ Multi-Use Trail

Shared-use paths or greenways are non-motorized facilities most often built on exclusive rights-of-way with limited motor vehicle crossings. A shared-use path is a facility that is physically separated from motor vehicle traffic by an open space or barrier, and may be within the roadway right-of-way or within an open space. Paths are normally two-way facilities and are used by a variety of users (cyclists, runners, walkers, skaters, etc.) and skill levels.

## Existing & Planned Accommodations

The greater Nashville area has seen significant progress in the last ten years in terms of the growth in the number of bike lanes, bike routes, and greenway trails throughout the region as well as the presence of sidewalk accommodations. A regional inventory taken in 2009 revealed that there are currently over 354 miles of bike lanes, bike routes, and greenways in the greater Nashville area and for arterial and collector roadways within the region, approximately 460 miles of sidewalk accommodations.

While on and off-road bicycle and pedestrian facilities exist in every MPO county, Davidson County has the highest concentration of bike lanes, bike routes, and greenway facilities. While the provision of bike lanes and bike routes throughout the region adhere to AASHTO standards the exact definition for a greenway has had many variations since the facilities were first introduced. While the typical definition for greenways across the region seems to follow the AASHTO standard for a ‘shared use path’, widths and materials vary greatly per each community. The designated greenways or multi-use paths in this region are typically paved and range from 12-foot wide asphalt or concrete paths to only 5-foot concrete paths in some communities. It should be noted that a 10-foot wide path is the minimum standard per AASHTO standards.

The number of on and off-road facilities that have been put in place in the region in the last ten years is considerable given that many communities over that time period had no bicycle facilities at all. Since 2000 a number of municipalities in the MPO area have developed bicycle and pedestrian master plans and greenway master plans as well as enacted policies encouraging pedestrian and bicycle accommodations.

Figure 39. Miles of Sidewalks by County

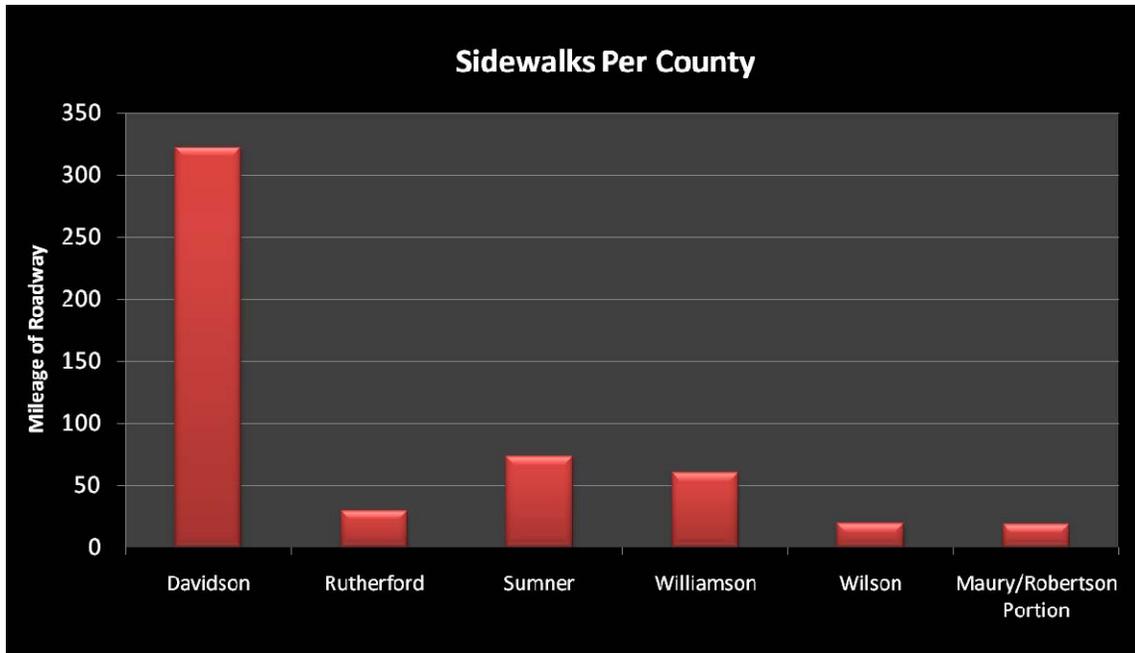
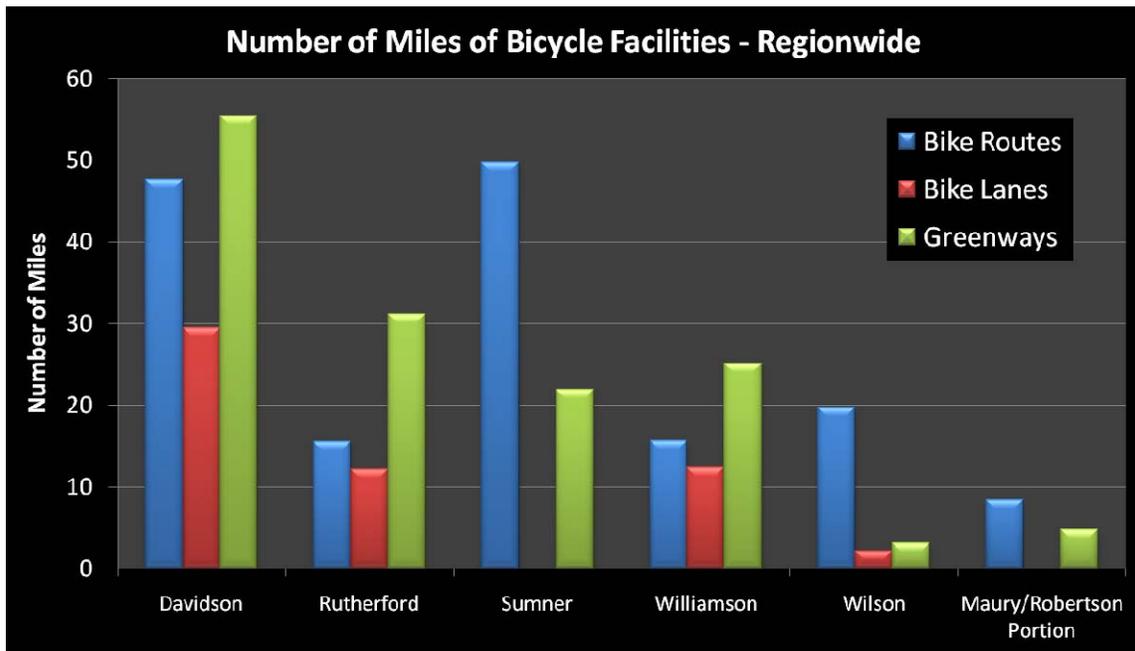


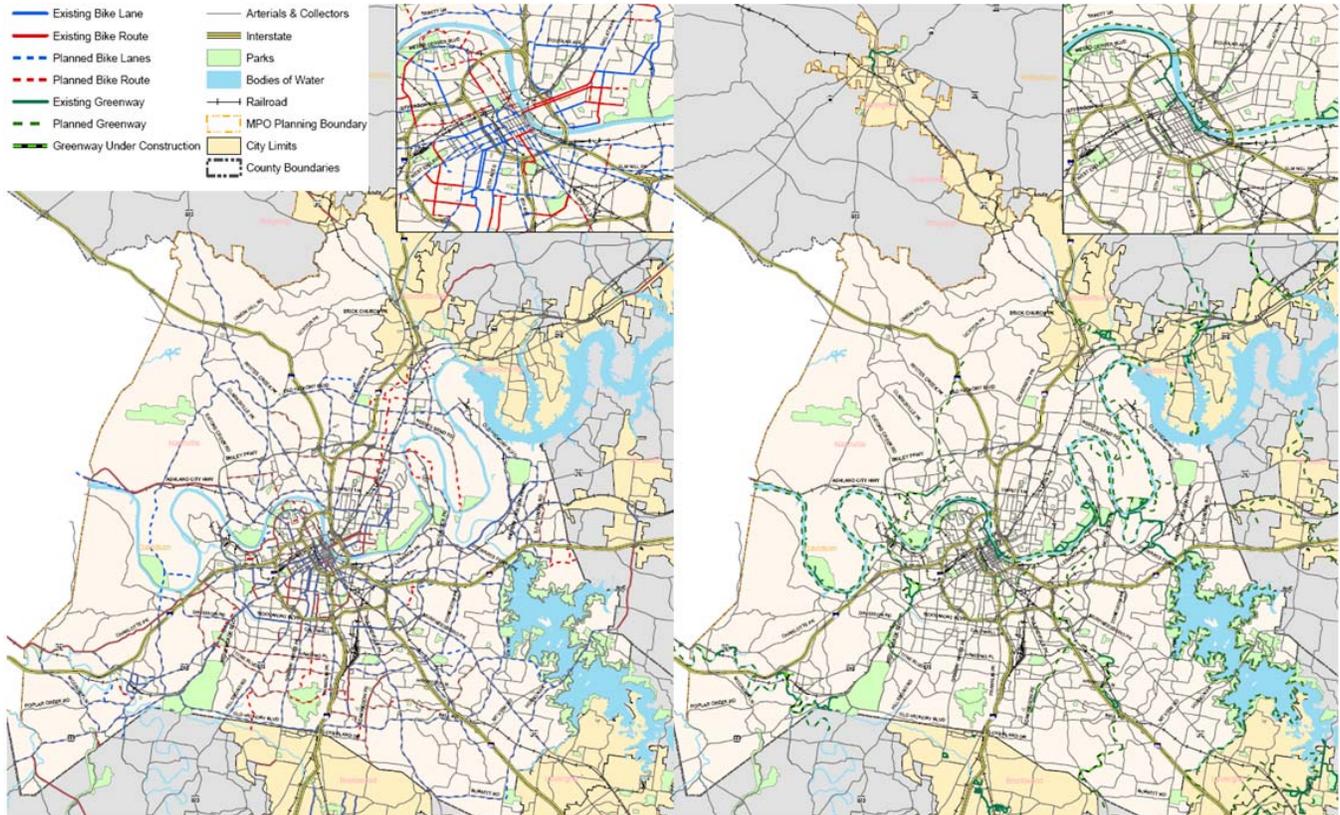
Figure 40. Miles of Bicycle Facilities by County



The following provides a county by county summary of existing on and off-road bicycle and pedestrian facilities in the greater Nashville region. These summaries also include information on future planned bicycle and pedestrian accommodations based on locally approved plans.

### *Davidson County*

Approximately 30 miles of bike lanes in Davidson County were identified as part of the regional inventory taken by the 2009 Regional Bicycle and Pedestrian Study. The inventory also showed approximately 48 miles of signed bike routes where extra pavement like a paved shoulder or wide outside lane is sometimes provided. The bike lanes inventoried in the Nashville-Davidson County area provide at least four feet of pavement with pavement markings and signs.



Nashville-Davidson County has the most extensive existing greenway facilities in the region with approximately 55 miles on the ground. The standard trail section for Davidson County is a 12-foot wide asphalt path, although many of the paths in the floodplain also utilize extensive boardwalk and sections of concrete trail which vary in width. A unique feature of Nashville’s greenway system is the development of a number of significant bridges, which have provided important system-wide connections. The Cumberland River Bridge spanning the Cumberland River connects the Stones River greenway and Shelby Bottoms greenway. The rehabilitation of the Shelby Pedestrian Bridge across the Cumberland River and also the Old White Bridge Road Bridge across the railroad tracks provide unique and historic connections. Without these connections the river and railroad tracks can be obstacles for pedestrians and bicyclists.

The inventory found approximately 322 miles of collector and arterial roadways within Nashville-Davidson County that have a sidewalk on one or both sides of the road. The majority of the sidewalks did not have a buffer area between the curb and the sidewalk and therefore did not provide any appurtenances such as trees.

## Existing Bicycle & Pedestrian and Greenway Master Plans

Since the adoption of the Nashville-Davidson County Strategic Plan for Sidewalks & Bikeways in 2003 (updated in 2008), the Metro Nashville area has consistently made bicycle and pedestrian facilities part of redevelopment and resurfacing projects as well as including the facilities in the construction of new developments. The adoption of the plan was the first step towards improving the bicycle and pedestrian accommodations in the Nashville-Davidson County area.

The vision for the Strategic Plan is to provide bike lanes and bike routes on most collector and arterial roadways. Phase One of the plan shows bike lanes and bike routes on the major downtown routes such as Charlotte Pike, Broadway, 8th Avenue/Franklin Pike, Lafayette Street/Murfreesboro Pike, and Gallatin Pike.

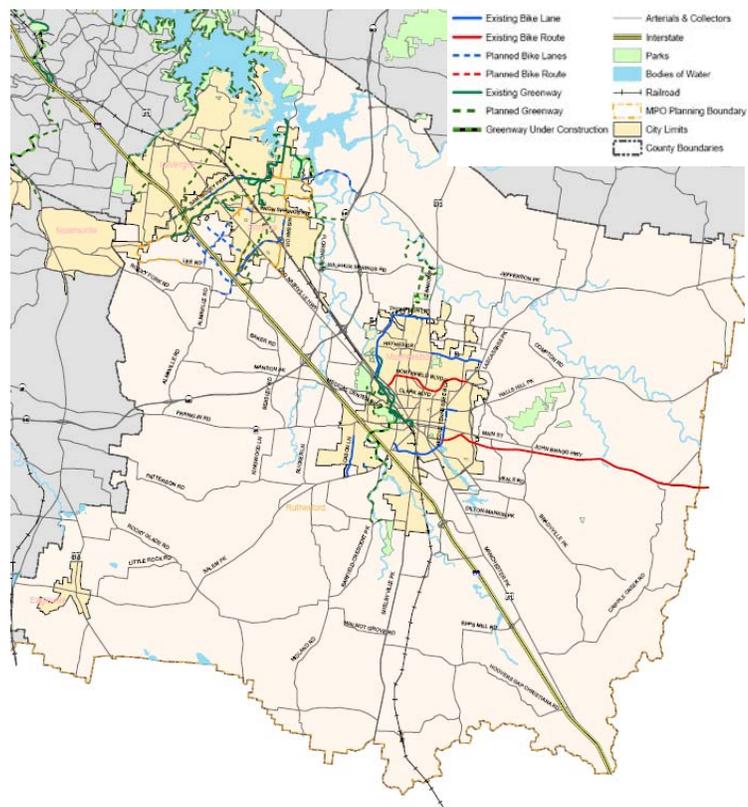
The Nashville-Davidson County Strategic Plan also includes policies to improve sidewalk accommodations. The plan targets pedestrian facility conditions and connections between land uses. It focuses on providing ADA compliant crossings, ramps, and sidewalk clearances.

Metro Nashville developed the Metropolitan Parks & Greenways Master Plan in November 2002. A major component of the vision and master plan for Metro Nashville is to locate greenways along waterways with the Cumberland River acting as the spine. It is envisioned that a multi-use path will eventually be located on both sides of the Cumberland River the entire way through the county. The system will eventually include several hundred miles of greenway throughout Nashville/Davidson County. A main priority is to acquire greenway easements for environmental, recreation, and transportation purposes.

### *Rutherford County*

According to the regional inventory conducted in 2009, Rutherford County has approximately 16 miles of signed bike routes and 12 miles of bike lanes. Of the 12 miles of bike lanes within the county, all of them are located within the City of Murfreesboro and are four feet wide with pavement markings and signs. In addition, the City of Murfreesboro provides bike lanes on some local roads that were not included as part of this inventory. Bike routes are signed on John Bragg Highway located in the eastern portion of the county and along Northfield Boulevard in the City of Murfreesboro.

There are approximately 30 miles of existing trails on the ground in Rutherford County. The vast majority of these facilities are located in the cities of Murfreesboro and Smyrna. Murfreesboro is the largest city in Rutherford County and has 12.5 miles of existing greenway facilities including the Stones River and Lytle Creek Greenways. Smyrna has an extensive



network of greenway trails, second only to Nashville in the region. They have just over 17 miles of existing facilities. These facilities include eight-foot to twelve-foot asphalt trails and eight-foot concrete sidewalks. Many of the projects have been able to utilize Corps of Engineers land adjacent to Percy Priest Lake.

The sidewalks inventoried were all located within the Smyrna, LaVergne, and Murfreesboro city limits. Sidewalks were found on approximately 29 miles of collector and arterial roadways, on one or both sides of the road.

### Existing Bicycle & Pedestrian and Greenway Master Plans

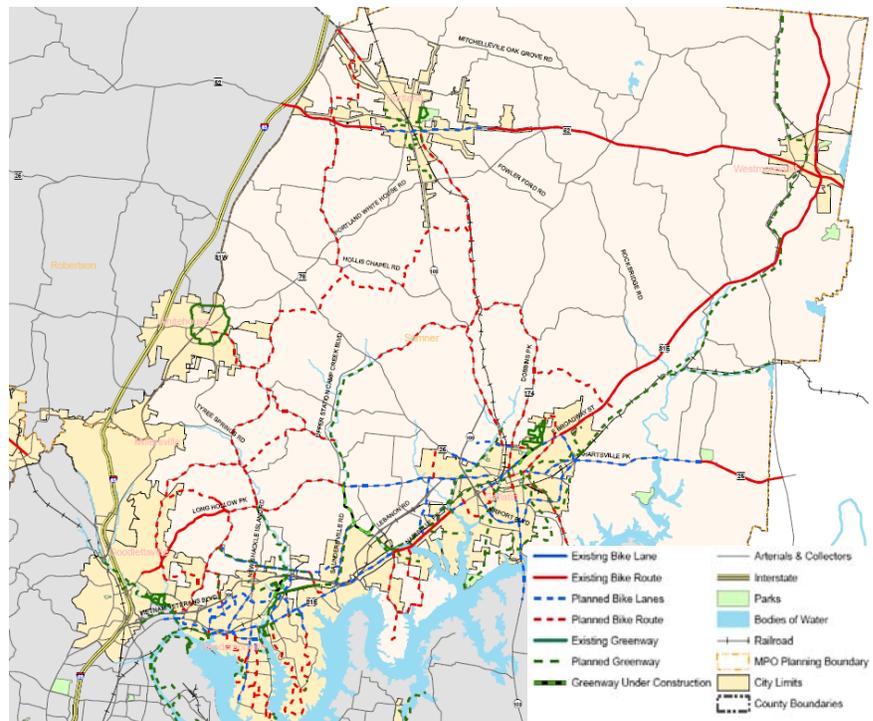
Within Rutherford County, the cities of LaVergne, Smyrna, and Murfreesboro have prepared bicycle and greenway plans. Also, the Town of Smyrna has prepared a comprehensive plan that sets a goal to provide bicycle and pedestrian travel between destinations and activity centers. Rutherford is one of the counties in the region that does not have a completed master plan for greenways; however the cities of Smyrna, LaVergne and Murfreesboro do have completed master plans.

LaVergne’s master plan for their greenway network was completed in conjunction with Smyrna. The plans provide a good connection between cities so that multi-modal travel will be possible between the two cities. While the desire for greenways is high, LaVergne has not been able to implement any trails to date.

### *Sumner County and Springfield, Greenbrier, Ridgetop in Robertson County*

The 2009 regional inventory documented approximately 50 miles of bike routes and no bike lanes in Sumner County and the MPO area of Robertson County. The facilities that were found to be signed during the inventory are on Highway 52, Highway 31E, and Long Hollow Pike and Highway 41 in Robertson County.

Within Sumner County and its municipalities, there are approximately 23 miles of trails on the ground. Many of the existing facilities parallel existing roadways. Hendersonville has approximately five miles of trail facilities, which vary from asphalt paths to five-foot concrete sidewalks. Many of the existing five-foot wide facilities are undersized per AASHTO design standards. Many of the trails are provided in relationship to Drakes Creek Park and to nearby schools.



Other areas in Sumner County with significant trail systems either in place or under design include the City of Gallatin, the City of Goodlettsville, White House, and Portland. White House’s greenway system includes a loop around the city, which provides connections to Robertson County. Springfield also has a greenway system that links to the City’s downtown district.

Additionally, there are approximately 84 miles of sidewalks along arterial and collector roadways in Sumner County and the MPO area of Robertson County. The majority of these sidewalks are provided in the cities of Gallatin, Hendersonville, and Goodlettsville.

### Existing Bicycle & Pedestrian and Greenway Master Plans

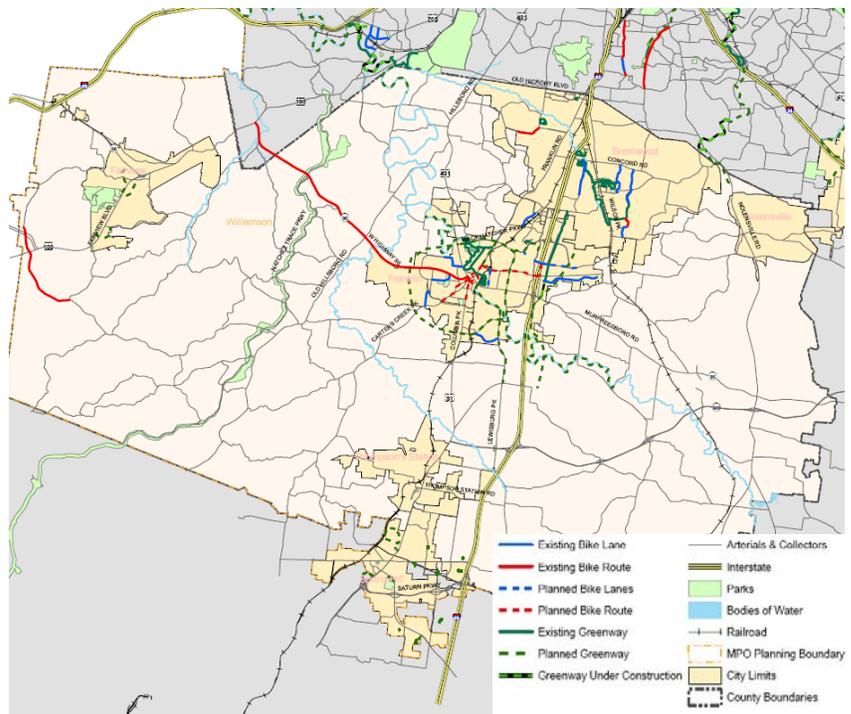
In 2000, Sumner County and the Cities of Gallatin and Hendersonville jointly developed individual bicycle and pedestrian master plans for their respective communities. Development of the three plans concurrently resulted in a high level of coordination and understanding of connectivity of facilities between each of these communities. The plans have been utilized by Sumner County and the Cities to determine the feasibility and location of bicycle and pedestrian facilities. Also included in the plans are recommended cross-sections and design standards.

Sumner has a countywide master plan for their greenway system. Gallatin has recently completed a 2020 master plan that includes over 25 miles of potential greenway corridors. The City of Goodlettsville just this year adopted a greenway and open space master plan and they are in the process of developing a bicycle and pedestrian plan for the City as well.

### *Williamson County and Spring Hill in Maury County*

According to the 2009 inventory, there are over 12 miles of bike lanes and approximately 16 miles of bike routes in Williamson County and the portion of Maury County included in the MPO planning area. The majority of the bike lanes are in the cities of Brentwood and Franklin. The longest bike route is on Highway 96 West and runs from the county boundary to the downtown Franklin area.

There are approximately 25 miles of greenways in Williamson County, which are largely located in the cities of Brentwood and Franklin. The City of Brentwood has 12.6 miles of existing trails, which are primary asphalt pathways, including an extensive trail from Concord Road to Crockett Park.



There are currently 12.4 miles of existing greenways in the City of Franklin. Recently completed projects within Franklin include trails along Carothers Parkway and a trail utilizing an old roadway near the new Nissan Headquarters.

The inventory showed that there are 60 miles of sidewalks along arterial and collector roadways in the Williamson County area and the MPO area of Maury County. The sidewalks are provided within the city boundaries and connect commercial, office, and residential areas.

## Existing Bicycle & Pedestrian and Greenway Master Plans

Both the cities of Brentwood and Franklin have bicycle and pedestrian plans and the City of Franklin has recently completed a greenway and open space master planning project. The Cities of Fairview and Spring Hill both have a bikeway plan map but no formal bicycle and pedestrian plan. Williamson County does not have a bicycle and pedestrian or a greenway master plan.

The City of Brentwood updated their 2020 plan in 2006, which includes a bicycle and pedestrian facilities inventory and review. In addition, the City of Franklin prepared a Bicycle and Pedestrian Plan in 2003, which is currently being updated. Both of the plans emphasize the importance of including bicycle and pedestrian accommodations in future development as well as in redevelopment projects. Both cities have an extensive greenway system that is complemented with on-road bicycle facilities.

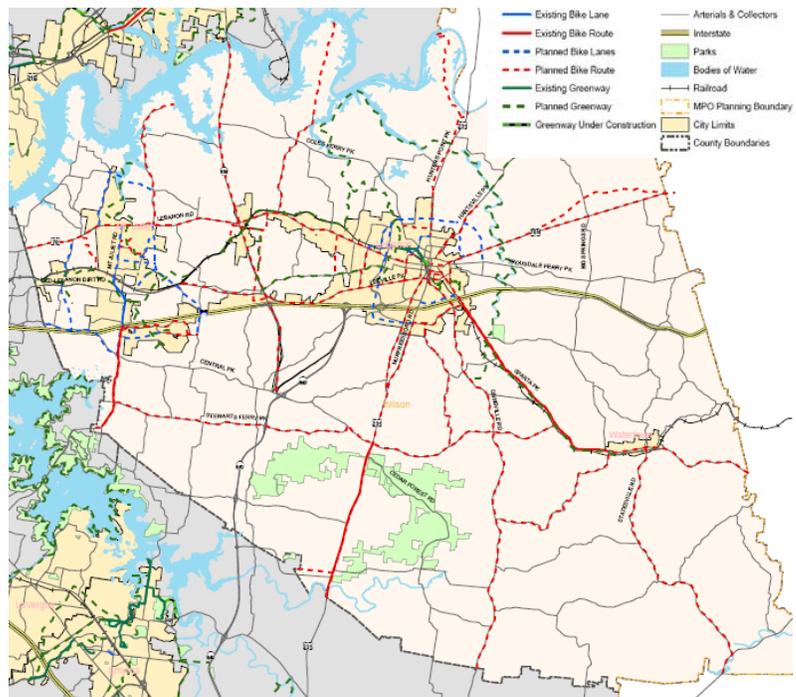
The City of Fairview has a bicycle facilities map as part of its open space plan, and the Town of Nolensville has been working to establish a bicycle and pedestrian and greenways master plan.

### *Wilson County*

According to the 2009 inventory, there are approximately 20 miles of bike routes in the Wilson County area and about 2 miles of bike lanes. The bike lanes are located in the City of Mount Juliet on State Route 171. The bike routes are located on Highway 231, South Mount Juliet Road and Sparta Pike between Lebanon and Watertown.

Currently, there are approximately 3.1 miles of existing trails in Wilson County. These trails are located in the City of Lebanon. The City of Mount Juliet does not currently have any greenway trails on the ground; however, there is an eight-foot wide sidewalk as part of the recent Providence development in Mount Juliet. This facility was not included in the total for the greenways.

The inventory also showed approximately 19 miles of sidewalk along arterial and collector roadways in Wilson County. The majority of these sidewalks are provided in the City of Lebanon and Mount Juliet.



## Existing Bicycle & Pedestrian and Greenway Master Plans

The Bicycle and Pedestrian Master Plan for Mount Juliet, Lebanon, and Wilson County, was prepared to guide the county in developing a bicycle and pedestrian system that will be usable for the two major cities in the county as well as for Wilson County. Since this plan was developed the cities and county have implemented several policies that support the construction of pedestrian and bicycle accommodations. In 2003, the City of Mount Juliet updated its bicycle and pedestrian plan and added additional recommendations for greenway improvements.

## Existing Levels of Service for Non-Motorized Modes

Many factors influence one's decision to walk or bike when making a transportation choice. Many of these factors have to do with the physical environment, which includes the presence of adequate walking and biking accommodations. Various tools have been developed in recent years to assist engineers and planners in evaluating the ability of roads to serve pedestrians and bicyclists. Similar to the vehicular Level of Service, there are models that have been developed to evaluate the suitability of the roadway for walking and bicycling. The Level of Service for walking and bicycling is based on the comfort level of the pedestrian and bicyclist on the roadway. Both the Pedestrian Level of Service (PLOS) and the Bicycle Level of Service (BLOS) models were developed using input from actual pedestrians and bicyclists on various roadway segments. There are various factors used to evaluate the comfort level of the users which involve the roadway geometry, motor vehicles using the road, and the presence and condition of pedestrian and bicycle facilities. In addition, the 2010 Highway Capacity Manual includes a multimodal level of service (MMLoS) , comprised of four tools – two of which are the BLOS and PLOS, which evaluates roadway level of service for all modes.

### *Pedestrian Level of Service*

A Pedestrian Level of Service (PLOS) analysis was conducted for roadway segments inventoried in the Nashville MPO based on the National Cooperative Highway Research Program (NCHRP) Report 616 on Multimodal Level of Service Analysis for Urban Streets. The evaluation of pedestrian levels of service involves the walking conditions within the shared roadway environment (e.g. sidewalk or path to the side of the roadway) since pedestrians typically do not utilize the roadway unless there is no other option.

As discussed in NCHRP Report 616, part of the development of the pedestrian level of service model involved pedestrians walking on a variety of roadway segments and rating their comfort level on each segment on a scale from A to F, with A being the best conditions and F the worst conditions. The pedestrians used in the research study consisted of all age groups and various levels of walking experience. Based on the response of the participants, the researchers developed an equation to determine the PLOS for the roadway segment. The PLOS equation uses some of the same measurable traffic and roadway factors that transportation planners and engineers use for other travel modes. The model reflects the effect on walking suitability or “compatibility” due to factors such as roadway width, presence of sidewalks and intervening buffers, barriers within those buffers, traffic volume, motor vehicles speed, and on-street parking.

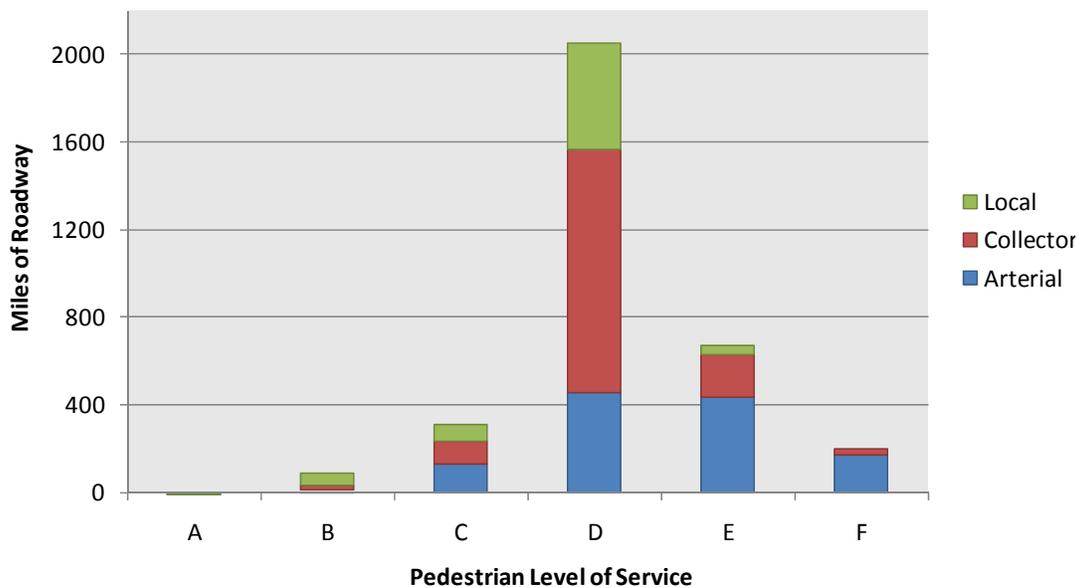
The chart below contains examples of the different PLOS. Each of the examples provides a brief, general description of the characteristics associated with each PLOS rating A thru F.

**Figure 41. Pedestrian Level of Service Rating Definitions**



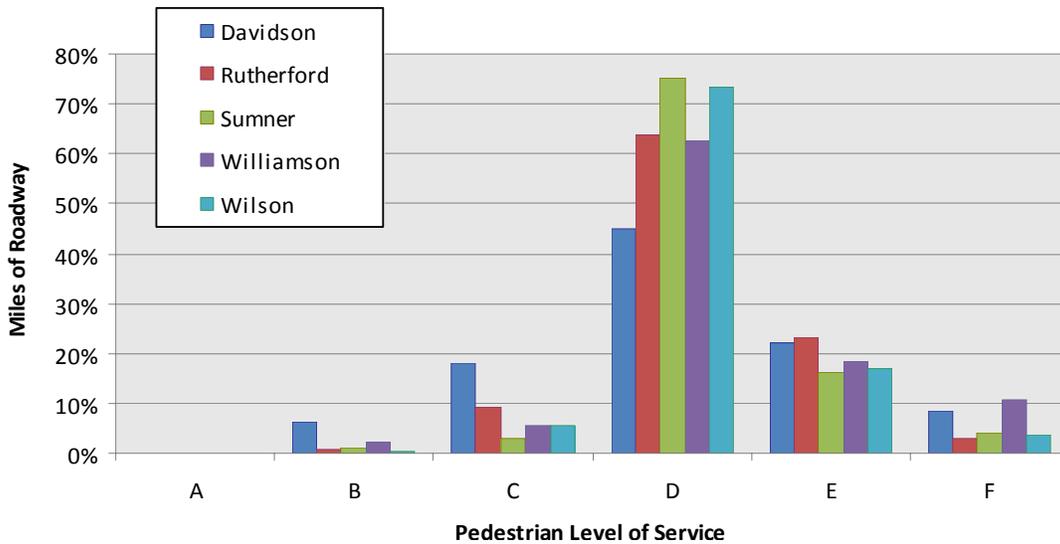
Results of the Nashville area PLOS analysis are divided according to the roadway classification as well as the Level of Service. The following figure shows the results for the whole MPO area broken down for arterial, collector, and some local roads. As shown in the chart, a majority of the arterial, collector, and local roads that were inventoried are operating at a LOS D (2,048 miles). The mileage in this chart includes several roads that were inventoried outside the MPO boundary.

**Figure 42. Pedestrian Level of Service by Roadway Class**



The following figure presents the results of the PLOS by county. As shown, at least 50 percent of roadways in each of the MPO counties are operating a PLOS of D or worse. Davidson County roadways provide the highest level of service when compared with other counties, with Williamson and Wilson having the highest percentage of roadways operating at an E or F PLOS.

**Figure 43. Pedestrian Level of Service by County**



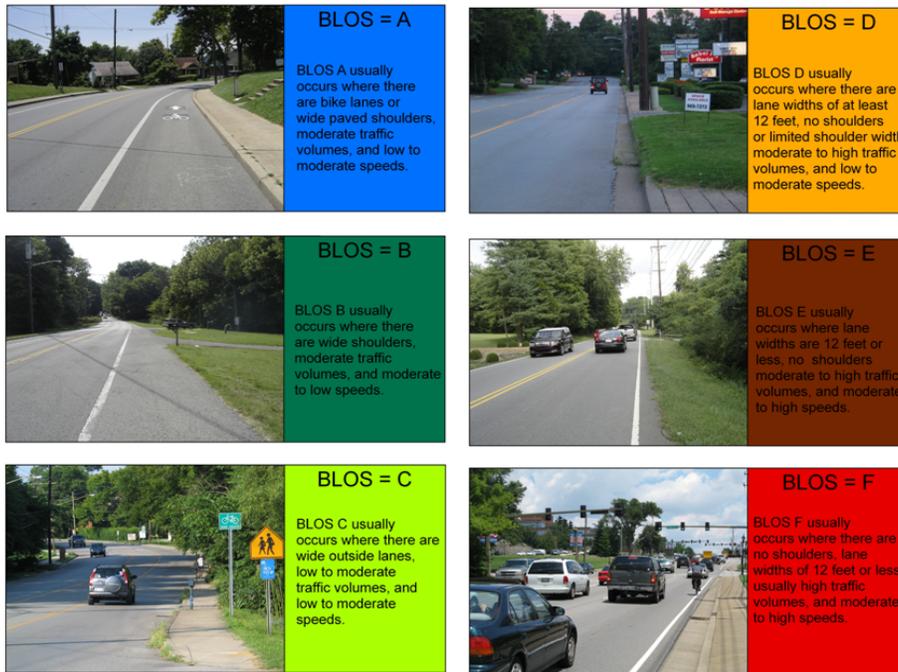
***Bicycle Level of Service***

Similar to the PLOS analysis, a Bicycle Level of Service (BLOS) model for the Nashville region was developed based on NCHRP Report 616 for the analyses of the roadway segments inventoried in the Nashville MPO area.

As discussed in the NCHRP Report 616, bicyclists were asked to ride on a variety of roadway segments and then rate their comfort level on each segment on a scale from A to F with A being the best conditions and F the worst conditions. Like the pedestrians, the bicyclists used in the research study consisted of all age groups and riding capabilities. Based on the response of the participants, the researchers developed an equation to determine the BLOS for the roadway segment. The BLOS equation uses some of the same measurable traffic and roadway factors that transportation planners and engineers use for other travel modes. The factors used in the calculation include the Average Daily Traffic (ADT) volume, number of through lanes on the roadway segment, speeds, percentage of trucks, the width of the outside travel lane, shoulder, and bike lane, the condition of the pavement, and the occupancy rate of on-street parking.

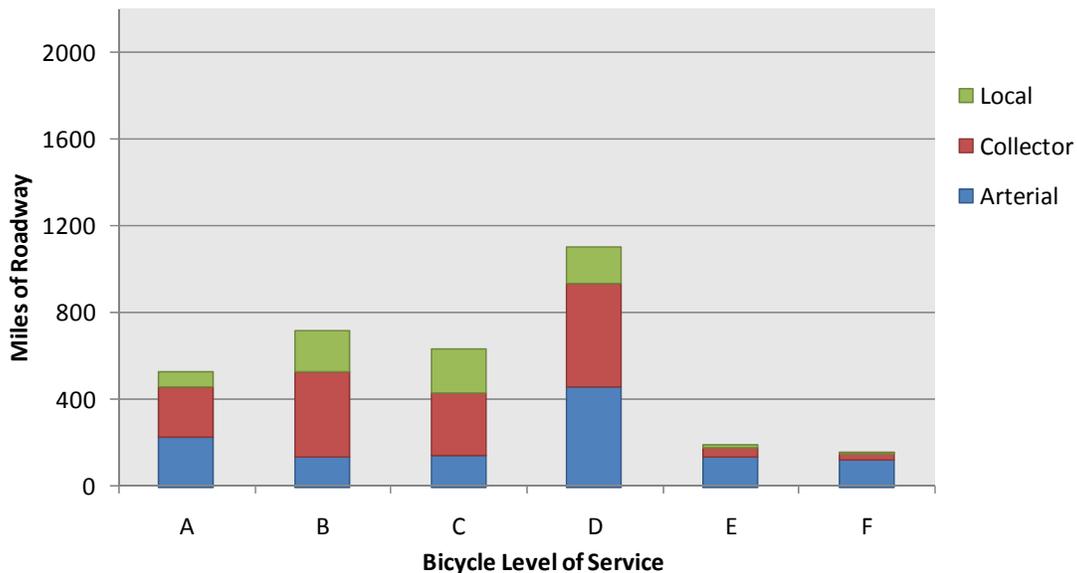
The chart below contains examples of the different BLOS. Each of the examples provides a brief, general description of the characteristics associated with each BLOS rating A thru F.

**Figure 44. Bicycle Level of Service Rating Definitions**



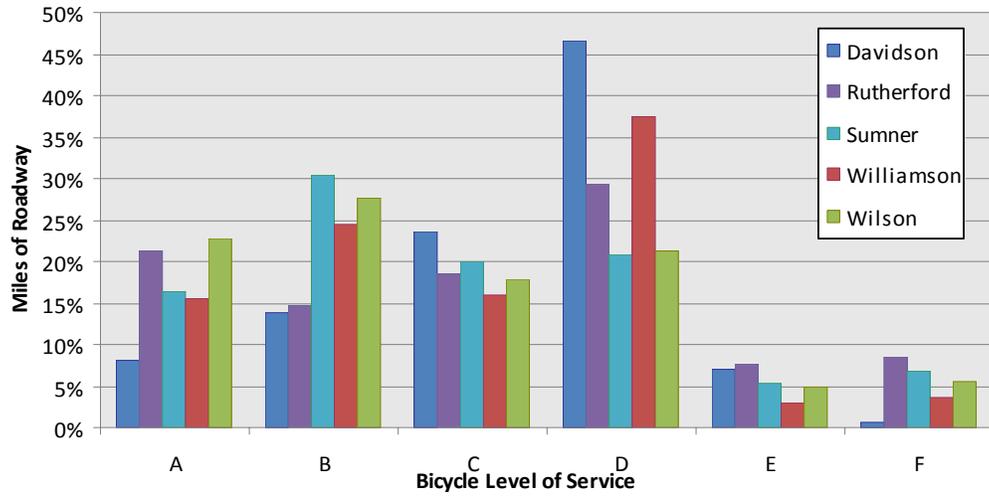
Results of the Nashville area BLOS analysis are broken into the roadway classification as well as the Level of Service. The following figure shows the results for the whole MPO area broken down for arterial, collector, and local roads. As shown in the chart the highest number of arterial and collector roadways were determined to operate at a LOS D.

**Figure 45. Bicycle Level of Service by Roadway Class**



The next figure presents the results of the BLOS by county. As shown, levels of service provided by roadways in each of the counties for bicycle movements is significantly better than the level of service provided for pedestrian movements. All counties have at least 80 percent of roadways operating at a BLOS of D or better.

**Figure 46. Bicycle Level of Service by County**



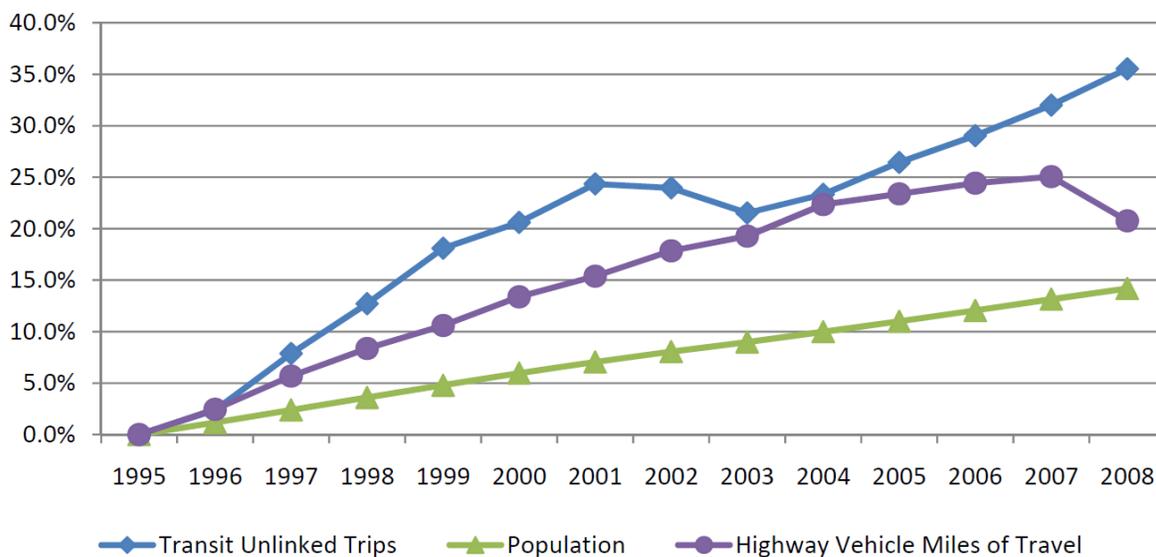
## 5.0 A Bold, New Vision for Mass Transit

### 5.1 Transit for Mobility, Economy, and Livability

Public transportation in the United States is a crucial part of the solution to the nation's economic, energy, and environmental challenges – helping to bring a better quality of life for both those who ride transit and those who do not. Every segment of American society – individuals, families, communities, and businesses – benefits from the integration of public transportation choices into the transportation system.

In the last decade and a half, public transportation ridership has grown by 36 percent, almost three times the growth rate of the U.S. population (14 percent) and substantially more than the growth for vehicle miles of travel (VMT) on our nation's streets and highways (21 percent) over the same period.

**Figure 47. Growth in National Transit Ridership, Population, Highway VMT, 1995 to 2008**



It is no surprise that ridership is on the rise. Regions across the nation are becoming more aware of the benefits of public transportation. The Middle Tennessee region's top economic competitors (e.g., Charlotte, Austin, Denver, etc.) have recently invested billions of dollars in modernizing their public transportation system to position their areas for attracting and retaining the labor force that will be required to compete in an ever-changing global economy. That, combined with transit's unique ability to help provide alternatives to traffic congestion, prepare for higher energy prices, and establish a more sustainable path for future growth and development, is a major reason why the MPO has established as one of its three major policy initiatives of the 2035 Regional Transportation Plan, a call to create and adopt a bold, new vision for mass transit. The following provides a quick overview of the more obvious reasons to invest.

**Mobility & Convenience** - Mobility, the freedom and ability to travel, has always been an important part of the American lifestyle. However, as more and more vehicles crowd the nation's roadways, traffic congestion is having an increasingly debilitating effect on our quality of life.

- Congestion caused 4.2 billion hours of travel delay and 2.9 billion gallons of wasted fuel in 2005, according to the 2007 Texas Transportation Institute (TTI) Urban Mobility Report.

- The average person in the Nashville-Davidson area loses about 40 hours and wastes 25 gallons of fuel per year sitting in traffic congestion.
- Public transportation services in America's most congested cities saves more than 1.1 billion hours of additional delay.
- Public Transit enhances economic growth by increasing the local customer base for a range of services.
- National research shows that four out of five seniors believe public transit is a better option than driving alone. By 2025, an estimated 20 percent of Americans will be over the age of 65 and more reliant on alternative forms of transportation.
- The greater Nashville region is expected to grow from 1.3 million people in 2008 to more than 2.1 million by 2030, adding significant demands to the regional transportation network.
- Public transportation is an important part of most disaster relief or emergency evacuation plans.
- Transit offers mobility options for rural residents that might have no other way to medical appointments, work, or school.
- Public transportation provides a safe alternative to driving with 0.03 fatalities per 100 million miles, about 1/25<sup>th</sup> the rate for automobiles.

**Personal & Regional Economic Prosperity** - Transportation is the backbone of a strong and prosperous economy, and investments in public transportation generate significant economic benefits.

- The average household spends 18 cents of every dollar on transportation, and 94 percent of this goes to buying, maintaining, and operating cars, the largest expenditure after housing.
- Public transportation provides an affordable, and for many, necessary, alternative to driving.
- Households that are likely to use public transportation on a given day save over \$8,400 every year.
- According to the American Public Transportation Association, for every 10 dollars invested in transit capital, 30 dollars is returned to the economy through increased business sales. Even more is returned for every 10 dollars invested in transit operations.
- Public transportation provides economic stimulus by creating jobs. Every \$1 billion in federal investment in transportation infrastructure supports and creates 47,500 jobs in manufacturing, construction, finance, insurance, real estate, retail, and other services.
- Mass transit enhances personal economic opportunity by saving employees money on daily commutes. The average household spends 18 cents out of every dollar earned on transportation costs – 94 percent of that on maintaining and operating personal autos. Transit riders save an average of \$1,400 per year on gas and up to \$6,251 in savings by eliminating the need for one car.
- A multi-modal transportation systems saves everyone money. For every \$10 million invested in transit, more than \$15 million is saved by highway and transit users. Americans living in areas with transit save an estimated \$18 billion in annual congestion costs.
- Transit provides access to jobs and education.
- Residential, commercial, or office properties that are served by public transportation are valued more highly than properties not accessible by transit.

**Environmental Sustainability** - As we become more conscious of how our travel behaviors affect our environment, public transportation will play an important role in meeting local, state, and federal environmental sustainability goals.

- Each year, public transportation saves the U.S. 1.4 billion gallons of gasoline per day, the equivalent of one supertanker leaving the Middle East every 11 days.
- The health effects of mobile source pollution are a growing hazard for people across America. According to the U.S. EPA, asthma accounts for more than 2 million emergency room visits, 5,000 deaths, and costs the nation more than \$14 billion per year.
- Public transportation produces 95 percent less carbon monoxide, 90 percent less volatile organic compounds, and 50 percent less carbon dioxide and nitrogen oxide per passenger mile than private vehicles.
- The Nashville region is expected to be designated by the EPA as non-attainment for ozone levels by 2011 – indicating a growing health hazard for residents.
- Public transportation supports quality growth management policies aimed at reducing sprawling land development patterns by providing residents more choices for travel.
- Communities that invest in public transit reduce the nation’s carbon emissions by 37 million metric tons annually – equivalent to New York City; Washington, DC; Atlanta; Denver; and Los Angeles combined stopping using electricity.
- One person switching to public transit can reduce daily carbon emissions by 20 pounds or more than 4,800 pounds in a year.
- A single commuter switching his or her commute to public transportation can reduce a household’s carbon emissions by 10 percent, and up to 30 percent if he or she eliminates a second car. When compared to other household actions that limit CO<sub>2</sub>, taking public transportation can be 10 times greater in reducing this harmful greenhouse gas.

## 5.2 Transit Service Strategies and Technologies

There is a wide range of mass transit services offered throughout the United States and in order to develop a regional vision for transit that makes sense for Middle Tennesseans, it is extremely important that policy-makers understand the menu of options available to the region so that the appropriate solutions are deployed to address the unique service needs of different communities.

In forming a more complete understanding of that menu, planners typically categorize or describe available transit options by the types of markets they serve (i.e., service strategy) or by the mode or technologies employed to provide the service (e.g., light rail, commuter rail, etc.).

### Transit Service Strategies

In discussing the characteristics of mass transit service and appropriate areas for implementing them, it is helpful to start by grouping services based on the types of markets served and/ or function.

- **Commuter Transit:** This service is principally operated during the periods of day when commuting is at its heaviest levels (e.g., AM or PM rush hours) and serves to connect regional employment centers with suburban residential areas. A range of choices are available to connect people with job sites including commuter rail, express bus, and vanpool service. The most appropriate mode for a particular area or



corridor will be determined by the level of expected ridership, available right-of-way, average trip length, and travel patterns.

- **Rapid Transit:** This service is intended to move large numbers of people along well-defined corridors to a variety of employment, retail, and recreational destinations throughout day, not just the peak commuting periods. Rapid transit operates in fixed-guideway or exclusive lanes with limited stops at designated stations. Examples of technologies used to provide rapid transit include heavy rail, light rail, and bus rapid transit.
- **Urban Fixed-Route Transit:** This is the most predominant type of service provided throughout the country, particularly in urbanized areas. Large- and medium-sized buses use the existing road network to carry up to 30-50 passengers on shorter trips on scheduled routes, usually with unlimited stops, although sometimes offering express service. In some higher-density communities, urban fixed-route service may be provided by streetcars which may or may not operate in exclusive lanes.
- **Suburban or Community Circulators:** Circulator services primarily focus on connecting neighborhoods or job centers to other primary destinations including connections to other transit service. They are operated using a variety of methods including busses, shuttles, vans and in some cases can be offered as door-to-door services or flexibly routed services within individual communities, as well as in low-density, rural areas. They also include community or employer shuttle service between fixed-route transit lines and scattered employment, shopping, or residential areas within individual communities.
- **Demand-Response/ Paratransit:** Shared ride/door to door/flexibly routed services are van or small bus based services that generally operate in lower density areas (with fewer residences per square mile). Unlike door to door services which are required by the Americans with Disabilities Act, these services are designed to serve everyone, and are not limited to individuals with disabilities. They are often used either to provide transportation from rural or other low density areas to minor urban centers or as a feeder service to other types of transit. Trips generally need to be pre-scheduled, sometimes 24 hours or more in advance. Service may be provided seven days per week, on weekdays only (especially for employment focused services), or on only a few days every week (especially rural transportation services).

## Transit Modes and Technologies

The following sections look more specifically at each type of transit service of interest and the conditions where it is appropriate. The final section summarizes the discussion of transit mode technologies and provides tables which further describe the operating and financial characteristics of each specific type of service

### Commuter Rail Transit



Commuter rail is intended to carry large volumes of passengers with stations typically spaced in the 3 to 5 mile range. It is oriented to the peak period and typically serves suburban residents commuting to downtown employment centers. Usually, trains consist of one locomotive and several passenger cars which accommodate approximately 140 riders per car. Commuter rail is typically diesel powered and can operate on tracks shared with freight traffic. Another alternative is the diesel multiple unit (DMU) which is a train of several cars, each of which is powered by its own diesel engine (although trains can use a mixture of DMUs and regular coaches). DMU trains scale well as they allow extra motive power to be added at the same time as extra passenger

capacity. If the DMUs comply with the requirements of the Federal Railway Administration (FRA) safety requirements, they can be used at the same time as freight rail service.

### ***Financial Characteristics***

The actual cost of constructing a commuter rail line depends on the type of upgrades to the track and signaling system, the number of stations, and the negotiations with the owner of the track. For example, the Northstar Commuter Rail Line serving Minneapolis was constructed by improving a major freight rail line that was already double-tracked. Improving 40 miles of track and constructing 6 stations cost approximately \$170 million, or just over \$4 million per mile (2009 dollars), excluding vehicles. Similarly, the current cost estimate for the 33 mile Kenosha-Racine-Milwaukee Commuter Rail Line is approximately \$4.7 million per mile (2009 dollars), excluding vehicles.

Another issue is how payments to the owner of the track will be accounted for, with the Northstar line requiring a payment to the private owner of the line of \$100 million and the Kenosha-Racine-Milwaukee line considering lease payments for the line as an operating expense.

While the total range of costs experienced for commuter rail systems have ranged from about \$1.5 million to \$10 million per mile, given the assumptions that service in the greater Nashville region will take place in existing right of ways, and that that limited double tracking will be required, it is likely that the costs for the commuter rail alternatives being considered in the Nashville region would be around \$4.5 million per mile, and probably between \$3.2 million and \$5.6 million, excluding vehicles and payments for use of the existing rail line. FRA compliant DMUs cost approximately \$2.7 million - \$3 million each. Payments for use of the existing rail line vary with each line owner, the existing traffic on the line, and the improvements to the line being funded by the commuter rail project.

### **Light Rail Transit**



Light rail transit (LRT) is an electrically powered rail passenger system used for urban transportation, typically used on shorter routes than those covered by commuter rail. LRT typically operates at grade, primarily within a dedicated right-of-way. It can also operate in mixed traffic on street. LRT is capable of high speed (55 mph) when in an exclusive right-of-way. Stations are generally spaced at minimum of half mile intervals to allow the vehicles to reach higher speeds. Stops within a city's downtown, especially when the LRT is operating in the street, are often spaced much closer together, similar to bus stops. LRT typically operates with at least two cars in a train; each car can accommodate approximately 150 - 220 riders. LRT systems operate with overhead catenary wires and poles required for electrification.

### ***Financial Characteristics***

The cost of LRT depends on the characteristics of the line, with elevated segments and underground segments adding substantially to the cost of a project. Denver's T-Rex Line, which was constructed along several freeways at the same time as other work on the freeways, had a cost of approximately \$46 million per mile (2009 dollars), excluding vehicles. A similar light rail system in Portland, OR had costs of about \$69 million per mile (2009 dollars).

A good estimate for the costs of LRT around the Nashville region would be between the costs of these two projects, or about \$58 million per mile (2009 dollars). A reasonable range of costs would probably be between

\$46 million and \$69 million per mile. LRT cars cost between \$3 and \$5 million depending on capacity, power source, and other design characteristics and generally are operated in 2 car trains.

## Bus Rapid Transit



A bus rapid transit (BRT) is in theory a rubber-tire version of light rail transit, with the added advantage of being able to phase-in improvements over time with greater ease than a rail-mode provides. Many communities introduce BRT short of its ultimate goal of emulating LRT by improving regular bus service with increased amenities or travel time savings. Some of those improvements over regular bus may include operations on reserved or restricted lanes, priority at traffic signals, express operations with limited stops, special low floor buses, enhanced passenger facilities, branding, and other means for buses to emulate the

reliability and convenience of rail transit. Bus lanes can be designed for conventionally steered buses or for Curb Guided Bus operation. This latter option allows buses to operate at high speed in a right-of-way barely wider than the bus itself.

BRT services are flexible, and in some places like Nashville, vehicles operate on the street within mixed traffic as a standard bus. The key to BRT however, is that it has sufficient priority in traffic so that its operating speed is closer to the private automobile than a regular route bus service.

BRT buses usually have a more modern look than standard buses. Ridership is lower than some of the rail options as buses accommodate 40 to 60 riders. Typical station spacing is 1-2 miles apart. Stops within a city's downtown, especially when the BRT is operating in the street, are often spaced much closer together, similar to regular bus stops. Buses operate on shorter headways (or frequencies); 5 to 10 minutes apart ideally.

### *Financial Characteristics*

The capital cost of BRT systems depends upon the cost of the running way, the stations, the fare collection system, and the cost of the technologies implemented (e.g., Automatic Vehicle Location, Automatic Passenger Counters, Transit Signal Priority, and Driver Assist).

For the running way, designating existing lanes for BRT use through painting and signage (with no physical barriers) is on the order of \$50,000 - \$200,000 per mile. Reconstructing arterial lanes costs about \$2.6 to \$3.1 million per mile (2009 dollars). If new lanes need to be constructed, such as in a median, the capital costs of the lanes typically rise to between \$5 and \$10 million per mile, plus any right-of-way acquisition costs. Cleveland's Health Line is a one of the kind system, with costs of \$24.7 million per mile for a 6.8 mile system. The Health Line involved a complete reconstruction of Euclid Avenue from building face to building face. The reconstructed roadway included exclusive bus lanes, one lane of auto travel in each direction, and streetscape enhancements like new sidewalks, crosswalks, lighting, trees and other landscaping.

For Transit Signal Priority, which can play a very valuable role at highly congested intersections, the capital cost is roughly between \$3,000 and \$20,000 per intersection depending on the type of equipment currently used to control the intersections. The costs for stations along arterial streets (not including buildings) average in the range between \$50,000 and \$150,000 each, although much simpler (and cheaper) as well as more complex (and expensive) stations have been implemented by many transit agencies. For example, Cleveland's cost for a standard shelter with a bench, posted bus information and a ticket machine is about \$40,000, while an upgraded shelter with a bench, real-time bus information, and a ticket machine is about \$175,000. The cost of stations is

significantly increased if they include substantial parking lots, which can cost around \$4,000 - \$5,000 per parking spot.

The buses themselves also vary widely in cost, with stylized standard 45' buses costing between \$400,000 and \$600,000, while specialized BRT articulated buses can cost anywhere from \$600,000 to \$1,600,000. Automatic Vehicle Location systems are required for real-time bus information, and add about \$5,000 to the cost of each bus. For the Nashville region, assuming that 1/3 of the length of the entire route is on existing arterial streets, which lanes are not reconstructed but only designated through painting and signage, and 2/3 is new median lanes in freeways, with stations averaging every ½ mile, the probable cost would be between \$4 million per mile and \$8 million, plus the cost of vehicles.

## Streetcar



Streetcars are electrically or diesel powered vehicles designed to travel in urban cores and serve a wide variety of trip types over shorter distances. The cars are “light weight” and maneuverable. They have relatively fast acceleration and can travel quickly between shorter spaced stations, typically within mixed traffic in the street. They accommodate a lower ridership because each train typically has one car. The vehicles can be modern (which accommodate up to 180 riders) or historic replicas (which accommodate approximately 50 riders) as shown below.

### *Financial Characteristics*

Streetcar systems are generally cheaper than LRT systems as the vehicles are smaller and lighter. LRT often requires reconstruction of urban roadway lanes as the roads are not designed to support the weight of the LRT vehicles. This is usually not required for streetcars. Furthermore, the size (and cost) of stations and other system elements are also usually less. Streetcar systems therefore tend to cost about 70 percent to 80 percent of the cost of LRT systems. Streetcar vehicles, however, tend to cost around the same amount as LRT vehicles, or between \$3 and \$5 million.

## Regular Fixed-Route Bus

Regular route bus is the most common type of bus service where buses operate over fixed routes according to the preset schedule. Service is generally provided from early morning through the evening, although the frequency of service may vary between peak and off-peak periods. Stop spacing is generally based on the density of the area, with stops as close as 1/8<sup>th</sup> of a mile in high density areas, such as the urban center, and up to 3/4<sup>th</sup> of a mile in low density areas.

**Express bus or coach service** is a bus operating strategy that is designed to operate faster than regular bus service. This is generally accomplished by dividing the route into three sections:

- A section which operates as regular bus service,
- A line-haul section with that operates at higher speeds with few or no stops, possibly along a limited-access highway,
- A distribution section which operates as regular bus service within a downtown core or other high density area.

Express bus is typically oriented to the peak period and serves suburban residents (or residents or outer urban areas) commuting to downtown or other major employment centers. Peak period headways can be anywhere from every 10 minutes to hourly, and frequently service is reduced or eliminated during off-peak periods.

Another version of express bus operates between smaller urban centers on a less frequent service, anywhere from hourly to only 2 or 3 trips per day. This service may be focused on a major employer, a major shopping center, or a major medical center that serves the entire region and is intended to provide a minimal level of access to that location from the entire region.

Express bus services frequently make the collection of riders more efficient by serving one or more park & ride lots in addition to, or instead of, operating regular service in a suburban area. The park & ride lot has the effect of collecting relatively large numbers of riders at a limited number of locations, significantly increasing the effectiveness and efficiency of the express bus.

Express bus service can be operated either with regular transit buses or with coaches similar to those used for intercity bus services. Such coaches may have reclining seats, luggage storage, Wi-Fi, and/or other amenities. These coaches also often have less standing room and may have fewer or smaller entrances and exits. The additional amenities are most common on long routes where additional time spent boarding and disembarking from the bus is of less importance than the additional comfort during the line-haul section of the route.



### ***Financial Characteristics***

Buses vary significantly in costs. Standard buses cost between \$40,000 and \$500,000, while articulated buses generally are generally in the range between \$500,000 and \$700,000.

A 100 parking space park & ride lots generally ranges in cost between \$450,000 and \$550,000, excluding land acquisition costs. However, many agencies have arrangements with churches and malls to use a portion of their existing parking lots as park & ride lots, since these lots generally have low usage during the periods when there is high demand for the park & ride lot. Such lots can have capital costs as low as a few thousand dollars, primarily for signage.

### **Shared-Ride/ Vanpool Service**

Shared ride/door to door/flexibly routed services are van or small bus based services that generally operate in lower density areas (with fewer residences per square mile). Unlike door to door services which are required by the Americans with Disabilities Act, these services are designed to serve everyone, and are not limited to individuals with disabilities. They are often used either to provide transportation from rural or other low density

areas to minor urban centers or as a feeder service to other types of transit. Trips generally need to be pre-scheduled, sometimes 24 hours or more in advance. Service may be provided seven days per week, on weekdays only



(especially for employment focused services), or on only a few days every week (especially rural transportation services).

**Table 12. Summary of Service Concepts for Transit Options**

<b>Transit Option</b>	<b>Service Concept</b>	<b>Characteristics of Service Area</b>	<b>Width of Corridor</b>	<b>Average Passenger Trip Length</b>
<b>Commuter Rail</b>	Operates 4 – 6 car trains on exclusive ROW (may be shared with freight trains)	Low population and employment density terminating in a major population/employment center with either another major center at the other terminus or clusters of employment/population along the route	5 miles around park & ride; farther at terminal stations	37 miles
<b>Light Rail</b>	Operates 2-4 car trains primarily on exclusive ROW	4750 households per square mile and/or 35 MSF of commercial/office space	Primarily ¼ mile, lesser importance out to ½ mile	7 miles
<b>Streetcar</b>	Operates 1-2 car trains primarily in mixed traffic	4750 households per square mile and/or 35 MSF of commercial/office space	Primarily ¼ mile, lesser importance out to ½ mile	5 miles
<b>Bus Rapid Transit</b>	Operates generally in exclusive ROW with limited stops, possibly no stops along part of the corridor	4750 households per square mile and/or 12 MSF of commercial/office space	Primarily ¼ mile, lesser importance out to ½ mile	4 miles
<b>Express Bus</b>	Operates with limited stops, possibly no stops along part of the corridor	Service to an area with over 10,000 employees and over 32,000 employees per square mile AND corridor meets the qualifications for moderate regular route bus service (see below)	Primarily ¼ mile, lesser importance out to ½ mile. 5 miles around park & ride.	5 miles
<b>Regular Route Bus</b>	Frequent stops along route	Moderate service (2 buses per hour) – 3325 households per square mile and/or 8 MSF of commercial/office space. Minimum service (1 bus per hour) – 1900 households per square mile and/or 5 million square feet (MSF) of commercial/office space. Lower densities are appropriate to serve where walking conditions encourage transit use.	Primarily ¼ mile, lesser importance out to ½ mile	3 miles
<b>Door to Door/ Flexibly Routed Service</b>	May pick up customers at the curb or at special pick-up points by arrangement	May serve small neighborhoods or entire counties.	Any	13 miles (reflecting distances in rural systems)

The following table provides more detail on the operating characteristics of the different modes, including average speed, carrying capacity of the service per hour and per vehicle, type of right-of-way and typical station or stop spacing. Light rail has the highest carrying capacity on a per hour basis, whereas the door to door or flexibly routed services have the lowest carrying capacity.

**Table 13. Summary of Transit Operating Characteristics by Mode**

Transit Option	Avg. Speed w/ Stops	Route Capacity	Passengers / Vehicle	Right-of-Way (ROW)	Station Spacing
Commuter Rail	20 – 50 mph	2,000 – 10,000 passengers per hour	100 - 200	Exclusive ROW (may share with freight traffic)	2 - 5 miles
Light Rail	20 – 30 mph	3,000 – 15,000 passengers per hour	150 – 220	Exclusive ROW, generally running at-grade	0.5 – 1.5 miles
Streetcar	15 – 30 mph	1,000 – 6,000 passengers per hour	50 - 180	Mixed traffic, may have some exclusive lanes or ROW	¼ – 1 mile
Bus Rapid Transit	15 – 30 mph	2,000 – 10,000 passengers per hour	75 -100	Exclusive ROW or mixed traffic with priority measures	1/2 – 1.5 miles, may have larger gap in middle of route
Express Bus	10 – 20 mph	500 – 3,000 passengers per hour	40 – 110	Mixed traffic, may include freeways	¼ – 1.5 miles, may have larger gap in middle of route
Fixed-Route Bus	5 – 15 mph	200 – 1,200 passengers / hour	40 – 60	Mixed traffic on regular roads	¼ mile
Door to Door/ Flexibly Routed Services		< 20 passengers per hour / vehicle	4 – 8 in urban areas, less in rural areas	Mixed traffic	NA

**Table 14. Summary of Typical Costs by Transit Option**

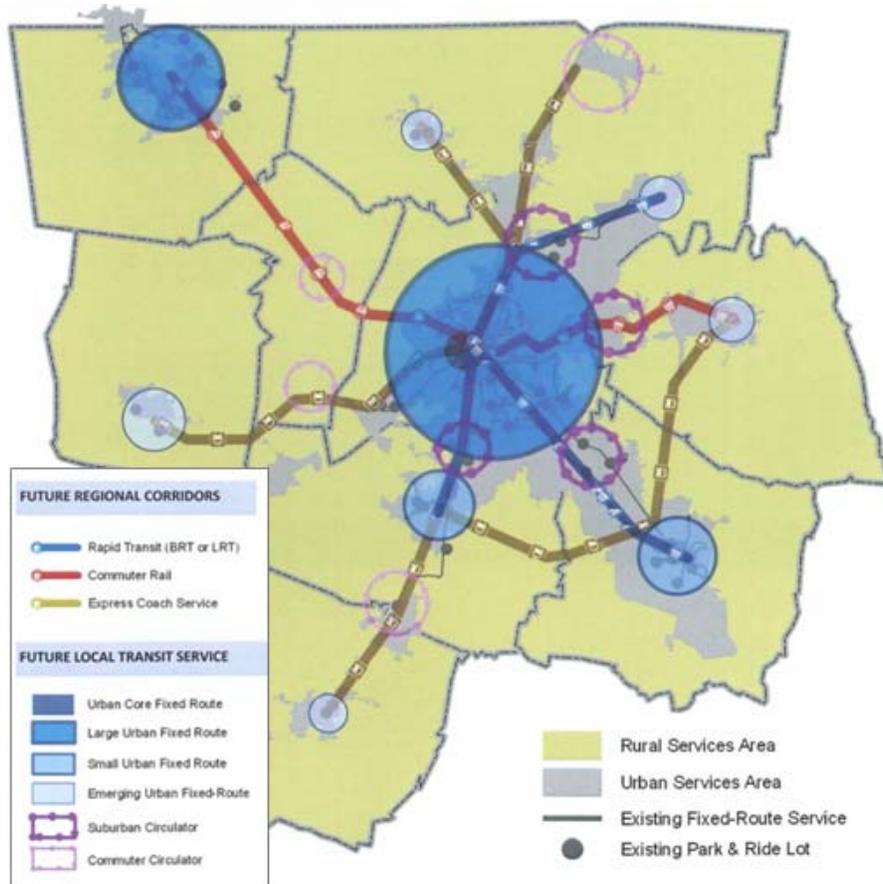
Transit Option	Capital Cost per Mile (millions)	Capital Cost per Vehicle (millions)	Operating Cost Per Hour (hundreds)
Commuter Rail	\$3.2 - \$5.6	\$2.7 - \$3.0	\$300 - \$400
Light Rail	\$46 - \$69	\$3.5 - \$5	\$200 - \$250
Streetcar	\$31 - \$56	\$3.5 - \$5	\$140 - \$170
Bus Rapid Transit	\$4 - 8	\$0.6 – \$1.6	\$120 - \$160
Express Bus	n/a	\$0.4 - \$0.7	\$100 - \$110
Regular Route Bus	n/a	\$0.4 - \$0.5	\$95 - 100
Door to Door/Flexibly Routed	n/a	\$0.05 - \$0.07	\$70 - \$75

*Costs in 2009 Dollars. Capital costs exclude cost of Right-of-Way.*

## 5.3 Long-Range Vision for Transit

A significant element of the 2035 Regional Transportation Plan involves the formal act of adopting a bold, new vision for mass transit that calls for the expansion and modernization of the region’s mass transit system. Such a move is a necessary part of the region’s preparation for the increasing competitive global economy, and proactively addresses the growing concerns about the health of our environment, worsening congestion, and the sprawling land development pattern that has begun to encroach upon the area’s cherished rural countryside. The vision includes a variety of new and expanded services for regional corridors, urban centers, suburban communities, and even the rural countryside.

**Figure 48. Long-Range Vision for Regional Transit**



The long-range vision for mass transit calls for a strategic mix of transit options for future generations of Middle Tennesseans, ranging from high-frequency rapid transit service to the continued provision of rural transit services for those who do not live nearby to fixed-route options. The following describes the various types of services proposed for Middle Tennessee.

- **Rapid Transit:** Three corridors are identified for future regional rapid transit service including the region’s northeast, southeast, and south corridors. These areas are the most densely populated and fastest growing within the region and have a well-established pattern of cross-county travel. The long-range vision for rapid transit in these corridors includes the development of either light rail transit or dedicated-lane bus rapid transit that would operate at high levels of service throughout the day. The specific mode or technology used will be determined by future study and depend heavily on development patterns, anticipated ridership, cost of construction, and public support for funding.

- **Commuter Rail:** The long-range vision calls for continued support for the Music City Star’s east corridor commuter rail service and the development of a new commuter rail line in the region’s northwest corridor to connect Clarksville and Nashville, two of Tennessee’s five most populous cities.
- **Express Coach Service:** In corridors with strong commuting patterns but without the land development patterns or traffic congestion to warrant dedicated-lane transit service, the vision calls for the implementation of premium express coach service. Such service will offer a comfortable and stress-free ride to and from work for commuters, providing enhanced amenities along the way including high-back seats, wireless internet access, on-board televisions, and restrooms.
- **Urban Fixed-Route Service:** By far the most critical piece of the long-range vision, the region must continue to expand the existing urban fixed-route services in Nashville-Davidson County, Clarksville, Franklin, and Murfreesboro. Urban services are the backbone of any regional transit system and must be optimized in order to ensure the success of investments in regional rapid transit or commuter rail. The vision calls for continued investment in existing local bus systems, the eventual introduction of fixed-route service in Springfield, Gallatin, Lebanon, Columbia, and Dickson, and the return of the urban streetcar in downtown Nashville which serves as the central hub for the region.
- **Suburban and Commuter Circulators:** As the region begins to implement rapid transit, commuter rail, or express coach services in each of the regional corridors, the vision calls for the development of local circulators markets where a full-fledged urban fixed-route system would not make sense. Such local circulation will be important to customers to access regional services from primary destinations within their community. Suburban circulators, which would operate throughout the day, are envisioned for places like Goodlettsville, Hendersonville, Smyrna, La Vergne, and Brentwood, while commuter circulators, which would operate during peak commuting times, are envisioned for places like Portland, Spring Hill, Kingston Springs, and Ashland City.
- **Other Regional Services:** In addition to the geographically defined train, bus, and circulator services described above, the vision also calls for the expansion of the regional vanpool program and rural paratransit services. The regional vanpool program has been proven to be a popular and cost-effective way to provide ride-sharing opportunities to commuters who live too far away from fixed-route lines, and as the region’s population continues to grow older, rural paratransit services will be needed to ensure older Middle Tennesseans have transportation to and from life-sustaining services.

While the adoption of a bold, new long-range vision for mass transit is a momentous step by Middle Tennesseans towards the expansion and modernization of its public transportation system, the vision itself will not guarantee the successful implementation of transit improvements. The transit vision seeks to communicate the region’s intent for developing mass transit, but more difficult work is needed in order to make the vision a reality. The following sections of this plan provide specific guidance for how to achieve significant portions of the vision over the next 25 years.

## 5.4 Regional Corridor Recommendations

The Middle Tennessee area is served by seven major regional corridors, each a significant part of the overall vision for mass transit to provide increased connectivity between downtown Nashville and other traditional town centers and emerging activity centers across the area. Additionally, the MPO has begun to plan for emerging development along the SR 840 corridor, particularly between Lebanon, Murfreesboro, and Franklin, where the long-range vision calls for future express bus/ coach service as commuting patterns begin to yield sufficient demand for transit.

- North Corridor – Nashville to Springfield and Portland.
- Northeast Corridor – Nashville to Goodlettsville, Hendersonville, and Gallatin,
- East Corridor – Nashville to Mt. Juliet and Lebanon,
- Southeast Corridor – Nashville to La Vergne, Smyrna, and Murfreesboro,
- South Corridor – Nashville to Brentwood, Franklin, Spring Hill, and Columbia,
- West Corridor – Nashville to Kingston Springs and Dickson,
- Northwest Corridor – Nashville to Ashland City and Clarksville,

The region’s vision for mass transit calls for the implementation of rapid transit services in three of the seven major regional corridors, commuter rail in two, and premium express coach service in three. The following presents a set of recommendations for the short and long-term to encourage progress towards the vision.

## Rapid Transit Corridors

### Northeast Corridor (Davidson and Sumner Counties)

The region’s 30-mile Northeast Corridor extends between downtown Nashville and the City of Gallatin and is generally defined along US 31 (Gallatin Road, Nashville Pike), Interstate 65, SR-386 (Vietnam Veterans Blvd) and encompasses the areas of East Nashville, Madison, Goodlettsville, Hendersonville, and Gallatin.

The corridor ranges from relatively mature development in the southwest to new development in the northeast. East Nashville is undergoing revitalization of its commercial areas and residential neighborhoods while maintaining a traditional, compact urban development pattern. Gallatin Pike is an important transportation corridor in the East Nashville and Madison communities and future land use plans call for concentrating development in nodal community centers with a pedestrian-oriented character. The cities of Hendersonville and Gallatin are experiencing faster population growth and development with new upscale residential and commercial development occurring in less concentrated suburban development patterns.

The area is served by a variety of transportation services, highlighted by major north-south roadway facilities. Traffic volumes on those and other major facilities have increased significantly over the past decade, resulting in higher levels of congestion. A variety of transit services also are available within the corridor including fixed route bus service, express service and park and ride lots.

- Four north-south roadway facilities run in parallel in the northeast Nashville area, each with different transportation characteristics: Interstate 65, Vietnam Veteran’s Blvd (SR 386), Gallatin Road/ Nashville Pike (US 31E), Dickerson Pike (SR 11), and Ellington Parkway.
- Average traffic volumes have increased by 6 percent on the roadways in the study area between 2000 and 2006.
- An HOV lane is currently in use on I-65 between Briley Parkway and the I-65/Vietnam Veteran’s Blvd. interchange.
- CSX owns and operates a mainline railroad which travels through downtown Nashville, Madison, Hendersonville, and Gallatin.
- In 2005, there were about 96 trains per day using two existing tracks between downtown Nashville and Madison. Between Madison and Gallatin there were about 32 trains per day using one existing track.

- The Nashville MTA currently provides bus service (Route 26) between downtown Nashville and Rivergate Mall. In 2004 it carried 10 percent of all fixed route customers in the MTA's network and was the route with the overall highest ridership. 2007 data indicates substantially increased ridership.
- MTA introduced light Bus Rapid Transit (Route 56) in late September 2009. The service covers 12 miles along Gallatin Pike and runs between Music City Central in downtown Nashville to the edge of Sumner County, just north of Rivergate Mall.
- Bus service also is provided via Route 35X which extends from downtown Nashville to Hendersonville with service provided in the morning and evening rush hours.
- According to a 2006 survey, 54 percent of the MTA transit riders had no working vehicle and 74 percent had incomes less than \$15,000 per year indicating a heavily transit dependent customer base.
- RTA introduced Express Coach Service between downtown Nashville and Hendersonville and Gallatin in Sumner County via Route 92X on September 29, 2008. Since its inception, the service has been very popular. It currently operates two morning inbound trips and two afternoon outbound trips and averages around 2,200 passenger per month.
- Several park and ride lots are provided in the study area for bus transfers and car and van pools. These lots are located at the Madison Kmart, Madison Square, Hendersonville Kohl's (RTA), New Shackle Island (Hendersonville), Rivergate Mall and Gallatin Walmart. In total, over 250 parking spaces are available.

The urban design characteristics of the corridor represent a continuum of development patterns representative of time periods as the region has expanded over the last 50 years. Each community has small commercial nodes that formed their original town centers. Connecting these nodes are various scales of strip commercial. The scale of these strip commercial areas is smaller within the segment between Nashville's central business district and Madison.

With the exception of large grocery store developments, the size of these developments is typically under an acre with less than 100ft of street frontage. Larger strip commercial developments are more characteristic of the segments around the Rivergate Mall. These developments commonly include 3 or more acres with street frontage exceeding 150ft. Indian Lake Village in Hendersonville, a large office, residential, and retail center currently under construction, has begun to introduce a large-scale multi-use development pattern to the north Hendersonville portion of the corridor.

### **Short-Term Recommendations for Express Coach Service**

Options should be sought to further improve the express service to Gallatin. Recommendations are to add a third trip during each peak, either by combining the service with one trip on the 35X which could be extended, or adding a trip independently to Route 92X. Efforts should also be made to develop a formal Park & Ride lot east of the merge of the Vietnam Veterans Parkway merge with I65 north. Such a lot could add capacity to the Rivergate Mall Park & Ride (which is reasonably well utilized), it could make it easy and quick for the 92X to serve the Rivergate area. It could also be a very visible lot from the highway which would increase use.

An additional morning trip departing Gallatin at 7:00AM is recommended. An additional early evening trip would depart 21<sup>st</sup> and West End at 5:20PM. The one-way travel time would be approximately 70 minutes. One vehicle would be needed to operate these additional trips at a total capital cost of \$450,000. The annual operating cost would be around \$110,000. The additional trip is expected to increase in annual ridership by 13,000 passengers or about 50 per day.

Funding should be allocated for a Park & Ride lot in the vicinity of Conference Drive and Vietnam Veterans Boulevard. The cost for a 200 space lot at \$9,000/space can be estimated as \$1,800,000.

### Mid-Term Recommendations for Evolutionary Bus Rapid Transit

Understanding that implementing the region’s Light Rail Transit vision for the Northeast Corridor will not happen overnight, a series of interim projects based on a Bus Rapid Transit alternative are being recommended to lay out the path to accomplish that ultimate vision. Some of those recommendations for the Davidson County portion of the corridor include the intensification of the light BRT service currently operated by MTA on Gallatin Pike to add dedicated lanes at selected locations north of Briley Pkwy, enhancing bus stations to include real time information and ticket vending machines as recommended on phase 2 of MTA’s BRT implementation plan, and incorporation of queue jumps at selected intersections to allow buses to improve travel time. In the Sumner County portion of the corridor, dedicated/managed lanes are recommended for bus travel including the possibility of slip ramps to provide access to TOD sites along the corridor like in the case on Indian Lake Village in Hendersonville. Additionally, new circulator routes providing access to the main line in certain strategic areas in both counties is also recommended.

### Long-Term Vision for Rail Transit

Following a similar approach to that one taken by the Denver region for its southeast corridor (T-Rex), an urban/suburban LRT alignment along a freeway corridor represents the locally desired alternative for Nashville’s Northeast Corridor. In order to get there, an alternative growth scenario that provides a different approach to the trend that has been taking place during the last several years needs to be designed and followed. This alternative approach is imperative to position the corridor in a place where an LRT investment makes sense and can respond to the different realities permeating these types of investments. Answers to several question ranging from future ridership and capital and operating costs to economic and land use impacts and public policy and funding need to be considered and analyzed thoroughly in order to move forward. At a minimum, the following steps needs to be taken to advance the long term vision



- Translate revised growth scenario into the future land use plans of local governments;
- Educate the public and policy-makers on the benefits of targeted density with good urban design;
- Analyze gaps in policies to identify regulatory barriers to a more compact land development pattern;
- Identify and promote market incentives that encourage increased development around targeted TOD locations;
- Align public sector investment strategies with stated vision to help created a more suitable environment for major transit investment, or at least to not contradict it.

## **Southeast Corridor (Davidson and Rutherford Counties)**

The Southeast Corridor area is approximately 30 miles in length from downtown Nashville to just south of the City of Murfreesboro and encompasses an area of approximately 350 square miles. The corridor has experienced tremendous population growth in recent years and is expected to continue growing at a rapid pace. The population in the study area, which includes portions of both Davidson and Rutherford Counties, was 331,000 in 2000 and is forecast to grow to more than 438,000 by the year 2025.

There are two major thoroughfares in the corridor, Interstate 24 (I-24) and Murfreesboro Road (US-41/70S), which connect Nashville with La Vergne, Smyrna and Murfreesboro. Both thoroughfares provide access to high concentrations of employment sites, including large state and federal offices in downtown Nashville, commercial/retail development in suburban areas, and single-family and multi-family housing throughout. With rapid growth in the area, congestion along these major roadways is forecast to increase. This increased congestion will make existing bus service less attractive due to longer travel times and buses that are stuck in traffic.

There are limited opportunities for roadway expansion due to topographic constraints and development adjacent to the right of way. For example, I-24 in and around downtown Nashville was constructed in the late 1950s and roadway improvements over the last several decades have expanded to the maximum amount of available right-of-way within the corridor. As a result, there is no available median right-of-way. The outside travel lanes are 20 to 30 feet below the surrounding topography and abut rock walls. The physical challenges and potential costs of expanding the right-of-way under these conditions, along with the impacts of taking the highly developed urban and industrial land which surrounds the right-of-way, limits the potential to expand the roadway. Additionally, in other parts of the I-24 corridor, major widening has occurred within the available median right-of-way to avoid affecting development alongside the edge of the roadway. Similar limitations exist along Murfreesboro Road which includes numerous commercial and retail establishments with driveways or parking facilities that directly access the roadway.

Currently, few options in the corridor provide alternatives to driving in heavily congested conditions. Options for longer-distance commuters are limited to: carpools and vanpools using park-and-ride lots; the Regional Transportation Authority (RTA) "Relax-and-Ride" commuter bus service which operates only during rush hour periods; local and express Metropolitan Transit Authority (MTA) routes that operate over shorter segments of the corridor; and use of the HOV lane on I-24. The HOV lane on I-24 runs between Murfreesboro and Nashville but terminates at Harding Road, several miles short of downtown Nashville. Drivers using the HOV lane must enter mixed traffic at that point creating significant congestion and limiting the utility of the HOV lane for carpools and transit. In addition, the HOV lane is not enforced, further limiting its benefit. For existing bus service there are no options that enable buses to bypass congestion. Considering this, ridership on the existing commuter services is relatively high which indicates a potential unmet demand for transit options in the corridor.

Potential commuters that do not have access to private transportation are denied access to jobs and educational opportunities throughout the corridor as a result of the lack of transit options. This lack of access reduces opportunities for all people throughout the region, hinders social and economic advancement, and reduces regional economic development. As the Southeast Corridor High-Performance Transit study illustrates, the lack of mobility and transportation options combined with the current and projected growth of population, employment—and traffic congestion—requires that transportation alternatives be developed now to address these needs.

### **Short-Term Recommendations for Express Coach Service**

It is recommended that the Murfreesboro trips be modified to provide easier connections between Rover, Murfreesboro's bus system, and the express route. The Murfreesboro express trips could begin at the Rover transfer location at Walnut and Burton. The bus would then run on Medical Center Parkway and serve a new Park & Ride located near the interchange with I-24. A Park & Ride could either be established at the Avenue Shopping Center or a new one could be constructed since land is available near the interchange. This location is preferred over the existing Park & Ride at Old Fort Park. It is unlikely that there is space for a transit coach to serve this lot and it is located two miles east of the I-24 interchange.

From the I-24 and Medical Center Parkway interchange, the route would run express to Downtown Nashville, using the HOV lane from Highway 96 to the Davidson County line. The estimated travel time to Nashville is about 50 minutes.

Possible morning inbound departure times for the Murfreesboro route could be 6:00 AM, 6:30 AM, 7:00 AM, and 7:30 AM. Possible afternoon outbound departure times could be 3:50 PM, 4:10 PM, 4:50 PM, and 5:20 PM. Two additional vehicles would be needed to operate this service, with a total capital cost of \$900,000. The annual operating cost would be \$157,000 with an expected increase in annual ridership of 23,000 passengers or about 90 per day.

Funding should be allocated for a Park & Ride lot in the vicinity of Medical Center Parkway and I-24. The cost for a 100 space lot at \$9,000/space can be estimated as \$900,000.

The Smyrna and La Vergne express service would begin at the Smyrna K-Mart and run north on US 41 through La Vergne, serving the Park & Ride at the Kroger. It would then turn left on Parthenon Boulevard to reach I-24 and run express to downtown. The travel time from La Vergne to downtown should improve to around 30 minutes.

Possible morning inbound departure times for the Smyrna and La Vergne route could be 6:00 AM, 6:30 AM, 7:00 AM, and 7:30 AM. Possible afternoon outbound departure times could be 3:50 PM, 4:10 PM, 4:50 PM, and 5:20 PM. Two additional vehicles would be needed to operate this service, with a total capital cost of \$900,000. The annual operating cost would be \$142,000 with an expected increase in annual ridership of 23,000 passengers or about 90 per day.

The local service connecting Nashville to Murfreesboro would operate similar to the current service. There would be three northbound trips and three southbound trips. The trip times should be reviewed with MTSU to make sure the service is meeting the travel needs of its students, staff, and faculty.

### **Mid-Term Recommendations for Enhanced Bus Service/ Bus Rapid Transit**

In 2007, the MPO completed a Transit Alternatives Analysis which determined that the most practical investment in the short- and mid-term was to significantly enhance the regional express bus service by integrating features to increase its attractiveness to choice users that have access to a personal automobile. The study also recommended the implementation of new local circulator service in communities along the corridor including LaVergne and Smyrna. The MPO has budgeted planning funds to assist those communities in identifying possible startup services.

### **Long-Term Vision for Rapid Transit Service**

Given the continued rapid growth between Nashville and Murfreesboro, and the ongoing interest in rapid transit in the region's urban corridors, the MPO recommends that as bus service is incrementally improved along I-24 and US 41 and local governments find opportunities to densify existing communities, the Southeast corridor be re-evaluated for possible fixed-guideway investments within the next five to ten years.



## **South Corridor (Davidson, Williamson, and Maury Counties)**

The south corridor stretches 15 plus miles between Nashville and Franklin, TN and another 20 miles to Columbia. Currently served by express bus service during peak commuting periods, the corridor is a top candidate for more significant transit investment over the next decade. Williamson County is expected to more than double its population by the year 2035 and high-capacity rapid transit may be one of the most effective ways to keep this part of the region moving efficiently.

The long-range vision for the south corridor calls for high-capacity rapid transit in the form of light rail or bus rapid transit to connect residents to major employment and shopping destinations between Nashville and Franklin. The service should be integrated with local transit services in Franklin and Nashville and provide a catalyst for new local circulation in the Brentwood area.

Within the next two years, the MPO should work with the RTA and local governments in Davidson and Williamson Counties to conduct a major corridor study to evaluate the feasibility of light rail and bus rapid transit investments. Such a study will cost up to \$1.2 million and could be paid for with MPO planning grants with local governments providing the required 20 percent local matching funds.

### **Short-Term Recommendations for Express Coach Service**

#### ***Williamson County***

Almost 30,000 Williamson County residents commute to Davidson County. To serve this commuter market, the RTA started a new express service in December 2009 from Franklin and Brentwood to Downtown Nashville. Route 91X Franklin/Brentwood Express serves two Park & Ride lots in Franklin, one at the Williamson Square Kroger near Route 96 and I-65 and another at Lowe's Home Improvement near Cool Springs Boulevard and I-65. The route also serves a Park & Ride at the Brentwood Civitan Ball Park.

There are two trips to Nashville in the morning departing at 6:30 AM and 7:00 AM and two trips from Nashville in the afternoon departing at 4:20 PM and 4:45 PM. Running only two trips in each direction limits customers' choices of when to travel. The last afternoon departure is before 5:00 PM, the traditional end of the workday for many professions.

It is recommended that a third trip operate in both directions. The additional morning trip would depart Franklin at 7:30 AM and serve all three Park & Rides. The additional early evening trip would depart Music City Central at 5:30 PM and serve all three Park & Rides. The one-way travel time would be approximately 50 minutes.

One vehicle would be needed to operate these additional trips at a total capital cost of \$450,000. The annual operating cost would be \$79,000 with an expected increase in annual ridership of 13,000 passengers or about 50 per day.

The RTA also started an express bus service to Spring Hill, which sits partly in Williamson County and partly in Maury County. Population in Spring Hill has almost quadrupled in eight years from 7,725 to 26,320. Route 95X Spring Hill Express serves two Park & Rides in Spring Hill, one at Thompson's Station Baptist Church and another at Spring Hill Kroger. Route 95X only runs two trips. One trip departs Spring Hill at 6:20 AM and another departs Music City Central at 4:10 PM. The one-way running time is approximately 60 minutes.

The times these trips operate only allow employees to be at work 8.5 hours. Many professional positions require longer work days. Two additional morning and two additional early evening trips are recommended to provide an express bus option for these employees.

The two additional morning trips would depart Spring Hill at 6:50 AM and 7:20 AM and serve both Park & Rides. The additional early evening trips would depart Music City Central at 5:00 PM and 5:45 PM and serve both Park & Rides.

Two vehicles would be needed to operate these additional trips at a total capital cost of \$900,000. The annual operating cost would be \$189,000 with an expected increase in annual ridership of 23,000 passengers or about 90 per day.

### ***Maury County***

The number of commuters between Maury and Davidson counties has increased rapidly from 3,077 in 2000 to 7,073 in 2008. This 130 percent increase is the largest increase in the ten-county region. Some of this growing commuter market may be served by the new express Route 95X Spring Hill Express discussed above. RTA Express Bus Service to Columbia is not recommended in the short-term because of the length of trip required, which is more appropriately served by intercity service. However, a Park & Ride lot is recommended near Nashville Highway (US 31) and Bear Creek Pike (US 412). The lot could serve as a carpool and vanpool staging area. The cost of a 50 space lot can be estimated as \$450,000.

The South Central Tennessee Development District has begun intercity service that serves Columbia (stopping at the McDonalds at 110 Bear Creek Pike near Route 31). One trip leaves Columbia at 8:00AM and arrives at the Nashville Greyhound station at 9:45AM on Tuesdays, Thursdays and Fridays. The return trip leaves Nashville at 12:00 noon. On Monday and Wednesday, the trip runs to the Greyhound station in Murfreesboro, arriving at 9:45AM, with a return at 12:00 noon. This service is not aimed at the commuter market..

## **Commuter Rail Corridors**

### **East Corridor (Davidson and Wilson Counties)**

The region's east corridor stretches 30 plus miles between Nashville and Lebanon, TN. Currently served by the area's first example of local fixed-guideway rail service since the InterUrban rail lines closed down several decades ago. While ridership levels continue to ebb and flow with the price of fuel, the corridor is well positioned for growth over the next two decades as development begins to occur near stations. The MPO should continue to provide support to the line and seek ways to encourage densification of development to spawn new ridership.

Currently, the train operates 3 trips inbound to Nashville and 3 trips outbound to Wilson County in the morning peak period and 3 trips outbound to Wilson County and inbound to Nashville in the afternoon. The Music City Star also provides a fourth trip in the early evening from Wilson County to Nashville on Fridays only with a return trip leaving Nashville at 9:30PM.

### **Northwest Corridor (Davidson, Cheatham, and Montgomery Counties)**

Clarksville, the largest city in Montgomery County and the fifth largest city in Tennessee, is increasingly becoming a bedroom community to Davidson County. The number of commuters traveling from Montgomery County to Davidson County increased from 4,698 to 8,335 (68%) from 2000 to 2008.

Vanpools and informal carpools operate from six Park & Rides and Jarmon D and Q Transportation operates express bus service from northeast Clarksville to Nashville. With the increase in the number of commuters from Montgomery County to Davidson County, express bus service from Park & Rides along I-24 to Nashville is recommended en route to the longer-term vision for commuter rail.

## Short-Term Recommendations for Express Coach Service

### *Montgomery County*

Two new routes are recommended between Clarksville and Nashville. The first route would begin at the Park & Ride at the Walmart on Wilma Rudolph Boulevard near Exit 4 on I-24. The route would run on I-24, serve the Park & Ride at Exit 8, and then run express to Downtown Nashville. The travel time to downtown would be approximately 55 minutes. This route is similar to the Jarmon Transportation service, which could be used to demonstrate the feasibility of express bus service from Exit 4. This existing service would need to be marketed to commuters as it appears it is currently mostly marketed to Ft. Campbell personnel.

Possible morning inbound departures could be 6:45AM, 7:15AM, and 7:45AM. These departures would make timed connections to Clarksville Transit System (CTS) Route 7 at the Walmart.

A reverse trip could depart Nashville at 7:45 AM. This route would be designed to serve Hemlock Semiconductor (HSC) and other business in Commerce Park. Commerce Park is located approximately 1.5 miles east of I-24 on the northwest side of Highway 79. HSC is currently under construction and is expected to create at least 500 jobs for the region. Many of these jobs will require skilled professionals that are well paid and are likely to reside in Nashville.

Possible afternoon outbound departure times could be 4:00 PM, 5:00 PM, and 6:00 PM, with a reverse trip at 5:15 PM. Three vehicles would be needed to operate this service at a total capital cost of \$1.35 million. The annual operating cost would be \$345,000 with an expected annual ridership of 45,000 passengers or about 175 per day.

The second route would begin at the downtown transit center. The route would run east on Ashland City Road and Martin Luther King Parkway, serve the Park & Ride lot at Exit 11 and then operate express on I-24 to downtown. The travel time to downtown would be approximately 60 minutes.

Possible morning inbound departures could be 6:30 AM, 7:00 AM, and 7:30 AM. These departures would make timed connections to all Clarksville Transit System (CTS) routes at the transit center. A reverse trip could depart Nashville at 7:45 AM and operate express to downtown Clarksville. Possible afternoon outbound departure times could be 4:00 PM, 5:00 PM, and 6:00 PM, with a reverse trip at 5:15 PM. Three vehicles would be needed to operate this service at a total capital cost of \$1.35 million. The annual operating cost would be \$377,000 with an expected annual ridership of 45,000 passengers or about 175 per day.

### *Cheatham County*

While anticipated growth between Nashville and Ashville City is not as robust as that projected between Nashville and Clarksville along I-24, the plan recommends the introduction of express bus service from Ashland City. While the number of commuters from Cheatham County to Davidson has remained unchanged from 2000 to 2008, the total of 10,500 commuters is above the minimum threshold of 5,000 commuters.

A Park & Ride could be established at the Walmart just east of Ashland City (Route 12 and Old Hydes Ferry Run). The route would then run express on Route 12 into Davidson County, follow 8<sup>th</sup> Avenue into Downtown Nashville, and end at Music City Central. Possible morning inbound departures could be 6:40 AM, 7:20 AM, and 8:00 AM. Possible afternoon outbound departures could be at 4:15 PM, 5:10 PM, and 6:00 PM. The one-way travel time would be approximately 40 minutes.

Two vehicles would be needed to operate these trips at a total capital cost of \$900,000. The annual operating cost would be \$189,000 with an expected increase in annual ridership of 34,500 passengers or about 135 per day.

### Long-Term Vision for Commuter Rail

Over the next several years no major highway projects are expected to significantly improve intercity commute times in the Clarksville-Nashville corridor. Over the next 20 years, intercity commute time is expected to deteriorate further to 1 hour and 35 minutes from the 50 minute drive of today. Clarksville-Nashville commuters need a travel option which bypasses the deteriorating traffic conditions on I-24 and Clarksville Highway. That transportation option should be developed within the next 5-7 years.



The Nashville Area MPO recently participated in a study along with the Clarksville Urbanized Area MPO, TDOT, the Cheatham Rail Authority, and the Nashville Western Rail Authority to evaluate the feasibility of a high-capacity commuter service which would improve the current travel times and provide flexibility for low-cost expansions of capacity as travel demand increases. The study evaluated commuter rail service via three different alignments including I-24, existing CSX tracks through Springfield, and the old

Tennessee Central Railroad through Cheatham County. The study concluded that the following scenario was the most feasible, but further study is needed prior to the selection of a preferred alignment.

- **Project Alignment:** The old Tennessee Central Railroad, which follows the Cumberland River and passes through Ashland City, was found to be the most practical alignment. Most of the old railroad bed is still in place and the Nashville and Western short line freight railroad now operates on the line from the Farmer's Market area of Nashville to the Ashland City Industrial Park just south of Ashland City. The CSX alignment proves impractical since the private rail company has limited capacity to share with passenger service. The initial estimates for the cost of constructing new track along the I-24 corridor did not appear to be competitive with the Tennessee Central Railroad alignment.
- **Service Concept:** Passenger stations would be located in Mid-Town Nashville, Downtown Ashland City, and the Old Hospital/Madison Street area of Clarksville. Two train sets each make the full Clarksville/Nashville trip; 2 times in the AM and 2 times in the PM. Speeds would be up to 79 miles per hour over long sections, with an overall 50 minute Clarksville to Nashville trip time.
- **Initial Capital Costs:** \$114.8 million is the projected cost to rehab 16 miles of existing track, construct 27 miles of new track, upgrade 54 bridges or overpasses, construct 3 stations and the support and maintenance facilities, acquire new rights of way, purchase locomotives and train cars, and includes a budgeted contingency.

- **Annual Operating Costs:** \$5.7 Million to operate the service during peak commuting times, two runs in the AM, and two runs in the PM.

To date, the conceptual feasibility study represents the latest evaluation of the potential commuter rail in the corridor. In order to advance to the next level, the Nashville Area MPO recommends a continued partnership with the Clarksville Urbanized MPO and TDOT to further refine projects for ridership and costs to allow decision-makers to better understand the benefits and costs of moving forward with commuter rail in the northwest corridor. The following are proposed as the immediate next steps:

- Conduct a 10-county regional household travel survey in FY 2011 (\$800,000 to \$1.2 million) in order to update information about current regional travel behaviors. Such data will be needed in order to conduct a more thorough transit alternatives analysis to compete for Federal Transit Administration (FTA) grants for implementation.
- Program funds (\$800,000 to \$1.2 million) for the detailed corridor study to include the required FTA Alternatives Analysis that is required to qualify for federal grant funding. Should funds be available, the study could begin as early as Fall 2012, but not sooner than the completion of the household travel survey.
- Integrate corridor study recommendations into the MPO's regional transportation plan. Given the required work elements to complete the study, it is likely that those findings and project recommendations will be presented as part of the region's 2040 Regional Transportation Plan, scheduled for adoption in late 2015.
- Begin efforts to preserve and protect potential right-of-way located along the corridor. Such action now can help significantly reduce the cost of implementation by preventing unnecessary land acquisitions or business relocations to make way for the construction of tracks or stations.
- Work with TDOT to secure Truman-Hobbs funding for a new Cumberland River bridge that could be used by the commuter rail service should the FTA Alternative Analysis recommend an alignment through Ashland City.
- Continue investment in interim transit solutions along the corridor including inter-city bus service and the vanpool program to serve existing commuters and to help build ridership for future rail service.

## Regional Express Coach Services

Even within the “bold” vision for mass transit, much of the region does not have the concentrated development that is needed to support regularly scheduled transit service such as local fixed-bus service or light rail service. However, to build towards a future with a comprehensive public transportation system, some steps can be taken to improve and fill gaps in the public transportation services available today. In particular, Park & Ride with express coach services are an excellent way to accommodate transit commuters in less dense areas. Express coach service, combined with strategically located park and ride lots, allow customers of public transportation to access the service by car and thus this option increases the residential area that transit can serve by many times.

The potential for Park & Ride/express bus service is dependent upon the number of commuters traveling between a Park & Ride service area and the destinations served by the express bus service. Actual usage of Park & Ride lots will depend upon the quality and quantity of transit service, the degree of highway congestion, and the availability of parking at the destination. Following is an assessment of the potential for Park & Ride with express bus.

### **West Corridor (Dickson County)**

The number of commuters from Dickson County to Davidson County in 2008 was 6,620. This is barely above the threshold of 5,000 and express bus service from Dickson County can be considered a lower priority compared to the other eight counties.

A Park & Ride could be established near the intersection of I-40 and State Route 46. The route would then run express on I-40 and stop at existing informal and formal Park & Rides located at the intersection Interstate 40 and State Route 96 near the border of Dickson and Williamson Counties. The bus would continue to run express along I-40 and end at Music City Central. Possible morning inbound departures could be 6:30 AM, 7:00 AM, and 7:30 AM. Possible afternoon outbound departures could be at 4:15 PM, 5:10 PM, and 6:00 PM. The one-way travel time would be approximately one hour.

Three vehicles would be needed to operate this service at a total capital cost of \$1.35 million. The annual operating cost would be \$283,000 with an expected annual ridership of 34,500 passengers or about 135 per day. The cost of a 50 space Park & Ride can be estimated as \$450,000.

### **North Corridor (Robertson County)**

While the number of commuters from Robertson County to Davidson has increased slightly from 2000 to 2008, the total of 12,357 commuters is above the minimum threshold of 5,000 commuters.

A Park & Ride could be established near the intersection of I-65 and State Route 52. The route would then run express on I-65 and stop at another newly established Park & Ride located at the intersection I-65 and State Route 25. The bus would continue to run express along I-65 and end at Music City Central. Possible morning inbound departures could be 6:30 AM, 7:00 AM, and 7:30 AM. Possible afternoon outbound departures could be at 4:15 PM, 5:10 PM, and 6:00 PM. The one-way travel time would be approximately 55 minutes.

Three vehicles would be needed to operate this service at a total capital cost of \$1.35 million. The annual operating cost would be \$259,000 with an expected annual ridership of 34,500 passengers or about 135 per day. Two 50 space Park & Ride lots at \$9,000 per space can be estimated to cost \$900,000.

### **Summary of Park & Ride Service Recommendations**

The recommendations for new and additional Park & Ride service are summarized in the following table. Altogether improvements are recommended for ten existing routes, and five new routes are recommended. The total additional operating cost for these services is \$2.5 million, some of which will be offset by fares collected. Assuming similar fares of \$2.10 for express bus service in Davidson County (the current fare for express bus service) and \$3.50 for express bus service outside Davidson (the current RTA fare), and that the average fare will be around 70 percent of full fare (to allow for fare discounts), the overall net operating cost of service would be \$1.66 million. The additional capital cost for 33 vehicles is \$14.8 million. The cost for six new Park & Ride lots is \$4.5 million.

**Table 15. Summary of Express Coach and Park & Ride Service Recommendations**

County	Express Service	Total Operating Cost	Net Operating Cost	Capital Cost for Vehicles	Capital Cost for Park & Ride	Passengers
Davidson	Add 11 trips to existing express bus services	\$358,000	\$238,950	\$4,950,000		81,000
Sumner	Additional trip to/from Gallatin	\$110,000	\$78,150	\$450,000	\$1,800,000	13,000
Rutherford	Modify and improve express service on 96X	\$157,000	\$100,650	\$900,000	\$900,000	23,000
Rutherford	Modify and improve Smyrna and La Vergne service on 96X	\$142,000	\$85,650	\$900,000		23,000
Williamson	Improve service on 91X	\$79,000	\$47,150	\$450,000		13,000
Williamson/Maury	Improve service on 95X	\$189,000	\$132,650	\$900,000		23,000
Maury					\$450,000	
Cheatham	Ashland City to Downtown Nashville	\$189,000	\$ 104,475	\$900,000		34,500
Dickson	Intersection of I-40 and State Route 46	\$283,000	\$ 198,475	\$1,350,000	\$450,000	34,500
Robertson	I-65 to Downtown Nashville	\$259,000	\$ 174,475	\$1,350,000	\$900,000	34,500
Montgomery	Exit 4 I-24 to Downtown Nashville	\$345,000	\$ 234,750	\$1,350,000		45,000
Montgomery	Clarksville Transit Center to Downtown Nashville	\$377,000	\$ 266,750	\$1,350,000		45,000
<b>Total</b>		<b>\$2,488,020</b>	<b>\$1,662,125</b>	<b>\$14,850,000</b>	<b>\$4,500,000</b>	<b>369,500</b>

## 5.5 Local Fixed-Route Recommendations

### Nashville MTA

During most of the first decade of the 21st century, the Nashville MTA has been improving its service incrementally along several dimensions. Ridership has grown in response to service improvements and partnerships with Nashville employers. Service effectiveness (rides provided per each vehicle hour) has been increasing. The downtown Music City Central Station now provides a modern facility to shelter bus passengers and provide convenient transfers. Support from Nashville Metropolitan Government will allow further service improvements, such as a BRT on Gallatin Road. Also, the state of Tennessee now has enabling legislation to permit a larger regional solution to providing public transportation.

Nashville MTA is poised to take another step forward by increasing the level of service provided so that MTA will rise to the upper levels of some of our peer regions. The following sections present further recommendations for Nashville MTA service expansion over the short-, mid-, and long-term horizons. Further detail is available in the MTA's recently published *Strategic Master Plan*, which provides the foundation for the following.

## *Short Term Recommendations (2010-2015)*

### **Gallatin Road BRT**

*Implement a BRT service for Gallatin Road.* MTA is planning to use hybrid 60 foot long articulated BRT vehicles, as used by the Los Angeles MTA on its Orange Line BRT, on a new BRT along Gallatin Road. The proposed BRT will have stops around every  $\frac{3}{4}$  mile with enhanced stop amenities such as electronic signs giving the arrival time of the buses in real time, enhanced shelters and amenities. Weekday service will be every 15 minutes all day and 30 minutes off-peak. The system will include traffic signal priority for the buses to give them some additional green time as they proceed along the corridor.

The BRT service will improve service frequency in the Gallatin corridor, increase speed of many trips, improve signage, and improve the image of transit. In short, the BRT will make improvements in 4 out of the 5 priority categories. The increased operating cost for the recommended service is \$2.3M per year. The increase in capital cost will be \$9.4 M.

### **Increase Frequency of Service**

*Provide frequency improvements on eleven routes to bring them up to minimums as described in the Service Delivery Policy.* Note that many of these suggested service additions are in off-peak hours which do not require additional vehicles, and which can provide an excellent boost to ridership. The total operating cost per year for these improvements is estimated at \$1,156,000 and the capital cost for new buses at \$300,000 each is \$5.1 M.

With the addition of improvements on Route 26 Gallatin Road, altogether 12 routes are recommended for frequency improvements. These frequency improvements will affect 44 percent of households which are located within  $\frac{1}{2}$  mile from each route that is improved. Frequency improvements on express routes will greatly increase the availability of higher speed transit to outer areas of the county. These are areas that are growing—and since ridership per trip on the existing express routes is quite good, providing additional trips should be an effective way to draw new riders.

### **Downtown Circulator**

*Institute a Downtown Circulator.* A Downtown Circulator will provide better connections between transit facilities such as Music City Central and the Music City Star, as well as connect state office buildings, downtown businesses/residents, and tourist destinations. The Downtown Circulator will speed transit service as it will provide very frequent pickups for any passenger arriving in the downtown.

While the exact routing(s) have not yet been established the service can be estimated to require 4 buses to provide a very frequent level of service. Operating 17 hours a day weekdays and 8 hours a day on Saturdays and Sundays would cost around \$1.8 M for operations and \$1.3M for vehicles and specially signed bus stops. In March 2009, 2010 MTA implemented the Music City Circuit, a circulator providing free of cost service around downtown Nashville. The Circuit started with two routes, the Blue Circuit (Bicentennial Mall) and the Green Circuit (Gulch). On September 27, 2010 a third route named the Purple Circuit (Richard H. Fulton Complex) was introduced.

### **Service to New or Unserved Areas**

*Reserve funding for service to a new or unserved area.* While the densities in most unserved neighborhoods are not sufficient to recommend fixed route services, MTA will continue to refine the flexibly routed services concept, BusLink, that can link neighborhoods with important destinations and other fixed route services. In particular, neighborhoods with densities of greater than 2500 persons per square mile with a pedestrian

environment that would encourage walking to transit stops would be good candidates for a pilot project. A budget of \$700,000 would allow for two buses operating 12 hours weekdays and 10 hours on Saturday.

**Marketing**

Provide an additional marketing budget to help non-users learn how to use the service. This effort will continue the work done by Transit Now on a video for helping non-users to learn how to use the service. A budget of \$30,000 is recommended for this project. Note that BRT implementation also calls for a special marketing budget of \$50,000.

The table below summarizes the short-term list of projects along with the five areas for improvement: As can be seen, all of the priority areas are affected by the improvements. The total of the recommended service improvements comes to around \$6M in additional operating funding and \$16M in capital funding.

**Table 16. Recommended Short-Term MTA Improvements and Priority Areas**

Service	Operating Cost (\$1000)	Capital Cost (\$1,000)	Increase Frequency	Faster Transit	Serve New Areas	Easier to Use	Improve Image
Gallatin Road BRT	\$2,305	\$9,400	X	X		X	X
Frequency improvements on 11 routes to bring to minimums	\$1,156	\$5,100	X			X	
Downtown Circulator	\$1,800	\$1,300	X	X		X	X
Service to new or unserved areas (undesignated)	\$700	\$250			X		
Program to show new users how to use the service	\$30					X	X
<b>Total</b>	<b>\$5,991</b>	<b>\$16,050</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>

***Opportunities for Transit Investment in the Mid Term (2016-2025)***

In the mid-term this plan assumes that MTA, working with the Mayor’s Office, Metro Council, Tennessee DOT, the Nashville MPO, Cumberland Region Tomorrow and other stakeholders will have been successful in finding a new source of funding for regional transit services. If this is the case, it is likely that the MTA will be able to offer additional regional service. Recommendations for Nashville/Davidson County include:

- Extend the Gallatin BRT service from the Music City Central (MCC) to Vanderbilt/ West End.
- Improve night service on certain routes to continue in the same pattern as during the day. Routes affected would be Routes 2 Belmont, 4 Shelby, 7 Hillsboro, 19 Herman, 20 Scott, 28 Meridian, 29 Jefferson, and 30 McFerrin.
- Establish mini-hubs at Clarksville Pike and Gallatin Road.
- Provide signal priority and BRT elements for other corridors including Route 15 Murfreesboro Road, Route 12 Nolensville Road, and Route 23 Dickerson Road.

- Add park and ride capacity for Routes 35X Rivergate Express and 41 Golden Valley.
- Extend and expand park and ride service to Rutherford, Sumner and Williamson Counties. In particular, offer half hour service during the peak hour to Murfreesboro and Hendersonville. Institute park and ride service to Franklin.
- Expand service to unserved areas including new fixed route or flexible service in areas meeting density standards such as:
  - Two neighborhoods to the east of Gallatin Pike and just north of the new Madison Bus Link area. These might be served by expanding BusLink service northward to Anderson Lane.
  - An area between Routes 3 West End and 7 Hillsboro, part of the Hillsboro-West End area. This area would be a candidate for a neighborhood route or flexible route connecting to the Mall at Green Hills.
  - A area south of I-440 between MTA Route 12 Nolensville Road and I-24. Feeder routes could connect neighborhoods north of Route 72 Edmondson Pike Connector with the 100 Oaks Shopping Center.

### ***Opportunities for Transit Investment in the Long Term (2026-2035)***

Long-term (2026-2035) project recommendations include providing high capacity transit service beyond Davidson County (BRT or commuter rail) to Rutherford, Sumner and Williamson Counties, further improving transit capacity between Nashville and the West End with streetcar or dedicated bus lanes, extend current route services to reach developing residential and employment centers, and institute additional mini-hubs to improve connections.

- Extend Route 23, Dickerson Road to reach emerging employment areas north of the current service area.
- Extend Route 6 southward to reach new developing communities and employment areas, including Summit Medical Center.
- Further improve transit capacity between downtown Nashville and the West End with light-rail or if BRT, with dedicated bus lanes and/or queue jump lanes.
- Provide high capacity service (BRT, light rail or commuter rail) to Rutherford, Sumner and Williamson Counties. If BRT service, improve existing right-of-way for buses with exclusive lanes or queue jump lanes.
- Provide additional service to the developing neighborhoods currently served by Route 37X Tusculum/McMurray Express and Route 38X Antioch Express. These neighborhoods are expected to reach densities that would justify more than peak hour service. The express bus services could be expanded throughout the day and into the early evening or alternatively, the service could be used to connect with the regional high capacity service.
- Institute an additional mini-hub at 100 Oaks to improve connections.

## Murfreesboro Rover

Rover is the City of Murfreesboro's public transportation system and it provides fixed-route transit service within the City of Murfreesboro. It also works with and/or assists other regional providers with mobility issues.

Rover began bus transportation service to the public in April of 2007 along six routes throughout the city and expanded to eight routes in December 2008. Rover buses run Monday through Friday from 6 a.m. until 6 p.m. and all buses are equipped with bike racks and are wheelchair-accessible.

In August 2010, Rover completed a Transit Service Assessment study. The study purpose was to evaluate the system and identify service improvement needs and opportunities. The following are the specific study goals:

- Understand the needs of current riders,
- Identify opportunities to attract more riders,
- Identify if the current service is meeting rider needs,
- Identify unmet rider needs,
- Measure current levels of customer service delivery, including service quality, cleanliness, timeliness, etc.

Study results show that Rover has been doing a good job in general to provide frequent and reliable transit services as well as providing good geographic area coverage in Murfreesboro. The study also identifies some key findings that provide insight on how Rover can improve and increase service in the future. Several of those findings are already being addressed by Rover as specific projects included in the MPO's FY2011-15 Transportation Improvement Program. Additionally, the study outlines short and long term recommendations that can be implemented as additional resources become available. Those findings and service recommendations are described below.

### *Key Findings*

An on-board survey was conducted to learn more about Rover customers, how they ride Rover, and what would encourage them to ride more often. Survey analysis revealed:

- Rover passengers are very satisfied with the service and likely to continue riding.
- A majority of passengers use Rover to travel to and from work and ride frequently.
- Almost all of the customers do not have a car available for these trips.
- Passengers wish Rover went further west on Old Fort Parkway, served Cason Lane, and went further south on Church Street.
- Evening service until 9:00 p.m. and weekend service ranked the highest of the elements that may encourage customers to ride more frequently.
- Increasing the availability of shelters could contribute to an overall increase in satisfaction.

Stakeholder interviews were conducted to gain an understanding of the current and projected conditions in Murfreesboro. Overall, stakeholders had a positive view of Rover. The most common comments during interviews were:

- Extend service on weekdays,
- Start operating service on Saturdays,



- Add service on MTSU campus,
- Install shelters and benches.

A fixed route assessment was conducted. This assessment included an analysis of ridership data and on-board ridechecks to determine stop-level passenger activity. Rover is doing the following items well:

- Increasing ridership – Three routes (Mercury, Highland, Medical Center) continue to have ridership growth. Ridership on the remaining routes is stable.
- Frequency of service – Four of eight routes operate every 30 minutes. This level of frequency makes the service more attractive, especially to choice riders as it allows them the flexibility to travel when they want to travel.
- Better productivity than in-state peers – Rover’s overall productivity (passengers per revenue hour) is 10.2. This slightly exceeds the average productivity of Rover’s in-state peers<sup>1</sup> of 9.0 passengers per revenue hour.
- Service coverage – The eight routes provide good geographic coverage of Murfreesboro
- Disabled use – Several passengers with disabilities routinely use the fixed-routes. It is less expensive to transport these passengers on fixed route service than on paratransit service.

### ***Recommended Service Changes***

Two short-term service improvements were recommended for consideration:

- The extension of every other trip on S Church to Innsbrooke Boulevard near the frequently requested Barfield Crescent area. *This recommendation was implemented on September 1, 2010.*
- Creation of a taxi subsidy program to provide evening trips, Saturday trips, and serve areas of Murfreesboro not served by Rover. In a subsidized taxi program, eligible individuals can purchase discount coupons to use as taxi fare.

Three long-term service improvements were recommended for consideration for implementation after the taxi subsidy program has established demand for each service and funding is available:

- Westside route restructuring,
- Evening demand response service,
- Saturday fixed-route service.

### **Franklin Transit Authority**

Franklin Transit’s 5-Year Service Plan responds to the challenges of the next five years by refining the service standards by exploring new ways Franklin Transit can continue its innovative development with flexible services, use of smaller/efficient buses, connectivity with express services, and community shuttles, all supporting and complementing the network of regional transit services in our area. Three key components of Franklin Transit’s 5-Year Service Plan include:

- Replacement of aging equipment;
- Adding new vehicles and staff, as existing transit services continue to expand especially TODD (Transit On Demand) service;

- Planning and implementation of new sustainable transit services to continually meet the needs of the passengers and the community.

## 5.6 The Return of Urban Streetcar

Nashville once had an active streetcar system beginning in 1860 with mule drawn streetcars running on city streets operated by the McGavock & Mt. Vernon Horse Railroad Company and the South Nashville Street Railroad. In 1887 several “dummy” lines (streetcars pulled by little engines) were in operation and by 1889 the first electric streetcar ran in Nashville.

From the NashvillePost.com “The electrification of the street railways was a great occasion. Nashville was one of the first cities in the country to adopt the trolley. While the wires were being put up, everybody was speculating on how the trolley could run on the main wire without being obstructed by the supporting cross wires. .When the great day came and the first electric car, handsomely finished with plush upholstery, appeared, the streets were crammed and jammed with a curious crowd to see the lightning harnessed. Everybody was afraid of these half-tamed thunderbolts of Jove.”



Highlights of Nashville's history with streetcar include:

- In the 1890's the Nashville Street Railway built a casino at Shelby Park that later became a community center.
- On June 22, 1901 the Nashville Street Railway was forced into receivership when it defaulted on the interest payment for \$2,060,000 in bonds.
- In 1909 the Nashville-Franklin Interurban Railroad began running between Nashville and Franklin and it operated until 1943. The Nashville Gallatin Interurban operated from 1913 to 1932.
- Streetcars in the city of Nashville which once ran on many routes completed their last run in 1941

### Economic Development Potential of Streetcars

Today, the nation is seeing a resurgence of the streetcar all across the country. Communities instituting this mode of transit are using streetcars for many of the same reasons that they were originally built at the turn of the century. Streetcars are uniquely suited to serve high density areas in downtown districts across the country. They are slow and integrate well into an urban environment. They are much cheaper than light rail, are hugely successful in promoting development and street life, and fit easily into built environments with little disruption to existing businesses, residents and traffic. People are attracted to streetcars because they are nostalgic and a reminder of a simpler time. They are a comfortable mode of transportation with fixed routes making them less confusing than buses for the public regarding their destinations. They are an attraction in their own right and because people like to ride the streetcars, developers are attracted to them. Streetcars today are a form of entertainment as well as a mode of transportation that provides a tangible economic impact, while connecting core downtown districts.

In many cities today, the construction of a streetcar line produces significant businesses and residential development and attracts many more riders than a bus service following a similar route. People are more apt to give up their automobiles and ride the streetcars than with any other mode of transportation. People are also drawn to live in areas served by a streetcar route.

**Table 17. Economic Development Results for Streetcar Projects**

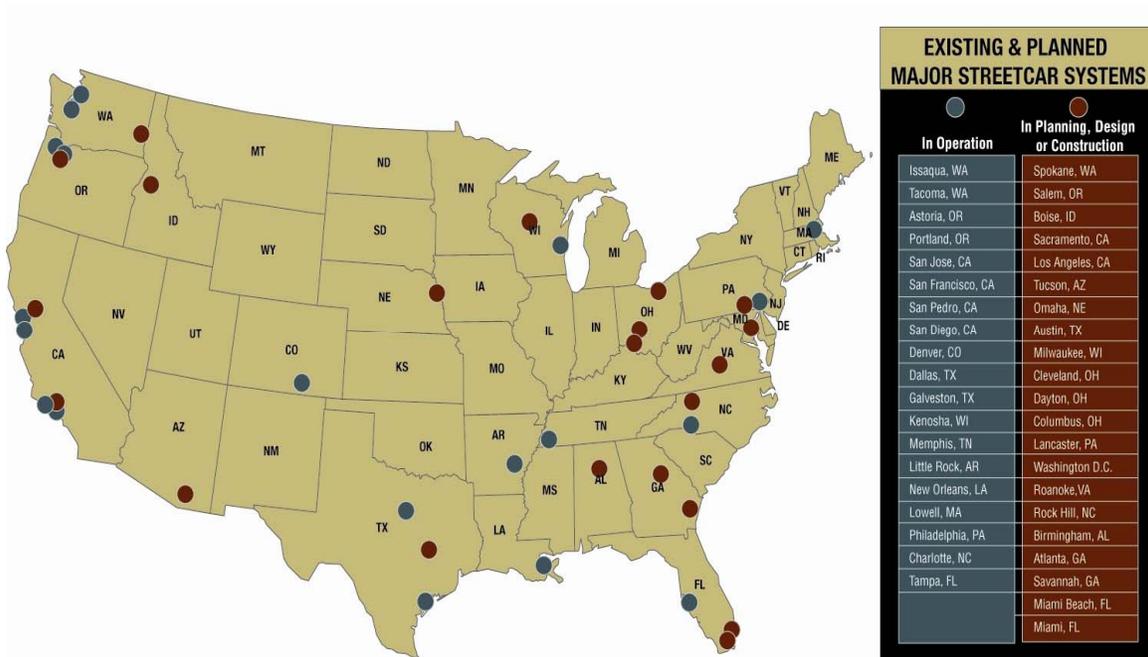
ECONOMIC DEVELOPMENT RESULTS FOR STREETCAR PROJECTS						
Recent Projects	Year Opened	Miles	Number of Cars	Cost in Millions	Economic Development	Return on Investment
Kenosha	2000	2	5	\$5.2	\$150,000,000	2885%
Tampa	2002	2.4	11	\$53.0	\$2,000,000,000	3774%
Little Rock (2 phases)	2004-2007	3.4	5	\$28.5	\$260,000,000	912%
Memphis (3 phases)	1993-2006	6.5	20	\$24.0	\$137,000,000	571%
Portland (2 phases)	2003	6	5	\$73.0	\$2,399,000,000	3286%

Source: Street Smart

Some of the cities benefiting from the construction of a streetcar route are Portland OR, Tampa FL, Little Rock AK, Kenosha WI and Dallas TX. Economic development in all of these cities has achieved financial success well beyond the original expectations and all of these cities have either expanded their original systems or plan to expand them in the near future.

Most of the streetcar systems constructed in the USA in the last 15 or 20 years have been constructed to encourage or spur economic development. All of the projects have been successful to various degrees.

**Figure 49. Map of Existing and Planned Streetcar Systems in U.S.**



The following table presents more information about the successes of streetcars in peer regions.

**Table 18. Examples of Recent Streetcar Success**

**Streetcar Example**



**Portland, Oregon**

A modern streetcar system (cars by Skoda) was constructed in Portland. The operation of the system began in 2001, and it has been extended several times. Initially, the system operated over a 3 mile loop with an approximately 13 minute headway. Economic development in the area surrounding the streetcar route has been \$2.3 Billion since the construction of the system.



**Charlotte, North Carolina**

This is a modern streetcar system that was just completed in the fall of 2007 in conjunction with a new light rail line. Development along the streetcar system has been rapid and more than \$400 Million in development has occurred prior to the start up of the system.



**Tampa, Florida**

Tampa built a heritage streetcar system using replica streetcars constructed by Gomaco Corp. of Iowa. The 2.3 mile system began operation in October of 2002. This system resulted in \$600 million in development that occurred prior to the opening of the system and over \$2 Billion in development through 2004.



### **Kenosha, Wisconsin**

Dealing with double digit unemployment, the loss of 5,300 jobs in three years and a dying downtown, the City of Kenosha undertook a massive redevelopment effort with a 2 mile streetcar loop as the centerpiece of development. Beginning construction in 1999, the system opened for business in 2000 using ex-Toronto PCC cars painted in the liveries of cities that had used the PCC car in their streetcar systems. Since the start up of the system, Kenosha has seen the construction of hundreds of condominiums, a museum and a park. Economic development is estimated at \$120 Million with three more museum buildings in the planning stages.



### **Little Rock, Arkansas**

The original project completed in 2003 consisted of 2.5 miles of track with three Gomaco replica streetcars. Since the original construction and second phase has been completed providing service to the William Jefferson Clinton Presidential Library, economic development has been calculated in the \$2 Billion range.

## **Lower Broadway-West End Streetcar Concept**

Generally streetcars are thought of as a circulator system and that lends itself to the establishment of circular routes. An added advantage of a circular route is the area of effect for the system is increased by using parallel streets for the return track. Several possible route locations were investigated including Demonbreun, Broadway, Central and Church Streets as possible route alternatives. After investigating these possible routes and walking or riding each of them, it was determined that the recommended route would be using Broadway as a two way spine from 1st Avenue to just beyond 31st Avenue, very close to the I-440 exit.

This route is recommended as a starter route because it has the best connectivity of any of the routes investigated. Connecting the high density residential units at the west end of the system, Centennial Park, Baptist Hospital, Vanderbilt University, a myriad of hotels, all to the most vibrant street in the downtown at the east end of the system, would be a great benefit to the community.

The route would also be close enough to the new convention center and be able to connect to the riverfront commuter rail station and the various activities that take place along the riverfront throughout the year.

The system would be three miles from end to end or six miles long for a round trip, and be able to operate with four cars, each making the complete circuit every 40 minutes providing a 10 minute headway. The street cars could be modern, newly constructed heritage (historic replication) cars or reconstructed older cars that would meet all current safety and ADA requirements. All cars would be powered electrically by a single overhead wire spanning between single poles that would be in the center of the spine on Broadway up to West End Avenue

and then be mounted behind the curb line on West End, 21st and the upper section of Broadway. Cars could be stored and displayed in a Car Barn in an area adjacent to the streetcar line.

### ***Capital Cost Estimates***

Estimated capital costs for the proposed 6 mile track system including track, power, maintenance, car barn (and property acquisition), cars and stops was estimated to be in the \$110 million dollar range.

The capital costs for the system have been estimated using the following assumptions:

- Two way spine in dedicated right of way on lower Broadway and street running on upper Broadway and West End Avenues;
- The existing bridges can be used as is with minor paving adjustments for the track structure and approaches;
- The car barn will be constructed within 1,000 feet of the existing or proposed streetcar line;
- Four new cars will be purchased;
- Project will be constructed within two years;
- Minimal utility relocations in existing streets will be required;
- Track and Overhead Wire;
- Car Barn and Related Track.

### ***Operating Cost Estimates***

Operating costs will vary based upon the hours of operation, the number of cars in service and system operator. At this stage of development, it is impossible to provide accurate forecasting for actual operating costs, but a range of \$2 to \$2.5 million per year would be a reasonable estimate. Many decisions will have to be made before an accurate estimate of operating costs can be put together. The largest portion of operating costs is the labor and direct overhead costs. Mechanic costs might be a little higher than bus costs because there are fewer cars to spread the cost over. Fuel costs are much lower as electric power does not increase at the rate that fuel will increase and the power consumption of streetcars is relatively low.

Operating assumptions include:

- Seven days per week operation;
- Average of 17 hours operation per day;
- Operations 7 days per week;
- Ten minute headway (time between cars);
- Four Vehicles operating to maintain headways.

### ***Funding Considerations***

The following are established funding methods utilized in successful systems across the country:

- Instituting a Business Improvement District (BID).
- Seeking a subsidy from the benefiting private entities and from Economic Development budgets.

- Launching a Capital Campaign to raise dollars from philanthropic sources. Many of the streetcar projects have also had a 501-C3 non-profit organization set up to help raise funds.
- Creating sponsorship models utilizing naming opportunities.
- Establishing agreements with the transit operator to provide operating funds when a streetcar replaces a transit service.
- Selling advertising in the streetcars and along the right of way.
- Using parking revenues to fund operations.
- Charging riders to generate fare box income.

### *Streetcar Design Considerations*

**Cars (Heritage & Historic):** There are several types of streetcars available. Portland used modern cars manufactured by Skoda, Little rock, Tampa and Charleston used newly constructed historic looking streetcars, Memphis and Savannah used reconstructed historic streetcars. The type of car used has little or no effect on the design of the track and the overhead contact system (OCS) and generally the type of cars that can be used are interchangeable.

There is a major difference in costs between the various types of cars. The new modern cars are currently selling between \$3.7 million and \$4.6 million per car. The new historic looking cars are currently selling for \$1 million and rebuilt cars either modern, art deco or historic can be purchased for between \$.75 and 1.25 million each depending upon the type of car and level of rebuild.

**Stations/Stops:** Car stops can vary greatly depending upon location and purpose. The amenities can be as simple as a concrete or bricked waiting area with a bench and an overhead shelter to a major stop with a waiting room, electronic signing showing the wait to the next streetcar and a ticket booth.

**Electrification System:** The overhead wire system proposed for this project would be a very simple system consisting of a single 4-0 copper wire suspended between a single pole using a pipe arm. The system is extremely safe with the powered wire suspended a minimum of 18' above the roadway and using the track for a grounded return.

Power is provided from the standard Nashville power grid using a transformer to change the voltage to 600 volts and a rectifier to change the current from AC (alternating current) to DC (direct current). It is expected that for the initial system, three substations with a footprint of approximately 80 square feet will be required within the project area. A smaller station would be placed inside the car barn for maintenance.

**Car Barn:** A 30,000 square foot car barn is proposed that will serve as a storage and maintenance facility for the streetcars as well as a public space for meetings and viewing areas. A small gift shop might be included that would sell streetcar memorabilia and books. The working shop would be separated from the viewing area with a glass or Plexiglas wall that would allow spectators to watch repairs and renovations without being exposed to any safety hazards. The building would also include public restrooms, office space, storage for parts inventory and parking.

**Methods of Propulsion:** Traditionally, streetcars have been powered by overhead 600 volt DC electric using single wire. Power is furnished through the standard electric grid to a transformer and rectifier that changes the standard AC power to DC for the streetcar and adjusts the voltage. This unit, called a sub-station, usually is supplied as an enclosed pre-packaged unit which has a footprint approximately eight feet square. Nashville will need to power their cars with the overhead electric because Nashville streetcars will travel a long distance, will

have extreme grades to traverse, will require heated and air conditioned cars and will operate in extreme temperatures.

### *Urban Design & Pedestrian Considerations*

As urban designers and planners will tell you, elements of an urban environment that blend into and enhance the street experience are key to creating a pedestrian friendly place where people want to be, a place of choice.

That is why streetcars are so appealing. They do not require the massive infrastructure of big stations, structures, bus bays, turn around areas or exclusive rights of way. Consequently, these systems are a particularly effective tool to connect and shape neighborhoods because they become an enhancement to the neighborhood streetscape. Streetcars are considered as circulators, and thus tend to have frequent stops for passengers, usually no more than a couple of blocks apart. These stops are designed to fit attractively into the urban space they occupy, yet must be signed to allow easy visibility, as well as to permit arriving passengers to find their way easily to nearby destinations.

The amenities provided at the various stops will be largely determined by the urban context of the stop. Some locations will need little more than way-finding signage, others may require more significant landscaping and perhaps benches or a shelter. The cost figures presented herein assume an average level of amenity which would allow a range of different stop designs.

Recent streetcar systems are completely compliant with the requirements of the Americans with Disabilities Act. Modern cars are generally low floor design and heritage type cars have an incorporated lift mechanism. They can also be boarded using a high block boarding platform. One of the advantages of the streetcar is that it can share the street with auto traffic and act as a traffic calming mechanism in neighborhoods.

Streetcars move at the pace of traffic, and have performance characteristics which allow them to flow with urban traffic. Thus, there is usually little need for special signaling or traffic pre-empt devices. The exception occurs where the streetcar must turn across one or more lanes of traffic at an intersection, such as the fork in the road where Broadway meets West End Avenue. Similarly, because the street grades are not adversely impacted under normal conditions, street drainage can be handled by normal design methods. This results in opportunities for the street and sidewalk designs to be enhanced for pedestrians. Streetcars are also very pedestrian-friendly because they are non-threatening to pedestrians.

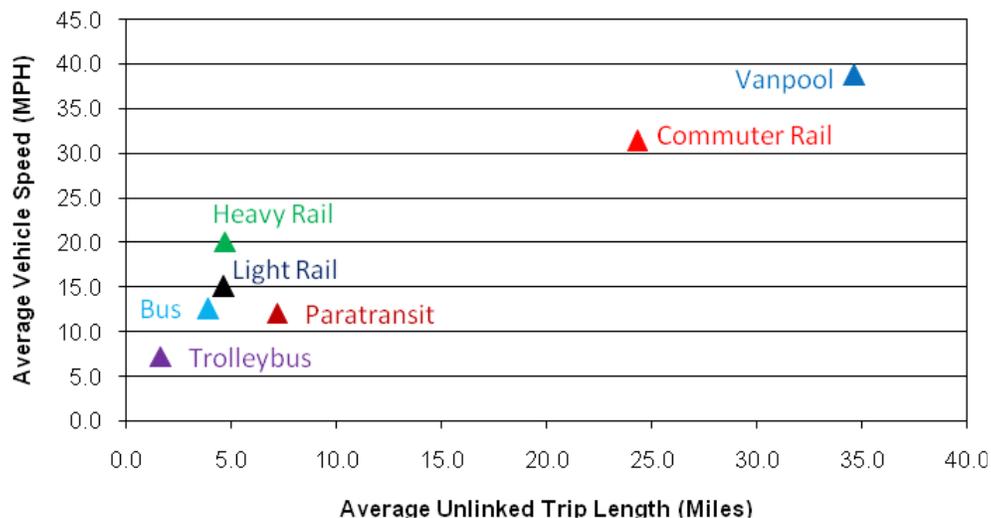
As the streetcar system for Nashville moves forward, attention should be paid to a number of urban design related areas, including:

- Stop locations,
- Streetlight locations,
- Sidewalk widths, pedestrian signage, and crossing areas,
- Street drainage,
- Intersection visibility & signage,
- Waiting area capacities,
- Waiting area shelter design (size, type, lighting),
- ADA compatibility,
- Service frequency & traffic flow impacts.

## 5.7 Regional Vanpool Program

Vanpools are a successful and efficient Transportation Demand Management strategy to move long-distance, intercity commuters. Currently, the vanpools managed and operated by The TMA Group on behalf of the Regional Transportation Authority and Williamson County eliminate 1,654 single vehicle trips daily. Existing vanpools reduce annual vehicle miles traveled by more than twelve million miles and reduce annual mobile emissions by over 38,000 pounds and save more than 600,000 gallons of fuel. Our air quality is improved by the removal of 21 thousand tons of ozone pollutants. Sharing a commute through a vanpool reduces parking and fuel costs, allows access to HOV lanes, consumes fewer resources and is often cheaper, more flexible, and faster than other mass transit choices.

**Figure 5: Vehicle Speed vs. Trip Length by Mode**



The average cost to start up a vanpool, including the cost of the vehicle is \$36,000. Riders in the regional program pay according to miles traveled at the rate of \$.431 per mile. Almost 60 percent of annual operating and vehicle replacement costs are covered by the vanpool riders' fares. Bus transit recovers almost 25% of operating costs and no vehicle replacement costs through fares and advertising.

- The region is currently working to develop a Comprehensive Marketing Plan for the regional vanpool program. Research results will be used to:
  - Develop a prototype of person(s) in Middle Tennessee mostly likely to choose vanpooling as their commute choice;
  - Identify where these persons are most likely to commute from in Middle Tennessee;
  - Identify marketplace forces affecting each audiences' actions, i.e., demographics, lifestyle, social and cultural; health, environmental trends, economic, competition; and
  - Identify the motivations behind why residents in the identified target markets choose to vanpool while others do not.

Based upon the findings, the Vanpool program partners (e.g., RTA, The TMA Group) will develop a customizable and audience-centered marketing campaign. The plan will include a brand, theme, and message(s).

### ***Vanpool Program Recommendations:***

- Implement the Vanpool Marketing Plan, evaluate its effectiveness, and update as needed.

- Expand Vanpool Service throughout the region. The goal is to increase the regional vanpool network by forty percent per year for the next five years, but the goal may be adjusted based upon the size of the market identified through the market research.
- Provide Emergency Ride Home options (including car-sharing).
- Make vanpool seat subsidies available, as needed.
- Provide ridematching services for vanpools, carpools, and special events
- Streamline the reporting and payment procedures required of program administrators and vanpool drivers through the procurement of a vanpool management system that will improve efficiency of vanpool services by automating manually-intensive National Transit Database (NTD) reporting tasks. The system will also provide a social network approach to vanpool formation and real-time information regarding upcoming stops and riders.
- Add a school-pool option to the vanpool program for middle schools in Middle Tennessee. A school-pool is a group of parents who take turns carpooling their children to school.