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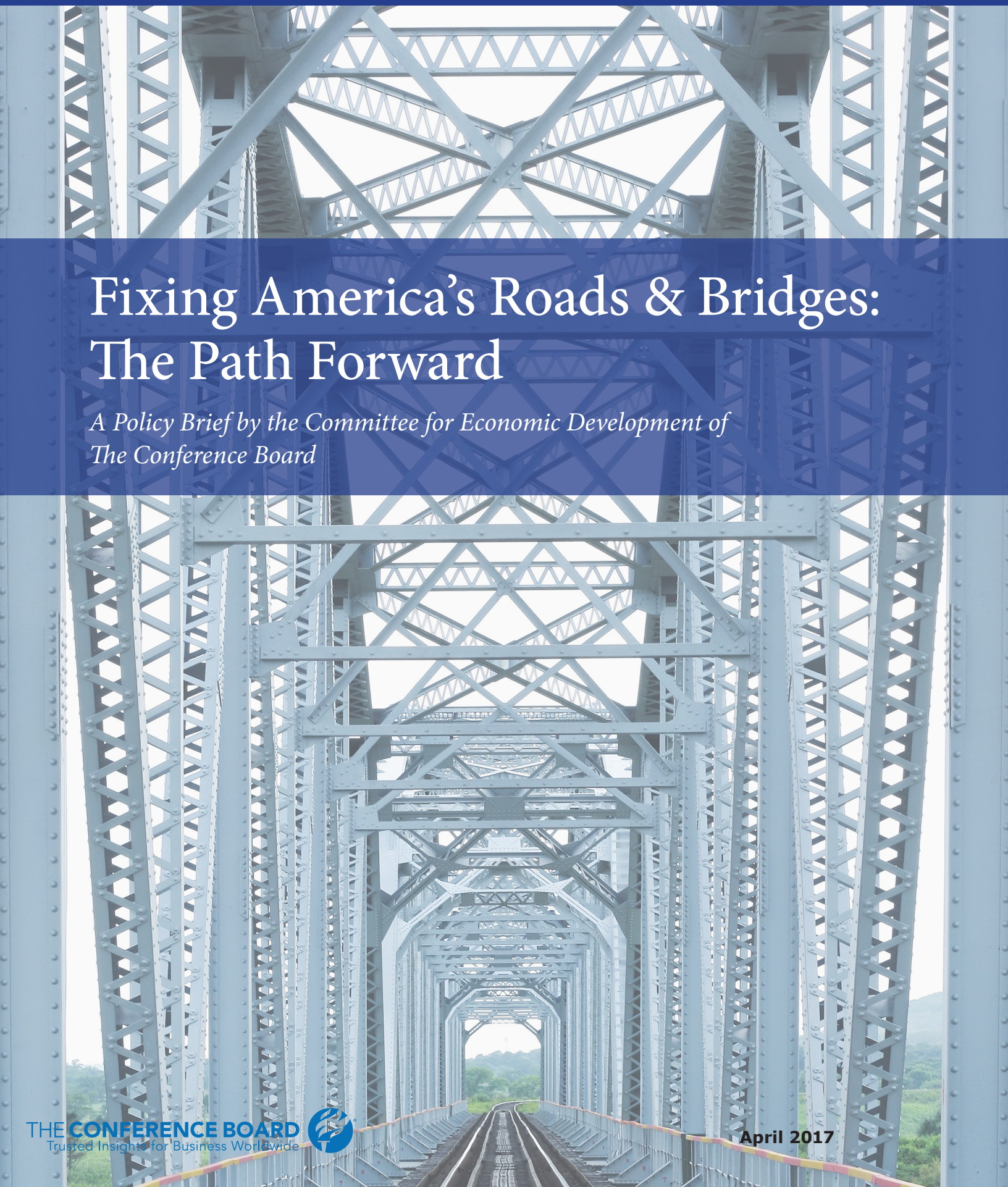

Fixing America's Roads & Bridges: The Path Forward

A Policy Brief by the Committee for Economic Development of The Conference Board

THE CONFERENCE BOARD
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April 2017

Authored by

R. Richard Geddes, PhD, Professor, Policy Analysis & Management, Cornell University and Director of the Cornell Program in Infrastructure Policy

Thomas J. Madison, Jr., Principal, TJM Advisors LLC and Executive Director of the Cornell University Program in Infrastructure Policy

Commissioned by

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Introduction

America's surface transportation system is a complex array of many subsystems—multiple modes of movement composed of different infrastructure, vehicles, owners, and operators. The surface transportation network includes aviation terminals, waterways, port and marine terminals, freight railroads, commuter and light-rail trains, bus transit systems, pipelines, and the nation's highways, roads, bridges, and tunnels. Separately and together, these modes enable the efficient movement of people and goods around the United States and beyond every day.

All elements of the surface transportation system face similar challenges that are compounded by ever-increasing demand, advancing age, and inadequate and unsustainable funding. Another compelling challenge is the lack of sufficient comprehensive planning and coordination between and among transportation modes, which limits their ability to truly operate as an integrated system.

This policy brief focuses on America's highways, roads, and bridges to illustrate the broader limitations faced by all transportation modes. Highways and bridges are commonly referred to as the "backbone" of the US transportation system and serve as the nation's central artery of commerce and economic activity. Motor vehicles traveling roads and bridges remain the primary mode of transportation in America, accounting for 88 percent of person miles of travel (PMT). To compare, air travel accounts for about 8 percent of PMT, while buses and trains account for only 1 percent.[1]

CED's Recommendations: Summary

1. Move toward user fees to fund roads and bridges.
2. Encourage greater private-sector participation in road building and maintenance.
3. Improve project selection and foster "modal coordination" across systems.
4. Streamline regulatory review and permitting at all levels.
5. Invest in technology.
6. Inform and educate the public.

Keeping America's roads and bridges in a state of good repair contributes to a robust economy and favorably impacts the quality of life of all Americans. The National Highway System (see page 7) is a network of strategic highways, which includes the Interstate Highway System and other roads that serve major airports, ports, rail or truck terminals, railway stations, pipeline terminals and other strategic transport facilities. It is the largest highway system in the world.[2]

> "When properly executed, transportation infrastructure investment raises economic growth, improves productivity, and increases land values."

The National Highway System (NHS) alone carries more than 40 percent of the nation's highway traffic, 75 percent of heavy truck traffic, and 90 percent of all tourist traffic. Nearly $14 trillion in goods are shipped from sites in the United States to domestic and international destinations each year, and about 87 percent of those goods are carried by trucks or courier.[3] Almost all economic activity, to some degree, depends on the mobility of our highways, roads, and bridges—the centerpiece of a safe and effective surface transportation system.

Transportation is a critical aspect of the US economy. In 2014 alone, various levels of government spent almost $165 billion to build, operate, and maintain highways. They also spent $65 billion on mass transit systems.[4] Most of that spending was at the state and local levels—about one-quarter of funding came from the federal government, mostly through the Highway Trust Fund (HTF).[5]

On average, American families spend more than $7,600 per year on transportation.[6] That cost is greater than expenditures on food and more than twice what they spend on out-of-pocket health care costs. Transportation absorbs about one out of every seven dollars of income for 90 percent of American families.[7]

Yet, when properly executed, transportation infrastructure investment raises economic growth, improves labor productivity, and increases land values. It can also create positive spillovers, including improved public health, higher energy efficiency, and greater economic development.[8]

When the Interstate Highway System turned 60 years old last year, its birthday marked unprecedented levels of travel, especially by the heavy commercial trucks that keep our economy moving. It also saw a system with increasing congestion, deteriorating conditions, and a compelling need for substantial investment. To keep the system in a state of good repair and meet the country's growing travel needs, the US Department of Transportation estimates that it will cost about $189 billion to clear the backlog of necessary system improvement projects. The average annual capital investment necessary to maintain highway and bridge conditions at 2010 levels is between $65 billion and $87 billion. Meaningful improvements to system performance would cost as much as $145.9 billion per year—currently, we spend less than two-thirds of that amount.[9]

To compound that funding gap, the United States lacks a long-term sustainable transportation funding source to pay for needed investments and improvements. The HTF remains America's primary funding source for interstate highways, local roads, bridges, and transit systems.

Revenues flowing into the HTF come almost entirely from motor fuels taxes (18.4 cents per gallon for gasoline and 24.4 cents per gallon for diesel fuel).[10]

But motor fuel taxes are not indexed for inflation and have not increased since 1993. The HTF spends substantially more on projects than it takes in each year. Consequently, the fund is expected to reach an annual shortfall of $16 billion by 2020 and a cumulative deficit of $180 billion over the next 10 years. Since 2008, shortfalls have been addressed by Congress with general fund bailouts totaling $62 billion.[11]

Just as we expect water and light to appear at the turn of the knob and flip of a switch, Americans also take for granted that our roads and bridges will be forever well-conditioned and readily accessible for safe, reliable travel. Unfortunately, a massive amount of deferred maintenance and a rapidly growing gap between investment needs and available funds threaten the ability of America's surface transportation system to deliver on this expectation.

How We Got Here: From the Interstate Highway System to Crumbling Roads and Bridges

In the minds of many, roads are inextricably linked to what it means to be American—from the lure of the "open road" to the interstate highway system's role in America's postwar boom. As Americans, we benefit from a network of roads and bridges that is extensive and largely complete. However, the system is exhibiting signs of stress that tax Americans' patience, pocketbooks, and, most disturbingly, their safety.

- In 2014, traffic congestion wasted 6.9 billion hours of motorists' travel time and almost 3.1 billion gallons of fuel.[12] The "invoice" in the United States for fuel and time lost due to congestion grew from $42 billion in 1982 to about $160 billion in 2014 (in 2014 dollars)—almost a three-fold increase.[13] Traffic congestion adds not only length but also uncertainty to travel time, which detracts from both commerce and quality of life.

- Driving on poor roads with deteriorating conditions costs motorists roughly $67 billion in additional operating and repair costs annually and contributes to increased traffic congestion and delays.

- Heavy trucks remain the biggest player in the US business supply chain. As just one example, the average daily delay for a UPS truck is five minutes due to substandard road conditions, congestion, and capacity issues. That translates to $105 million in additional annual cost to this one company alone.[14] Other carriers suffer similarly, and the increased cost is passed on to consumers.

- Americans take more than 200 million trips daily across deficient bridges in the 102 largest metropolitan regions. One in nine of the nation's bridges is rated as "structurally deficient," and the average age of the nation's 607,380 bridges is 42 years.[15]

ASCE Grades

Bridges	C+
Rail	C+
Ports	C
Aviation	D
Roads	D
Transit	D
Inland waterways	D-

Source: American Society of Civil Engineers, *2017 Infrastructure Report Card* (www.infrastructurereportcard.org).

- The American Society of Civil Engineers (ASCE) gave the overall condition of US infrastructure a grade of D+ in its most recent report.[16]

How did the United States reach this unfortunate state of affairs, after enjoying a surface transportation system that was the world's best in the 1950s and 60s?

Who Owns America's Roads?

Although our system of roads and bridges is often viewed as "national" in many ways, it is actually owned almost entirely by state and local governments—the federal government owns only 3.7 percent of all US roads, states own 20 percent, including the entire interstate highway system.[a] Local government jurisdictions own and maintain the more than 3 million miles of urban and rural roadways that constitute the other 77 percent. Ownership matters because it affects how the infrastructure is funded, maintained, and operated.

a How Many Miles of Roads Are There in the U.S.?" American Road and Transportation Builders Association (ARTBA) (www.artba.org/about/faq/).

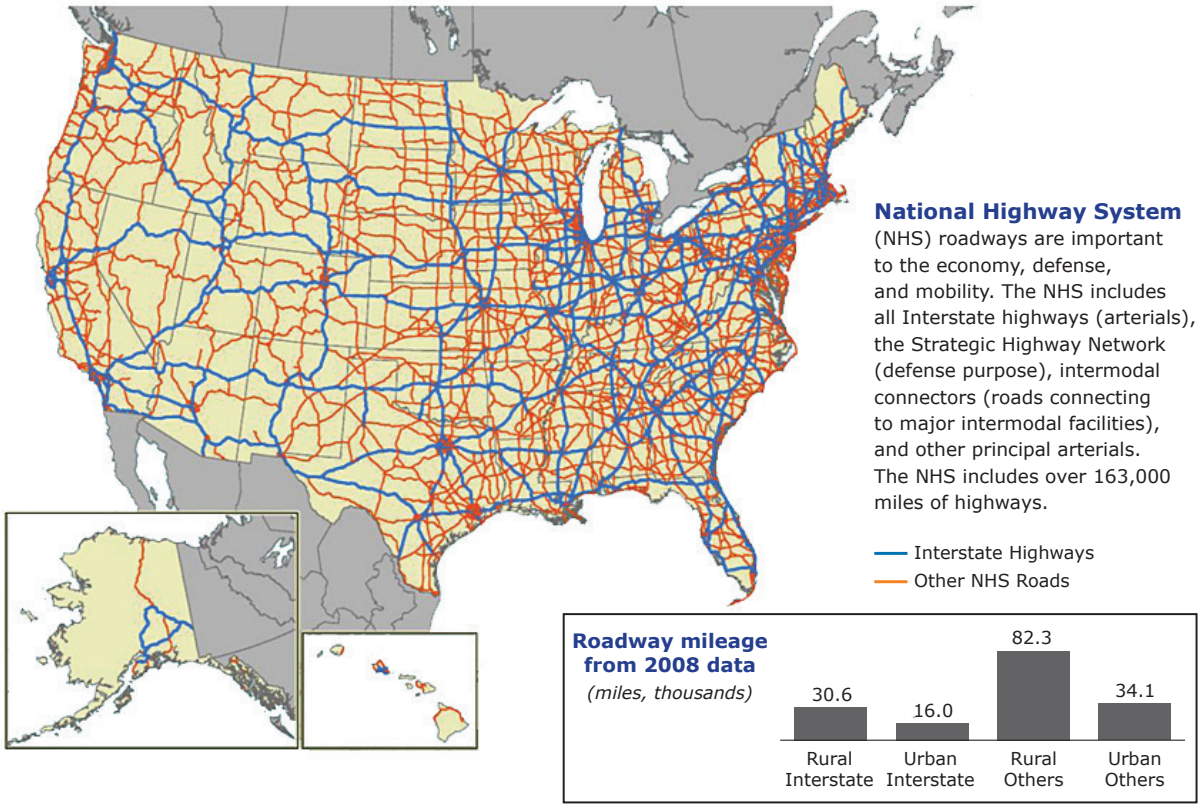
The National Highway System

The Interstate Highway System epitomizes what many Americans think of when we think of the federal government's role in transportation. Signed into law by President Dwight Eisenhower in 1956, the system has been described as the world's greatest construction project that reshaped the American landscape and way of life, "the most grandiose and indelible signature that Americans have ever scratched across their land." Or in one writer's words: "To understand America, you must understand highways."[a] Consisting of 46,876 miles of road today, the Interstate Highway System represented the height of advanced road design at the time of its construction in the 50s, 60s, and 70s.

Today 218 million users travel over 3.2 trillion miles annually over interstate highways.

The interstate highways form only the most well-known part of our larger National Highway System (NHS), which includes another 117,000 miles of roadways in rural and urban areas that facilitate access to ports, airports, public transportation, and intermodal facilities.

Although the NHS constitutes only about 4 percent of the nation's roads, it carries more than 40 percent of all highway traffic, 75 percent of heavy truck traffic, and 90 percent of all tourist traffic.[b] More than 90 percent of Americans live within 5 miles of this network.



Source: FHWA Office of Highway Policy Information, "National Highway System" (www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter1.cfm).

a *The Interstate Highway System Turns 60: Challenges to Its Ability to Continue to Save Lives, Time and Money*, TRIP, June 27, 2016 (www.tripnet.org/docs/Interstate_Highway_System_TRIP_Report_June_2016.pdf).

b Bureau of Transportation Statistics, US Department of Transportation, *State Summaries: 2012 Commodity Flow Survey*, June 2016 (www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/2012/state_summaries/index.html).

Deferred maintenance

Although America's network of roads, bridges, and tunnels is critical to the economy and American quality of life, it has been poorly maintained for decades. Estimates indicate that at least $170 billion of annual capital investment is needed to address deteriorating conditions, system performance, and highway congestion. The United States currently spends a little more than half that amount.[17]

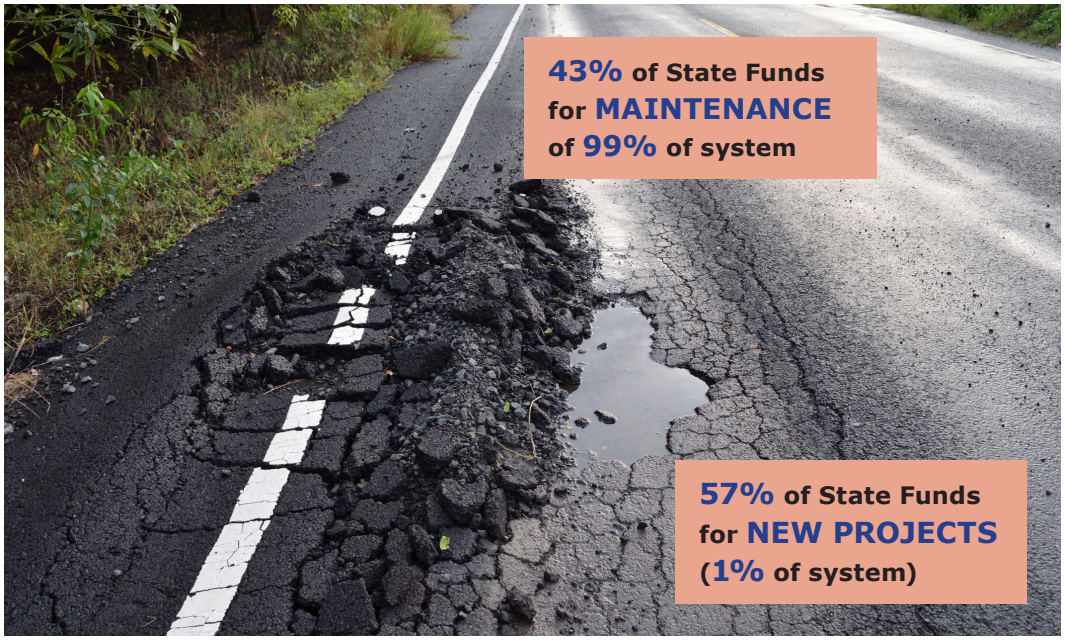
The state of America's bridges is emblematic of the consequences of deferred maintenance and inadequate system investment. The NHS currently has 5,479 structurally deficient bridges; another 53,312 bridges that are not part of the NHS are also considered structurally deficient. The replacement and rehab costs associated with those bridges are $21.5 billion and $14.5 billion, respectively.[18]

An additional 84,121 bridges are considered "functionally obsolete."[19] The United States is currently investing only about $12.8 billion per year to address deteriorating bridge conditions when at least $20.5 billion is needed, according to the Federal Highway Administration.[20]

America's deferred maintenance problem stems, in part, from prioritizing the construction of new roads and bridges instead of fixing existing facilities. For example, between 2004 and 2008, state transportation departments dedicated 43 percent of their capital construction budgets to maintaining existing roads and bridges, even though they made up 99 percent of the overall road system. This compares with more than 50 percent of state transportation dollars going to new construction projects during the same period, even though they constitute only 1 percent of the entire system.[21]

Another cause of inadequate maintenance may be a failure to consider the true lifecycle cost of maintaining an infrastructure asset over its entire expected life. States and localities typically do not budget for the operation and maintenance of an asset when it is constructed, which may lead to lower spending on maintenance later.

State Road Budget Allocation (2004–2008)



Source: Eric Jaffe, "America's Infrastructure Crisis Is Really a Maintenance Crisis," CityLab, February 12, 2015 (http://www.citylab.com/cityfixer/2015/02/americas-infrastructure-crisis-is-really-a-maintenance-crisis/385452/).

Inadequate and unpredictable funding

Another contributor to America's deferred maintenance problem is the lack of a stable stream of funding sufficient to keep the system in a state of good repair. Adequate, predictable funding is critical for proper operation and maintenance of our roads and bridges, especially for a largely "built out" and aging system like that of the United States.

As previously stated, the HTF is the primary federal funding source for the nation's roads, bridges, and tunnels. Over 90 percent of its revenues come from federal taxes on gasoline and diesel fuel. Most states impose similar fossil fuel taxes, over and above the federal tax, to fund their transportation infrastructure. Overall, more than half of highway spending at all levels of government depends on fossil fuel taxes.

Since 1993, the federal motor fuel tax has been fixed at 18.4 cents per gallon of gas and 24.4 cents per gallon of diesel, respectively.[22] Additionally, inflation has reduced the purchasing power of these funds for maintenance and expansion projects by 62 percent over this same time period.[23] This has increasingly diminished the amount of funds available for repairs.

Another issue affecting maintenance is that these fuel taxes are based on sales volume. When prices rise at the pump, people tend to drive fewer miles, so less revenue is generated. Funding for road maintenance and expansion becomes unpredictable because it is affected by the market forces that drive fossil fuel prices.

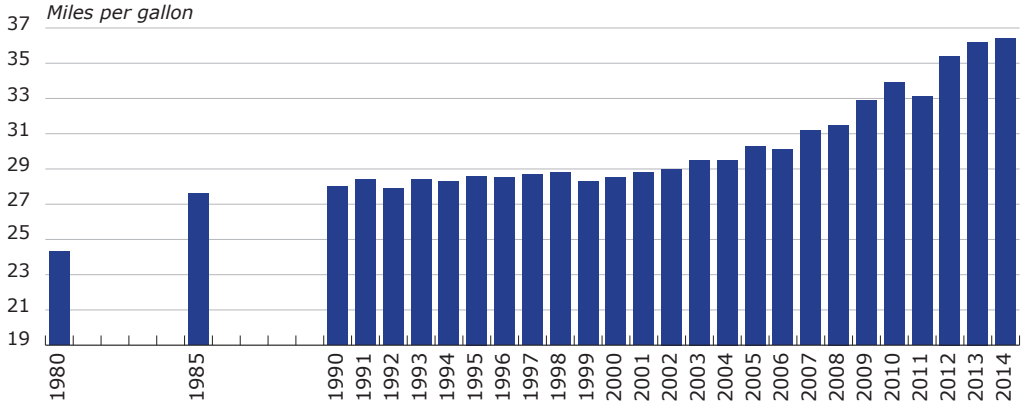
Revenues from taxes on fossil fuels also decline as vehicles become more efficient and as alternative-fuel vehicles proliferate. These trends are likely to continue and accelerate. The most fuel-efficient vehicles pay little or nothing for the roads they utilize, making the fuel tax less reflective of each vehicle's contribution to roadway wear and tear. Over time, this means that road-system costs shift from all users to the general taxpayer and to poorer motorists, who disproportionately rely on older, less fuel-efficient vehicles.

Moreover, US motor-vehicle fuel efficiency appears to be increasing at *an increasing rate*, as Chart 1 shows. This bodes poorly for fossil-fuel taxes as a sustainable funding source for transportation infrastructure over the long term.

Although relying on motor fuel taxes worked well for decades, it now generates inadequate and declining revenues. The United States needs a stable and predictable source of revenue that meets the operational and maintenance needs of our mature network of roads, bridges, and tunnels.

Chart 1

Average Fuel Usage of New Vehicles in the United States



Source: Bureau of Transportation Statistics, US Department of Transportation.

Poor project selection

Poor project selection and the politicization of transportation spending have afflicted America's road, bridge, and tunnel system for decades. At the federal level, spending has been especially susceptible to political pressure and unwise project selections. For years, federal earmarks for ill-advised projects, such as Alaska's infamous "bridge to nowhere," became symbols of misdirected transportation spending. In their heyday, earmarks grew from 10 projects costing $360 million in 1982 to 6,371 earmarks totaling $47 billion in the 2005 transportation reauthorization bill. Approximately $16.5 billion was spent on earmarked projects in fiscal year 2010 alone.[24]

Although Congress curtailed the federal earmarking process in 2011, undue political influence over project selection remains. The most recent federal transportation bill did not expressly restore the practice, but there are discussions in Washington about reinstating some new form of earmarks. At the state level, political influence over selection of capital projects has remained. In fact, it is commonplace for billions of dollars in transportation project priorities to be horse-traded for noncapital budget items, and for critical project selections to be made by a small group of powerful politicians rather than by engineers, planners, and other industry professionals. Ironically, earmark funds have often gone unused because the federal allocation is too small to support the project and the state receiving the federal funds is unable to pay for the balance. Since the formal ban of federal earmarks, states have been heavily reliant on traditional formula funding from Washington.[25]

Earmarks—like any purely political project—are troubling for several reasons: They circumvent processes that independently assess a project's merit and weed out the most wasteful and unnecessary cases. Earmarked projects are typically exempt from detailed review and need not pass a cost-benefit analysis, rigorous or otherwise. As a result, they can easily generate costs that exceed any realized benefits. Politically selected projects also lack a data-driven engineering needs analysis that considers overall asset management and validates the purpose and nature of a project and its contribution to an integrated transportation system.

Inefficient project delivery

After project selection, the United States faces another set of problems related to project delivery—namely, the approval, design, and construction of infrastructure projects. Many projects are completed slowly and over budget. Many are delayed due to a protracted environmental permitting process. It can take as long as a decade for a project to progress from initial planning to ribbon-cutting.[26] Such delays increase project costs substantially. A study by Common Good estimates that a six-year delay in the start of construction costs the country more than $3.7 trillion, once the inefficiencies and environmental harms of delaying the project are included.[27] Ironically, today's required extensive review may actually harm the environment in many cases because older, less-efficient roads and bridges remain in place during the long delay.

Slow adoption of new technologies

Thanks to the rapid emergence of disruptive technologies—such as driverless cars, connected vehicles, vehicles that electronically interface with the physical infrastructure, new construction materials that improve safety, and a host of other innovations—transportation today is changing faster than it has in decades. Private-sector innovation and investment have largely driven these changes, and governments at all levels have been left scrambling for policies to accommodate them.

Without government action, we may face the scenario of private technology gurus working at the cutting edge of the computer communications and vehicle interface, using space-age science and materials, only to have the resulting technologies operate on antiquated infrastructure that cannot talk back and cannot accommodate such rapid progress. The public sector's glacial speed in adopting emerging technologies may limit the US economy's ability to capture the value of private-sector innovation.

CED Recommendations

CED recommends the following actions to address the challenges facing America's surface transportation system. The objectives of these policies are to return America's roads and bridges to a state of good repair, to construct new capacity where most needed, and to develop approaches to road funding that are sustainable over the long term.

1. Move toward user fees to fund roads and bridges

We've highlighted three significant issues regarding current methods of funding. First, the gap between the revenues available from current user fees and taxes versus the dollars needed to keep our roads and bridges in good repair will only grow without a fresh approach.

Second, revenues generated from taxes on fossil fuels worked well when the challenge was to design and construct a new nationwide system, but they are less appropriate for the operation and maintenance of America's mature, largely complete transportation system.

Finally, allocations from Congress can be less stable and predictable than is ideal for these purposes. They depend on the outcome of future elections, among other uncertain events.

New sources of funding are clearly needed. The box on page 12 ("Transportation Funding Options") lists the pros and cons of potential alternative sources of funding.

One promising approach is increased reliance on mileage-based user fees, or MBUFs. MBUFs assess a price or fee per mile of road use by a vehicle. That price may vary depending on the demand for road space at that particular time of day. This approach is facilitated greatly by new electronic technologies that reduce the cost of toll collection.

In essence, the availability of a safe, uncongested road is similar to a utility, such as the availability of water, electricity, or phone service. Per-unit fees are a standard approach used to pay for service for those utilities that require networked infrastructure. Examples include payment per minute for cell phone use, per kilowatt hour for electricity, per gallon for water, and per BTU for natural gas. Indeed, the per-unit approach is so embedded in utility pricing that prices are more frequently referred to as "rates."

Roads and bridges are now an anomaly for *not* utilizing direct fees to pay for service. Such fees would provide an equitable, reliable revenues source to cover the operational and maintenance costs of a mature system. MBUF revenues would also be independent of the type of fuel used. It is important to note that such user fees would be a *replacement* for fossil fuel taxes rather than simply an added tax, and they should be explained as such to secure support from motorists and other voters.

A key benefit of MBUFs is that they can fluctuate based on the demand for road space at a particular time of day. Variable pricing has been used successfully in other sectors, including electricity and telecommunications, to manage demand over the course of a day. This helps to allocate scarce road space to those who value it the most. Some motorists will make adjustments to conserve on that road space, thus freeing it up for use by others who value it more highly. This is same way that the vast majority of scarce goods and services are allocated.

Even a small reduction in road use during peak times can greatly improve traffic flows. Motorists can adjust to higher prices by altering commuting schedules, taking alternative modes (buses or mass transit), telecommuting, carpooling, or (in the longer-term) moving closer to work.

Transportation Funding Options

OPTIONS	DESCRIPTION	BENEFITS	PROBLEMS
Motor Fuel Tax Increase	A tax imposed on the sale of gasoline, diesel, and other fuels, with higher rates charged for transportation use. Federal Motor Fuel Taxes were last increased in 1993. 2017 National Motor Fuel Tax Average (cents/gallon)[a] Gas / Diesel Federal Excise Tax 18.4 / 24.4 State Excise Tax 21.03 / 20.73 Other State Tax 10.01 / 10.28 **TOTAL 49.44 / 55.41**	• Historical revenue source to the Federal Highway Trust Fund (HTF), motor fuel taxes pay for maintenance and expansion projects for highway and transit infrastructure • Low costs of collection • Traditionally offered horizontal equity; was close to a user-pays mechanism	• These taxes are unsustainable, and have not adequately funded the HTF for years. • From 2008-2015 Congress provided a total of $62 billion in general fund appropriations to 'bail out" the HTF from its annual tax revenue shortfalls ($13 billion in 2015 alone)[b] • The Congressional Budget Office predicts a $22 billion annual tax shortfall by 2025 • Taxes are not indexed for inflation or adjusted for usage; inflation increased 64.6% between 1993 and 2015
Mileage-Based User Fee (MBUF)	MBUF assesses a fee-per-mile of road usage and is also called a Vehicle Miles Traveled (or VMT) payment. As gasoline sales decline, this is a more equitable and sustainable means of payment than traditional fuel taxation.	• Real-time variable pricing based on demand fluctuation allows congestion management • Creates reliable funding source • Funding source unrelated to fuel type • Reduces congestion and improves traffic flow	• Some assert MBUFs may cause an unfair burden to lower income groups when compared to motor fuel taxes • Higher cost of collection • Politically difficult to shift from per-gallon tax to per-mile fee • Privacy concerns, depending on the collection mechanism
Expanded Tolling[c]	Increase toll rates on existing roads to all electric toll facilities.	• Sustainable, fair and equitable direct user fee (like MBUFs) • Can link usage cost to vehicle impacts on infrastructure conditions (i.e. heavy trucks) • Tolling scalable to adjust for cost of maintenance, upgrades and expansion projects	• Political opposition • Difficult to convert existing, non-tolled facilities • Privacy concerns
Income Tax Revenues[d]	A dedicated revenue stream for transportation/infrastructure could be derived from current tax revenues or by increasing personal and/or business income taxes.	• Small tax increase can yield substantial revenues • Could be a long-term sustainable funding source	• Political opposition • Poor link to road usage, and thus poor economic efficiency and horizontal equity • Negative budget impact if it inhibits income tax increases needed for the general fund
Sales Tax Revenues[e]	National sales tax on motor fuels as a percentage of motor fuel costs – in addition to the traditional cent/gallon tax. Some states do this now (4-6% range).	• Small percentage tax raises significant revenues • Does not decline with inflation • Sustainable (short term) and provides flexible, dedicated transportation funding	• Fuel price volatility means unpredictable revenues • Long-term sustainability problem as with motor fuel tax • Political and public opposition increases with price spikes

a American Petroleum Institute, "State Motor Fuel Taxes," January 2017 (www.api.org/~/media/Files/Statistics/StateMotorFuel-OnePagers-Jan-2017.pdf).
b Michael Sargent, *Highway Trust Fund Basics: A Primer on Federal Surface Transportation Spending*, The Heritage Foundation, May 11, 2015 (http://www.heritage.org/transportation/report/highway-trust-fund-basics-primer-federal-surface-transportation-spending).
c Robert W. Poole, Jr, and Adrian T. Moore, *Ten Reasons Why Per-Mile Tolling Is a Better Highway User Fee Than Fuel Taxes*, Reason Foundation, Policy Brief 114, February 2014 (http://reason.org/files/why_tolling_is_better_than_fuel_taxes.pdf).
d American Association of State Highway and Transportation Officials, *Matrix of Illustrative Surface Transportation Revenue Options*, 2015 (http://downloads.transportation.org/TranspoRevenueMatrix2014.pdf).
e Ibid.

A second approach that should be considered is increased use of managed traffic lanes in congested areas. Many travelers are willing to pay a fee (where there currently is none) or a premium (where a fee already exists) to achieve a more reliable travel experience. This is true whether the customer is a commuter on the same road every day, a long-haul freight carrier with tight deadlines and hours-of-service restrictions, or a single-trip tourist. Time is precious, financially valuable, and central to our everyday commerce and quality of life.

In addition to generating new revenue, managed lanes can be used in conjunction with intelligent transportation systems (ITS) to manage our roads more efficiently.[28] They can also relieve congestion, reduce pollution, and improve safety. Such lanes are typically separated from general-purpose traffic lanes and added to existing roadways.

Modern managed lanes are fully electronic, accepting no cash payments, thus dispensing with the outdated, inefficient toll booth model. Although privacy is an often-cited source of concern, motorist privacy is guarded by the owners of electronic tolling systems. While state laws vary, in most instances even law enforcement is prohibited from tracking vehicles or sharing customer data for speed enforcement or other purposes without a specific court order relating to a serious crime or imminent threat to public safety. In most cases, the systematic deletion of vehicle travel data occurs after a required record retention period.

Movement toward more direct user fees is not without concerns. There likely would be higher transaction costs associated with the collection of these user fees relative to taxes on fossil fuels, as installing and maintaining the needed technology and billing users have their own additional costs.

A second concern relates to equity or fairness. To understand this issue, it is critical to distinguish between vertical and horizontal equity.

Horizontal equity refers to charging similar users of a good or service similar rates. In the road pricing context, this means that all users of a particular road who drive the same type of vehicle would be charged the same fee per mile. Motorists imposing more damage on the roads due to heavier vehicles, for example, would be charged more, regardless of the vehicle's owner. MBUFs are fair in a horizontal equity sense since they impose the same burden on each user, regardless of income.

Vertical equity, in contrast, refers to placing a lower burden on lower-income groups relative to higher-income groups, with an eye toward reducing payment burdens on lower-income households. Fairness concerns regarding MBUFs arise regarding vertical equity. The key issue is whether MBUFs impose a greater burden on rural, often lower-income users relative to increasing tax rates on fossil fuels. There is a common belief that rural residents drive longer distances than urban residents. Thus, a shift from a per-gallon charge to a per-mile charge would affect them disproportionately.

2. Encourage greater private-sector participation in road building and maintenance

American governments at all levels should encourage greater private-sector participation in everything from simple operation and maintenance contracts (in which a private firm or firms takes over specified operation and maintenance duties for a fixed period of time) to so-called design-build contracts. More extensive partnerships can take the form of design-build-finance-operate-maintain contracts, in which private companies are involved in each step of a project's development and delivery, including equity financing and a long-term operation, management, and maintenance concession in partnership with the public owner of the road, bridge, or other facility.

> "...private participation ensures that appropriate maintenance occurs and makes the true lifecycle costs of such facilities more transparent to policymakers and voters, alike."

There are, however, important costs associated with greater private-sector participation in infrastructure delivery. Inclusion of the private sector requires a higher level of public-sector expertise in procurement and contract monitoring, which may result in greater contracting (or "transaction") costs than traditional infrastructure procurement. It can, however, help address several policy challenges, such as those surrounding deferred maintenance. For example, when the public sector signs an operations and maintenance contract, it pre-commits to spending the resources necessary to effectively maintain a transportation asset over its entire lifecycle. This means that maintenance is not deferred, and the typically higher cost of repairs associated with deferred maintenance are avoided.

By contractually binding the public sector to provide sufficient resources for the operation and maintenance of roads and bridges, appropriate maintenance is ensured and the true lifecycle costs of such facilities are more transparent to policymakers and voters, alike.

More generally, increased private-sector participation can:

- Improve project selection by incorporating lifecycle costing into the upfront cost of a project.
- Accelerate project completion by transferring the risk of time delays to private partners through contractual penalties and rewards, which is not possible without a private partner.
- Improve project-cost certainty by transferring the risk of cost overruns and schedule delays from public owners to private partners.
- Ensure maintenance of the road or bridge over its entire lifecycle (for contracts that include an operations and maintenance component).
- Fast-track technology adoption by allowing private partners to capture a portion of the gains.
- Provide access to equity investors—a new class of infrastructure financiers (in addition to traditional debt investors) that has previously been unable to participate under traditional approaches to US infrastructure delivery. This is particularly important to investors with "patient money," like pension and insurance funds.
- Provide more accurate pricing of the substantial risks inherent in infrastructure delivery.
- Unleash the creativity of the private sector to promote efficiency, reduce risks, and accelerate project delivery schedules. This is particularly important for projects that pose complex design and construction challenges.

3. Improve project selection and foster "modal coordination" across systems

Road, bridge, and other modal investment decisions should be considered as part of the larger transportation network and not as standalone projects. For the reasons previously described, project selection and capital program decisions driven by politics, rather than system needs, are costly and counterproductive. Despite the reduction of federal earmarking per se, political traditions and arcane, outdated formulas are still widely utilized in project selection. Examples abound where "historical percentages" of capital spending are fixed for particular regions based on past precedent with minimal regard for actual need. The result is geographic variation in conditions and system performance within a state, and even along different sections of the same highway or transit route.

A more data-driven approach to project selection that emphasizes detailed engineering reviews and priorities is desirable. This should include deployment of a uniform process of asset management that looks at true needs and lifecycle costs instead of elective politics, internal bureaucratic influences, or other distracting priorities. Establishing and carefully applying standardized metrics to guide project selections for both preservation and new capacity projects will drive coordination and save money.

Take, as an example, a state highway department that embarks on a significant project that was planned long ago in its multiyear capital plan.

The project may impact another owner's jurisdiction, such as a county or town government, or a sister state agency. With improved coordination protocols, the adjacent local owner might decide to accelerate its own planned infrastructure project in the area to: (1) minimize disruption and inconvenience to area travelers, residents, and businesses; (2) expand the scope of one or both projects to maximize improvements and minimize costs; (3) consider joint procurement and bulk purchasing opportunities; (4) truncate the schedules of the two (or more) projects; and (5) maximize synergies between infrastructure owners, residents, and businesses.

Scarce resources can be stretched even further by requiring comprehensive guidelines for project selection, funding, design, and scheduling that are based on overarching system priorities and needs. Agencies should review a project's impact on other potential projects within its own capital plan, as well as on the project priorities and schedules of other public agencies. Additionally, the needs of existing or potential private-sector neighbors who rely on the transportation system should be taken into account.

"Governments at all levels must work more closely together to eliminate redundancies in our surface transportation system and make comprehensive plans for future growth."

Although this brief focuses specifically on roads and bridges, the long-term design, planning, and financing of the United States' entire transportation system must become more coordinated. This will require rigorous analysis of metrics related to safety, system performance, and connectivity to other systems, the level and nature of usage, and ownership and operating relationships. It also means closer collaboration between and among the different transportation modes. The improvements such a model would make to our freight system alone would be considerable, and the federal government could incentivize such coordination, where practical, across modal owners and operators, levels of government, and geographic boundaries.

Governments at all levels must work more closely together to eliminate redundancies in our surface transportation system and make comprehensive plans for future growth. This will enhance joint project development across transportation modes, the pooling of financial resources, joint permitting and environmental reviews, and may even attract private-equity investment from the businesses that rely on, or are currently hampered by, America's highways, transit systems, ports, airports, and waterways.

4. Streamline regulatory review and permitting at all levels

Infrastructure projects in the United States have long suffered from onerous, inefficient, and often redundant regulatory review processes across different levels of government. These processes often cause long delays and substantial cost increases. In 2011, the average time to secure needed environmental approvals and advance a major infrastructure project in the United States was between six and eight years.[29]

Significant progress has been made to improve the federal permitting and review process since 2011.[30] Such efforts are laudable and have already proven effective in compressing project development and implementation times and in reducing cost increases due to protracted delays. However, more can be done by extending relief beyond the federal review process and facilitating close coordination among all involved government regulators, agencies, and other stakeholders.

Streamlining the review process, as required by the National Environmental Policy Act (NEPA), has helped secure permits and approvals in a more timely fashion. Including all participants in the development and delivery of infrastructure projects will help even more. Regulatory relief should also be expanded to include regular consultation protocols and requirements among all involved agencies, not just federal ones, and should extend permitting improvements to smaller infrastructure projects as well.

5. Invest in technology

As the private sector continues to advance and make considerable investments in various transportation technologies, it often lacks a full public-sector partner. In addition to the important work of developing regulations to adapt to new technologies, such as autonomous vehicles, governments at all levels must also make important system investments to accommodate the new vehicles if the benefits of these advances are to be fully realized.

This requires a focused set of public-private partnerships to explore the potential and the limitations of new technologies and how the built environment can better accommodate them. Although the necessary provisions to prepare our infrastructure for the future exist, the value and impact of emerging technologies will be limited without these changes.

The emerging technology of driverless and increasingly autonomous cars offers one example. Driverless vehicles rely on a system of cameras and light-emitting radar to observe the infrastructure conditions around them. Because they rely on clearly seeing line paint, signs, and other road features, this technology requires that roads be kept in a state of good repair and that those features be consistent across jurisdictions.

In addition to the high-tech changes, there are many examples of lower-tech modifications to roads and bridges that would make them safer and more reliable. Greater use of construction materials and techniques that prolong the useful life of roads and bridges, interactive signage and safety features, roadbed sensors to communicate with vehicles, and integration of real-time traffic and weather alerts and other communications should be the norm, not the exception.

6. Inform and educate the public

Although this recommendation may seem like the least compelling and most obvious, it could well be the most consequential. Transportation infrastructure plays a vital role in every American's life every single day. Yet we often take infrastructure for granted until a crisis or serious problem occurs. Many Americans believe that their tax dollars already adequately fund public roads and bridges. They don't understand the complexities of infrastructure funding or why the system continues to deteriorate. At the same time, the public regularly hears America's infrastructure described as comparable to that of a "third-world country" and that it is far inferior to more sophisticated and efficient systems in Europe, Asia, and elsewhere.

To develop the necessary political awareness to support a robust surface transportation system, a more effective and concerted educational appeal must be made directly to all Americans. Surveys have shown that Americans are willing to pay their share to support roads and bridges—including taxes, tolls, and even premium fees—if they recognize a benefit to their quality of life. Leaders in both the public and the private sectors should take the message directly to the public to mobilize their interest and support for a US transportation system that is second to none.

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Policy Brief

April 2017

Committee For Economic Development of The Conference Board
1530 Wilson Blvd
Suite 400
Arlington, VA 22209
202.296.5860
www.ced.org

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