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13. Abstract

For decades, motor fuel taxes have served as the primary source of revenue for surface transportation infrastructure at both the federal and state levels in the United States. However, the reliability of this funding mechanism is challenged by declining fuel consumption, driven by advancements in vehicle engine efficiency and the growing consumer shift toward alternative fuel and electric vehicles (EVs). In response to this challenge, transportation agencies are seeking alternative sustainable funding solutions. This study conducted a comprehensive review of publicly available literature from the past 15 years in the United States about the evolving landscape of fuel tax alternatives being explored or implemented to support transportation investments. It examines 24 distinct revenue mechanisms grouped into several categories: fuel taxes, vehicle fees, direct and indirect usage fees, externality taxes, and other funding sources. Findings show that states commonly combine multiple approaches to create more resilient and adaptable revenue systems. While each mechanism presents unique challenges, layered strategies reflecting diverse funding sources appear promising for maintaining long-term financial stability in transportation funding.

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Alternatives to Motor Fuel Taxes for State DOT Funding

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The contents of this report reflect the views of the author/principal investigator, who is responsible for the facts and the accuracy of the data presented herein.

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Abstract

For decades, motor fuel taxes have served as the primary source of revenue for surface transportation infrastructure at both the federal and state levels in the United States. However, the reliability of this funding mechanism is challenged by declining fuel consumption, driven by advancements in vehicle engine efficiency and the growing consumer shift toward alternative fuel and electric vehicles (EVs). In response to this challenge, transportation agencies are seeking alternative sustainable funding solutions. This study conducted a comprehensive review of publicly available literature from the past 15 years in the United States about the evolving landscape of fuel tax alternatives being explored or implemented to support transportation investments. It examines 24 distinct revenue mechanisms grouped into several categories: fuel taxes, vehicle fees, direct and indirect usage fees, externality taxes, and other funding sources. Findings show that states commonly combine multiple approaches to create more resilient and adaptable revenue systems. While each mechanism presents unique challenges, layered strategies reflecting diverse funding sources appear promising for maintaining long-term financial stability in transportation funding.

Acknowledgements

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Introduction

Funding for the capital, operation, and maintenance of surface transportation in the United States comes from a mix of federal, state, and local revenue sources. These sources include highway-user taxes and fees, such as motor fuel taxes, vehicle registration fees, and tolls; general revenues, such as sales taxes and property taxes; and miscellaneous sources, such as transportation-related fines and penalties. Historically, motor fuel taxes have been the primary source of revenue at the federal and state levels. However, motor fuel tax reliability has been challenged by declining fuel consumption driven by technological advancements in vehicle engine efficiencies, consumer preferences for alternative fuel vehicles, and changes in energy policies worldwide.

In the United States, progressively higher fuel economy standards under the Corporate Average Fuel Economy (CAFE) program have led to declining fuel consumed per mile driven, resulting in less fuel tax revenue available for transportation. The effects of CAFE standards are compounded by the growing market penetration of electric vehicles (EVs) and other zero-emission vehicles (ZEVs), which consume no motor fuel.

The decline in motor fuel tax revenue is intensifying the burden on already scarce funding resources needed for transportation investments across the United States. Anticipating that this trend will continue, states are exploring and implementing a variety of alternative revenue options to counteract declining motor fuel tax receipts and to diversify their revenue base for a sustainable future. This report reviews the state of practice among state transportation agencies to supplement or replace motor fuel taxes with alternative funding sources. This report describes the concepts behind each alternative mechanism and provides examples of where and how they have been implemented in various states. The funding mechanisms covered include:

1. Motor Fuel Taxes
2. Vehicle-Related Fees: Base Registration Fees
3. Vehicle-Related Fees: Alternative Fuel Vehicle Registration Fees
4. Vehicle-Related Fees: Value-Based Registration Fees
5. Vehicle-Related Fees: Fuel Economy-Based Registration Fees
6. Direct Usage Fees: Road Usage Charges
7. Direct Usage Fees: Tolling

8. Direct Usage Fees: Truck Weight-Distance Taxes
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Objective

This report provides current information regarding the spectrum and current implementation status of fuel tax alternatives to support transportation investments. These alternatives come in response to declining fuel tax revenues caused by the growing adoption of fuel-efficient and alternative fuel vehicles. The research conducted for this report aimed to: (1) examine various alternative funding mechanisms under exploration or recently implemented across the United States; (2) evaluate legislative and pilot initiatives in various states; and (3) identify emerging trends and patterns in transportation funding policy.

Scope

The scope of this project was to conduct a comprehensive review of the literature, including from industry and academia, on alternative funding mechanisms to bridge the funding gap necessary to support roadway investments in years to come. The literature review exclusively focused on the United States over the past 15 years, specifically addressing the topic of funding in surface transportation.

For this study, no new empirical data were collected, nor were revenue forecasting models of the various mechanisms conducted. The purpose is to synthesize information about the various funding mechanisms in a single document to inform comparative assessments.

Methodology

To systematically assess the literature on transportation funding alternatives to the motor fuel tax, a national scan of transportation funding literature was undertaken. The national scan examined academic research, industry reports, and policy documents, including legislation, related to transportation funding mechanisms in response to declining fuel tax revenue. The scan followed a three-step process for selecting and analyzing material as follows:

1. First, peer-reviewed academic literature was identified via searches on Google Scholar and JSTOR with terms such as "fuel tax decline," "transportation revenue," and "road usage charge." Preference was given to studies from the past 15 years and those cited frequently in relevant research.
2. Second, state-level reports were reviewed, with an emphasis on documents published by Departments of Transportation, special state-appointed task forces, or legislative bodies. Reports with detailed reviews of transportation funding and potential funding alternatives were prioritized. In total, 12 alternative revenue studies and policy reports from nine states (Indiana, Maine, Nevada, North Carolina, Ohio, Pennsylvania, Vermont, Washington, and Wyoming) were reviewed.
3. Third, enacted legislation was reviewed to identify transportation funding mechanisms that have been implemented. Legislation that focused primarily on funding mechanisms was prioritized, with a preference for more recent legislation. In total, legislation from eight states (California, Colorado, Georgia, Hawaii, Indiana, Michigan, Minnesota, and Missouri) was examined.

Findings from the national scan, which are presented in the next chapter, comprise 24 distinct revenue mechanisms organized into six categories. Where available, findings reference actual implementation data and fiscal outcomes, with attention to recurring recommendations across multiple states or studies.

The discussion of findings covers four topics. First is revenue alternatives exploration, with a focus on two mechanisms that consume the greatest attention from the literature: vehicle-related fees and road usage charges. Next is a discussion of factors influencing the feasibility and implementation of alternative funding mechanisms. Third, the discussion covers approaches used to address declining transportation revenues, such as the formation of task forces and conduct of pilot programs. Finally, the discussion offers a synthesis of alternative

revenue mechanism evaluations across seven states, following the four step process outlined below:

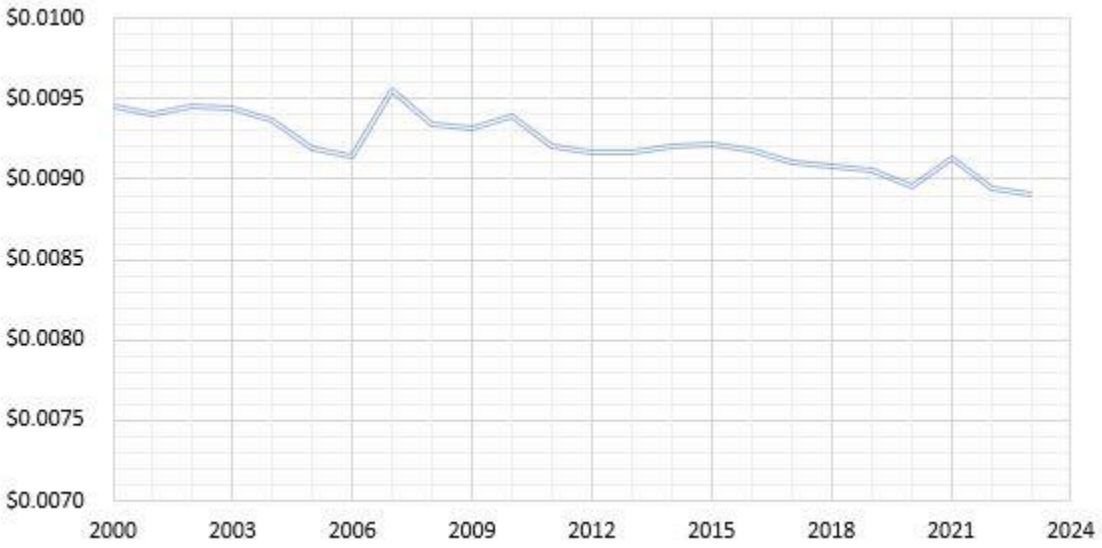
1. **Identification of evaluation criteria.** The evaluation criteria from each state were extracted and compared across reports. From this comparison, the seven most common, but not universally applied, criteria were identified and used for the combined evaluation matrix:
    a. **Revenue Stability:** The degree to which a funding source provides consistent, reliable revenue over time.
    b. **User Equity:** The extent to which those who use the transportation system contribute fairly to its costs.
    c. **Social Equity:** The extent to which the costs and benefits of a funding mechanism are distributed across groups by income.
    d. **Administrative Feasibility:** The practicality of implementing and managing the funding mechanism, including cost and complexity.
    e. **Revenue Generation Potential:** The expected ability of the mechanism to raise sufficient funds to meet transportation needs.
    f. **Public Acceptance:** The likelihood that the funding mechanism will be supported by the public.
    g. **Environmental Sustainability:** The extent to which the funding mechanism supports environmental goals and long-term environmental sustainability.
2. **Selection of revenue mechanisms.** The revenue mechanisms examined in each state report were compared, and the ten most common mechanisms were chosen for evaluation in the final matrix. Note that these ten mechanisms constitute a subset of the 24 covered in the findings from the national scan. Because states varied in how specifically they categorized mechanisms, the broadest groupings were used for consistency. Where states provided more detailed distinctions (e.g., multiple fuel-tax scenarios), the results were averaged into a single representative mechanism.
3. **Standardization of Scoring.** Data from each report were compiled into a common scoring system. Where states assigned scores directly, those scores were translated into a five-point scale: Poor, Poor/Fair, Fair, Fair/Good, and Good. For states that identified evaluation criteria but did not provide direct scores (Pennsylvania and Wyoming), findings or narratives were interpreted and translated into scores for consistency.

4. **Development of Summary Scoring.** A final Summary score for each mechanism was calculated as the straight average of all available state scores, using number equivalents (Poor =1 through Good =5) and rounding to the nearest whole number.

Findings from National Scan of Alternative Funding Mechanisms

Motor fuel taxes have historically been the primary source of revenue for surface transportation at the federal and state levels. However, the progressively higher fuel economy standards under the CAFE program and consumer preferences for alternative fuel vehicles have led to a steady decrease in fuel consumption per mile driven since 2007; see Figure 1. As a result, the financial stability of motor fuel taxes as a primary source of revenue has diminished over the past 20 years.

Figure 1. Federal gasoline tax revenues per mile driven in the United States



Source: CDM Smith using Table MF-2 and VM-1 from FHWA Highway Statistics Series

Table 1 shows the share of revenues by source used by states for highways in the United States. State motor fuel tax as a share of the total has declined from nearly 31% in 2000 to approximately 19% in 2023 [1]. Federal funds, primarily derived from motor fuel taxes, used by the states have also experienced a modest decline. According to the FHWA Highway Statistics series, motor fuel tax revenues deposited into the Highway Trust Fund have only increased at an average rate of 0.3% per year from 2000 to 2023 despite road usage measured in VMT increasing more than double that rate (i.e., over 0.7% per year). The revenue yield is further diminished when factoring in the erosion of purchasing power, as federal fuel tax rates have remained constant per gallon since 1993, failing to keep pace with inflation.

Consequently, states have been addressing the funding shortfall by allocating money from other revenue sources.

Table 1. Share of revenues used by states for highways in the United States

	2000	2005	2010	2015	2020	2023
Motor Fuel Taxes	31.1%	25.8%	19.6%	19.2%	19.5%	19.1%
Motor Vehicle Taxes	16.8%	15.1%	14.7%	16.2%	15.4%	16.4%
Tolls	5.1%	5.3%	5.1%	6.8%	7.1%	7.4%
Appropriations from General Funds	4.5%	2.8%	4.7%	3.9%	3.5%	5.3%
Other State Funding Sources	5.6%	6.0%	9.6%	13.1%	16.5%	18.9%
Bonds	9.9%	17.6%	18.6%	15.3%	12.9%	8.0%
Federal Funds	25.5%	25.7%	25.6%	23.0%	23.3%	23.2%
Local Governments	1.6%	1.8%	2.2%	2.5%	1.7%	1.6%

Source: CDM Smith using Table SF-1 from FHWA Highway Statistics Series

This section reviews the most common alternative approaches to fuel taxes for generating transportation funding. It begins with fuel taxes themselves, given that many states have explored and implemented adjustments to the motor fuel tax structure to enhance its viability even as the rate of increase of fuel consumption declines. The mechanisms span six categories:

- **Fuel taxes:** per-gallon charges on gasoline, diesel, and other motor fuels used on public roads, including base excise taxes, special surcharges, and supplemental fees on alternative fuels.
- **Vehicle-related fees:** base registration fees, alternative fuel vehicle registration fees, value-based registration fees, and fuel economy-based registration fees.
- **Direct usage fees:** road usage charging (RUC), tolling, and truck weight-distance taxes.
- **Indirect usage fees:** kilowatt-hour (kWh) taxes, retail delivery fees, for-hire transportation fees, auto sales taxes, vehicle inspection fees, rental car taxes, and tire taxes.
- **Externality taxes:** cap and trade and safety violation fees.

- **Other revenue mechanisms:** development impact fees, payroll taxes, bicycle sales and use taxes or registration fees, property taxes, personal income taxes, corporate taxes, and value capture.

Motor Fuel Taxes

Used by every U.S. state, the most common mechanism for generating transportation funding is a fuel tax. There are several specific approaches to taxing fuel. The most common is a flat per-gallon excise tax, where a fixed amount is charged for each gallon sold regardless of fuel price. Fuel taxes are legally imposed separately on gasoline (typically defined as "motor fuel" along with other products such as gasohol and ethanol) and diesel (typically defined as "special fuel" along with other products such as bio-diesel and kerosene). Definitions, collection and enforcement mechanisms, and exemptions vary between gasoline and diesel. Rates also sometimes vary between gasoline and diesel, depending on the state.

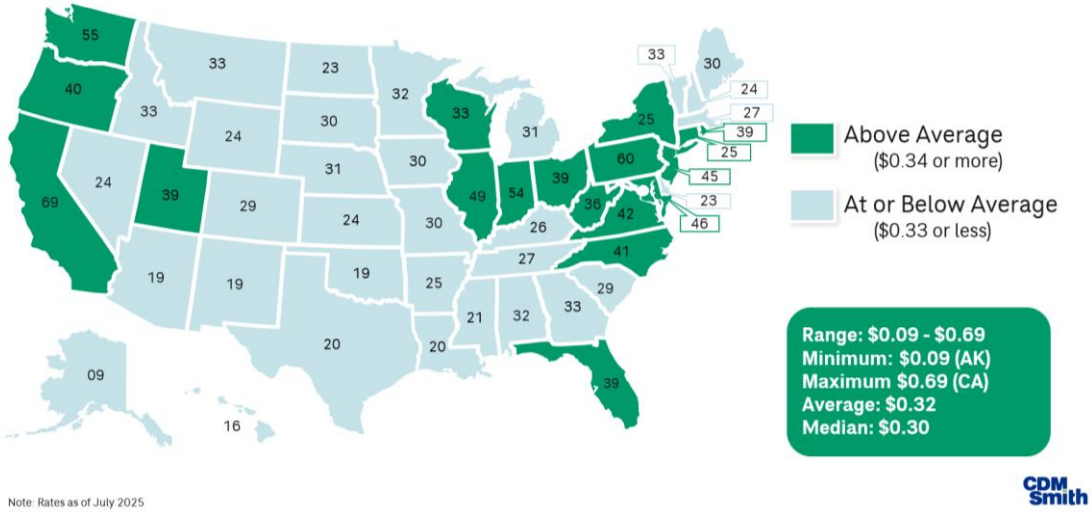
Three states (Michigan, Illinois, and Hawaii) also impose a sales tax, with the amount of the per-gallon sales tax based on a percentage of the average price of fuel over a period such as six or 12 months. Sales tax on motor fuel generates revenue that fluctuates with market prices of fuel. This hybrid approach introduces more dynamic pricing into fuel taxation. Illinois dedicates a portion of motor fuel sales tax revenue to transportation.

To support long-term funding needs, many states have also adopted indexing mechanisms that automatically adjust tax rates for the excise tax component based on the Consumer Price Index (CPI), fuel prices, or other indicators. Indexing allows the per-gallon rate to increase gradually with inflation and construction costs, reducing the need for frequent legislative updates to the base per-gallon rate.

While indexing fuel taxes to inflation can stabilize revenues in the short term, research suggests it may not be a sufficient long-term solution. Inflation-based indexing is supported as a transitional measure, but rising vehicle fuel efficiency will continue to erode fuel tax revenues over time [2].

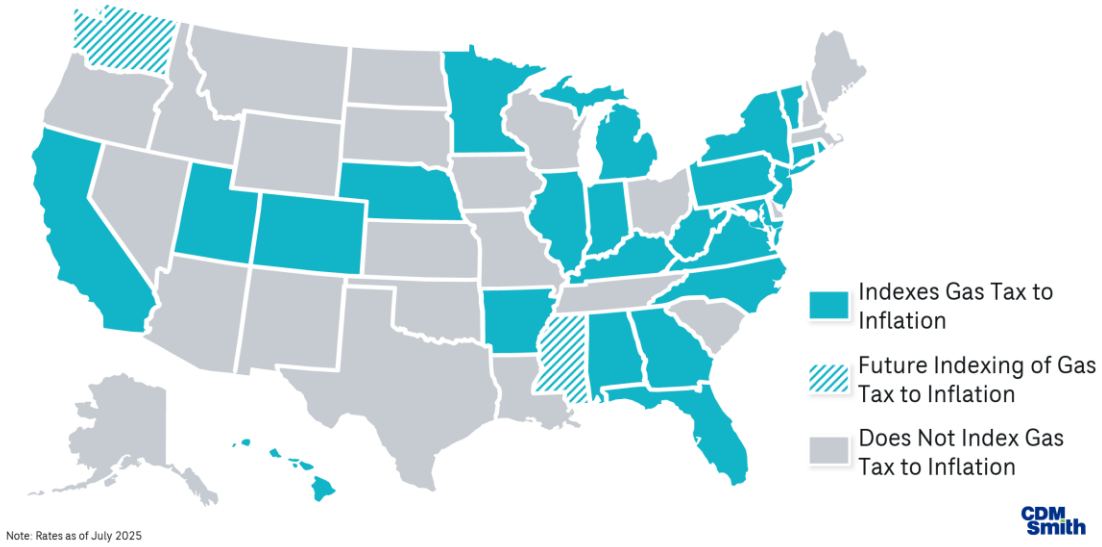
Figure 2**Error! Reference source not found.** summarizes the state gasoline tax rates in the United States in cents per gallon. The average rate is $0.32, and the median rate is $0.30. States above the national average are shown in green, and states below the national average are shown in blue. California has the highest rate at $0.69 per gallon, while Alaska has the lowest rate at $0.09 per gallon.

Figure 2. 2025 state gasoline tax rates (cents per gallon, rounded)



As of May 2025, 26 states have or will soon have a fuel tax that is indexed; see Figure 3**Error! Reference source not found.**. Among these states, many have chosen to index to inflation (CPI). These include California, Florida, Illinois, Indiana, Maryland, Michigan, New Jersey, Rhode Island, Utah, Vermont, and Virginia. Some states index gasoline tax rates to highway construction costs, including Arkansas, Colorado, Minnesota, Mississippi, and Nebraska. North Carolina indexes its gas tax to both the state's population growth and CPI. Georgia indexes to both fuel efficiency standards and CPI. Kentucky, Pennsylvania, and West Virginia base their rates on the average wholesale price of gasoline. Hawaii, New York, and Ohio adjust their rates through legislation. Washington and Mississippi have passed legislation to mandate the beginning of gasoline fuel tax indexing in the coming years. Washington will index to inflation, and Mississippi will index to the average national highway construction cost index.

Figure 3. 2025 fuel tax indexing by state



Vehicle-Related Fees: Base Registration Fees

Base vehicle registration fees are payments the vehicle owner must pay, usually on an annual or biennial basis, to legally operate their vehicle on public roads. Every state imposes a base vehicle registration fee, with most using the revenues to cover the administrative cost of vehicle licensing. Additionally, almost every state charges higher fees for heavier vehicles. The range of fee schedules varies widely, with some states charging progressively higher registration fees only for medium and heavy duty vehicles (i.e., those over 10,000 pounds), while others charge variable fees for light duty vehicles. Hawaii, for example, assesses a state vehicle weight tax per pound on top of the state's base registration fee, while Washington imposes a base registration fee that increases for vehicles over 4,000 pounds.

Many states have increased base registration fees to generate additional revenue to invest in transportation. While these fee increases do not cover the entire funding deficit, they can begin to close the gap and provide additional methods of revenue collection to encourage diversified sources. Academic literature tends to assess these fees as easier to administer than more direct charging alternatives like RUC or tolling. However, these fees may grow less equitable over time since they do not account for road usage. These fees are commonly viewed as temporary or partial solutions as longer-term mechanisms like RUC are being developed.

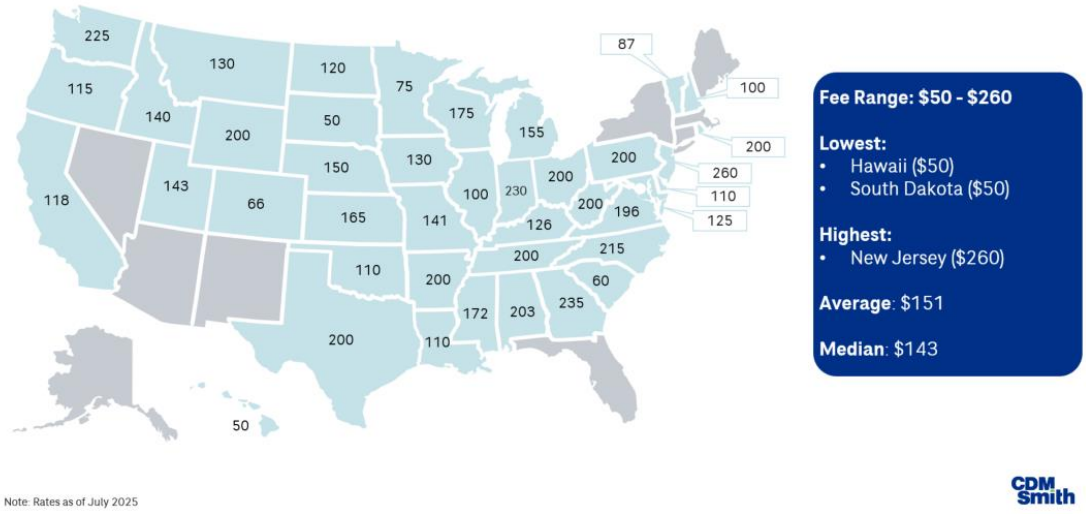
In addition to basic vehicle registration fees, which often incorporate a weight factor, states employ many factors for assessing variable or additional registration fees, including fuel type, value, fuel economy, and age. The following sections explore the first three of these variants.

Vehicle-Related Fees: Alternative Fuel Vehicle Registration Fees

Alternative fuel vehicle fees, such as EV fees, are flat annual charges common in states to ensure that EV owners contribute to the funding of road maintenance. These fees are often introduced because EVs, unlike traditional gasoline-powered vehicles, do not pay fuel taxes, which are a primary source of transportation funding. As a result, states have turned to these flat annual fees to fill the funding gap, ensuring that all vehicles, including EVs and hybrids, contribute for infrastructure upkeep.

As shown in Figure 4**Error! Reference source not found.**, 41 of the 50 states charge EV fees. The average EV fee is $151, and the median EV fee is $143. New Jersey currently has one of the highest EV registration fees in the U.S., set at $260 for 2025. This fee will increase by $10 every July 1 until it reaches $290 in 2028. Michigan also has a high fee of $255 for EV vehicles weighing 8,000 pounds or more. However, EVs weighing less than 8,000 pounds in Michigan are only charged $155. Hawaii and South Dakota have the lowest EV fee at $50. Some states also charge PHEVs and/or hybrid vehicles a registration surcharge at rates lower than those for EVs. As recent examples of enabling legislation, Colorado's SB 260 [3] and Indiana's HB 1002 [4] increased registration fees for EVs and hybrid vehicles.

Figure 4. 2025 annual light EV surcharges by state



Vehicle-Related Fees: Value-Based Registration Fees

Although more common at the local or regional level, value-based registration fees are assessed statewide in several states including California, Nevada, and Minnesota [5]. Value-based registration fees function equivalently to personal property taxes, but specifically on motor vehicles. A tax rate is applied to an estimated market value, which in turn is typically calculated by taking the manufacturer's suggested retail price of the vehicle when purchased new and depreciating it based on age.

Vehicle-Related Fees: Fuel Economy-Based Registration Fees

Two states, Oregon and Virginia, impose fees based on the fuel economy rating of a vehicle, measured in MPG, for vehicles with relatively high fuel economy ratings. These fees are used to approximate the fuel tax revenue that would have been collected if the vehicle consumed fuel at the rate of an average vehicle in the state.

Virginia imposes a Highway Use Fee (HUF) on vehicles with a combined fuel economy rating of 25 MPG or higher. The fee is calculated as 85% of the difference between what a 23.7 MPG vehicle would pay in fuel taxes and what the more efficient vehicle would pay, based on an average of 11,600 miles driven annually in the state at the current fuel tax rate [6]. Vehicles subject to the HUF may choose to pay a per-mile fee in lieu of the HUF. By contrast, Oregon's MPG-based registration fee is much coarser, with vehicles 40 MPG and

higher paying an “enhanced registration fee,” and vehicles between 20 and 40 MPG paying a slightly lower enhanced registration fee. Vehicles under 20 MPG pay only the base registration fee.

Direct Usage Fees: Road Usage Charges

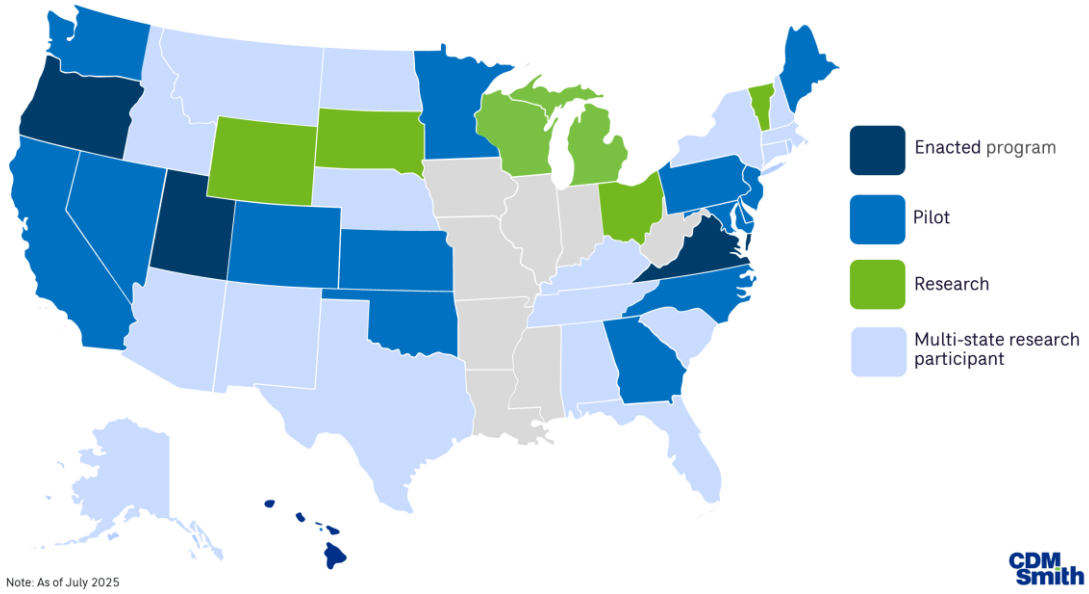
Road usage charges (RUC) are assessed based on the number of miles a vehicle travels. In all cases in which RUC has been studied or enacted to date, it serves as a replacement for the fuel taxes paid by subject vehicles. Distance traveled is calculated through a variety of methods, including odometer readings, odometer image capture, plug-in devices that wirelessly transmit odometer data to a billing system, or on-board telematics systems that likewise transmit miles driven data wirelessly. RUC has been widely studied in academic literature and has undergone extensive pilot testing in 16 states. Research highlights the long-term sustainability and fairness of RUC, particularly as EV adoption increases. However, administrative complexity and privacy concerns remain as potential obstacles to overcome in some states.

As shown in Figure 5, four states (Hawaii [7], Oregon [8], Utah, and Virginia) have enacted RUC programs. Hawaii's program, which began on July 1, 2025, is particularly notable as the first to require mandatory participation. Initially, the program is voluntary for EV owners, offering a choice between a per-mile charge and a flat annual fee. However, by July 1, 2028, the RUC will become mandatory for all EVs. Further, the Hawaii Department of Transportation is tasked with developing a plan to transition the entire vehicle fleet to a RUC system by 2033, making Hawaii the only state with a definitive timeline for a fully mandatory, fleet-wide RUC. The other three states with enacted programs (Oregon, Utah, and Virginia) currently operate their RUC programs as voluntary alternatives to EV registration fees and, in the case of Oregon and Virginia, MPG-based registration fees.

Beyond these four states, many other states are actively exploring RUC. Sixteen states have implemented various RUC pilot or demonstration programs to test feasibility, technology, and public acceptance: the 14 indicated in the map, plus Oregon and Hawaii. Six additional states have conducted RUC-focused research. A collaborative approach is evident through the participation of roughly 18 states in multi-state RUC research studies through either the RUC America consortium west of the Mississippi River and The Eastern Transportation Coalition (TETC) in the eastern part of the country. Several states, such as Minnesota [5], have passed legislation to promote the continued study of RUC. While most states have engaged in some

form of RUC exploration, eight states have yet to publicly initiate any RUC-related research or legislative interest.

Figure 5. 2025 Road Usage Charging by state



Direct Usage Fees: Tolling

Tolling has been offered as another partial solution to address transportation funding shortfalls. Academic research highlights that tolling could help offset the decline in fuel tax revenue [9] [10]. Toll revenues tend to be used to generate funding for specific facilities, such as a bridge, tunnel, expressway segment, or managed lane. However, some examples of tolling exist in which revenues are used for purposes beyond the tolled facility or network of facilities under common management by a toll authority. A recent example is New York City's Central Business District Congestion Charge. Revenues from this new charge will be dedicated to improving multiple modes of transportation, including public transit. New York is also the first example in the U.S. of using tolls to address congestion through cordon pricing.

Direct Usage Fees: Truck Weight-Distance Taxes

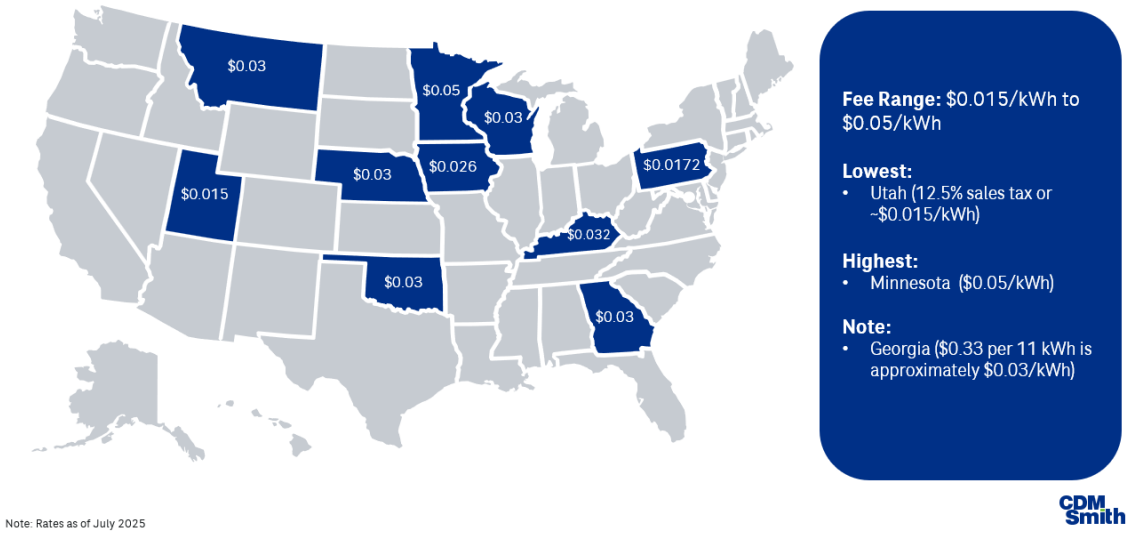
Truck weight-distance taxes apply to heavy commercial vehicles based on their gross weight and the number of miles driven within the state. Motor carriers are typically required to register, record miles driven, and file periodic reports. These taxes are currently used by five states to fund transportation infrastructure: Oregon, New York, New Mexico, Kentucky, and Connecticut. Kentucky levies a mileage tax for vehicles with a combined gross weight or licensed weight more than 59,999 pounds, excluding farm licensed vehicles. For each qualified vehicle operating on public highways within Kentucky, the weight-distance tax is computed at the rate of $0.0285 (2.85 cents) per mile. Tax returns and remittance covering the taxes owed are due quarterly [11]. The other four states have more complex fee schedules, with tiered per-mile rates that increase with vehicle axle-weight.

Indirect Usage Fees: Kilowatt-Hour Taxes

Like fuel taxes, kilowatt-hour (kWh) taxes are indirect usage fees applied to the electricity consumed by EVs during charging. Unlike flat annual EV fees, which do not account for how much a vehicle is driven, kWh taxes attempt to link revenue generation to actual electricity consumption, and therefore indirectly to road usage. These taxes can be implemented at public charging stations and collected per unit of electricity delivered. In some models, the tax is embedded in the price paid by the driver at the charging station. However, kWh taxes present an implementation challenge. Tracking electricity used for vehicle charging at home is not currently feasible. Since most EV charging happens at home, kWh taxes miss 85-90% of electricity consumption.

As Figure 6 illustrates, ten states currently impose taxes on electricity dispensed at public EV charging stations. These kWh taxes vary significantly. Minnesota has the highest rate at 5 cents per kWh. Georgia's rate is approximately 3 cents per kWh (33 cents per 11 kWh), and it is adjusted annually for inflation. As a contrasting approach, Utah applies a 12.5% tax rate on the retail sale of electricity at these stations.

Figure 6. 2025 Kilowatt Hour (kWh) Taxes by state

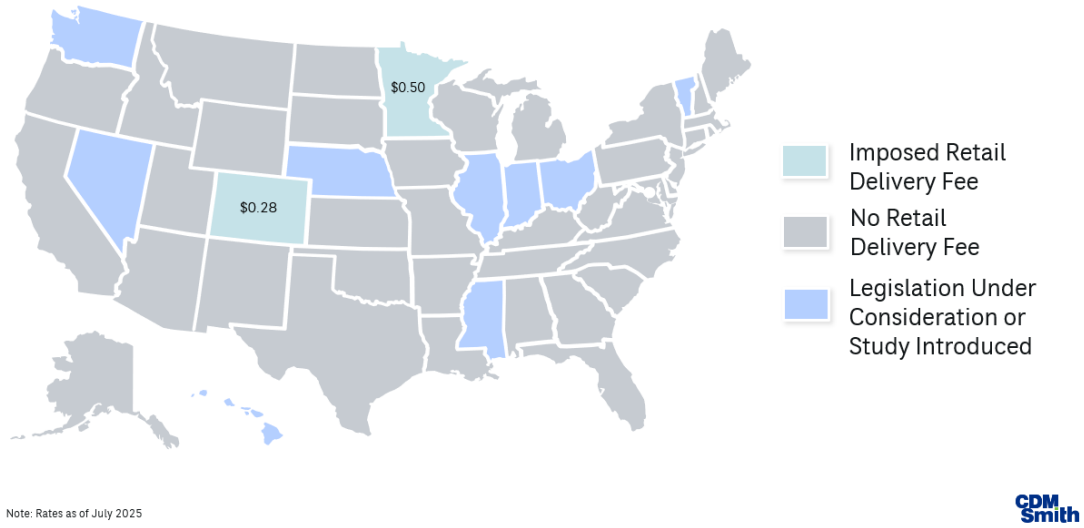


Indirect Usage Fees: Retail Delivery Fees

Retail delivery is a relatively new funding mechanism in which a charge is added to certain retail purchases that are delivered to a customer's home or business. The retailer adds the fee at checkout, and the customer pays the fee as part of the total purchase cost. Retailers then remit the fees collected to the state to help fund transportation infrastructure. The fee, currently present in two states, is a flat charge per delivery aimed at offsetting costs imposed by delivery vehicles for their road usage.

These fees are promoted in state reports for their potential to link revenue to system usage [5] [12] [3]. Colorado and Minnesota have enacted such fees; see Figure 7. Colorado imposes a $0.28 delivery fee, and Minnesota charges a $0.50 delivery fee for purchases greater than $100. Colorado's fee yielded $79.5 million in the first year, and Minnesota projected a revenue of $59 million in its first year [12]. However, administrative burdens can be a concern, particularly for smaller retailers and delivery platforms that must track fee applicability, which has led to calls for small business exemptions and choices of how fees are administered by businesses.

Figure 7. 2025 Retail Delivery Fees by state

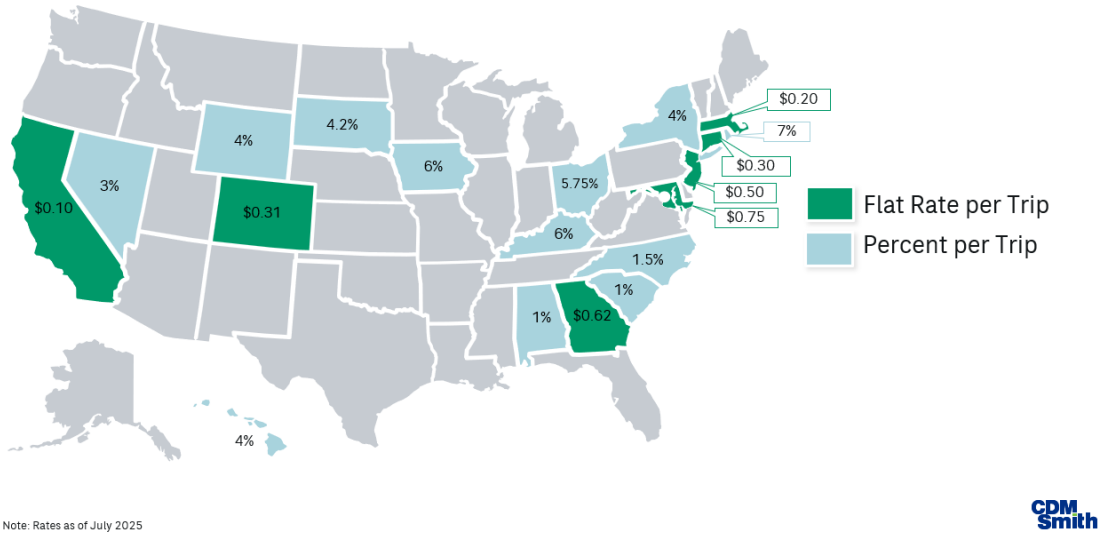


Indirect Usage Fees: For-Hire Transportation Fees

For-hire transportation fees, also known as transportation network company (TNC) fees, are an emerging revenue mechanism at the state level. These fees are typically structured as flat per-ride charges or as a percentage of the cost of a trip. There may also be varied costs based on trip type (e.g., airport rides or solo vs. pooled rides). State reports highlight the potential for TNC fees to generate meaningful revenue from a growing travel mode, particularly in urban areas with high ride-hailing volumes. Administrative costs for collecting TNC fees can be relatively low, especially when coordinated through state tax agencies already collecting sales taxes from TNC platform operators.

As depicted in Figure 8, seven states have implemented flat-rate per-trip fees for rideshares or deliveries. Among these, Georgia imposes the highest fee at $0.62 per trip ($0.31 for shared trips), and this is adjusted annually for inflation. California has the lowest fee at $0.10. Additionally, eight other states assess fees as a percentage of the gross trip fare. Rhode Island leads the nation with the highest percentage at 7%, while Alabama and South Carolina have the lowest at 1%.

Figure 8. 2025 For-Hire Transportation Fees by state

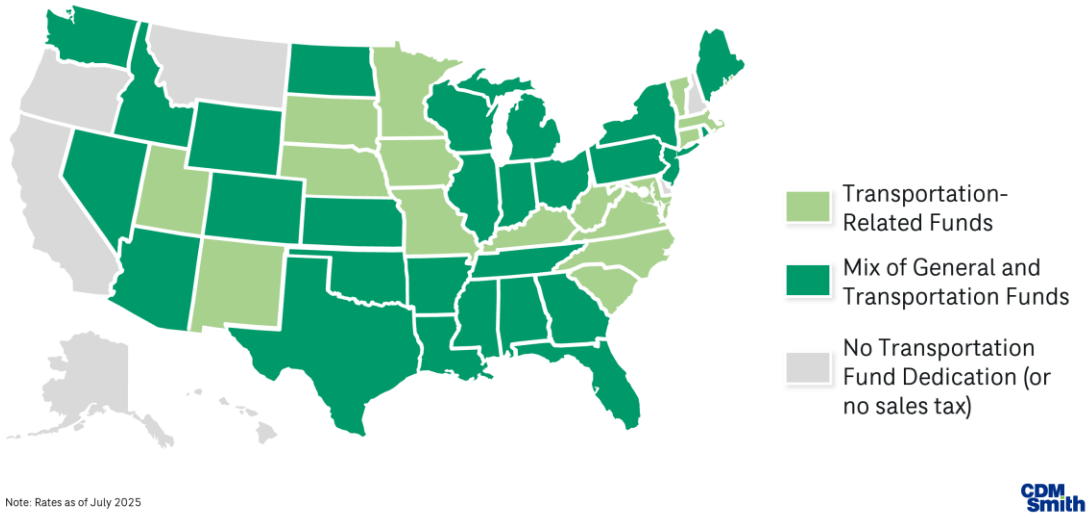


Indirect Usage Fees: Auto Sales Taxes

Auto sales taxes are a significant source of transportation funding in many states, typically applied as a percentage of a vehicle's purchase price at the point of sale. Most states levy this tax on both new and used vehicle purchases, with rates ranging from 3% to over 7%. Many states dedicate a portion or all revenue from vehicle sales taxes to transportation infrastructure, based on the indirect connection between vehicle ownership and usage. Because vehicle purchases are high-cost transactions, even a relatively small sales tax rate can generate meaningful revenue. However, this funding source is sensitive to economic cycles, as car sales tend to drop during recessions, creating potential volatility in revenue streams.

States take diverse approaches when it comes to allocating auto sales tax revenues; see Figure 9. Sixteen states funnel all proceeds from auto sales taxes directly into transportation-related funds, ensuring a dedicated source for infrastructure. Twenty-seven states opt to split the revenue between transportation purposes and their general fund, allowing for broader budgetary flexibility while partially supporting transportation. Two states direct all auto sales tax receipts to their general fund, with no allocations from the general fund for transportation. Five states entirely forgo a sales tax on vehicles. This wide mix highlights the lack of a standardized approach to utilizing this significant revenue stream for transportation funding across the nation.

Figure 9. 2025 Dedication of Auto Sales Tax by state



Indirect Usage Fees: Vehicle Inspection Fees

Many states collect vehicle inspection fees as a partial source of funding for their transportation trust funds. The two primary types of inspection fees are associated with vehicle safety inspections and emissions testing. Safety inspection programs are designed to ensure that vehicles registered in the state meet minimum standards for safe operation on public roads. Emissions inspections aim to reduce air pollution by verifying that vehicles comply with environmental standards.

North Carolina requires all motor vehicles to pass an annual safety inspection, and 19 North Carolina counties require emissions inspections [13]. Safety inspection fees are charged at a rate of $13.60, while emissions fees cost an additional $16.40. These fees are used primarily to fund the North Carolina Highway Fund [14]. However, the revenues are modest and generally designed to cover the cost of administering inspection programs themselves.

Indirect Usage Fees: Rental Car Taxes

All 50 states and the District of Columbia have implemented rental car taxes as a funding mechanism, with many using the proceeds for transportation purposes. These taxes are typically levied on short-term vehicle rentals, but some states also impose a tax on peer-to-peer car rentals through car sharing networks. States charge customers for vehicle rentals

using a mix of mechanisms, including general sales or use taxes, rental-specific taxes or excise taxes, and daily surcharges [15]. Virginia levies a 4% rental tax on the rental of vehicles with a gross vehicle weight or gross combined weight rating of 26,000 pounds or less [16].

Indirect Usage Fees: Tire Taxes

Many U.S. states impose a tire-specific tax at the point of sale, typically to support recycling and proper disposal efforts. These fees generally range from $0.25 to $5 per tire. The structure of the tax varies by state. Some apply a flat fee, while others base the amount on the tire's weight or size. At the federal level, a tire tax is only levied on those used by heavy trucks, with the revenue directed to the Highway Trust Fund. The amount of revenue that can be generated is directly related to the replacement cycle for vehicle tires, with most tires designed to last at least 60,000 miles, meaning the average driver would only need to replace tires about once every five years. Tire tax revenues generally support recycling program costs. However, some states, such as Washington in 2025, have increased tax rates to fund their highway programs.

Externality Taxes: Cap and Trade

Cap-and-trade programs are designed to reduce greenhouse gas emissions by placing a cap on total emissions and requiring companies to purchase allowances for each ton of carbon dioxide (CO_2) they emit. Proceeds from the allowances are then used to fund projects that reduce CO_2 emissions. Two states, California and Washington, administer such programs, and the Regional Greenhouse Gas Initiative (RGGI) administers a program for a group of cooperating northeastern and Mid-Atlantic states. Washington's program generates funding that is allocated to transportation purposes.

RGGI sets a regional cap on CO_2 emissions from the electric power sector across participating states. Large electric power plants in the RGGI states are required to hold one tradable emissions allowance for each ton of CO_2 they emit. Each participating state originates allowances in proportion to its share of the regional cap. The RGGI states distribute these allowances at quarterly auctions, where they can be purchased by power plants and other entities. Plants monitor and report their emissions. If they emit less than expected, they can sell excess allowances to other plants; if they emit more, they must buy additional allowances to remain in compliance [17].

Another approach to reducing carbon emissions is direct carbon taxation, which works in an inverse manner to cap-and-trade. A carbon tax sets a price per ton of carbon emissions and allows the market to determine how much emissions it can bear. By contrast, cap-and-trade sets a firm limit on total emissions and lets the market determine the price of emissions allowances through trading. While carbon taxes aim to incentivize reductions by making emissions more expensive, cap-and-trade predetermines the acceptable level of emissions and creates a market where companies can buy and sell the right to emit within that cap [18]. Both approaches generate revenue that can be used to fund transportation projects. Few states have studied carbon taxes, and none have implemented one.

Externality Taxes: Safety Violation Fees

Safety violation fees are fines for traffic infractions such as speeding or driving under the influence (DUI). Increased fines serve two purposes: funding safety upgrades and encouraging better driver behavior. This is usually handled at the state level, although local governments often add their own extra fees.

Florida has increased fines for certain traffic violations, including aggressive driving and DUI offenses, with portions of the revenue directed to the Highway Safety Operating Trust Fund [19]. Georgia imposes a Super Speeder fee, an additional $200 fine on top of standard speeding tickets for drivers exceeding 75 mph on two-lane roads or 85 mph on any road [20].

Other Revenue Mechanisms: Development Impact Fees

Development impact fees are one-time charges on new developments to fund infrastructure improvements necessitated by growth, such as roads, sidewalks, and transit facilities. Although no states use developer impact fees, many local governments impose them based on projected infrastructure needs tied to new development. Typically assessed at the time of building permit issuance, the fees are used for off-site improvements and are implemented primarily by cities and counties [21].

These fees are widely used in southern states like Florida, Texas, and North Carolina. Florida has a well-established legal framework for development impact fees under the Florida Impact Fee Act [22], and development fees help fund a variety of transportation projects [23].

Fort Worth, Texas, uses transportation impact fees to help fund roadway infrastructure improvements necessitated by new development. The city is divided into multiple Service

Areas, each approximately six square miles in size. Fees collected in each Service Area must be spent on eligible improvements within that same area [24].

In North Carolina, cities such as Wake Forest use Transportation Impact Fees to address growth-driven infrastructure needs. Enabled by the 1989 Enabling Act passed by the North Carolina State Legislature, the town may levy fees in up to ten service areas. Wake Forest applies a detailed fee schedule based on land use type, such as residential, retail, medical, and industrial, and unit type, including per dwelling unit, per 1,000 square feet, per student, or per fuel position [25].

Other Revenue Mechanisms: Payroll Taxes

Payroll taxes are taxes based on salaries paid by employers, taxing income based on a worker's place of employment rather than place of residence [26]. Oregon and Kentucky allow for payroll taxes to be levied to fund transportation. In Oregon, payroll taxes exist at the local and statewide levels to fund public transportation. In Kentucky, payroll taxes are imposed at the local level [27] by the Transport Authority of River City in Louisville, which receives 60% of its funding through a local payroll tax [28].

Other Revenue Mechanisms: Bicycle Sales and Use Taxes or Registration Fees

A bicycle sales and use tax refers to a state or local sales tax applied to the retail purchase of bicycles, and in some cases, related accessories or parts. Oregon charges a $15 excise tax on bicycles with a retail price of $200 or more at the point of sale [29]. Some municipalities also levy bicycle taxes, such as Colorado Springs, Colorado, which levies a $4 excise tax on adult bicycles to fund bike infrastructure improvements [30].

Bicycles may also be subject to use taxes, which are imposed when a bicycle is purchased out of state and brought into the taxing jurisdiction for use, especially if sales tax was not collected at the point of sale. Georgia charges taxes on bicycles as use taxes on personal property. If a bicycle is purchased online without sales tax and brought into Georgia, the buyer may owe use tax on it. This use tax is not just for bicycles and applies to a variety of personal items [31].

Bicycle registration fees are charged on bicycles when they are registered. Hawaii charges a one-time $15 registration fee for bicycles with wheels 20 in. or more in diameter [32]. Some

municipalities also have bicycle registration, but enforcement varies from municipality to municipality. For example, New Orleans requires bicycles to be registered for $5 [33].

Other Revenue Mechanisms: Property Taxes

Property taxes are levies imposed on real estate, primarily by local governments, based on the assessed value of land and buildings. Localities across the U.S. often use property taxes to support local transportation infrastructure. Dedicated property taxes are usually used for road and capital maintenance needs, but some jurisdictions also use dedicated property taxes for transit [34]. In 2022, voters in Ann Arbor, Ypsilanti, and Ypsilanti Township, Michigan, approved a 2.38 mill property tax to fund the Ann Arbor Area Transportation Authority (AAATA), known as TheRide. This millage, effective in 2024, aims to expand and improve transit services, including increased frequency, longer service hours, and new express routes [35].

Other Revenue Mechanisms: Personal Income Taxes

Personal income taxes are imposed on the incomes of individuals or families. They are primarily levied at the statewide level [36]. States such as Michigan use income tax revenue to help fund their transportation projects. In FY 2024-2025, $600 million in personal income tax funding was earmarked to the Michigan Transportation Fund [37].

Other Revenue Mechanisms: Corporate Taxes

Some states allocate a portion of their corporate income tax revenues for transportation purposes. 44 states and the District of Columbia currently levy corporate taxes [38]. In 2024, New Jersey implemented a 2.5% surcharge on corporations with profits over $10 million, in addition to the existing 9% corporate tax rate, to fund New Jersey Transit [39].

Other Revenue Mechanisms: Value Capture

Value capture techniques, such as monetizing air rights and rights-of-way associated with transportation infrastructure, can help pay for infrastructure. By capturing a portion of the economic benefit through mechanisms like special assessments or tax increment financing

(TIF), governments can reinvest in transportation projects without raising other taxes and fees. This tool is used primarily at the local and regional levels and often tied to transit expansions or roadway improvements.

Chicago used a TIF to help fund the Red-Purple Line Modernization Project for the Chicago Transit Authority. A special transit TIF district was created along the transit corridor to capture rising property values and reinvest them into the rail system [40].

Discussion of Findings

Revenue Alternatives Exploration

Both academic literature and state reports consistently identify the decline in fuel tax revenue as a trend expected to continue and a concern for maintaining transportation infrastructure funding. According to the 2025 Annual Energy Outlook (AEO) from the U.S. Energy Information Administration (EIA), the fleetwide average fuel efficiency from new light-duty vehicles in the U.S. will average 41.63 miles per gallon (MPG) by 2030, increasing to 50.91 MPG by 2040 [41]. The fleetwide average fuel efficiency for all on-road light-duty vehicles in the U.S., currently at 23.0 MPG, is projected to improve to 36.3 MPG by 2040.

One state grappling with the challenge of fuel taxation is Nevada, which published a study of transportation funding in 2022. The study concluded that the state's reliance on fuel taxes is no longer sufficient to meet growing transportation funding needs, predicting a cumulative funding gap of at least $6 billion through 2032 [42]. In Ohio, likewise, a revenue alternatives study projected a significant shortfall in motor fuel tax revenue, estimating expected annual revenues in 2040, $877 million below what they would be without any changes in vehicle fuel efficiency [43]. The decline is primarily attributed to increasing fuel efficiency and the adoption of EVs.

Several states have taken steps to address the issue through the implementation of new revenue-generating mechanisms, such as increasing or indexing the fuel tax, increasing vehicle registration fees, expanding the use of tolling, introducing road usage charges (RUC), imposing retail delivery fees, and more. Each method of generating revenue comes with its own administrative, political, and technical challenges to overcome. The literature predominantly covers two alternatives to the gas tax: enhanced registration fees on alternative fuel vehicles and road usage charges.

Alternative Fuel Vehicle Registration Fees

As alternative fuel vehicle adoption grows, states are exploring ways to ensure their owners contribute to road funding since they pay little or no fuel taxes. Many states have introduced annual registration fees specifically for alternative fuel vehicles to recoup some of the lost fuel tax contributions. These fees are generally designed to approximate the amount that a comparable internal combustion engine vehicle would pay in fuel taxes over a year, with EVs

typically having higher fees than plug-in hybrid electric vehicles (PHEVs) and hybrid vehicles. For example, Georgia's HB 170 introduced annual EV fees of $200, indexed to inflation, reflecting political interest in maintaining revenue from EV owners [44].

While such measures have generated modest additional revenue and partially mitigated the shortfall, multiple studies and state-level fiscal analyses indicate that these fees fall short of fully offsetting fuel tax revenue declines [45] [46] [47].

Road Usage Charges

Road usage charges (RUC), also referred to as mileage-based user fees (MBUF), is a concept of charging vehicles based on the number of miles traveled, rather than on the amount of fuel consumed. The charges are designed to fund transportation infrastructure maintenance and improvements as a substitute for fuel taxes.

Academic literature covers RUC extensively as a gas tax alternative. Bayen et al. highlight technology features of RUC and note the possibility of integrating RUC with existing road pricing systems, such as high-occupancy toll lanes and truck tolling [10]. Steadman et al. emphasize that pilot programs demonstrate that RUC can effectively replace the fuel tax, but it requires addressing challenges such as privacy concerns and interstate coordination [48]. Agrawal and Nixon suggest public support for mileage fees grows when the fee is tied to specific uses (e.g., maintenance or safety) [9]. The success of RUC relies on educating the public and ensuring transparency in revenue allocation.

Several states have implemented RUC programs by enacting legislation. Oregon was the first state to create a RUC program with the passage of Senate Bill (SB) 810 in 2013, which created a voluntary RUC program later named OReGO. Since then, House Bill (HB) 2017, which passed in 2017, reaffirmed the state's commitment to RUC by requiring ongoing program development and expanding enrollment in the OReGO [8]. Similarly, Utah's SB 72, passed in 2019, authorized the state to implement a RUC program for alternative fuel vehicles [49]. Utah's SB 150, which passed in 2020, expanded this initiative by formalizing the program's administration and establishing per-mile charges as an alternative to annual registration fees for electric and hybrid vehicles [50]. In 2020, Virginia's General Assembly established an annual Highway Use Fee (HUF) for fuel-efficient and electric vehicles, with an optional Mileage Choice program that lets eligible vehicle owners pay per mile instead [51]. Passed in 2023, the Hawaii Road Usage Charge (HiRUC) program began on July 1, 2025, allowing EV owners to choose between a per-mile fee of $8 per 1,000 miles (capped at $50) or a flat $50 annual charge at registration renewal [52].

Factors Influencing the Feasibility and Implementation of Alternative Funding Mechanisms

Public Perception and Political Feasibility

Public acceptance and political feasibility remain challenges in transitioning to new transportation revenue mechanisms. Research by Agrawal and Nixon finds that public understanding and trust significantly affect support for RUC, and that acceptance grows when people see clear links between fees paid and transportation benefits received [9]. Similarly, Nelson and Rowangould emphasize that fairness and transparency in how revenue is used are key to improving public support [53]. Multiple state reports confirm this as well. Indiana's 2015 study on transportation funding found that the public misunderstood how much they pay, often overestimating their contributions. Opinions on sales taxes and RUC were evenly split, with people divided on whether each was acceptable [45]. Ohio's *Revenue Alternative Study* from 2023 included public opinion research, which found that the public lacks knowledge on transportation funding and that fairness is a primary concern for funding mechanisms [43]. RUC programs in California [54] and Oregon [55] both contain extensive public outreach components.

Administrative and Technical Complexity

Fuel taxes feature relatively small numbers of taxpayers, since the tax is collected from wholesalers at the "terminal rack," rather than from retailers or consumers. As a result, the fuel tax is one of the most efficient taxes state governments collect, at 2.3% of revenue among states reporting the cost of collection for FHWA's Highway Statistics Table MF-3 [56].

The transition from fuel taxes to alternative revenue mechanisms may result in increases in administrative and technical complexity. Vehicle-related fees, for example, face higher administrative costs due to the need to conduct transactions with each vehicle owner–that is, millions of taxpayers rather than hundreds under the fuel tax model. Likewise, direct charges like tolling and RUC generally require more investments in administrative and technical resources compared to other alternatives. Hamre et al. [57] and Bayen et al. [10] describe the requirements for data collection, privacy protection, system security, and cost-effective billing under RUC. Oregon's final report on the OReGO RUC program outlines several mileage-reporting options (e.g., flat fee, smartphone tracking with or without location, non-GPS mileage devices, and GPS-enabled devices) and highlights the trade-offs among them in

terms of cost, accuracy, and user trust [55]. Colorado's SB 260, which passed in 2021, takes a hybrid approach, implementing new EV registration fees while directing the Colorado Department of Transportation (CDOT) to study the feasibility of broader RUC programs [3]. Research, pilot programs, and phased implementation are addressing challenges by identifying scalable models.

Federal Leadership and Interstate Coordination

The International Fuel Tax Agreement (IFTA) and International Registration Plan (IRP) are state-led organizations involving the 48 continental states, District of Columbia, and Canadian provinces, which collect and allocate motor fuel taxes and registration fees, respectively, from heavy-duty vehicles that cross state lines. In 2012, with the enactment of MAP-21, Congress required national tolling interoperability within four years, but that has still yet to materialize. Otherwise, federal involvement and multi-state coordination for transportation funding is largely non-existent; each state administers its own tax collection and vehicle registration programs independently.

By contrast, academic and state literature point to the possibility of a more active federal role for RUC. Greene [58] and Dumortier et al. [2] argue that the federal government should take an active role in creating consistent rules for mileage measurement, revenue sharing, and data privacy. Washington’s 2020 RUC study recommends federal coordination, citing administrative inefficiencies and legal ambiguity for individual states to address out-of-state travel [59]. Pennsylvania’s Transportation Revenue Options Commission report discusses the implementation of RUC and notes that national implementation is expected, suggesting anticipation of federal coordination [46]. Oregon’s final RUC report underscores the importance of interoperability among states to ensure efficient administration and user trust across jurisdictions [55]. Vermont’s 2025 Funding Study also highlights challenges that states face in isolation, emphasizing that multi-state cooperation and a unified approach can overcome legal and technical barriers [60]. While the Infrastructure Investment and Jobs Act (IIJA) provided funding for national RUC pilot programs, no overarching federal legislation has yet established a cohesive framework. IIJA also created the Strategic Innovation for Revenue Collection (SIRC) grant program, which allows states to seek funding to support the exploration, testing, and implementation of user-based funding alternatives to fuel taxes, with an emphasis on interstate collaboration.

Pilot Programs and Incremental Transitions

Pilot programs have played a critical role in allowing states to test RUC models before full implementation, and most state-level reports recommend phased or incremental adoption. Washington's multi-year pilot tested user choices between GPS and non-GPS systems and revealed insights into public preferences, cost efficiency, and privacy concerns [59]. Oregon's OReGO program, the longest-running RUC program in the U.S., followed two pilot tests of per-mile fees [55]. Hawaii's SB 1534 created a RUC program following extensive state pilot testing [7]. Colorado passed legislation directing CDOT to study per-mile fees for EVs first [3]. Pilots help build gradual political support and administrative capacity. Phased introductions, such as first applying fees only to EVs or offering voluntary enrollment, are a common strategy for launching RUC programs. This approach helps manage the inherent risks while fostering innovation.

Other Findings

The Indexed Roadway User Toll on Energy (IRoUTE) is a proposed user fee system designed to finance U.S. surface transportation [58]. It involves charging a fee on all forms of commercial energy used for transportation, indexed to the average energy efficiency of vehicles on the road. This system aims to encourage energy efficiency in vehicle design, purchase, and operation, resulting in significant reductions in greenhouse gas emissions and petroleum use. Limitations include the inability to address issues like traffic congestion or the cost responsibility of heavy vehicles.

Approaches Used to Assess Declining Transportation Revenues

A range of strategies has been deployed across states and in academic research to identify potential solutions to the problem of declining transportation revenues. The following discussion outlines each of these common strategies, with examples from states and researchers who have applied them. Strategies include the following:

- Stakeholder engagement, public engagement, and opinion research
- Technical assessments of revenue mechanisms
- Transportation funding task forces
- Definition of guiding principles and evaluation criteria
- Review of existing mechanisms, revenues, and needs

- Historical data analysis
- Baseline revenues and needs assessment
- Case studies
- Pilot testing

Stakeholder Engagement, Public Engagement, and Opinion Research

The most frequently used strategy for determining and pursuing alternative revenue mechanisms is stakeholder and public engagement, including public opinion research. Many reports and academic papers incorporated interviews, focus groups, surveys, or public meetings to gather input from residents and other transportation stakeholders regarding transportation funding. State-level studies consistently highlight the critical role of public outreach in the success of new transportation funding initiatives. For example, Washington's 2024 *Retail Delivery Fee Analysis* [12], Indiana's 2015 *Study of Indiana Transportation Funding Mechanisms* [45], Maine's 2019 *Blue Ribbon Commission* [61], and Pennsylvania's 2021 *Final Report and Strategic Funding Proposal* [46] all emphasized the necessity of engaging the public throughout the process. These efforts included public meetings, stakeholder advisory groups, and large-scale surveys. For example, Pennsylvania's survey gathered feedback from over 6,000 participants.

Among the many stakeholders consulted, local governments are frequently cited. For example, local government consultation and analysis appeared in funding mechanism studies from Washington in 2010 [62] and Indiana in 2015 [45]. This strategy ensures that any proposed state-level solutions are compatible with local funding structures and address regional concerns.

Academic research, such as Bayen et al. [10], Hamre et al. [57], and Nelson and Rowangould [53], has shown that support for new transportation funding approaches often hinges on public understanding of how funds will be used, highlighting the importance of clear communication alongside engagement. Surveys embedded in these engagements help gauge baseline understanding, quantify support levels for alternative funding approaches, identify common concerns, and explore reactions to funding alternatives.

Agrawal and Nixon's work conducted nationwide surveys that revealed persistent public resistance to increasing gas taxes but also growing openness to RUC, especially when revenues are specifically dedicated to transportation purposes [9]. These findings are important for shaping broader policy narratives, helping states position new funding

mechanisms in ways that align with public sentiment. National survey data also provides a benchmark for state-level studies, allowing policymakers to compare local attitudes to national trends.

Technical Assessments of Revenue Mechanisms

Nearly as common as stakeholder and public engagement, technical assessment of revenue mechanisms appeared in almost every comprehensive study of funding alternatives conducted by states. States such as Indiana [45], Maine [61], Nevada [42], North Carolina [47], Ohio [43], Pennsylvania [46], Vermont [60], and Wyoming [63] conducted thorough assessments of potential funding options, often comparing alternatives based on revenue yield, administration costs, technical feasibility, and alignment with policy goals. Ohio's 2023 report, for example, prioritized the top ten mechanisms using both quantitative revenue forecasts and qualitative assessment criteria [43]. These assessments help identify the most effective and appropriate revenue tools for a given state and narrow the range of viable solutions for policymakers to consider.

Scenario planning was used to test the performance of funding options under varying future conditions. North Carolina's *Final Commission Report* from 2021 modeled investment scenarios ranging from "maintain current conditions" to "excellent infrastructure" [47]. Academic work by Dumortier et al. [2] and Steadman et al. [48] similarly explored scenarios such as varying oil prices, vehicle miles traveled (VMT) trends, and policy interventions such as carbon taxes or congestion pricing. This strategy helps policymakers understand how mechanisms might perform under various economic trends or technological trajectories. However, scenario planning appears less often in the literature than other approaches such as stakeholder and public engagement or technical assessment of revenue mechanisms.

Transportation Funding Task Forces

Another commonly used strategy is the formal establishment of a task force (also known by various names such as working groups, advisory committees, and steering committees, sometimes with the distinction of being "blue ribbon") to lead the problem definition, analysis of alternatives, and development of recommendations. Oregon (2001), Vermont (2016), Maine (2019), North Carolina (2019), Pennsylvania (2021), Nevada (2022), Ohio (2023), Illinois (2023), and Massachusetts (2024), among others, have all formed such groups to specifically examine transportation funding.

These bodies, often composed of industry representatives, state and local government officials, community groups, and policy experts, are typically tasked with developing specific, strategic funding recommendations for consideration by state officials. Pennsylvania's Transportation Revenue Options Commission (TROC), for example, was created by executive order [46]. The Commission led a broad analysis of transportation funding needs and potential sources of future funding. Task forces help ensure diverse input, provide a structure for analysis, and legitimize the process of developing recommendations for policymakers to consider.

Task forces can be created through legislation, by executive order, or as an initiative of a state transportation agency. For example, governors created task forces in North Carolina, Pennsylvania, and Massachusetts, while state legislatures created task forces in Oregon, Maine, Nevada, Illinois, and Vermont. Ohio's task force was a state DOT initiative. The nature of task forces and the scope of their work vary depending on who creates them. For example, legislatures often prescribe membership, specific topics to research, topic areas or boundaries for recommendations, and a timeline, and they typically direct state agencies to conduct the work accordingly. Governors, by contrast, exercise greater discretion in membership, scope, and timeline, while state DOTs tend to respond to perceived needs or informal requests of their governors and legislatures. The output of such task forces is often a framework, if not the actual text, for legislation to address transportation funding.

Define Guiding Principles and Evaluation Criteria

Several studies, including Indiana [45], Nevada [42], North Carolina [47], Ohio [43], Pennsylvania [46], and Vermont [60], defined principles and criteria to apply in assessing potential revenue mechanisms. These principles commonly include revenue stability, user equity, social equity, administrative feasibility, revenue potential, public acceptance, and environmental sustainability. Pennsylvania's nine guiding principles addressed issues ranging from fairness to feasibility. In Vermont, principles such as flexibility and consistency with state climate policies helped shape recommendations. Establishing such a framework ensures that new funding mechanisms are consistent with a state's broader values and priorities and adds transparency to the decision-making process of the task force. The next section will compile and summarize the results of these evaluations.

Review of Existing Mechanisms, Revenues, and Needs

Several studies began by reviewing existing fees and taxes, often focusing on the adequacy of fuel taxes and whether they should be indexed to inflation or construction costs. Washington's studies, released in 2010 [62] and 2020 [64], as well as Vermont's study, published in 2016 [65], examined how current revenue streams have failed to keep pace with infrastructure funding needs. This method is often a necessary precursor to evaluating new mechanisms and is especially useful for illustrating the degree of urgency of the funding situation in a particular jurisdiction.

Historical Data Analysis

Historical analysis was used to evaluate past revenue trends and test assumptions. Washington's 2025 retail delivery report used historical sales data to predict potential revenues for the state [12]. Jue et al. applied the 2017 National Household Travel Survey data to simulate the effects of RUC [66]. Steadman et al. also used historical data to explore how different pricing strategies might affect revenue and travel behavior [48]. Historical data analysis provides a foundation for future modeling and forecasting. Simulated models were used in academic research to test revenue mechanisms under hypothetical scenarios. Bayen et al. calibrated a model using data from California's Road Charge Pilot Program to simulate a RUC [10]. Dumortier et al. used projections from the U.S. EIA to test three taxation models [2]. These models can be technically complex but offer valuable insight into long-term system dynamics and policy impacts.

Baseline Revenues and Needs Assessment

Building on past revenue analysis, future revenue calculations and needs assessments were often conducted in tandem, reflecting their interdependence for long-term consideration of funding policies. A needs assessment helps determine the scope of future transportation investments by analyzing anticipated infrastructure repairs, capacity expansions, safety enhancements, and system goals. The 2015 *Study of Indiana Transportation Infrastructure Funding Mechanisms* [45], Maine's 2019 *Blue Ribbon Commission* report [61], and Pennsylvania's 2021 *Final Report and Strategic Funding Proposal* [46] analyzed the differences between expected funding levels and system needs. For example, in 2021, Pennsylvania determined that PennDOT's $8.8 billion budget fell $9.35 billion short of the state's $18.15 billion state-level transportation needs, with an additional $3.9 billion identified in local needs. Quantifying funding gaps enables more accurate and informed

discussions about alternative revenue options and the level of funding they need to generate. Aligning revenue analysis with infrastructure needs ensures that policy recommendations are grounded in both fiscal realities and system investment priorities. This approach helps decision-makers clearly understand the baseline funding shortfall and plan effectively for the resources required to achieve the state's long-term transportation goals.

Case Studies

As part of their funding assessments, many states consult one another for guidance on transportation funding approaches, frequently through case studies. Wyoming's 2024 *State Transportation Revenue Sources Short Report* examined implementation challenges and successes from peer states [63]. Vermont's 2025 *Report of the Vermont Transportation Funding Study* [60] and North Carolina's 2021 *Final Commission Report* [47] also used comparative case studies to assess policy impacts. Case studies can ground analysis in real-world experience and highlight best practices or cautionary lessons.

Pilot Testing

Pilot testing is another strategy to assess the technical and operational feasibility of alternative funding mechanisms. As mentioned in the literature review, many states have conducted pilot tests of RUC as a potential large-scale replacement mechanism for fuel taxes. Likewise, some tolling concepts have been tested through pilots as precursors to full deployments. Bayen et al. used California's Road Charge Pilot Program to inform their modeling [10]. Pilot programs provide critical real-world insights into the functioning and public feedback regarding proposed systems such as RUC.

Conclusion

The diverse strategies used by states and researchers reveal that no single method for identifying and analyzing alternative revenue mechanisms is sufficient on its own. Rather, changing transportation funding policy depends on combining approaches that are both technically complete and publicly informed. While common strategies like stakeholder engagement and technical assessment of revenue mechanisms may provide the foundation, supplementary methods, such as revenue forecasting, needs assessment, and pilot programs, enhance the depth of research to inform the development of options and recommendations for policymakers.

Synthesis of State-Level Revenue Mechanism Evaluations

This section presents the results of a comparative evaluation of revenue mechanisms. Table 2 through **Table 11** summarize how each mechanism performed across the seven common evaluation criteria, based on available state-level data.

Because states varied in the number and detail of mechanisms assessed, not all criteria were evaluated for every mechanism in every state. Accordingly, results are only shown where data were available. The "Summary" score shown in each table represents the average of all available scores for a given mechanism.

Pennsylvania's analysis was qualitative rather than quantitative. In this case, narrative findings were interpreted and assigned scores to ensure comparability with other states. Similarly, Wyoming evaluated revenue mechanisms only against the criterion of Revenue Generation Potential; therefore, this is the only criterion available from Wyoming.

Table 2. Evaluation of Revenue Mechanisms: Motor Fuel Taxes

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Poor	Fair	Poor	Poor/Fair	Poor	Fair	-	Poor/Fair
User Equity	Good	Good	Fair	Fair	Fair	-	-	Fair/Good
Social Equity	Poor	Poor	Poor	Poor/Fair	Poor	-	-	Poor
Administrative Feasibility	Good	Good	Good	Good	Good	Good	-	Good
Revenue Generation Potential	Good	-	Good	Good	Fair	-	Good	Good
Public Acceptance	Poor	-	-	-	-	Poor	-	Poor
Environmental Sustainability	-	-	Fair	-	Fair/Good	-	-	Fair/Good

Table 3. Evaluation of Revenue Mechanisms: Base Registration Fees

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Fair/Good	Good	-	Fair	-	Fair/Good
User Equity	Good	Fair	Fair/Good	Fair	-	-	-	Fair/Good
Social Equity	-	Poor	Fair/Good	Poor	-	-	-	Poor/Fair
Administrative Feasibility	-	Good	Fair	Good	-	Good	-	Fair/Good
Revenue Generation Potential	-	-	Fair	Fair	-	-	-	Fair
Public Acceptance	Poor/Fair	-	-	-	-	Fair	-	Fair
Environmental Sustainability	-	-	Poor/Fair	-	-	-	-	Poor/Fair

Table 4. Evaluation of Revenue Mechanisms: Alternative Fuel Vehicle Registration Fees

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Good	Good	-	-	-	Good
User Equity	Good	Good	Fair	Fair	-	-	-	Fair/Good
Social Equity	-	Fair	Fair	Fair	-	-	-	Fair
Administrative Feasibility	-	Good	Fair	Good	-	-	-	Fair/Good
Revenue Generation Potential	-	-	Good	Fair/Good	-	-	Poor/Fair	Fair/Good
Public Acceptance	Poor/Fair	-		-	-	-	-	Poor/Fair
Environmental Sustainability	-	-	Poor	-	-	-	-	Poor

Table 5. Evaluation of Revenue Mechanisms: Fuel Economy-Based Registration Fees

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Fair	Good	Good		-	Good
User Equity	Good	Fair	Fair	Fair	Fair	-	-	Fair
Social Equity	-	Poor	Fair	Fair	Poor	-	-	Poor/Fair
Administrative Feasibility	-	Good	Fair	Fair	Good		-	Fair/Good
Revenue Generation Potential	-	-	Good		Fair	-	-	Fair/Good
Public Acceptance	Poor/Fair	-	-	-	-		-	Poor/Fair
Environmental Sustainability	-	-	Poor/Fair	-	Good	-	-	Fair/Good

Table 6. Evaluation of Revenue Mechanisms: Road Usage Charges

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	-	Good	Good	Good	Good	Fair	-	Good
User Equity	Good	Good	Good	Good	Good	-	-	Good
Social Equity	-	Fair	Fair	Fair	Fair	-	-	Fair
Administrative Feasibility	Poor	Fair	Fair	Fair	Fair	Poor/Fair	-	Fair
Revenue Generation Potential	-	-	Good	Good	Fair/Good	-	Fair	Fair/Good
Public Acceptance	Poor	-	-	-	-	Fair	-	Poor/Fair
Environmental Sustainability	Good	-	Fair	-	Fair/Good	-	-	Fair/Good

Table 7. Evaluation of Revenue Mechanisms: Tolling

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	-	Fair	-	-	-	-	-	Fair
User Equity	Good	Good	-	-	-	-	-	Good
Social Equity	Poor	Poor	-	-	-	-	-	Poor
Administrative Feasibility	-	Poor	-	-	-	-	-	Poor
Revenue Generation Potential	Good	-	-	-	-	-	Good	Good
Public Acceptance	Poor	-	-	-	-	-	-	Poor
Environmental Sustainability	-	-	-	-	-	-	-	

Table 8. Evaluation of Revenue Mechanisms: Kilowatt Hour Taxes

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Fair	Good	-	-	-	Good
User Equity	Good	Fair	Fair	Poor	-	-	-	Fair
Social Equity	-	Fair	Good	Fair	-	-	-	Fair/Good
Administrative Feasibility	-	Poor	Poor	Poor	-	-	-	Poor
Revenue Generation Potential	-	-	Poor	-	-	-	Poor	Poor
Public Acceptance	-	-	-	-	-	-	-	-
Environmental Sustainability	-	-	Poor	-	-	-	-	Poor

Table 9. Evaluation of Revenue Mechanisms: Retail Delivery Fees

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	-	Good	Good	Good	-	-	Good
User Equity	Good	-	Fair	Fair	Good	-	-	Fair/Good
Social Equity	-	-	Fair	Fair	Fair	-	-	Fair
Administrative Feasibility	-	-	Fair	Fair	Fair	-	-	Fair
Revenue Generation Potential	-	-	Fair	Poor	Fair	-	Fair	Poor/Fair
Public Acceptance	-	-	-	-	-	-	-	-
Environmental Sustainability	-	-	Fair	-	Fair	-	-	Fair

Table 10. Evaluation of Revenue Mechanisms: For-Hire Transportation Fees

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Fair	Good	Fair	-	-	Fair/Good
User Equity	Good	Fair	Fair	Fair	Good	-	-	Fair/Good
Social Equity	-	Fair	Fair	Fair	Poor	-	-	Fair
Administrative Feasibility	-	Good	Good	Fair	Fair	-	-	Fair/Good
Revenue Generation Potential	-	-	Poor	Poor	Fair	-	-	Poor/Fair
Public Acceptance	-	-	-	-	-	-	-	-
Environmental Sustainability	-	-	Fair	-	Fair	-	-	Fair

Table 11. Evaluation of Revenue Mechanisms: Dedication of Auto Sales Taxes

	PA	NC	NV	OH	VT	IN	WY	Summary
Revenue Stability	Good	Good	Good	Good	-	Good	-	Good
User Equity	-	Good	Fair	Fair	-	-	-	Fair/Good
Social Equity	-	Fair	Good	Good	-	-	-	Fair/Good
Administrative Feasibility	-	Good	Fair	Fair	-	Good	-	Fair/Good
Revenue Generation Potential	Good	-	Good	Fair	-	-	Good	Good
Public Acceptance	Poor/Fair	-	-	-	-	Fair	-	Fair
Environmental Sustainability	-	-	Poor	-	-	-	-	Poor

The consolidated evaluation highlights how state task forces have assessed various transportation revenue mechanisms against common criteria. Several themes emerge from the comparative results.

First, no mechanism performs well across all evaluation criteria. Given the challenge to identify and enact transportation funding measures, this outcome is not surprising. Some mechanisms perform relatively better than others: for example, kilowatt-hour taxes perform poorly across most criteria. By contrast, alternative fuel vehicle registration fees perform relatively better, as do RUC and the dedication of auto sales taxes.

Looking at revenue generation potential, perhaps the most salient criterion when examining funding options to replace the gas tax, the mechanisms that consistently perform the best are vehicle-based registration fees, RUC, tolling, and the dedication of auto sales taxes.

Although measured less frequently, public acceptance consistently lags other criteria. Almost all of the mechanisms receive low or mixed results for public acceptance. This shows that technical strength does not translate to political viability, and it underscores the challenges associated with any form of funding for transportation through taxes or fees.

The "Summary" scores provide a useful overall view, but examining individual criteria can reveal important differences. For instance, **Table 4** shows evaluations of alternative fuel vehicle registration fees. Nevada and Ohio rate the revenue generation potential of this mechanism relatively highly (Good and Fair/Good, respectively), whereas Wyoming ranks it

as Poor/Fair. These differences likely reflect variations in vehicle fleets and levels of EV adoption across the states.

Trade-offs are evident between user equity and social equity. Mechanisms based on system use (e.g., fuel taxes and RUC) score higher on user equity but lower on social equity, suggesting that while they align with the “user pays” principle, they may disproportionately affect lower-income populations.

Conclusions

Funding for capital, operation, and maintenance activities related to surface transportation in the United States comes from a mix of federal, state, and local revenue sources. The motor fuel tax, a major funding source for both federal and state governments, is expected to produce declining revenue in the future due to macroeconomic forces such as increases in vehicle engine efficiency and the increasing adoption by consumers of alternative fuel vehicles, primarily EVs.

Due to decreasing fuel tax revenues, states are investigating various alternative revenue mechanisms aimed at maintaining long-term financial stability for transportation programs. Based on a thorough review of literature from the past decade, including academic research and state-level studies and legislation, this report summarizes the range of current practices employed by state transportation agencies, and sometimes local authorities, to identify revenue mechanisms that can supplement or replace per-gallon motor fuel excise taxes. It explains the principles behind each approach and provides examples of their implementation across varying states.

Facing the challenge of replacing declining fuel tax revenues, states have taken a variety of approaches ranging from detailed technical studies of revenue alternatives to transportation funding task forces to extensive stakeholder and public outreach to pilot testing of potential alternatives. This range of approaches has led to a gain in agency knowledge, policymaker perspective, and public understanding of the transportation funding challenge and the alternatives available to address it.

Numerous funding mechanisms are available to address declining fuel tax revenues, from adjusting the method of fuel taxation itself to imposing a range of vehicle-related fees, direct usage fees, indirect usage fees, externality taxes, and other mechanisms like general taxes. This report surveys 24 mechanisms, along with variations within them, which have been enacted by states in the past decade. These states offer models of research and exploration to identify policy prescriptions that work to address their challenges. Other states interested in addressing the challenge of transportation funding can follow the methodologies of these states to explore similar mechanisms and create sustainable funding policies that work for their constituencies.

Acronyms, Abbreviations, and Symbols

Term	Description
AAATA	Ann Arbor Area Transportation Authority
AASHTO	American Association of State Highway and Transportation Officials
AEO	Annual Energy Outlook
CAFE	Corporate Average Fuel Economy
CO_2	Carbon dioxide
CPI	Consumer price index
DOTD	Louisiana Department of Transportation and Development
DUI	Driving under the influence
EIA	Energy Information Administration
EV	Electric vehicle
FHWA	Federal Highway Administration
GPS	Global positioning system
HB	House Bill
HUF	Highway use fee
IFTA	International Fuel Tax Agreement
IIJA	Infrastructure Investment and Jobs Act
IRoUTE	Indexed Roadway User Toll on Energy
IRP	International Registration Plan
kWh	Kilowatt-hour
LTRC	Louisiana Transportation Research Center
MBUF	Mileage based user fee
MPG	Miles per gallon
MPGe	Miles per gallon equivalent
PHEV	Plug-in electric vehicle
RGGI	Regional Greenhouse Gas Initiative
RUC	Road usage charge
SB	Senate Bill
STC	Southeast Transportation Consortium

Term	Description
TIF	Tax Increment Financing
TNC	Transportation network company
VMT	Vehicle miles traveled
ZEV	Zero-emission vehicle

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