Center for American Progress

Advancing a Multimodal Transportation System by Eliminating Funding Restrictions

By Kevin DeGood and Andrew Schwartz

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Introduction and summary

Most of our assumptions have outlived their uselessness.–Marshall McLuhan[1]

One of the most pervasive, durable, and detrimental myths in transportation policy is that highways pay for themselves, while public transportation does not. In reality, both modes require significant public subsidies, as user fees—such as fuel taxes and farebox revenues—cover only a portion of total costs. States and the federal government supplement these user fees with property taxes, bonding, and general revenues. On average, these nonuser fee revenues represent 26 percent of total annual highway expenditures.[2]

Moreover, treating all highways equally obscures the fact that per-mile construction and maintenance costs, driving levels, and motor fuel tax revenues vary substantially depending on the location, size, and population around a particular road. While the overwhelming majority of driving occurs within metropolitan areas, many large urban highways and arterial roads cost substantially more money to maintain than they generate in fuel taxes. This is also true of many rural and exurban arterial roads. This means that states must cross subsidize thousands of miles of roads that generate insufficient gas tax revenues each year.

Research by the Center for American Progress shows that nearly 4 in 10 miles of interstate highway and other principal arterial roadways fail to generate enough in user fees to cover their long-term maintenance costs. For the purposes of this analysis, maintenance costs include one reconstruction and multiple resurfacings over the course of three decades while excluding the costs of land acquisition, engineering, construction, and inflation.

When the analysis is conducted assuming 1 percent annual inflation, the share of interstate and other principal arterial roadways that fail to cover their costs rises by more than 22,000 miles, or 9 percent. In all likelihood, actual construction inflation will be much higher than 1 percent per year over the next 30 years. Furthermore, if land acquisition and construction expenses were amortized over the same period, an even higher share of roadways would fail to cover their costs.

This research also strongly suggests that an even higher share of minor arterial roadways, collectors, and other local roads fail to cover their long-term costs. A disproportionately large percentage of driving occurs on interstates and principal arterials—which make up the National Highway System, or NHS—relative to the rest of the roadway network. Data from the U.S. Department of Transportation's Federal Highway Administration shows that the NHS accounts for only 5.5 percent of all roadway miles yet carries 55 percent of all vehicle miles traveled, or VMT, each year.[3] As a result, the remaining 94 percent of the system generates much less user fee revenue on a per-mile basis, since it carries less than half of all driving.

TABLE 1

Fiscal performance of interstates and principal arterials

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	5,340	44%	2,054	17%	4,643	39%
Urban areas, between 200,000 and 1 million residents	6,125	23%	3,973	15%	17,027	63%
Urban areas, between 50,000 and 200,000 residents	43,286	47%	11,178	12%	37,893	41%
Urban subtotal	54,752	42%	17,205	13%	59,564	45%
Rural subtotal	34,979	35%	10,764	11%	55,338	55%
National total	**89,731**	**39%**	**27,968**	**12%**	**114,903**	**49%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

TABLE 2

Fiscal performance of interstates and principal arterials including inflation

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	7,672	64%	1,750	15%	2,616	22%
Urban areas, between 200,000 and 1 million residents	9,295	34%	5,366	20%	12,463	46%
Urban areas, between 50,000 and 200,000 residents	50,816	55%	11,353	12%	30,190	33%
Urban subtotal	67,783	51%	18,469	14%	45,269	34%
Rural subtotal	44,523	44%	11,722	12%	44,836	44%
National total	**112,306**	**48%**	**30,191**	**13%**	**90,105**	**39%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

States and the federal government fund a substantial portion of their transportation expenditures by taxing the sale of gasoline and diesel fuel. Highway proponents have successfully enacted prohibitions against using fuel tax revenues to support public transportation and other multimodal projects in 30 states.[4] At the federal level, there is an unofficial rule that no more than 20 percent of fuel tax revenue can support public transportation, also referred to as transit.[5] These prohibitions and unofficial limits hamper the ability of states and metropolitan regions to effectively plan for future needs, as many worthwhile transit and multimodal projects languish due to a lack of funds.

Highway boosters have exploited the myth of self-sufficiency to argue that fuel tax revenue should only fund highway and bridge projects. In effect, highway boosters argue that the source of the money should determine what that money builds. This approach misses that, in many urban areas, transit, passenger rail, or other multimodal projects are the most effective means of achieving an efficient, economically productive, equitable, and environmentally sustainable transportation system. While a roadway may produce an important share of transportation tax revenues, additional roadway construction may not be the most appropriate mobility solution. In short, objective measures of transportation system needs should determine transportation priorities regardless of the source of funds.

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In addition to the myth of highway user fee self-sufficiency, funding restrictions are predicated on the false notion that public transportation riders do not pay gas taxes and therefore do not pay into the system. The primary issue is the assumption that people who ride transit never drive. In fact, the vast majority of transit riders does indeed drive and, as a result, pays motor fuel taxes. A recent national survey by the American Public Transportation Association found that 82 percent of transit riders live in a household with a car.[6] Of those transit riders with access to a car, 87 percent used the vehicle more than three times per week.[7] As this research shows, driving and public transportation are complementary, with residents paying into the system that allows them the flexibility to choose the mode of transportation that meets their needs for any given trip.

Beyond the issue of funding, transit provides significant benefits for people who exclusively drive, as public transportation lowers roadway congestion.[8] In the absence of transit service, riders would be forced to drive for all trips, adding vehicles to the network during the peak periods of travel demand—the morning and the evening. Research by Texas A&M University shows that if transit services were stopped in the top 10 largest metropolitan regions, it would increase roadway delay by 677 million hours each year.[9] Yet prohibitions on the use of gas taxes to fund public transit mean that metropolitan and state transportation authorities are often denied the ability to implement a balanced surface transportation system capable of delivering the most benefits to residents and businesses.

The negative consequences of funding restrictions are especially harmful in metropolitan areas with growing roadway congestion. Research shows that total hours of roadway delay in urban areas increased by 400 percent from 1982 to 2011.[10] Yet state and local planners are often prevented from using user fee revenues, overwhelmingly generated by urban drivers, to improve the transportation system through balanced investment.

Data from the Federal Highway Administration show that 67 percent of all VMT—or 1.9 trillion miles annually—occurs within urban areas.[11] Urban drivers generate nearly $7 out of every $10 in user fees, but they face counterproductive restrictions regarding how those funds may be used. States and metropolitan regions should have the flexibility to implement needed transportation projects regardless of the source of funding.

The U.S. surface transportation system is a complex mix of different modes, including highways, intercity passenger rail, public transportation, freight rail, and intermodal connections that allow freight to flow from ship to train and from train to truck. Funding restrictions at the state and federal levels represent a major barrier to successfully planning and implementing an efficient, equitable, sustainable, and globally competitive transportation system.

Reforming surface transportation will require changes at the federal and state levels. Specifically, Congress should establish a multimodal account within the Highway Trust Fund to provide funding for highway, transit, passenger and freight rail, port development, and intermodal facilities, among other projects. Funding from this multimodal account should be distributed through a competitive program administered by the Department of Transportation's Office of the Secretary. In addition, states should be given the flexibility to use any portion of their federal highway funds for any project category eligible under the multimodal program.

TABLE 3

Annual hours of additional roadway delay if transit service ended

Metro region	Hours
New York	440,647,000
Chicago	67,432,000
Boston	37,943,000
Washington	33,810,000
Los Angeles	32,345,000
Philadelphia	30,167,000
Miami	11,589,000
Atlanta	10,520,000
Houston	6,733,000
Dallas-Fort Worth	6,292,000
Total	**677,478,000**

Source: David Schrank, Bill Eisele, and Tim Lomax, "Urban Mobility Report 2012" (College Station, TX: Texas A&M Transportation Institute, 2012), available at http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/mobility-report-2012.pdf.

At the state level, legislatures should repeal any statutory or state constitutional prohibitions that prevent the use of motor fuel taxes or other user fees for projects other than highways. Once these restrictions have been lifted, states should require their respective transportation departments to engage in scenario planning based upon achieving objectives and quantifiable system performance goals.

Taken together, increased funding flexibility from Congress and state legislatures and goal-driven scenario planning will allow transportation agencies to implement a truly multimodal, integrated, and balanced system.

Need for multimodal investments and flexibility

Following the end of World War II, the U.S. economy and population expanded rapidly. Yet existing highway infrastructure was inadequate to meet the need for efficient long-distance travel and land development around cities. Originally, early road funds from the federal government flowed through the U.S. Department of Agriculture. Later, they flowed through the U.S. Department of Commerce.[12] While important, this modest funding did not represent a national investment program.

In 1956, then-President Dwight D. Eisenhower signed into law the Federal-Aid Highway Act, which established the Highway Trust Fund and created a program to build the interstate highway system.[13] The initial focus of the federal surface transportation program was highway development. The Federal-Aid Highway Act of 1956 and subsequent authorizations succeeded in providing seamless and efficient connections between urban areas, while also supporting rural communities with better farm-to-market roads.

However, the narrow focus of the program addressed only part of the country's transportation needs, leaving out mass transit and other multimodal priorities. In 1982, then-President Ronald Reagan signed into law the Surface Transportation Assistance Act.[14] The legislation expanded the mandate of the Highway Trust Fund by establishing the Mass Transit Account to provide dedicated funding in support of transit operation, as well as capital needs.[15]

The time has come to once again expand the mandate of the Highway Trust Fund to include a third multimodal account to support surface transportation projects currently excluded from the federal program, as well as major highway and transit capital projects. The Surface Transportation Assistance Act of 1982 recognized the shortcoming of only providing dedicated funding for highway construction and maintenance. Similarly, a new multimodal account would recognize the shortcoming of excluding freight and passenger rail, port development, and other multimodal projects.

In addition to these excluded project categories, a new multimodal account should support major highway and transit capital projects that are too large for a state or metropolitan region to complete using annual formula funds. The core highway and transit formula programs, which account for 95 percent of all federal surface transportation outlays, are a vital source of funds to complete thousands of projects each year.[16] On average, states have more than 2,300 active highway and transit projects receiving trust fund support at any given time.[17] The vast majority of these projects are modest in scope and cost. These projects are essential to the ongoing maintenance and incremental improvement of our roadway and transit systems. However, these funds are often inadequate to address larger capital needs. A single large highway or transit project with regional or national significance could easily consume a state's entire allocation for multiple years, displacing thousands of smaller projects as a result.

Defining the roadway network

The federal government measures the roadway system in terms of centerline miles and lane miles. Centerline miles measure system length, and lane miles measure capacity by multiplying the roadway length by the number of lanes in each direction. For instance, a roadway that connects two cities 10 miles apart with four travel lanes in each direction is said to have 10 centerline miles and 80 lane miles. This report presents data in terms of centerline miles, and all shorthand references to "miles" denote centerline miles. In addition, roadways are classified by their purpose and design characteristics. Limited-access highways and other roadways designed to move vehicles at high speeds are classified as major arterial roadways. Major arterials include the interstate highway system, freeways and expressways, and other high-speed signalized roadways. These facilities make up the National Highway System. This paper will use the terms "arterial roadway" and "NHS" interchangeably to refer to all major arterial roads.

In many ways, a new multimodal program would function as a much larger version of the Transportation Investment Generating Economic Recovery, or TIGER, grant program. Created as part of the American Recovery and Reinvestment Act of 2009 and continued by Congress in subsequent years, the TIGER program functions as a competitive grant program that supports surface transportation projects regardless of mode. A multimodal account would provide funding for a competitive program that would build on the best aspects of the TIGER program, with the added benefit of providing dedicated funding not subject to annual appropriations. In short, expanding the types of projects covered by the Highway Trust Fund would ensure a truly comprehensive and balanced federal program capable of making the types of investments needed to advance the nation's 21st century economy.

Beyond providing grant funding for a competitive multimodal program, the next surface transportation authorization bill should substantially expand the flexibility of states and metropolitan regions to use their annual highway formula dollars as they see fit. Currently, states and metropolitan regions have the flexibility to use highway funds allocated under the Surface Transportation Program, or STP, for either a roadway or transit capital projects. While beneficial, this practice continues to limit the project selection decisions of states and regions. The flexibility should be extended to any project eligible under the multimodal program. Under this approach, a state or region could use its formula funds for surface transportation projects, including passenger and freight rail, port access, and multimodal facilities, among others.

Moreover, the STP represents only 26 percent of annual formula funds.[18] The expanded flexibility should also apply to the National Highway Performance Program, or NHPP, and the Railway-Highway Crossing Program. Taken together, these three programs account for more than 80 percent of formula funds, allowing states both the flexibility and the dollar volumes necessary to make substantial multimodal investments as needed.[19]

Finally, these funding reforms point to a more comprehensive role for the federal government in surface transportation. The language used to describe that role is important and should reflect the scope of the program. The Highway Trust Fund received its name as part of the Federal-Aid Highway Act of 1956. At the time, the name reflected the fact that the federal government made investments exclusively focused on highways. Renaming the Highway Trust Fund the Transportation Trust Fund would mirror the comprehensive nature of the restructured federal program.

Future growth and investment needs

Since the Highway Trust Fund was last reformed in 1982, the U.S. population has grown by 76 percent, from 226 million to 315 million people.[20] Over the next 50 years, the U.S. population will grow by approximately 100 million people.[21] With this population growth will come more than 85 million additional commercial and light-duty vehicles, increasing travel demand and stress on the transportation system.[22] Moreover, this travel demand will not be distributed evenly. In fact, growth will overwhelmingly occur within metropolitan regions. More than 80 percent of Americans live in urban areas, and urban populations are growing 25 percent faster than rural populations.[23]

This has important implications for transportation policy because growing urban congestion requires a broad mix of investments to efficiently move both people and freight. The need for more transit, passenger and freight rail, and intermodal projects reflects both the severe constraints facing highway expansion and economic research that shows a precipitous decline in return on investment from additional highway expansion. Initial highway investments following the Federal-Aid Highway Act of 1956 and subsequent legislation produced substantial economic returns. This productivity surge stemmed from the dramatic efficiency gains offered by major highways compared with the existing roadway network. Yet further investments have produced only marginal additional economic benefits, since the vast majority of the efficiency gains have already been realized.[24]

Moreover, dense urban development patterns often make right-of-way acquisition and property condemnation prohibitively expensive and politically challenging. In the abstract, the American public often supports highway expansion. However, this tentative support regularly switches to hostile opposition when the reality of bulldozing homes and businesses becomes apparent. For this reason, highway expansion tends to occur at the periphery of metropolitan regions where costs and population densities are lower. Expansion on the periphery does little to nothing to reduce economically damaging congestion in the rest of the region. These cost and political realities are reflected by the fact that while the numbers of registered vehicles and total miles driven have increased exponentially in recent decades, the roadway network has only grown modestly.

TABLE 4

Changes in population, travel, and system capacity

	1960	1980	2012	Percent change 1960–2012
Population	180 million	226.5 million	315 million	76%
Registered vehicles	74.4 million	161.5 million	253 million	240%
Vehicle miles traveled	718 billion	1.5 trillion	2.9 trillion	313%
Centerline miles	3.5 million	3.8 million	4.1 million	15%
Lane miles	-	7.9 million	8.6 million	8.6%

Source: Bureau of the Census, "Historical National Population Estimates: July 1, 1900 to July 1, 1999," available at https://www.census.gov/popest/data/national/totals/pre-1980/tables/popclockest.txt (last accessed October 2014); Bureau of the Census, *Table 1. Monthly Population Estimates for the United States: April 1, 2010 to November 1, 2013* (U.S. Department of Commerce, 2013), available at http://www.census.gov/popest/data/state/totals/2012/tables/NA-EST2012-01.xls; Bureau of Transportation Statistics, *Table 1-11: Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances* (U.S. Department of Transportation), available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/table_01_11.xlsx; Federal Highway Administration, *Public Road Mileage - VMT - Lane Miles 1920 - 2012* (U.S. Department of Transportation, 2012), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/xls/vmt421c.xls.

The lack of balanced investments combined with the rapid growth in travel demand has dramatically increased congestion. Between 1982 and 2011, total hours of roadway delay in urban areas increased by 400 percent.[25] Each year, congestion costs the economy $120 billion in lost productivity and wasted fuel.[26] Continuing to focus limited transportation funds disproportionately on highway investments that provide marginal returns will only exacerbate this economic cost.[27]

This is especially troubling for the freight sector and for businesses that rely on international trade, a global supply chain, and just-in-time delivery. As a share of our gross domestic product, trade accounted for less than 10 percent of economic activity in 1960.[28] Today, trade accounts for more than 20 percent of economic activity each year, or $3.2 trillion.[29] This share will continue to rise in the coming decades, as international freight shipments are projected to grow by 3.4 percent each year.[30] Research from the Federal Highway Administration shows that over the next 30 years, truck freight will increase by 65 percent, reaching more than 18 billion tons annually.[31]

Business-as-usual transportation investments will not be sufficient to accommodate and support this expected growth. States and the federal government must make diverse investments to more efficiently, equitably, and sustainably move people and goods.

Multimodal best practices

The lack of funding flexibility and the historic imbalance in the federal program have left many beneficial transportation projects on the shelf to collect dust. The following examples represent best practices and the kinds of projects that a multimodal account and greater programmatic flexibility would fund.

Alameda Corridor

The ports of Los Angeles and Long Beach, California, make up the busiest port complex in the United States, handling 14.5 million twenty-foot equivalent unit containers, or TEUs, annually, with a value well in excess of $300 billion.[32] The port plays a significant role in the regional economy, accounting for 1 out of every 15 jobs in Southern California.[33] Yet this economic productivity comes at a price. The busy port complex generates a substantial amount of rail and truck traffic. Prior to the completion of the Alameda Corridor, long freight trains traveling at grade—meaning that they traveled on tracks that intersected with local streets—caused lengthy delays to the roadway network dozens of times per day.[34] In effect, transportation bottlenecks exterior to the port threatened to limit its ability to grow and remain competitive in the long term.

The Alameda Corridor is a 20-mile-long railroad trench that separates freight trains from street traffic, linking the port complex to the transcontinental rail network near downtown Los Angeles. The trench removed more than 200 at-grade crossings.[35] Today, the corridor carriers a staggering 16,500 trains per year, dramatically reducing roadway congestion, noise, and pollution from idling vehicles.[36]

The $2.4 billion project was financed through a combination of $400 million in government grant funding and $2 billion in revenue bonds to be repaid with container fees paid by the railroads and collected by the Alameda Corridor Transportation Authority. As of January 1, 2014, rail carriers must pay $22.58 for each loaded TEU; $5.41 for each TEU returning empty; and $10.82 for other types of rail cars, such as tankers.[37] The project involved 1,280 construction jobs for local residents, including 637 workers placed in union apprenticeships.[38]

Each day, the Alameda Corridor carries approximately 45 trains and 13,000 TEUs.[39] The congestion and environmental benefits from the corridor project are substantial. A single train eliminates the equivalent of between 250 and 280 trucks.[40] This translates into the removal of between 4.3 million and 4.9 million truck trips from the port each year.[41]

Alameda Corridor Rail Trench

Alameda Corridor Connection with Transcontinental Rail Yard

Photos courtesy of the Alameda Corridor Transportation Authority.

Hudson River tunnel

The Northeast Corridor rail line, which stretches from Boston, Massachusetts, to Washington, D.C., is the busiest rail line in the United States. One of the most critical and overburdened sections is the Hudson River tunnels—also known as the North River Tunnels—that connect New York City's Lower Manhattan with Jersey City, New Jersey. The tunnels are more than 100 years old and in need of replacement. Recently, the CEO of Amtrak stated that the existing tunnels have as little as 20 years of useful life remaining before one or both will have to be shut down permanently.[42] Losing one or both tunnels would have substantial negative transportation and economic consequences. The tunnels operate at capacity during the morning and evening peak periods, moving 23 trains through per hour.[43] The timing of service is so tight that a single 15-minute disruption can affect 15 commuter and passenger rail trains.[44]

Beginning in the 1990s, planners studied more than 100 different project alternatives to determine the most effective way to meet future travel demand.[45] The analysis showed that the most effective solution was to construct two new tunnels under the Hudson River to expand rail access between New York and New Jersey.

The new tunnels would more than double the number of trains per hour—increasing capacity from 23 to 48—and eliminate more than 32,000 daily transfers.[46] In addition, the expanded service would reduce commute times by an average of 23 minutes. The new tunnels would also eliminate approximately 22,000 automobile trips and 590,000 miles of driving every day—a significant benefit to drivers who already face heavily congested roadways.[47] In short, the new tunnels would provide the transportation access necessary to allow the region to grow for decades to come.

Chicago freight rail

For nearly 150 years, the Chicago region has served as a hub for national freight and passenger rail traffic. In fact, one-quarter of all freight rail traffic—37,500 rail cars each day—flows through the Chicago region.[48] The extensive rail network suffers from bottlenecks and numerous conflict points with local roadways, causing significant delays that add environmental pollution from idling vehicles and reduce productivity. In fact, the average rail car requires almost 30 hours to travel through the Chicago area.[49]

The Chicago Region Environmental and Transportation Efficiency program, or CREATE, is a series of infrastructure improvements designed to considerably improve freight and passenger rail travel times in the Chicago metropolitan area. The program represents a unique partnership that includes the state of Illinois, the city of Chicago, the commuter rail operator Metra, Amtrak, and the U.S. Department of Transportation.[50] The CREATE program consists of 70 projects, including 25 road-rail grade separations; six rail-rail grade separations; and 36 other improvements to tracks, switches, and signal systems.

Once the CREATE program is completed, area residents will save approximately 3,800 hours each day—hours they currently spend idling as trains pass.[51] The improved efficiency for freight trains and the reduced wait times for trucks will save 3.4 million gallons of diesel fuel each year.[52] This includes reductions of 36,000 metric tons of carbon dioxide, 155 metric tons of nitrogen oxide, and 5 metric tons of particulate matter.[53] Finally, the Chicago region relies heavily on commuter rail and passenger rail operations, with Metra serving 36 million riders and Amtrak serving more than 2.6 million. The CREATE program will reduce total annual delay for Metra and Amtrak riders by a projected 817,000 hours.[54]

CREATE Program Project Map

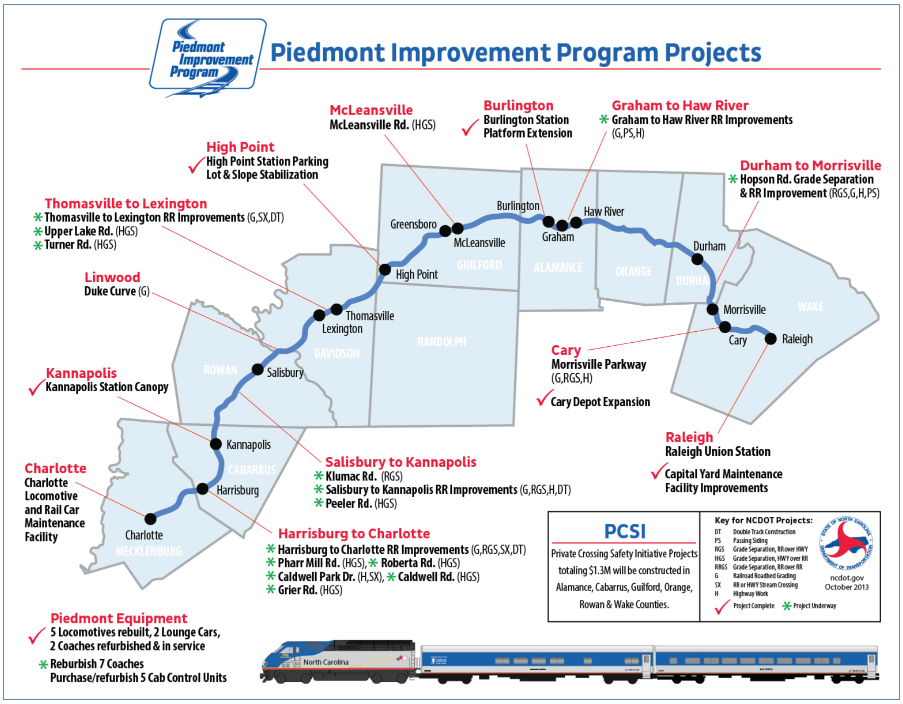
Rendering courtesy of the Chicago Department of Transportation.

The CREATE program has a total estimated cost of $3.8 billion.[55] To date, the program has received $1.2 billion, with 22 projects waiting for funding.[56] Yet this incredibly important program of projects has received only $339 million in federal funds, with the largest share coming from a one-time infusion through the American Recovery and Reinvestment Act.[57]

North Carolina passenger rail

Over the next 20 years, North Carolina's population is anticipated to grow by 52 percent, which is the seventh-fastest population growth in the nation.[58] Much of this growth will occur within the Piedmont region, which extends from Charlotte to the Raleigh-Durham-Chapel Hill Triangle region. This growth will substantially increase intercity travel demand and highway congestion.

Piedmont Improvement Program Project Map



Rendering courtesy of the North Carolina Department of Transportation.

North Carolina is unique in that it owns 317 miles of railroad track with a 200-foot wide right of way extending from Charlotte through the Triangle region to Morehead City on the coast. For years, Amtrak has offered two daily round trips between Raleigh and Charlotte as part of its Piedmont and Carolinian lines. In addition to passenger service, Norfolk Southern and CSX Transportation use the track to provide freight rail operations.

As far back as the 1990s, the state initiated planning to expand passenger rail service along the Piedmont corridor. The project became known as the Piedmont Improvement Program, or PIP. PIP consists of a series of infrastructure improvements that will increase passenger rail service from two to five round trips each day.[59] The program includes adding 13 new bridges and removing 23 rail crossings to separate vehicle and rail traffic in order to reduce accidents and improve overall travel times.[60] In addition, the program involves adding 32 miles of additional track to allow passing zones for passenger trains traveling at higher speeds than freight traffic. State traffic modeling shows that the expanded rail service will remove 66,000 automobile trips and 8 million miles of driving between Charlotte and Raleigh each year.[61] In 2013, the corridor carried a total of 363,000 passengers.[62]

The Piedmont project is primarily supported by $520 million in one-time funding from American Recovery and Reinvestment Act.[63] In total, the Federal Railroad Administration received grant requests for seven times more funding than was available.[64] The overwhelming response by states to the availability of American Recovery and Reinvestment Act funds highlights the pent-up demand for federal investment in rail. Yet now that the Federal Railroad Administration has distributed these one-time funds, states and metropolitan regions are once again faced with a federal transportation program that does not provide ongoing rail capital projects.

Diminishing productivity and poor fiscal performance from highways

Highways are an essential part of our surface transportation system. The 4.1 million miles of public roadway in the United States form a comprehensive national network that links our largest urban centers with our most rural communities.[65] In fact, the size and extent of the system creates a network effect whereby the economic utility of the system is greater than any one part. Yet the initial productivity gains that resulted from investments following World War II have given way to substantially lower returns in recent decades.

Research indicates that the net economic benefit of highway investments has fallen by more than 70 percent from its peak after World War II.[66] For example, one study showed that highway expenditures added approximately 1.4 percent per year to economic growth prior to the mid-1970s but have added only 0.4 percent per year since.[67] These results highlight a fundamental truth: Making incremental improvements to a transportation network are never as productive as the initial construction.[68]

The arguments in support of transportation policies that disproportionately favor highway investments over other modes are further diminished when fiscal performance and congestion are added to the analysis. While total driving levels have risen substantially in the past 40 years—especially within urban areas—this increase has not resulted in positive fiscal performance for many roadways, even in the largest metropolitan regions.

Texas is a state known for driving, and it provides a powerful example of the paradox of rising congestion and poor roadway fiscal performance. Texas has 3,961 arterial miles in its five largest metropolitan regions—Houston, Dallas-Fort Worth, San Antonio, Austin, and El Paso. Of this total, 73 percent of these roadways have insufficient vehicle traffic to generate enough gas tax revenue to cover long-term maintenance costs. At the same time, research by Texas A&M University shows there were almost 408 million hours of delay in 2011 due to congestion in the same five metropolitan areas.[69]

TABLE 5

Rising congestion in five largest Texas metro regions, 1982–2011

Metro area	Increase in total delay	Increase in congestion cost per driver	Increase arterial roadway lane miles
Houston	339%	292%	136%
Dallas-Fort Worth	1335%	897%	84%
San Antonio	1243%	1212%	69%
Austin	1073%	579%	181%
El Paso	1061%	1066%	72%

Source: Results based on authors' calculation from Texas A&M University, "Complete Data" (2012), available at http://tti.tamu.edu/documents/ums/congestion-data/complete-data.xls.

Increased driving and poor fiscal performance may seem counterintuitive. After all, how can metropolitan areas have both increased congestion and facilities that cost far more to build and maintain then they generate in user fees from gas taxes? The answer is twofold: First, travel demand is not distributed uniformly throughout the day. The morning and evening rush hours can easily overwhelm a highway or arterial roadway, causing substantial delays and lost productivity. Yet that same facility may be significantly underutilized throughout the rest of the day. As a result, highways can be both congested and a serious fiscal burden.

Second, building and maintaining major highways and arterial roadways in urban areas is expensive. Land acquisition, construction, and maintenance costs are far greater in urban areas than in rural areas. On average, 1 mile of urban interstate costs between 6 and 23 times more than 1 mile of rural interstate.[70] And while low-density suburban and exurban land-use patterns push people to drive slightly more than their rural- or urban-core counterparts, the additional driving is not enough to offset the added cost of these facilities. According to the Texas Department of Transportation, the agency needs a staggering $5 billion more each year just to maintain congestion levels as they currently stand.[71]

Scenario planning

In addition to removing funding restrictions and providing greater programmatic flexibility, states and regions must reform how they engage in transportation planning. Contemporary transportation planning is dominated by a focus on incremental improvements in the absence of a compelling vision of how investments will produce change in the future. All too often, future growth and land-use patterns are taken as fixed, without regard for how transportation shapes where and what developers build. Under this approach, investments take on a certain air of inevitability. Past investment decisions extend into the future and produce more of the same results.

Scenario planning represents a dynamic approach to planning that discards the idea that the future is predetermined and instead looks at how different bundles of investments could shape future growth around economic, social, and environmental goals. Rather than starting with a narrow review of existing transportation assets and lists of project requests from local communities, scenario planning asks more fundamental questions about what a community should look like 10, 20, or 30 years in the future and then works backward to find the appropriate mix of projects to achieve that vision. After all, transportation infrastructure has a profound effect on the built environment and how people move through it.

One of the most important benefits of scenario planning is that it shifts the transportation conversation away from a debate over one project versus another and instead asks a community to define its goals and values. These goals may include improved safety or more affordable and equitable access to community amenities such as health care, parks, schools, and job training. In effect, through scenario planning, a community is able to express how transportation should facilitate and help accomplish larger social, economic, and environmental goals.

Typically, scenario planning involves a consideration of multiple alternative investment approaches and a look at how these approaches would shape the community in the coming years. Detailed transportation planning involves thousands of projects over a long period of time. Understandably, this is more than most people care to follow or try to understand. Scenarios cut through this complexity by focusing on the ultimate outcomes rather than the process along the way.

Scenario planning is also beneficial because it does not look at transportation investments through the lens of a particular mode of transportation. Once planners have worked with the community to set clear goals, the task becomes finding the best mix of investments to achieve those goals. Instead of allowing the source of money to determine project selection, planners allow the performance characteristics of each mode and potential project to drive the process. This rational approach to planning recognizes that transportation is not its own end but rather a means to other ends.

Additional information on scenario planning is available from the following publications: **FHWA Scenario Planning Guidebook**, available at http://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook/guidebook.pdf and **Building a 21st Century Infrastructure**, available at http://www.americanprogress.org/issues/economy/report/2014/02/12/84015/building-a-21st-century-infrastructure/

Policy recommendations

The U.S. surface transportation system is a complex mix of different modes, including highways, intercity passenger rail, public transportation, freight rail, and intermodal connections that allow freight to flow from ship to train and from train to truck. State and federal funding restrictions are a major barrier to successfully planning and implementing a transportation system that is efficient, equitable, sustainable, and globally competitive.

With the current federal surface transportation authorization measure—Moving Ahead for Progress in the 21st Century, or MAP-21—set to expire in May 2015, Congress should take the following steps to increase programmatic flexibility and invest in multimodal projects as part of the next authorization:

- Establish a multimodal account within the Highway Trust Fund to provide funding for highway, transit, passenger and freight rail, port development, and intermodal facilities, among other projects.
- Allocate multimodal funds through a competitive program administered by the Department of Transportation's Office of the Secretary.
- Allow states to flex any portion of their federal highway funds for any project category eligible under the multimodal program.
- Rename the Highway Trust Fund the Transportation Trust Fund to reflect its broad surface transportation mandate.

At the state level, legislatures should substantially increase the flexibility of transportation departments to plan and implement a truly integrated and balanced system by removing funding barriers:

- Repeal any statutory or state constitutional prohibitions on using motor fuel taxes or other user fees for projects other than highways.

- Require state departments of transportation to set objective system performance goals and to evaluate multiple projects and modes to determine which investments will most cost effectively achieve those goals.

Taken together, these policy changes will allow limited transportation funding to flow to the projects that produce the greatest improvement to overall system performance and that deliver the most economic, social, and environmental benefits. Yet removing funding restrictions is only part of the challenge. Decades of funding silos have created planning silos. Beyond funding flexibility, states must reform their planning processes to set objective economic, social, and environmental goals. These goals should be independent of any one transportation mode or funding source. With these goals in hand, state transportation departments must learn to evaluate different investment scenarios that include multiple modes to determine which project mix will be most cost effective.

Research results and methodology

This report presents an analysis of the fiscal performance of principal arterial roadways, which also make up the National Highway System. Fiscal performance is calculated by comparing the daily gas tax revenue generated by drivers on each individual roadway with the daily cost to maintain that road. While the NHS represents only 5.5 percent of all roadway miles, it carriers 55 percent of all vehicle miles traveled.[72] For this reason, the NHS will have the highest fiscal performance of any roadway classification. Stated differently, the NHS represents the high-water mark for fiscal performance, since the remainder of the roadway system carries much less traffic per mile but has a similar cost profile.

The methodology used to conduct this analysis makes four assumptions intended to yield the most favorable results for the NHS. First, the life cycle cost estimates do not include right-of-way acquisition, engineering, or initial construction. This lowers the total cost over the 30-year period and reduces the amount of driving a roadway requires to break even or generate a surplus.

Second, the analysis assumes that gas tax revenues for light- and heavy-duty vehicles will remain constant in the future. Rising vehicle efficiency standards have already eroded the revenue-generating capacity of state and federal gas taxes. And while some legislatures have increased gas taxes, these raises have not kept pace with efficiency gains. For instance, Congress has not raised the federal gas tax since 1993.[73] This methodological choice also reduces the amount of driving needed for a roadway to break even or generate a surplus.

Third, this analysis adjusts the life cycle cost estimate for each roadway down to reflect the share of roadway expenditures covered by user fees. States fund their roadway investments with revenues from multiple sources. As a result, user fees in the form of gas taxes and tolls cover only a portion of the annual total. Fiscal performance calculations reflect this reality by multiplying the life cycle cost estimate by the share of roadway expenditures covered by user fees. For instance, if a state derives 75 percent of its highway funding from user fees, the life cycle cost estimate would be reduced by 25 percent. By adjusting the life cycle cost downward, the analysis remains neutral about how a state chooses to fund its roadways. In effect, this downward adjustment means that roadways are only being held accountable for the share of life cycle costs intended to be covered by user fees. Again, this reduces the amount of driving needed for a roadway to break even or generate a surplus.

Fourth, this analysis uses a 30 percent range for break-even calculations. This means that the break-even driving level is adjusted up and down by 15 percent to create a generous break-even range. Even though the life cycle cost estimates from the Federal Highway Administration already reflect a national sample of high- and low-cost areas, adding the 30 percent range around the break-even point ensures that borderline roadways are treated as breaking even.

Results

Even with four methodological choices intended to yield favorable results for highways, 39 percent of all NHS miles fail to generate enough user fee revenues to cover their long-term maintenance costs. When moderate inflation of 1 percent per year is added to the analysis, the share of NHS miles that lose money jumps to 48 percent. Given historic inflation patterns in the construction industry, this rate is likely substantially lower than what the actual rate will be. With a higher inflation target, the share of underperforming arterials would rise even higher. The following tables present national summary data for both the noninflation and inflation scenarios, as well as the results by state if no inflation is assumed.

TABLE 6

Fiscal performance of interstates and principal arterials

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	5,340	44%	2,054	17%	4,643	39%
Urban areas, between 200,000 and 1 million residents	6,125	23%	3,973	15%	17,027	63%
Urban areas, between 50,000 and 200,000 residents	43,286	47%	11,178	12%	37,893	41%
Urban subtotal	54,752	42%	17,205	13%	59,564	45%
Rural subtotal	34,979	35%	10,764	11%	55,338	55%
National total	**89,731**	**39%**	**27,968**	**12%**	**114,903**	**49%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

TABLE 7

Fiscal performance of interstates and principal arterials including inflation

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	7,672	64%	1,750	15%	2,616	22%
Urban areas, between 200,000 and 1 million residents	9,295	34%	5,366	20%	12,463	46%
Urban areas, between 50,000 and 200,000 residents	50,816	55%	11,353	12%	30,190	33%
Urban subtotal	67,783	51%	18,469	14%	45,269	34%
Rural subtotal	44,523	44%	11,722	12%	44,836	44%
National total	**112,306**	**48%**	**30,191**	**13%**	**90,105**	**39%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

TABLE 8

Fiscal performance by state

State	Loss	Break even	Surplus
Alaska	89%	2%	9%
Arkansas	59%	14%	28%
Arizona	29%	12%	59%
California	20%	14%	66%
Colorado	42%	17%	41%
Connecticut	48%	4%	47%
District of Columbia	24%	19%	58%
Delaware	0%	0%	100%
Florida	9%	12%	79%
Georgia	38%	16%	47%
Hawaii	2%	2%	97%
Iowa	33%	22%	44%
Idaho	63%	13%	24%
Illinois	12%	14%	74%
Indiana	21%	14%	66%
Kansas	28%	18%	54%
Kentucky	11%	19%	71%
Louisiana	23%	13%	64%
Massachusetts	16%	17%	67%
Maryland	11%	8%	81%

State	Loss	Break even	Surplus
Maine	23%	13%	64%
Michigan	26%	14%	60%
Minnesota	34%	21%	45%
Missouri	46%	17%	36%
Mississippi	58%	16%	25%
Montana	91%	4%	6%
North Carolina	15%	13%	72%
North Dakota	83%	10%	7%
Nebraska	41%	16%	43%
New Hampshire	1%	4%	95%
New Jersey	0%	0%	99%
New Mexico	65%	11%	24%
Nevada	78%	4%	17%
New York	1%	2%	97%
Ohio	33%	16%	51%
Oklahoma	42%	14%	45%
Oregon	35%	11%	53%
Pennsylvania	11%	9%	80%
Rhode Island	40%	22%	38%
South Carolina	58%	12%	30%
South Dakota	94%	4%	2%
Tennessee	47%	15%	38%
Texas	47%	16%	37%
Utah	30%	13%	57%
Virginia	12%	11%	78%
Vermont	16%	12%	72%
Washington	11%	10%	79%
Wisconsin	26%	14%	59%
West Virginia	19%	12%	68%
Wyoming	84%	11%	6%

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

In order to understand this result, it helps first to review how states fund roadway projects. In addition, this section reviews the process for calculating the fiscal performance of NHS roadway segments. The next section presents fiscal performance data for 12 case-study states. These states were chosen because they broadly represent the regional, size, and population diversity of the United States.

Roadway funding

The United States has more than 4 million miles of public roadways.[74] The funding to build and maintain these facilities comes from a combination of sources, including motor fuel taxes, tolling, vehicle registration fees, license fees, general governmental revenues, and the proceeds from issuing debt in the form of bonds, among others. These revenue sources may be grouped into two categories: user fees and nonuser fees. A user fee is a tax levied on drivers that corresponds to how much they use the roadway system. This means that the total amount of user fee taxes paid by drivers is directly related to their annual mileage. By comparison, a nonuser fee is a tax levied on drivers regardless of how much they use the roadway system.

All 50 states and the District of Columbia levy a tax on every gallon of gasoline and diesel fuel sold within their respective borders. In addition, the federal government levies a tax of 18.4 cents per gallon on gasoline and 24.4 cents per gallon on diesel.[75] Motor fuel taxes are a user fee because additional driving increases fuel consumption and, as a result, the amount of fuel taxes paid each year.

Annual vehicle registration charges are nonuser fees because the amount paid is the same regardless of total driving. Often, registration fees are calculated as a percentage of the current value of the vehicle. In this way, they function as a form of property tax. Similarly, annual license charges are not user fees because obtaining a license does not require either owning a car or driving.

Motor fuel taxes are the largest source of funding for highway construction and maintenance.[76] However, not all roadways carry the same amount of traffic or generate the same level of fuel tax revenue. Roadways not only vary in how much revenue they generate, but they also have substantially different life cycle costs, which include both initial construction and ongoing maintenance. Life cycle costs vary based on the size, geographic location, and type of roadway in question. State departments of transportation functionally classify all roadways according to their design and purpose, paying particular attention to vehicle speed and land access. The primary purpose of local streets is to provide land access. As a result, they carry fewer cars and limit vehicle speeds. Local roads funnel cars onto collectors, which are larger roads that offer increased travel speeds and less land access. In turn, collector roads funnel traffic onto arterial roadways, which have much higher travel speeds. Arterial roads include a wide range of facilities, from major commercial corridors in urban areas to fully access-controlled highways and the interstate system.[77]

The Department of Transportation publishes a database with information on all public roadways called the Highway Performance Monitoring System, or HPMS.[78] Each roadway is broken up into small segments, typically between 0.1 and 1 mile in length. For each segment, the database provides multiple roadway characteristics.

This analysis focuses on four characteristics: geography, functional classification, average daily traffic count, and number of through lanes.[79] The geography code labels roadway segments as either urban or rural. The functional classification code labels each segment as interstate, freeway, expressway, other principal arterial, collector, or local. The average daily traffic count represents the number of vehicles expected to travel along a road segment on a given day. The count includes all vehicles in all lanes in both directions of a segment. The through-lanes code indicates the total number of lanes per segment. Finally, each segment has a spatial reference available as a shapefile, which allows each segment to be mapped. When combined with other data from the Department of Transportation, these characteristics allow for an estimate of daily maintenance cost and user fee revenue, which forms the basis of the fiscal performance determination.

The Department of Transportation also publishes roadway cost information as part of the annual "Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance" report. The Department of Transportation derives its estimates from taking a sample of actual project costs by improvement type, including reconstruction and resurfacing. The estimates are broken out by roadway type and geography to reflect the cost differences associated with these characteristics. The four geographical categories are rural, small urbanized, large urbanized, and major urbanized. Small-urbanized areas are those with a population between 50,000 and 200,000 people, large-urbanized areas are those with a population between 200,000 and 1 million people, and major-urbanized areas are those with a population of more than 1 million people.

The Department of Transportation report also provides a cost estimate for small urban areas that have a population of between 5,000 and 49,000 people. The cost differences between small urban and small urbanized is less than 1 percent. In order to simplify the analysis, all nonrural roadway segments within an area that has a population of under 200,000 people are treated as small urbanized.

While the HPMS dataset labels roadway segments as urban and rural, this does not provide enough information to label an urban segment as small, large, or major. In order to ensure that each segment was assigned the appropriate cost, this analysis added additional geographic information using data from the Bureau of the Census on metropolitan statistical areas. A metropolitan statistical area, or MSA, is made up of a central urbanized population center of at least 50,000 individuals, along with the adjacent communities that have a high degree of integration with the central area.[80] For instance, if an interstate segment lies within an MSA with a population of more than 1 million people, it is assigned the life cycle cost that corresponds to interstates within major-urbanized areas. This process was repeated for every roadway segment in the nation.

The following table presents the Department of Transportation's cost estimates for different types of roadway work. Based on feedback from state department of transportation officials, this analysis assumes that interstate segments will require one reconstruction and three resurfacings over the next 30-year period. Furthermore, the analysis assumes that other principal arterial roadways will require one reconstruction and two resurfacings. These estimates were used to determine the total long-term maintenance cost for each roadway segment. This total was then divided by the total number of days in 30 years to derive a daily cost.

TABLE 9

Typical costs per lane mile for roadway reconstruction and resurfacing

Road category	Reconstruct	Resurface	Full cost per lane
Rural: other principal arterial	$737,000	$524,000	$1,261,000
Rural: interstate	$920,000	$981,000	$1,901,000
Small urbanized: other principal arterial	$1,368,000	$766,000	$2,134,000
Large urbanized: other principal arterial	$2,005,000	$962,000	$2,967,000
Major urbanized: other orincipal arterial	$4,009,000	$1,554,000	$5,563,000
Small urbanized: freeway, expressway, interstate	$1,605,000	$1,371,000	$2,976,000
Large urbanized: freeway, expressway, interstate	$2,626,000	$1,839,000	$4,465,000
Major urbanized: freeway, expressway, interstate	$5,253,000	$3,045,000	$8,298,000

Source: Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014).

The following table presents data on gas and diesel tax rates by state, along with the adjustment factors on both the cost and revenue sides of the fiscal performance equation. As noted previously, states fund their roadway networks with revenues from multiple sources. The column labeled "Highway expenditure adjustment factor" indicates the share of roadway expenditures that come from user fees.[81] This factor is used to adjust the roadway cost estimate downward to reflect the share of that cost that must be covered by user fees. Similarly, all states receive user fee revenues, but not all of this money is directed to roadways. In many states, a portion of user fees is diverted to cover other expenses such as highway patrol officer salaries or public education. The column labeled "Revenue adjustment factor" indicates the share of user fees dedicated to roadways. This factor represents a 10-year average to avoid fluctuations from one-time transfers, especially in the wake of the Great Recession.

TABLE 10

Motor fuel taxes by state

State	State gas	Combined state and federal gas	State diesel	Combined state and federal diesel	Highway expenditure adjustment factor	Revenue adjustment factor
Alabama	20.87	39.27	21.85	46.25	76%	100%
Alaska	12.4	30.8	12.7	37.1	61%	96%
Arizona	19	37.4	27	51.4	42%	87%
Arkansas	21.8	40.2	22.8	47.2	73%	94%
California	52.89	71.29	49.58	73.98	48%	100%
Colorado	22	40.4	20.5	44.9	47%	94%
Connecticut	49.3	67.7	54.9	79.3	49%	67%
Delaware	23	41.4	22	46.4	52%	90%
District of Columbia	23.5	41.9	23.5	47.9	48%	81%
Florida	36.02	54.42	32.37	56.77	56%	77%
Georgia	28.45	46.85	31.97	56.37	54%	83%
Hawaii	48.05	66.45	50.08	74.48	58%	92%
Idaho	25	43.4	25	49.4	63%	90%
Illinois	39.1	57.5	44.9	69.3	56%	87%
Indiana	40.81	59.21	51.29	75.69	65%	94%
Iowa	22	40.4	23.5	47.9	48%	96%
Kansas	25	43.4	27	51.4	51%	94%
Kentucky	30.1	48.5	27.1	51.5	56%	92%
Louisiana	20.01	38.41	20.01	44.41	59%	100%
Maine	30.01	48.41	31.21	55.61	73%	97%

State	State gas	Combined state and federal gas	State diesel	Combined state and federal diesel	Highway expenditure adjustment factor	Revenue adjustment factor
Maryland	27	45.4	27.75	52.15	49%	50%
Massachusetts	26.5	44.9	26.5	50.9	39%	61%
Michigan	41.39	59.79	39.81	64.21	56%	88%
Minnesota	28.6	47	28.6	53	52%	87%
Mississippi	18.38	36.78	18	42.4	77%	94%
Missouri	17.3	35.7	17.3	41.7	59%	98%
Montana	27.75	46.15	28.5	52.9	76%	74%
Nebraska	27.3	45.7	26.7	51.1	49%	97%
Nevada	33.15	51.55	28.56	52.96	65%	84%
New Hampshire	19.63	38.03	19.63	44.03	55%	91%
New Jersey	14.5	32.9	17.5	41.9	43%	51%
New Mexico	18.88	37.28	22.88	47.28	46%	72%
New York	49.86	68.26	50.39	74.79	51%	59%
North Carolina	37.75	56.15	37.75	62.15	61%	89%
North Dakota	23	41.4	23	47.4	73%	99%
Ohio	28	46.4	28	52.4	71%	96%
Oklahoma	17	35.4	14	38.4	53%	63%
Oregon	31.07	49.47	30.34	54.74	46%	80%
Pennsylvania	41.8	60.2	52.1	76.5	58%	80%
Rhode Island	33	51.4	33	57.4	57%	47%
South Carolina	16.75	35.15	16.75	41.15	78%	93%
South Dakota	22	40.4	24	48.4	75%	87%
Tennessee	21.4	39.8	18.4	42.8	73%	91%
Texas	20	38.4	20	44.4	47%	58%
Utah	24.5	42.9	24.5	48.9	38%	92%
Vermont	32.05	50.45	31	55.4	56%	74%
Virginia	17.28	35.68	26.08	50.48	43%	86%
Washington	37.5	55.9	37.5	61.9	48%	98%
West Virginia	35.7	54.1	35.7	60.1	70%	99%
Wisconsin	32.9	51.3	32.9	57.3	53%	80%
Wyoming	24	42.4	24	48.4	59%	66%

Source: American Petrolium Institute, "State Motor Fuel Tax Rates Effective 4/1/2014" http://www.api.org/oil-and-natural-gas-overview/industry-economics/~/media/Files/Statistics/State-Motor-Fuel-Excise-Tax-Update-Oct-2014.pdf; Federal Highway Administration, "Revenues Used By States For Highways - 2012 1/," available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/sf1.cfm (last accessed October 2014); Federal Highway Administration, "State Motor Fuel Taxes and Related Receipts – 2010 1/," available at https://www.fhwa.dot.gov/policyinformation/statistics/2010/mf1.cfm (last accessed October 2014).

Estimating segment revenue

Determining the fiscal performance of a given roadway segment begins with calculating the amount of user fee revenue generated by drivers on a daily basis. Calculating revenue requires several pieces of information, including vehicle counts, average fuel economy, traffic composition, and segment length.

The HPMS dataset provides an average annual daily traffic count, or AADT. This number represents the number of vehicles that can be expected to traverse a road segment on any given day. The counts include all vehicles in all lanes in both directions of a segment. The Federal Highway Administration extrapolates these estimates based on actual vehicle traffic counts from numerous locations around the country. The AADT forms the foundation of the revenue calculation.

The next step is to determine the average fuel economy of vehicles on the road. Research by the Department of Transportation finds that light-duty vehicles—including cars; sport utility vehicles, or SUVs; and noncommercial trucks—average 23.6 miles per gallon.[82] Heavy-duty vehicles have an average fuel economy of 6 miles per gallon.[83] Revenue per mile can be calculated by dividing the fuel tax by the fuel economy.

$$\text{Revenue per mile} = \frac{\text{Per-gallon fuel tax}}{\text{Fuel economy}}$$

The light- and heavy-duty per-mile revenue rates are combined into a blended rate based on traffic composition. Data from the Federal Highway Administration shows that trucks represent 10 percent of vehicle traffic on most classifications of arterial roadways. The heavy-duty truck share rises to 13 percent on rural arterials and 24 percent on rural interstates.[84]

The next step is multiplying the per-mile revenue estimate by the length of the segment. Since the estimate is on a per-mile basis, it must be adjusted to reflect the segment length. The final step is to adjust the revenue estimate based on the revenue adjustment factor for that state, which represents the share of user fee revenues that actually support the roadway network. An example calculation will help show this process. This example assumes a large urban interstate segment in Wisconsin that is 1.2 miles long with 12,000 daily vehicles, four through lanes, and a 9-to-1 light- to heavy-duty-vehicle traffic ratio.

In Wisconsin, the combined state and federal gas and diesel taxes are 51.3 and 57.3 cents per gallon, respectively. Given this tax rate, the average light-duty vehicle with a fuel economy of 23.6 miles per gallon, or mpg, will generate 2.2 cents per mile in gas tax revenues. At the same time, a heavy-duty truck with a fuel economy of 6 miles per gallon will generate 9.5 cents per mile.

$$\text{Light–duty-vehicle revenue per mile} = \frac{\$0.513}{23.6\text{ mpg}} = \$0.022$$

$$\text{Heavy–duty-vehicle revenue per mile} = \frac{\$0.573}{6\text{ mpg}} = \$0.095$$

These two different per-mile rates are then combined into a blended rate by multiplying each by their share of traffic. With light-duty vehicles making up 90 percent of traffic on the urban interstate segment and heavy-duty vehicles making up only 10 percent, the blended rate works out to 2.9 cents per mile.

$$\text{Blended-per-mile revenue} = (\$0.022 \times 90\%) + (\$0.095 \times 10\%) = \$0.029$$

The resulting blended rate is multiplied by the segment length, since the example segment is greater than 1 mile in length. This yields an adjusted blended rate of 3.5 cents, which is then multiplied by the number of daily vehicles. This yields a revenue estimate of $417 per day.

$$\text{Segment-length adjusted rate} = (\$0.029 \times 1.2\text{ miles}) = \$0.035$$

$$\text{Initial revenue estimate} = (\$0.035 \times 12{,}000\text{ vehicles}) = \$417$$

The last step is to multiply the estimate by the revenue adjustment factor for Wisconsin, which is 80 percent. Thus, the final revenue estimate for this segment is $334 per day.

$$\text{Final revenue estimate} = (\$417 \times 80\%) = \$334$$

Estimating segment cost

The second step in determining fiscal performance is to calculate a daily segment cost. Highways, like all forms of infrastructure, require maintenance. Unlike driving, however, there are long periods of time between projects. This analysis amortizes total maintenance costs over a 30-year period in order to have a daily value that matches with daily revenues from driving. Maintenance can take many forms, and this analysis focuses on repaving and reconstruction, which involves substantial rebuilding of the roadway. The last step in the process is to adjust the total daily cost downward to reflect the share of costs covered by user fees.

The Federal Highway Administration's Highway Economic Requirement System, or HERS, provides reconstruction and rehabilitation cost estimates on a per-lane-mile basis for various road types and locations in 2010 dollars. Due to near-zero inflation in recent years, costs were not updated to 2014 dollars.[85] HERS provides different estimates based on the location and type of highway facility. The estimates for rural roads vary depending on the topography, with three categories: flat, rolling, and mountainous terrain. Since the HPMS database does not include topographical information, this analysis treats all rural segments as flat, which is the lowest-cost category.

To appropriately categorize urban roadways, HPMS segment data were combined with 2010 Census population data. All roadway segments within a metropolitan statistical area of more than 1 million in population were categorized as major urban, an MSA of between 200,000 and 1 million people was categorized as large urban, and an MSA of between 50,000 and 200,000 people was categorized as small urban. By combining these two datasets, each segment was assigned the appropriate maintenance costs given its size, location, and functional classification.

This analysis assumes that each interstate segment will require a repaving every 10 years, as well as one reconstruction, while principal arterials will require two repavings and one reconstruction. The Federal Highway Administration presents costs estimates on a per-lane-mile basis. For this reason, the segment-cost calculation includes the number of lanes as well as the segment length. The total cost is then divided by 10,950 days, which is the total number of days over the 30-year life cycle.

TABLE 11
Roadway categories

Rural: other principal arterial
Rural: interstate
Small urbanized: other orincipal arterial
Large urbanized: other principal arterial
Major urbanized: other orincipal arterial
Small urbanized: freeway, expressway, interstate
Large urbanized: freeway, expressway, interstate
Major urbanized: freeway, expressway, interstate

Source: Based on data from Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014).

$$\text{Interstate daily segment cost} = \frac{(1\text{ reconstruction} + 3\text{ repavings}) \times \text{lanes} \times \text{segment length}}{10{,}950\text{ days in life cycle}}$$

The last step in the cost calculation is to adjust the daily segment cost downward to reflect the share of roadway costs that are covered by user fees. This adjustment ensures that the fiscal performance determination only holds each roadway accountable for the share of costs that user fees are intended to cover.

$$\text{Final interstate daily segment cost} = (\text{Daily cost estimate} \times \text{user-fee percentage})$$

Fiscal performance is determined by the ratio of daily segment revenue to daily segment cost. Since every segment has a slightly different length, the break-even analysis could not use a static or universal break-even number. The ratio indicates whether a segment loses money, breaks even, or generates a surplus. Technically, the break-even point would be a ratio of exactly 1. However, this analysis uses a range of 15 percent above and below. The break-even ratio is 0.85-to-1.15.

$$\text{Segment break–even ratio} = \frac{\text{Daily segment revenue}}{\text{Daily segment cost}}$$

The example of the large-urbanized interstate segment in Wisconsin would have a daily cost estimate based on three repavings and one reconstruction, for four lanes of through traffic over 1.2 miles.

$$\text{Interstate daily cost} = \frac{(\$4{,}465{,}000 \times 4) \times 1.2}{10{,}950\text{ days}} = \$1{,}957$$

$$\text{Downward cost adjustment} = (\$1{,}957 \times 53\%) = \$1{,}037$$

$$\text{Fiscal performance determination} = \frac{\$334}{\$1{,}037} = 0.32$$

The ratio of $334 in daily revenue compared with a daily cost of $1,037 yields a ratio of 0.32, which is substantially lower than the lower bound of the break-even range of 0.85 to 1.15. Therefore, this segment fails to generate enough revenue to cover its long-term maintenance costs.

Inflation adjustment

The national fiscal performance numbers that include inflation follow the same calculation steps. The only difference is that the cost estimates have been inflated before being plugged into the calculation. For interstates, this analysis assumes that repavings occur every 10 years, with one reconstruction occurring in year 20. For all other principal arterials, the analysis assumes a repaving every 15 years and a reconstruction in year 20. These intervals are not intended to reflect the exact timing of a maintenance plan for an arterial highway. In reality, a state department of transportation must assess each segment of roadway to determine maintenance needs. Many heavily traveled urban highways will require more frequent and substantial work than is captured in this analysis, while other segments may require less. This methodological choice is intended to sufficiently account for the fact that maintenance is spread over the life of a facility. Again, exact timing will vary.

The inflation assumption included in the model is modest. Data from the past 10 years are historical outliers since they include the Great Recession. From the period of 2003 to 2013, construction inflation in the transportation sector averaged approximately 1 percent growth each year.[86] This analysis uses a 1 percent annual compound interest rate. As a result, the inflation coefficient for year 10 is 1.10; it is 1.22 in year 20 and 1.35 in year 30. Taken together, these inflation coefficients result in full cost per lane miles as follows.

TABLE 12

Inflation-adjusted roadway costs per lane mile

Road category	Reconstruction	Resurfacing	Full cost per lane
Rural: other principal arterial	$899,140	$961,540	$1,860,680
Rural: interstate	$1,122,400	$1,200,090	$2,322,490
Small urbanized: other principal arterial	$1,668,960	$1,405,610	$3,074,570
Large urbanized: other principal arterial	$2,446,100	$1,765,270	$4,211,370
Major urbanized: other principal arterial	$4,890,980	$2,851,590	$7,742,570
Small urbanized: freeway, expressway, interstate	$1,958,100	$1,677,190	$3,635,290
Large urbanized: freeway, expressway, interstate	$3,203,720	$2,249,710	$5,453,430
Major urbanized: freeway, expressway, interstate	$6,408,660	$3,725,050	$10,133,710

Source: Based on authors' calculation from Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); Federal Highway Administration, "Construction Cost Trends For Highways 1/," available at https://www.fhwa.dot.gov/policyinformation/nhcci/pt1.cfm (last accessed October 2014).

It is important to note that prior to the recession, construction costs increased by a total of 40 percent from 2003 to 2006. Thus, the 1 percent annual compound interest rate constitutes a very conservative estimate. In all likelihood, inflation will be substantially higher over the next 30 years. Even with this low inflation assumption, however, the analysis shows that the share of roadways that fail to generate enough revenue to cover their long-term costs rises by 9 percent when compared with the baseline analysis.

State case studies

Texas

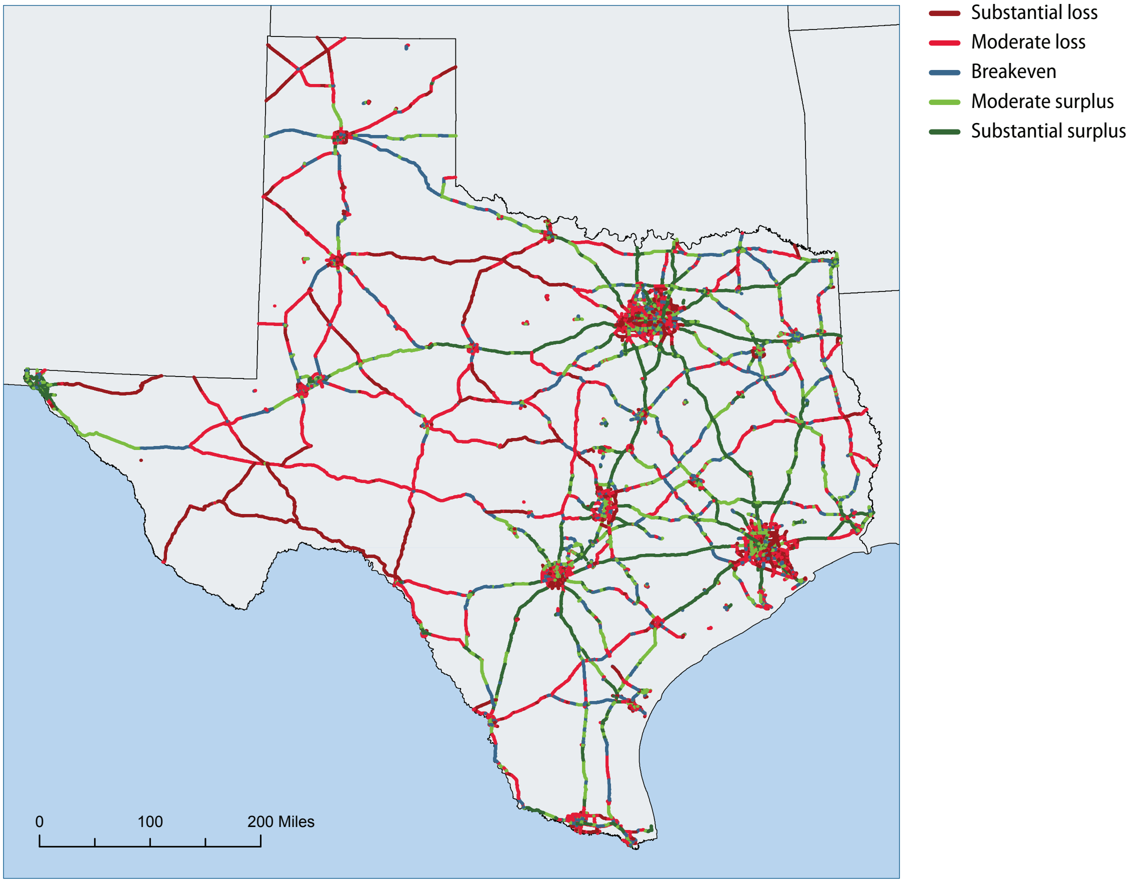
Texas is the second-largest state in terms of population and geographic size. It has an estimated population of 26.4 million,[87] with 15.7 million registered vehicles[88] spread out over 261,000 square miles.[89] The state includes 18,265 centerline miles of interstate and principal arterial roadway—the most of any state.[90] This works out to 1,445 residents per centerline mile of arterial roadway.[91] The combined state and federal tax rate is 38.4 cents per gallon for gasoline and 44.4 cents per gallon for diesel, which ranks 40th among all states.[92] Even with a large population, the combination of an extensive arterial network and a low gas tax rate means that 51 percent of Texas' network fails to generate enough user fee revenue to cover its long-term costs.

Texas fiscal performance of interstate and arterial roadways

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	2,900	73%	411	10%	650	16%
Urban areas, between 200,000 and 1 million residents	615	61%	202	20%	197	19%
Urban areas, between 50,000 and 200,000 residents	751	49%	313	21%	462	30%
Urban subtotal	4,266	66%	927	14%	1,309	20%
Rural subtotal	5,002	43%	2,006	17%	4,756	40%
National total	**9,268**	**51%**	**2,933**	**16%**	**6,065**	**33%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

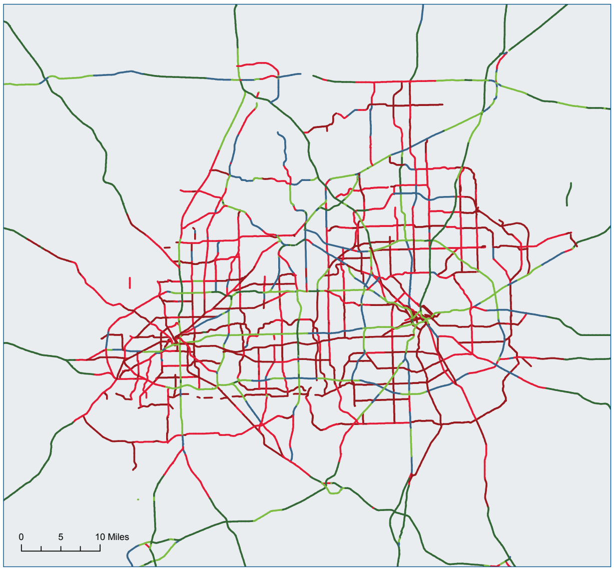
Texas arterial roadway fiscal performance



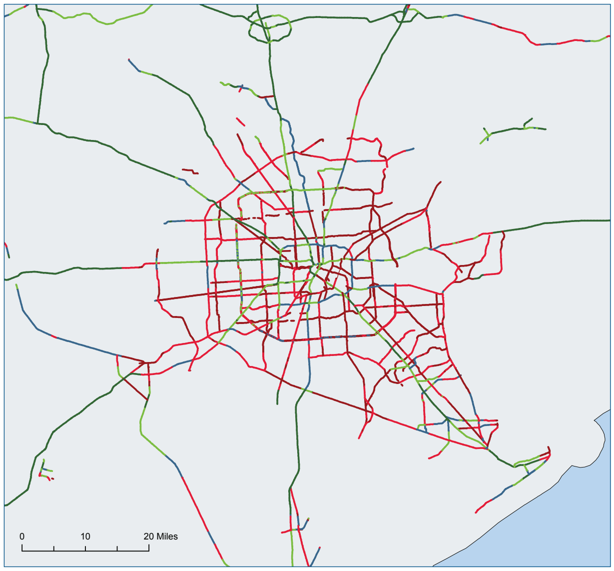
The Texas Triangle megaregion encompasses a significant portion of the state's population, as well as a large amount of Texas' total vehicular travel. This area includes Houston, Dallas-Fort Worth, and San Antonio, which are the three largest metropolitan areas in the state. Together, they account for 58 percent of the registered vehicles but less than 30 percent of highway miles in the state.[93] Seventy-three percent of the 3,961 arterial miles within urban areas that possess populations of more than 1 million people do not generate sufficient vehicle traffic and gas tax revenue to cover long-term maintenance costs. This highlights that, while urban areas account for a substantial portion of all driving, the resulting revenue is not enough to cover the high cost of maintaining large arterial roadways.

Most of the area west of the Texas Triangle is rural. With the exception of El Paso, a few other urban areas, and portions of Interstate 20 and Interstate 40, a significant percentage of these roads lose money. This result stems from the extent of the highway system, low fuel taxes, and low population density in that part of the state.

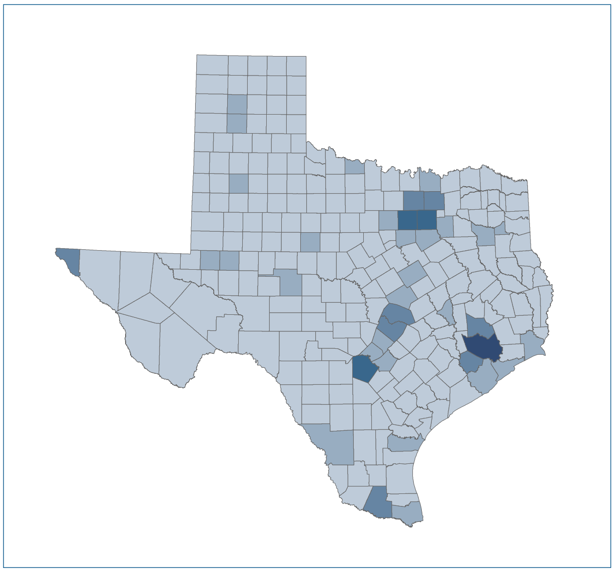
Dallas-Fort Worth



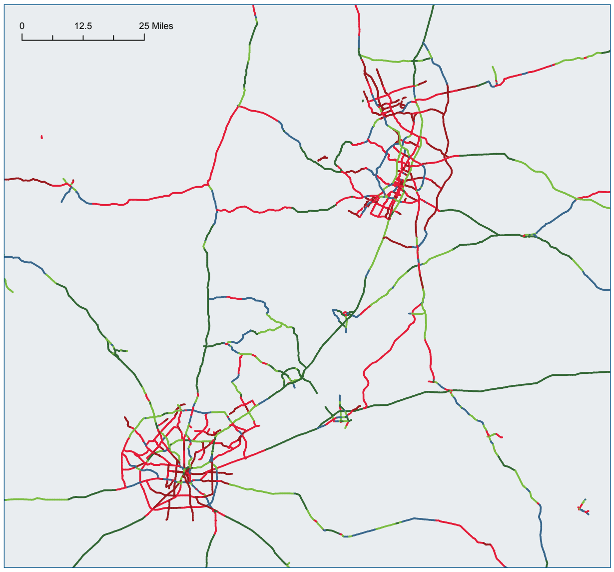
Houston



Registered vehicles as a share of all vehicles in state



Central Texas



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Arizona

Arizona is a rapidly growing state with an estimated population of 6.6 million people[94] covering 113,000 square miles.[95] Gas and diesel taxes are 37.4 cents per gallon and 51.4 cents per gallon, respectively.[96] This ranks Arizona 43rd for gas tax and 26th for diesel tax among all states. Phoenix and Tucson are Arizona's two major metropolitan areas, and together, they possess 80 percent of the state's 4 million vehicles[97] and a little under half of the state's 4,073 miles of interstate highways and principal arterial roadways.[98] This works out to 1,620 residents per centerline mile of arterial roadway.[99]

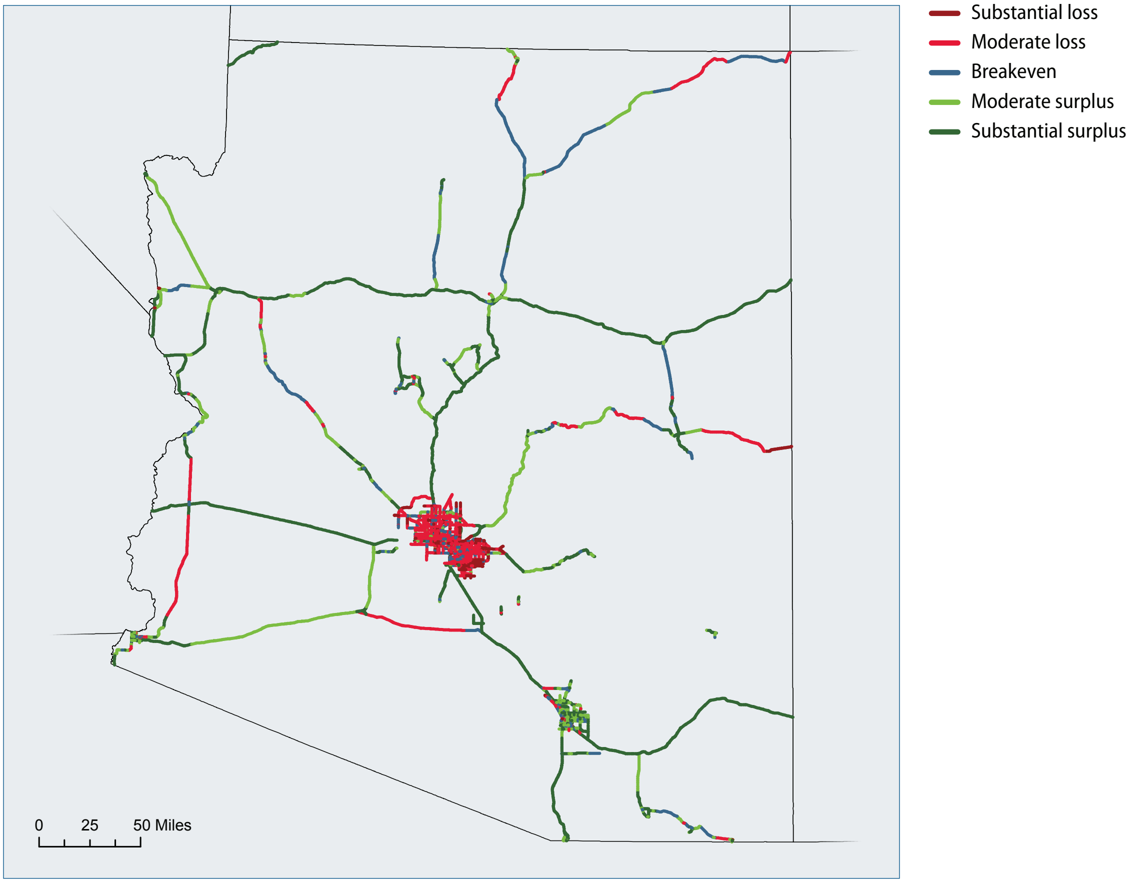
Overall, nearly 60 percent of Arizona's interstate and arterial roadways generate enough revenue to cover or exceed their long-term costs. This stems from the fact that Arizona heavily supplements its roadway budget with nonuser fee revenues. As a result, gas-tax receipts only need to cover a modest share of long-term costs. The fiscal performance of arterial roadways in Arizona differs significantly between urban and rural areas. In urban areas, 58 percent of arterial roadways fail to generate sufficient revenue to cover costs, while only 12 percent of rural arterials do not.[100]

Arizona fiscal performance of interstate and arterial roadways

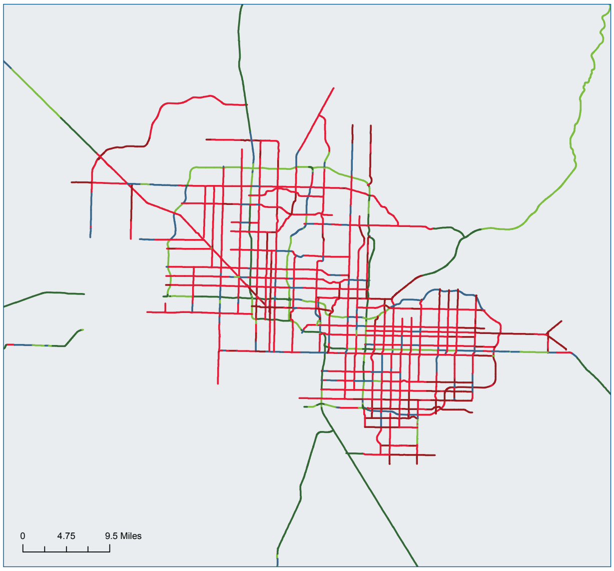
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	812	74%	124	11%	157	14%
Urban areas, between 200,000 and 1 million residents	27	9%	40	14%	220	77%
Urban areas, between 50,000 and 200,000 residents	6	8%	8	11%	59	81%
Urban subtotal	845	58%	171	12%	435	30%
Rural subtotal	314	12%	323	13%	1,902	75%
National total	**1,158**	**29%**	**494**	**12%**	**2,337**	**59%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

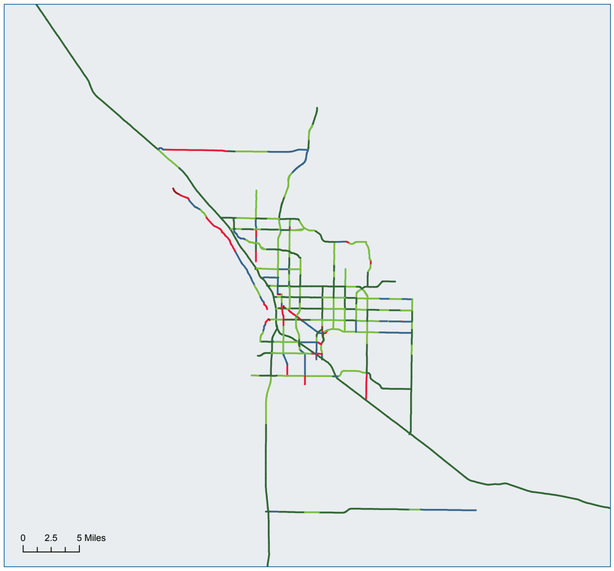
Arizona arterial roadway fiscal performance



Phoenix

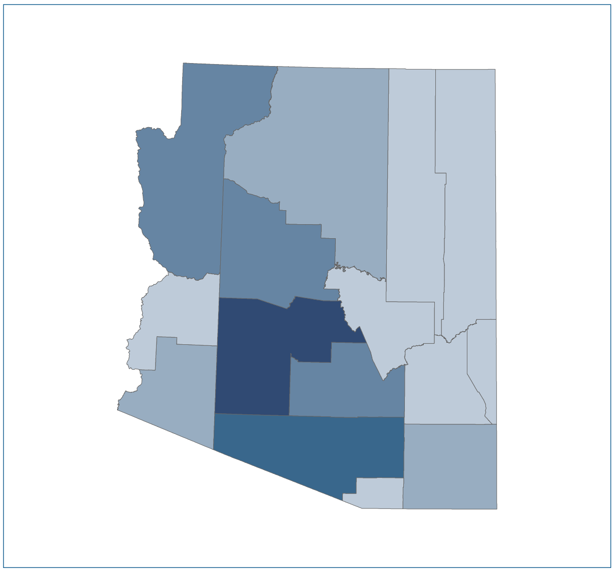


Tucson



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Colorado

Colorado has 5.3 million residents,[101] 3.7 million registered vehicles,[102] and is the eighth-largest state in the country at 103,641 square miles.[103] The Denver, Colorado Springs, and Boulder metropolitan areas have two-thirds of the state's registered vehicles[104] and slightly more than one-third of Colorado's 4,800 interstate and principal arterial miles.[105] Drivers in the three largest metropolitan regions lost a total of 88 million hours to congestion delay in 2011.[106]

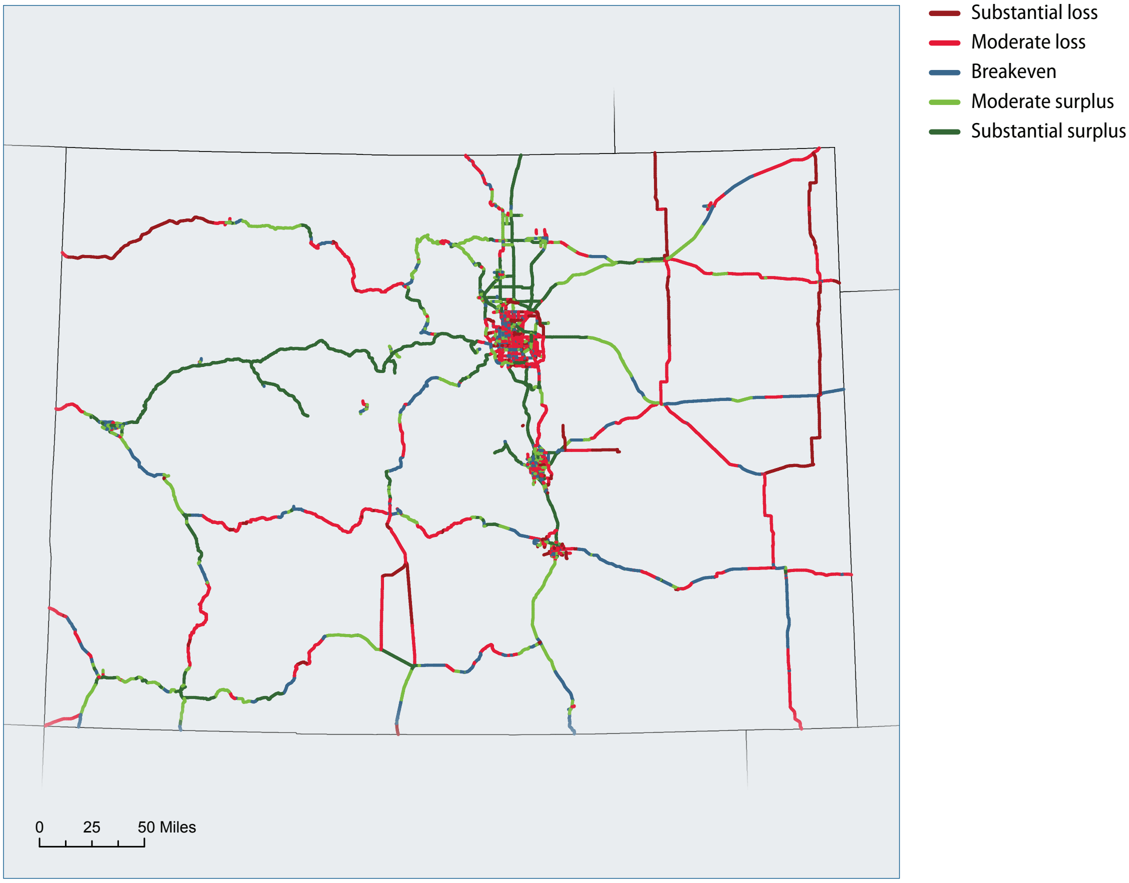
The state has the 34th-highest gas tax at 40.4 cents per gallon and the 41st-highest diesel tax at 44.9 cents per gallon.[107] Overall, 42 percent of interstate and principal arterial roadways fail to generate enough revenue to cover long-term costs. Colorado has 1,104 residents per centerline mile of arterial roadway.[108] At the same time, 17 percent of arterial roadways break even, and 41 percent are generating surplus revenue.

Colorado fiscal performance of interstate and arterial roadways

Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	446	59%	137	18%	173	23%
Urban areas, between 200,000 and 1 million residents	97	29%	59	17%	179	53%
Urban areas, between 50,000 and 200,000 residents	80	25%	59	18%	185	57%
Urban subtotal	624	44%	254	18%	537	38%
Rural subtotal	1392	41%	563	17%	1429	42%
National total	**2015**	**42%**	**817**	**17%**	**1967**	**41%**

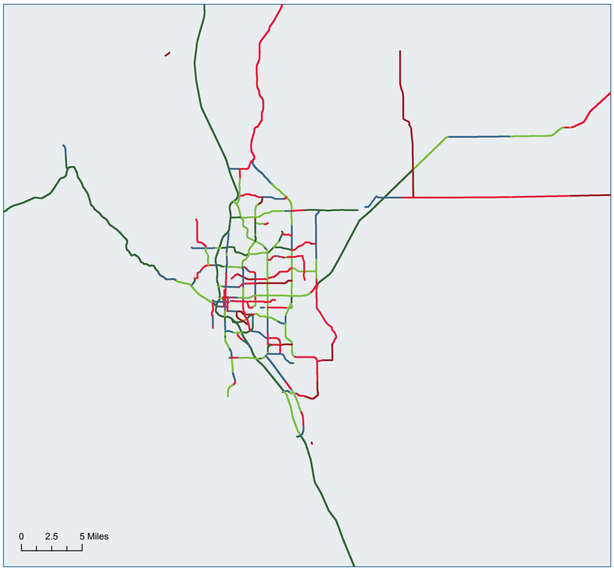
Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

Colorado arterial roadway fiscal performance

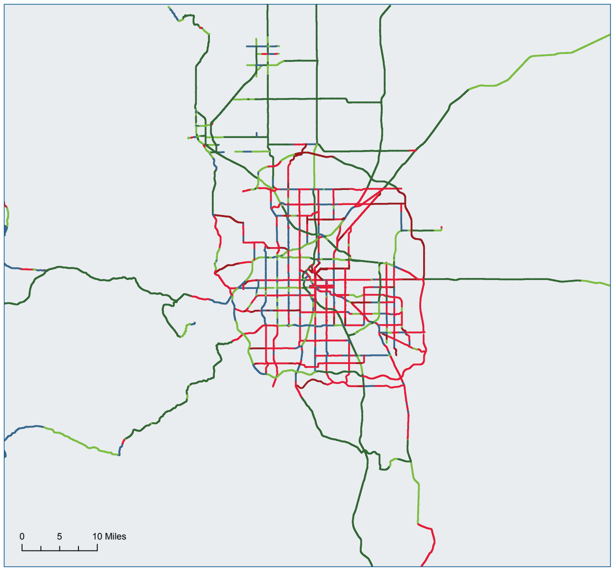


With traffic concentrated along the communities that front the Rocky Mountains, U.S. Highway 87 and a majority of Interstate 70 and Interstate 76 generate adequate traffic to cover long-term costs. However, the less populated eastern third of the state experiences substantial losses.

Colorado Springs

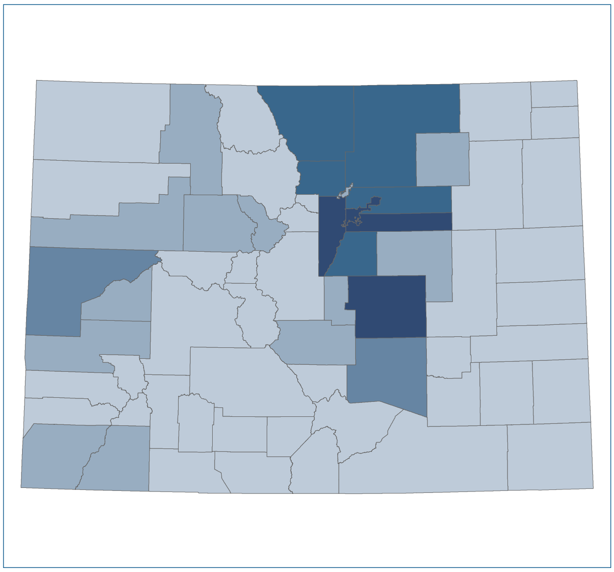


Denver



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Georgia

Georgia has a population of 9.9 million residents covering 59,425 square miles, making it the 24th-largest state in the nation.[109] Compared with other states, Georgia's gas tax ranks 21st at 45.9 cents per gallon, and its diesel tax ranks 15th at 55.3 cents per gallon.[110] Georgia has 6.3 million registered vehicles[111] and 4,800 arterial miles[112] for an average of 2,062 residents for each mile of arterial roadway.[113] Taken together, the Atlanta, Augusta, and Savannah metropolitan areas account for 63 percent of all registered vehicles but only 34 percent of all arterial miles within the state.

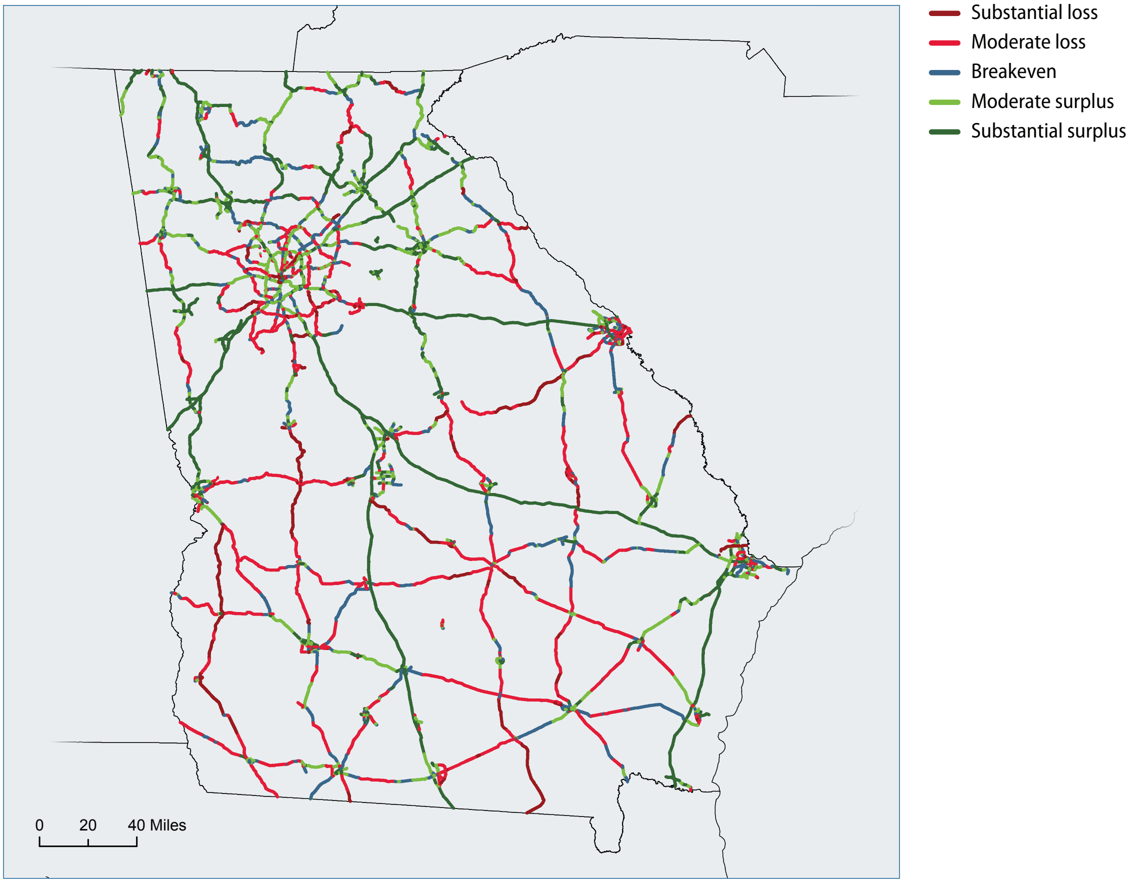
The differences between the Atlanta metropolitan area and other parts of the state are pronounced. Research by Texas A&M University shows that each driver in the Atlanta region loses 51 hours each year to congestion.[114] At the same time, many arterial roadways in the southern portion of the state—outside of Interstates 16, 75, and 95—fail to generate sufficient revenue to cover their long-term costs.

Georgia fiscal performance of interstate and arterial roadways

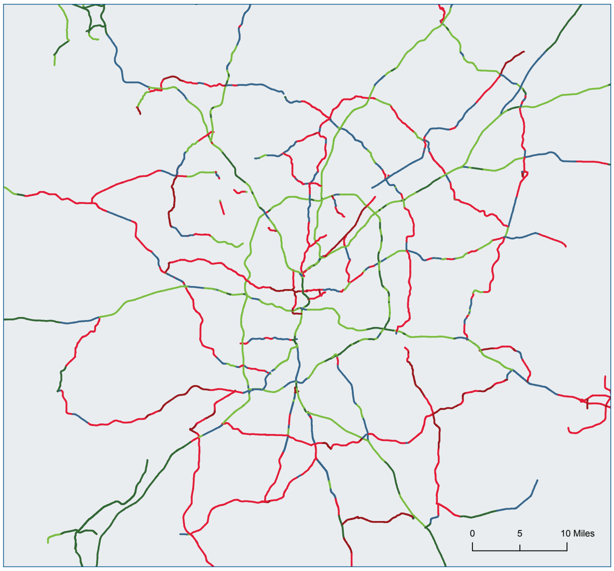
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	436	47%	192	21%	308	33%
Urban areas, between 200,000 and 1 million residents	125	37%	79	23%	135	40%
Urban areas, between 50,000 and 200,000 residents	132	21%	104	17%	391	62%
Urban subtotal	693	36%	376	20%	835	44%
Rural subtotal	1,571	38%	559	14%	1,958	48%
National total	**2,264**	**38%**	**935**	**16%**	**2,793**	**47%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

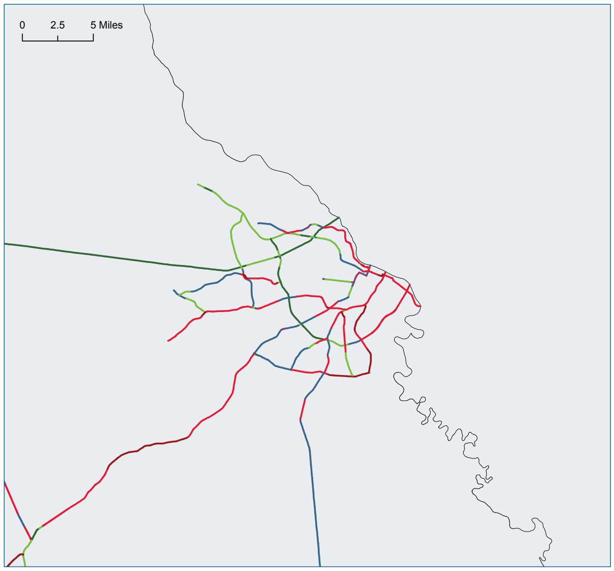
Georgia arterial roadway fiscal performance



Atlanta

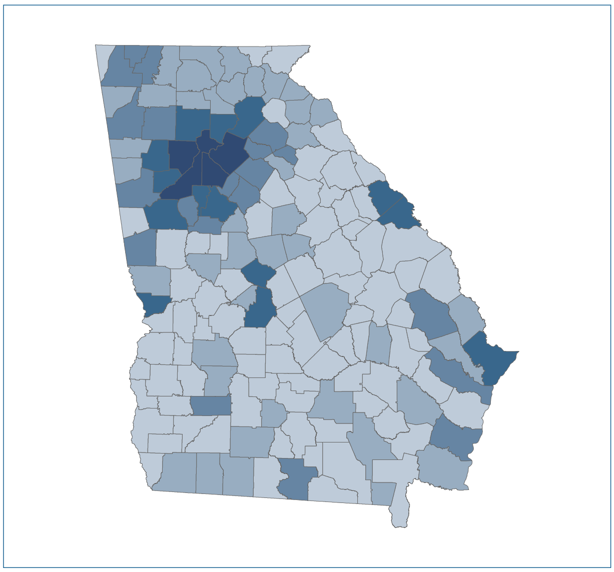


Augusta



Substantial loss
Moderate loss
Breakeven
Moderate surplus
Substantial surplus

Registered vehicles as a share of all vehicles in state



Low share
Moderate share
Intermediate share
Elevated share
High share

Indiana

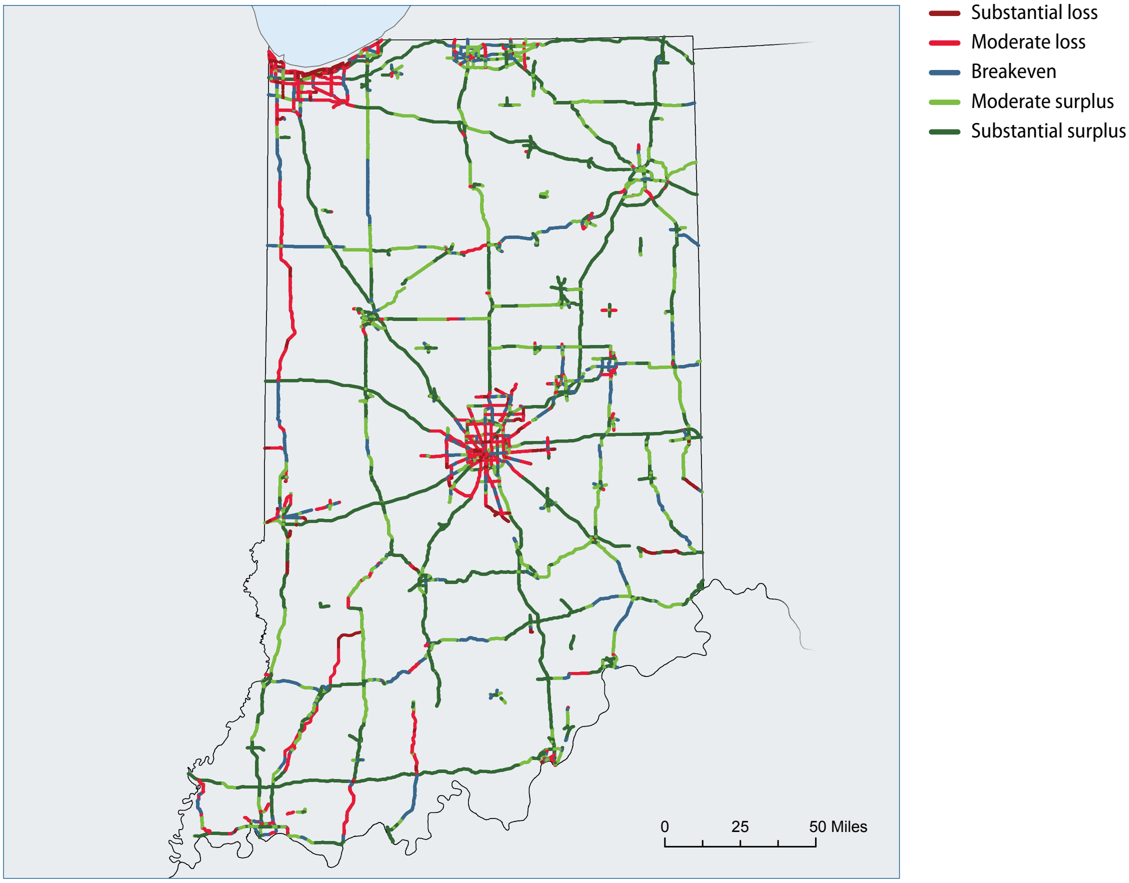
Indiana has 6.5 million people, 4.5 million registered vehicles, and a total area of 35,826 square miles. This makes Indiana the 16th-most populous[115] and 38th-largest[116] state in the country, with 1,330 residents per arterial mile. Indiana has the eighth-highest gas tax at 60.19 cents per gallon and the third-highest diesel tax at 76.13 cents per gallon.[117] Overall, two-thirds of all arterial miles break even or generate a surplus due to Indiana's high fuel tax rates and relatively dense population. The Indianapolis metropolitan area is the largest region, with 27 percent of the state's population[118] and more than one-quarter of all registered vehicles.[119] The region has 17 percent of the state's 4,884 arterial miles.[120]

Indiana fiscal performance of interstate and arterial roadways

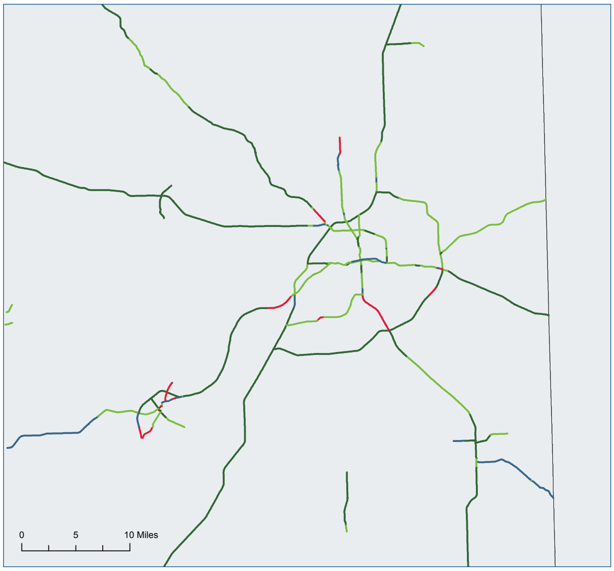
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	579	61%	161	17%	203	21%
Urban areas, between 200,000 and 1 million residents	55	15%	84	23%	221	61%
Urban areas, between 50,000 and 200,000 residents	96	17%	111	19%	374	64%
Urban subtotal	730	39%	357	19%	797	42%
Rural subtotal	276	9%	315	10%	2,409	80%
National total	**1,007**	**21%**	**672**	**14%**	**3,206**	**66%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

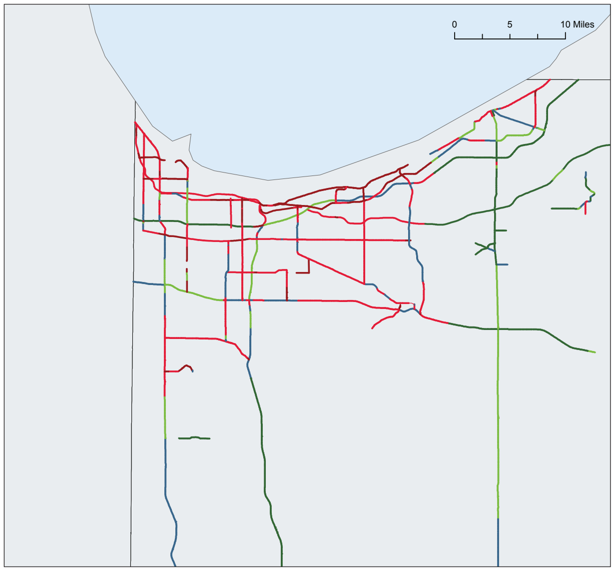
Indiana arterial roadway fiscal performance



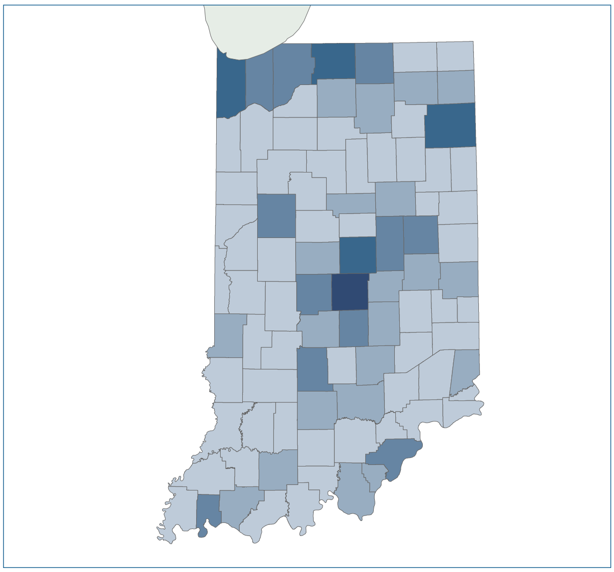
Fort Wayne



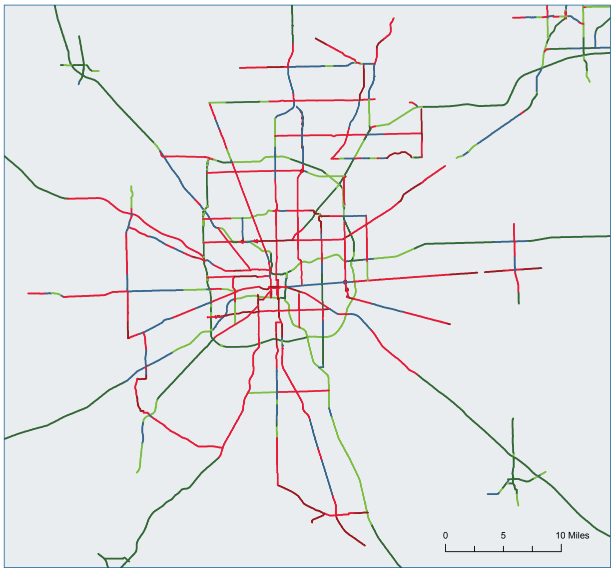
Gary



Registered vehicles as a share of all vehicles in state



Indianapolis



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Minnesota

Minnesota has 5.4 million residents, with a majority living in Minneapolis-Saint Paul and the surrounding areas.[121] The state's nearly 80,000 square miles of land make it the 14th-most expansive state in the nation.[122] The gas tax is 47 cents per gallon, and the diesel tax is 53 cents per gallon.[123] Approximately 1.6 million of the 3.9 million vehicles in Minnesota are registered in the Minneapolis-Saint Paul metropolitan area.[124]

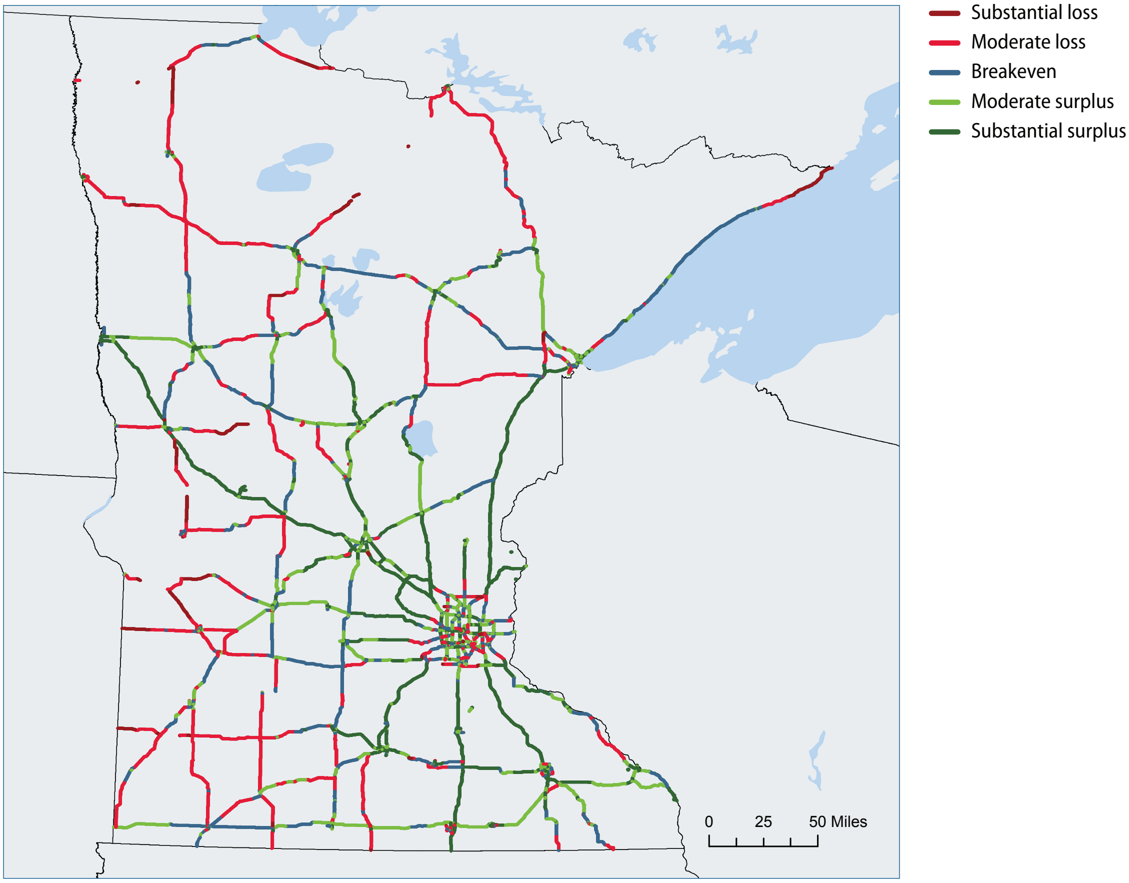
The state has 5,362 highway miles,[125] with 45 percent of the highway miles generating sufficient revenue to break even. More than 40 percent of Minnesota's other principal arterials fail to break even. With the exception of the corridor along Interstate 94, few highways in the western portion of the state break even.

Minnesota fiscal performance of interstate and arterial roadways

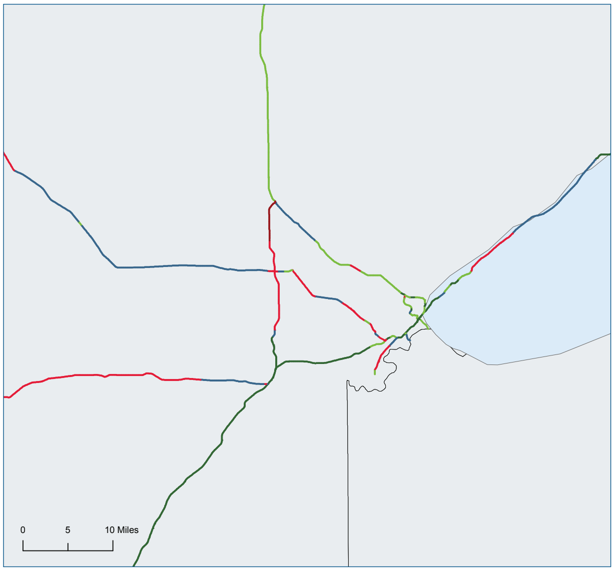
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	135	25%	144	27%	258	48%
Urban areas, between 200,000 and 1 million residents	0	-	0	-	0	-
Urban areas, between 50,000 and 200,000 residents	25	17%	16	11%	111	73%
Urban subtotal	160	23%	160	23%	369	54%
Rural subtotal	1,678	36%	943	20%	2,052	44%
National total	**1,837**	**34%**	**1,104**	**21%**	**2,421**	**45%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

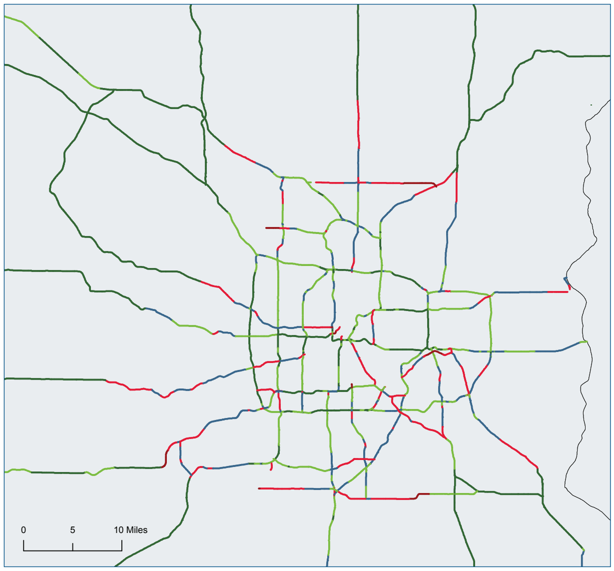
Minnesota arterial roadway fiscal performance



Duluth

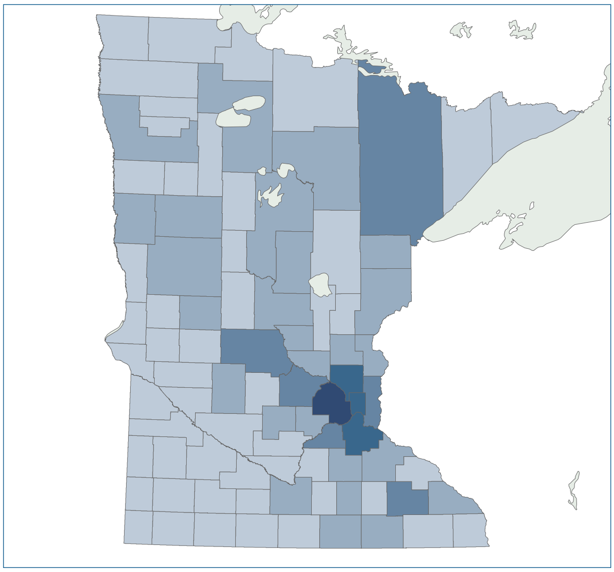


Twin Cities



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Missouri

Missouri has more than 6 million people and 68,000 square miles of land.[126] Still, much of the population resides in the St. Louis and Kansas City metropolitan areas.[127] As a result, these two metropolitan statistical areas have almost 55 percent of the 2.3 million registered vehicles in the state.[128]

Missouri's fuel taxes are 35.7 cents for each gallon of gas and 41.7 cents for each gallon of diesel, which rank among the lowest in the nation.[129] This, in part, explains why 41 percent of the 5,866 highway miles in Missouri do not break even.[130] Interstates 35, 44, 49, 55, and 70 generate sufficient revenue, but many highways in the northern and southeast portions of the state do not.

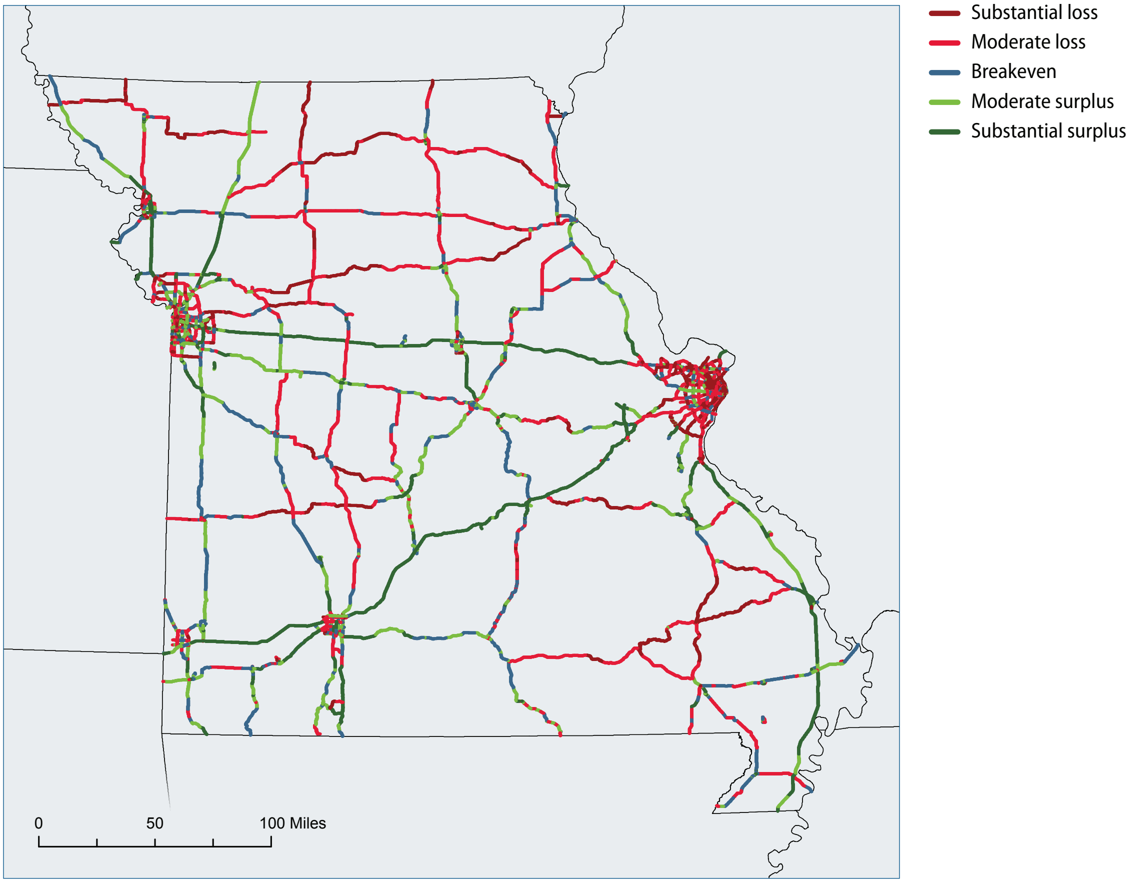
Furthermore, 78 percent of major-urbanized highways do not have enough traffic to break even. Additional traffic would surely make traffic problems worse, since Missourians in St. Louis and Kansas City already lose around 30 hours annually per capita due to congestion.[131]

Missouri fiscal performance of interstate and arterial roadways

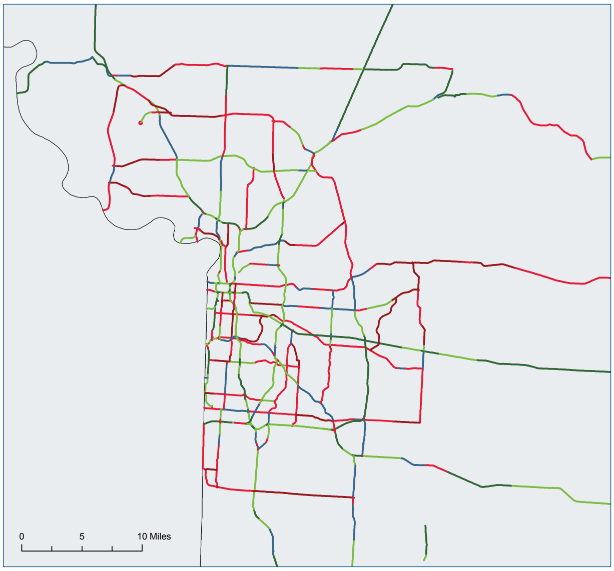
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	523	78%	91	14%	60	9%
Urban areas, between 200,000 and 1 million residents	324	51%	97	15%	209	33%
Urban areas, between 50,000 and 200,000 residents	56	38%	32	21%	61	41%
Urban subtotal	903	62%	220	15%	330	23%
Rural subtotal	1801	41%	806	18%	1806	41%
National total	**2,704**	**46%**	**1,026**	**17%**	**2,136**	**36%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

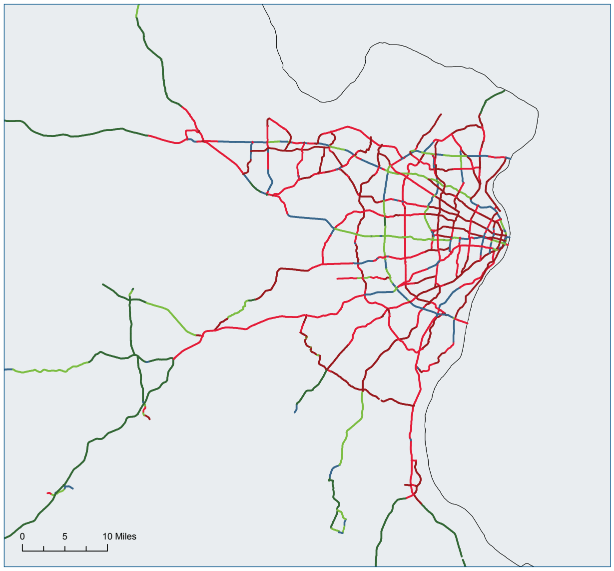
Missouri arterial roadway fiscal performance



Kansas City

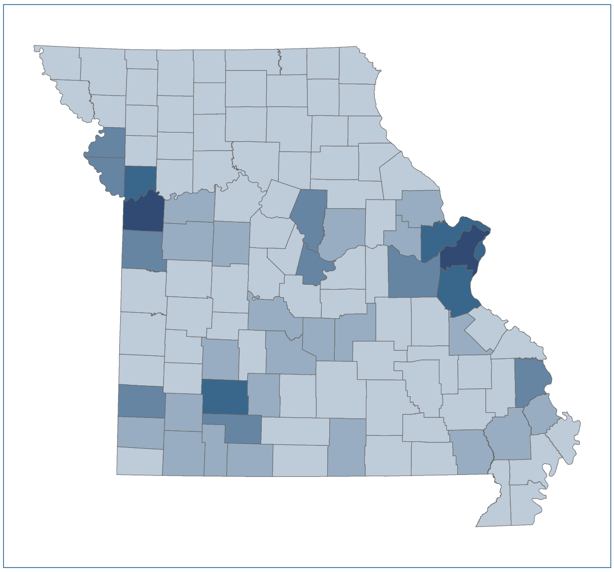


St. Louis



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Montana

Montana, with a land area of more than 145,000 square miles—making it the fourth-largest state—is sparsely populated, with a little more than 1 million people; it is the 44th-most-populous state in the country.[132] The fuel taxes are 46.15 cents per gallon of gas and 52.9 cents per gallon of diesel.[133]

There are almost 832,000 vehicles registered in Montana, and half of those are registered in the five most populous counties: Yellowstone, Missoula, Gallatin, Flathead, and Cascade.[134] These counties contain 22 percent of the state's 4,006 centerline highway miles.[135]

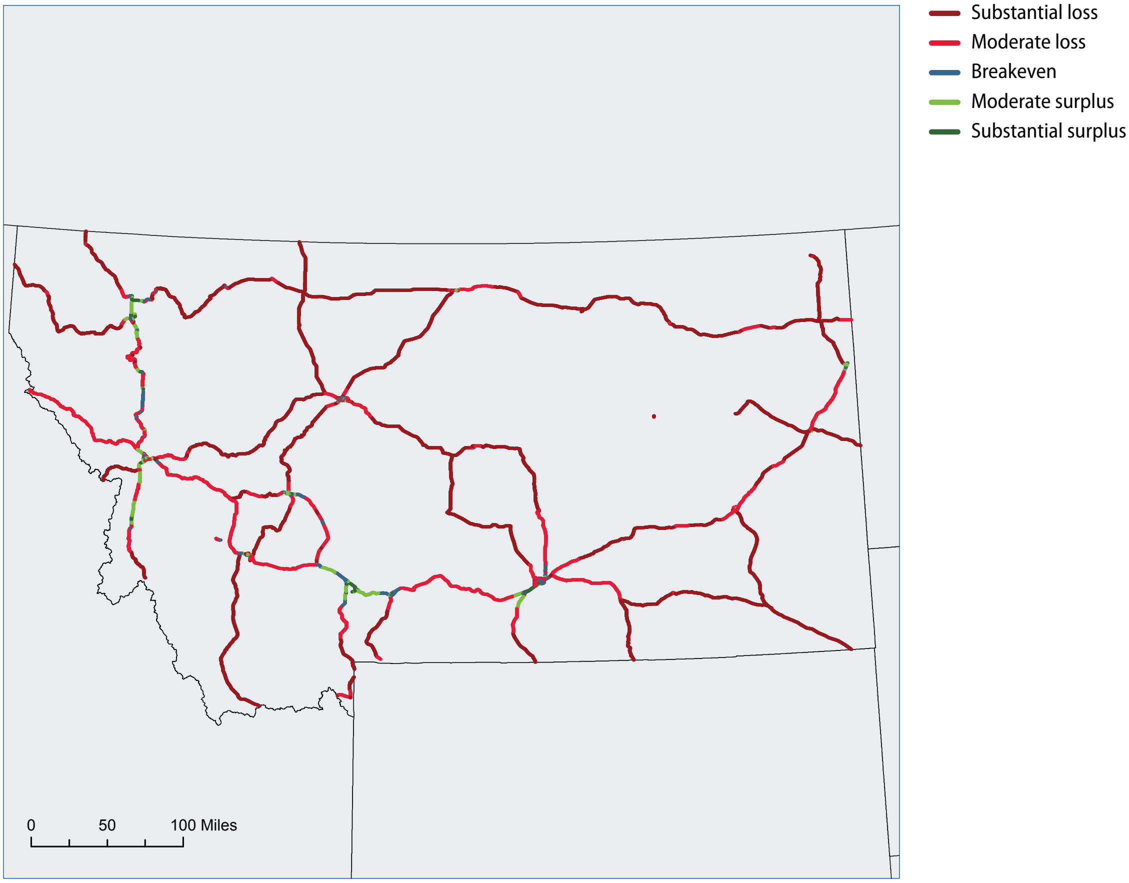
Only about 10 percent of Montana's highway miles break even or generate revenue, mostly due to the small and dispersed population. Highways in small-urbanized areas tend to generate a higher break-even ratio than those in rural areas. Unlike most states, even interstate highways rarely break even in Montana.

Montana fiscal performance of interstate and arterial roadways

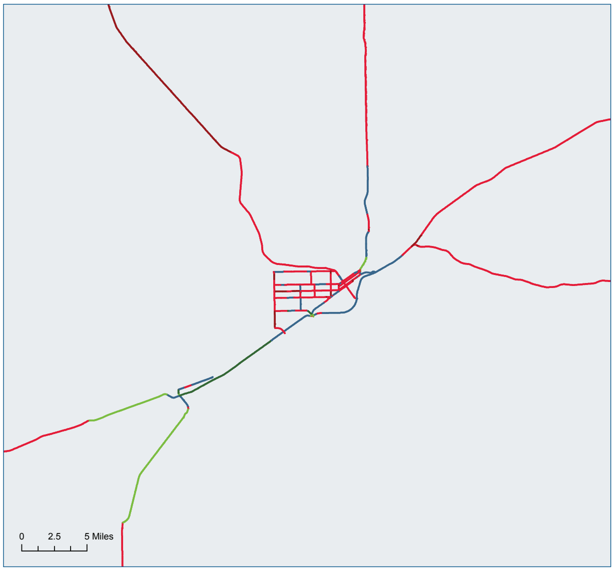
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	0		0	0%	0	0%
Urban areas, between 200,000 and 1 million residents	0	0%	0	0%	0	0%
Urban areas, between 50,000 and 200,000 residents	92	65%	34	24%	16	11%
Urban subtotal	92	65%	34	24%	16	11%
Rural subtotal	3546	92%	108	3%	210	5%
National total	**3,638**	**91%**	**142**	**4%**	**226**	**6%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

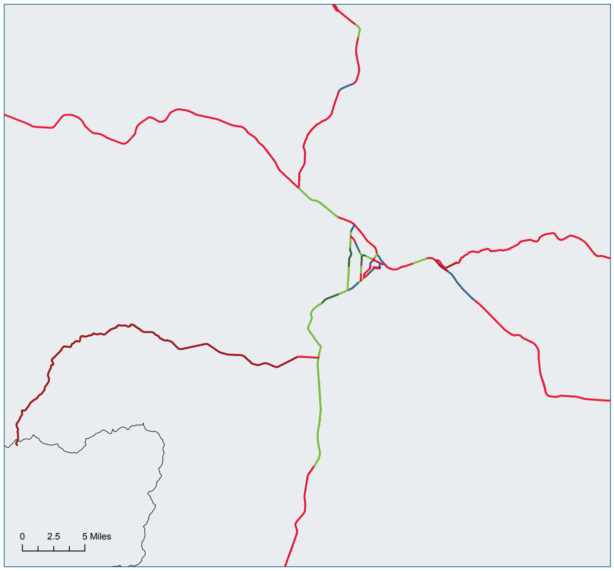
Montana arterial roadway fiscal performance



Billings

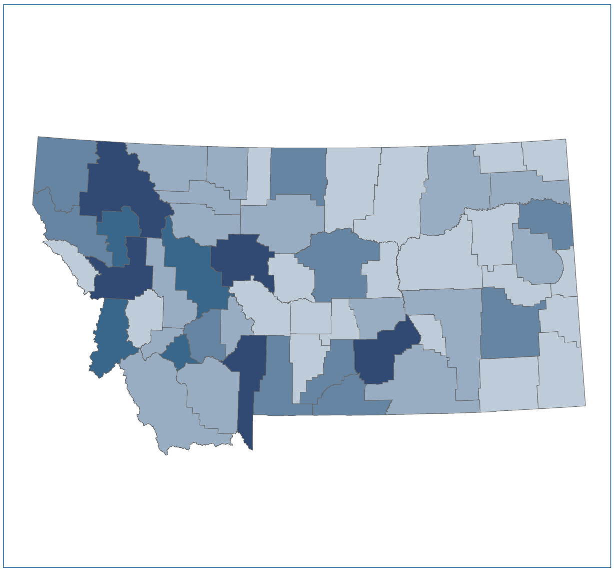


Missoula



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Ohio

Ohio is the seventh-most populous state in the country, with 11.5 million residents.[136] The gas tax is 46.4 cents per gallon, and the diesel tax is 52.4 cents per gallon.[137] There are 8.1 million vehicles registered in Ohio.[138] The state has 6,457 highway miles, the seventh-highest number in the country.[139]

The state has six metropolitan areas: Akron, Cincinnati, Cleveland, Columbus, Dayton, and Toledo. These major population centers have 3.9 million vehicles—two-thirds of all registered vehicles in the state—and 51 percent of all highway miles.

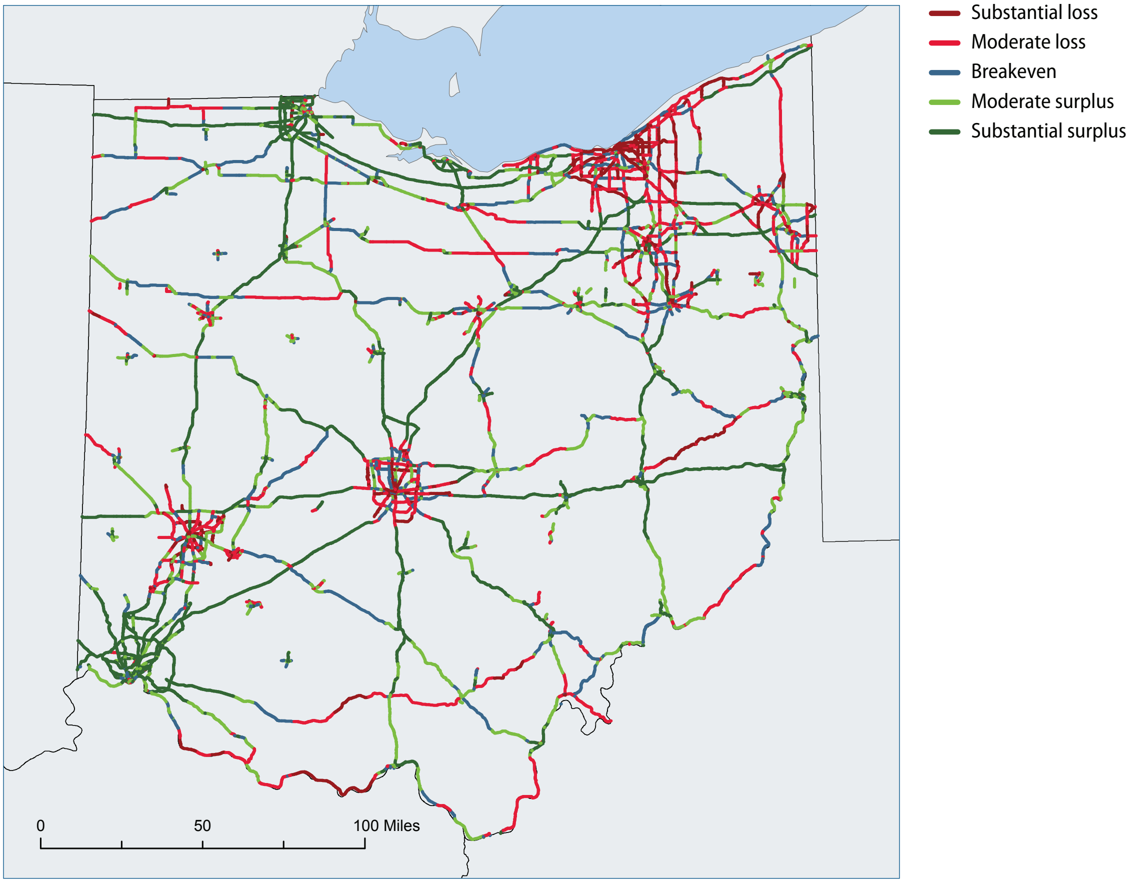
Only 18 percent of rural highways fail to generate sufficient revenue based on traffic counts, but more than 60 percent of urban highways do not meet that threshold. It is noticeable that certain urban areas do better than others. As a whole, Cincinnati and Toledo have far more highway miles that at least reach the break-even point when compared with Akron, Cleveland, Columbus, and Dayton.

Ohio fiscal performance of interstate and arterial roadways

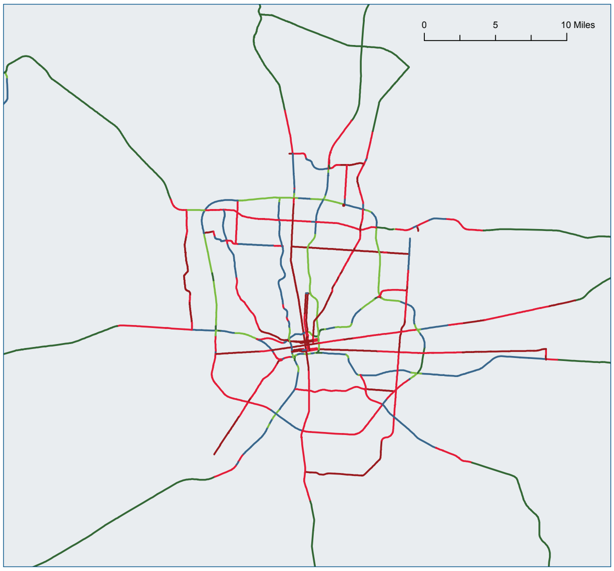
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	730	76%	162	17%	72	7%
Urban areas, between 200,000 and 1 million residents	480	54%	164	18%	251	28%
Urban areas, between 50,000 and 200,000 residents	126	37%	65	19%	154	45%
Urban subtotal	1336	61%	391	18%	477	22%
Rural subtotal	781	18%	635	15%	2838	67%
National total	**2,117**	**33%**	**1,025**	**16%**	**3,315**	**51%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

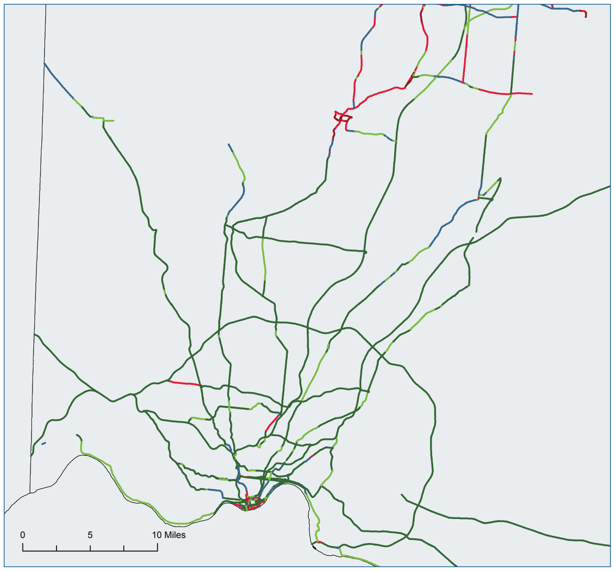
Ohio arterial roadway fiscal performance



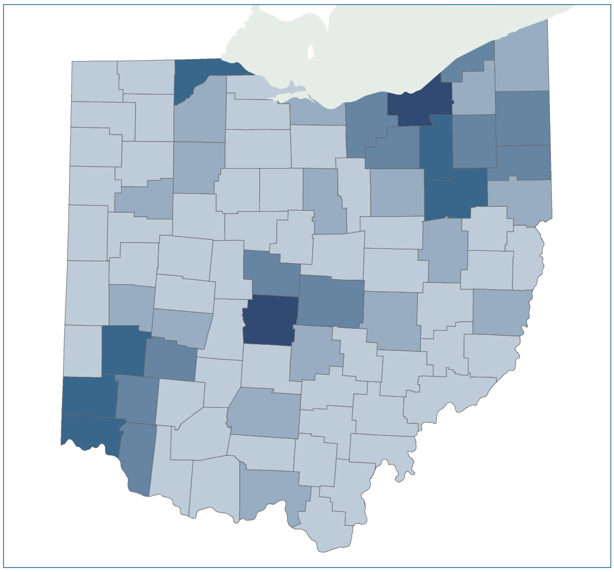
Columbus



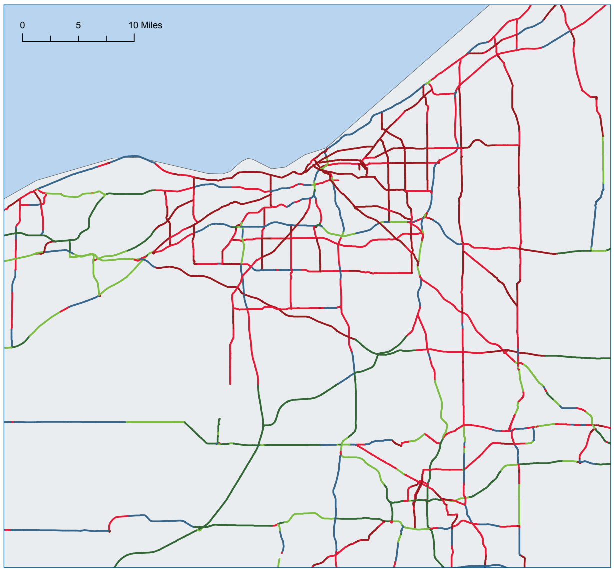
Cincinnati



Registered vehicles as a share of all vehicles in state



Cleveland



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Tennessee

Tennessee has a population of 6.5 million people, with almost 4.6 million registered vehicles,[140] and covers 41,000 square miles.[141] Tennessee has the 36th-highest gas tax at 39.8 cents per gallon, as well as the 45th-highest diesel tax at 42.8 cents per gallon.[142]

It has close to 4.6 million registered vehicles, 40 percent of which are in the Nashville and Memphis regions. These major metropolitan areas have 29 percent of the state's 4,703 highway miles.

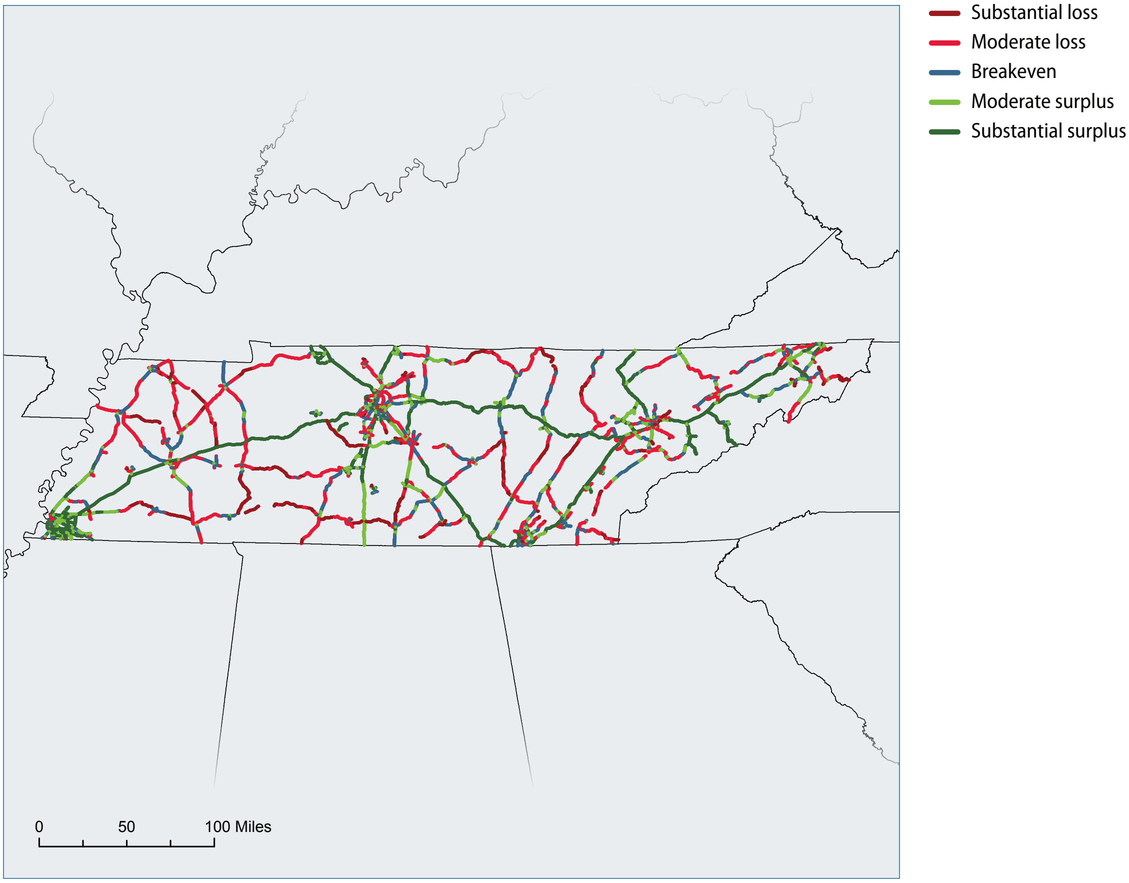
Both rural and urban highways are somewhat bifurcated between less than breakeven and greater than breakeven, with a smaller proportion at breakeven. Most of the nonbreak-even miles are other principal arterials, particularly those in rural areas.

Tennessee fiscal performance of interstate and arterial roadways

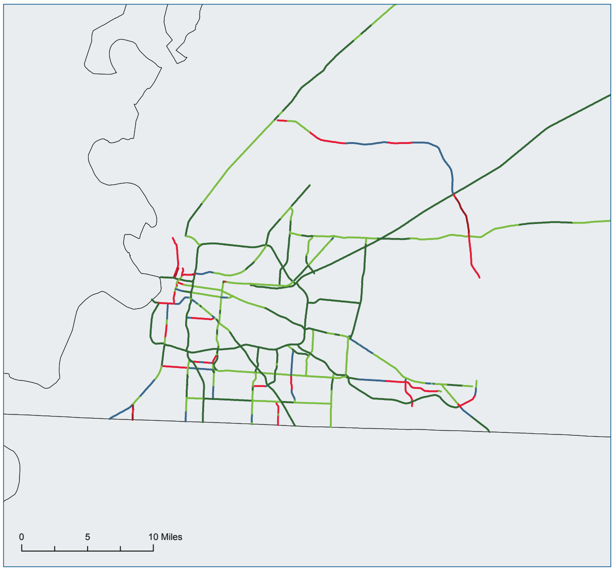
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	0	0%	0	0%	0	0%
Urban areas, between 200,000 and 1 million residents	352	52%	159	23%	171	25%
Urban areas, between 50,000 and 200,000 residents	222	51%	94	22%	121	28%
Urban subtotal	574	51%	252	23%	293	26%
Rural subtotal	1626	45%	459	13%	1500	42%
National total	**2,200**	**47%**	**712**	**15%**	**1,792**	**38%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

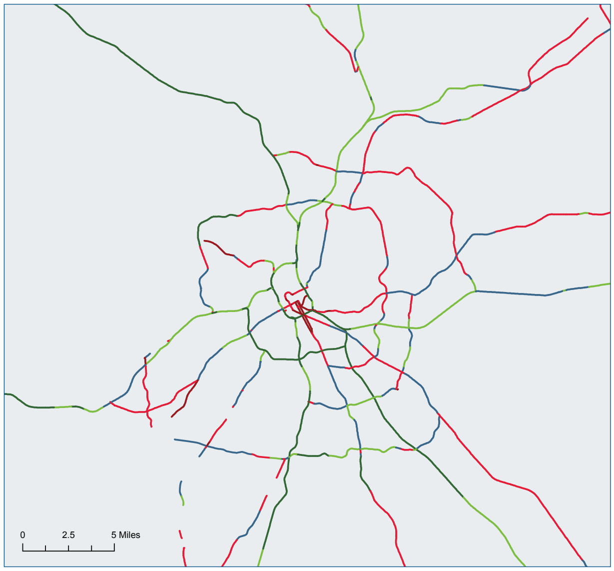
Tennessee arterial roadway fiscal performance



Memphis

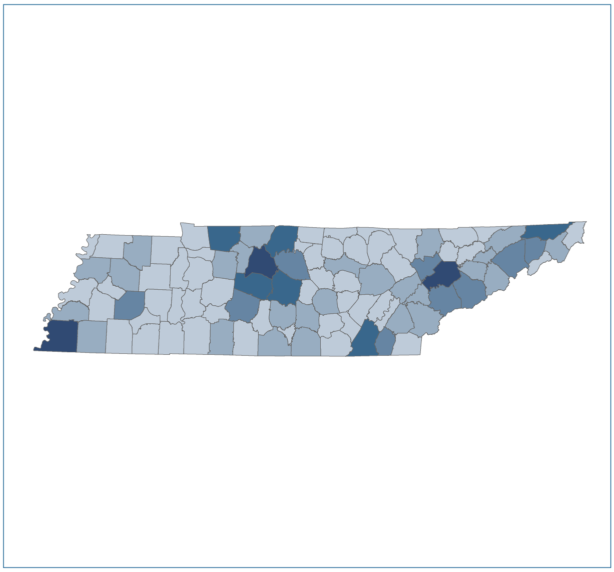


Nashville



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Washington

Washington state has nearly 7 million residents, 5 million registered vehicles,[143] and covers 66,455 square miles, making it the 20th-largest state by area.[144] The state has 4,504 miles of arterial roadway, which works out to 1,110 residents per mile. Washington has the 10th-highest gasoline and diesel taxes at 55.9 cents and 61.9 cents per gallon, respectively.[145] The high tax rates mean that only 25 percent of the state's arterial roadways fail to generate enough revenue to cover long-term costs.

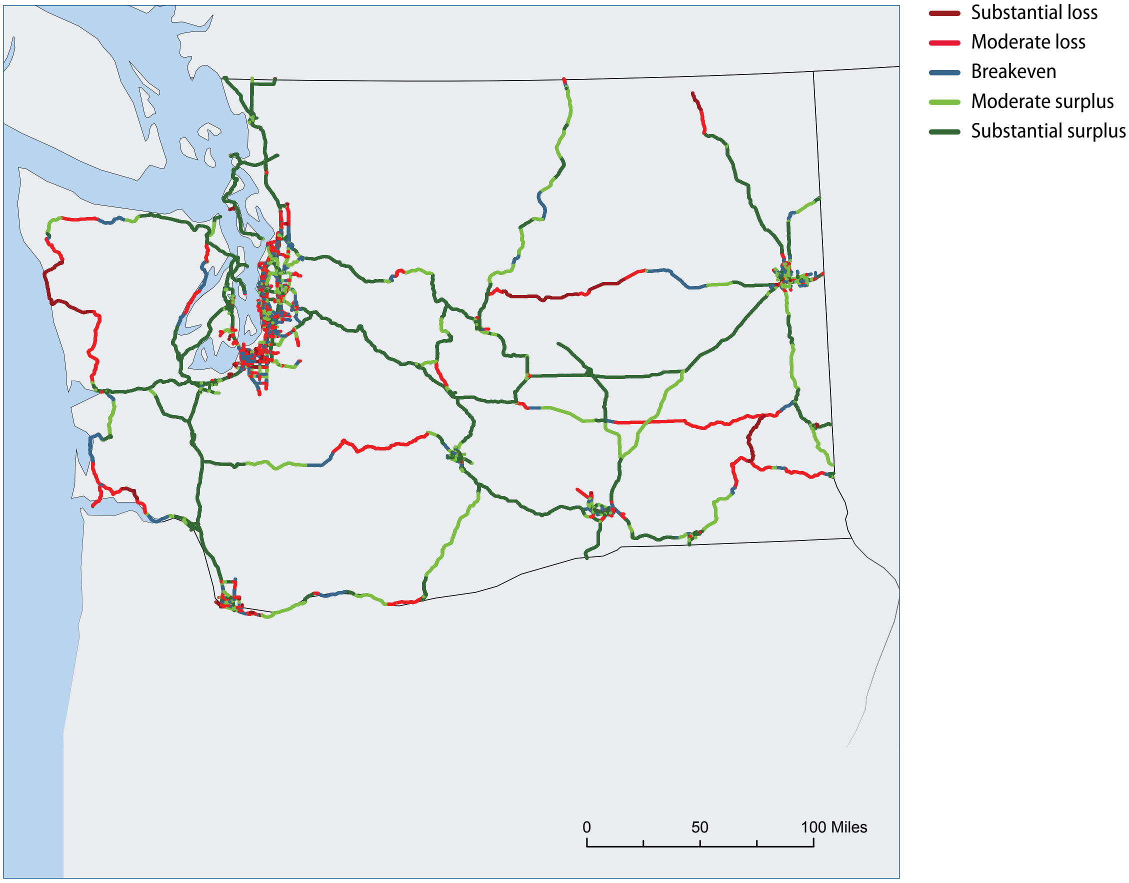
Half of all Washington residents live in the Seattle-Tacoma metropolitan area.[146] The region accounts for half of all registered vehicles and more than one-quarter of the state's arterial miles.[147] A majority of the region's principal arterials—excluding interstate miles—do not generate enough revenue to cover their costs. Each year, residents in the Seattle-Tacoma region lose 48 hours per capita to congestion.[148]

Washington fiscal performance of interstate and arterial roadways

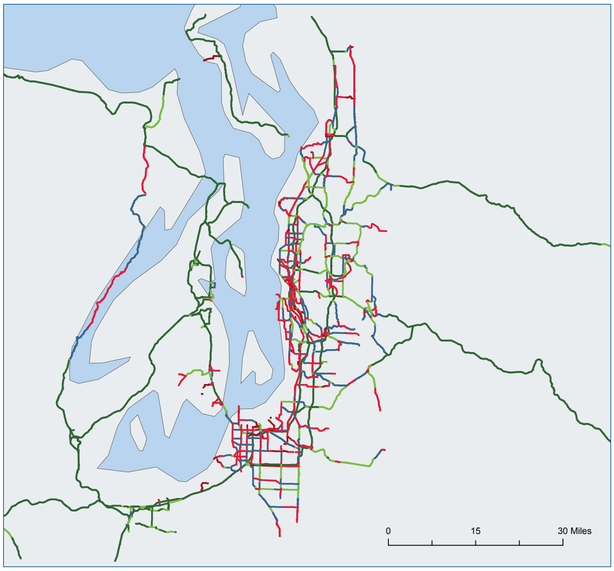
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	475	40%	292	24%	432	36%
Urban areas, between 200,000 and 1 million residents	74	23%	78	24%	173	53%
Urban areas, between 50,000 and 200,000 residents	9	3%	21	7%	272	90%
Urban subtotal	558	31%	392	21%	878	48%
Rural subtotal	571	21%	196	7%	1909	71%
National total	**1,129**	**25%**	**588**	**13%**	**2,787**	**62%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

Washington arterial roadway fiscal performance



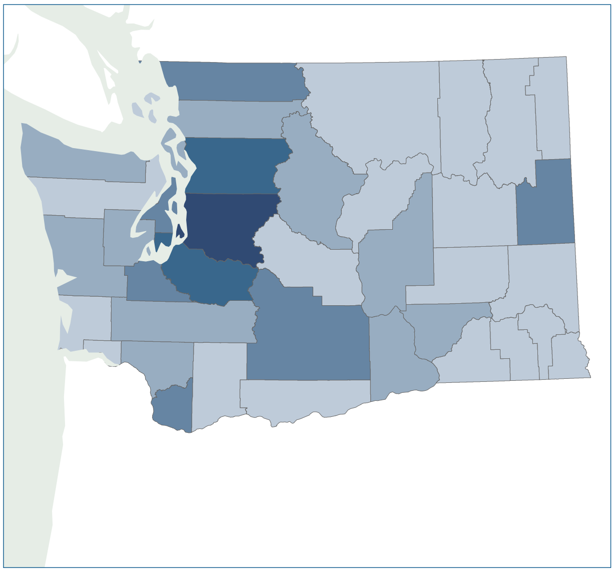
Seattle



Spokane

- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Wyoming

Wyoming is the 10th-largest state by area at 97,814 square miles[149] but is the smallest state by population, with only 582,658 residents.[150] Wyoming has 481,292 registered vehicles[151] and 3,126 interstate arterial miles, which works out to only 186 residents per mile of arterial roadway. The combined state and federal fuel taxes are 42.4 cents and 48.4 cents per gallon for gasoline and diesel, respectively.[152] This gives Wyoming the 30th-highest fuel tax. The large geographic size, low tax rate, and low travel demand mean that 83 percent of interstate and principal arterial miles lose money each year.

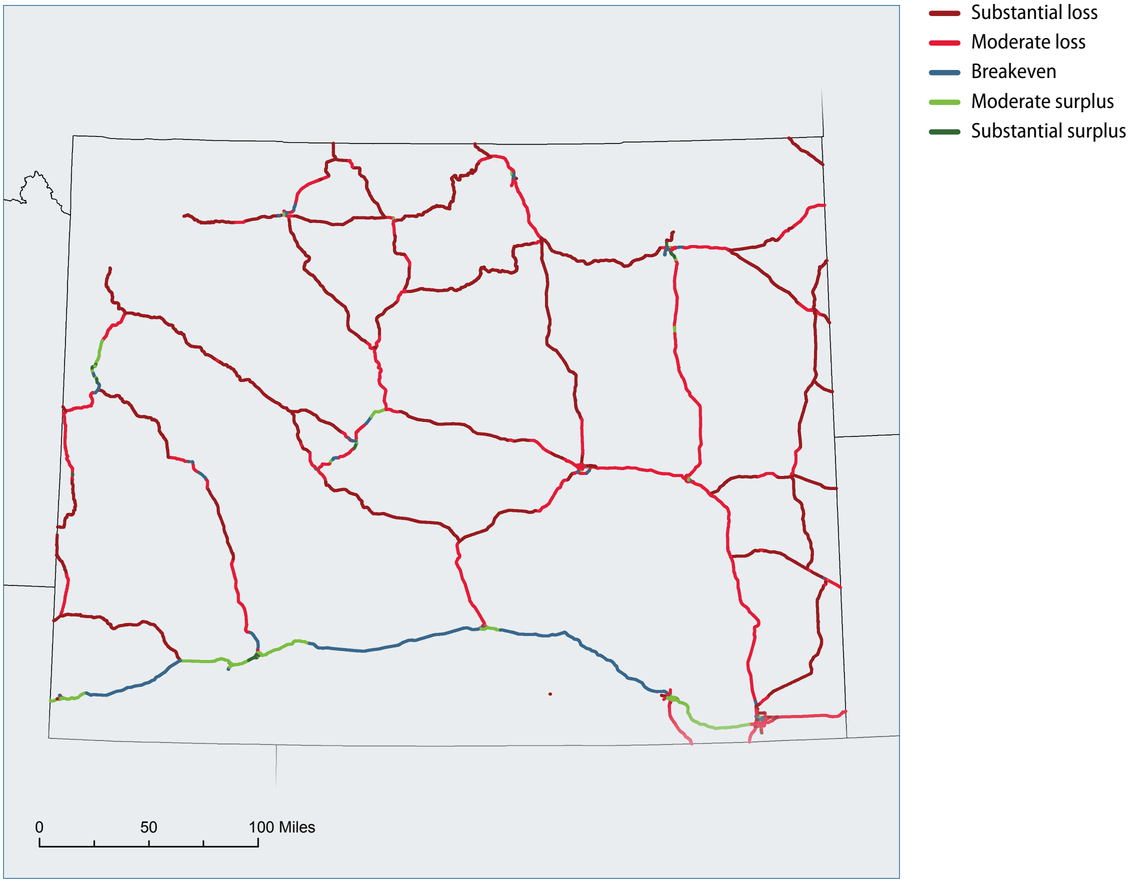
Wyoming's five largest counties—Laramie, Natrona, Campbell, Sweetwater, and Fremont—have more than half of the registered vehicles in the state and a little more than 30 percent of the arterial miles. Only 18 percent of the 141 highway miles in urban areas break even or generate revenue. Similarly, only 17 percent of the 2,985 rural arterial roadway miles break even or generate revenue. With the exception of Interstate 80, nearly all of Wyoming's arterial roadways fail to generate sufficient revenue.

Wyoming fiscal performance of interstate and arterial roadways

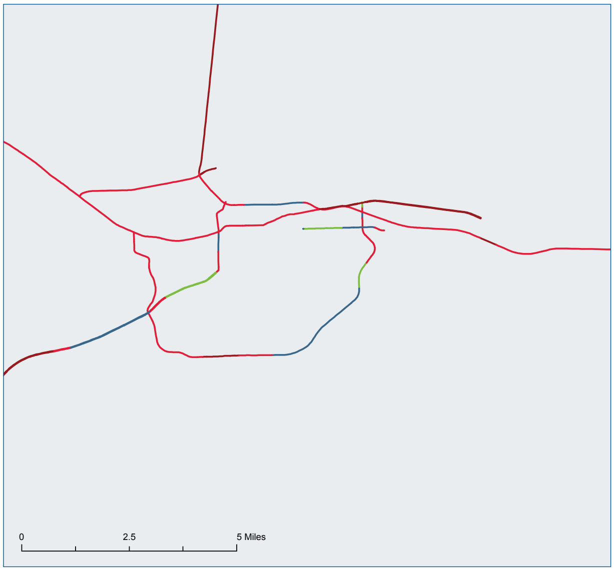
Geography	Loss	Share	Breakeven	Share	Surplus	Share
Urban areas, more than 1 million residents	0	0%	0	0%	0	0%
Urban areas, between 200,000 and 1 million residents	0	0%	0	0%	0	0%
Urban areas, between 50,000 and 200,000 residents	115	82%	17	12%	9	6%
Urban subtotal	115	82%	17	12%	9	6%
Rural subtotal	2483	83%	287	10%	215	7%
National total	**2,598**	**83%**	**304**	**10%**	**224**	**7%**

Source: Based on authors' calculations from the Federal Highway Administration, "HPMS Public Release of Geospatial Data in Shapefile Format," available at http://www.fhwa.dot.gov/policyinformation/hpms/shapefiles.cfm (last accessed October 2014); Federal Highway Administration, "2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance," available at http://www.fhwa.dot.gov/policy/2013cpr/appendixa.htm (last accessed October 2014); U.S. Energy Information Administration, *Petroleum Marketing Monthly May 2014* (U.S. Department of Energy, 2014), available at http://www.eia.gov/petroleum/marketing/monthly/pdf/mgt.pdf; Federal Highway Administration, *State Motor-Fuel Taxes and Related Receipts - 2012* (1) (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mf1.pdf; Federal Highway Administration, *Revenues Used By States for Highways - 2012 1/* (U.S. Department of Transportation, 2013), available at http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/sf1.pdf.

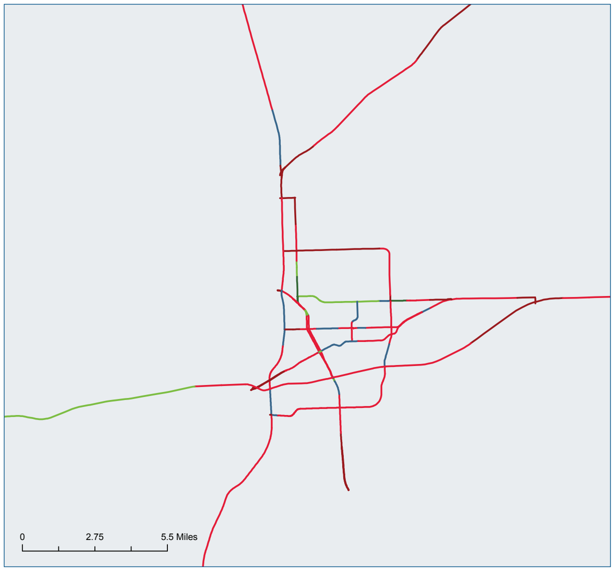
Wyoming arterial roadway fiscal performance



Casper

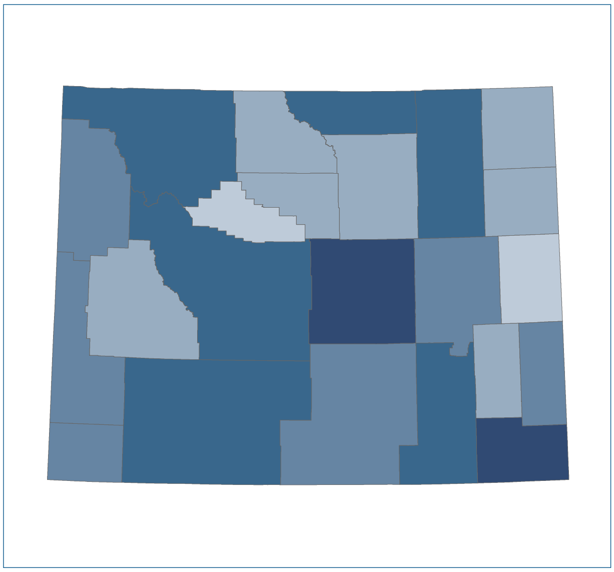


Cheyenne



- Substantial loss
- Moderate loss
- Breakeven
- Moderate surplus
- Substantial surplus

Registered vehicles as a share of all vehicles in state



- Low share
- Moderate share
- Intermediate share
- Elevated share
- High share

Conclusion

Every mode of transportation requires substantial public subsidy, and highways are no exception. As this report shows, 40 percent of all National Highway System miles fail to generate sufficient user fee revenues to cover their long-term maintenance costs, even when initial construction and inflation costs are removed from the analysis. This is not an argument in favor of shuttering nearly half of all major roadways. Clearly, the benefits derived from a large roadway network are greater than the productivity of any one part. At the same time, however, economic research clearly demonstrates a decline in marginal productivity from additional highway investments. In effect, we have realized the benefits that come from creating a comprehensive national network, and subsequent highway investments yield only modest gains at the expense of more-productive projects.

This reality has profound implications for state and federal transportation policy. Most notably, this research indicates that objective measures of need and return on investment should drive expenditure decisions without regard for the money source. For states, this means removing statutory or constitutional prohibitions on the use of user fee revenues. At the federal level, this means providing greater programmatic flexibility and establishing a multimodal fund. The new fund would ensure that beneficial projects no longer sit on the shelf because of a historical holdover that omits freight, passenger rail, and intermodal projects, among others, from the federal program.

Failure to undertake these reforms will mean that limited resources flow disproportionately to low-productivity highway investments. Without greater modal balance, the transportation system will face even greater congestion and economic loss. In short, the stakes are too high to continue with a business-as-usual approach. States and the federal government must modernize their policies to deliver the infrastructure needed to keep the U.S. economy moving forward in the 21st century.

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