

TENNESSEE TRANSPORTATION BY THE NUMBERS:

Meeting the State's Need for Safe, Smooth
and Efficient Mobility

JANUARY 2016



Founded in 1971, TRIP® of Washington, DC, is a nonprofit organization that researches, evaluates and distributes economic and technical data on surface transportation issues. TRIP is sponsored by insurance companies, equipment manufacturers, distributors and suppliers; businesses involved in highway and transit engineering and construction; labor unions; and organizations concerned with efficient and safe surface transportation.

Key Transportation Numbers in Tennessee

\$5.6 billion	Driving on deficient roads costs Tennessee motorists a total of \$5.6 billion annually in the form of additional vehicle operating costs (VOC), congestion-related delays and traffic crashes.
\$1,440 \$1,282 \$1,821 \$1,632	TRIP has calculated the cost to the average motorist in Tennessee's major urban areas in the form of additional VOC, congestion-related delays and traffic crashes. The average Chattanooga driver loses \$1,440 annually, while each Knoxville driver loses \$1,282. On average, Memphis drivers each lose \$1,821 annually and Nashville drivers lose \$1,632 each year.
990 4,948	On average, 990 people were killed annually in Tennessee traffic crashes from 2010 to 2014, a total of 4,948 fatalities over the five year period.
2.5X	The fatality rate on Tennessee's non-interstate rural roads is nearly two and a half times that on all other roads in the state (2.38 fatalities per 100 million vehicle miles of travel vs. 1.03).
40% 36% 14% 52% 20%	Statewide, 40 percent of Tennessee's major urban roads are in poor, mediocre or fair condition. Thirty-six percent of major roads in the Chattanooga urban area are in poor or mediocre condition, while in the Knoxville urban area, 14 percent of major roads are in poor or mediocre condition. Fifty-two percent of major roads in Memphis are in poor or mediocre condition and 20 percent of Nashville's roads are in poor or mediocre condition.
\$433 billion \$266 billion	Annually, \$433 billion in goods are shipped from sites in Tennessee and another \$266 billion in goods are shipped to sites in Tennessee, mostly by truck.
19%	A total of 19 percent of Tennessee bridges are in need of repair, improvement or replacement. Five percent of the state's bridges are structurally deficient and 14 percent are functionally obsolete.
28 hours 35 hours 43 hours 45 hours	The average driver in the Chattanooga area loses 28 hours to congestion annually, while each driver in the Knoxville urban area loses 35 hours each year. Drivers in the Memphis area lose 43 hours annually due to congestion and drivers in Nashville/Davidson lose 45 hours annually.
\$1.20	From 2009 to 2013, the federal government provided \$1.20 for road improvements in Tennessee for every dollar paid in Tennessee in federal motor fuel fees.
\$1.00 = \$5.20	The Federal Highway Administration estimates that each dollar spent on road, highway and bridge improvements results in an average benefit of \$5.20 in the form of reduced vehicle maintenance costs, reduced delays, reduced fuel consumption, improved safety, reduced road and bridge maintenance costs, and reduced emissions as a result of improved traffic flow.

Executive Summary

Seven years after the nation suffered a significant economic downturn, Tennessee's economy continues to rebound. The rate of economic growth in Tennessee, which will be greatly impacted by the reliability and condition of the state's transportation system, continues to have a significant impact on quality of life in the Volunteer State.

An efficient, safe and well-maintained transportation system provides economic and social benefits by affording individuals access to employment, housing, healthcare, education, goods and services, recreation, entertainment, family, and social activities. It also provides businesses with access to suppliers, markets and employees, all critical to a business' level of productivity and ability to expand. Conversely, reduced accessibility and mobility - as a result of traffic congestion, a lack of adequate capacity, or deteriorated roads, highways, bridges and transit facilities - diminishes a region's quality of life by reducing economic productivity and limiting opportunities for economic, health or social transactions and activities.

With an economy based largely on agriculture, tourism, and the manufacturing of chemicals, textiles, furniture and apparel, the quality of Tennessee's transportation system will play a vital role in the state's level of economic growth and in the quality of life in Tennessee.

This report examines the condition, use and safety of Tennessee roads, highways and bridges, federal, state and local funding needs, and the future mobility needs of the state.

In December 2015, Congress passed, and the president signed into law, a long-term federal surface transportation program that includes modest funding increases and allows state and local governments to plan and finance projects with greater certainty through 2020. The Fixing America's Surface Transportation Act (FAST Act) provides approximately \$305 billion for surface transportation with highway and transit funding slated to increase by approximately 15 and 18 percent, respectively, over the five-year duration of the program. While the modest funding increase and certainty provided by the FAST Act are a step in the right direction, the funding falls far short of the level needed to improve conditions and meet the nation's mobility needs and fails to deliver a sustainable, long-term source of revenue for the federal Highway Trust Fund.

An inadequate transportation system costs Tennessee residents a total of \$5.6 billion every year in the form of additional vehicle operating costs (VOC), congestion-related delays and traffic crashes.

- TRIP estimates that Tennessee roadways that lack some desirable safety features, have inadequate capacity to meet travel demands, or have poor pavement conditions cost the state’s residents approximately \$5.6 billion annually in the form of additional vehicle operating costs (including accelerated vehicle depreciation, additional repair costs, and increased fuel consumption and tire wear), the cost of lost time and wasted fuel due to traffic congestion, and the financial cost of traffic crashes.
- TRIP has calculated the average cost to drivers in the state’s largest urban areas as a result of driving on roads that are deteriorated, congested and lack some desirable safety features. The chart below details the costs to drivers in the Chattanooga, Knoxville, Memphis and Nashville urban areas.

Location	VOC	Safety	Congestion	TOTAL
Chattanooga	\$426	\$284	\$730	\$1,440
Knoxville	\$188	\$245	\$849	\$1,282
Memphis	\$516	\$225	\$1,080	\$1,821
Nashville	\$239	\$225	\$1,168	\$1,632
Tennessee - Statewide	\$1.3 Billion	\$1.5 billion	\$2.8 billion	\$5.6 billion

Population and economic growth in Tennessee have resulted in increased demands on the state’s major roads and highways, leading to increased wear and tear on the transportation system.

- Tennessee’s population reached approximately 6.5 million residents in 2014, a 34 percent increase since 1990. Tennessee had 4.6 million licensed drivers in 2013.
- Vehicle miles traveled (VMT) in Tennessee increased by 52 percent from 1990 to 2013 – from 46.7 billion VMT in 1990 to 71.1 billion VMT in 2013.
- Vehicle miles of travel in Tennessee for the ten months of 2015 were 4.0 percent higher than the first ten months of 2014. During the first ten months of 2015, U.S. vehicle miles of travel were 3.4 percent higher than the first ten months of 2014.
- By 2030, vehicle travel in Tennessee is projected to increase by another 30 percent.
- From 1990 to 2013, Tennessee’s gross domestic product, a measure of the state’s economic output, increased by 71 percent, when adjusted for inflation. U.S. GDP increased 65 percent during this time.

A lack of adequate state and local funding has resulted in 40 percent of major urban roads and highways in Tennessee having pavement surfaces in poor, mediocre or fair condition, providing a rough ride and costing motorists in the form of additional vehicle operating costs.

- Eleven percent of Tennessee’s major locally and state-maintained urban roads and highways have pavements in poor condition, while 29 percent are in mediocre or fair condition and the remaining 60 percent are rated in good condition.
- Roads rated in poor condition may show signs of deterioration, including rutting, cracks and potholes. In some cases, poor roads can be resurfaced, but often are too deteriorated and must be reconstructed.
- Driving on rough roads costs Tennessee motorists a total of \$1.3 billion annually in extra vehicle operating costs. Costs include accelerated vehicle depreciation, additional repair costs, and increased fuel consumption and tire wear.
- The chart below details pavement conditions on major urban roads in Chattanooga, Knoxville, Memphis and Nashville:

Location	Poor	Mediocre	Fair	Good
Chattanooga	20%	16%	17%	47%
Knoxville	6%	8%	17%	69%
Memphis	23%	29%	13%	35%
Nashville	9%	11%	15%	65%

Nearly one-fifth of locally and state-maintained bridges in Tennessee show significant deterioration or do not meet current design standards often because of narrow lanes, inadequate clearances or poor alignment. This includes all bridges that are 20 feet or more in length.

- Five percent of Tennessee’s bridges are structurally deficient. A bridge is structurally deficient if there is significant deterioration of the bridge deck, supports or other major components. Structurally deficient bridges are often posted for lower weight or closed to traffic, restricting or redirecting large vehicles, including commercial trucks and emergency services vehicles.
- Fourteen percent of Tennessee’s bridges are functionally obsolete. Bridges that are functionally obsolete no longer meet current highway design standards, often because of narrow lanes, inadequate clearances or poor alignment.
- The chart below details bridge conditions in Chattanooga, Knoxville, Memphis and Nashville:

Location	Structurally Deficient	Functionally Obsolete
Chattanooga	4%	16%
Knoxville	2%	29%
Memphis	6%	19%
Nashville	4%	17%

Tennessee’s rural traffic fatality rate is nearly two and a half times the fatality rate on all other roads in the state. Improving safety features on Tennessee’s roads and highways would likely result in a decrease in the state’s traffic fatalities and serious crashes. It is estimated that roadway features are likely a contributing factor in approximately one-third of all fatal and serious traffic crashes.

- Between 2010 and 2014 a total of 4,948 people were killed in traffic crashes in Tennessee, an average of 990 fatalities per year.
- Tennessee’s overall traffic fatality rate of 1.40 fatalities per 100 million vehicle miles of travel in 2013 is significantly higher than the national average of 1.09.
- The fatality rate on Tennessee’s rural non-Interstate roads was 2.38 fatalities per 100 million vehicle miles of travel in 2013, nearly two and a half times higher than the 1.03 fatality rate on all other roads and highways in the state.
- Roadway features that impact safety include the number of lanes, lane widths, lighting, lane markings, rumble strips, shoulders, guard rails, other shielding devices, median barriers and intersection design. The cost of serious crashes includes lost productivity, lost earnings, medical costs and emergency services.
- Several factors are associated with vehicle crashes that result in fatalities, including driver behavior, vehicle characteristics and roadway features. TRIP estimates that roadway features are likely a contributing factor in approximately one-third of fatal traffic crashes.
- Where appropriate, highway improvements can reduce traffic fatalities and crashes while improving traffic flow to help relieve congestion. Such improvements include removing or shielding obstacles; adding or improving medians; improved lighting; adding rumble strips, wider lanes, wider and paved shoulders; upgrading roads from two lanes to four lanes; and better road markings and traffic signals.

- Investments in rural traffic safety have been found to result in significant reductions in serious traffic crashes. A 2012 report by the [Texas Transportation Institute](#) (TTI) found that improvements completed recently by the Texas Department of Transportation that widened lanes, improved shoulders and made other safety improvements on 1,159 miles of rural state roadways resulted in 133 fewer fatalities on these roads in the first three years after the improvements were completed (as compared to the three years prior). TTI estimates that the improvements on these roads are likely to save 880 lives over the next 20 years.

Increasing levels of traffic congestion cause significant delays in Tennessee, particularly in its larger urban areas, choking commuting and commerce. Traffic congestion robs commuters of time and money and imposes increased costs on businesses, shippers and manufacturers, which are often passed along to the consumer.

- According to the Texas Transportation Institute (TTI), the average driver in the Chattanooga urban area loses \$730 each year in the cost of lost time and wasted fuel as a result of traffic congestion. The average Chattanooga commuter wastes 28 hours each year stuck in traffic.
- According to TTI, the average driver in the Knoxville urban area loses \$849 each year in the cost of lost time and wasted fuel as a result of traffic congestion. The average Knoxville commuter wastes 35 hours each year stuck in traffic.
- TTI estimates that the average driver in the Memphis area loses \$1,080 annually in the cost of lost time and wasted fuel due to traffic congestion. The average Memphis commuter wastes 43 hours each year stuck in traffic.
- According to TTI, the average driver in the Nashville urban area loses \$1,168 each year in the cost of lost time and wasted fuel as a result of traffic congestion. The average Nashville commuter wastes 45 hours each year stuck in traffic.
- Increasing levels of congestion add significant costs to consumers, transportation companies, manufacturers, distributors and wholesalers and can reduce the attractiveness of a location to a company to consider expansion or even to locate a new facility. Congestion costs can also increase overall operating costs for trucking and shipping companies, leading to revenue losses, lower pay for drivers and employees, and higher consumer costs.

The efficiency of Tennessee’s transportation system, particularly its highways, is critical to the health of the state’s economy. Businesses rely on an efficient and dependable transportation system to move products and services. A key component in business efficiency and success is the level and ease of access to customers, markets, materials and workers.

- Annually, \$433 billion in goods are shipped from sites in Tennessee and another \$266 billion in goods are shipped to sites in Tennessee, mostly by truck.
- Eighty-two percent of the goods shipped annually from sites in Tennessee are carried by trucks and another 12 percent are carried by courier services or multiple mode deliveries, which include trucking.
- Businesses have responded to improved communications and greater competition by moving from a push-style distribution system, which relies on low-cost movement of bulk commodities and large-scale warehousing, to a pull-style distribution system, which relies on smaller, more strategic and time-sensitive movement of goods.
- Increasingly, companies are looking at the quality of a region’s transportation system when deciding where to re-locate or expand. Regions with congested or poorly maintained roads may see businesses relocate to areas with a smoother, more efficient and more modern transportation system.
- Highway accessibility was ranked the number two site selection factor behind only the availability of skilled labor in a 2013 survey of corporate executives by [Area Development Magazine](#).
- The [Federal Highway Administration](#) estimates that each dollar spent on road, highway and bridge improvements results in an average benefit of \$5.20 in the form of reduced vehicle maintenance costs, reduced delays, reduced fuel consumption, improved safety, reduced road and bridge maintenance costs and reduced emissions as a result of improved traffic flow.

The federal government is a critical source of funding for Tennessee’s roads, highways and bridges and provides a significant return in road and bridge funding based on the revenue generated in the state by the federal motor fuel tax.

- From 2009 to 2013, the federal government provided \$1.20 for road improvements in Tennessee for every dollar the state paid in federal motor fuel fees.
- Signed into law in December 2015, the Fixing America’s Surface Transportation (FAST) Act, provides modest increases in federal highway and transit spending, allows states greater long-term funding certainty and streamlines the federal project approval process. But the FAST Act does not provide adequate funding to meet the nation’s need for highway and transit improvements and does not include a long-term and sustainable funding source.

- The five-year, \$305 billion FAST Act will provide approximately a 15 percent boost in highway funding and an 18 percent boost in transit funding over the duration of the program, which expires in 2020.
- In addition to federal motor fuel tax revenues, the FAST Act will also be funded by \$70 billion in U.S. general funds, which will rely on offsets from several unrelated federal programs including the Strategic Petroleum Reserve, the Federal Reserve and U.S. Customs.
- According to the 2015 AASHTO Transportation Bottom Line Report, a significant boost in investment in the nation's roads, highways, bridges and public transit systems is needed to improve their condition and to meet the nation's transportation needs.
- AASHTO's report found that based on an annual 1 percent increase in VMT that annual investment in the nation's roads, highways and bridges needs to increase 36 percent, from \$88 billion to \$120 billion, to improve conditions and meet the nation's mobility needs, based on an annual one percent rate of vehicle travel growth. Investment in the nation's public transit system needs to increase from \$17 billion to \$43 billion.
- The [2015 AASHTO Transportation Bottom Line Report](#) found that if the national rate of vehicle travel increased by 1.4 percent per year, the needed annual investment in the nation's roads, highways and bridges would need to increase by 64 percent to \$144 billion. If vehicle travel grows by 1.6 percent annually the needed annual investment in the nation's roads, highways and bridges would need to increase by 77 percent to \$156 billion.

Sources of information for this report include the Tennessee Department of Transportation (TDOT), Federal Highway Administration (FHWA), the Bureau of Transportation Statistics (BTS), the U.S. Census Bureau, the American Association of State Highway and Transportation Officials (AASHTO), the Texas Transportation Institute (TTI) and the National Highway Traffic Safety Administration (NHTSA).

Introduction

Tennessee's roads, highways, bridges and public transit systems form vital transportation links for the state's residents, visitors and businesses, providing daily access to homes, jobs, shopping, natural resources and recreation. Modernizing Tennessee's transportation system is critical to fostering quality of life improvements and economic competitiveness in the Volunteer State.

As the U.S. and Tennessee work to achieve long-term economic growth, the preservation and modernization of the state's transportation system could play an important role in retaining Tennessee's economic competitiveness and improving its economic well-being by providing critically needed jobs in the short term and by improving the productivity and competitiveness of the state's businesses in the long term. As Tennessee faces the challenge of preserving and modernizing its transportation system, the future level of federal, state and local transportation funding will be a critical factor in whether the state's residents and visitors continue to enjoy access to a safe and efficient transportation network. Meeting Tennessee's need to modernize and maintain its system of roads, highways and bridges will require a significant boost in local, state and federal funding. And while the new Federal transportation bill will provide states with greater funding certainty over the next five years, the FAST Act does not provide adequate funding to meet the nation's need for highway and transit improvements and does not include a long-term and sustainable funding source.

This report examines the condition, use and safety of Tennessee's roads, highways and bridges, federal, state and local funding needs, and the future mobility needs of the state. Sources of information for this study include the Tennessee Department of Transportation (TDOT), the Federal Highway Administration (FHWA), the U.S. Census Bureau, the American Association of State Highway and Transportation Officials (AASHTO), the Texas

Transportation Institute (TTI), the Bureau of Transportation Statistics (BTS), and the National Highway Traffic Safety Administration (NHTSA).

Population, Travel and Economic Trends in Tennessee

Tennessee residents and businesses require a high level of personal and commercial mobility. Population increases and economic growth in the state have resulted in an increase in the demand for mobility as well as an increase in vehicle miles of travel (VMT). To foster quality of life and spur economic growth in Tennessee, it will be critical that the state provide a safe and modern transportation system that can accommodate future growth in population, tourism, recreation and vehicle travel.

Tennessee's population grew to approximately 6.5 million residents in 2014, a 34 percent increase since 1990.¹ Tennessee had 4.6 million licensed drivers in 2013.² From 1990 to 2013, Tennessee's gross domestic product (GDP), a measure of the state's economic output, increased by 71 percent, when adjusted for inflation.³ U.S. GDP increased 65 percent during this time.⁴

From 1990 to 2013, annual VMT in Tennessee increased by 52 percent, from 46.7 billion miles traveled annually to 71.1 billion miles traveled annually.⁵ During the first ten months of 2015, vehicle miles of travel in Tennessee were 4.0 percent higher than the first ten months of 2014.⁶ Similarly, U.S. vehicle miles of travel were 3.4 percent higher during the first ten months of 2015 than the first ten months of 2014.⁷

Based on population and other lifestyle trends, TRIP estimates that travel on Tennessee's roads and highways will increase by another 30 percent by 2030.⁸

Condition of Tennessee's Roads

The life cycle of Tennessee's roads is greatly affected by the state and local governments' ability to perform timely maintenance and upgrades to ensure that road and highway surfaces last as long as possible.

Eleven percent of Tennessee's major, locally and state-maintained urban roads and highways have pavements rated in poor condition.⁹ Another 29 percent of Tennessee's major urban roads are rated in mediocre or fair condition and the remaining 60 percent are rated in good condition.¹⁰

The chart below details pavement conditions on major urban roads in Chattanooga, Knoxville, Memphis and Nashville.¹¹

Chart 1. Pavement conditions on major roads.

Location	Poor	Mediocre	Fair	Good
Chattanooga	20%	16%	17%	47%
Knoxville	6%	8%	17%	69%
Memphis	23%	29%	13%	35%
Nashville	9%	11%	15%	65%

Source: Federal Highway Administration

The pavement data in this report for all arterial roads and highways is provided by the Federal Highway Administration, based on data submitted annually by the Tennessee Department of Transportation (TDOT) on the condition of major state and locally maintained roads and highways in the state.

Pavement failure is caused by a combination of traffic, moisture and climate. Moisture often works its way into road surfaces and the materials that form the road's foundation. Road surfaces at intersections are even more prone to deterioration because the slow-moving or standing loads occurring at these sites subject the pavement to higher levels of stress. It is critical

that roads are fixed before they require major repairs because reconstructing roads costs approximately four times more than resurfacing them.¹² As roads and highways continue to age, they will reach a point of deterioration where routine paving and maintenance will not be adequate to keep pavement surfaces in good condition and costly reconstruction of the roadway and its underlying surfaces will become necessary.

The Costs to Motorists of Roads in Inadequate Condition

TRIP has calculated the additional cost to motorists of driving on roads in poor or unacceptable condition. When roads are in poor condition – which may include potholes, rutting or rough surfaces – the cost to operate and maintain a vehicle increases. These additional vehicle operating costs include accelerated vehicle depreciation, additional vehicle repair costs, increased fuel consumption and increased tire wear. TRIP estimates that additional vehicle operating costs (VOC) borne by Tennessee motorists as a result of poor road conditions is \$1.3 billion annually.¹³

The chart below details per-driver vehicle operating costs in Chattanooga, Knoxville, Memphis, Nashville and statewide.

Chart 2. Vehicle operating costs due to rough roads.

Location	VOC
Chattanooga	\$426
Knoxville	\$188
Memphis	\$516
Nashville	\$239
Tennessee - Statewide	\$1.3 Billion

Source: TRIP estimate

Additional vehicle operating costs have been calculated in the Highway Development and Management Model (HDM), which is recognized by the U.S. Department of Transportation and more than 100 other countries as the definitive analysis of the impact of road conditions on vehicle operating costs. The HDM report is based on numerous studies that have measured the impact of various factors, including road conditions, on vehicle operating costs.¹⁴

The HDM study found that road deterioration increases ownership, repair, fuel and tire costs. The report found that deteriorated roads accelerate the pace of depreciation of vehicles and the need for repairs because the stress on the vehicle increases in proportion to the level of roughness of the pavement surface. Similarly, tire wear and fuel consumption increase as roads deteriorate since there is less efficient transfer of power to the drive train and additional friction between the road and the tires.

TRIP's additional vehicle operating cost estimate is based on taking the average number of miles driven annually by a motorist, calculating current vehicle operating costs based on AAA's 2014 vehicle operating costs and then using the HDM model to estimate the additional vehicle operating costs paid by drivers as a result of substandard roads.¹⁵ Additional research on the impact of road conditions on fuel consumption by the Texas Transportation Institute (TTI) is also factored into TRIP's vehicle operating cost methodology.

Bridge Conditions in Tennessee

Tennessee's bridges form key links in the state's highway system, providing communities and individuals access to employment, schools, shopping and medical facilities, and facilitating commerce and access for emergency vehicles.

Nineteen percent of Tennessee’s locally and state- maintained bridges (20 feet or longer) are currently rated as structurally deficient or functionally obsolete.

Five percent of Tennessee’s locally and state maintained bridges are rated as structurally deficient.¹⁶ A bridge is structurally deficient if there is significant deterioration of the bridge deck, supports or other major components. Bridges that are structurally deficient may be posted for lower weight limits or closed if their condition warrants such action. Deteriorated bridges can have a significant impact on daily life. Restrictions on vehicle weight may cause many vehicles – especially emergency vehicles, commercial trucks, school buses and farm equipment – to use alternate routes to avoid posted bridges. Redirected trips also lengthen travel time, waste fuel and reduce the efficiency of the local economy.

Fourteen percent of Tennessee’s locally and state maintained bridges are rated functionally obsolete.¹⁷ Bridges that are functionally obsolete no longer meet current highway design standards, often because of narrow lanes, inadequate clearances or poor alignment with the approaching roadway.

The chart below details bridge conditions in the state’s largest urban areas.

Chart 3. Bridge conditions in Tennessee’s largest urban areas.

Location	Structurally Deficient	Functionally Obsolete
Chattanooga	4%	16%
Knoxville	2%	29%
Memphis	6%	19%
Nashville	4%	17%

Source: Federal Highway Administration National Bridge Inventory, 2014

The service life of bridges can be extended by performing routine maintenance such as resurfacing decks, painting surfaces, insuring that a facility has good drainage and replacing

deteriorating components. But most bridges will eventually require more costly reconstruction or major rehabilitation to remain operable.

Traffic Safety in Tennessee

A total of 4,948 people were killed in motor vehicle crashes in Tennessee from 2010 through 2014, an average of 990 fatalities per year.¹⁸

Chart 4. Traffic fatalities in Tennessee from 2010 – 2014.

<i>Year</i>	<i>Fatalities</i>
2010	1,031
2011	946
2012	1,014
2013	995
2014	962
Total	4,948

Source: National Highway Traffic Safety Administration

Three major factors are associated with fatal vehicle crashes: driver behavior, vehicle characteristics and roadway features. It is estimated that roadway features are likely a contributing factor in approximately one-third of fatal traffic crashes. Roadway features that impact safety include the number of lanes, lane widths, lighting, lane markings, rumble strips, shoulders, guard rails, other shielding devices, median barriers and intersection design.

Tennessee’s overall traffic fatality rate of 1.40 fatalities per 100 million vehicle miles of travel in 2013 is significantly higher than the national average of 1.09.¹⁹ The fatality rate on Tennessee’s non-Interstate rural roads was 2.38 fatalities per 100 million vehicle miles of travel in 2013, nearly two and a half times the fatality rate of 1.03 on all other roads and highways in the state.²⁰

Improving safety on Tennessee's roadways can be achieved through further improvements in vehicle safety; improvements in driver, pedestrian, and bicyclist behavior; and a variety of improvements in roadway safety features.

The severity of serious traffic crashes could be reduced through roadway improvements, where appropriate, such as adding turn lanes, removing or shielding obstacles, adding or improving medians, widening lanes, widening and paving shoulders, improving intersection layout, and providing better road markings and upgrading or installing traffic signals.

Roads with poor geometry, with insufficient clear distances, without turn lanes, having inadequate shoulders for the posted speed limits, or poorly laid out intersections or interchanges, pose greater risks to motorists, pedestrians and bicyclists.

Investments in rural traffic safety have been found to result in significant reductions in serious traffic crashes. A 2012 report by the [Texas Transportation Institute](#) (TTI) found that improvements completed recently by the Texas Department of Transportation that widened lanes, improved shoulders and made other safety improvements on 1,159 miles of rural state roadways resulted in 133 fewer fatalities on these roads in the first three years after the improvements were completed (as compared to the three years prior). TTI estimates that the improvements on these roads are likely to save 880 lives over the next 20 years.²¹

Traffic Congestion in Tennessee

Increasing levels of traffic congestion cause significant delays in Tennessee, particularly in its larger urban areas, choking commuting and commerce. Traffic congestion robs commuters

of time and money and imposes increased costs on businesses, shippers and manufacturers, which are often passed along to the consumer.

The chart below details the cost to of congestion in the form of lost time and wasted fuel for drivers in Tennessee’s largest urban areas, as well as the hours lost to congestion annually by the average motorist in each area.

Chart 5. Congestion costs and hours lost annually.

Location	Congestion Cost	Hours Lost
Chattanooga	\$730	28
Knoxville	\$849	35
Memphis	\$1,080	43
Nashville	\$1,168	45

Source: Texas Transportation Institute Urban Mobility Report, 2015

Increasing levels of congestion add significant costs to consumers, transportation companies, manufacturers, distributors and wholesalers. The increased levels of congestion can reduce the attractiveness of a location to a company to consider expansion or even to locate a new facility. Congestion costs can also increase overall operating costs for trucking and shipping companies, leading to revenue losses, lower pay for employees, and higher consumer costs.

Transportation Funding

Investment in Tennessee’s roads, highways and bridges is funded by local, state and federal governments. The federal government provides funding for the state’s transportation system largely as part of the recently approved FAST Act.

The federal government is a critical source of funding for Tennessee’s roads, highways, bridges and transit systems and provides a significant return to Tennessee in road and bridge

funding based on the revenue generated in the state by the federal motor fuel tax. From 2009 to 2013, the federal government provided \$1.20 for road improvements in Tennessee for every dollar that motorists in the state paid in federal motor fuel fees.²²

Most federal funds for highway and transit improvements in Tennessee are provided by federal highway user fees, largely an 18.4 cents-per-gallon tax on gasoline and a 24.4 cents-per-gallon tax on diesel fuel. Since 2008 revenue into the federal Highway Trust Fund has been inadequate to support legislatively set funding levels so Congress has transferred approximately \$53 billion in general funds and an additional \$2 billion from a related trust fund into the federal Highway Trust Fund.²³

Signed into law in December 2015, the Fixing America's Surface Transportation (FAST) Act, provides modest increases in federal highway and transit spending. The five-year bill also provides states with greater funding certainty and streamlines the federal project approval process. But the FAST Act does not provide adequate funding to meet the nation's need for highway and transit improvements and does not include a long-term and sustainable funding source.

The five-year, \$305 billion FAST Act will provide approximately a 15 percent boost in highway funding and an 18 percent boost in transit funding over the duration of the program, which expires in 2020.²⁴ In addition to federal motor fuel tax revenues, the FAST Act will also be funded by \$70 billion in U.S. general funds, which will rely on offsets from several unrelated federal programs including the Strategic Petroleum Reserve, the Federal Reserve and U.S. Customs.

According to the [2015 AASHTO Transportation Bottom Line Report](#), a significant boost in investment in the nation's roads, highways, bridges and public transit systems is needed to

improve their condition and to meet the nation's transportation needs. The AASHTO report found that based on an annual one percent increase in VMT that annual investment in the nation's roads, highways and bridges needs to increase by 36 percent, from \$88 billion to \$120 billion to improve conditions and meet the nation's mobility needs.²⁵ Investment in the nation's public transit system needs to increase from \$17 billion to \$43 billion.²⁶

The [2015 AASHTO Transportation Bottom Line Report](#) found that if the rate of vehicle travel increased by 1.4 percent per year, the needed annual investment in the nation's roads, highways and bridges would need to increase by 64 percent, to \$144 billion. If vehicle travel grows by 1.6 percent annually the needed annual investment in the nation's roads, highways and bridges would need to increase by 77 percent, to \$156 billion.²⁷

Importance of Transportation to Economic Growth

Today's culture of business demands that an area have well-maintained and efficient roads, highways and bridges if it is to remain economically competitive. Global communications and the impact of free trade in North America and elsewhere have resulted in a significant increase in freight movement, making the quality of a region's transportation system a key component in a business's ability to compete locally, nationally and internationally.

Businesses have responded to improved communications and the need to cut costs with a variety of innovations including just-in-time delivery, increased small package delivery, demand-side inventory management and e-commerce. The result of these changes has been a significant improvement in logistics efficiency as firms move from a push-style distribution system, which relies on large-scale warehousing of materials, to a pull-style distribution system, which relies on

smaller, more strategic movement of goods. These improvements have made mobile inventories the norm, resulting in the nation's trucks literally becoming rolling warehouses.

Highways are vitally important to continued economic development in Tennessee, particularly to the state's manufacturing, mineral extraction and tourism industries. As the economy expands, creating more jobs and increasing consumer confidence, the demand for consumer and business products grows. In turn, manufacturers ship greater quantities of goods to market to meet this demand, a process that adds to truck traffic on the state's highways and major arterial roads.

Every year, \$433 billion in goods are shipped from sites in Tennessee and another \$266 billion in goods are shipped to sites in Tennessee, mostly by trucks.²⁸ Eighty-two percent of the goods shipped annually from sites in Tennessee are carried by trucks and another 12 percent are carried by courier services or multiple-mode deliveries, which include trucking.²⁹

The cost of road and bridge improvements are more than offset by the reduction of user costs associated with driving on rough roads, the improvement in business productivity, the reduction in delays and the improvement in traffic safety. The [Federal Highway Administration estimates](#) that each dollar spent on road, highway and bridge improvements results in an average benefit of \$5.20 in the form of reduced vehicle maintenance costs, reduced delays, reduced fuel consumption, improved safety, reduced road and bridge maintenance costs and reduced emissions as a result of improved traffic flow.³⁰

Local, regional and state economic performance is improved when a region's surface transportation system is expanded or repaired. This improvement comes as a result of the initial job creation and increased employment created over the long-term because of improved access, reduced transport costs and improved safety.

Increasingly, companies are looking at the quality of a region's transportation system when deciding where to re-locate or expand. Regions with congested or poorly maintained roads may see businesses relocate to areas with a smoother, more efficient and more modern transportation system. Highway accessibility was ranked the number two site selection factor behind only the availability of skilled labor in a 2013 survey of corporate executives by [Area Development Magazine](#).³¹

Conclusion

As Tennessee works to build and enhance a thriving, growing and dynamic state, it will be critical that it is able to provide a 21st century network of roads, highways and bridges that can accommodate the mobility demands of a modern society.

As the nation makes further economic progress, the U.S. will need to modernize its surface transportation system by improving the physical condition of its transportation network and enhancing the system's ability to provide efficient and reliable mobility for motorists and businesses. Making needed improvements to Tennessee's roads, highways and bridges could provide a significant boost to the state's economy by creating jobs in the short term and stimulating long-term economic growth as a result of enhanced mobility and access.

While the modest funding increase provided by the FAST Act will be helpful, numerous projects to improve the condition and expand the capacity of Tennessee's roads, highways, bridges and transit systems will not be able to proceed without a substantial boost in state or local transportation funding. If Tennessee is unable to complete needed transportation projects in the state it will hamper Tennessee's ability to improve the condition and efficiency of its

transportation system and to enhance economic development opportunities and quality of life in the state.

#

Endnotes

-
- ¹ U.S. Census Bureau (2014).
- ² Highway Statistics 2013 (2014). Federal Highway Administration. DL-1C
- ³ TRIP analysis of Bureau of Economic Analysis data.
- ⁴ Ibid.
- ⁵ U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 1990 and 2013.
- ⁶ TRIP analysis of Federal Highway Administration's monthly Traffic Volume Trends (2015) Federal Highway Administration.
- ⁷ Ibid.
- ⁸ TRIP calculation based on U.S. Census and Federal Highway Administration data.
- ⁹ Federal Highway Administration (2015). Pavement condition data is for 2013.
- ¹⁰ Ibid.
- ¹¹ Federal Highway Administration (2014). Pavement condition data is for 2012.
- ¹² Selecting a Preventative Maintenance Treatment for Flexible Pavements. R. Hicks, J. Moulthrop. Transportation Research Board. 1999. Figure 1.
- ¹³ TRIP calculation
- ¹⁴ Highway Development and Management: Volume Seven. Modeling Road User and Environmental Effects in HDM-4. Bennett, C. and Greenwood, I. 2000.
- ¹⁵ Your Driving Costs. American Automobile Association. 2014.
- ¹⁶ Federal Highway Administration National Bridge Inventory, 2014.
- ¹⁷ Ibid.
- ¹⁸ National Highway Traffic Safety Administration data.
- ¹⁹ TRIP analysis of National Highway Traffic Safety Administration and Federal Highway Administration data (2014).
- ²⁰ TRIP analysis of FHWA data (2015). Highway Statistics 2013, charts VM-2, FI-20.
- ²¹ Adding Highway Shoulders, Width, Reduce Crash Numbers and Save Lives (August 9, 2012). Texas Transportation Institute.
- ²² TRIP analysis of Federal Highway Administration data. 2009 to 2013 Highway Statistics fe-221.
- ²³ "Surface Transportation Reauthorization and the Solvency of the Highway Trust Fund," presentation by Jim Tyson, American Association of State Highway and Transportation Officials (2014).
- ²⁴ 2015 "Fixing America's Surface Transportation Act." (2015) American Road and Transportation Builders Association. <http://www.artba.org/newsline/wp-content/uploads/2015/12/ANALYSIS-FINAL.pdf>
- ²⁵ 2015 AASHTO Bottom Line Report (2014) AASHTO. P. 2.
- ²⁶ Ibid.
- ²⁷ Ibid.
- ²⁸ Bureau of Transportation Statistics (2010), U.S. Department of Transportation. 2007 Commodity Flow Survey, State Summaries. http://www.bts.gov/publications/commodity_flow_survey/2007/states/
- ²⁹ Ibid.
- ³⁰ FHWA estimate based on its analysis of 2006 data. For more information on FHWA's cost-benefit analysis of highway investment, see the 2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance.
- ³¹ Area Development Magazine (2014). 28th Annual Survey of Corporate Executives: Availability of Skilled Labor New Top Priority. . <http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2014/28th-Corporate-Executive-RE-survey-results-6574981.shtml?Page=2>