

Supplement to Inquiring Minds topic paper – March 30, 2018

The State of U.S. Infrastructure
CFR Backgrounder by [James McBride](#)
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Amid deliberations over President Trump's first budget, debate has intensified over how to improve the nation's infrastructure, as analysts say U.S. transportation, water, and other systems face major shortfalls.

Introduction

The \$18 trillion U.S. economy relies on a vast network of infrastructure from roads and bridges to freight rail and ports to electrical grids and internet provision. But the systems currently in place were built decades ago, and economists say that delays and rising maintenance costs are holding economic performance back. Civil engineers raise safety concerns as well, warning that many bridges are structurally deficient and that antiquated drinking water and wastewater systems pose risks to public health. Meanwhile, Americans' international peers enjoy more efficient and reliable services, and their public investment in infrastructure is on average nearly double that of the United States.

U.S. Innovation and Economic Recovery

During his campaign, Donald J. Trump promised to focus on the issue, and debate has since intensified over how to improve the nation's infrastructure. Skeptics of federal spending have pushed for new models of private sector involvement, arguing that it is more efficient and cost-effective. Others argue that increased public spending will be necessary to meet the country's growing needs and ensure that development is in the public interest.

How important is infrastructure to the U.S. economy?

Economists argue that robust investment in infrastructure in the twentieth century set the foundation for the nation's strong growth in the aftermath of World War II. And as engineer and historian Henry Petroski explains in his book *The Road Taken: The History and Future of America's Infrastructure*, poor infrastructure can impose large costs on the U.S. economy. In addition to the threat to human safety of catastrophic failures like bridge collapses or dam breaches, inadequately maintained roads, trains, and waterways cost billions of dollars in lost economic productivity.

Many analysts say that investing in both new infrastructure and current maintenance would positively impact the economy in a number of ways. By increasing efficiency and reliability and lowering transportation costs, it would boost long-term U.S. competitiveness and insulate the economy from shocks. It would also directly add demand and employment, as some fourteen million workers, or 11 percent of the total U.S. labor force, are currently employed in infrastructure-related sectors, according to the Brookings Institution.

Economists generally see infrastructure spending as having a significant "multiplier effect," though estimates differ. A 2014 University of Maryland study found that infrastructure investments added as much as \$3 to GDP growth for every dollar spent, with a bigger effect

during a recession. Global consulting firm McKinsey estimates that increasing U.S. infrastructure spending by 1 percent of GDP would add 1.5 million jobs to the economy.

What is the overall state of the nation's infrastructure?

The U.S. population has more than doubled since the 1960s, when most of the country's major infrastructure systems were designed. Many are reaching the end of their lifespan, and are dangerously overstretched, experts say.

The American Society of Civil Engineers (ASCE) has compiled regular "report cards" on the state of U.S. infrastructure since the 1980s. In its 2017 report, the ASCE finds that the nation's infrastructure averages a "D," meaning that conditions are "mostly below standard," exhibiting "significant deterioration," with a "strong risk of failure." The group estimates that there is a total "infrastructure gap" of nearly \$1.5 trillion needed by 2025.

Other analysts agree that the shortfall is large. The U.S. Department of Transportation (DOT) estimates that over \$800 billion is required just to shore up the nation's roads and bridges. McKinsey researchers say that \$150 billion per year will be required between 2017 and 2030 to keep abreast of all the country's infrastructure needs.

Transportation will require the largest chunk of funding needs. The DOT finds that one in four bridges are structurally deficient or not designed for the traffic they now support. While America's airports carry the most passengers of any country in the world, its aviation infrastructure is also overburdened, with some 20 percent of all arrivals and departures delayed, according to the DOT.

The country's rail systems are a mixed bag. U.S. commercial rail is among the most developed in the world, moving nearly 40 percent of the nation's goods, more than any other country. At the same time, the focus on freight rail has relegated passenger rail to a lower priority. According to the DOT, nearly a fifth of all passenger rail lines are in "poor condition."

The country's water and energy systems are under stress. The Environmental Protection Agency estimates that drinking water, wastewater, and irrigation systems will require \$632 billion in additional investment over the next decade. Ports and waterways, which handle over one-fourth of the country's freight transport, face mounting delays. The operators of the U.S. electrical grid are struggling to make the necessary investments, and increasing power outages are costing the economy billions of dollars.

New technologies are also posing challenges. The next generation of cell phone and wireless service will require [PDF] major investments in "small cell" wireless nodes, which are expected to replace traditional cell towers. Quickly advancing drone technology has the potential to revolutionize transportation, disaster response, and delivery services, but it also threatens to expose vulnerable infrastructure to attack or sabotage.

Meanwhile, experts warn of the "broadband gap," in which rural and low-income communities suffer from a lack infrastructure to deliver reliable, fast internet, referred to as broadband. A 2017 Brookings report on the state of the nation's internet access finds that a quarter of Americans live in "low subscription" neighborhoods, in which less than 40 percent of

residents have access to broadband. Less than 20 percent live in “high subscription” areas with broadband coverage of over 80 percent.

How does that compare internationally?

The United States generally lags behind its peers in the developed world. According to the World Economic Forum’s Global Competitiveness Report, in 2016 the United States ranked tenth in the world in a broad measure of infrastructure quality—down from fifth place in 2002. That places it behind countries like France, Germany, Japan, and Spain.

U.S. infrastructure performance suffers from its comparatively low quality, with consequences for businesses, workers, and travelers. Average commuting time in the United States, at forty-eight minutes per day, is well above that of its peers due to congestion and poor public transit; it is thirty-eight minutes in the United Kingdom and thirty-one minutes in Italy. U.S. passenger trains average just half the speed of Europe’s high-speed rails. Aviation industry rankings cited by Business Roundtable [PDF], a group of American CEOs, put only four U.S. airports in the top fifty worldwide, with the top-ranked coming in at number thirty....

When it comes to internet, the World Economic Forum ranks the United States nineteenth worldwide in broadband coverage. At the same time, Americans pay more than their European peers, and receive slower internet speeds. Some analysts attribute this to the lack of competition in most U.S. markets, which are often served by only one internet provider. Others argue that the incoherence of federal internet regulations discourages telecommunications companies from investing in better infrastructure, especially in rural areas where running broadband lines across vast distances is more expensive.

Much of the discrepancy between the United States and its peers can be traced to very different funding levels. On average, European countries spend the equivalent of 5 percent of GDP on building and maintaining their infrastructure, while the United States spends 2.4 percent. Other countries, including Australia, Canada, France, and the United Kingdom have also developed national infrastructure frameworks that allow the central government to direct and prioritize projects in a way that the United States’ more decentralized system has struggled to do.

How is U.S. infrastructure funded and financed?

The United States differs from most other industrialized countries in the extent to which it relies on local and state spending to meet its infrastructure needs. While most European countries fund the bulk of their infrastructure development at the national level, only 25 percent of U.S. public infrastructure funding comes from the federal government. That is down from a peak of 38 percent in 1977, leaving often cash-strapped local governments to bear more of the costs of investment and maintenance.

Washington’s primary mechanism for funding transportation infrastructure is through direct grants to states, paid out from the Highway Trust Fund (HTF), created in 1956 to fund the creation of the interstate highway system. The HTF raises money through the gas tax and other transportation-related taxes, and spends it on roads and highways (about 80 percent) as well as mass transit projects (about 20 percent). But analysts say that the HTF is facing

insolvency, and that without a rise in the gas tax (which has not been increased for over two decades) or other additional funding sources, it could run out of money as soon as 2021.

The federal government supports infrastructure in some indirect ways, through financing mechanisms or tax incentives. These include the 1998 Transportation Infrastructure Finance and Innovation Act (TIFIA), which provides low interest loans and other credit assistance that local governments can use to finance their infrastructure projects. The Congressional Research Service calculates that TIFIA has provided nearly \$25 billion in financing since its creation.

The federal government also supports the municipal bond market, which is what local governments mostly rely on to finance infrastructure projects. States and other municipalities issue bonds to raise money from private investors, and Washington gives these bonds a number of tax incentives. Most significantly, the interest on municipal bonds is exempt from federal taxes. The CRS estimates this costs the federal government some \$37 billion a year.

Finally, a small but growing number of infrastructure projects are being organized as joint efforts between government and private developers, known as public-private partnerships, or P3s. Under this model, private firms win a concession from the state to build infrastructure, say a highway, as well as the right to charge tolls or user fees on it in exchange for the responsibility of operating and maintaining it. P3s are much more popular in European countries partially because, experts say, the low cost of private financing via municipal bonds in the United States is often an easier and cheaper route for local governments to secure financing....

What are the proposals to improve the system?

Many observers argue that the United States will have to find ways to spend significantly more money to address its infrastructure deficit. Proposals to do so often break down along partisan lines, with Democrats backing more direct federal funding, whether financed by debt or higher taxes, and Republicans generally arguing that better results can be achieved at lower cost by encouraging more private sector development.

Many economists support raising revenue by increasing user fees, like tolls, or taxes on infrastructure usage. They argue that requiring users to shoulder more of the cost of the nation's infrastructure both raises revenue and encourages more efficient use of resources. At the federal level, the most common proposal is increasing the gas tax. (The Obama administration also unsuccessfully floated the idea of taxing drivers by the mile.) States could also increase the use of toll roads in order to raise revenue for road maintenance.

Cities like New York have considered following the example of their international peers, like London and Singapore, by imposing congestion pricing, or fees on cars entering certain parts of the city. New York's 2007 proposal would have reduced car traffic in Manhattan while raising funds that could be spent on upgrading the city's aging transit and other infrastructure. The New York State Assembly never approved the plan, however, and in general such user fees remain politically unpopular in the United States.

Another proposal that has seen some support in Congress is a national infrastructure bank. Such a bank would be a government-owned corporation and, like the TIFIA program, would provide cheap, long-term financing for infrastructure projects. Supporters argue that this could overcome the fractured nature of local spending, help coordinate developments that cross state borders, and give Washington greater ability to prioritize important projects; they point to the European Union's version of such a bank, the European Investment Bank, as evidence of this. Skeptics point out that municipal bonds already offer very cheap financing, especially with interest rates near record lows.

Some conservative and libertarian economists also worry about expanding the federal role, given what they see as a history of politically driven and economically wasteful federal infrastructure spending. Some argue that a steady flow of federal money gives states an incentive to build things they don't need and that they struggle to maintain. Others say that onerous regulations and complex approval processes slow down projects and raise costs, and that the federal government should work to reduce them.

JORDAN GOLSON, IT'S TIME TO FIX AMERICA'S INFRASTRUCTURE.

HERE'S WHERE TO START, - WIRED, JANUARY 23, 2015

PRESIDENT OBAMA BELIEVES America must build "21st century infrastructure—modern ports, stronger bridges, faster trains and the fastest Internet," and in his State of the Union this week he asked the Republican-controlled Congress to pass a bipartisan infrastructure plan, likely the trillion-dollar legislation Senator Bernie Sanders proposed earlier this month.

It's an ambitious plan that many agree is desperately needed.

The American Society of Civil Engineers says the US needs massive investments in all essential infrastructure, from bridges and airports to dams and railways. According to the society's most recent infrastructure report card, the US earns a D+ for its infrastructure. It is, in a word, a mess. This is about much more than potholes. This is about keeping the economy, literally and figuratively, moving. Much of the economic boom the United States has experienced over the last 50 years is because the network of highways makes it easy to ship goods. If it continues into a state of disrepair, the long-term hit to our economy could be catastrophic.

"The grades in 2013 ranged from a high of B- for solid waste to a low of D- for inland waterways and levees," the society wrote in the 2013 report, which is issued every four years. Things got a bit better, but not by much. "Solid waste, drinking water, wastewater, roads, and bridges all saw incremental improvements, and rail jumped from a C- to a C+. No categories saw a decline in grade this year." Bringing it all up to current standards will be a massive, and massively expensive, undertaking akin to the construction of the interstate highway system. At the bottom line, the US would have to invest \$3.6 trillion to bring it all up to snuff by 2020.

"Let's set our sights higher than a single oil pipeline," President Obama in the State of the Union, referring to the controversial Keystone XL oil pipeline. "Let's pass a bipartisan infrastructure plan that could create more than thirty times as many jobs per year, and make this country stronger for decades to come."

There's a lot of work to be done. Here's an overview of the American infrastructure that needs to be fixed, and some good places to start the work.

Highway Funding

In 2007, taxpayers spent \$146 billion on highways in the United States, with three-quarters of that coming from state and local governments and the rest from the feds. For major highway projects, federal funds are matched with state or local dollars, especially if the project benefits interstate travel. Much of highway investment comes from the Highway Trust Fund, funded by an 18.4 cent per gallon excise taxes on gasoline, and 24.4 cents per gallon on diesel. There are also revenues generated various taxes on trucks.

Unfortunately, highway fund revenues have been insufficient to fully fund existing highway spending, with Congress authorizing billions of dollars in transfers from the US Treasury's General Fund into the Highway Trust Fund to keep it solvent, including a \$10.8 billion transfer last August. It has ongoing funding needs that will continue unless a more permanent solution can be found, either by raising the national gas tax (which hasn't been increased since 1993), or some other funding measure. The Congressional Budget Office expects the Highway Trust Fund to have an annual shortfall of \$15 billion.

A number of solutions have been proposed including mileage-based fees on drivers, additional gas taxes, or simply pulling more money from the Treasury's General Fund. And that's just for highways.

Falling Down Bridges

One in 10 bridges are deemed structurally deficient, meaning the bridge has a significant defect that requires reduced weight or speed limits. (It does not necessarily mean the bridge is unsafe.) Another 14 percent of the nation's 607,380 bridges are considered "functionally obsolete," meaning they are no longer suited to their current task because of overuse or a lack of safety features, yet are still in use.

This is not an academic issue. Just last week, an overpass collapsed on I-75 in Cincinnati as it was being dismantled, killing a construction worker and gravely injuring a truck driver. It remains to be seen if the collapse was due to the age and condition of the span, or was an unfortunate demolition accident, but it underscores the risks we face. More well known was the collapse of the I-35 West Mississippi River Bridge in Minneapolis seven years ago. Thirteen people were killed and 145 injured. The bridge had been deemed structurally deficient in 1990, though the collapse was attributed to a design flaw that was exacerbated by an increase in bridge load over time.

"For many years we have underfunded the maintenance of our nation's physical infrastructure," Sen. Sanders wrote in an op-ed earlier this week. "I will soon be introducing legislation for a \$1 trillion investment, over five years, to modernize our country's physical infrastructure."

Waterways

Inland waterways, including canals and rivers, move the equivalent of 51 million truckloads of goods every year—and half the locks are more than 50 years old. According to the ASCE, the problem is so bad that many barge operators have supported an increase in their fuel tax to increase funding to the Inland Waterways Trust Fund, the main user funding mechanism for construction and rehabilitation of inland waterways. So, what needs to be done?

The US Army Corps of Engineers, which maintains most of the system, says it will take \$13 billion through 2020, with 27 percent of that going towards new lock and dam facilities and 73 percent toward improving existing facilities. Without an increase in funding, it could take the Army Corps until 2090 to finish everything on the to-do list.

The Olmstead Lock Project on the Ohio River, estimated at \$3 billion, has been one of the biggest drains on the Inland Waterways Trust Fund. Originally authorized by Congress in 1988 for \$775 million, the project isn't expected to be completed until 2020. It's the largest and most expensive inland water navigation installation in the country.

Before legislation introduced last year, the project absorbed almost all of the Trust Fund, though now Congress has separately appropriated funds to pay for the project, freeing up cash for other overdue projects.

Ports, Harbors, and Dams

Then there are the hundreds of commercial ports and harbors. But it's not the cargo terminals that need upgrading—those have seen significant investment as shipments in standardized containers have risen over the past couple of decades. Instead, it's the navigation channels that need upgrading, and taxpayers foot that bill. To handle the New Panamax ships—which, at 1,200 feet long and 161 feet wide, are the largest capable of navigating the new locks being built in the Panama Canal—navigation channels as deep as 45 feet will need to be dredged.

The ASCE cites the Port of Savannah, in Georgia—the fourth busiest in the country—as needing improvement, claiming that deepening its channels by just six feet will reduce the cost of shipping in and out of the port by 15 to 20 percent.

Our dams are equally in need of investment and upgrades. In 2012, nearly 14,000 dams were considered a high-hazard, where failure of the dam would likely cause the loss of life. They're not necessarily unsafe, but if they were to fail, very bad things would result. Complicating matters, just 4 percent of the nation's 84,000 dams are owned and operated by the federal government; the rest are managed by state governments, regional authorities or private entities like utility companies. These dams are overseen by state, rather than federal, safety

programs, many of which lack sufficient funding. South Carolina, for example, has one full-time inspector and one half-time inspector to inspect the state's 2,380 dams.

They're also frightfully expensive to maintain. The US Army Corps of Engineers says it will take more than \$25 billion to do all of the maintenance required at the 694 dams it manages, and without an infusion of cash it will take 50 years to complete the repairs. According to the Association of State Dam Safety officials, rehabilitation of all dams categorized as high-hazard would cost some \$21 billion.

"For the U.S. economy to be the most competitive in the world, we need a first class infrastructure system" said the ASCE report. "We must commit today to make our vision of the future a reality—an American infrastructure system that is the source of our prosperity."

Whether a Republican Congress and the Democratic President can actually get together and agree to do it is another question entirely.

