

# ***MAINE TRANSPORTATION BY THE NUMBERS:***

Meeting the State's Need for Safe and Efficient Mobility

**OCTOBER 2012**



*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 Maine

<b>7</b>	The fatality rate on Maine’s non-interstate rural roads is approximately seven times higher than on all other roads in the state.
<b>33%</b> <b>61%</b> <b>40%</b>	Thirty-three percent of Maine’s major locally and state-maintained roads and highways are either in poor or mediocre condition. Sixty-one percent of Portland’s major urban roads are in poor or mediocre condition, while 40 percent of Bangor major urban roads are in poor or mediocre condition.
<b>\$150 million</b>	Maine faces a \$150 million annual shortfall in funds needed to meet the state’s goals for improving road and bridge conditions, improving traffic safety and addressing some traffic congestion challenges over the next decade.
<b>\$299</b> <b>\$301 Million</b> <b>\$516</b> <b>\$375</b>	Driving on rough roads costs the average Maine motorists \$299 annually in additional vehicle operating costs – a total of \$301 million each year. The average Portland driver loses \$516 annually due to deteriorated roads, while rough roads cost the average Bangor driver \$375 annually.
<b>169</b>	The average number of people killed annually in Maine traffic crashes over the five-year-period from 2006 to 2010.
<b>30</b>	The percent of Maine bridges that are in need of repair or replacement. Fourteen percent of the state’s bridges are structurally deficient and 16 percent are functionally obsolete.
<b>1/3</b>	TRIP estimates that roadway features are a factor in approximately one-third of serious traffic crashes.
<b>81</b>	The percent of goods shipped annually by truck from sites in Maine.
<b>20</b>	The anticipated percentage increase in vehicle miles of travel in Maine by the year 2030.
<b>1,019,738</b>	The number of licensed drivers in Maine.

## Executive Summary

Maine's extensive system of roads, highways and bridges provides the state's residents, visitors and businesses with a high level of mobility. This transportation system forms the backbone that supports the Pine Tree State's economy. Maine's surface transportation system enables the state's residents and visitors to travel to work and school, visit family and friends, and frequent tourist and recreation attractions while providing its businesses with reliable access to customers, materials, suppliers and employees.

As Maine looks to achieve further economic growth, the state 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 and reliable mobility for motorists and businesses. Making needed improvements to Maine's roads, highways and bridges 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.

Meeting Maine's need to modernize and maintain its system of roads, highways and bridges will require a significant boost in local, state and federal funding.

**Maine faces a significant funding shortfall in the cost of maintaining its transportation system in its current condition. Meeting the state's need for a well-maintained, safe and reliable network of roads, highways and bridges will also enhance Maine's economy by creating numerous jobs.**

- The Maine Department of Transportation (MaineDOT) projects that it would need to increase investment by an additional \$150 million annually over the next decade to allow the state to meet legislative goals for improving road and bridge conditions, boosting traffic safety and addressing some traffic congestion challenges.
- A 2007 analysis by the Federal Highway Administration found that every \$1 billion invested in highway construction would support approximately 27,800 jobs, including approximately 9,500 in the construction sector, approximately 4,300 jobs in industries supporting the construction sector, and approximately 14,000 other jobs induced in non-construction related sectors of the economy.

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

- Maine's population reached 1,333,074 in 2010, a nine percent increase since 1990, when the state's population was approximately 1.2 million. Maine has 1,019,738 licensed drivers in the state.
- Vehicle miles traveled in Maine increased by 23 percent from 1990 to 2010 – jumping from 11.9 billion vehicle miles traveled (VMT) in 1990 to 14.5 billion VMT in 2010.

- By 2030, vehicle travel in Maine is projected to increase by another 20 percent.
- From 1990 to 2010, Maine's gross domestic product, a measure of the state's economic output, increased by 33 percent, when adjusted for inflation.

**One in three miles of major locally and state-maintained roads and highways in Maine have pavement surfaces in poor or mediocre condition, providing a rough ride and costing motorists in the form of additional vehicle operating costs.**

- Currently, 10 percent of Maine's major roads and highways have pavements in poor condition, while an additional 23 percent of the state's major roads are rated in mediocre condition. Twenty-three percent are rated in fair condition and the remaining 44 percent are rated in good or excellent condition.
- In the Portland urban area, 28 percent of major roads are rated in poor condition and 33 percent are rated in mediocre condition. Nineteen percent of Portland's major urban roads are rated in fair condition and 20 percent are rated in good condition.
- In the Bangor urban area, 18 percent of major roads are rated in poor condition and 22 percent are rated in mediocre condition. Twenty-seven percent of Bangor's major urban roads are rated in fair condition and 33 percent are rated in good condition.
- The 2010 pavement data in this report is provided by the Federal Highway Administration, based on data submitted annually by the Maine Department of Transportation (MaineDOT) on the condition of major state and locally maintained roads and highways in the state.
- 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. Roads rated in mediocre condition may show signs of significant wear and may also have some visible pavement distress. Most pavements in mediocre condition can be repaired by resurfacing, but some may need more extensive reconstruction to return them to good or excellent condition.
- Driving on rough roads costs the average Maine motorist an average of \$299 annually in extra vehicle operating costs – a total of \$301 million statewide. Costs include accelerated vehicle depreciation, additional repair costs, and increased fuel consumption and tire wear.
- Driving on rough roads costs the average Portland motorist \$516 annually in extra vehicle operating costs. The the average motorist in the Bangor area loses an additional \$375 annually due to driving on deteriorated roads.

**Nearly a third – 30 percent - of bridges in Maine show significant deterioration or do not meet current design standards. This includes all bridges that are 20 feet or more in length.**

- Fourteen percent of Maine’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.
- Sixteen percent of Maine’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.

**Maine’s traffic fatality rate on rural, non-Interstate routes is approximately seven times higher than on all other roads and highways in the state. Improving safety features on Maine’s roads and highways would likely result in a decrease in traffic fatalities and serious crashes in the state. Roadway features are likely a contributing factor in approximately one-third of all fatal and serious traffic crashes.**

- Between 2006 and 2010, a total of 846 people were killed in traffic crashes in Maine, an average of 169 fatalities per year.
- Maine’s overall traffic fatality rate of 1.11 fatalities per 100 million vehicle miles of travel in 2010 is the same rate as the national average.
- The fatality rate on Maine’s rural non-Interstate roads was 1.76 fatalities per 100 vehicle miles of travel in 2010, approximately seven times higher than the 0.25 fatality rate in 2010 on all other roads and highways in the state.
- Several factors are associated with vehicle crashes that result in fatalities, including 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.
- 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.

**The efficiency of Maine’s transportation system, particularly its highways, is critical to the health of the state’s economy. Businesses are increasingly reliant on an efficient and reliable 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, \$31 billion in goods are shipped from sites in Maine and another \$41 billion in goods are shipped to sites in Maine, mostly by truck.
- Eighty-one percent of the goods shipped annually from sites in Maine are carried by trucks and another 13 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.
- Site Selection magazine’s 2010 survey of corporate real estate executives found that transportation infrastructure was the third most important selection factor in site location decisions, behind only work force skills and state and local taxes.

*Sources of information for this report include the Maine Department of Transportation (MaineDOT), the Federal Highway Administration (FHWA), the Bureau of Transportation Statistics (BTS), the U.S. Census Bureau, the Texas Transportation Institute and the National Highway Traffic Safety Administration (NHTSA).*

## **Introduction**

Maine'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. Today, with the state hoping to foster quality of life improvements and economic competitiveness, the modernization of Maine's transportation system is crucial, particularly to critical areas of the state's economy including tourism, agriculture and manufacturing.

As the U.S. and Maine look to rebound from the recent economic downturn, the modernization of the state's transportation system could play an important role in improving Maine's economic wellbeing 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 Maine faces the challenge of preserving and modernizing its transportation system, the future level of federal, state and local highway 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.

This report examines the condition, use and safety of Maine'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 Maine Department of Transportation (MaineDOT), the Federal Highway Administration (FHWA), the U.S. Census Bureau, the Texas Transportation Institute, the Bureau of Transportation Statistics (BTS), and the National Highway Traffic Safety Administration (NHTSA).

## **Population, Travel and Economic Trends in Maine**

Maine residents and businesses require a high level of personal and commercial mobility. Population and economic growth in the state has resulted in an increase in the demand for mobility as well as an increase in vehicle miles of travel (VMT). To foster a high quality of life in Maine, 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, as well as economic development.

Maine's population grew to 1,333,074 in 2010, a nine percent increase since 1990, when the state's population was approximately 1.2 million.<sup>1</sup> Maine has 1,019,738 licensed drivers in the state.<sup>2</sup> From 1990 to 2010, Maine's gross domestic product (GDP), a measure of the state's economic output, increased by 33 percent, when adjusted for inflation.<sup>3</sup>

Population and economic growth in Maine have resulted in an increase in vehicle travel in the state. From 1990 to 2010, annual vehicle miles of travel in Maine increased by 23 percent, from 11.9 billion miles traveled annually to 14.5 billion miles traveled annually.<sup>4</sup> Based on population and other lifestyle trends, TRIP estimates that travel on Maine's roads and highways will increase by another 20 percent by 2030.<sup>5</sup>

### **Condition of Maine's Roads**

The life cycle of Maine's roads is greatly affected by the state's ability to perform timely maintenance and upgrades to ensure that road and highway surfaces last as long as possible. The pavement condition of the state's major roads – generally roads other than neighborhood roads or minor local roads --is evaluated and classified as being in poor, mediocre, fair or good condition.

The 2010 pavement data in this report is provided by the Federal Highway Administration, based on data submitted annually by the Maine Department of Transportation (MaineDOT) on the condition of major state and locally maintained roads and highways in the state.

Throughout the state, approximately one in three miles of major locally or state-maintained roads and highways have deficient pavements, providing motorists with a rough ride.<sup>6</sup> Ten percent of Maine's major roads and highways have pavements rated in poor condition.<sup>7</sup> Another 23 percent of Maine's major roads are rated in mediocre condition, while 23 percent are rated in fair condition and the remaining 44 percent are rated in good condition.<sup>8</sup>

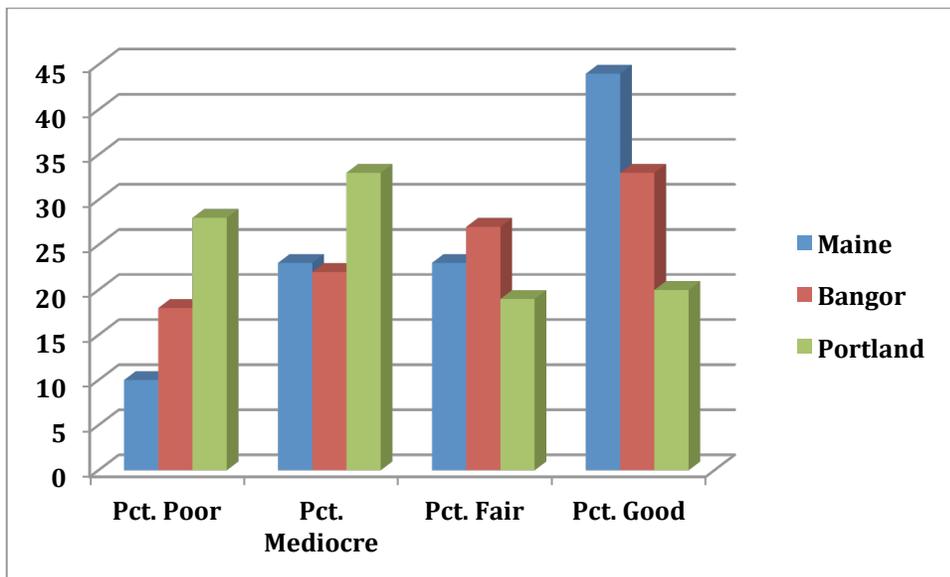
Roads rated poor may show signs of deterioration, including rutting, cracks and potholes. In some cases, poor roads can be resurfaced but often are too deteriorated and must be reconstructed. Roads rated in mediocre condition may show signs of significant wear and may also have some visible pavement distress. Most pavements in fair condition can be repaired by resurfacing, but some may need more extensive reconstruction to return them to good condition.

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.<sup>9</sup> 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.

In the Portland urban area, 28 percent of major roads are rated in poor condition, 33 percent are rated in mediocre condition, 19 percent are rated in fair condition and 20 percent are rated in good condition.<sup>10</sup>

In the Bangor urban area, 18 percent of major urban roads are rated in poor condition, 22 percent are rated in mediocre condition, 27 percent are rated in fair condition and 33 percent are rated in good condition.<sup>11</sup>

**Chart 1. Percentage of Major Roads by Pavement Conditions (2010).**



Source: TRIP analysis of FHWA data

### **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 borne by Maine motorists annually as a result of poor road conditions is \$301 million, or \$299 per motorist.

Driving on rough roads costs the average motorist in the Portland area \$516 annually in extra vehicle operating costs, while the average motorist in the Bangor area loses an additional \$375 annually.

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.<sup>12</sup>

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 2012 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.<sup>13</sup> 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 Maine

Maine'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.

Nearly a third – 30 percent -- of Maine's bridges (20 feet or longer) are currently rated as structurally deficient or functionally obsolete.

Fourteen percent of Maine's bridges (20 feet or longer) are rated as structurally deficient.<sup>14</sup> 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.

Sixteen percent of Maine's bridges are rated functionally obsolete.<sup>15</sup> 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 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 Maine

A total of 846 people were killed in motor vehicle crashes in Maine from 2006 through 2010, an average of 169 fatalities per year.<sup>16</sup>

**Chart 2. Traffic fatalities in Maine from 2006 – 2010.**

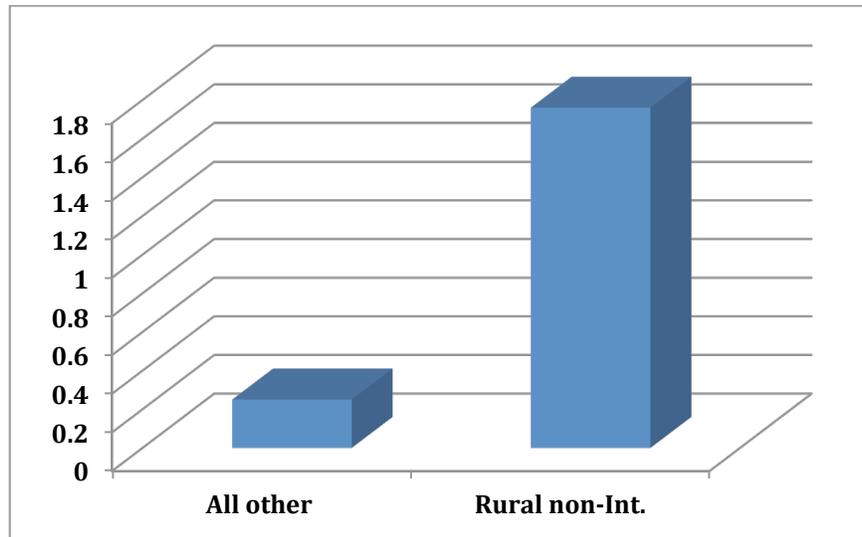
<i>Year</i>	<i>Fatalities</i>
2006	188
2007	183
2008	155
2009	159
2010	161
<b>Total</b>	<b>846</b>

**Source: National Highway Traffic Safety Administration**

Three major factors are associated with fatal vehicle crashes: driver behavior, vehicle characteristics and roadway design. It is estimated that roadway features are a contributing factor in approximately one-third of fatal traffic crashes. Roadway features which 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.

Maine's overall traffic fatality rate of 1.11 fatalities per 100 million vehicle miles of travel in 2010 is the same rate as the national average.<sup>17</sup> But Maine's traffic fatality rate on rural, non-Interstate routes is approximately seven times higher than on all other roads and highways in the state. The fatality rate on Maine's non-Interstate rural roads was 1.76 fatalities per 100 vehicle miles of travel in 2010, approximately seven times higher than the 0.25 fatality rate in 2010 on all other roads and highways in the state.<sup>18</sup> And while 57 percent of vehicles miles of travel in Maine in 2010 occurred on rural, non-Interstate routes, 90 percent of all traffic fatalities in the state in 2010 occurred on rural, non-Interstate roads.<sup>19</sup>

**Chart 3. Traffic Fatality Rate Per 100 Million Vehicle Miles of Travel in Maine on Non-Interstate Rural Roads and on All Other Roads (2010).**



**Source: TRIP analysis of FHWA data**

Improving safety on Maine’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 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 where appropriate.

Roads with poor geometry, with insufficient clear distances, without turn lanes, 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.<sup>20</sup>

### **Importance of Transportation to Economic Growth**

The new culture of business demands that an area have well-maintained and efficient roads, highways and bridges if it is to remain economically competitive. The advent of modern national and global communications and the impact of free trade in North America and elsewhere have resulted in a significant increase in freight movement. Consequently, the quality of a region's transportation system has become 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 by accepting customer orders through the Internet. 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 Maine, particularly to the state's tourism, lumber, agriculture and manufacturing sectors. 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, \$31 billion in goods are shipped from sites in Maine and another \$41 billion in goods are shipped to sites in Maine, mostly by trucks.<sup>21</sup> Eighty-one percent of the goods shipped annually from sites in Maine are carried by trucks and another 13 percent are carried by courier services or multiple-mode deliveries, which include trucking.<sup>22</sup>

### **Maine's Ability to Fund Needed Transportation Improvements**

Maine currently faces a significant funding shortfall over the next decade in the cost of maintaining its transportation system in its current condition. MaineDOT projects that it would need to increase investment by an additional \$150 million annually over the next decade to allow the state to meet legislative goals for improving road and bridge conditions, improving traffic safety and addressing some traffic congestion challenges.<sup>23</sup>

Increasing investment in the state's roads, highways and bridges will also assist the state's economy by creating jobs. A 2007 analysis by the Federal Highway Administration found that every \$1 billion invested in highway construction would support approximately 27,800 jobs, including approximately 9,500 in the construction sector, approximately 4,300 jobs in industries supporting the construction sector, and approximately 14,000 other jobs induced in

non-construction related sectors of the economy.<sup>24</sup>

## **Conclusion**

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

As the nation looks to rebound from the current economic downturn, 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 Maine'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.

But without a substantial boost in federal, state and local highway funding, numerous projects to improve the condition and expand the capacity of Maine's roads, highways and bridges will not be able to proceed, hampering the state's ability to improve the condition of its transportation system and to enhance economic development opportunities in the state.

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## Endnotes

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- <sup>1</sup> U.S. Census Bureau (2011).
- <sup>2</sup> Highway Statistics (2010). Federal Highway Administration. DL-1C
- <sup>3</sup> TRIP analysis of Bureau of Economic Analysis data.
- <sup>4</sup> U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 1990 and 2010.
- <sup>5</sup> TRIP calculation based on U.S. Census and Federal Highway Administration data.
- <sup>6</sup> Federal Highway Administration (2012). Data provided in response to a TRIP request.
- <sup>7</sup> Ibid.
- <sup>8</sup> Ibid.
- <sup>9</sup> Selecting a Preventative Maintenance Treatment for Flexible Pavements. R. Hicks, J. Moulthrop. Transportation Research Board. 1999. Figure 1.
- <sup>10</sup> Ibid.
- <sup>11</sup> Ibid.
- <sup>12</sup> Highway Development and Management: Volume Seven. Modeling Road User and Environmental Effects in HDM-4. Bennett, C. and Greenwood, I. 2000.
- <sup>13</sup> Your Driving Costs. American Automobile Association. 2012.
- <sup>14</sup> Federal Highway Administration (2012). National Bridge Inventory.
- <sup>15</sup> Ibid.
- <sup>16</sup> TRIP analysis of National Highway Traffic Safety Administration data (2012).
- <sup>17</sup> TRIP analysis of National Highway Traffic Safety Administration and Federal Highway Administration data (2012).
- <sup>18</sup> Ibid.
- <sup>19</sup> Ibid.
- <sup>20</sup> Adding Highway Shoulders, Width, Reduce Crash Numbers and Save Lives (August 9, 2012). Texas Department of Transportation.
- <sup>21</sup> 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/](http://www.bts.gov/publications/commodity_flow_survey/2007/states/)
- <sup>22</sup> Ibid.
- <sup>23</sup> MaineDOT (2012).
- <sup>24</sup> Federal Highway Administration, 2008. Employment Impacts of Highway Infrastructure Investment.