

# Revisiting the Gas Tax

David Farnsworth and Jim Lazar

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As they electrify their transportation sectors, states will need to consider how best to incorporate electric vehicles (EVs), electric buses, and other vehicles using electricity as fuel into the way they fund transportation sector construction and maintenance. In recent years, various taxes and other mechanisms have been unable to keep up with transportation infrastructure costs. These mechanisms are also designed largely without regard for the ways bridge and roadway costs are incurred. Here, we look at how transportation infrastructure has been funded and recommend how states can improve on that track record as they consider how the addition of electrified transport will contribute to maintaining and improving our transportation infrastructure.

## Background

The American Society of Civil Engineers periodically characterizes the condition and performance of the nation's infrastructure. In 2017, the society gave an overall score of D-minus, which includes a C-plus for bridges, a D for roads, and a D-minus for public transit.<sup>1</sup> The US Chamber of Commerce echoes these conclusions: "America's infrastructure is in terrible condition."<sup>2</sup>

According to the 2017 American Society of Civil Engineers report, "the U.S. has been underfunding its highway system

for years," resulting in a \$543 billion backlog of highway and bridge repairs.<sup>3</sup> Federal investment in highways has historically been paid for from the dedicated Highway Trust Fund, supported by user fees.<sup>4</sup> However, the fund has come close to insolvency for many years due to the limitations of its primary funding source, the federal motor fuels tax—a tax per gallon of gasoline and diesel that has not been raised for 25 years.<sup>5</sup> (Although it applies to both fuels, we refer to it as a gas tax.)

In discussing the design of the federal gas tax, the Institute on Taxation and Economic Policy in 2014 identified two reasons for the tax's growing ineffectiveness.<sup>6</sup> The first is that fuel efficiency of automobiles has improved. The institute estimated that since 1997, fuel efficiency gains reduced federal gas tax purchasing power by 6 percent. The second reason—which has far greater consequence—is the rising cost of construction. The Institute on Taxation and Economic Policy estimated

### Roadway Funding Mechanisms

- Gasoline and other fuel taxes per gallon;
- Annual registration fees;
- Annual gross weight fee;
- Sales tax;
- Property taxes;
- Per-mile charge; and
- Developer impact and mitigation fees.

1 American Society of Civil Engineers. *2017 Infrastructure report card*. Retrieved from <https://www.infrastructurereportcard.org/wp-content/uploads/2017/10/Full-2017-Report-Card-FINAL.pdf>. A grade of D indicates that the "infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure."

2 US Chamber of Commerce. (2018). *Roadmap to modernizing America's infrastructure*. Retrieved from <https://www.uschamber.com/lets-rebuild-america>

3 American Society of Civil Engineers, 2017.

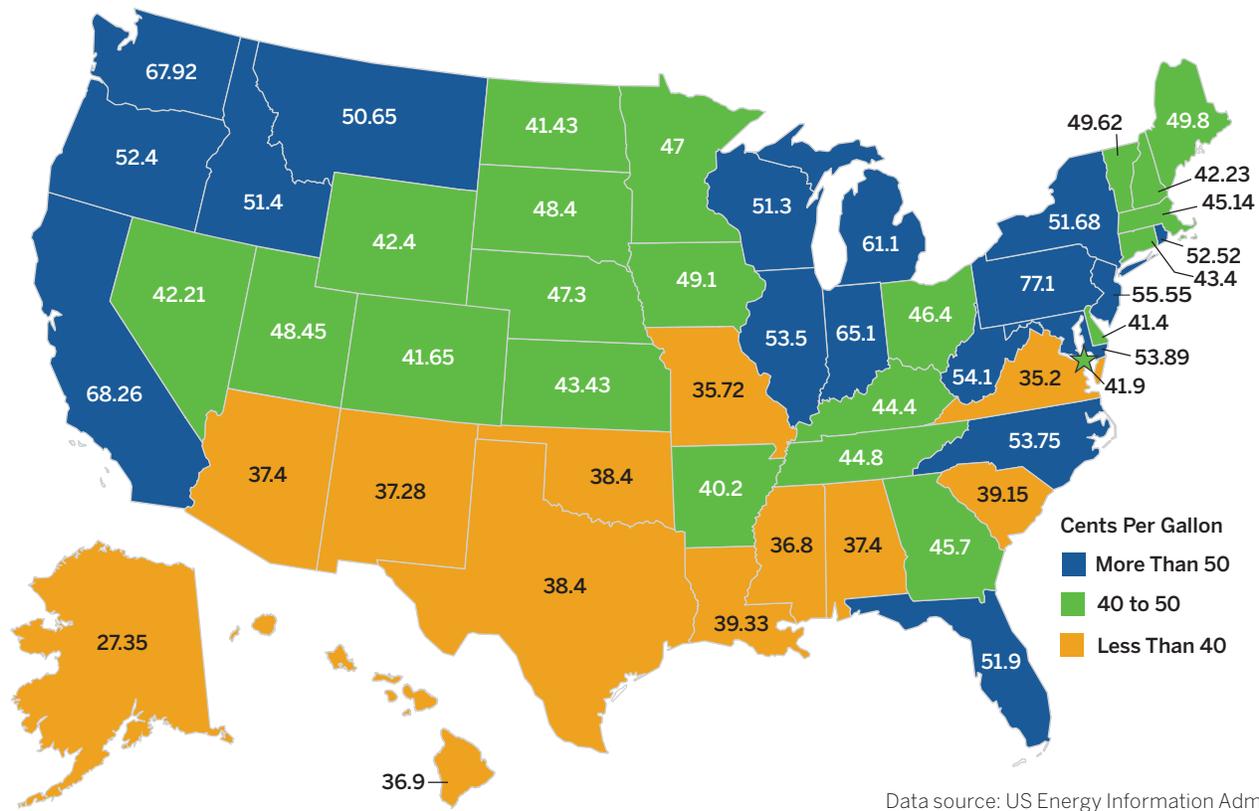
4 The fund is also supported through congressional authorizations and Treasury general fund revenues. Federal Highway Administration. (2017).

*Funding federal-aid highways* (Publication No. FHWA-PL-17-011). Washington, DC: Author. Retrieved from [https://www.fhwa.dot.gov/policy/olsp/fundingfederalaid/FFAH\\_2017.pdf](https://www.fhwa.dot.gov/policy/olsp/fundingfederalaid/FFAH_2017.pdf)

5 The tax of 18.4 cents per gallon for gasoline and 24.4 cents for diesel has remained the same since 1993. Institute on Taxation and Economic Policy. (2014, May). *The federal gas tax: Long overdue for reform*. Washington, DC: Author. Retrieved from <https://itep.org/wp-content/uploads/pb43fedgastax.pdf>

6 The Congressional Budget Office projects that the revenues credited to the highway and transit accounts of the Highway Trust Fund will be insufficient to meet the fund's obligations by 2026. Hall, K. (2016, September 9). [Letter to Sen. Jim Inhofe, chairman of the Committee on Environment and Public Works]. Retrieved from <https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/costestimate/inhofeletteraugust2016hntf.pdf>

Figure 1. Gasoline Taxes: Combined State and Federal



that since 1997, the increase in transportation construction costs reduced the purchasing power of the federal gas tax by 22 percent. Together, these factors have caused the gas tax to lose 28 percent of its value since 1997.<sup>7</sup> More recently, the US Chamber of Commerce has argued that inflation has eroded nearly 40 percent of the federal gas tax's value.<sup>8</sup>

States also fund road and bridge construction and maintenance through numerous mechanisms, including a gas tax. States assess these taxes in different ways, including a per-gallon tax collected at the pump and a value-added tax on the wholesale price of a gallon.<sup>9</sup>

Other measures states use include tolls and licensing fees. The Tax Foundation reports that, as of fiscal year 2013,

the revenue from these different approaches covered just 41.4 percent of state and local road spending and is losing purchasing power to the degree that states don't index taxes to inflation.<sup>10</sup> Figure 1 shows the combined state and federal gasoline taxes in each state.<sup>11</sup>

Perceiving that non-gasoline vehicles don't pay their share, several states are considering mechanisms to ensure that EVs also contribute.<sup>12</sup> As of the summer of 2017, 17 states had adopted registration fees, and two states were considering fees based on vehicle miles traveled.<sup>13</sup> As states go forward with such efforts, we recommend they first reconsider how to allocate roadway costs equitably among users—that is, in light of the construction and maintenance costs they create.

7 Institute on Taxation and Economic Policy, 2014.

8 US Chamber of Commerce, 2018.

9 Drenkard, S. (2017, January 27). State gasoline tax rates in 2017 [Blog post]. Tax Foundation. Retrieved from <https://taxfoundation.org/state-gasoline-tax-rates-2017>

10 Drenkard, 2017.

11 Based on US Energy Information Administration state-by-state fuel tax data. Retrieved from <https://www.eia.gov/tools/faqs/faq.php?id=10&t=10>

12 Spector, J., and Pyper, J. (2017, July 5). *Updated: 17 states now charge fees for electric vehicles*. Greentech Media. Retrieved from <https://www.greentechmedia.com/articles/read/13-states-now-charge-fees-for-electric-vehicles#gs.sxcV5=c>

13 Spector and Pyper, 2017.

## Spreading the Costs

Before continuing, we want to recognize that we are asking utility regulators to consider transportation sector funding, a key aspect of transportation policymaking. We do this because electrification is obviously connecting the utility sector with the transportation sector, but also because utility regulators are especially well-suited to this type of discussion. Understanding how EVs should contribute to the development and maintenance of the transportation system is a cost-of-service question, the type regulators face every day. Utility rates, like transportation funding, include distinct elements that together determine the utility's overall revenue requirements, the portion to be derived from each class of user, and the rates by which these will be recovered from individual consumers.

Many cost-of-service principles are equally applicable to transportation sector issues. Electric utilities and transportation agencies, for example, face:

- A mix of heavy industrial users and small residential users;
- High-use peak periods and costs, as well as low-use and off-peak periods and costs. (Utility cost allocation studies consider both size and character of the usage of each class, and costs.);
- A similar system structure. Roadways (and electric grids) are networks, with arterial roadways (transmission lines carrying heavy loads) tied to residential streets and rural roads (distribution power lines carrying lighter loads); and
- Vastly different costs for construction and maintenance of different types of roads (or power lines).

To use utility regulatory language: Current highway cost allocation and rate design frameworks do not track these cost drivers well.<sup>14</sup> Although electric utility cost allocation studies

Table 1. User Fee Payments Relative to Allocated Costs

Vehicle class	Portion of allocated costs paid in fees (federal and state)
<b>Autos</b>	100%
<b>Single-unit trucks (pounds)</b>	
25,000 or less	190%
25,001 to 50,000	80%
50,001 or more	50%
<b>Combination trucks (pounds)</b>	
50,000 or less	160%
50,001 to 70,000	110%
70,001 to 75,000	100%
75,001 to 80,000	90%
More than 80,000	90%

Source: Based on Federal Highway Administration. (1997). *1997 Cost Allocation Study Final Report*.

are performed every few years, there has been a fairly limited amount of work on highway cost allocation. But the principles are well-developed: Traffic volume, vehicle weight, and vehicle length are primary drivers of highway construction and maintenance costs. The Federal Highway Administration's most recent full study of cost allocation estimated that automobiles pay their appropriate share of allocated federal and state highway costs but most trucks do not.<sup>15</sup> Table 1 summarizes these findings.<sup>16</sup> The federal government has not updated this study for many years, however.<sup>17</sup>

A 2017 Oregon highway cost allocation study articulates the central purpose behind identifying cost causation:

Cost responsibility is the principle that those who use the public roads should pay for them and, more specifically, that users should pay in proportion to the road costs for which they are responsible.<sup>18</sup>

14 We recognize that roadway costs are a small part of the total costs of driving. See Victoria Transport Policy Institute. (2016, October). *Transportation cost and benefit analysis: Techniques, estimates and implications* (2nd edition). Retrieved from <http://www.vtpi.org/tca/>

15 Federal Highway Administration. (1997). *1997 Cost allocation study final report*. Washington, DC: Author. Retrieved from <https://www.fhwa.dot.gov/policy/hcas/final/toc.cfm>

16 Based on Federal Highway Administration, 1997, Table ES-5.

17 An addendum in 2000 reported similar inequities. Federal Highway Administration. (2000). *Addendum to the 1997 cost allocation study final report*. Washington, DC: Author. Retrieved from <https://www.fhwa.dot.gov/policy/hcas/addendum.cfm>

18 ECONorthwest. (2017). *Oregon highway cost allocation study*, p. 3. Oregon Department of Administrative Services. Retrieved from <https://www.oregon.gov/das/OEA/Documents/2017report.pdf>

Roadway costs consist of distinct construction and maintenance expenses. Construction costs include those associated with corridor land acquisition; the initial design and construction of new roads with adequate capacity to carry anticipated types and volumes of traffic; and adjustments to the design and capacity of simple roads to carry heavier and wider vehicles. Heavy vehicles require stronger roads, and wider vehicles require wider roads. Both requirements increase costs.

To build state highways, interstate highways, and some arterial roadways within cities, government makes capital expenditures to acquire land. When roads are widened, additional land often must be acquired. These costs are generally proportional to the width of the corridor.

In the case of new residential developments or subdivisions, the land use approval process normally requires the real estate developer to provide residential streets, so there is no capital cost to the municipality for constructing these roads. There are maintenance costs, however, which we will address.

Cars are 5 to 6 feet wide. Trucks are up to 8.5 feet wide. Roadway lanes must be about 9 feet wide to accommodate car traffic, but up to 12 feet wide to accommodate truck traffic. Thus, about 75 percent of the width-related costs of roadways are attributable to all traffic (cars and trucks), but 25 percent should be assigned exclusively to truck traffic. Neither fuel taxes nor registration fees reflect this.

Construction costs for a road with 9-foot lanes and sufficient strength to carry auto traffic (such as asphalt 2 to 4 inches thick) should be assigned to all traffic, as part of having roadway capacity. Any incremental width and strength demands (for example, lanes 12 feet wide, roadbeds up to 24 inches thick, and concrete or asphalt layers up to 8 inches thick) are truck-related costs and should be assigned exclusively to wider and heavier trucks. Current roadway funding schemes do not do this.

Maintenance costs include expenses related to weather and time that do not vary with usage. They also include usage-related costs associated with wear and tear from vehicles, which increases exponentially with heavier vehicles and varies

with lane width needed for wider vehicles.

Some maintenance costs are a function of weathering. Asphalt absorbs moisture, which freezes, resulting in potholes. Earth movement from earthquakes and land subsidence shifts the soil and damages roads. These costs are largely unrelated to usage. In the absence of a way to equitably allocate such costs, it would be reasonable to assign them to all users.

Most major highway maintenance costs, however, are related to usage. Highways with more and heavier traffic require more maintenance. And that maintenance is much more expensive, as lanes must be closed for hours (often overnight) at considerable expense. Although residential streets may be maintained with a light treatment (for example, every few decades), arterial roads require resurfacing at much shorter intervals and complete “grind and overlay” maintenance closer to every decade. This is usage-related maintenance. It is reasonable to assign these costs on the basis of traffic volume, weight, and width.

Light vehicles seldom exceed the elastic limits of roadways and cause very little wear-related maintenance requirement. Studded tires cause significant damage to roadway surfaces. And heavy vehicles cause the clear majority of roadway structure damage.

Because approximately 25 percent of the roadway width for highways is exclusively needed for large trucks, so should 25 percent of maintenance be assigned exclusively to these vehicles. All traffic should share the balance, but in proportion to the wear caused by different vehicle weights, with the impacts growing exponentially, not linearly, with increased weight.

Table 2 illustrates the roadway impact, per gallon, of typical cars, pickup trucks, and heavy trucks.<sup>19</sup> Because of its greater width and weight, a pickup has a roadway impact that is nearly 3 times that of a car. But because a car is 50 percent more fuel-efficient than a pickup, the pickup pays only 1.5 times as much through fuel taxes. Given its width and weight, the heavy truck has 34 times the roadway impact of a car but pays only 6 times as much toward those costs through a fuel tax. An appropriately designed charge would impose costs on different vehicle types consistent with their roadway impact ratio.

<sup>19</sup> Table 2 assumes a linear relationship between weight and roadway impact and thus probably understates the heavy vehicle cost responsibility.

**Table 2. Illustrative Charges Compared With Roadway Impacts**

Vehicle	Width without mirrors (feet)	Weight (pounds)	Roadway impact (width times weight)	Roadway impact relative to car	Typical fuel economy (MPG)	Fuel consumption relative to car	Fuel tax as percentage of roadway impact
<b>Car</b>	5	4,000	20,000	1:1	30	1:1	100%
<b>Hybrid car</b>	5	4,000	20,000	1:1	45	0.67:1	67%
<b>¾ ton pickup</b>	7	8,000	56,000	2.8:1	20	1.5:1	54%
<b>Large truck</b>	8.5	80,000	680,000	34:1	5	6:1	18%

Source: Author analysis

## Raising Revenue Equitably

As we have outlined, roadway construction and maintenance costs are driven by four key factors: vehicle width, vehicle weight, peak period traffic volume, and weather. At the center of determining the suitability of various roadway funding mechanisms is the question of how well each addresses the four key factors of cost causation.

Table 2 demonstrates how, as a class, all automobile users subsidize truckers. Even though trucks pay about 5 times more per mile than cars, this is only about 18 percent of their impact, and an inequitable assessment. Even hybrid automobiles, with high fuel efficiency, pay a disproportionate share of roadway costs based on weight, width, and volume.

Table 3 illustrates the relationship of different motor vehicle revenue mechanisms to roadway cost drivers. Neither the gross weight fee, the annual registration fee, nor the sales tax incorporates any characteristics of road usage. Gross weight fees are applied annually. Although they track weight closely, they do not track weight-induced roadway costs

**Table 3. Do Different Motor Vehicle Revenue Mechanisms Reflect Roadway Cost Drivers?**

	Fuel tax per gallon	Gross weight fee	Annual registration fee	Sales tax
<b>Width</b>	Yes, weakly	Yes, weakly	No	No
<b>Weight</b>	Yes, weakly	Yes, weakly	No	No
<b>Peak usage</b>	Yes, weakly	No	No	No
<b>Weather</b>	No	No	No	No

Source: Author analysis

because the fee is identical whether a truck travels 1,000 or 100,000 miles a year.

The only mechanism in Table 3 that is usage-related is the fuel tax per gallon. But since diesel vehicles are typically wider and get more ton-miles per gallon than gasoline vehicles, this approach undercharges diesel vehicles. To properly recognize the construction and maintenance costs diesel vehicles impose, the diesel tax per gallon would need to be about 2 or 3 times the gasoline tax.

A common criticism of the gasoline tax is that less-efficient vehicles, like pickups and sport-utility vehicles, use more fuel and thus pay more tax than lighter and smaller vehicles. This is true—but the larger vehicles also require wider roads and impose greater wear on roads, thus creating greater need for road maintenance. As illustrated in Table 2, even with inferior fuel economy, these heavier vehicles contribute less than their share toward paying roadway costs.

## Equity and Electric Vehicles

EVs do not pay typical fuel taxes, despite using electricity as a fuel. But they do use roads and arguably should share in the cost of roadway construction and maintenance. As noted earlier, 17 states have imposed fixed fees on EVs to offset the fact that, because they do not use gasoline or diesel fuel, these vehicles do not contribute to this pool of roadway construction and maintenance revenues.<sup>20</sup>

Electricity in many states is subject to a state excise tax that goes to the state general fund and not necessarily to

<sup>20</sup> Spector and Pyper, 2017.

transportation-related matters. Electricity may also be subject to municipal taxes. These funds are directed to general government purposes, including maintenance of local streets and roads. Natural gas is subject to similar state and local taxes. Propane is subject to retail sales and use taxes, which are general fund taxes for state and local government. Gasoline and diesel fuel typically are not subject to these general government taxes.

So, EVs do not pay “road tax,” but they do pay general government tax as a levy on fuel consumption. Vehicles powered by gasoline and diesel fuel do pay road tax but do not contribute to general government tax receipts on their fuel consumption. It would be equitable to recognize and redirect the general government taxes paid on electricity as a vehicle fuel from general government purposes to roadway purposes.

To improve the equity of taxation, where EVs pay a fee for roadway use, it would be equitable to extend the sales and use taxes and gross revenue taxes paid by electricity consumers to gasoline and diesel fuel.<sup>21</sup> If this were done, then all roadway usage (by any type of vehicle) would contribute equitably to roadway costs, and all categories of vehicular fuel consumption (electricity, gasoline, diesel fuel) would contribute equitably to general government costs.

## Conclusion

Transportation system funding is a larger problem than determining the appropriate contribution that should be collected from vehicles that use electricity for fuel. Current gasoline and diesel taxes are inequitable and do not provide sufficient support, simply because larger vehicles impose more ton-miles of use on roadways per gallon. Vehicle weight has an exponential, not linear, impact on roadway construction costs and on wear and maintenance requirements. To be equitable, the taxes for larger vehicles need to be 2 or 3 times the amount per gallon of the gasoline tax imposed on passenger vehicles.

The annual registration fee is the most inequitable of all roadway charges today. The mere existence of a vehicle (unless parked on a public street) creates no annual costs for roadways. Only the use of the vehicle creates such costs. Building these costs into usage-related charges, such as the fuel tax, will be more equitable than annual fees. Much of the current inequity can be addressed by reducing annual vehicle registration fees, raising the gasoline tax, and setting the diesel fuel tax at a more rational multiple of the gasoline fuel tax.

Decision-makers can address the issue of EVs by recognizing and appropriating into the motor vehicle fund, where applicable, any general government taxes that EV drivers currently pay on electricity.

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21 See the proposal by Acadia Center for an energy equivalent surcharge, “which would apply across all transportation fuels not currently taxed ... on a per-energy-unit basis [per Btu]. An energy-equivalent surcharge could operate like the gas tax, with the surcharge assessed when the vehicle refuels. For an EV, the energy-equivalent surcharge could be assessed per

kilowatt hour of electricity.” Acadia Center. (2018, March). *Electric vehicles and state funds: Current contributions in Massachusetts and long-term solutions to transportation funding*. Retrieved from <https://acadiacenter.org/document/electric-vehicles-and-state-funds/>



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