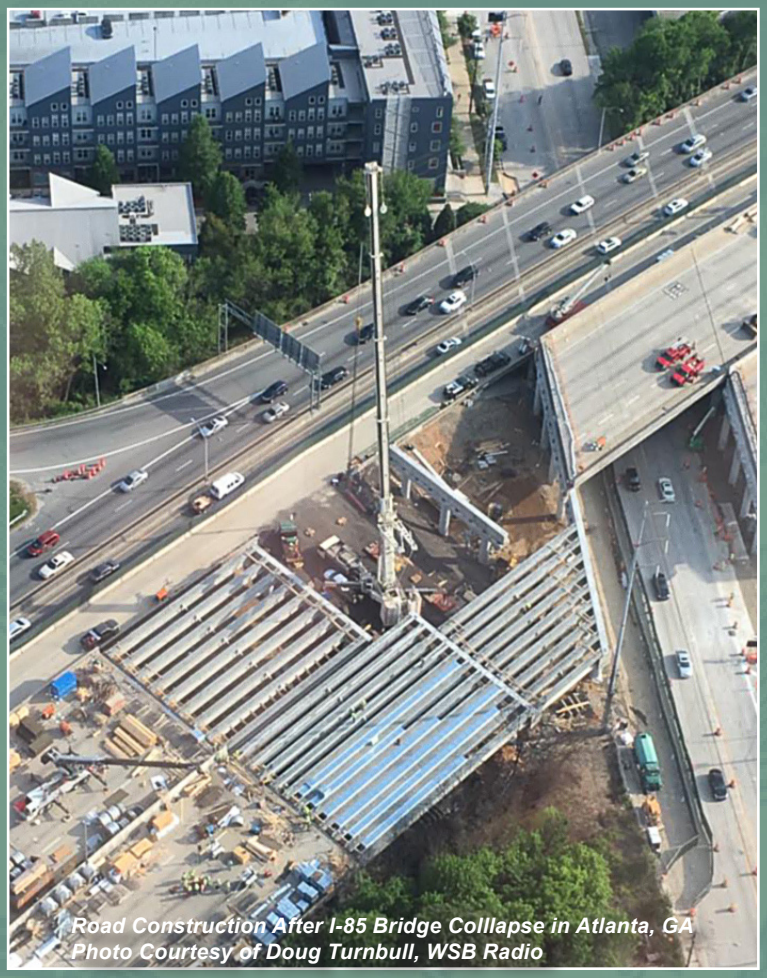
A Framework for Infrastructure Funding

November 2017



Road Construction After I-85 Bridge Colllapse in Atlanta, GA
Photo Courtesy of Doug Turnbull, WSB Radio

Prepared by the American Transportation Research Institute

ATRI American Transportation Research Institute

A Framework for Infrastructure Funding

November 2017

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LIST OF ACRONYMS

ARTBA	American Roadway and Transportation Builders Association
ATRI	American Transportation Research Institute
ASCE	American Society of Civil Engineers
ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
CBO	Congressional Budget Office
DOT	Department of Transportation
EDC	Every Day Counts
EIA	Energy Information Agency
EIS	Environmental Impact Statement
EV	Electric Vehicle
FAST	Fixing America's Surface Transportation
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FTA	Federal Transit Administration
GARVEE	Grant Anticipated Revenue Vehicle
GDP	Gross Domestic Product
GPS	Global Positioning System
HOT	High-Occupancy Toll
HTF	Highway Trust Fund
HVUT	Heavy Vehicle Use Tax
IRS	Internal Revenue Service
MBUF	Mileage Based User Fee
ISTEA	Intermodal Surface Transportation Efficiency Act
MPG	Miles-Per-Gallon
NCFRP	National Cooperative Freight Research Program
NEPA	National Environmental Policy Act
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
RAC	Research Advisory Committee
RFID	Radio Frequency Identification

LIST OF ACRONYMS (continued)

SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investment Generating Economic Recovery
TPIMS	Truck Parking Information Management System
U.S.	United States
U.S. DOT	United States Department of Transportation
UK	United Kingdom
VMT	Vehicle Miles Traveled
WS DOT	Washington State Department of Transportation

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INTRODUCTION

In 2007 the American Transportation Research Institute (ATRI) published a comprehensive report on the state of highway funding in the United States (U.S.).[1] One key finding of the report was that a persistent transportation funding shortfall was due, in part, to an erosion of federal motor fuels tax revenues. Since the original report was published in 2007, there have been three U.S. presidents and six sessions of Congress, yet no long-term solutions for addressing federal transportation funding issues have emerged. While many elected officials publicly highlight the need for infrastructure investment, increasing the federal motor fuels tax rate (the primary source of transportation funding) remains politically challenging. It has been more than two decades since the federal fuel tax was increased, and during this time the buying power of tax revenues has diminished due to inflation and rising construction costs.

The Great Recession also contributed to shortfalls in transportation funding by reducing demand for transportation and fuel, and in turn decreasing transportation-related tax revenues. The subsequent economic recovery underscores the intricate relationship between infrastructure demand, bridge and pavement conditions, fuel prices, and tax revenues.

In 2016, ATRI's Research Advisory Committee (RAC)[2] requested an update to ATRI's 2007 highway funding analysis, recognizing the need to reassess current highway funding needs and identify funding options that would ensure a viable surface transportation system for the future. This report describes the current state of infrastructure, current highway funding levels, and includes an analysis of transportation revenue options. The report concludes with key recommendations for improving the nation's surface transportation infrastructure through improvements in transportation revenue collection and investment.

[1] Jeffrey Short, Dan Murray and Sandra Shackelford, *Defining the Legacy for Users: Understanding Strategies and Implications for Highway Funding,* American Transportation Research Institute, Alexandria, VA, May 2007.

[2] ATRI's RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, labor and driver groups, law enforcement, Federal government and academia. The RAC is charged with annually recommending a research agenda for the Institute.

1. THE NATION'S SURFACE TRANSPORTATION INFRASTRUCTURE

Background

In 1939 President Roosevelt received a report from the Secretaries of the Department of Agriculture and the Department of War on the feasibility of a system of transcontinental toll roads.[3] In a subsequent letter, Roosevelt told Congress that the report offered evidence of the need in the U.S. for a "special system of direct interregional highways … designed to meet the requirements of national defense and the needs of a growing peacetime traffic of longer range."[4] The report itself indicated that tolling this system was not appropriate, thus offering a pathway for interstate "freeways" to be built across the U.S.

The system of interstate highways envisioned in the 1930s was eventually named the *Dwight D. Eisenhower National System of Interstate and Defense Highways,* and was built during the decades that followed World War II. These interstate highways provided large economic benefits to the U.S., allowing goods and people to move efficiently throughout the country. Locations that were once relatively remote were suddenly connected to the rest of the nation. The interstate system also met a military logistics objective, allowing for the quick movement of military supplies and personnel, as well as providing efficient routes for civilian evacuation during emergencies such as hurricanes.

All of this activity is predicated on the management of over 4 million miles of roadway – more than any other nation.[5] A critical component of this network is the National Highway System (NHS), which includes more than 220,000 miles of highways.[6] [7] The limited access highways within the NHS are essential to efficiently connecting people with their places of employment, and freight with manufacturers, retailers and consumers.

Through this connectivity, the nation's surface transportation system contributes greatly to the U.S. economy and its $18.56 trillion annual Gross Domestic Product (GDP).[8] One leading user and tax contributor to the transportation system is the U.S. trucking industry, which moves nearly 10.5 billion tons of freight on U.S. roadways each year.[9] This freight movement generates $726 billion in gross revenues, representing four percent of U.S. GDP.[10] [11] To support the nation's infrastructure, the trucking industry pays $41.3 billion in federal and state highway-user taxes.[12]

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[3] U.S. Secretary of Agriculture, "Toll Roads and Free Roads" (United States Congress, April 27, 1939), http://transportationfortomorrow.com/final_report/pdf/volume_3/historical_documents/06_toll_roads_and_free_roads_1939.pdf.

[4] Ibid.

[5] The World Bank, "Data: United States," accessed September 10, 2017, https://data.worldbank.org/country/united-states.

[6] W. Ford Torrey, "Table 1: NHS Roadway Network Statistics," *Estimating the Cost of Congestion to the Trucking Industry*, American Transportation Research Institute. Arlington, VA., April 2016.

[7] Federal Highway Administration, "Estimated MAP-21 Mileages," accessed April 17, 2017. https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/map21estmileage.cfm.

[8] The World Bank, "Data: United States," accessed September 10, 2017, https://data.worldbank.org/country/united-states.

[9] American Trucking Associations. *American Trucking Trends 2016*. Arlington, VA, 2016.

[10] Bob Costello (Chief Economist & Senior Vice President, American Trucking Associations), e-mail message to author, March 17, 2017.

[11] American Trucking Associations. *American Trucking Trends 2017*. Arlington, VA, 2017.

[12] Ibid. This figure represents $18.7 billion in Federal highway-user taxes and $22.6 billion in state highway user taxes.

The trucking industry, in fact, pays nearly 46 percent of highway user fees collected for the Highway Trust Fund (HTF).[13]

Though the U.S. highway system is critically important to the country's economy and quality of life, in its 2017 *Report Card for America's Infrastructure*, the American Society of Civil Engineers (ASCE) graded the nation's roadways a D for Poor.[14] The report cites that more than 40 percent of major urban highways are routinely congested at a cost of $160 billion annually in wasted fuel and time, and estimates that the U.S. highway system is currently underfunded by $836 billion.[15] This funding backlog is the result of a number of significant infrastructure and transportation investment trends.

The U.S. surface transportation system is dependent on significant revenue sources. In 2015 more than $235 billion was expended by federal, state and local governments on highways for capital improvements, maintenance and other costs.[16] Even with this large expenditure there are widespread infrastructure problems:

- 11 percent of bridges are classified as structurally deficient, and 14 percent are classified as functionally obsolete;
- 16.7 percent of Federal-Aid Highway pavement is rated as poor;
- 6.7 billion hours of delay are experienced by travelers annually.[17]

Vehicle Miles Traveled

Vehicle Miles Traveled (VMT) measures, which are published annually by the U.S. Department of Transportation (U.S. DOT), are a key indicator of transportation demand for roadways. In the post-Great Recession economy, demand for the nation's roadways has continued on an upward trajectory after a brief period of decline. But this overall upward trend has existed for more than a century. Figure 1 details VMT-based demand for roadways, and the supply of roadways based on public road mileage and lane miles.[18] The VMT data displayed in Figure 1 documents a steady increase in driving after World War II, a flattening of VMT during the Great Recession, and a post-recession continuation of growth.[19,20]

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[13] The HTF collected $40.8 billion in 2015 according to FHWA's Highway Statistics 2015, Table FE-210. In 2015 commercial trucks paid $18.7 billion in highway-user taxes according to ATA's Trucking Trends 2017, Table 5-1.

[14] American Society of Civil Engineers, "ASCE Infrastructure Report Card- Roads," 2017, http://www.infrastructurereportcard.org/cat-item/roads/.

[15] Ibid.

[16] Federal Highway Administration, "Chart HF-10 - Highway Statistics 2015," accessed February 15, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/hf10.cfm.

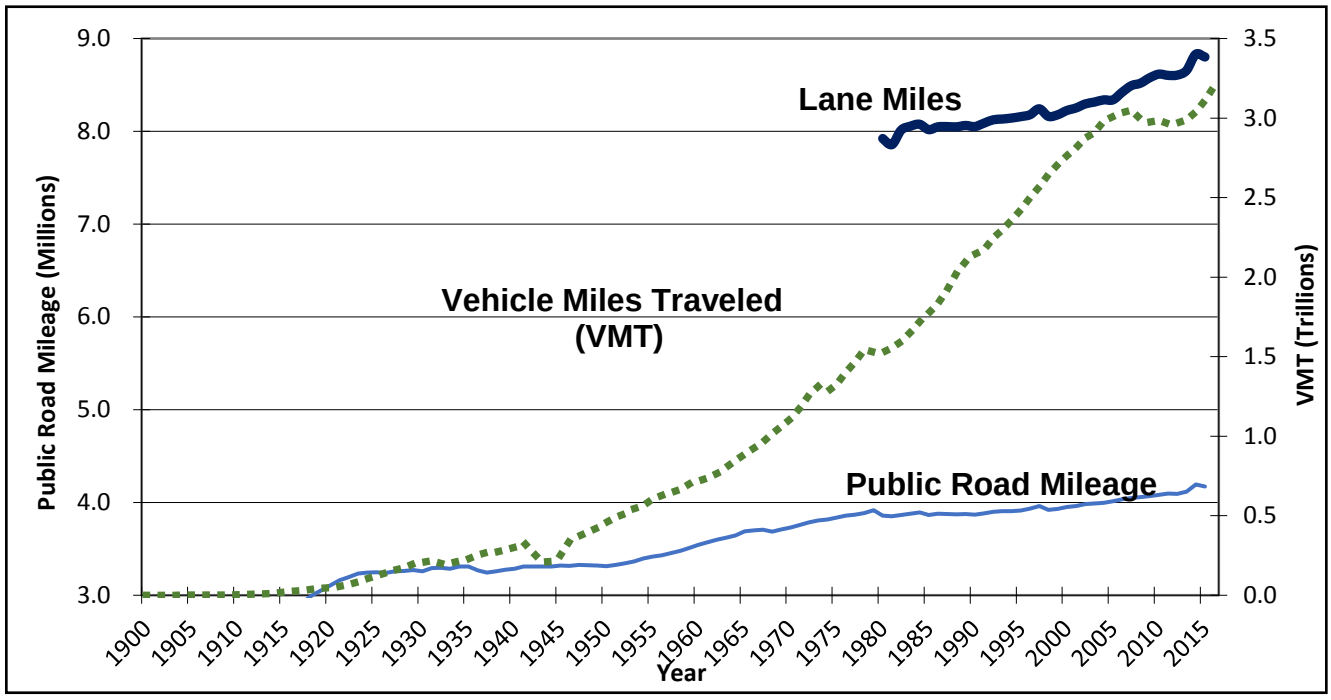
[17] Ibid.

[18] Public road mileage refers to the total public road length (1). Lane-miles figures incorporate the increased capacity of multiple lanes into public road mileage figures by multiplying public road mileage by the number of continuous lanes on the road (2).
(1) Federal Highway Administration, "Highway Performance Monitoring System (HPMS) – Policy," accessed April 17, 2017. https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/appendixb.cfm.
(2) Minnesota Department of Transportation, "Roadway Data Collection Methods - TDA," accessed April 17, 2017. http://www.dot.state.mn.us/roadway/data/coll-methods.html.

[19] Federal Highway Administration, "Chart VMT-422 - Highway Statistics 2015," accessed February 15, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/vmt421c.cfm.

[20] Federal Highway Administration, "Press Release: 3.2 Trillion Miles Driven On U.S. Roads In 2016, 2/21/2017," accessed February 23, 2017. https://www.fhwa.dot.gov/pressroom/fhwa1704.cfm.

Figure 1: Public Road Mileage, VMT and Lane Miles



In 2016, 3.2 trillion miles were driven in the U.S. in what the Federal Highway Administration (FHWA) referred to as a "historic new record."[21] Car and truck travel trends experienced similar VMT increases and decreases over this 10-year period.

Congestion

Traffic congestion typically occurs when roadway infrastructure supply does not meet vehicle demand. Looking back to Figure 1, there is a clear indication that VMT growth has consistently outpaced growth in lane miles and public road miles. However, this VMT growth rate only explains part of the congestion issue.

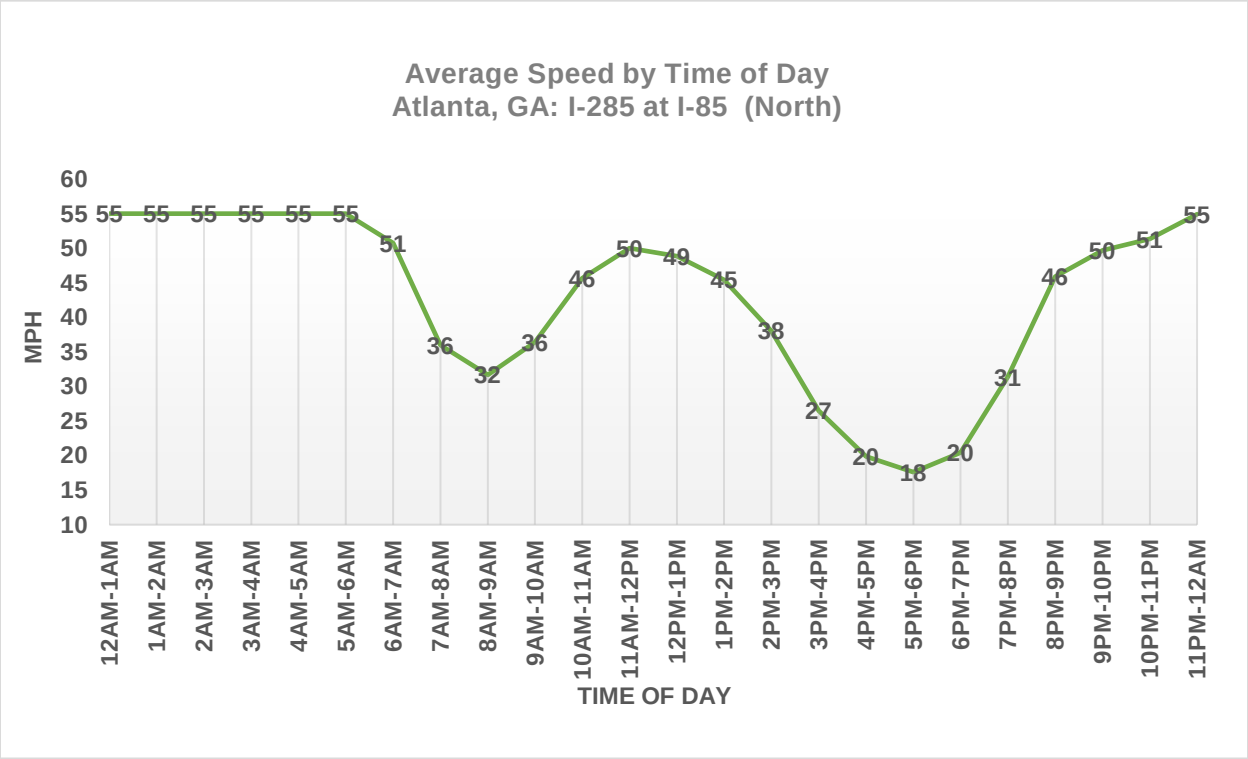
One key consideration is that the level of roadway demand varies greatly based on location. The U.S. has more than twice as many rural lane-miles as urban lane-miles, yet urban roadways account for 70 percent of the nation's VMT.[22] The result of this imbalance is urban highway congestion. Empirical data supports the urban congestion proclivity; ATRI's 2017 report on truck bottlenecks found that all of the top 100 truck bottleneck locations in the U.S. reside within urban areas.[23]

In addition to location, time-of-day also impacts travel demand. Peak-hour driving in urban areas – when commuters are traveling to and from work – tends to create the greatest levels of congestion and delay. An example of this from ATRI's truck bottleneck report is shown in Figure

[21]Federal Highway Administration, "Press Release: 3.2 Trillion Miles Driven On U.S. Roads In 2016, 2/21/2017."
[22] Ibid.
[23] American Transportation Research Institute, "2017 Top 100 Truck Bottleneck List," January 25, 2017, http://atri-online.org/2017/01/17/2017-top-100-truck-bottleneck-list/.

2, where the lowest average hourly speed at a key freight bottleneck is 18 mph during evening rush hour. During off-peak hours, however, the location operates at a speed limit of 55 miles per hour or more.

Figure 2: Example of Peak Hour Congestion



Congestion has a significant cost. In 2012, when the economy was still recovering from the recession, the average automobile commuter was delayed 21 hours per year due to congestion, with a total nationwide cost of $154.2 billion.[24] Additionally, trucking industry time delays on the NHS in 2015 were over 996 million hours, equating to $63.4 billion in congestion-related costs.[25] These congestion costs are in part the result of a lack of infrastructure investment, and are more than three times higher than the $18.7 billion paid annually by the industry in federal user fees.[26]

To mitigate congestion there are generally two strategies. One is to "manage" travel demand through policies and programs. Many economists, for instance, believe that this can be accomplished through "congestion pricing" strategies. A second strategy for congestion mitigation is to increase supply of roadway infrastructure, either through investment in expanded roadway capacity, roadway improvement or through vehicle improvements, all of which can increase vehicle throughput.

[24] Federal Highway Administration, "2015 Conditions and Performance - Policy," accessed February 10, 2017, https://www.fhwa.dot.gov/policy/2015cpr/pdfs.cfm.
[25] W. Ford Torrey, *An Analysis of the Operational Costs of Trucking: 2017 Update,* American Transportation Research Institute, Arlington, VA. May 2017.
[26] American Trucking Associations, *American Trucking Trends 2017*. Arlington, VA, 2017.

There is evidence that supports congestion relief through infrastructure investment. For instance, a one-mile auxiliary lane added to I-394 in Minneapolis in 2005 resulted in a reduction of 87,000 annual hours of delay.[27]

On a national scale, improving roadways to mitigate congestion requires significant funding as detailed in FHWA's 2015 Conditions and Performance report to the U.S. Congress. The report states that reducing total delay by 13.4 percent on the nation's Federal-Aid Highway system would require a sustained federal infrastructure investment of $57.4 billion annually over 20 years. For reference, in 2016 Highway Trust Fund (HTF) Highway Account outlays were $44.7 billion.[28] To reduce total delay at a slightly higher level (16.5%), it would cost $75.4 billion annually according to the report.

Infrastructure Condition and Investment Needs

Beyond traffic congestion, infrastructure deterioration is also a significant concern. Bridges are considered structurally deficient if significant load-carrying elements are in poor condition due to deterioration, damage or both. In August 2007 the I-35W Mississippi River Bridge crossing in Minneapolis collapsed, killing 13 people and injuring 145 in an incident that highlighted the nation's need for infrastructure investment.[29] In 2002, prior to the Minneapolis bridge collapse, 84,031 bridges in the United States were classified as structurally deficient by the National Bridge Inventory. By 2012 that number had decreased to 66,749 after funds were allocated to bridge repair through the American Recover and Reinvestment Act of 2009. [30,31] Although structurally deficient bridges are on the decline, American Road and Transportation Builders Association (ARTBA) researchers estimate it would take 21 years to completely eliminate the structurally deficient category at current repair rates.[32]

Another example of how deficient infrastructure can create strategic impacts is the rapid emergence of e-commerce, which marks one of the most significant shifts in the U.S. economy over the past two decades. Changing consumer demand and spending patterns have supported this trend, as e-commerce spending now accounts for over nine percent of total retail sales, up from less than one percent in 2000, and has continued to grow at 3 to 4 times the rate of overall spending activity.[33] E-commerce now encompasses a broad swath of consumer goods, including electronics, apparel, furniture, and groceries. Furthermore, consumers now expect these goods to be delivered within short delivery windows and at little-to-no added shipping costs.[34] While e-commerce trends are presently re-shaping the economic landscape of the U.S. economy, crumbling transportation infrastructure and growing urban congestion pose a major

[27] Minnesota Department of Transportation, "MnPASS Express Lanes," accessed September 29, 2017. http://www.dot.state.mn.us/mnpass/mnpassexpresslanes.html.
[28] Federal Highway Administration, "2015 Conditions and Performance - Policy."
[29] Elizabeth Stawicki, "Why Did the Bridge Collapse?," MPR News, accessed February 10, 2017, http://www.mprnews.org/story/2007/08/02/inspection.
[30] Federal Highway Administration, "2015 Conditions and Performance - Policy."
[31] "Investments in bridges were bolstered in 2009 and 2010 with the influx of additional funding from the American Recovery and Reinvestment Act and peaked in 2010 with $18 billion spent." "ASCE Infrastructure Report Card- Bridges," 2017, http://www.infrastructurereportcard.org/cat-item/roads/.
[32] Nick Iannelli, "Deficient Bridges Decreasing, Study Finds, but Challenges Remain," WTOP, February 18, 2016, http://wtop.com/sprawl-crawl/2016/02/deficient-bridges-decreasing-study-finds-challenges-remain/.
[33] "Quarterly E-Commerce Report." United States Census Bureau. Washington D.C. Available online: https://www.census.gov/retail/index.html#ecommerce
[34] Howland, Daphne. "Same-day delivery services tripled in a year." Supply Chain Dive. 19 September, 2017. Available online: https://www.supplychaindive.com/news/retail-same-day-delivery-triples/505237/

threat to the continued emergence of e-commerce. Slower traffic and deteriorating road conditions could derail the hyper-efficient supply chain logistics that the industry needs to meet consumer expectations.

This can readily be seen in that e-commerce activity has thrust a greater proportion of supply chain logistics and "last-mile" deliveries into the midst of dense urban regions. Indeed, the hub-and-spoke logistics model has evolved to include smaller but many more warehouses in urban population centers. The net effect is that these distribution facilities are both closer to large population centers to meet consumer needs for high-speed, low-cost shipping – at the same time they are at the epicenter of traffic snarls and freight bottlenecks.[35] Taken together, not only is the volume of e-commerce logistics activity growing rapidly, it is increasing the most in urban areas where transportation infrastructure is severely strained.

Based on increasing truck travel times on the National Highway System, inadequate or deteriorating transportation infrastructure may already be constraining the logistics industry's ability to meet the growing volume of e-commerce activity. Going forward, it is a certainty that that the challenges associated with short-term retail shipping will be increasingly difficult for e-commerce players, and the cost to ship goods will increase with travel delays. Given the importance of low-cost and expeditious shipping to the e-commerce business model, it is clear that deficient transportation infrastructure is one of the most significant obstacles facing the industry today.

Exacerbating this issue, from 2002 to 2012 the percentage of pavement on Federal-Aid Highways that was classified as "poor" rose from 12.6 percent to 19.7 percent.[36] A separate analysis found that 32 percent of major urban roads, including "Interstates, freeways, and other major routes" were classified as substandard, or poor, as of 2014.[37]

FHWA's 2015 Conditions and Performance report to Congress offers three potential system-wide scenarios for future investment.[38] In each scenario, the expected system conditions are estimated using various metrics such as pavement condition, average delay time and bridge structure ratings. The most impactful of the three funding scenarios would increase capital investments to an average annual $142.5 billion across 20 years. This 35 percent increase in funding would decrease pavement roughness by 14 percent and decrease congestion by 16.5 percent across the entire system.

Federal Infrastructure Investment Trends

The primary federal surface transportation funding mechanism is the Highway Trust Fund (HTF). As discussed later in this report, the federal government currently collects revenue from fuel taxes and other user fees, and distributes that money back to states for transportation infrastructure. From fiscal year 2009 to 2011, a total of $144 billion was obligated from the HTF by a number of federal agencies – FHWA, the Federal Transit Administration (FTA), the National

[35] Phillips, Erica E. "Online Sales Leading Toward Smaller, Urban Warehouses. The Wall Street Journal. New York, New York. 7 August, 2015. Available online: https://www.wsj.com/articles/online-sales-leading-toward-smaller-urban-warehouses-1438979692

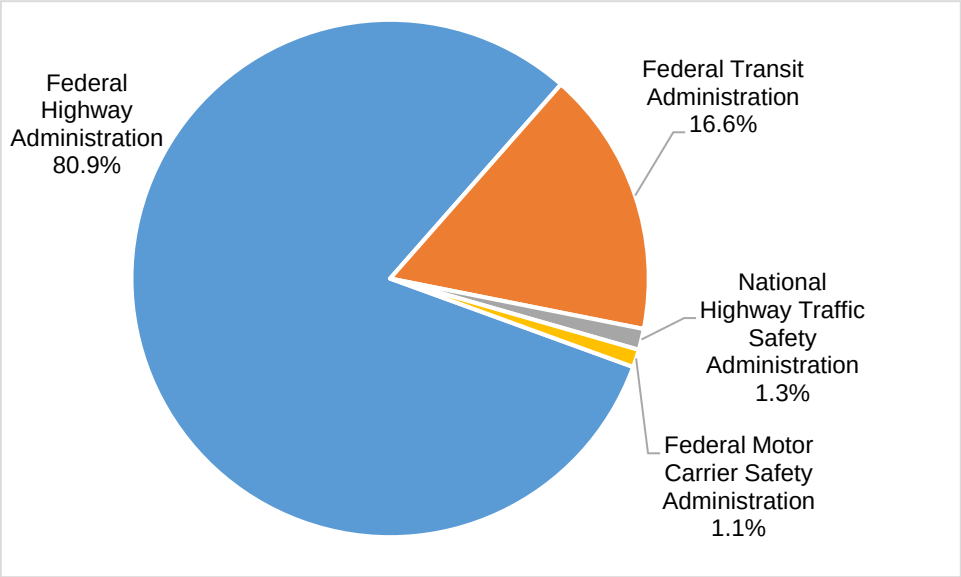
[36] Federal Highway Administration, "2015 Conditions and Performance - Policy."

[37] TRIP, "Bumpy Roads Ahead: America's Roughest Rides and Strategies to Make Our Roads Smoother," November 2016, http://tripnet.org/docs/Urban_Roads_TRIP_Report_November_2016.pdf.

[38] Federal Highway Administration, "2015 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Executive Summary," accessed October 3, 2017. https://www.fhwa.dot.gov/policy/2015cpr/pdfs/es.pdf.

Highway Traffic Safety Administration (NHTSA), and the Federal Motor Carrier Safety Administration (FMCSA). Figure 3 displays the obligations of these agencies. [39,40]

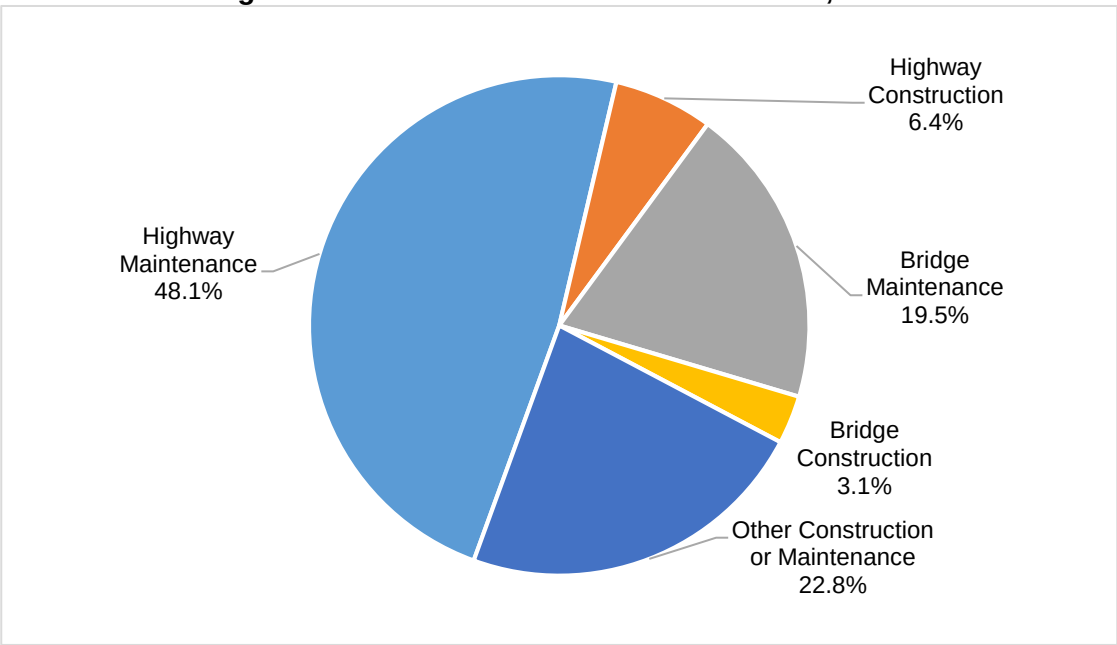
Figure 3: Highway Trust Fund Obligations by Agency, Fiscal Years 2009 – 2011



The vast majority of FHWA's obligated funds – 81 percent from 2009 through 2011 – go to the maintenance and construction of highways and bridges.[41] The breakout of these funds is shown in Figure 4 which documents that most funding goes to maintenance rather than new construction. [42,43,44]

[39] Government Accountability Office, "Highway Trust Fund Obligations, Fiscal Years 2009 to 2011," January 16, 2013. http://www.gao.gov/assets/660/651315.pdf.
[40] This includes transfers from the General Fund of the U.S. Treasury to the Highway Trust Fund, but excludes funds appropriated from the American Recovery and Reinvestment Act of 2009 and obligations funded directly by the General Fund of the U.S. Treasury.
[41] Government Accountability Office, "Highway Trust Fund Obligations, Fiscal Years 2009 to 2011."
[42] Ibid. http://www.gao.gov/assets/660/651315.pdf.
[43] This includes transfers from the General Fund of the U.S. Treasury to the Highway Trust Fund, but excludes funds appropriated from the American Recovery and Reinvestment Act of 2009 and obligations funded directly by the General Fund of the U.S. Treasury.
[44] The "Other Construction or Maintenance" category includes activities supporting bridge and highway maintenance, such as preliminary engineering and right-of-way acquisition.

Figure 4: FHWA Obligations for Maintenance and Construction, Fiscal Years 2009 - 2011



Beyond the 81 percent that is detailed in Figure 3, the remaining funds are used for debt service, planning, traffic management, and safety programs.

Grant Programs

Several grant programs are available to states and other entities to help cover the cost of specific initiatives. Three such programs, TIGER, FASTLANE and ATCMTD grants, are described briefly below.

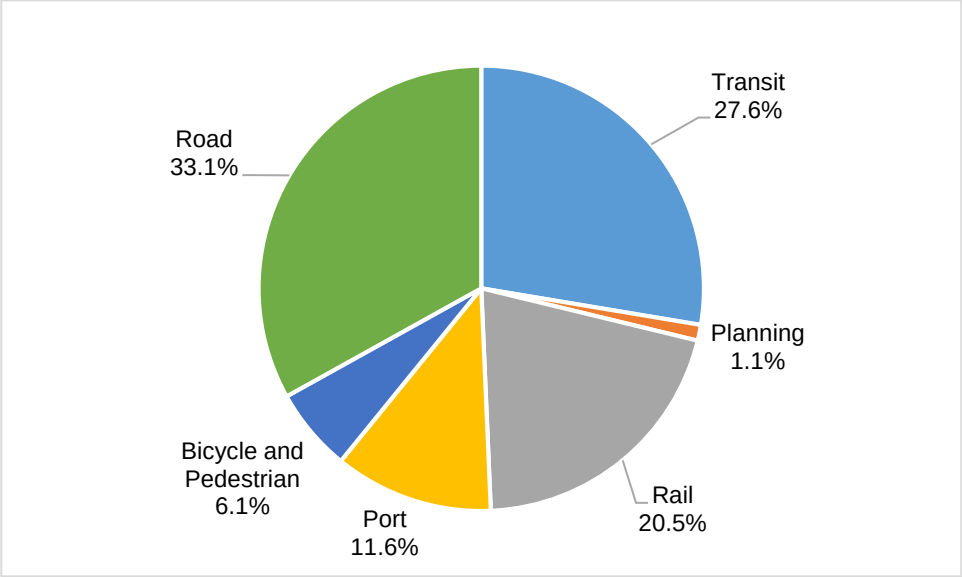
Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grants

The TIGER grant program is a competitive program that supports a variety of innovative transportation projects and is funded through the General Fund. The program was designed and implemented during the Great Recession, in part, to generate economic activity. Projects funded through TIGER grants include multi-modal and multi-jurisdictional projects, which can be more challenging to fund than through traditional federal programs.

Since 2009, the TIGER grant program has awarded $5.1 billion to 421 individual projects in the United States.[45] Figure 5 displays TIGER grants awarded from 2009 to 2016 by type. Projects selected for previous TIGER grants are typically road (33.1%), transit (27.6%) or rail (20.5%).[46]

[45] U.S. Department of Transportation, "TIGER Discretionary Grants," accessed March 1, 2017. https://www.transportation.gov/tiger.
[46] U.S. Department of Transportation, "About TIGER Grants," accessed February 25, 2017. https://www.transportation.gov/tiger/about.

Figure 5: TIGER Grant Awards by Type, 2009 - 2016



An example of a multi-jurisdictional project that would be difficult to fund through traditional means is the $25 million TIGER grant awarded to eight Midwestern states for the Truck Parking Information Management System (TPIMS). TPIMS will disseminate real-time truck parking availability information to truck drivers throughout the eight state region to reduce search times for parking and improve public safety by preventing illegal parking.

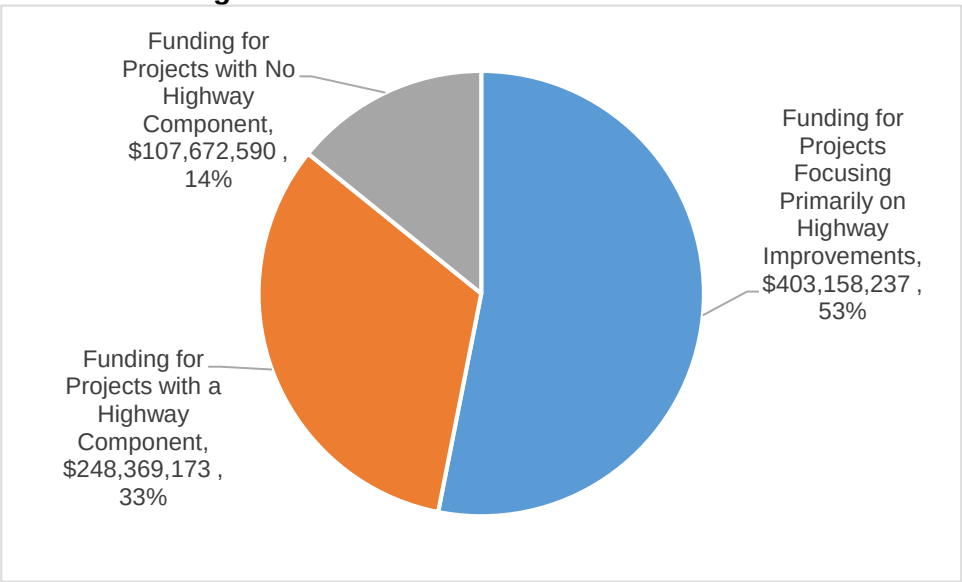
However, not all TIGER projects have such clear benefits. An example is Atlanta's Streetcar project which cost nearly $100 million to build, has seen low ridership and is not able to cover operating costs through fares (it was originally free to ride).[47] [48]

FASTLANE Grants

The Fixing America's Surface Transportation (FAST) Act established the FASTLANE program, a grant program to fund critical freight and highway projects from the HTF Highway Account. Through the FASTLANE program Congress authorized $4.5 billion for fiscal years 2016 to 2020.[49] In 2016, the FASTLANE program awarded nearly $800 million across the U.S. for numerous highway projects. The distribution of FASTLANE grants is displayed in Figure 6.[50]

[47] Eric Boehm, "Atlanta Plans to Blow More Money On Failed Streetcar Line," Reason.com, September 13, 2016, accessed August 31, 2017. http://reason.com/blog/2016/09/13/atlanta-plans-to-blow-more-money-on-fail.
[48] Jason Flynn, "Atlanta Streetcar Ridership Falls Following Fare Hike," Curbed Atlanta, February 17, 2016, accessed August 31, 2017. https://atlanta.curbed.com/2016/2/17/11080440/atlanta-streetcar-ridership-fall-fare.
[49] U.S. Department of Transportation, "FASTLANE Grants Awarded," accessed September 2, 2016. https://www.transportation.gov/buildamerica/fastlanegrants/fastlane-grants-awarded
[50] Ibid.

Figure 6: Distribution of FASTLANE Grants



Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Program

ATCMTD is a competitive grant program established under the FAST Act for the development and deployment of transportation technologies to improve safety, efficiency, and system performance. The ATCMTD program is funded at $300 million for fiscal years 2016 to 2020.[51] Examples of technologies supported by ATCMTD include advanced traveler information systems and vehicle-to-vehicle/vehicle-to-infrastructure communications.

[51] Federal Highway Administration, "Advanced Transportation and Congestion Management Technologies Deployment - FAST Act Fact Sheets," accessed March 13, 2017. https://www.fhwa.dot.gov/fastact/factsheets/advtranscongmgmtfs.cfm.

Infrastructure Development

While there is a well-documented need for new infrastructure, from planning to completion it can take years to build new highway infrastructure. To illustrate the phases and timelines for building a roadway, one state Department of Transportation (DOT) publication[52] offers the following estimates:

1. Planning Phase – up to 24 months
2. Scoping Phase – up to 8 months
3. Preliminary Design Phase – up to 18 months
4. Detailed Design Phase – up to 12 Months
5. Final Design and Right of Way Acquisition Phase – up to 24 months
6. Advertisement Phase – up to 5 months
7. Construction Phase – up to 36 months

Based on this schedule, it could take up to 10.5 years to complete a project from initial planning to project completion. Megaprojects such as Boston's Central Artery/Tunnel Project or "Big Dig," however, can take much longer. The Big Dig entered the planning phase in 1982 and was completed 25 years later in 2007.[53]

Each of the seven phases in the state DOT example above can be impacted by environmental planning, permitting or mitigation based on state and federal laws. The state DOT publication cited above states that "environmental experts are needed in fields such as biology, noise, air quality, archaeology, architecture and wildlife, to identify environmental requirements and issues to address in the planning, development, construction and maintenance of the highway system."[54] As a result, myriad delays and costs are associated both with studying an issue or potential issue, and remedying an issue appropriately.[55]

The National Environmental Policy Act (NEPA) of 1969 requires that federal agencies understand the impact of projects or actions on the environment. For transportation, this includes projects that receive funding from the U.S. DOT. These projects will often produce an environmental impact statement (EIS) and/or an environmental assessment that documents the impacts (both negative and positive) of a given project on the environment. For instance, FHWA states that key elements of meeting the NEPA requirements include a very broad assessment of social, economic, and environmental impacts of a proposed action or project.[56] FHWA even states the following in a report: "the perception that NEPA results in delays and additional costs to the delivery of transportation projects is a common one; projects for which the preparation and approval of EIS have taken several years to complete are well known."[57]

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[52] Virginia Department of Transportation, "How a Road Gets Built," accessed March 16, 2017, http://www.virginiadot.org/projects/pr-howroadblt.asp.
[53] "Big Dig," W*ikipedia, The Free Encyclopedia*, s.v. "Big Dig," accessed February 27, 2017. https://en.wikipedia.org/w/index.php?title=Big_Dig&oldid=767754163.
[54] Virginia Department of Transportation, "How a Road Gets Built."
[55] ICF International, Venner Consulting, CH2M Hill, and the University of Florida, "Guide to Estimating Environmental Costs," October 2008, accessed March 6, 2017, http://environment.transportation.org/pdf/proj_delivery_stream/nchrp25-25task%2039guidance.pdf.
[56] Federal Highway Administration, "Environmental Review Toolkit: NEPA and Transportation Decision-making," accessed March 16, 2017, https://www.environment.fhwa.dot.gov/projdev/pd3tdm.asp.
[57] Federal Highway Administration, "Environmental Review Toolkit: Streamlining and Stewardship NEPA Baseline Study," accessed March 16, 2017, https://www.environment.fhwa.dot.gov/strmlng/baseline/index.asp.

The 2005 federal transportation bill, SAFETEA-LU, enacted requirements to make the environmental review process for applicable projects more efficient.[58] The 2015 FAST Act also has NEPA-related provisions intended to accelerate project delivery.[59] Finally, The White House in 2017 released an Executive Order entitled *Expediting Environmental Reviews and Approvals for High Priority Infrastructure Projects*.[60] This illustrates that decreasing the delay and cost inefficiencies of environmental reviews is recognized as a priority by both the legislative and executive branches.

Finally, significant highway construction can be completed in a very short time period when conditions are right. An example of this is found along Atlanta's I-85 where a fire caused a bridge collapse. With the help of federal funding,[61] Georgia DOT incentivized the contractor with bonuses for early project delivery.[62] As a result, 10 lanes of elevated interstate highway were constructed and reopened in under 45 days.

[58] Federal Highway Administration, "SAFETEA-LU Environmental Review Process (Public Law 109-59)," accessed March 16, 2017, https://www.fhwa.dot.gov/hep/guidance/section6002/page02.cfm.
[59] Federal Highway Administration, "A Summary of Highway Provisions - FAST Act," accessed March 16, 2017, https://www.fhwa.dot.gov/fastact/summary.cfm.
[60] Expediting Environmental Reviews and Approvals for High Priority Infrastructure Projects, Exec. Order No. 13766, 82 FR 8657 (January 30, 2017). https://www.federalregister.gov/documents/2017/01/30/2017-02029/expediting-environmental-reviews-and-approvals-for-high-priority-infrastructure-projects.
[61] "Transportation Secretary Elaine L. Chao Announces $10 Million for Emergency Repairs to Atlanta's Collapsed I-85 Overpass." *U.S. Department of Transportation*, March 31, 2017. https://www.transportation.gov/briefing-room/dot2817.
[62] David Wickert, "State offers $3.1 million incentive to finish I-85 bridge early," AJC.com, April 12, 2017, accessed November 6, 2017. http://www.ajc.com/news/local/state-offers-million-incentive-finish-bridge-early/q2GXzPu7wHKfWtlmA2hGRP/.

2. FEDERAL AND STATE SURFACE TRANSPORTATION REVENUE

Any time that a consumer purchases gasoline or diesel, a federal motor fuels tax of 18.3 cents per gallon for gasoline and 24.3 cents per gallon for diesel is paid into the federal HTF. These taxes are not, however, directly paid to the HTF by the consumer, but instead are collected by the U.S. Treasury from approximately 1,300 major fuel distributors.

Through its Highway Account, the majority of the HTF funds go to state-led efforts to improve, maintain and/or construct roadways. In federal fiscal year 2016, net tax receipts deposited into the HTF Highway Account totaled more than $35 billion while outlays totaled $44.7 billion. In part to keep the Highway Account solvent, Congress authorized a transfer $52.1 billion from the General Fund to the Highway Account through the FAST Act in 2016.[63] The continued deficit between HTF revenues and outlays highlights the insufficiency of the fuels tax at current levels to adequately fund surface transportation.

Options to solve this issue, including raising the fuels tax, have been debated extensively. However, Congress is the only body that can increase the federal excise taxes on gasoline and diesel, and an increase has not been passed since 1993.[64] Other strategies for funding transportation infrastructure have been studied at the local, state and federal level, and include alternative forms of taxation and fee assessment, tolling and mileage-based user charges.

Current Revenue

Federal, state and local fuel taxes are critical sources of user-based highway funding, bringing in nearly $80 billion in annual transportation revenue. Table 1 shows total receipts at each jurisdiction level.[65]

Table 1: 2014 Fuel Tax Receipts by Jurisdiction

Jurisdiction	Fuel Tax Receipts	Percent of Total
Federal	$35,175,859,688	44.3%
State	$41,036,359,688	51.7%
Local	$3,124,252,000	3.9%

In addition to fuel taxes, highway funding is also collected through registration fees, tolls, sales taxes, excise taxes on certain equipment and other sources. This section offers an assessment of current federal and state revenue sources and levels.

[63] Federal Highway Administration, "Status of the Highway Trust Fund- Fiscal Year 2017," December 2017, https://www.fhwa.dot.gov/highwaytrustfund/docs/fe-1_dec17.pdf.
[64] Sean Lowry, "The Federal Excise Tax on Motor Fuels and the Highway Trust Fund: Current Law and Legislative History," August 12, 2015, http://nationalaglawcenter.org/wp-content/uploads/assets/crs/RL30304.pdf.
[65] Federal Highway Administration, Highway Statistics Series, https://www.fhwa.dot.gov/policyinformation/statistics.cfm, accessed May 2, 2017. Note: Federal receipts are for October 1, 2013 to September 30, 2014 and local figure also includes motor vehicle receipts.

Federal HTF Revenue Trends

Fuel tax revenues make up nearly 85 percent of the funds collected for the HTF. Other revenue sources for the HTF include excise taxes on vehicles, the Heavy Vehicle Use Tax (HVUT) and tires (Table 2). [66]

Table 2: Source of HTF Revenues

Source	Revenue	Percent of Total Revenue
Gasoline	$ 24,923,754,000	61.1%
Diesel and Special Fuels	$ 9,659,972,000	23.7%
Excise Tax on Trucks, Buses, and Trailers	$ 4,554,325,000	11.2%
Heavy Vehicle Use Tax (HVUT)	$ 1,149,768,000	2.8%
Tires	$ 500,968,000	1.2%
Miscellaneous	$ 26,076,000	0.1%
Total	**$ 40,814,863,000**	

HTF revenues are divided into two accounts – the Highway Account and the Mass Transit Account. As shown in Table 3, 87.6 percent of the revenue was deposited into the Highway Account in 2015. [67] Though the Mass Transit Account receives the other 12.4 percent from the HTF, the Mass Transit sector contributes almost nothing back to the HTF.

Table 3: HTF Revenue Allocation 2015

	Revenue	Percent of Total
Highway Account	$ 35,765,841,000	87.6%
Mass Transit Account	$ 5,049,022,000	12.4%
Total	**$ 40,814,863,000**	

In 2016, the Highway Account collected less money through its user-based revenue sources than was distributed. Combined with the FAST Act authorizations, this necessitated a transfer of more than $52 billion from the General Fund (Table 4).[68]

[66] Federal Highway Administration, "Highway Statistics 2015: Table FE-210", accessed February 23, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/fe210.cfm.
[67] Ibid.
[68] Federal Highway Administration, "Status of the Highway Trust Fund- Fiscal Year 2017," accessed May 22, 2017. https://www.fhwa.dot.gov/highwaytrustfund/docs/fe-1_dec17.pdf.

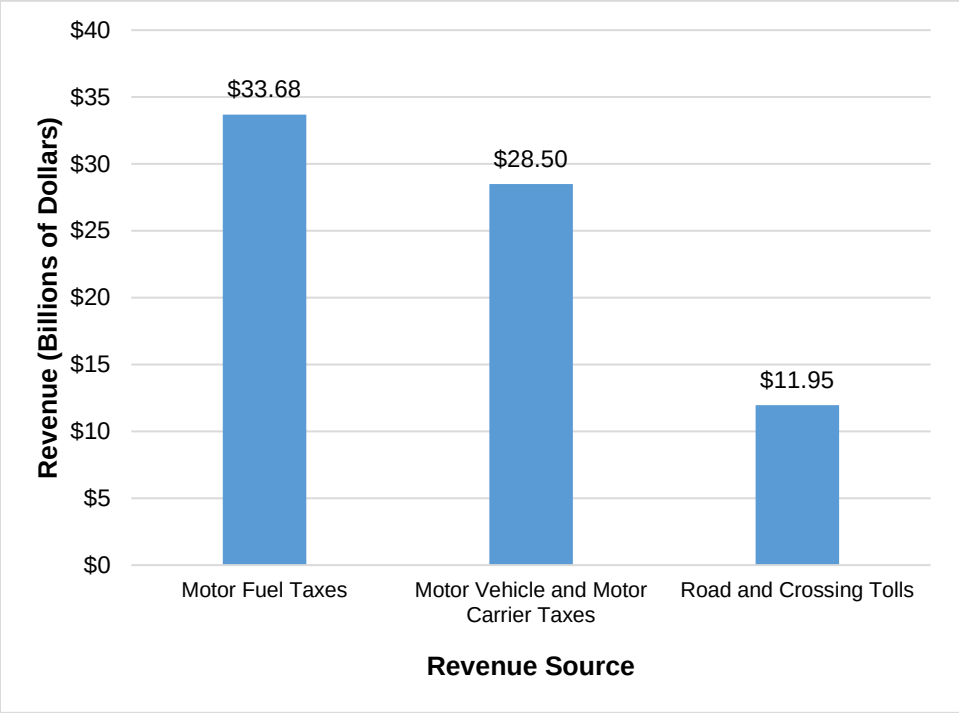
Table 4: Highway Account Receipts and Outlays, Federal FY 2016

Total Receipts	$	88,273,866,323
Net Tax Receipts	$	36,062,387,580
Interest Income	$	91,965,993
Other Receipts (General Fund)	$	52,119,512,749
Outlays	$	44,787,377,375

State Revenue Trends

As discussed earlier, states currently collect more transportation-related revenues – totaling $74.1 billion – than does the federal government. Of the state revenues, motor fuels are the largest generator of transportation funds as shown in Figure 7. This is followed by motor vehicle and motor carrier taxes – which include items such as registration fees, and finally tolls – which make up only 16.1 percent of revenues. [69,70]

Figure 7: Key State Revenue by Source (2015)



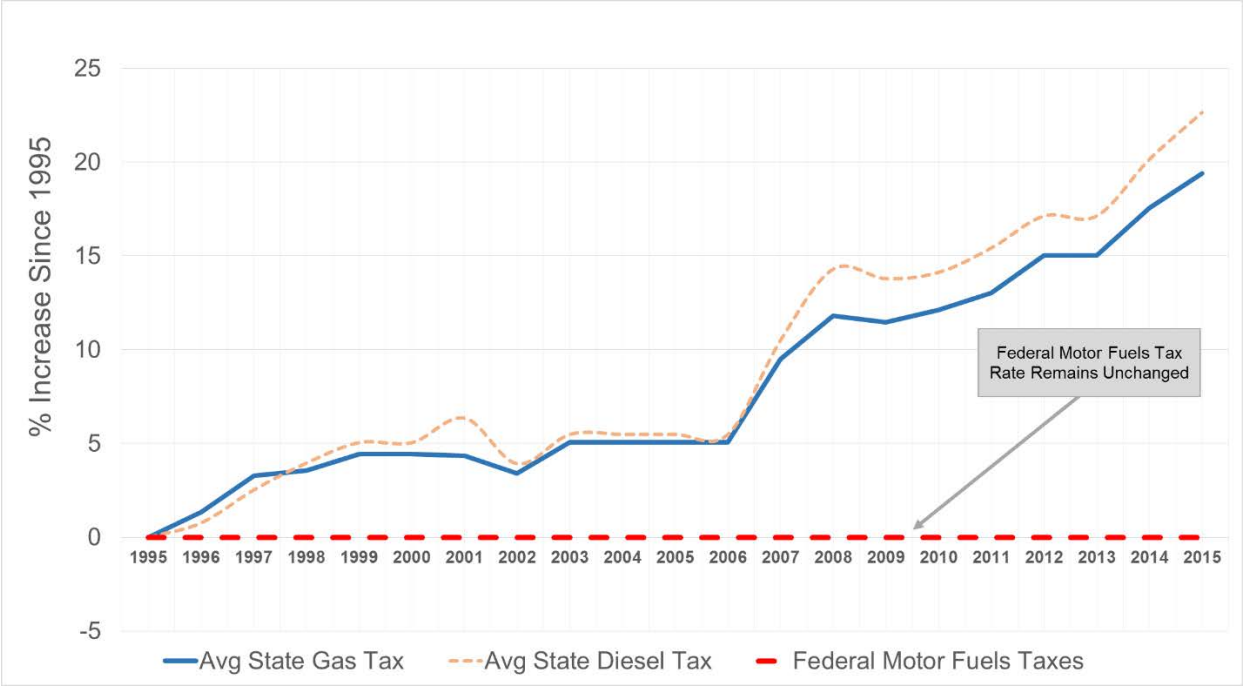
[69] Federal Highway Administration, "Highway Statistics 2015: Table SF-1," accessed May 22, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/sf1.cfm.

[70] Motor fuel taxes represent state excise taxes on gasoline, diesel, and special fuels. Motor vehicle and motor carrier taxes include to state motor vehicle sales taxes, motor vehicle registration fees, and special taxes on motor carriers. Road and crossing tolls represent revenue from state toll facilities, but not privately run or local toll roads or crossings.

Since the mid-1990s transportation revenue collected by the states has nearly doubled. In 1995 state transportation revenue was $39.3 billion compared to the most recent figure of $74.13 billion.[71]

Most of this increase can be attributed to increases in state motor fuel tax rates. Since 1995 state diesel taxes have increased 22.6 percent and state gasoline taxes have increased 19.4 percent as shown in Figure 8. During this same time period the federal motor fuels tax has not changed.[72]

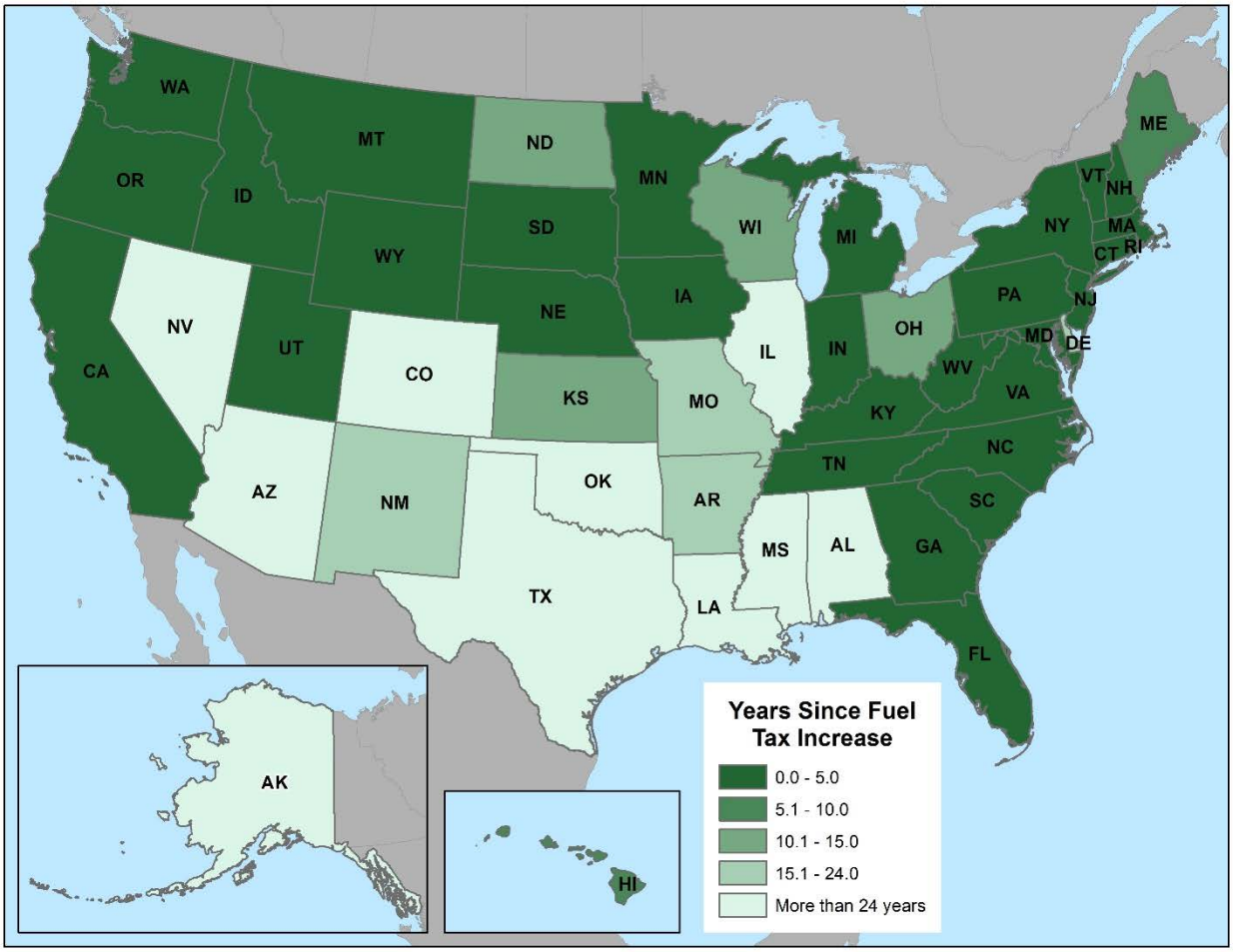
Figure 8: Fuel Tax Rate Trends



The state tax increases occurred in both traditionally Democrat and Republican states. Figure 9 indicates that only 11 states have not increased state fuel taxes since the federal fuel tax rates were last changed.[73,74] Appendix A contains a more detailed look at the state gasoline tax increases and rates illustrated in Figure 9.

[71] Federal Highway Administration, "Revenues Used By States For Highways – 1995," https://www.fhwa.dot.gov/ohim/1995/sf1.pdf.
[72] Office of Highway Policy Information, "Highway Statistics Series: Table MF-121T", 1995-2015, accessed August 3, 2017. https://www.fhwa.dot.gov/policyinformation/statistics.cfm.
[73] Sophie Quinton, "Reluctant States Raise Gas Taxes to Repair Roads," The Pew Charitable Trusts, accessed August 24, 2017. http://pew.org/2v5yt8m.
[74] Institute on Taxation and Economic Policy, "How Long Has It Been Since Your State Raised Its Gas Tax?", accessed August 24, 2017. https://itep.org/how-long-has-it-been-since-your-state-raised-its-gas-tax-4/.

Figure 9: Years since Last Gasoline Tax Increase



3. KEY EXISTING AND POTENTIAL FUNDING MECHANISMS

The need for surface transportation infrastructure improvements and for greater federal leadership in funding those improvements is well established. What remains is to quantify how to provide funding for those transportation improvements.

The following criteria have been utilized to evaluate the ability of several key transportation revenue mechanisms to fund the nation's transportation system:

Administration: How feasible is revenue collection, and how many collection points are there?

Efficiency: How much does it cost to collect revenue?

Equity: Who pays the tax/fee and who benefits?

Effectiveness: Is this tax/fee able to raise sufficient transportation revenue?

Federal Motor Fuels Tax

The federal motor fuels tax has long been a successful model for assessing a road user charge and states have followed the federal lead with their own state-level fuel taxes. Since this tax is assessed on a per-gallon basis, it is directly tied to road usage and vehicle type/size (i.e. bigger/heavier vehicles burn more fuel, and thus generate more fuel tax revenue).

Unlike tolling, the tax is tied to use of all roadways, and not limited to specific road segments. Additionally, fuel tax collection is a highly efficient process, particularly when compared to tolling and other funding schema as is cited below.

It is estimated that the cost for collecting federal motor fuel excise tax revenue is just 0.2 percent of the revenue collected. [75] Applying this figure, the 2015 cost of federal fuel tax collection was approximately $69 million to collect $34.5 billion in revenue. The key to this efficiency is the limited number of excise tax transactions; there are only 1,304 collection points made up mostly of major fuel distributors who pay the tax directly to the U.S. Treasury Department.[76]

That said, many federal fuel tax detractors describe the tax as "unsustainable."[77] This perceived sustainability issue, however, is largely due to political recalcitrance and an outdated tax rate that has not been increased by Congress since 1993.

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[75] Jonathan R. Peters and Jonathan K. Kramer, "The Inefficiency of Toll Collection as a Means of taxation: Evidence from the Garden State Parkway," Transportation Quarterly, Summer 2003, 57.3:17-31.
See also: U.S. Senate, Committee on Environment and Public Works, "ISTEA, Role of Federal, State, and Local Governments in Surface Transportation: Hearing Before the Subcommittee on Transportation and Infrastructure," HRG: 104-745, Government Printing Office, Washington, DC, 1997.
See also: Internal Revenue Service. "Report to the Assistant Commissioner from the Excise Tax Task Force – Doc# 9065." Washington, DC: IRS, December 1996.

[76] Internal Revenue Service, "Refineries with Terminal Racks: ExSTARS Reporting Information," December 12, 2016. https://www.irs.gov/businesses/small-businesses-self-employed/refineries-with-terminal-racks.

[77] In 2008, then-U.S. Transportation Secretary Mary E. Peters warned a Senate subcommittee that the "fuel tax is unsustainable in the future." See also: Ashley Halsey III, "Racking up miles? Maybe not,"

Two key factors that greatly impact the revenue collected through the fuel tax – vehicle fuel efficiency increases and inflation – are described below. Surprisingly, both factors offer justification for a fuel tax increase.

Increasing Fuel Efficiency of U.S. Fleet

Though VMT is on an upward trend, which tends to increase fuel tax revenues, the fuel efficiency of the U.S. fleet is also increasing. New vehicle fuel efficiency for passenger cars in 2014 model vehicles averaged a record high miles-per-gallon (MPG) of 36.4.[78] At current federal gasoline excise tax rates (18.3 cents per gallon), that equates to a per-mile charge of approximately ½ of one cent per mile, or $50 per 10,000 miles driven. By comparison in 1993, the year when the fuel tax was last changed, average MPG for new passenger vehicles was 28.4.[79] The average vehicle in 1993 would therefore raise approximately $64 for the same 10,000 miles. This represents a 21 percent decrease in fuel tax revenue generated by an average new vehicle. This improved efficiency could also be described as a large tax cut for the average driver.

Trucking, on the other hand, has not seen comparable gains in fuel efficiency. The Energy Information Administration (EIA) reports a 6.1 MPG fuel economy rate for heavy duty trucks in 1993 versus a 6.3 fuel economy rate in 2014.[80] At 24.3 cents per gallon (the rate of the federal diesel fuel tax), each 10,000 miles driven would result in $393 in federal fuel tax in 1993 down to $385 by 2014, representing a two percent decrease. Thus the trucking industry pays slightly less today per mile, but what it pays has not suffered the same erosion that is found with automobile-derived revenues.

Inflation

The buying power of per-gallon fuel tax revenue has decreased since 1994, as demonstrated through the inflation statistics in Figure 10.[81] Increased driving and fuel consumption have helped balance this, but inflation will always have a negative impact on revenues derived from a source that has a fixed rate.

Washington Post, accessed August 3, 2017. http://www.washingtonpost.com/wp-dyn/content/article/2010/02/05/AR2010020504790.html.

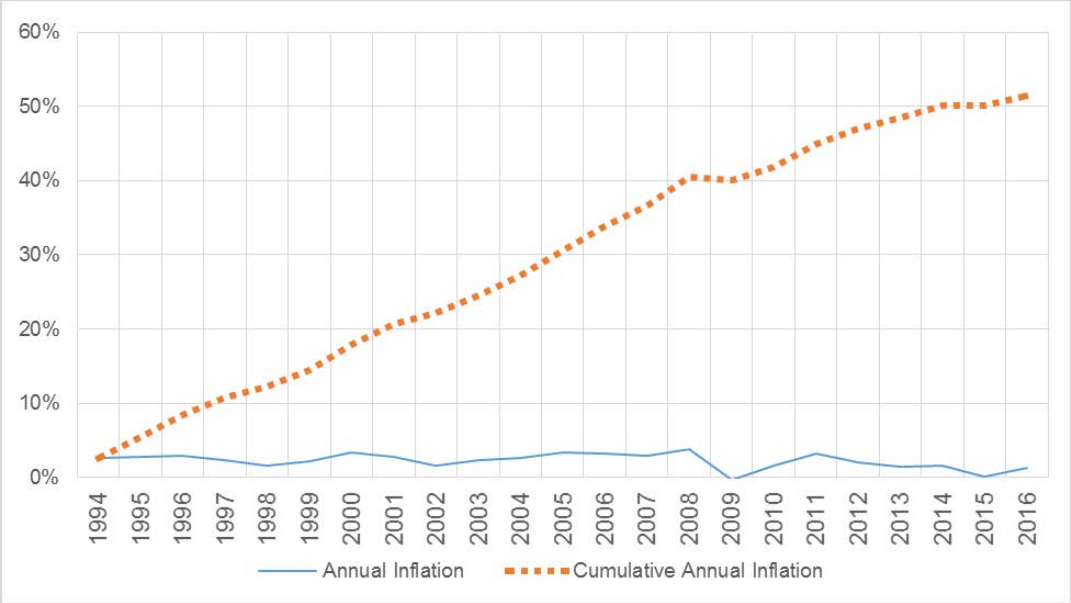
[78] Federal Highway Administration, "Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles," accessed August 3, 2017. https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html.

[79] Ibid.

[80] U.S. Energy Information Administration, "Monthly Energy Review August 2017: Table 1.8 Motor Vehicle Mileage, Fuel Consumption, and Fuel Economy," accessed August 25, 2017. https://www.eia.gov/totalenergy/data/monthly/pdf/sec1_19.pdf

[81] World Bank, Inflation, consumer prices for the United States, retrieved from FRED, Federal Reserve Bank of St. Louis, accessed August 3, 2017. https://fred.stlouisfed.org/series/FPCPITOTLZGUSA.

Figure 10: Inflation Statistics since 1994



Two other factors – the deployment of electric vehicles and fuel tax exemptions – also impact revenues generated from the fuel tax.

Electric Vehicles

It is estimated that less than one percent of U.S. vehicles are categorized as electric.[82] [83] That said, in 2016 annual electric vehicle (EV) sales in the U.S. increased 70 percent year-over-year, reaching nearly 160,000 vehicles sold, a figure driven in large part by electric models made by Tesla, Chevrolet and Nissan.[84]

Electric vehicles, by their very nature, do not pay the motor fuels tax. Assuming that each of the 160,000 new 2016 electric vehicles accrue an average of 11,000 miles per year, approximately 1.76 billion miles will be driven annually. If these electric vehicles had consumed gasoline an average of 24.5 miles per gallon, which would be on par with an average automobile in 2016, they would have burned more than 71 million gallons of fuel, contributing more than $13 million to the HTF each year. Additional state fuel taxes would have been paid as well.

If sales of electric vehicles continue to grow, and new methods for capturing revenue from these vehicles are not created, an increasing number of vehicles will act as free-riders on the nation's highways. Forecasts for the total number of EVs operating in the U.S. by 2025 range from 7.5

[82] Sierra Club, "2016 U.S. Electric Vehicle Sales Soar: Jumping 80 Percent Over Previous December and 37 Percent Over 2015," January 5, 2017. http://www.sierraclub.org/compass/2017/01/2016-us-electric-vehicle-sales-soar-jumping-80-percent-over-previous-december-and-37.
[83] David Shepardson, "U.S. May Not Hit One Million Electric Vehicles until 2020: Official," Reuters, January 21, 2016. http://www.reuters.com/article/us-autos-electric-moniz-idUSKCN0UZ2MK.
[84] Robert Rapier, "U.S. Electric Vehicle Sales Soared In 2016," Forbes, accessed August 3, 2016. https://www.forbes.com/sites/rrapier/2017/02/05/u-s-electric-vehicle-sales-soared-in-2016/#68296928217f.

million to 11.4 million.[85] Using the average annual mileage and MPG assumptions from the earlier EV analysis, this would range between $616 million and $936 million in annual costs to the HTF. However, the very small number of EVs on the road are not a strong justification for abandoning the fuel tax system for the 99 percent of vehicles which still consume fuel.

Exemptions

An exemption from federal motor fuels taxes can be granted to "any state, or any political subdivision of a governmental entity." This includes government fleets, school bus fleets, and public transit systems.[86] Also included are qualified non-profit organizations.

State exemptions include many of the same categories, resulting in additional exemptions from fuel taxes. Vehicles used for government business, non-profit educational organization fleets, school buses, and transit systems are all typically exempt from state fuel tax. Some states include exemptions for commercial driving schools, qualified ambulances and first-responder vehicles, and fire department vehicles, among others.[87] [88]

ATRI's 2007 Highway Funding analysis quantified $907,000,000 lost annually due to exemptions at the federal and state level.[89]

[85] Dan Cohan, "Electric car sales predictions are all over the map," TheHill.com, accessed May 25, 2017. http://thehill.com/blogs/pundits-blog/transportation/315958-forecasts-for-electric-car-sales-are-all-over-map.
[86] U.S. Department of the Treasury, "Excise Taxes (Including Fuel Tax Credits and Refunds", Publication 510. Feb 16, 2016, accessed May 25, 2017, https://www.irs.gov/pub/irs-pdf/p510.pdf.
[87] Federal Highway Administration, "Exemptions," Fuel Sales and Taxes: Exemptions - FHWA Motor Fuel Tax Compliance Outreach, accessed May 25, 2017. https://www.fhwa.dot.gov/motorfuel/sales_taxes_exemptions.html
[88] Minnesota Department of Public Safety, "Driver and Vehicle Services: License Plates- Tax Exempt-Local," 2017, accessed September 29, 2017. https://dps.mn.gov/divisions/dvs/Pages/dvs-content-detail.aspx?pageID=628.
[89] Jeffrey Short, Dan Murray and Sandra Shackelford, *Defining the Legacy for Users: Understanding Strategies and Implications for Highway Funding,* American Transportation Research Institute, Alexandria, VA, May 2007.

Fuel Tax Summary

Administration. The federal fuel tax is administered through mechanisms that are already in place. These mechanisms collect transportation revenue for the entire nation through transactions with a relatively small number of fuel distributors.

Efficiency. The fuel tax is highly efficient due to the low number of transactions, resulting in administrative costs of .02 percent. An increase in the fuel tax would not change the cost of collection, making it progressively more efficient.

Equity. The fuel tax that is collected from distributors is, generally speaking, passed on to and paid by drivers. Thus, the tax is a direct proxy for charging for roadway use. As discussed earlier, a driver with a vehicle that achieves the average new car MPG of 36.4 MPG will pay a little more than $50 in federal gasoline taxes to drive 10,000 miles, which is the equivalent of $1 per 200 miles. It can be argued that this represents a very low cost to drivers. For the light-duty fleet, which includes vans and light trucks, FHWA estimates an average of 22.0 MPG, or approximately $83.6 per 10,000 miles, or $1 per 119 miles.[90] For large trucks, the cost is higher. At 5.9 MPG a combination truck would pay $411 in federal diesel taxes per 10,000 miles, or $1 per 25 miles driven. Table 5 illustrates the increased annual costs that would be paid by a typical light-duty vehicle and combination truck.[91]

Table 5: Annual Cost of Current and Potential Federal Fuel Tax Rates

	Average Annual Miles	Average MPG	Current Fuel Tax Rate	Annual Tax Cost	10 Cent Increase	25 Cent Increase
Light Duty Vehicles	11,443	22.0	$0.184	$95.71	$147.72	$225.74
Combination Trucks	61,978	5.9	$0.244	$2,563.16	$3,613.63	$5,189.34

Effectiveness. The federal fuel tax effectively collects revenue from all U.S. drivers and all roadways through a limited number (1,300) of collection points. The effectiveness of the fuel tax to collect sufficient revenues is however at risk due to the following:

- Unwillingness of elected officials to increase the tax;
- New vehicles that are more fuel efficient than their predecessors or are electric;
- Erosion of the purchasing power of collected revenues due to inflation;
- Road users that are exempt from paying the tax;
- Tax evasion.

One way to improve the effectiveness of the federal fuel tax would be to increase the tax and/or index the tax to inflation and increasing fuel economy.

[90] Federal Highway Administration, "Table VM-1 - Highway Statistics 2015 – Policy, All Light Duty Vehicles," accessed September 20, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/vm1.cfm.
[91] Ibid.

Revenue Mechanism Two: Registration Fees

Annual vehicle registration fees are required in all states and some local governments.[92] Registration fees typically consider vehicle type, sale price, value, and weight. At the federal level, the heavy vehicle use tax (HVUT), which is a charge for vehicles with a gross weight of 55,000 lbs. or more, is a revenue stream that has similarities to state registration fees.[93]

As discussed previously, one fuel tax revenue challenge is the growth of electric vehicles, which pay no fuel tax. To address the issue, ten states currently impose an electric vehicle/hybrid electric vehicle registration surcharge. Currently, these charges range from $50 to $150 per vehicle.[94] Registration fees have therefore been used on a limited basis as a substitute for the gas tax at the state level.

The concept of a federal-level registration fee exists in the literature.[95] According to the National Cooperative Freight Research Program's (NCFRP) Report 15, such a program could be implemented through the use of administrative programs already in place. State motor vehicle departments could simply collect a federal fee within the existing administrative infrastructure.

There were approximately 250 million private and commercial cars, trucks and buses registered in the U.S. in 2015.[96] [97] Hypothetically, a modest $20 annual federal registration fee on all vehicles, which would be collected through the already implemented state registration process, would generate revenue of $5 billion annually. A more aggressive per-vehicle average fee of $75 would add $18.7 billion to the HTF annually.

These fees could be structured based on vehicle type or weight to capture some degree of the burden that each vehicle places on the system. That said, vehicle registrations are not tied directly to vehicle use. The same registration is paid if a vehicle is driven 1 mile or 10,000 miles.

[92] Federal Highway Administration, "Cost Allocation Study Final Report – Policy," accessed May 26, 2017. https://www.fhwa.dot.gov/policy/hcas/final/four.cfm.
[93] Office of Highway Policy Information, "What Is the HVUT and Who Must Pay It?," accessed August 3, 2017. https://www.fhwa.dot.gov/policyinformation/hvut/mod1/whatishvut.cfm.
[94] Jim Gorzelany, "More States Charging Added Fees For Plug-In Cars," Forbes, accessed May 26, 2017. http://www.forbes.com/sites/jimgorzelany/2017/01/11/more-states-charging-added-fees-for-plug-in-cars/.
[95] Daniel S. Smith, NCFRP 15: Dedicated Revenue Mechanisms for Freight Transportation Investment, October 17, 2011, accessed August 3, 2017. http://www.trb.org/Publications/Blurbs/166971.aspx.
[96] Federal Highway Administration, "Highway Statistics 2015: Table MV-1," accessed June 5, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/mv1.cfm.
[97] The 250 million figure does not include approximately 13 million vehicles that are classified as either publicly owned or as motorcycles. Registrations for these 13 million vehicles could also generate revenue depending on how a federal fee was structured.

Registration Fee Summary:

Administration. The administration of vehicle registrations and the associated fees at the state level serve numerous purposes including revenue generation. Beyond revenue generation it is a necessary function of government that establishes vehicle safety, ownership, and gives law enforcement vehicle identification information.

Efficiency. The cost of collecting this revenue serves multiple purposes beyond transportation funding, and therefore costs are spread across those separate functions.

Equity. Registration fees are paid by vehicle owners and do not consider how many miles are driven or on which roadways a vehicle drives.[98] Thus drivers with different levels of roadway use could potentially pay the same fee.

Effectiveness. Registration fees can effectively collect transportation revenue. The registration process already exists and is a necessary function of government. As part of the registration process, revenue is collected from roadway users and those funds can be used for improving safety and surface transportation. The fee is difficult to evade as there is significant legal risk associated with driving a vehicle that is not registered. Vehicle registration is strictly enforced in the U.S. by all levels of jurisdiction.

Revenue Mechanism Three: Tolling

Tolls are fees paid by roadway users for access to very specific segments of infrastructure. Tolling captures revenue for less than one percent of U.S. roadway miles; of the more than 4,000,000 miles of roads in the U.S. only 5,051 miles are tolled.[99] That said, many of the nation's tolled facilities are heavily traveled urban highways and bridges, and are thus critical to the transportation system.

A key issue related to tolling is the administrative cost to collect toll revenue. Tolling systems generally require more resources to collect, often requiring between 12 percent and 25 percent of the revenue collected. ATRI's previous highway funding report, in fact, found that some toll authorities expend as much as 30.3 percent of toll revenue to collect the tolls.[100]

Individual users are charged directly in most cases – resulting in millions of discrete transactions that have to be managed, processed, monitored and enforced for non-payment. Toll facilities are run by two types of organizations: public/quasi-public entities and private sector entities. While both aim to maximize revenue, it is inherent in the mission of private sector toll operators to maximize profits and minimize expenses for owners and investors. Unlike public agencies, private sector toll operators are not required to provide the same level of financial reporting as the public sector; thus the cost of collecting tolls for the private sector is not well documented through publicly available information.

[98] It should be noted that the International Registration Plan (IRP) does take into account miles driven at the state level for commercial vehicles operating in an interstate capacity.
[99] Federal Highway Administration, "Chart HM-25 - Highway Statistics 2010," accessed November 06, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2010/hm25.cfm
[100] Jeffrey Short, Dan Murray and Sandra Shackelford, *Defining the Legacy for Users: Understanding Strategies and Implications for Highway Funding,* American Transportation Research Institute, Alexandria, VA, May 2007.

Most toll operators, however, are considered public sector agencies. While there is extensive reporting of data from many public toll agencies, there is a considerable amount of variation and complexity in the reporting of toll collection costs. Thus, any assessment of toll collection costs requires careful analysis and review of financial statements, internal data and public reports to correctly identify the true components of costs that should be considered in the cost of collecting road user fees. An analysis of toll collection costs and financial statements is found later in this section.

In the past 10 years there have been several key developments for both public and private sector toll operators.

Public Toll Operations

Tolling by the public sector offers government a means to collect revenue from the users of specific highways and bridges. The goal of this revenue collection is often to pay for highway maintenance or the debt associated with the tolled infrastructure. That revenue is collected from all users of tolled facilities and is usually dedicated to paying for the immediate roadway that is tolled, though in recent years these principals have been eroded in several situations which are highlighted below.

The State of Rhode Island, for instance, has opted to toll only some roadway users to cover the costs of infrastructure investments. In 2015 the state began deployment of a toll-based plan – named RhodeWorks – to repair the state's existing bridge system by tolling only trucks.[101] The plan would build 33 new toll gantries, and impose a $3-$20 per day toll on trucks travelling on certain key facilities in the state.[102] [103] This has been a contentious subject, and many have questioned the viability of paying for infrastructure with a truck-only toll. The Rhode Island Trucking Association commissioned a study that estimated RhodeWork's traffic projections are inflated, with actual traffic patterns slated to generate roughly half of projected revenue.[104] One concern with the plan in particular is toll diversion (discussed in detail later in this report), which may be widespread as truckers use highways in Connecticut to bypass Rhode Island tolls.

Over the past several years there has also been other controversy involving how toll road proceeds are used. In one example, the New York State Thruway Authority had been using toll revenues to support canal infrastructure. In 2016, the American Trucking Associations successfully appealed a court case against the New York State Thruway Authority regarding the usage of toll revenue. The court found that the use of approximately 10 percent of toll income ($61 million annually) to maintain state canals unlawfully burdened interstate commerce.[105]

[101] Ian Donnis, "Raimondo Unveils $1.1 Billion Infrastructure Improvement Plan," accessed March 1, 2017, http://ripr.org/post/raimondo-unveils-11-billion-infrastructure-improvement-plan.
[102] David Elfin, "Rhode Island Approves Truck Tolling Plan," Transport Topics Online, accessed February 6, 2017, http://www.ttnews.com/articles/basetemplate.aspx?storyid=40873.
[103] Special Carriers and Rigging Association, "Number of Proposed Tolling Gantries in Rhode Island Skyrockets to 33," accessed August 3, 2017. https://www.scranet.org/SCRA/News_Release/Newsletter/Industry_News/Number_of_Proposed_Tolling_Gantries_in_Rhode_Island_Skyrockets_to_33.aspx.
[104] Patrick Anderson, "Study: R.I. Tolls Would Only Generate Half of Revenue Projected," Transport Topics Online, accessed February 6, 2017, http://www.ttnews.com/articles/basetemplate.aspx?storyid=40545.
[105] Jonathan Stempel, "New York's use of tolls to maintain canals unconstitutional –judge." Reuters. August 10, 2016, accessed June 5, 2017. http://www.reuters.com/article/new-york-tolls-lawsuit-idUSL1N1AR2EA.

Private Toll Operations

Private toll operations typically involve a contract between a public sector entity, such as a state, and one or more private companies. Such operations allow the private sector entity to generate profit through its management of the roadways. There have been various arrangements including the leasing of existing tolled infrastructure and even private sector development of new highways. The following three examples shed light on the numerous issues related to private toll operations.

Texas 130. In 2008, the State of Texas partnered with two private companies, Cintra and Zachry Corp., to build the 41-mile southern extension of the Texas 130 toll road.[106] Previous research from the state, however, indicated tolling revenues from traffic volumes would be insufficient to cover construction costs.[107] The project cost was estimated at $1.35 billion.[108] While the project contract stipulated that some toll revenue be shared with the state as a concession, Cintra and Zachry Corp were contracted to build, maintain and operate the road for a period of 50 years with funding acquired from multiple sources including $686 million from European banks and $430 million in a Transportation Infrastructure Finance and Innovation and Innovation Act (TIFIA) federal loan. Cintra-Zachry paid $25 million out of a promised $197 million to the Texas Department of Transportation at the project outset with an additional $100 million paid while the road was under construction. In September 2012, construction finished and the road opened. When the toll road failed to meet its projected traffic volumes by almost 70 percent in 2014, the concession company declared bankruptcy. It is estimated that the TIFIA loan makes up one third of Texas 130's outstanding debt and without comment from the U.S. Department of Transportation, it is unknown whether or not the outstanding TIFIA funds will be returned to the federal government. As of September 2016, the concession company has paid the state of Texas only $3 million out of a projected $245 million in potential toll revenue over the 50-year contract period.[109]

Indiana Toll Road. Another example of private sector tolling is found in the high-profile 2006 leasing of the Indiana Toll Road. In this deal, Cintra and Macquarie, two international investment companies, acquired rights from the state to operate the Indiana Toll Road, and paid Indiana nearly $4 billion.[110] During the first decade of their 75-year lease of the infrastructure, the private sector toll road operators experienced massive deficits that were due in part to inaccurate traffic volume projections.[111] After multiple rounds of toll increases, the concession company

[106] Jamie Lovegrove, "SH 130 Toll Road Operator Files for Bankruptcy," TexasTribune.org, March 2, 2016, accessed September 5, 2017. https://www.texastribune.org/2016/03/02/sh-130-toll-road-files-bankruptcy/
[107] Angie Schmitt, "Private Toll Road Backed By $430 Million in Federal Funds Goes Bust." StreetsBlog USA. October 18, 2016, accessed May 30, 2017. http://usa.streetsblog.org/2016/10/18/private-toll-road-backed-by-430-million-in-Federal-funds-goes-bust/.
[108] Ibid.
[109] Katherine Blunt, "The End of the Road," San Antonio Express-News. September 16, 2016, accessed May 26, 2017. http://projects.expressnews.com/the-end-of-the-road-texas-130-toll-road.
[110] Angie Schmitt and Payton Chung, "The Indiana Toll Road and the Dark Side of Privately Financed Highways," Streetsblog USA, November 18, 2014, accessed May 30, 2017. http://usa.streetsblog.org/2014/11/18/the-indiana-toll-road-and-the-dark-side-of-privately-financed-highways/.
[111] Ibid.

operating the road filed for Chapter 11 bankruptcy protection in 2013 after negotiations to restructure its payments failed and entered bankruptcy in 2014.[112]

Ambassador Bridge. A third example of private sector infrastructure is the Ambassador Bridge, a tolled facility that connects Detroit, Michigan and Windsor, Ontario. This bridge, built in 1929, is privately owned and is a key crossing point for trucking between the U.S. and Canada.[113] Recently, U.S. and Canadian public sector entities identified the need for a second bridge, though the Ambassador Bridge owner is in opposition to a second bridge as it would compete for toll-paying customers. Despite this opposition, the U.S. and Canada eventually came to an agreement to build a second bridge by 2022.[114] Ambassador's owner, however, filed multiple lawsuits attempting to block or slow the construction of a second bridge. Many of the lawsuits allege unfair discrimination in favor of the alternative project, but this and other allegations were dismissed in 2015.[115] In September 2017 the owner of Ambassador announced the receipt of a final permit to replace the Ambassador with a new bridge, though the second bridge (Gordie Howe) will still be built.[116]

Cost of Collection

Comparing tolling costs versus revenue is critical to understanding the true cost of toll systems. Unfortunately, there is no standard financial reporting used by toll authorities. For instance, some toll authorities combine operations and maintenance in financial statements.[117] As Peters and Kramer commented in their 2003 paper, there is concern regarding the reporting of costs in toll collection systems: "There is a bit of controversy over the correct assignment of costs to the toll collection process. Some of the areas of concern relate to other than direct toll collection costs such as capital expenditures on buildings, additional paving necessitated by wide toll plazas and road maintenance, and snow removal on toll plazas."[118]

[112] Angie Schmitt and Payton Chung, "The Indiana Toll Road and the Dark Side of Privately Financed Highways."
[113] Detroit Chamber, "Bridging the border: Do we need a new bridge? (part 1)," Detroit Regional Chamber, August 13, 2012, accessed May 26, 2017. http://www.detroitchamber.com/bridging-border-bridge-part-1/.
[114] Ron Stange, "Gordie Howe bridge start date now set for next summer," Truck News, May 24, 2017, accessed May 26, 2017. http://www.trucknews.com/features/gordie-howe-bridge-start-date-now-set-next-summer/.
[115] Todd Spangler, "Morouns lose on virtually all counts in bridge lawsuit," Detroit Free Press, September 30, 2015, accessed May 26, 2017. http://www.freep.com/story/news/local/michigan/2015/09/30/morouns-lose-virtually-all-counts-bridge-lawsuit/73083798/.
[116] "Ambassador Bridge officials say they have 'final permit' to build new span," CBC News, September 6, 2017, accessed September 29, 2017. http://www.cbc.ca/news/canada/windsor/ambassador-bridge-windsor-detroit-1.4277609
[117] "Florida's Turnpike Systems Comprehensive Annual Financial Report: Fiscal Years Ended June 30, 2016 and 2015," Florida Turnpike, accessed August 3, 207. http://www.floridasturnpike.com/documents/reports/Comprehensive%20Annual%20Financial%20Report/CAFR_2016.pdf.
[118] Jonathan R. Peters and Jonathan K. Kramer, "The Inefficiency of Toll Collection as a Means of Taxation: Evidence from the Garden State Parkway," *Transportation Quarterly*, Vol. 57, No. 3, Summer 2003 (17–31).

There is considerable variation in the reporting of costs by area. A 2011 National Academy of Sciences' (NAS) report offers guidance as to what components of operating and capital costs should be considered part of the cost of collection.[119] The NAS list includes the following:

- Operation and maintenance of tollbooths;
- Operation and maintenance of ETC and video tolling systems as well as the related information technology hardware and software;
- Customer account management, payment processing, and banking charges relating to toll accounts;
- Inventory, distribution, and sale of transponders; and
- Cash counting, transportation and vault services.

In terms of enforcement costs, the NAS report listed the following elements of costs:

- Catching violators;
- Assessing administrative fees and fines;
- Account settlement before the toll violation reaches court; and
- Prosecuting violators (court costs).

Financial data reported by any given toll collection agency, however, does not list costs with this level of specificity.

The Congressional Research Service in their August 26, 2016 report "Tolling U.S. Highways" reported an average cost of collection for the roads examined at 8-11 percent of the revenue collected, while openly acknowledging that one of the sample cases – the New Hampshire Turnpike – did not include the costs of depreciation of toll collection equipment or enforcement costs.[120] In another example within the same report, found that the Oklahoma Turnpike, with the lowest administrative cost – at 7.1 percent, was excluding a significant amount of customer service costs for their electronic toll tag systems. If these costs had been included, it would raise their estimated cost of collection percentage to 12.7 percent of revenue collected. These examples illustrate why considerable post-analysis is required to get good estimates of the cost of collection given existing financial reporting practices.

[119] Patrick Balducci et all, *NCHRP Report 689: Costs of Alternative Revenue-Generation Systems*, National Cooperative Highway Research Program, Transportation Research Board: Washington DC, 2011, DOI: 10.17226/14532.
[120] Robert S. Kirk, "Tolling U.S. Highways," Congressional Research Service, August 26, 2016, accessed October 26, 2017, https://fas.org/sgp/crs/misc/R43575.pdf.

For this report, the research team closely examined financial statements from four agencies.

Case Study 1: Ohio Turnpike

In fiscal year 2016, toll revenues at this facility were approximately $288.4 million and services and toll operations costs were $55.3 million. In this case the cost to collect the toll revenues was 19.2 percent of revenue, though other collection-related costs may be present in-line items related to administration, enforcement and the maintenance of structures.[121] Thus, the actual collection costs for the Ohio Turnpike may be well over 19.2 percent.

Case Study 2: New Jersey Turnpike Authority

The New Jersey Turnpike Authority (NJTA) releases annual financial reports, special revenue and performance reports as well as accompanying information from their bond issue documents. Utilizing data from the 2017A Revenue Bond Issue and the 2016 NJTA Annual Report, it was found that the NJTA reported collection costs of $160.5 million in 2016. Further, the bond issue provides an estimate of $25.8 million in violation costs – or 1.6 percent of the revenue collected. These violation costs, combined with the reported administrative cost of collection indicate that the NJTA experienced a toll collection cost of 11.41 percent of revenue. It is interesting to note that the administrative costs reported in 2016 at the NJTA are very similar to the administrative costs reported in 2007, which was $167.7 million and represented 21 percent of revenue. Thus, despite a growing percentage of electronic tolls, the actual dollar amount spent collecting tolls is relatively stable. Further, the improvement in the collection cost percentage is primarily driven by the higher toll prices. Also, given that this information is not audited to verify that all collection costs were included by the authority, ATRI cannot fully verify that the reported costs are correctly assigned or recorded. Table 6 offers details of the collection cost estimate.[122] [123]

[121] Comptroller's Office and the Office of Marketing and Communications. "Comprehensive Annual Financial Report For The Years Ended December 31, 2016 and 2015," Ohio Turnpike, April 12, 2017, accessed July 11, 2017. http://www.ohioturnpike.org/docs/default-source/annual-report-files/2016.pdf?sfvrsn=2. Note: Other line items that may include toll collections costs are "Administration and Insurance," "Traffic Control, Safety, Patrol and Communications," and "Maintenance of Roadways and Structures."

[122] New Jersey Turnpike Authority, "Turnpike Revenue Bonds, Series 2017 A," May 29, 2017, accessed October 26, 2017.

[123] New Jersey Turnpike Authority, "Comprehensive Annual Financial Report for Years Ended December 31, 2016 and 2015."

Table 6: 2016 Toll Collection Cost Estimate – New Jersey Turnpike Authority (New Jersey Turnpike [NJTP] & Garden State Parkway [GSP])

Toll Revenue	$1,570,662,000
E-Z Pass Revenue	$62,579,000
Total Revenue	$1,633,241,000
Toll Collection Costs (Admin)	$160,485,000
Collection Costs (Admin) Percent	9.83%
Violation Costs	$25,819,000
Violation Costs Percent	1.6%
Estimated Toll Collections Costs with Violations	$186,304,000
Collection Costs (Admin and Violations)	11.41%

Case Study 3: Pennsylvania Turnpike Authority

Similar to NJTA, the Pennsylvania Turnpike Commission (PA Turnpike) produces annual financial reports, special revenue and performance reports as well as accompanying information that is released in their bond issue documents. In addition, due to legislative actions, the PA Turnpike has been reviewed by the Auditor General of the Commonwealth of Pennsylvania. Utilizing data from the 2016 Annual Report and the September 2016 Auditor General's Report, it is possible to begin to quantify the costs of collection at the PA Turnpike.[124,125] The turnpike reports the administrative cost of collection was $64.3 million in 2016. In 2016, the Auditor General of Pennsylvania reported an estimate of $61.3 million in violation costs – or 6 percent of the revenue collected. These violation costs, combined with the reported administrative cost of collection indicate that PA Turnpike experienced a cost of collection of 12.19 percent of revenue. Again, given that this information is not audited to verify that all collection costs are reported by the authority, it cannot be fully verified that costs are correctly assigned or recorded; this issue was also highlighted by the Auditor General in its report.

Further examination of the reported toll collection costs indicates, however, that there may be significant gaps in the reporting of collection costs. In particular, an examination of the full operating costs of the authority and also the costs that are present on the authority's Income and Expense and Capital Costs reports would be necessary to see if the full costs of collection are being correctly reported. For instance, given that toll collection activities increase the operational needs of a transportation facility (including activities such as legal services and human resources costs that occur on an ongoing basis), costs that may be included within the General and Administration costs line item

[124] Pennsylvania Turnpike Commission, "Performance Audit," September 2, 2016, accessed October 30, 2017, https://www.paturnpike.com/pdfs/business/finance/AuditorGeneralsPerformanceAuditSept2016.pdf.
[125] Pennsylvania Turnpike Commission, "Comprehensive Annual Financial Report Fiscal Years Ended May 31, 2016 and 2015," September 2, 2016, accessed October 30, 2017, https://www.paturnpike.com/pdfs/business/PTC_CAFR_16-15.pdf.

on the Income and Expense statement should properly be allocated to the toll collection line item. Further, as toll collection requires more capital and also labor in many cases, a portion of the borrowing costs of the entity and the benefits (such as health care) and pension costs should be allocated toward toll collection costs. It is not clear from the financial reporting of the PA Turnpike if these costs have been correctly or appropriately allocated to toll collection. In 2016, the Turnpike reported that slightly more than 36 percent of staff (747 people) were employed in fare collection. If a similar portion of the central office staff is allocated to the toll collection service, the result is 46.5 percent of the staff at the PA Turnpike having a direct relationship to toll collection.

Re-estimating the cost of toll collection at the PA Turnpike utilizing an allocation of General and Administrative costs and Employee Benefits costs based upon the percent of employees by functional area (as is the practice at the Port Authority of New York and New Jersey) a more fully loaded toll collection cost of 20.62 percent of revenue collected is found at the PA Turnpike. Given that Employee Benefits are held out as a separate line item in the cost of services statement – it appears that their financial reporting has not allocated those costs to a particular functional area – and the same issue holds true for General and Administrative costs. These figures are detailed in Table 7.

Table 7: Full Toll Collection Cost Estimate – Pennsylvania Turnpike Authority - 2016

Total Revenue	$1,030,115,000
Total Reported Collection Costs	$64,275,000
Collection Costs (Admin) Percent	6.24%
Allocated Costs	
General and Administrative at 36.12%	$44,120,680
Employee Benefits at 36.12%	$42,630,293
G&A and Employee Benefits Percent	8.4%
Violation Costs	$61,340,131
Violation Costs Percent	6.0%
Estimated Toll Collections Costs (with Violations, General and Administrative and Employee Benefits Estimates)	$212,366,104
Collection Costs (+Violations, Admin, Benefits)	20.62%

Case Study 4: New York State Thruway Authority

The review of financial statements also found toll authorities that are experiencing significant operating losses. An example of this is illustrated in Table 8, which shows the New York State Thruway Authority operating at a loss – $272 million – in 2016.[126]

[126] "New York State Thruway Authority (A Component Unit of the State of New York) Financial Statements December 31, 2016 and 2015," New York Thruway Authority, accessed August 3, 2017. http://www.thruway.ny.gov/about/financial/statements/2016-audited-financial-statements.pdf.

Among the more significant costs listed as operating expenses are depreciation/amortization, general charges, maintenance and canals.

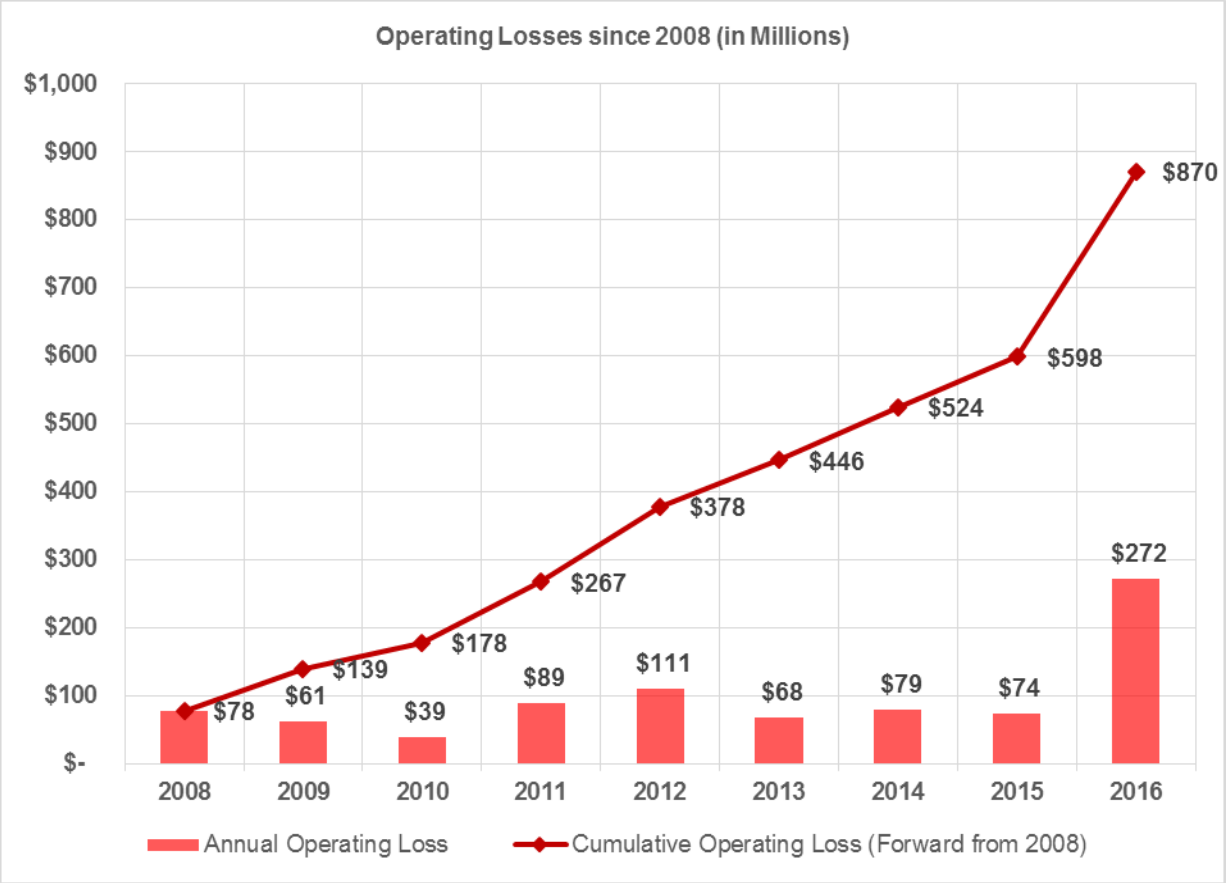
Table 8: Operating Revenue versus Expenses for Fiscal Year 2016, New York State Thruway

		2016
Operating Revenue	Tolls	$708,300,000
	Concessions	$14,800,000
	Other	$28,900,000
	Total	$752,000,000
Operating Expenses	Administrative	$17,100,000
	Engineering Services	$5,800,000
	Maintenance	$108,000,000
	Finance and Accounts	$7,900,000
	Operations	$42,800,000
	General Charges	$186,300,000
	Canals	$63,800,000
	State Police	$47,600,000
	Depreciation/Amortization	$544,700,000
	Total Operating Expenses	$1,024,000,000
Operating Loss		**($272,000,000)**

However, as shown in Figure 11, the New York State Thruway Authority has operated at a loss totaling $870,000,000 since the beginning of the 2008 fiscal year.[127]

[127] "New York State Thruway Authority (A Component Unit of the State of New York) Financial Statements December 31, 2010 - 2016," New York Thruway Authority, accessed September 20, 2017. http://www.thruway.ny.gov/about/financial/statements/

Figure 11: New York State Thruway Authority Annual Operating Losses (2008-2016)



All-Electronic Collections

Some toll authorities have, or are considering, all-electronic tolling to shift overhead costs from the operation of toll booths to technology and back-office support. An example of an all-electronic toll road is found in Massachusetts on the I-90 Massachusetts Turnpike. As of 2017, cash payments of road tolls are no longer accepted, though there a variety of ways to pay electronically. The primary payment method is via an "EZ-Pass Massachusetts" electronic transponder, available free of charge from the state. Drivers may also pay using out-of-state transponders, but will be charged more for using a non-Massachusetts-specific device. If no transponder is present in the vehicle, the tolling system photographs the car's license plate and the driver is billed via mail. These tolls may be paid through the mail or via an online system. This final method of payment is more expensive than the transponder method, and costs the driver almost twice as much to use in some cases.[128]

[128] The various types of tolling methods means that drivers pay unequal amounts for driving the same distance on the turnpike. For example, driving the full length of the turnpike from West Stockbridge to the Logan Airport exit will cost a 2-axle vehicle $7.45 with an EZ Pass MA, $9.35 with an out-of-state EZ Pass, and $13.55 via pay-by-plate. From Massachusetts Department of Transportation, "Toll Rates for Mass Turnpike," 2017, accessed May 30, 2017. https://www.ezdrivema.com/TollCalculator.

Toll Road Diversion

Many drivers, particularly truck drivers, avoid toll roads to escape paying the fee. In many cases the alternative routes taken are less direct, less efficient and sometimes less safe.

Toll authorities understand this dilemma and when planning new tolls, diversion should be taken into account. As an example, the Washington State Department of Transportation (WS DOT) implemented tolls on a State Route 520 bridge knowing it would produce considerable diversion; post-implementation diversion was measured at 34 percent, resulting in a decrease of 35,000 trips per day on the tolled facility.[129] In many cases those 35,000 trips shifted to less direct roadways such as SR 522 and I-90, resulting in increased travel times into Seattle.[130]

A study of data from the Ohio Turnpike showed that increases in tolling rates caused significant diversion onto local roads parallel to the Turnpike.[131] Given the additional vehicle traffic, the study concluded that the state would be unable to maintain local roads without tolling alternate routes, restricting truck access to local roads, or increasing state fuel taxes.

Congestion on alternate routes can have ramifications for nearby business communities as well. A 2013 Economic Assessment of the I-95 Corridor in North Carolina projected that toll avoidance would result in over $1 billion in lost revenue by 2050 for businesses near the corridor.[132]

Tolling Summary:

Administration. Tolls are collected electronically, at a staffed toll booth, or through the mail. In all cases, a tolling agency must administer a transaction with a driver each time a toll road or bridge is utilized.

Efficiency. The administration of tolling is never as efficient as other highway funding mechanisms. While financial statements from tolling entities vary dramatically in organization, reporting format and level of transparency, past research has shown that the cost of collecting tolls ranges from 21.9 percent to more than 30 percent of collected revenue.[133]

Equity. Drivers generally have a choice to pay a toll or opt for a different route. Toll revenue can be used for purposes other than transportation, thus placing a burden on a toll payer that goes beyond use of a particular facility.

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[129] Washington State Department of Transportation, "SR 520: Toll Operations and Traffic Performance Summary Report – 2012," 2012, accessed May 24, 2017. https://www.wsdot.wa.gov/NR/rdonlyres/DD8AD80C-1683-4B0A-ABDB-6493743833D1/0/SR520_TollOperationsandTrafficPerformanceSummaryReport_2012.pdf.

[130] Ibid.

[131] Peter Swan and Michael Belzer, "Empirical Evidence of Toll Road Traffic Diversion and Implications for Highway Infrastructure Privatization," Distributed Workplace Alternative, Inc., 2007, accessed May 24, 2017. http://www.distributedworkplace.com/DW/Research/Toll%20Road%20Traffic%20Diversion%20and%20Implications%20for%20Highway%20Infrastructure%20Privatization.pdf.

[132] Cambridge Systematics, Inc., "North Carolina I-95 Economic Assessment. Report," May 2013, accessed May 24, 2017. https://www.camsys.com/sites/default/files/publications/I-95_Economic.pdf.

[133] Jeffrey Short, Dan Murray and Sandra Shackelford, *Defining the Legacy for Users: Understanding Strategies and Implications for Highway Funding,* American Transportation Research Institute, Alexandria, VA, May 2007.

Effectiveness. Relative to far more efficient mechanisms, tolling is not an effective means of funding the nation's existing highways. Tolls can be and are regularly avoided by motorists resulting in inefficient roadway utilization. Additionally, toll coverage and revenue is limited to very specific facilities and does not cover the entire transportation system. Toll users typically pay for both tolls and fuel taxes for the use of the same facility, raising the specter of double-taxation. Finally, the practice of tolling requires significant overhead, including the purchase and installation of toll collection systems, which diverts revenue away from infrastructure investment. In summary, toll administration consumes a relatively large portion of gross revenue, revenues are sometimes diverted to other uses, and revenues are even used to provide profit payments to private sector owners and investors – even for properties that later file bankruptcy.

Revenue Mechanism Four: Vehicle Miles Traveled Tax

The VMT tax concept, which goes by various names including "mileage-based user fee" (MBUF), converts general roadway travel into a taxable commodity. At the national level, adoption of a VMT tax would require the federal government to track each vehicle, charge a variable mileage fee for each vehicle and ensure that mileage payments are not evaded.

In some ways this schema would be similar to the current motor fuels tax in that a gallon of gasoline is essentially a proxy for how many miles a specific vehicle could travel. The critical difference lies however in the administration of such an effort.

As discussed earlier, the motor fuels tax is collected from approximately 1,300 individual points. A federal VMT tax would have to be collected directly from the individual owners of more than 250,000,000 vehicles registered in the U.S.[134] More challenging, however, is how to determine the number of miles driven annually by a quarter billion vehicles. Placing tracking devices in each vehicle would be necessary, as would enforcing proper use to prevent evasion. If the goal is highly accurate data (e.g. separating frontage roads from freeways), then a vehicle-integrated device will be needed. Another issue is how to identify the "invisible" vehicles not using the tracking devices, a new anti-evasion challenge that is yet unsolved.

Using a hypothetical and very conservative cost of $50 annually per vehicle to install and maintain the technology, track, collect and enforce a national VMT tax, the total collection cost would be in the range of $12.5 billion annually.

Despite significant collection costs, several states have shown interest in the VMT tax concept, and have even conducted pilot tests. Furthermore, there has been interest among states and local governments to use a variable VMT tax at specific times and locations to decrease congestion.

[134] Federal Highway Administration, "Table MV-1: Highway Statistics 2015 – Policy," accessed September 21, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/mv1.cfm.

VMT Tax Summary:

Administration. The Internal Revenue Service (IRS) collects tax revenue for the Federal Government. In 2015, 79,890 employees of the IRS, using a budget of $11.4 billion, processed 240 million tax returns.[135,136] At the federal level, deploying, monitoring, collecting, and enforcing compliance for a VMT tax on a similar number of entities (i.e. 250 million registered vehicles in the U.S.) would require a similar, if not more technologically complex, government program. Additionally, many vehicle owners will dislike the idea of having their travel monitored and taxed by a government agency. The Oregon mileage-based road use tax pilot program, for instance, tested devices with and without GPS for collecting mileage information. Participants expressed privacy concerns related to the use of GPS-enabled devices to track mileage.[137] In fact, the Oregon DOT noted in their report that, "Citizens showed grave concerns about the potential for invasion of privacy, particularly about GPS-based mileage reporting devices, and the cost for government administration of a new revenue collection system."[138] However GPS monitoring is crucial to ensure that drivers are only taxed for miles driven on public roads in the relevant jurisdiction. To date it is unknown how the VMT tax payers would submit their tax revenue as the administrative infrastructure for managing a VMT tax does not currently exist. In any case, the system would be large, complex and inefficient in comparison to other methods of transportation revenue generation.

Efficiency. Deploying, monitoring, enforcing compliance and collecting revenue for the miles driven by each of the approximately 250 million registered vehicles in the U.S. is extremely inefficient relative to other mechanisms.

Equity. The VMT tax would be equitable to the degree that it is enforceable – the tax will only apply to those properly tracking miles and thus following the law. Much like a motor fuels tax, the VMT tax has the potential to cost higher-mileage drivers, such as those that live in rural areas, more than a typical urban driver. That said, if variable pricing were put into practice, miles driven in urban areas would likely cost more than rural miles.

Effectiveness. If implementation were feasible, the VMT tax concept could raise revenue for all roadway use.

[135] Internal Revenue Service, "The Agency, Its Mission and Statutory Authority," July 27, 2016. https://www.irs.gov/uac/the-agency-its-mission-and-statutory-authority.
[136] Internal Revenue Service, "Internal Revenue Service Data Book, 2015," Washington, D.C.: Internal Revenue Service, March 2016. https://www.irs.gov/pub/irs-soi/15databk.pdf.
[137] Robert S. Kirk, and Marc Levinson, "Mileage-Based Road User Charges," Congressional Research Service, June 22, 2016.
[138] Kathryn Jones, and Maureen Bock, "Oregon's Road Usage Charge: The OReGO Program, Final Report," Oregon Department of Transportation, April 2017.

Revenue Mechanism Five: Financing

A key component of highway funding is road financing through loans and bonds. This form of debt financing must be paid back through other revenue sources, such as those described above.

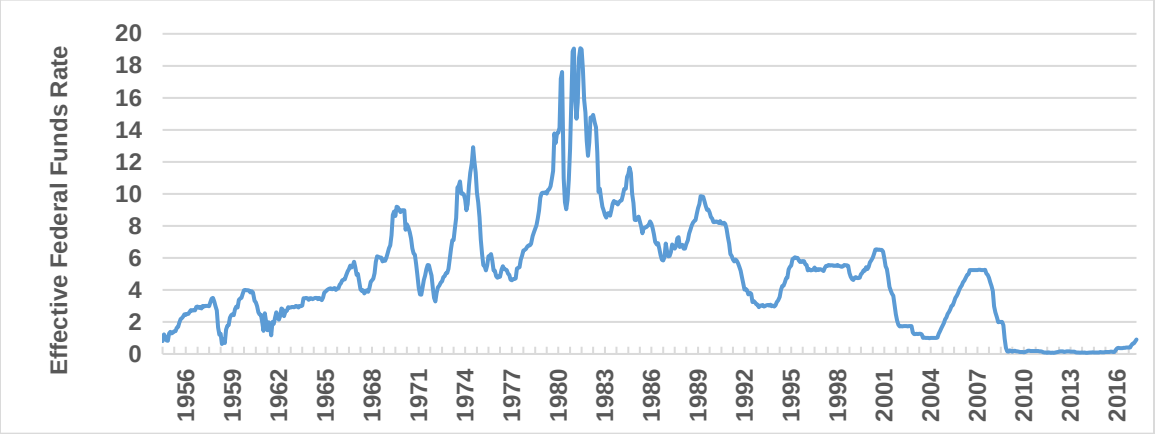
However, loan acquisition is justified when potential cost increases in the future, due to inflation and production costs, exceed interest rates, or if the benefits of a project confer greater benefits than the cost of interest rates.[139] Examples include loans from state infrastructure banks and Transportation Infrastructure Finance and Innovation Act (TIFIA) loans.[140]

Bonds are issued by state and local governments to raise revenue for transportation projects. Bonds are then purchased by investors, and yield an ongoing cash influx.[141] Bond costs are typically backed by the full faith and credit of the government, or by a specific revenue source, such as a toll. Bond issuance may require voter approval.

In addition, projects may be funded using Grant Anticipation Revenue Vehicles (GARVEEs). GARVEEs allow states' future Federal-aid highway apportionments to be used to pay for debt service and bond expenses.

Loans and bonds are tied to some degree to interest rates. As indicated in Figure 12, interest rates are currently at historic lows, thus making the cost of borrowing money low at this time.[142]

Figure 12: Interest Rate Trends



[139] Federal Highway Administration, "Project Finance Primer," August 2010. https://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf.
[140] Federal Highway Administration, "FHWA Center for Innovative Finance Support: Fact Sheets," accessed June 13, 2017. https://www.fhwa.dot.gov/ipd/fact_sheets/finance_introduction.aspx.
[141] Federal Highway Administration, "Project Finance Primer," August 2010. https://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf.
[142] Board of Governors of the Federal Reserve System (US), "Effective Federal Funds Rate," FRED, Federal Reserve Bank of St. Louis, accessed October 4, 2017. https://fred.stlouisfed.org/series/FEDFUNDS.

Financing Summary:

Administration and Efficiency. States and municipalities regularly borrow funds for capital improvements. Thus, mechanisms for borrowing for transportation purposes are in place and include standard borrowing-related fees.

Equity. Borrowed funds must be paid back, either through a transportation revenue stream or through other government revenue. Borrowing money allows for a project to commence before it can be paid for. Thus, depending on the terms of a loan or bond, future generations may have to pay for infrastructure that is already obsolete.

Effectiveness. Borrowing funds is an effective way to raise money quickly for capital projects, though it is critical to have a means for paying back those funds. Borrowing also raises the overall cost of an infrastructure project. As interest rates increase or money becomes more difficult to borrow this method is less effective (though it may still be necessary).

Revenue Mechanism Six: Appropriation of General Funds

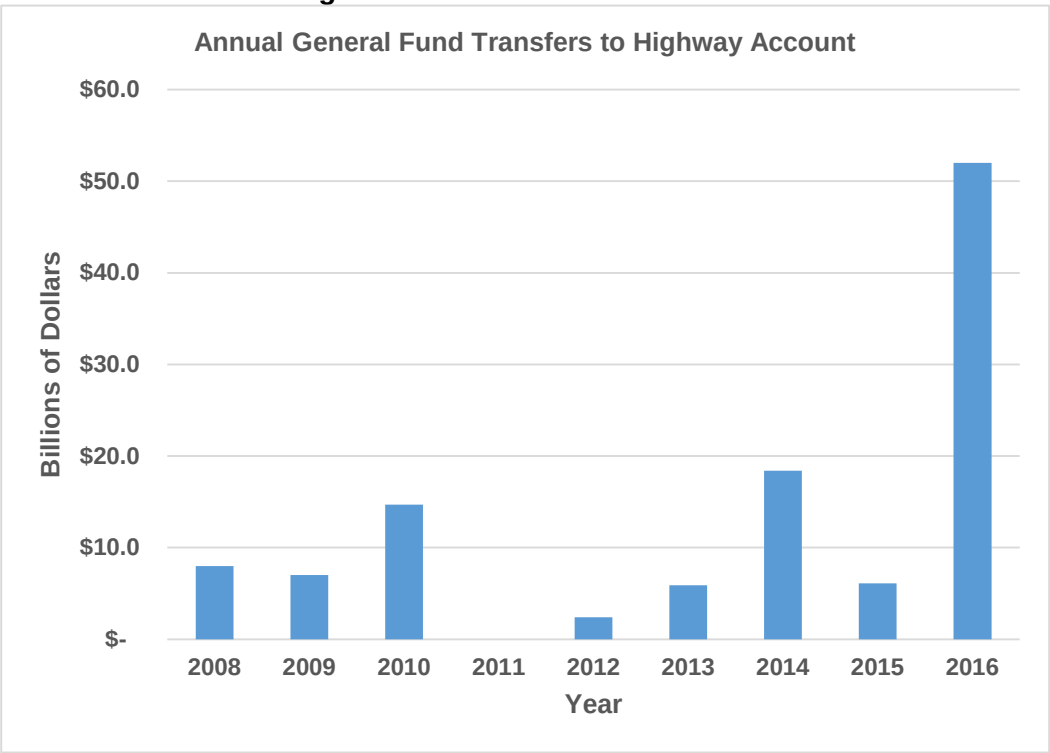
It can be argued that every American, regardless of travel habits, benefits directly from roadways. Even a person that does not directly pay registration fees, tolls or fuel taxes may utilize transit, or will consume food or other goods that have been delivered by a truck, for instance. Thus, consumers that are not direct road users still reap the benefits of an efficient transportation system, which then may offer justification for use of the General Fund to pay for transportation infrastructure.

Current law prohibits the HTF from incurring negative balances or borrowing funds to cover obligations.[143] In recent years, however, the HTF's outlays have often exceeded the revenues collected.[144]

Figure 13 displays the annual General Fund transfers to the Highway Account by fiscal year needed to balance the HTF. [145] Typically Congressionally-authorized transfers to the HTF come from the General Fund of the Treasury, but occasionally are taken from other sources.[146] The Congressional Budget Office (CBO) projects future Highway Account shortfalls of $80 billion by 2026.[147] If revenue streams are not modified, General Fund transfers will likely be needed in the future to cover Highway Account shortfalls.

[143] Congressional Budget Office, "Estimates of the Status of the Highway Trust Fund Based on CBO's August 2016 Baseline," September 2016. https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/costestimate/inhofeletteraugust2016htf.pdf. See "Under current law, the trust fund cannot incur negative balances, nor is it permitted to borrow to cover unmet obligations presented to the fund."
[144] Federal Highway Administration, "The Highway Trust Fund," accessed July 6, 2017. https://www.fhwa.dot.gov/policy/olsp/fundingFederalaid/07.cfm.
[145] Federal Highway Administration, "The Highway Trust Fund," accessed July 6, 2017. https://www.fhwa.dot.gov/policy/olsp/fundingFederalaid/07.cfm.
[146] Ibid.
[147] Congressional Budget Office, "Estimates of the Status of the Highway Trust Fund Based on CBO's August 2016 Baseline," September 2016. https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/costestimate/inhofeletteraugust2016htf.pdf.

Figure 13: General Fund Transfers



General Fund Appropriations Summary:

Administration. General Fund transfers require authorization from Congress. Due to regularly changing political climates, transfers are not guaranteed indefinitely. Thus, relying upon these transfers creates great uncertainty.

Efficiency. The transaction that transfers a sum of money to the HTF is highly efficient, but the funds were ultimately collected by U.S. Treasury through a variety of means that are not as efficient.

Equity: General Fund transfers to transportation are paid indirectly by all taxpayers, regardless of highway use. It can be argued, however, that all taxpayers benefit from the U.S. transportation system.

Effectiveness. General Fund transfers effectively fill in gaps in the Highway Trust Fund when they are employed.

4. RECOMMENDATIONS

The previous section offers analysis of the administration, efficiency, equity and effectiveness of six key highway funding options. Each funding option was next scored based on the findings of the analysis. The scoring criteria, which assesses the favorability of each option based on the findings from the previous section, is described in Appendix B. A summary of the findings is presented in Table 9 below, with fuel taxes scoring the highest of all options reviewed. Those funding options that were found to be least favorable were comparatively least able to fund the nation's transportation system.

Table 9: Highway Funding Options Matrix

	Administration	Efficiency	Equity	Effectiveness	Overall Score
Fuel Tax	5	5	5	5	**5.00**
Registration Fee	3	4	4	4	**3.75**
General Fund	5	3	2	2	**3.00**
Financing	4	3	2	2	**2.75**
VMT Tax	1	1	5	3	**2.50**
Tolling	2	2	3	1	**2.00**

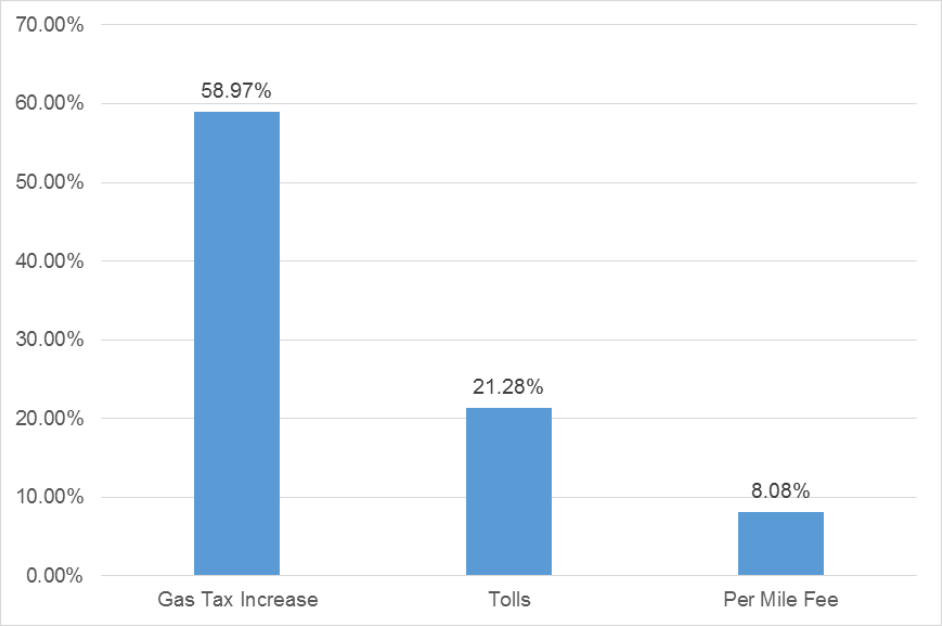
LEGEND

Favorable 5 | 4 | 3 | 2 | 1 **Unfavorable**

Additionally, these rankings mirror public opinion. In public opinion polling conducted by Public Opinion Strategies, respondents were asked to select a funding mechanism for the nation's transportation system; 58.9 percent selected the fuel tax, while only 21.2 percent selected tolling and 8.1 percent selected a VMT tax.[148]

[148] Neil Newhouse, "American Trucking Associations National Poll" (presentation, ATA Management Conference and Exhibition, Orlando, FL, October 21 – 24, 2017). Available online: http://portal.trucking.org/mce/Pages/Presentations.aspx." For this survey question, 800 respondents were asked: *If you had to choose one of the following ways to fund the nation's needed four trillion dollars of road, bridge and highway improvements, which would you find LEAST objectionable?*

Figure 14: Public Opinion on Funding Mechanisms



Based on these findings and the current status of the nation's highway funding structure and needs, the following recommendations are made:

Recommendation One: ***Increase and Index the Federal Motor Fuels Tax on Gasoline and Diesel to Make the Highway Trust Fund Solvent***

The federal motor fuels tax, which has been in place for more than 80 years, is a highly efficient method for raising transportation revenue as demonstrated in this report.[149] Likewise, the need for additional funding, and the benefits that would accrue through additional funding, are well documented. While the federal motor fuels tax has not increased in nearly a quarter century, 39 states in the U.S. have increased state fuel taxes to ensure that local transportation systems are funded at appropriate levels within that same time period.

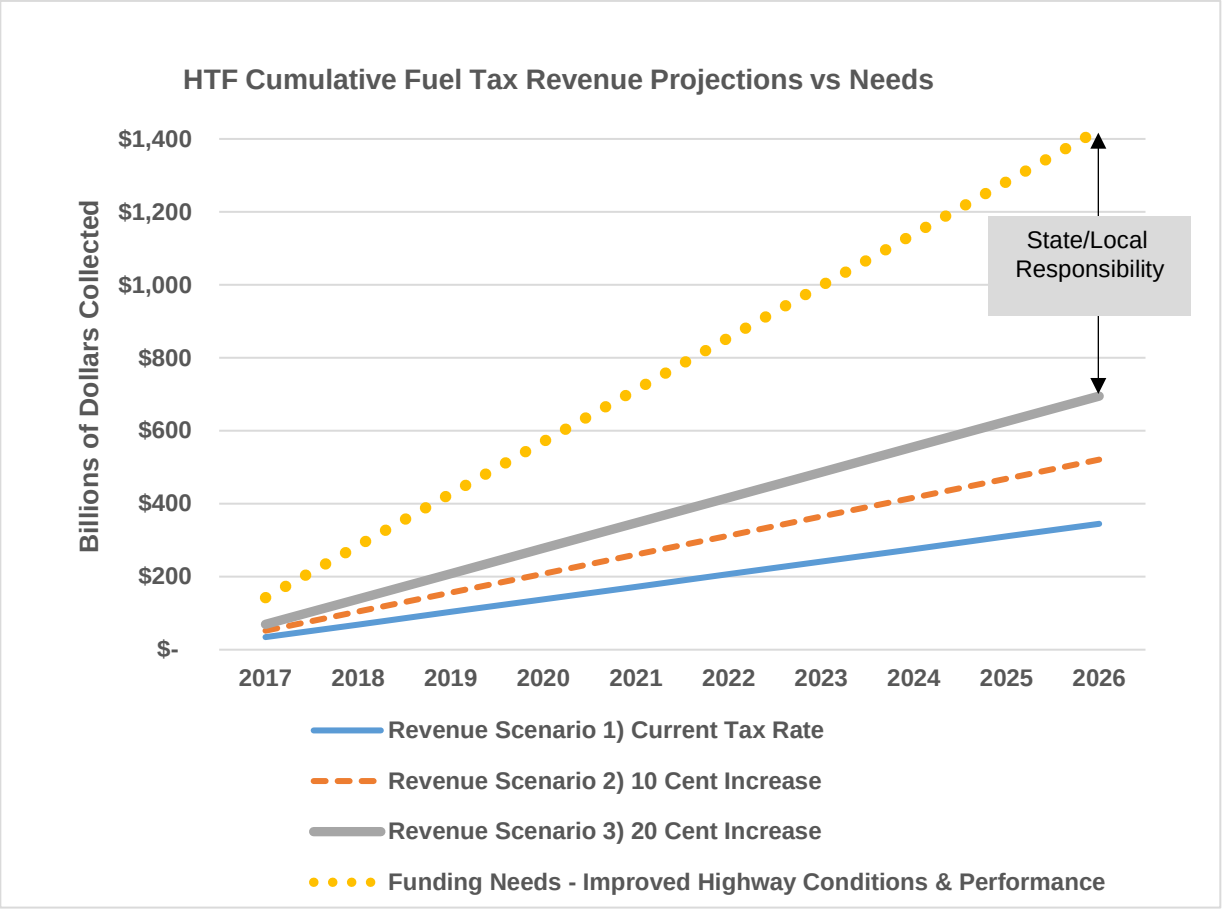
Therefore, a critical first step in improving federal transportation revenue streams is to update antiquated tax rates to reflect current transportation needs and to index the tax in some manner to address inflation. Increasing "taxes" is often shunned by lawmakers, but that barrier could be eliminated by officially recognizing the federal motor fuels tax as a user-based fee that funds the transportation system (this concept is discussed further in Recommendation Three). Additionally, the cost of not raising infrastructure revenue is represented by at least $63.4 billion in trucking industry congestion costs, which is in a sense a tax upon the industry borne from federal inaction.

Figure 15 illustrates three revenue scenarios where: 1) the current tax rate remains the same on both diesel and gasoline; 2) both fuel tax rates are increased 10 cents; and 3) both fuel tax rates are increased 20 cents. The cumulative revenue that would be collected by the HTF is charted

[149] See also: Revenue Act of 1932. From: Sean Lowry, "The Federal Excise Tax on Motor Fuels and the Highway Trust Fund: Current Law and Legislative History," August 12, 2015, http://nationalaglawcenter.org/wp-content/uploads/assets/crs/RL30304.pdf.

assuming all other conditions, particularly fuel consumption, remains constant.[150] These three scenarios are juxtaposed with the average annual investment level of $142.5 billion that FHWA estimates would be needed to improve both conditions and performance of the nation's highway system.[151] As indicated, even with the highest fuel tax revenue scenario, there would remain a $730 billion gap that would need to be filled by state and local governments.

Figure 15: Fuel Tax Increase Scenarios



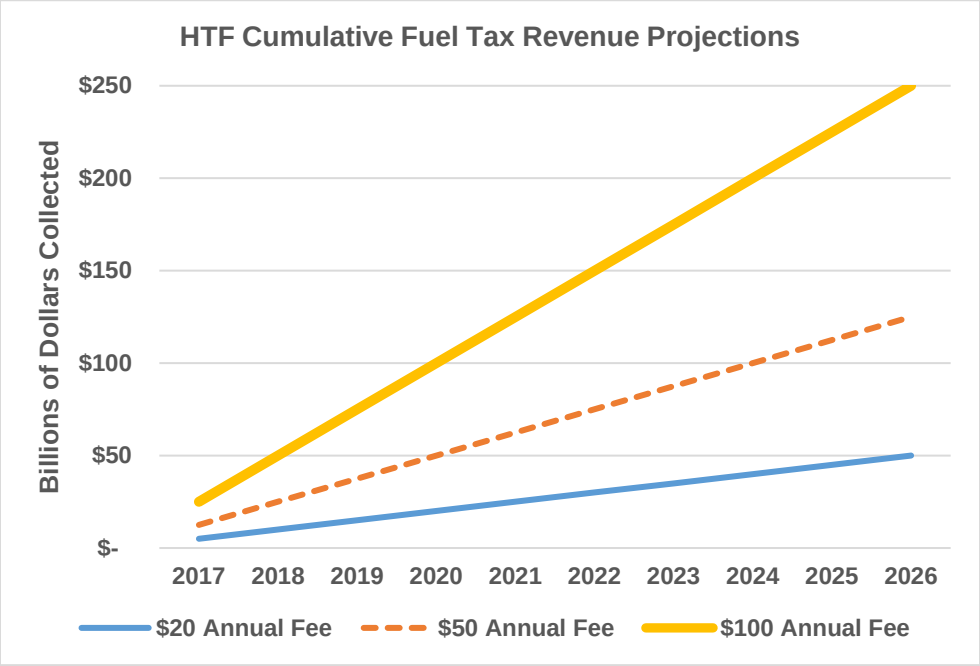
[150] Figure 13 assumes that excise tax revenues in 2017 will remain the same as 2015 revenues (found in FHWA's Highway Statistics 2015, Table FE-210). That annual figure is given an additional 10 and 20 cents per gallon boost in revenue by increasing the baseline of 18.4 cents for gasoline and 24.4 cents for diesel. Next, revenues are added up cumulatively assuming that gallons consumed annually remain the same. It is understood that consumption will fluctuate from the 2017 baseline but that the consumption will remain relatively similar from year to year.

[151] Federal Highway Administration, "2015 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Executive Summary," p. ES-18, accessed October 3, 2017. https://www.fhwa.dot.gov/policy/2015cpr/pdfs/es.pdf.

Recommendation Two: ***Investigate Collection of Registration Fees for the HTF through State Departments of Transportation***

The feasibility of collecting a national vehicle registration fee, which would help fund the HTF, should be investigated. Specifically, Congress could research the feasibility of a state-collected federal registration fee that would be deposited directly into the HTF by the 50 states. A similar registration fee is currently collected by the U.S. Treasury for certain vehicles (particularly those involved in freight operations) through the Heavy Vehicle Use Tax (HVUT). Assuming that 250 million vehicles would pay an annual registration fee, Figure 16 shows the cumulative revenue collection from such a program over 10 years for a fee of $20, $50 and $100 annually.

Figure 16: Cumulative Revenues under Three Federal Registration Fee Scenarios



The registration fee options would further decrease the state and local responsibility for meeting FHWA's Improved Conditions and Performance funding levels for highways.

Recommendation Three: ***Establish More Accurate Definitions of Revenue Mechanisms***

Many in Congress are vehemently opposed to raising taxes – and often show preference toward "user fees" and other alternative mechanisms for raising revenue. This is likely the underlying cause for the eroded value of federal motor fuels tax revenues. Many members of Congress, in fact, have followed a strict anti-tax doctrine that ultimately has prevented the motor fuels tax from increasing since 1993.

So, is the motor fuels tax actually a tax or is it a fee? One straightforward definition of taxes versus fees is as follows: "The difference between a tax and a fee generally turns on the use of the revenue. Is the revenue meant to raise money that can be used to defray the general costs

of government? It's a tax. Is the revenue meant to pay for the costs of a specific government program or service? It's a fee."[152]

The author of an article in the Gonzaga Law Review makes the following observations regarding fuel taxes:

> *Arguably, some taxes are so earmarked and so related to the activity generated that they are no longer best thought of as taxes at all. For example, Article 1I, Section 40 of the Washington State Constitution requires that all motor vehicle fuel taxes be "placed in a special fund to be used exclusively for highway purposes." WASH. CONST. art 11, § 40. Because there is a direct connection between fuel consumption and road use, the gas tax might be better thought of as a user fee of the "burden offset charge."*[153]

Another excerpt takes this idea further:

> *[The] motor vehicle fuel tax verges on being appropriately thought of as a burden offset street use charge instead of a tax. Gas taxes paid by drivers relate directly to road use, and by [Washington State] constitutional mandate, gas tax proceeds are deposited in a special fund for road and highway purposes only.*[154]

Similar to the fuel tax in Washington State, the federal motor fuels tax is deposited into the HTF – a special fund dedicated to funding U.S. transportation. Thus, it is valid to argue that the federal motor fuels tax may actually be better defined as a road user charge. It should be noted that in this report VMT-based revenues are described as being derived from a VMT tax. This nomenclature was selected since there is no certainty that a VMT-based revenue stream would be used directly for transportation, particularly one that contains variable pricing.

The above definitions also highlight some uncertainty with the term tolling. When public sector toll revenues are diverted to non-transportation uses they represent something closer to a tax than a user fee. Due to these seemingly small but ultimately critical nuances, it may benefit elected officials, private sector stakeholders and administrative bodies to better define the available funding mechanisms.

Recommendation Four: ***Investigate an Automatic Mechanism for Filling in HTF Gaps with General Fund Dollars***

Until a mechanism is developed to fully fund the HTF, the federal government could create an automatic mechanism to fill in the HTF gaps with general fund dollars. This is by no means an ideal strategy; the U.S. surface transportation system is, however, critical to the economy, commerce and even the security of the country. Therefore, a guaranteed source of revenue must be available to ensure that highways continue to receive funding. This guarantee is particularly necessary due to political uncertainty. While in the past, members of Congress have debated and allocated transportation funds from the general fund, there is no certainty that this will happen in the future.

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[152] Rebecca Helmes, "Extras on Excise: The Difference Between a 'Tax' and 'Fee' and Why It Matters," n.d. https://www.bna.com/extras-excise-difference-b17179894455/.
[153] Hugh D. Spitzer, "Taxes vs. Fees: A Curious Confusion," Gonz. L. Rev. 38 (2002): 335, footnote 31. https://www.law.gonzaga.edu/law-review/files/2008/11/38GonzLRev335.pdf
[154] Ibid. footnote 178.

Recommendation Five: ***Develop Program to Standardize and Measure the Cost of Revenue Collection Mechanisms***

Transportation revenue will always have an administrative collection cost. The current motor fuels tax, for instance, has a cost to the U.S. Treasury associated with collecting money from a relatively small number of companies in the energy sector, which is a highly efficient approach.

Many of the alternatives to the fuel tax require a transaction with individual highway users; this could be in the form of an electronic toll collection or through a mileage-based tax. Such collection approaches have bureaucratic inefficiencies that ultimately require the highway users to pay a significant percentage of their cost to cover collections. In the case of privatized toll roads, users are also paying a profit to the toll collector.

For the road user, it is ideal that most if not all transportation revenue ultimately goes for road maintenance, improvements and construction. If those revenues are spent alternatively on funding a new agency for collecting mileage-based charges, as an example, the road users and the roadways themselves ultimately suffer.

An ideal model for measuring and disseminating revenue collection information is found in the Energy Information Administration (EIA), which provides energy information to the public in an unbiased manner. A similar entity within U.S. DOT could focus on tracking transportation revenue from the point of collection to the point of disbursement. This would allow for sound policymaking related to the selection of revenue collection mechanisms at all levels of government, and would ensure that highway user fees are efficiently allocated to the transportation system. Likewise, the agency could require that toll authorities in particular adopt a standard set of accounting principles for identifying revenue collection costs if they wish to receive federal funds.

Recommendation Six: ***Identify Methods for Collecting Revenue from Electric Vehicles***

Many believe that electric vehicles will gain in popularity in the coming decades. The HTF, however, is not equipped to capture revenue from these particular road users. Electric vehicles do, however, consume a measurable, taxable form of energy. Methods for taxing this type of energy should be explored.

As a next step the U.S. DOT and the Department of Treasury could engage electricity producers and distributors (publicly owned utilities, investor-owned utilities and electric cooperatives) to identify methods for efficiently collecting transportation revenue.

Several clear options are available to stakeholders. One would be to require electric vehicles to electronically measure and report energy consumption, preferably to an electricity provider. This represents an option similar to the current fuel tax. Alternatively, the tax could be collected directly from the utilities based on estimates of transportation-related consumption. Unfortunately, this method would distribute the tax across all users of electricity, not just electric vehicle owners.

Critical to this process would be appropriately relating kilowatt hours used to miles driven, and appropriately taxing that usage. While it is likely the technology to measure vehicle electricity usage and report that usage to a utility does currently exist, requiring manufactures to install this technology is a critical and next step before the U.S. electric vehicle fleet grows any larger.

Recommendation Seven: ***Streamline the Planning and Construction Process to Lower Costs and Deliver Infrastructure Faster***

As discussed in this report, from the initial planning stages to completion, new road and bridge projects can take a significant amount of time.

In part this is due to NEPA and similar requirements that are both costly and time consuming. Recognizing this, a recent White House Executive Order aims to decrease delivery time on major infrastructure projects.[155] Notably, this order requires that the federal government assist in navigating major infrastructure projects through the federal permitting process in an expeditious and predictable manner. Other levels of government should consider adopting these principles during the permitting process and there should be consideration for applying the same principles to smaller infrastructure efforts.

Additionally, advances in technologies used by the construction industry have and will play a role in decreasing construction time. The FAST Act contained a continuation of the Technology and Innovation Deployment Program, an initiative aimed at reducing highway transportation project completion time by funding the use of new technologies. For instance, in order to streamline time and costs associated with construction project planning, the industry has begun implementing "e-construction" techniques. This can include the use of digital documents and electronic signatures to reduce signing time, the use of mobile devices such as tablets and smartphones in the field to improve site inspection, and the real-time tracking of materials through RFID chips and bar coding, among other practices. By 2015, FHWA had included e-construction elements in its Every Day Counts (EDC) initiatives. In early 2017, approximately 13 states had institutionalized e-construction practices such as electronic signatures, secure filing systems, and web-hosted data systems.

Federal financial incentives could encourage states to streamline planning and construction as well. A program that offers financial rewards or benefits to states to deliver projects under budget and within reasonable timelines may accomplish this. With such incentives state DOTs may reduce the time it takes for project selection, permitting, and may also be able to incentivize contractors to deliver quickly and efficiently.

[155] Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, Exec. Order No. 13807, 82 FR 40463 (August 24, 2017). https://www.federalregister.gov/documents/2017/08/24/2017-18134/establishing-discipline-and-accountability-in-the-environmental-review-and-permitting-process-for.

CONCLUSION

This report corroborates that an increase in federal transportation revenue can efficiently occur if the federal government can develop a multi-faceted, equitable and long-term funding program.

To highlight the direct and secondary benefits associated with an increase in the federal fuel tax, ATRI developed a Funding Impact Matrix using 2017 data highlighting the impact that a 10 or 20 cent increase in the federal motor fuels tax would have on both state funding and infrastructure-related jobs. Table 10 identifies the top 15 state recipients of FAST Act revenue allocations and the incremental benefits that are associated with fuel tax increases.[156] The full list of states can be found in Appendix C.

[156] Federal Highway Administration, "Chart FA-4 - Highway Statistics 2015," accessed February 15, 2017. https://www.fhwa.dot.gov/policyinformation/statistics/2015/fa4.cfm.

Table 10: Funding Impact Matrix for Top 15 States by New Job Creation

	Current Annual Allocation		Ten Cent Increase - Federal Motor Fuels Tax Annual Benefits				Twenty Cent - Increase Federal Motor Fuels Tax Annual Benefits			
STATE	FAST ACT Apportioned Funds (in milions)	Percent of National Funding	Additional $15 Billion Federal Funding (in millions)	State Match (20%) (in millions)	Total New Funds (in millions)	# of Jobs	Additional $30 Billion Federal Funding (in millions)	State Match (20%) (in millions)	Total New Funds (in millions)	# of Jobs
CALIFORNIA	$ 3,723	9.4%	$ 1,406	$ 281	$ 1,687	21,931	$ 2,812	$ 562	$ 3,374	43,862
TEXAS	$ 3,501	8.8%	$ 1,322	$ 264	$ 1,587	20,625	$ 2,644	$ 529	$ 3,173	41,250
FLORIDA	$ 1,922	4.8%	$ 726	$ 145	$ 871	11,321	$ 1,451	$ 290	$ 1,742	22,642
NEW YORK	$ 1,703	4.3%	$ 643	$ 129	$ 772	10,030	$ 1,286	$ 257	$ 1,543	20,059
PENNSYLVANIA	$ 1,664	4.2%	$ 628	$ 126	$ 754	9,804	$ 1,257	$ 251	$ 1,508	19,608
ILLINOIS	$ 1,442	3.6%	$ 545	$ 109	$ 653	8,495	$ 1,089	$ 218	$ 1,307	16,990
OHIO	$ 1,360	3.4%	$ 513	$ 103	$ 616	8,009	$ 1,027	$ 205	$ 1,232	16,019
GEORGIA	$ 1,310	3.3%	$ 495	$ 99	$ 593	7,715	$ 989	$ 198	$ 1,187	15,430
MICHIGAN	$ 1,068	2.7%	$ 403	$ 81	$ 484	6,291	$ 807	$ 161	$ 968	12,582
NORTH CAROLINA	$ 1,058	2.7%	$ 399	$ 80	$ 479	6,232	$ 799	$ 160	$ 959	12,464
VIRGINIA	$ 1,032	2.6%	$ 390	$ 78	$ 468	6,080	$ 780	$ 156	$ 935	12,161
NEW JERSEY	$ 1,013	2.5%	$ 382	$ 76	$ 459	5,966	$ 765	$ 153	$ 918	11,932
INDIANA	$ 967	2.4%	$ 365	$ 73	$ 438	5,693	$ 730	$ 146	$ 876	11,387
MISSOURI	$ 960	2.4%	$ 363	$ 73	$ 435	5,657	$ 725	$ 145	$ 870	11,313
TENNESSEE	$ 857	2.2%	$ 324	$ 65	$ 388	5,049	$ 647	$ 129	$ 777	10,098

As an example, Texas, which is 2nd on the list, annually receives approximately $3.5 billion from FHWA. This equates to 8.8 percent of the annual federal funding for fiscal year 2016. Assuming current revenues remain static, a 10 cent increase in the federal fuels tax on gasoline and diesel would increase the state's transportation revenue by $1.3 billion – based on the assumption that an additional $15 billion is raised through a 10 cent fuels tax increase, and that those funds are allocated to states using the existing federal formulas.[157] When the state match of approximately 20 percent is added, total new funds available for transportation in Texas will be $1.58 billion.[158]

As shown in Appendix C, beyond increased transportation funding, secondary benefits to the U.S. economy would include a nearly quarter-million new highway construction jobs.[159] It should be noted also that highway construction jobs can pay up to $50,000 per year or more, which further contributes to state and local tax revenue.[160]

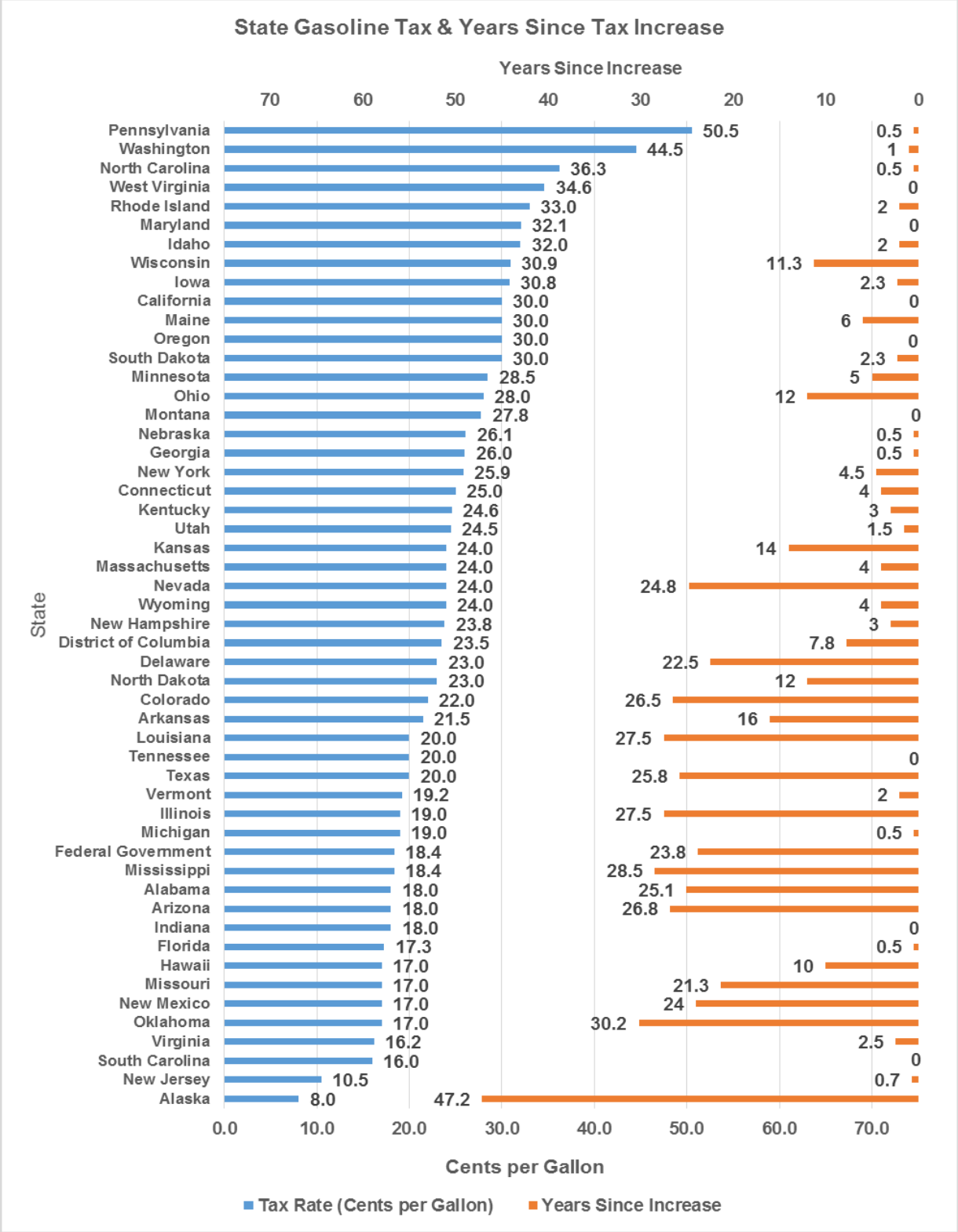
Looking back at the Texas example, and assuming 13,000 annual jobs are generated for every $1 billion spent on transportation infrastructure, the State of Texas would see an increase of 20,625 transportation infrastructure-related jobs as a result of a 10 cent motor fuels tax increase.[161]

A 20 cent increase would double these figures, resulting in $3.17 billion in additional funds for Texas, and an additional 41,250 jobs. Nationally, a 20 cent increase could result in 468,000 jobs added to the U.S. economy.

The 10 and 20 cent federal motor fuels tax increases are just two examples of how an efficient funding mechanism improves transportation while at the same time increasing employment. With improved federal guidance and increased transportation funding, the United States can once again invest in its transportation system, thus ensuring critical safety and mobility benefits for decades to come.

[157] It is assumed in Table 10 that, based on past revenue and fuel consumption levels, a 10 and 20 cent fuel tax increase would result respectively in approximately $15 and $30 billion in additional highway trust fund revenues available for states from the U.S. DOT.
[158] Additional state funds required for a match are assumed to be 20 percent.
[159] See Appendix C for national totals.
[160] "Construction and Extraction Occupations." accessed November 3, 2017. https://www.bls.gov/oes/current/oes470000.htm. Note: $50,680 average annual wage.
[161] Federal Highway Administration, "Employment Impacts of Highway Infrastructure Investment," U.S. Department of Transportation, accessed November 3, 2017. https://www.fhwa.dot.gov/policy/otps/pubs/impacts/. Note: The number of jobs created is assumed to be 13,000 for every $1 billion in funding based on the official estimate from the Council of Economic Advisers (CEA), which is part of the Executive Office of the President.

APPENDIX A: YEARS SINCE GAS TAX INCREASE BY STATE (as of July 26, 2017)[162]



[162] Sophie Quinton, "Reluctant States Raise Gas Taxes to Repair Roads," The Pew Charitable Trusts, accessed August 24, 2017. http://pew.org/2v5yt8m.

APPENDIX B: SCORING CRITERIA

The following criteria were used to score each of the six funding options covered in this study.

Grade	Administrative Qualities
5	Few transactions, low collection costs
4	Few transactions, moderate collection costs
3	Numerous annual transactions for all system users
2	Numerous per use transactions for some system users
1	Numerous transactions and tracking for all system users

Grade	Efficiency Qualities
5	Low collection costs from all system users
4	Moderate collection costs from all system users
3	Moderate collection costs from users and nonusers
2	High collection costs from some system users
1	High collection costs from all system users

Grade	Equity Qualities
5	Users fund full system, based on consumption
4	Users fund full system, not based on consumption
3	Users fund system segments, based on consumption
2	Users and nonusers fund full system, not based on consumption
1	Users and nonusers fund system segments, not based on consumption

Grade	Effectiveness Qualities
5	Funds full transportation system with user funds; low evasion or diversion probability
4	Funds full transportation system with user funds (that are not tied to consumption), low evasion or diversion probability.
3	Funds full transportation system with user funds; high evasion probability and potential for diversion with variable pricing.
2	Funds full transportation system with user and nonuser funds (not tied to consumption); low evasion or diversion probability
1	Funds partial transportation system with user funds; low evasion but high diversion probability

APPENDIX C: FUNDING IMPACT MATRIX - ANNUAL STATE-LEVEL JOB AND REVENUE INCREASES RESULTING FROM FEDERAL FUEL TAX INCREASES

	Current Annual Allocation		Ten Cent Increase - Federal Motor Fuels Tax Annual Benefits				Twenty Cent - Increase Federal Motor Fuels Tax Annual Benefits			
STATE	FAST ACT Apportioned Funds (in milions)	Percent of Total	Additional $15 Billion Federal Funding (in millions)	State Match (20%) (in millions)	Total New Funds (in millions)	# of Jobs	Additional $30 Billion Federal Funding (in millions)	State Match (20%) (in millions)	Total New Funds (in millions)	# of Jobs
ALABAMA	$ 770	1.9%	$ 291	$ 58	$ 349	4,533	$ 581	$ 116	$ 697	9,067
ALASKA	$ 509	1.3%	$ 192	$ 38	$ 230	2,996	$ 384	$ 77	$ 461	5,992
ARIZONA	$ 742	1.9%	$ 280	$ 56	$ 336	4,372	$ 560	$ 112	$ 673	8,744
ARKANSAS	$ 525	1.3%	$ 198	$ 40	$ 238	3,094	$ 397	$ 79	$ 476	6,187
CALIFORNIA	$ 3,723	9.4%	$ 1,406	$ 281	$ 1,687	21,931	$ 2,812	$ 562	$ 3,374	43,862
COLORADO	$ 542	1.4%	$ 205	$ 41	$ 246	3,195	$ 410	$ 82	$ 492	6,390
CONNECTICUT	$ 509	1.3%	$ 192	$ 38	$ 231	3,001	$ 385	$ 77	$ 462	6,002
DELAWARE	$ 172	0.4%	$ 65	$ 13	$ 78	1,011	$ 130	$ 26	$ 156	2,022
DIST. OF COL.	$ 162	0.4%	$ 61	$ 12	$ 73	953	$ 122	$ 24	$ 147	1,907
FLORIDA	$ 1,922	4.8%	$ 726	$ 145	$ 871	11,321	$ 1,451	$ 290	$ 1,742	22,642
GEORGIA	$ 1,310	3.3%	$ 495	$ 99	$ 593	7,715	$ 989	$ 198	$ 1,187	15,430
HAWAII	$ 172	0.4%	$ 65	$ 13	$ 78	1,011	$ 130	$ 26	$ 155	2,021
IDAHO	$ 290	0.7%	$ 110	$ 22	$ 131	1,709	$ 219	$ 44	$ 263	3,418
ILLINOIS	$ 1,442	3.6%	$ 545	$ 109	$ 653	8,495	$ 1,089	$ 218	$ 1,307	16,990
INDIANA	$ 967	2.4%	$ 365	$ 73	$ 438	5,693	$ 730	$ 146	$ 876	11,387
IOWA	$ 499	1.3%	$ 188	$ 38	$ 226	2,937	$ 376	$ 75	$ 452	5,873
KANSAS	$ 383	1.0%	$ 145	$ 29	$ 174	2,258	$ 289	$ 58	$ 347	4,516
KENTUCKY	$ 674	1.7%	$ 254	$ 51	$ 305	3,970	$ 509	$ 102	$ 611	7,940
LOUISIANA	$ 712	1.8%	$ 269	$ 54	$ 323	4,194	$ 538	$ 108	$ 645	8,387
MAINE	$ 187	0.5%	$ 71	$ 14	$ 85	1,103	$ 141	$ 28	$ 170	2,206
MARYLAND	$ 610	1.5%	$ 230	$ 46	$ 276	3,591	$ 460	$ 92	$ 552	7,181
MASSACHUSETTS	$ 616	1.6%	$ 233	$ 47	$ 279	3,629	$ 465	$ 93	$ 558	7,258
MICHIGAN	$ 1,068	2.7%	$ 403	$ 81	$ 484	6,291	$ 807	$ 161	$ 968	12,582
MINNESOTA	$ 661	1.7%	$ 250	$ 50	$ 300	3,896	$ 500	$ 100	$ 599	7,793
MISSISSIPPI	$ 491	1.2%	$ 185	$ 37	$ 222	2,890	$ 370	$ 74	$ 445	5,780
MISSOURI	$ 960	2.4%	$ 363	$ 73	$ 435	5,657	$ 725	$ 145	$ 870	11,313
MONTANA	$ 416	1.0%	$ 157	$ 31	$ 189	2,452	$ 314	$ 63	$ 377	4,903
NEBRASKA	$ 293	0.7%	$ 111	$ 22	$ 133	1,727	$ 221	$ 44	$ 266	3,454
NEVADA	$ 368	0.9%	$ 139	$ 28	$ 167	2,170	$ 278	$ 56	$ 334	4,339
NEW HAMPSHIRE	$ 168	0.4%	$ 63	$ 13	$ 76	987	$ 127	$ 25	$ 152	1,974
NEW JERSEY	$ 1,013	2.5%	$ 382	$ 76	$ 459	5,966	$ 765	$ 153	$ 918	11,932
NEW MEXICO	$ 372	0.9%	$ 141	$ 28	$ 169	2,194	$ 281	$ 56	$ 338	4,389
NEW YORK	$ 1,703	4.3%	$ 643	$ 129	$ 772	10,030	$ 1,286	$ 257	$ 1,543	20,059
NORTH CAROLINA	$ 1,058	2.7%	$ 399	$ 80	$ 479	6,232	$ 799	$ 160	$ 959	12,464
NORTH DAKOTA	$ 252	0.6%	$ 95	$ 19	$ 114	1,483	$ 190	$ 38	$ 228	2,967
OHIO	$ 1,360	3.4%	$ 513	$ 103	$ 616	8,009	$ 1,027	$ 205	$ 1,232	16,019
OKLAHOMA	$ 643	1.6%	$ 243	$ 49	$ 292	3,790	$ 486	$ 97	$ 583	7,579
OREGON	$ 507	1.3%	$ 191	$ 38	$ 230	2,987	$ 383	$ 77	$ 459	5,973
PENNSYLVANIA	$ 1,664	4.2%	$ 628	$ 126	$ 754	9,804	$ 1,257	$ 251	$ 1,508	19,608
RHODE ISLAND	$ 222	0.6%	$ 84	$ 17	$ 101	1,307	$ 168	$ 34	$ 201	2,614
SOUTH CAROLINA	$ 679	1.7%	$ 256	$ 51	$ 308	4,001	$ 513	$ 103	$ 616	8,002
SOUTH DAKOTA	$ 286	0.7%	$ 108	$ 22	$ 130	1,685	$ 216	$ 43	$ 259	3,370
TENNESSEE	$ 857	2.2%	$ 324	$ 65	$ 388	5,049	$ 647	$ 129	$ 777	10,098
TEXAS	$ 3,501	8.8%	$ 1,322	$ 264	$ 1,587	20,625	$ 2,644	$ 529	$ 3,173	41,250
UTAH	$ 352	0.9%	$ 133	$ 27	$ 160	2,075	$ 266	$ 53	$ 319	4,150
VERMONT	$ 206	0.5%	$ 78	$ 16	$ 93	1,213	$ 155	$ 31	$ 187	2,425
VIRGINIA	$ 1,032	2.6%	$ 390	$ 78	$ 468	6,080	$ 780	$ 156	$ 935	12,161
WASHINGTON	$ 688	1.7%	$ 260	$ 52	$ 312	4,051	$ 519	$ 104	$ 623	8,101
WEST VIRGINIA	$ 443	1.1%	$ 167	$ 33	$ 201	2,611	$ 335	$ 67	$ 402	5,223
WISCONSIN	$ 763	1.9%	$ 288	$ 58	$ 346	4,496	$ 576	$ 115	$ 692	8,992
WYOMING	$ 260	0.7%	$ 98	$ 20	$ 118	1,531	$ 196	$ 39	$ 235	3,061
TOTAL	**$ 39,724**	**100.0%**	**$ 15,000**	**$ 3,000**	**$ 18,000**	**234,000**	**$ 30,000**	**$ 6,000**	**$ 36,000**	**468,000**

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