EXTRA VEHICLE OPERATING COSTS: WHAT MOTORISTS PAY TO DRIVE ON ROADS IN NEED OF REPAIR

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Founded in 1971, TRIP is a non-profit organization that researches, evaluates and distributes economic and technical data on highway transportation issues.

Executive Summary

With the advent of spring, states are beginning to assess the damage to their roads caused by a winter that, in many regions of the country, was more severe than recent winters. Potholes are the most visible forms of road deterioration at this time of year, occurring often with the arrival of spring and the freeze/thaw process associated with the seasonal transition. Potholes and other forms of pavement damage have a price tag that must be paid each spring: in addition to the funds states allocate to pay for road repair each year, driving on roads in need of repair or improvement costs motorists billions in additional vehicle operating costs.

This report examines these additional costs on a national and state-by-state basis, the variables involved in the calculation of these costs, pavement condition trends and new techniques and materials used in road repair.

Driving on roads in need of repair or improvement costs American motorists an average of $222 annually each in extra vehicle operating costs -- $41.5 billion total.

- Pavement conditions are the single most important factor in determining extra vehicle operating costs. The amount of vehicle travel per driver is a secondary factor in the calculation of extra vehicle operating costs.
- More than one-fourth, or 28 percent, of major roads in the country are in need of repair or improvement.
- Nine percent of major roads are in poor condition and 19 percent are in mediocre condition.
- Because of additional state and federal funding for highway transportation, there has been some improvement in pavement conditions in recent years.
- New Mexican drivers pay the most in the nation, at $432 per motorist annually. Drivers in Missouri pay $388, in Louisiana, $387, in California, $354 and in Oklahoma, $351.

The timing and quality of the maintenance and rehabilitation of road surfaces is critical, affecting the cost-effectiveness of the repairs and ultimately the overall quality of a regional road network.

- If pavements can be resurfaced while still in fair condition, repairs generally cost about one-fourth the cost of repairing roads in poor condition, reducing the overall life cycle costs of that road.

- When roads need to be resurfaced or reconstructed it is desirable that these repairs are as long lasting as possible. States are increasingly using new engineering techniques and new pavement mixes to achieve more durable road surfaces.

A recently released government report, "Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities," by the Bureau of Transportation Statistics and the Federal Highway Administration (FHWA), found significant public support for the use of more durable paving materials in the resurfacing of roads.

- The use of durable paving materials was the top choice cited by motorists when asked about preferred transportation improvements to combat traffic delays.

- The next four most popular choices are: making repairs during non-rush hours; reducing repair time; improving traffic signal timing; clearing accidents quickly; and creating more travel lanes

Introduction

With the advent of spring, states are beginning to assess the damage to their roads caused by a winter that, in many regions of the country, was more severe than recent winters. Potholes are the most visible forms of road deterioration at this time of year, occurring often with the arrival of spring and the freeze/thaw process associated with the seasonal transition. Potholes and other forms of pavement damage have a price tag that must be paid each spring: in addition to the funds states allocate to pay for road repair each year, driving on roads in need of repair or improvement costs motorists billions in additional vehicle operating costs.

The timing of the maintenance and rehabilitation of road surfaces is critical, affecting the cost-effectiveness of the repairs and ultimately the overall quality of a regional road network. Also, more durable pavement mixes have begun to be introduced, a trend supported by a majority of motorists.

This report examines these additional costs on a national and state-by-state basis, the variables involved in the calculation of these costs, pavement condition trends and new techniques and materials used in road repair.

The report is based on TRIP's analysis of Federal Highway Administration (FHWA) data.

Pavement Conditions

A substantial portion of our nation's road system requires immediate repair or improvement – more than one-fourth, or 28 percent, of the nation's major roads are in poor and mediocre condition. Nine percent of the country's major roads are in poor condition and 19 percent are in mediocre condition. Roads rated poor are badly cracked or broken. In some cases, poor roads can be resurfaced, but often are too deteriorated and must be reconstructed. Roads rated in mediocre condition may show defects such as rutting and extensive patching and have riding qualities that are noticeably inferior to those of new pavements and may need more than resurfacing to return them to good condition.

While additional funding at the state and federal levels in recent years helped improve pavement conditions, there is still significant road deterioration nationwide. In 1995, 12 percent of major roads were in poor condition and 26 percent were in mediocre condition.

Why Roads Deteriorate

Cracks, ruts and potholes are the most obvious and costly examples of road deterioration, yet these visible signs actually represent the final stage in a process of deterioration. The primary agents in this process of deterioration are traffic and moisture.

Moisture from rain or snow often works its way into road surfaces and the soil underneath the roads. Heavy traffic, particularly from heavier vehicles, puts stress on the road surface, increasing the likelihood that cracks or potholes may form. This process is enhanced during periods of freezing and thawing, which peak in the late-winter and early spring,

expanding and contracting road surfaces, which increases the likelihood of pavement failure. 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.

Strategies to Make Roads Longer-Lasting

The timing of the maintenance and rehabilitation of road surfaces is critical, affecting the cost-effectiveness of the repairs and ultimately the overall quality of a regional road network. The wear-out rates of pavement surfaces are generally predictable, based on local climate and the level and mix of traffic carried. Most new pavement surfaces usually decline to fair condition between eight to ten years. After that point, their deterioration accelerates and road surfaces usually fall into poor condition at between 12 and 14 years. If pavements can be resurfaced while still in fair condition, repairs generally cost about one-fourth the cost of repairing roads in poor condition, reducing the overall life cycle costs of that road. Thus it is critical that pavement surfaces be rehabilitated while still in fair condition.

When roads need to be resurfaced or reconstructed it is desirable that these repairs are as long lasting as possible. States are increasingly using new engineering techniques and new pavement mixes to achieve more durable road surfaces. The new high-performance pavement technique includes making sure that the pavement mix is designed specifically for climate and traffic conditions of a particular road. FHWA reports that the percentage of state road construction projects using high-performance paving techniques increased from 4 percent in 1997 to 41 percent in 1999 and is expected to increase to 82 percent this year.

Another option that states including Illinois, New York and Washington have applied on some major highways is to build them to longer design standards by building them with thicker surfaces, deeper sub-bases below the road surface and improved drainage. While the construction or reconstruction process based on longer design standards is typically twice as costly as building roads to shorter design standards, for busier highways the use of a longer design standard may prove more cost effective by postponing the need for congestion causing reconstruction.

The Best Way to Repair Potholes

When patching a pothole, care should be taken to insure that the repair lasts as long as possible to delay the need to again divert traffic while the road is repaired. Inadequate pothole repairs quickly show signs of dishing, cracking or fail completely, creating the need for repeated repairs, causing continued traffic delays.

The Federal Highway Administration (FHWA) has published a study of a variety of pothole repair techniques to determine the best solution. The study, “Long-Term Monitoring of Pavement Maintenance Materials Test Sites,” was based on assessing 1,250 pothole patches at eight locations under varying weather conditions over a four-year period. The study found that 56 percent of the repairs were still functioning by the end of the study period. The report also found that the most critical issue in pothole repair is the quality of the materials used to fill in the pothole. “The cost of patching the same potholes over and over because of poor-quality patching material quickly offsets any savings form the purchases of less expensive mix,” the FHWA report concluded. Higher grades of pothole patching material typically have aggregate mixes that are less susceptible to moisture damage and are more durable.

Other key variables impacting the effectiveness of pothole repair include adequate compaction of pothole fill material following the repair, the preparation of the site for repair by removing loose material and underlying moisture and the subsequent levels of precipitation at the location and the amount of and vehicle mix of traffic on the road.

Public Support for More Durable Roads

A recently released government report found significant public support for the use of more durable paving materials in the resurfacing of roads. The use of durable paving materials was the top choice cited by motorists when asked about preferred transportation improvements to combat traffic delays. The report, “Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities,” shows that more than 60 percent of drivers favor using more durable paving materials. The next four most popular choices are: making repairs during non-rush hours; reducing repair time; improving traffic signal timing; clearing accidents quickly; and creating more travel lanes.

The report is a compilation of several nationwide surveys conducted by the Bureau of Transportation Statistics and FHWA. During the surveys, respondents were asked questions dealing with topics ranging from condition of highways to traffic congestion and on how well they thought highways serve communities.

Extra Vehicle Operating Costs

Driving on roads in need of repair and improvement cost motorists extra vehicle operating costs (EVOC). Road conditions play a significant role in determining the level of costs motorists must pay nationally and on a state-by-state basis. These costs also vary depending on the average amount of vehicle travel in each state. For example, motorists in rural and Western states typically drive greater distances on average per year than motorists in other states.

Nationally, motorists pay $222 each in extra vehicle operating costs per year – or $41.5 billion. New Mexico leads the country in extra vehicle operating costs per driver at $432, followed by Missouri, $388, Louisiana, $387, California, $354 and Oklahoma, $351.

Chart 1: Extra Vehicle Operating Costs, National and State-by-State Comparison

State	Total Extra Vehicle Operating Costs Per Motorist	Total Extra VOC (in millions)
Alabama	$ 91	$ 313
Alaska	$ 177	$ 81
Arizona	$ 119	$ 392
Arkansas	$ 325	$ 626
California	$ 354	$ 7,369
Colorado	$ 215	$ 643
Connecticut	$ 268	$ 637
Delaware	$ 247	$ 136
Dist. of Columbia	$ 273	$ 95
Florida	$ 53	$ 662
Georgia	$ 23	$ 124
Hawaii	$ 151	$ 114
Idaho	$ 193	$ 168
Illinois	$ 224	$ 1,779
Indiana	$ 236	$ 912
Iowa	$ 275	$ 532
Kansas	$ 133	$ 253
Kentucky	$ 192	$ 511

Louisiana	$	387	$	1,069
Maine	$	165	$	150
Maryland	$	278	$	887
Massachusetts	$	254	$	1,124
Michigan	$	259	$	1,779
Minnesota	$	148	$	430
Mississippi	$	278	$	498
Missouri	$	388	$	1,488
Montana	$	152	$	100
Nebraska	$	230	$	276
Nevada	$	160	$	212
New Hampshire	$	174	$	159
New Jersey	$	245	$	1,359
New Mexico	$	432	$	527
New York	$	218	$	2,315
North Carolina	$	259	$	1,423
North Dakota	$	107	$	49
Ohio	$	153	$	1,228
Oklahoma	$	351	$	812
Oregon	$	277	$	683
Pennsylvania	$	219	$	1,858
Rhode Island	$	201	$	139
South Carolina	$	178	$	501
South Dakota	$	325	$	177
Tennessee	$	157	$	656
Texas	$	251	$	3,349
Utah	$	192	$	276
Vermont	$	297	$	147
Virginia	$	275	$	1,300
Washington	$	116	$	479
West Virginia	$	240	$	306
Wisconsin	$	319	$	1,189
Wyoming	$	101	$	37
United States	$	222	$	41,518

Source: The Road Information Program

Chart 2: Top 10 States in Extra Vehicle Costs per Driver

State	Total Extra Vehicle Operating Costs Per Motorist
New Mexico	$ 432
Missouri	$ 388
Louisiana	$ 387
California	$ 354
Oklahoma	$ 351
South Dakota	$ 325
Arkansas	$ 325
Wisconsin	$ 319
Vermont	$ 297
Mississippi	$ 278
United States	$ 222

Source: The Road Information Program

Vehicle Operating Costs: Explanation of Methodology

Extra vehicle operating costs are based on vehicle travel occurring on roads that are in poor, mediocre and fair condition.

Extra 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.

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 extra vehicle operating cost estimate is based on taking the average number of miles driven annually by a region's driver, calculating current vehicle operating costs based on the Automobile Association of America's 2000 vehicle operating costs and then using the HDM model to estimate the extra vehicle operating costs being paid by drivers as a result of substandard roads. Additional research on the impact of road conditions on fuel consumption by the Texas Transportation Institute is also factored into the TRIP vehicle operating cost methodology.

Conclusion

Driving on roads in need of repair and improvement is costly for American drivers, who pay an additional $222 annually in vehicle operating costs because of bad roads. Pavement conditions are the most significant factor in the calculation of extra vehicle operating costs and more than one-fourth of the country's major roads are in poor and mediocre condition.

It is important to resurface a road before it deteriorates to the point when it requires reconstruction because it costs four times as much to repair a road in poor condition than a road in fair condition. In addition, states are starting to utilize more durable pavement mixes designed to last longer and be more cost-effective, a practice most Americans support, according to a new national survey.