

***TENNESSEE TRANSPORTATION
BY THE NUMBERS:***

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

APRIL 2017



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

Ten Key Transportation Numbers in Tennessee

\$6 billion	Driving on deficient roads costs Tennessee motorists a total of \$6 billion annually in the form of additional vehicle operating costs (VOC), congestion-related delays and traffic crashes.
Chattanooga- \$1,471 Knoxville - \$1,376 Memphis – \$2,019 Nashville - \$1,667	TRIP has calculated the cost to the average motorist in the state’s largest urban areas in the form of additional VOC, congestion-related delays and traffic crashes. Drivers in the state’s largest urban areas incur annual costs as a result of driving on deficient roads as follows: Chattanooga, \$1,471; Knoxville, \$1,376; Memphis, \$2,019; and, Nashville, \$1,667.
4,965 993 8%	A total of 4,965 people were killed in Tennessee traffic crashes from 2012 to 2016, an average of 993 fatalities annually. Traffic fatalities increased eight percent from 2015 to 2016, from 958 to 1,036.
9% 20%	Vehicle miles traveled (VMT) in Tennessee increased by nine percent from 2013 to 2016 –from 71.1 billion VMT to 77.7 billion VMT. By 2030, vehicle travel in Tennessee is projected to increase by another 20 percent.
2.5X	The fatality rate on Tennessee’s rural roads is more than two and a half times greater than the fatality rate on all other roads in the state (2.35 fatalities per 100 million VMT vs. 0.91).
1/4	Approximately one-quarter of Tennessee’s major urban roads are in either poor or mediocre condition, with 11 percent rated in poor condition and 13 percent rated in mediocre condition.
\$619 Billion	Annually, \$619 billion in goods are shipped to and from sites in Tennessee, mostly by truck.
\$5.7 Billion \$1.9 Billion	Traffic crashes in Tennessee imposed a total of \$5.7 billion in economic costs in 2015. TRIP estimates that traffic crashes in which roadway features were likely a contributing factor imposed \$1.9 billion in economic costs in 2015.
Chattanooga- 28 hours Knoxville – 35 hours Memphis – 43 hours Nashville – 45 hours	Mounting congestion robs drivers of time and fuel. Annual time wasted in congestion for drivers in the state’s largest urban areas is as follows: Chattanooga, 28 hours; Knoxville, 35 hours; Memphis, 43 hours; and, Nashville, 45 hours.
\$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

Nine years after the nation suffered a significant economic downturn, Tennessee's economy continues to rebound. The rate of economic growth in Tennessee, which is greatly impacted by the reliability and condition of the state's transportation system, has 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 access to suppliers, markets and employees, all critical to a business' level of productivity and ability to expand. 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 manufacturing, agriculture, natural resource extraction and tourism, the quality of Tennessee's transportation system plays a vital role in the state's economic growth and quality of life.

In this report, TRIP looks at the top transportation numbers in Tennessee as the state addresses modernizing and maintaining its system of roads, highways, bridges and transit.

COST TO TENNESSEE MOTORISTS OF DEFICIENT ROADS

An inadequate transportation system costs Tennessee motorists a total of \$6 billion every year in the form of additional vehicle operating costs (VOC), congestion-related delays and traffic crashes.

- 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.
- Traffic crashes in which roadway design was likely a contributing factor cost Tennessee motorists a total of \$1.9 billion each year in the form of lost household and workplace productivity, insurance and other financial costs.
- Traffic congestion costs Tennessee motorists a total of \$2.8 billion each year in the form of lost time and wasted fuel.

- The chart below details the average cost per driver in the state’s largest urban areas and statewide.

Urban Area	VOC	Safety	Congestion	TOTAL
Chattanooga	\$387	\$354	\$730	\$1,471
Knoxville	\$172	\$355	\$849	\$1,376
Memphis	\$589	\$350	\$1,080	\$2,019
Nashville	\$192	\$307	\$1,168	\$1,667
Tennessee	\$1.3 Billion	\$1.9 Billion	\$2.8 Billion	\$6 Billion

POPULATION, TRAVEL AND ECONOMIC TRENDS IN TENNESSEE

The rate of 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 6.7 million residents in 2016, a 17 increase since 2000. Tennessee had approximately 4.6 million licensed drivers in 2015.
- Vehicle miles traveled (VMT) in Tennessee increased by 18 percent from 2000 to 2016 – from 65.7 billion VMT in 2000 to 77.7 billion VMT in 2016.
- Vehicle travel in Tennessee has increased nine percent in the last three years (2013-2016).
- From 2000 to 2015, Tennessee’s gross domestic product, a measure of the state’s economic output, increased by 25 percent, when adjusted for inflation. U.S. GDP increased 27 percent during this time.
- By 2030, vehicle travel in Tennessee is projected to increase by another 20 percent.

TENNESSEE ROAD CONDITIONS

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

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

- Pavement data for Interstate highways and other principal arterials is collected for all system mileage, whereas pavement data for minor arterial and all collector roads and highways is based on sampling portions of roadways as prescribed by FHWA to insure that the data collected is adequate to provide an accurate assessment of pavement conditions on these roads and highways.
- Eleven percent of Tennessee’s major locally and state-maintained urban roads and highways have pavements in poor condition, while 13 percent are rated in mediocre condition. Thirteen percent of major urban roads are in fair condition and the remaining 63 percent are rated in good condition.
- Overall, eight percent of Tennessee’s major locally and state-maintained roads and highways have pavements in poor condition, while 14 percent are in mediocre condition. Sixteen percent of the state’s major roads are rated in fair condition and the remaining 61 percent are rated in good condition.
- The chart below details the share of pavement in poor, mediocre, fair and good condition in the state’s largest urban areas.

Urban Area	Poor	Mediocre	Fair	Good
Chattanooga	18%	15%	13%	55%
Knoxville	4%	12%	14%	70%
Memphis	29%	22%	16%	33%
Nashville	5%	13%	12%	69%

- Roads rated in mediocre to poor condition may show signs of deterioration, including rutting, cracks and potholes. In some cases, these 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.

TENNESSEE BRIDGE CONDITIONS

Five percent of locally and state-maintained bridges in Tennessee show significant deterioration. 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.
- The chart below details the share of structurally deficient bridges in Chattanooga, Knoxville, Memphis and Nashville.

Urban Area	Total Bridges	Number Structurally Deficient	Share Structurally Deficient
Chattanooga	864	29	3%
Knoxville	586	9	2%
Memphis	1,311	65	5%
Nashville	795	29	4%

HIGHWAY SAFETY AND FATALITY RATES IN TENNESSEE

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.

- A total of 4,965 people were killed in Tennessee traffic crashes from 2012 to 2016, an average of 993 fatalities per year. The number of traffic fatalities in the state increased eight percent from 2015 to 2016, from 958 to 1,036.
- Tennessee’s overall traffic fatality rate of 1.25 fatalities per 100 million vehicle miles of travel in 2015 was higher than the national average of 1.13.
- The fatality rate on Tennessee’s non-interstate rural roads in 2015 was more than two and a half times greater than on all other roads in the state (2.35 fatalities per 100 million vehicle miles of travel vs. 0.91).
- The chart below details the average number of people killed in traffic crashes from 2013 to 2015 in the state’s largest urban areas, as well as the cost per motorist of traffic crashes.

Urban Area	Average Fatalities	Safety Cost
Chattanooga	65	\$354
Knoxville	57	\$355
Memphis	122	\$350
Nashville	70	\$307

- Traffic crashes in Tennessee imposed a total of \$5.7 billion in economic costs in 2015. TRIP estimates that traffic crashes in which roadway features were likely a contributing factor imposed \$1.9 billion in economic costs in 2015.
- According to a 2015 National Highway Traffic Safety Administration (NHTSA) report, the economic costs of traffic crashes includes work and household productivity losses,

property damage, medical costs, rehabilitation costs, legal and court costs, congestion costs and emergency services.

- 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 20 years.

TENNESSEE TRAFFIC CONGESTION

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.

- Based on [Texas Transportation Institute](#) (TTI) estimates, the value of lost time and wasted fuel in Tennessee is approximately \$2.8 billion per year.
- The chart below details the number of hours lost to congestion by the average driver in the state's largest urban areas, as well as the annual cost of traffic congestion per driver in the form of lost time and wasted fuel.

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

- 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 when considering expansion or where 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.

TRANSPORTATION FUNDING IN TENNESSEE

Investment in Tennessee’s roads, highways and bridges is funded by local, state and federal governments. The current five-year federal surface transportation program includes modest funding increases and provides states with greater funding certainty, but falls far short of providing the level of funding needed to meet the nation’s highway and transit needs. The bill does not include a long-term and sustainable revenue source.

- Signed into law in December 2015, the [Fixing America’s Surface Transportation Act \(FAST Act\)](#), 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 a boost of approximately 15 percent in national highway funding and 18 percent in national 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 one percent increase in VMT 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,.

Investment in the nation's public transit system needs to increase from \$17 billion to \$43 billion.

- The 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.

TRANSPORTATION AND ECONOMIC GROWTH IN TENNESSEE

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, \$619 billion in goods are shipped to and from sites in Tennessee, mostly by truck.
- Seventy-six percent of the goods shipped annually to and from sites in Tennessee are carried by trucks and another 14 percent are carried by courier services or multiple mode deliveries, which include trucking.
- 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 2015 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.

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

Introduction

Tennessee's roads, highways and bridges 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 quality of life and economic competitiveness in the Volunteer State.

Supporting quality of life and a robust economy in Tennessee requires that the state provide a safe, efficient and well-maintained transportation system. Inadequate transportation investment, which will result in deteriorated transportation facilities and diminished access, will negatively affect economic competitiveness and quality of life in Tennessee.

To accommodate population and economic growth, maintain its level of economic competitiveness and achieve further economic growth, Tennessee will need to maintain and modernize its roads, highways and bridges by improving the physical condition of its transportation network and enhancing the system's ability to provide efficient, reliable and safe mobility for residents, visitors and businesses. Making needed improvements to Tennessee's roads, highways, bridges and transit systems could also 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.

This report examines the condition, use and safety of Tennessee's roads, highways and bridges, funding needs, and the future mobility needs of the state. Sources of information for this report include the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), the Bureau of Transportation Statistics (BTS), the U.S. Census Bureau, the Texas Transportation Institute (TTI), and the National Highway Traffic Safety Administration (NHTSA).

Population, Travel and Economic Trends in Tennessee

Tennessee motorists and businesses require a high level of personal and commercial mobility. To foster quality of life and spur continued 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, business, recreation and vehicle travel.

Tennessee's population grew to approximately 6.7 million residents in 2016, a 17 percent increase since 2000.¹ Tennessee had approximately 4.6 million licensed drivers in 2015.² From 2000 to 2015, Tennessee's gross domestic product (GDP), a measure of the state's economic output, increased by 25 percent, when adjusted for inflation.³ U.S. GDP increased 27 percent during this period.⁴

From 2000 to 2016, annual VMT in Tennessee increased by 18 percent, from 65.7 billion miles traveled annually to 77.7 billion miles traveled annually.⁵ Vehicle travel in Tennessee increased nine percent in the last three years (2013-2016).⁶

Based on population and other lifestyle trends, TRIP estimates that travel on Tennessee's roads and highways will increase by another 20 percent by 2030.⁷

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.

The pavement data in this report, which is for all arterial and collector roads and highways, is provided by the Federal Highway Administration (FHWA), based on data submitted annually by the Tennessee Department of Transportation (TDOT) on the condition of major state and locally maintained roads and highways. Pavement data for Interstate highways and other principal arterials is collected for all system mileage, whereas pavement data for minor arterial and all collector roads and highways is based on sampling portions of roadways as prescribed by FHWA to insure that the data collected is adequate to provide an accurate assessment of pavement conditions on these roads and highways.

Statewide, eight percent of Tennessee’s major locally and state-maintained roads are in poor condition, while 14 percent are in mediocre condition. Sixteen percent are in fair condition and the remaining 61 percent are in good condition.⁸

Nearly a quarter of Tennessee’s major urban roads are in poor or mediocre condition. Eleven percent of Tennessee’s major locally and state-maintained urban roads and highways have pavements rated in poor condition, while 13 percent are in mediocre condition.⁹ Thirteen percent of Tennessee’s major urban roads are rated in fair condition and the remaining 63 percent are rated in good condition.¹⁰

The chart below details pavement conditions on major urban roads in the state’s largest urban areas.¹¹

Chart 1. Pavement conditions on major roads in the state’s largest urban areas.

Urban Area	Poor	Mediocre	Fair	Good
Chattanooga	18%	15%	13%	55%
Knoxville	4%	12%	14%	70%
Memphis	29%	22%	16%	33%
Nashville	5%	13%	12%	69%

Source: TRIP analysis of Federal Highway Administration data.

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, mediocre or fair condition. When roads are in poor, mediocre or fair condition – which may include potholes, rutting or rough surfaces – the cost to operate and maintain a vehicle increases. These additional vehicle operating costs (VOC) include accelerated vehicle depreciation, additional - vehicle repair costs, increased fuel consumption and increased tire wear. TRIP estimates that additional VOC borne by Tennessee motorists as a result of deteriorated road conditions is \$1.3 billion annually, or \$271 per driver.¹³ The chart below details additional VOC per motorist in the state's largest urban areas.

Chart 2. Vehicle operating costs per motorist as a result of driving on deteriorated roads.

Urban Area	VOC
Chattanooga	\$387
Knoxville	\$172
Memphis	\$589
Nashville	\$192
Tennessee	\$1.3 Billion

Source: TRIP estimates.

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 VOC estimate is based on taking the average number of miles driven annually by a motorist, calculating current VOC based on AAA's 2016 VOC and then using the HDM model to estimate the additional VOC 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 in to 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.

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.

The chart below details the share of bridges in the state’s largest urban areas that are structurally deficient.

Chart 3. Share of structurally deficient bridges in Tennessee’s largest urban areas and statewide.

Urban Area	Total Bridges	Number Structurally Deficient	Share Structurally Deficient
Chattanooga	864	29	3%
Knoxville	586	9	2%
Memphis	1,311	65	5%
Nashville	795	29	4%

Source: TRIP analysis of Federal Highway Administration National Bridge Inventory.

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 4,965 people were killed in Tennessee traffic crashes from 2012 to 2016, an average of 993 fatalities per year.¹⁷ The number of traffic fatalities in the state increased eight percent from 2015 to 2016, from 958 to 1,036.¹⁸

Chart 4. Traffic Fatalities in Tennessee from 2011 – 2015.

<i>Year</i>	<i>Fatalities</i>
2012	1,014
2013	995
2014	962
2015	958
2016	1,036
Total	4,965

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 1.25 fatalities per 100 million vehicle miles of travel in 2015 is higher than the national average of 1.13.¹⁹ The traffic fatality rate on the state’s rural roads is disproportionately high. The fatality rate on Tennessee’s non-interstate rural roads is more than two and a half times higher than on all other roads in the state (2.35 fatalities per 100 million vehicle miles of travel vs. 0.91).²⁰

The chart below details the number of people killed in traffic crashes in the state’s largest urban areas between 2013 and 2015, as well as the cost of traffic crashes per driver.

Chart 5. Average fatalities between 2013 and 2015 and crash cost per driver.

Urban Area	Average Fatalities	Safety Cost
Chattanooga	65	\$354
Knoxville	57	\$355
Memphis	122	\$350
Nashville	70	\$307

Source: TRIP analysis.

Traffic crashes in Tennessee imposed a total of \$5.7 billion in economic costs in 2015.²¹ TRIP estimates that traffic crashes in which roadway features were likely a contributing factor imposed \$1.9 billion in economic costs in 2015.²²

According to a 2015 National Highway Traffic Safety Administration (NHTSA) report, the economic costs of traffic crashes includes work and household productivity losses, property damage, medical costs, rehabilitation costs, legal and court costs, congestion costs and emergency services.²³

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 TTI](#) found that improvements completed recently by TxDOT 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).²⁴ TTI estimates that the improvements on these roads are likely to save 880 lives over 20 years.²⁵

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.

Based on TTI methodology, TRIP estimates the value of lost time and wasted fuel in Tennessee is approximately \$2.8 billion per year. The chart below details the number of hours lost annually for each driver in the state’s largest urban areas, as well as the per-driver cost of lost time and wasted fuel due to congestion.

Chart 6. Annual hours lost to congestion and congestion costs per driver.

Urban Area	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.

Increasing levels of congestion add significant costs to consumers, transportation companies, manufacturers, distributors and wholesalers. Increased levels of congestion can reduce the attractiveness of a location to a company when considering expansion or where 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. A lack of sufficient funding at all levels will make it difficult to adequately maintain and improve the state's existing transportation system.

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

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.²⁶

Signed into law in December 2015, the [Fixing America's Surface Transportation Act \(FAST Act\)](#), 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 a boost of approximately 15 percent in highway funding and 18 percent in transit funding over the duration of the program, which expires in 2020.²⁷ 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.²⁸ Investment in the nation's public transit system needs to increase from \$17 billion to \$43 billion.²⁹

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.³⁰

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. 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, \$619 billion in goods are shipped to and from sites in Tennessee, mostly by trucks.³¹ Seventy-six percent of the goods shipped annually to and from sites in Tennessee are carried by trucks and another 14 percent are carried by courier services or multiple-mode deliveries, which include trucking.³²

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.³³

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 2015 survey of corporate executives by [Area Development Magazine](#).³⁴

Conclusion

As Tennessee works to build and enhance a thriving, growing and dynamic state, it will be critical that it is able to address the state's most significant transportation issues by providing

a 21st century network of roads, highways, bridges and transit that can accommodate the mobility demands of a modern society.

Tennessee 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, safe and reliable mobility for residents, visitors and businesses. Making needed improvements to the state's roads, highways, bridges and transit systems could provide a significant boost to the 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 it will hamper the state's ability to improve the condition and efficiency of its transportation system or enhance economic development opportunities and quality of life.

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Endnotes

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- ¹ U.S. Census Bureau (2016).
- ² Highway Statistics (2015). 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 2000 and 2015 and analysis of Federal Highway Administration Traffic Volume Trends (2016) https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm
- ⁶ U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 2013 and analysis of Federal Highway Administration Traffic Volume Trends (2016) https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm
- ⁷ TRIP calculation based on U.S. Census and Federal Highway Administration data.
- ⁸ Federal Highway Administration (2016). Pavement condition data is for 2014.
- ⁹ Ibid.
- ¹⁰ Ibid.
- ¹¹ Ibid.
- 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. 2016.
- ¹⁶ Federal Highway Administration National Bridge Inventory, 2016.
- ¹⁷ Federal Highway Administration National Highway Traffic Safety Administration, 2011-2015.
- ¹⁸ Ibid.
- ¹⁹ TRIP analysis of National Highway Traffic Safety Administration and Federal Highway Administration data (2016).
- ²⁰ Ibid.
- ²¹ TRIP estimate based on NHTSA report “The Economic and Societal Impact Of Motor Vehicle Crashes, 2010 (Revised), 2015. P. 146.
- ²² Ibid.
- ²³ The Economic and Societal Impact Of Motor Vehicle Crashes, 2010 (Revised) (2015). National Highway Traffic Safety Administration. P. 1. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013>
- ²⁴ Adding Highway Shoulders, Width, Reduce Crash Numbers and Save Lives (August 9, 2012). Texas Transportation Institute.
- ²⁵ Ibid.
- ²⁶ “Surface Transportation Reauthorization and the Solvency of the Highway Trust Fund,” presentation by Jim Tymon, American Association of State Highway and Transportation Officials (2014).
- ²⁷ 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>
- ²⁸ 2015 AASHTO Bottom Line Report (2014) AASHTO. P. 2.
- ²⁹ Ibid.
- ³⁰ Ibid.
- ³¹ TRIP analysis of Bureau of Transportation Statistics, U.S. Department of Transportation. 2012 Commodity Flow Survey, State Summaries.
- ³² Ibid.
- ³³ 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.
- ³⁴ Area Development Magazine (2016). 30th Annual Survey of Corporate Executives: Availability of Skilled Labor New Top Priority. <http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2016/corporate-executive-site-selection-facility-plans-441729.shtml>

