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The High-Speed Rail Money Sink

Why the United States Should Not Spend Trillions on Obsolete Technology

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EXECUTIVE SUMMARY

Secretary of Transportation Pete Buttigieg's proposal to make the United States a "world leader" in high-speed rail would add more than \$4 trillion to the federal debt for construction of new rail lines plus tens of billions of dollars of annual deficit spending to subsidize operating costs. In exchange, such a high-speed rail network is likely to carry less than 2 percent of the nation's passenger travel and no freight.

High-speed trains were rendered obsolete in 1958, six years before Japan opened its first bullet train, when Boeing's 707 entered commercial service; the airliner could cruise at more than twice the top speeds of the fastest scheduled high-speed trains today. Air travel cost more than rail travel in 1964, but average airfares today are less than a fifth of the average fares paid by riders of the Amtrak Acela, the only high-speed train operating in the United States.

The main disadvantage of high-speed trains, other than their slow speeds compared with air travel, is that

they require a huge amount of infrastructure that must be built and maintained to extremely precise standards. Since the United States is struggling to maintain the infrastructure it already has—particularly its urban rail transit systems and Amtrak's Northeast Corridor, which together have more than \$200 billion in maintenance backlogs—it makes no sense to build more infrastructure that the nation won't be able to afford to maintain.

Buttigieg's proposal is particularly poorly timed considering that the COVID-19 pandemic has made many people question mass transportation in general. One lesson of the pandemic is that the most resilient transportation system we have is motor vehicles and highways. Rather than funding an obsolete system we don't need, Buttigieg and Congress should find ways to relieve congestion, improve safety, and increase people's access to jobs and other economic opportunities by improving existing roads and building more highways that could be paid for with user fees.

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INTRODUCTION

Secretary of Transportation Pete Buttigieg wants to make the United States the “global leader” in high-speed rail.¹ That’s like wanting to be the world leader in electric typewriters, rotary telephones, or steam locomotives—all technologies that once seemed revolutionary but are functionally obsolete today.

High-speed trains were rendered obsolete in 1958—six years before Japan began operating its first high-speed “bullet” trains—when airlines started commercially operating the Boeing 707 jetliner, which cruised at 600 miles per hour (mph).² In comparison, Japan’s first bullet trains had a top speed of 130 mph.³ Today, the world’s fastest intercity trains have top speeds of about 250 mph.⁴ Since trains typically make multiple stops, their average speeds are much lower.

What made Japan’s trains appear feasible when they were introduced in 1964 was the fact that air travel cost more than rail travel: in the United States, average airmiles per passenger-mile were more than twice average rail fares.⁵ In addition, three-fourths of all passenger travel in Japan was by train, so there was a ready source of customers.⁶

The situation in the United States today is completely different. Airmiles averaged 13.8 cents per passenger-mile in 2019.⁷ By comparison, Amtrak (the only operator of intercity passenger trains in the United States) fares averaged 35 cents per passenger-mile while fares on Amtrak’s high-speed Acela were more than 90 cents per passenger-mile.⁸ Amtrak carried only 0.1 percent of all passenger travel in the United States, so existing rail customers provide a minimal market for faster trains.⁹

In 2009, President Barack Obama proposed an 8,600-mile high-speed rail system.¹⁰ With 22,000 miles of high-speed rail routes, China is currently the global leader. If Buttigieg’s idea of becoming the world leader means building more than China, it would take a massive effort.

The International Union of Railways defines “high-speed rail” as new rail lines capable of going 250 kilometers per hour (155 mph) or

upgraded existing lines capable of going 200 kilometers per hour (125 mph).¹¹ Amtrak’s Northeast Corridor, between Boston and Washington, qualifies as “high speed” because it is an upgraded route whose trains can run as fast as 150 mph. Most other Amtrak trains are limited to 79 mph, but the company does have a few routes where trains can run 90–110 mph. A company called Brightline is building a route between West Palm Beach and Orlando that will be capable of running trains at 120 mph. This paper considers trains that go slower than 80 mph *conventional* and trains that go at least 80 mph but slower than high-speed trains *moderate-speed*.¹²

This paper looks at the pros and cons of high-speed rail in general and specific high-speed rail plans for the United States in particular. It also reviews the results of the Obama administration’s high-speed rail spending. Finally, it suggests what Congress or the Department of Transportation should do instead of funding high-speed rail lines.

THE CASE AGAINST HIGH-SPEED RAIL

Several high-speed rail plans for the United States have been introduced in the past two decades. Obama’s 8,600-mile plan consisted of routes in six disconnected networks in the Northeast, South, Florida, Midwest, California, and Pacific Northwest.¹³ In 2010, Obama presented a revised plan that included several additional routes, including Phoenix–Tucson, Cheyenne–El Paso, and Minneapolis–Duluth, for a total of about 12,000 miles.¹⁴ In 2020, the U.S. High Speed Rail Association (USHSR) released a plan consisting of 17,000 miles of true high-speed rail (220 mph) in a single, fully connected network serving 43 states, supplemented by 11,000 miles of moderate-speed rail (110 mph) reaching those 43 states plus five more.¹⁵

At 22,000 miles of high-speed rail routes, China has roughly twice as many miles as the rest of the world combined.¹⁶ For the United States to become the world leader,

as Buttigieg proposes, it would have to build even more miles of high-speed rail routes than the USHSR proposed. Here are 10 reasons all these plans are bad ideas.

1. High-Speed Rail Is Too Expensive

California has spent an average of more than \$100 million per route-mile building 220 mph track on flat land.¹⁷ The latest estimates project that the entire 520-mile route will cost \$100 billion, of which \$20 billion is for 120 miles of flat land and \$80 billion is for 400 miles of hilly or mountainous territory.¹⁸ That works out to \$200 million a mile for hilly areas.

At these costs, Obama's original high-speed rail plan would require well over \$1 trillion, while the USHSR's plan would need well over \$3 trillion. Building a system longer than China's would cost at least \$4 trillion.

High-speed rail proponents are likely to predict lower costs, but costs always end up being higher than originally projected. In 1999, the 520-mile Los Angeles–San Francisco line was projected to cost \$25 billion.¹⁹ The most recent projection is \$100 billion.²⁰ Even after adjusting for inflation, costs have nearly tripled. Cost overruns are typical in other countries as well. Britain's 345-mile London–Scotland HS2 high-speed rail line was originally projected to cost £32.7 billion (about \$123 million per mile) and is currently expected to cost £106 billion (\$400 million per mile).²¹ Even Japan's original bullet train had a nearly 100 percent cost overrun.²²

Once built, high-speed rail systems are expensive to maintain. Long-run capital renewal requirements include replacement of rails and trainsets as frequently as every 10 years. Transit agencies in the United States currently have a \$176 billion maintenance backlog, mostly for rail infrastructure.²³ A country that can't keep its urban rail systems in shape is not likely to keep even more expensive high-speed rail lines running.

Rail planners often ignore these capital replacement costs. The California High-Speed Rail Authority is legally required to earn enough revenues to cover its operations and

maintenance costs. The agency's business plans estimate future capital replacement costs (which it calls "lifecycle costs"), but when it projects the future profitability of the project, it only counts operations and maintenance costs, not lifecycle costs, against the revenues.²⁴ This means taxpayers will be on the hook to cover those costs even in the unlikely event that the system manages to cover its operations and maintenance costs.

Passenger revenues probably won't even cover operating costs. Amtrak claims that the Acela, its high-speed train between Boston and Washington, covers its operating costs, but it doesn't count its second-largest operating expense: depreciation. By ignoring depreciation, Amtrak has managed to build up a \$52 billion maintenance backlog in the corridor.²⁵ If Amtrak's high-speed rail corridor through the most heavily and densely populated region of the country can't pay for its operating costs, then no other corridor will be able to do so either.

Where all this money will come from is even more problematic. In 2008, California voters agreed to allow the state's high-speed rail authority to sell \$9 billion worth of bonds without identifying any source of revenues to repay those bonds. The authority's original business plans anticipated that private investors would be willing to offset as much as \$7.5 billion of the construction costs in exchange for being able to profitably operate the line, but no investors have been willing to risk their money based on the state's projections that the line can operate at a profit.²⁶ The state also hoped to sell carbon credits to help pay for the line, but revenues fell well short of expectations.²⁷ Beyond this, California hopes for more federal funding, all of which would come from deficit spending.

Proponents often compare their high-speed rail ambitions with the Interstate Highway System, yet that system cost far less to build and didn't require any deficit spending. The 48,500 miles of interstate highways connect every state and every major urban area in the contiguous United States.²⁸ Constructing the

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“Unlike highways and airports, which are shared by passenger, freight, and national defense vehicles, high-speed trains can only be used for passengers, making them far less cost-effective.”

system cost about \$530 billion in present-day dollars, making the average cost of \$11 million per mile well below that for high-speed rail.²⁹ If built today, it might cost a little more but would still be less than a fifth of the cost, per mile, of high-speed rail lines.

Federal gas taxes and other highway user fees covered nine-tenths of the cost of interstate highways; state highway fees paid for the rest. The interstate system was also built on a pay-as-you-go basis, with no bond sales or other debt financing.³⁰ Since high-speed train ticket revenues are not likely to cover operating costs, much less capital costs, all of the construction cost would come from deficit spending.

While interstates make up only 1.2 percent of highway miles in the United States, they carry close to 20 percent of all passenger-miles and at least 16 percent, and probably closer to 20 percent, of freight ton-miles.³¹ In contrast, even the most extensive high-speed rail networks would carry less than 2 percent of passenger-miles and no freight. One projection by high-speed rail proponents estimated that Obama's 8,600-mile high-speed rail plan would carry 25 billion passenger-miles per year, which is less than 0.5 percent of all passenger travel in the country.³² Since the routes in the Obama plan were the ones most likely to succeed, doubling or tripling high-speed rail miles would result in less than double or triple passenger-miles. Thus, it is unlikely that high-speed trains would ever carry as much as 2 percent of passenger travel. Because of the lightweight equipment required for high-speed trains, such trains are incompatible with heavy freight trains for safety reasons, so such routes would carry zero freight.

2. Dedicated Infrastructure Is Wasted Infrastructure

Unlike high-speed trains, motor vehicles and aircraft required only incremental expansion of the infrastructure they used. In 1900, when the United States had only 8,000 registered automobiles, the country already had 2.3 million miles of road, mostly unpaved, for

them to drive on.³³ As autos became more popular, gas taxes and other fees paid by auto users covered the costs of paving roads and expanding the highway network. Similarly, when the first planes went into commercial air service, they could land in any open field. As air travel became more popular, airlines used their profits and air ticket fees to improve airports and air terminals.

In contrast, high-speed trains require that the high-cost infrastructure be put in place first. Moreover, unlike highways and airports, which are shared by passenger, freight, and national defense vehicles, high-speed trains can only be used for passengers, making them far less cost-effective. The incremental nature of highways and air travel made it possible to build infrastructure as revenues were collected without a serious risk to taxpayers that the projects would fail.

The differences in infrastructure requirements explain why air travel costs so much less than rail travel. For most of the lengths of their journeys, the only infrastructure modern airliners require is air traffic control. High-speed trains require extensive infrastructure that must be built and maintained to highly precise standards.

The requirement for dedicated, high-cost infrastructure is a problem common to the pipe dreams of many mass transportation enthusiasts, whether they are promoting light rail, monorails, maglevs, hyperloops, or personal-rapid transit. These systems are all far more expensive to build than highways and can't do nearly as much.

3. It's an Energy Hog

The USHSR has claimed that a single gallon of fuel can move an entire high-speed train 6,600 miles, or all the way from New York to Los Angeles and back.³⁴ This is nonsense unless the organization means “one gallon of lubricating oil plus 250 megawatts of electricity.” Most other claims about high-speed rail's energy efficiency are similarly misleading or wrong.

It takes a lot more energy to move a train at 220 mph than to move one at conventional

speeds of 60–80 mph. “The power required increases with the cube of the train speed,” notes engineering professor Alan Vardy.³⁵ To partially make up for this cube law, high-speed trains are built especially light, but they still require more energy to move. The East Japan Railway Company, which operates both high-speed and conventional trains in Japan, says that moving a high-speed train car one kilometer requires 57 percent more energy than a conventional train car.³⁶

Most high-speed trains are powered by electricity, which brings up another inherent inefficiency. Because of losses in generation and transmission, electrical generation plants must consume three units of energy (such as British thermal units, or BTUs) to deliver one unit to customers.³⁷ Most estimates of high-speed-train energy consumption are based on the energy delivered to the train, not the energy required to generate that power.

Many comparisons of the energy efficiency of high-speed trains with planes assume both are equally full. But, prior to the pandemic, airlines filled 85 percent of their seats while Amtrak filled only 51 percent of its seats.³⁸ That’s because most airline flights are non-stop, so the airlines can base the size of the plane on the projected demand for each individual route. Most passenger trains, however, make many intermediate stops, and the trains must be sized to meet the maximum demand along the route. As a result, many trains tend to be relatively empty for much of their journeys, greatly reducing their energy efficiency.

Rail proponents also generally assume that competing modes will be no more energy efficient in the future than they are today. In fact, the Department of Energy says that airliner fuel economy has improved at the rate of 2.9 percent per year since 1970 while intercity passenger trains have improved at only 1.7 percent per year.³⁹ Because airplanes are not tied to one type of infrastructure the way high-speed trains are, they can make improvements much faster than railroads.

The biggest factor working against the energy efficiency of high-speed rail is the huge

amount of energy required to build it as well as to periodically replace infrastructure such as rails and power facilities. Airports are practically the only infrastructure required for airlines, but high-speed rail lines need mile after mile of roadbed, ties, rails, power supplies, signals, and stations to operate. Even if high-speed train operations used somewhat fewer BTUs per passenger-mile than airlines, the high energy costs of building and replacing infrastructure would more than make up for that savings.

High-speed rail construction also releases a huge amount of greenhouse gases, particularly for concrete ties, steel rails, and other construction materials. One study predicted that building California’s 520-mile line would release 9.7 million metric tons of greenhouse gases, or 18,650 tons per mile. Assuming that California’s high-speed trains would fill, on average, 50 percent of their seats, the study estimated that operating those trains would reduce greenhouse gases but that it would take 71 years to repay the construction cost.⁴⁰ Since rails, concrete ties, and other infrastructure must be replaced or rebuilt every 30–40 years—and even more frequently on lines with frequent train service—and since such replacements would require the release of more greenhouse gases, the savings would never make up for the cost.

Even if we ignore construction emissions, high-speed rail does not appear to offer any environmental benefits. Outside of the West Coast and a few other states, most of the electricity that would power U.S. high-speed trains is generated by burning fossil fuels, so rail wouldn’t significantly reduce greenhouse gas emissions at all. While green-energy advocates hope to eventually replace fossil fuels, adding trains to electrical demands would simply increase the time and effort required to build a non-fossil-fuel electrical system.

4. It’s Slow

Jetliners typically cruise at 500–600 mph. Of course, takeoffs and landings are slower, resulting in slightly lower average speeds. But

“Building California’s high-speed rail line would release 18,650 tons of greenhouse gases per mile; any operational savings would require 71 years to repay this cost.”

“Asian and European high-speed trains gained most of their riders from conventional trains, not autos or airplanes. The United States doesn’t have enough conventional train riders for high-speed rail to succeed.”

high-speed train average speeds are also a lot lower than the 220 mph or so top speeds that proponents like to trumpet. Part of the reason for the slower train speeds is that they need to slow down in places for safety reasons and for intermediate stops. Amtrak’s Acela may have a top speed of 150 mph, but between New York and Washington, its average speed with stops is barely half that, and even the one nonstop train averages only 90 mph.⁴¹ In other countries, average speeds are typically about 70–80 percent of top speeds, so trains with top speeds of 220 mph may have average speeds of around 150–175 mph, which is well below the average speed of airliners.

Rail advocates argue that rail downtown-to-downtown times are competitive with planes, but this is only important where there are lots of downtown jobs. New York has 1.9 million jobs near Penn Station, and Washington, DC, has more than 400,000 jobs near Union Station, so this argument may be valid in this corridor. But the jobs in most other American cities are far more dispersed, with an average of 8 percent of urban jobs located in central city downtowns, where many train stations would be located.⁴² Many major cities are also served by multiple airports, and when all the jobs and residences near those airports are counted, they can greatly outnumber those located in or near downtown. The areas around the Los Angeles, Long Beach, and Burbank airports, for example, have twice as many jobs as downtown Los Angeles.⁴³

The biggest factor slowing down air travel is the time required to get through airport security. Yet, security systems can be streamlined for a lot less than it would cost to build high-speed rail. For a modest fee, for example, the Transportation Security Administration’s PreCheck program allows frequent travelers to swiftly bypass many security steps.⁴⁴

If high-speed rail ever became a significant mode of travel, it also would require security systems. Wait times to pass through security to ride the Eurostar from London to Paris, for example, can sometimes be 30 minutes or more.⁴⁵

5. It Doesn’t Go Where You Want to Go

The Obama administration’s 8,600-mile high-speed rail network was really designed as six different and disconnected systems. Even within each system, the routes were incomplete: travelers could get from Chicago to St. Louis and from St. Louis to Kansas City, but there was no planned direct route from Chicago to Kansas City.

USHSR’s proposed high-speed rail system would correct only a few of these problems. It still doesn’t include, for example, a 220 mph route from Chicago to Kansas City. The 220 mph network misses several urban areas with more than 500,000 people, and even the 110 mph system skips many urban areas with more than 100,000 people.

People driving on an interstate freeway can get off the freeway at any exit and access the nation’s other 4.1 million miles of roads. Once rail passengers arrive at a station, they must find some other mode of travel to reach their final destinations, greatly reducing the convenience of the system.

6. It Won’t Get Many People Out of Cars or Planes

The most heavily used high-speed rail lines in the world, including those in China, Europe, and Japan, gained their riders from conventional trains, not from autos or airplanes. The United States doesn’t have enough conventional train riders for high-speed rail lines to succeed.

When Japan opened its first high-speed rail line in 1964, nearly 70 percent of passenger travel was by rail and only 12 percent by automobile. Although Japan’s lines are considered highly successful, today only 25 percent of passenger travel is by rail and nearly 70 percent by auto.⁴⁶

The three European countries with the most high-speed rail lines are France, which opened its first high-speed rail line in 1981; Germany, which opened its first in 1991; and Spain, which opened its first in 1992. Since then, all three have built many lines, with Spain’s system extending the most miles. Yet,

as shown in Figure 1, none have seen rail reduce automobile or airline travel. At most, money-losing high-speed rail lines reduced the market share of profitable bus lines.

Rail advocates sometimes claim that the opening of high-speed rail lines has led to a reduction of air service in those corridors, as if the replacement of profitable airlines with unprofitable trains is to be applauded. But the reality is that air travel in Europe has massively increased thanks to the introduction and expansion of low-cost air carriers. While data sources are inconsistent for earlier years, between 2010 and 2019, air travel grew 260 percent faster than rail travel in France, 63 percent faster in Germany, and 56 percent faster in Spain.

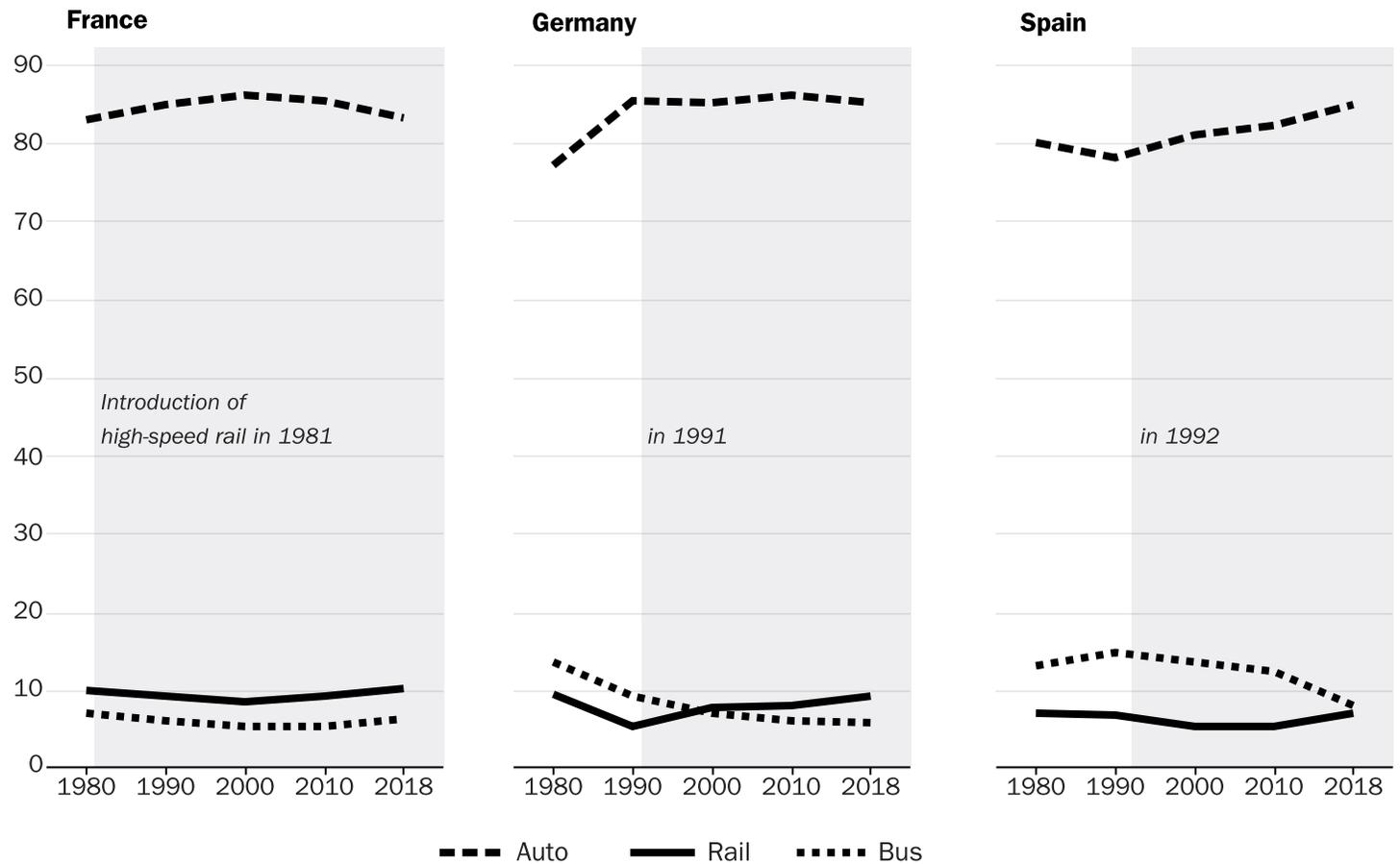
Information available about China is not as detailed as about Japan or Europe, but

automobile ownership in China is growing much more rapidly than rail ridership. In 2005, China had 21.3 million passenger cars.⁴⁷ By 2019, this had increased by more than 10 times to 340 million, a growth rate of 19.2 percent per year. By comparison, rail ridership has been growing at only a third of that rate, or 6.4 percent per year. While China still has fewer cars per capita than the United States, it has more total motor vehicles.⁴⁸ The rapid growth in auto ownership is likely mirrored by a similar growth in driving, showing that high-speed trains are not reducing auto driving. To enable these motor vehicles to travel around the country, China has built 40 percent more miles of freeways than the United States.

In both Asia and Europe, aggressive construction of new high-speed rail lines has failed

“High-speed rail has not prevented auto ownership in China from growing at 19.2 percent per year while rail travel is growing at only 6.4 percent per year.”

Figure 1
Auto, rail, and bus travel share (percentage)



Sources: 1980 data from *Panorama of Transport: Statistical Overview of Transport in the European Union, Data 1970–2000* (Luxembourg: Office for Official Publications of the European Communities, 2003), pp. 73–75; and later data from “Modal Split of Passenger Transport,” Eurostat, https://ec.europa.eu/eurostat/databrowser/view/t2020_rk310/default/table?lang=en.

“Driverless cars will sharply reduce the time-cost of auto travel before the United States can build much of a high-speed rail network.”

to make a dent in driving or flying. At best, it has slowed the decline of the importance of rail travel in those regions. But if the goal is to save energy, reduce greenhouse gas emissions, or achieve other social goals, building cars that are more energy efficient would do more than building high-speed rail.

7. There Is No “Sweet Spot”

A fundamental precept behind high-speed rail is that there is a “sweet spot” of distances between cities in which high-speed rail will thrive as the distance is supposedly too long for auto travel and too short for air travel. The Federal Railroad Administration, for example, claims that this sweet spot is between 100 and 600 miles.⁴⁹ This claim is entirely speculative, and there is no evidence that it is true. On one hand, many short-distance routes are served by numerous airliners each day. On the other hand, the distances people are willing to routinely drive continue to grow.

Before the pandemic, at least 35 to 45 flights per day (depending on the day of the week) flew the 240 miles between Dallas and Houston, and nearly that many are going today. Most of these flights are provided by Southwest Airlines, which doesn’t use a hub-and-spoke model, so many if not most of the people on those flights were only going between Dallas and Houston.⁵⁰ Similarly, Alaska Airlines had about two dozen flights a day each way between Seattle and Portland, whose airports are less than 170 miles apart. Both Portland and Seattle are hub cities for Alaska Air, so many if not most travelers on these planes were not connecting with other planes.

Amtrak often brags that it carries more people than the airlines carry between New York and Washington, which are 230 miles apart. But it admits that it really has only 6 percent of the intercity travel market in the Northeast Corridor, with airlines carrying about 5 percent and the other 89 percent going by highway.⁵¹

The coronavirus has increased people’s willingness to take long auto trips as an alternative to mass transportation. At the same

time, driver-assist systems such as adaptive cruise control are making driving less stressful and increasing people’s tolerance for such long trips. With the livery service Waymo having self-driving cars for hire in the Phoenix area and Ford, GM, and Tesla working hard to catch up, the time-cost of auto travel is likely to sharply decline before the United States can build much of a high-speed rail network.

8. It Won’t Help and May Hurt the Economy

Studies have found that high-speed trains can generate new economic development near the stations where the trains stop. However, the same studies show that economic development slows in communities not served by such trains. On a nationwide basis, high-speed rail is thus a zero-sum gain: as a study of the proposed California high-speed rail line concluded, “The economic development impacts of the California HSR project are likely to be more redistributive than generative.”⁵²

The paper adds that if higher-density development is more productive than low-density development, then the high densities encouraged by high-speed rail might result in a net gain. However, the COVID-19 pandemic has led people to question claims that high-density development is needed for economic productivity and whether they want to live and work in such densities.

Realistically, to produce actual economic growth, new transportation infrastructure must generate new travel or shipping that wouldn’t have taken place without the infrastructure. The Interstate Highway System, for example, stimulated billions of passenger-miles of new travel and billions of ton-miles of new shipping that weren’t taking place before the highways were built.

To generate new travel, a new transportation system must be faster, more convenient, and less expensive than existing systems. High-speed rail fails all these tests, being slower than flying, less convenient than driving, and more expensive than both. On that last point, airfares average less than 14 cents per

passenger-mile,⁵³ and Americans spend an average of 25 cents a passenger-mile on driving,⁵⁴ while Amtrak fares for its high-speed Acela average nearly \$1 per passenger-mile.⁵⁵

Far from boosting the economy, most countries that have built high-speed rail systems have gone heavily into debt to do so. Even if the first lines make economic sense, political pressures demand that the countries build more and more lines that are less and less sensible. Financing these lines requires huge amounts of debt that can significantly harm the national economies.

China has built more miles of high-speed rail than any other country and has gone more into debt doing it. At the end of 2019, China's state railway had nearly \$850 billion worth of debt, and most of its high-speed rail lines aren't covering their operating costs, much less their capital costs. As a result, China is slowing the rate at which it is constructing new lines.⁵⁶

France's state-owned railroad has piled up debts of more than \$50 billion and has been repeatedly bailed out by the government. About half the debt is due to operating losses, and half is due to the expense of building new high-speed rail lines.⁵⁷

Spain has built its high-speed rail system with an availability-payment public-private partnership. Officially, the private partner has gone into debt by \$18.5 billion.⁵⁸ While the country is obligated to pay the private partner enough money to repay its debt, the debt isn't on Spain's books, which allows it to evade euro-zone debt limits.⁵⁹ If the EU changes its rules, however, Spain would be in serious trouble.

Japan provides an object lesson for what happens when a country has a rail debt crisis. In 1987, state-owned Japanese National Railways had a debt of \$550 billion (in today's dollars), much of it due to political demands to build money-losing high-speed rail lines.⁶⁰ The government privatized rail lines that were profitable, continued to subsidize those that weren't, and hoped to recover some of the debt by selling railway property.⁶¹ But Japan was in the midst of a property bubble—at its peak, the few hundred acres making up the

Tokyo Imperial Palace was estimated to be worth more than all the land in California.⁶² Government plans to sell former railway land contributed to the bubble's collapse, and the government ended up absorbing more than \$400 billion in railway debt. Together, these led to at least two decades of economic stagnation.⁶³

Despite having to absorb the losses from lines built before 1987, the Japanese government has continued to build more high-speed rail lines. Typically, the national government pays two-thirds of the cost while local governments pay a third, and the lines are then leased to private railroads for a fraction of what it would take to repay those costs.⁶⁴

9. It Takes Decades to Plan and Build

The California legislature created a high-speed rail commission to study the possibility of a rail line in 1994. Construction didn't begin until 2015.⁶⁵ At that time, the authority projected it would be able to begin operating high-speed trains from Los Angeles to San Francisco by 2028.⁶⁶ However, because of cost overruns and the pandemic, the authority now projects completion no earlier than 2033, nearly 40 years after planning began.⁶⁷ Not all high-speed rail lines may take this long, but two decades seems a likely minimum.

A lot will happen in two or more decades that could completely nullify the claimed benefits of high-speed rail. The pandemic is likely to reduce people's eagerness to use various forms of mass transportation even after most people are vaccinated.⁶⁸ Driverless cars will reduce the cost of travel time because people will be able to work, socialize, or enjoy entertainment while they travel in personal vehicles.⁶⁹ Electric aircraft could reduce the dollar and environmental cost of short-distance air travel.⁷⁰ These and other uncertainties make big-budget, high-risk projects even less likely to succeed.

10. A Source of Political Corruption

As with any megaproject, high-speed rail is a tempting target for people who would

“At the end of 2019, China's state railway had nearly \$850 billion of debt, mostly due to the cost of building and operating high-speed trains.”

“Even if a high-speed rail line from Los Angeles to San Francisco were successful, political pressures would demand that more lines be built to places such as Duluth where it could never make sense.”

illegally or unethically divert government dollars to their own political or economic gains. In 2011, a fatal high-speed train crash in China was attributed to design flaws and hasty construction.⁷¹ This contributed to China’s arrest and conviction of the state minister of railways, Liu Zhijun, for embezzlement, accepting bribes, and conspiring to murder someone who threatened to expose him.⁷²

In 1974, Kakuei Tanaka had been prime minister of Japan for only 2.5 years when he left office under a cloud of scandal and corruption and was eventually convicted for accepting bribes and directing government contracts to businesses in his prefecture.⁷³ One of the biggest projects he promoted was the Jōetsu high-speed rail line.⁷⁴ This line cost far more than Japan’s first bullet train, yet it carries only a quarter as many passengers.⁷⁵

Similar political pressures have already influenced high-speed rail plans in the United States. For example, the Obama administration’s revised, 2010 high-speed rail plan included a line to Duluth, Minnesota, which has only 120,000 people in its urban area. Not coincidentally, at the time the map was issued, the chair of the House Transportation and Infrastructure Committee was from Duluth.⁷⁶

Politics also influenced the California rail project. Many people wonder why California started building high-speed rail in the Central Valley, which has the fewest people along the route. The answer goes back to 2010, when the Obama administration gave California a high-speed rail grant. Rep. Jim Costa (D-CA) was running a tough re-election campaign, so Obama required that funds granted to California be spent in or near Costa’s district and allowed Costa to announce the grant instead of the secretary of transportation, who usually makes such announcements.⁷⁷ Costa won by only 3,000 votes, so the grant may have made the difference to his campaign.⁷⁸

An Archaic and Obsolete Technology

The Tokyo–Osaka high-speed rail line supposedly made money, but it was built

across fairly flat territory when construction costs were low and in a corridor with some 60 million people who did nearly all of their intercity travel by train. The United States has no such corridors.

High-speed rail is an obsolete technology because it requires expensive and dedicated infrastructure that will serve no purpose other than moving passengers who could more economically travel by highway or air. The United States should not make the same mistake as China, Spain, and other countries that have gambled their economies on this archaic form of travel.

THE OBAMA HIGH-SPEED RAIL EXPERIENCE

Given the growing momentum behind high-speed rail, it is instructive to review how well the last frenzied spending on intercity passenger trains worked. In 2009 and 2010, President Obama persuaded Congress to dedicate \$10.1 billion to high-speed rail projects around the country. Amtrak also received \$804 million for the Northeast Corridor.⁷⁹ To this the Department of Transportation added at least \$1.4 billion in other federal funds, including funds from the Transportation Investment Generating Economic Recovery (TIGER) grant program.⁸⁰ State governments, mainly California, added more than \$7 billion in matching funds.⁸¹

Nearly all of this money was spent in 10 different corridors. Outside of California, the funds were not expected to produce true high-speed trains but were expected to increase speeds and frequencies of service, leading to more riders.

Ten years and nearly \$20 billion later, almost nothing has been accomplished. One corridor saw speeds increase by half a mile per hour and frequencies increase from two to four trains per day. A couple other corridors saw speeds increase by 1–3 mph and service extended to two small towns in Maine. Overall, the nation has little to show for more than \$19 billion in federal and state spending.

California

The California High-Speed Rail Authority began construction on its Los Angeles–San Francisco project in 2015 despite knowing that it only had about \$10 billion in hand to complete a project that it then estimated would cost \$55 billion.⁸² Since then, projected costs have risen to as high as \$100 billion.⁸³

The one good thing that has come of the project is that it has proven that building high-speed rail costs a lot more and takes a lot longer than experts claimed. The \$10 billion spent so far has produced zero results. The one Amtrak train connecting Los Angeles with the Bay Area still trundles along at an average speed of less than 39 mph.⁸⁴ **Result: \$4 billion in federal funds and at least another \$6 billion state and local funds wasted.**

The Northeast Corridor

Amtrak received \$2.4 billion for its route between Boston and Washington, DC. Before spending this money, the fastest trains in the corridor took 2 hours and 46 minutes to go between New York and Washington and 3.5 hours to go between New York and Boston.⁸⁵ By 2019, the fastest trains with the same scheduled stops between New York and Washington took 2 hours and 49 minutes, a slowdown from 81.7 to 80.2 mph. The fastest trains between New York and Boston still took 3.5 hours, but there are fewer trains that are that fast.⁸⁶

Amtrak did introduce one train a day that runs nonstop between New York and Washington in 2 hours and 33 minutes in one direction and 2 hours and 35 minutes in the other direction.⁸⁷ The faster speed was due solely to making fewer stops and not to any improvements in the corridor. While that sounds like progress, it is still slower than Penn Central's nonstop trains in 1969, which took 2 hours and 30 minutes.⁸⁸

The real problem is that the Northeast Corridor has such a huge maintenance backlog that Amtrak, and the commuter railroads that use some of the tracks, need to spend \$52 billion just to keep it running.⁸⁹ Only after spending that much could any additional

billions be expected to actually improve service. This makes the corridor little more than a giant money pit. **Result: \$954 million of high-speed rail funds wasted.**

Chicago–St. Louis

Before spending high-speed rail funds, this route had four trains a day running at an average speed of 53 mph.⁹⁰ The state of Illinois received \$1.343 billion from the federal high-speed rail fund, plus \$46 million in TIGER funds, to speed up and increase frequencies between Chicago and St. Louis.⁹¹

The state spent much of this money double-tracking the line and improving grade crossings to allow trains to run at 110 mph. This certainly benefited Union Pacific, which owned the tracks and can now run more freight trains in the corridor. However, passengers haven't seen any benefit: the route still has only four trains a day running an average of 53 mph.⁹² **Result: \$1.389 billion wasted.**

The Pacific Northwest

Washington State received more than \$830 million to speed up trains between Seattle and Portland.⁹³ The state estimated that it could reduce the 3.5-hour journey by 10 minutes, effectively increasing speeds from 53.4 to 56.1 mph, which is still not anything close to high-speed rail. The state also promised to increase train frequencies.⁹⁴

Most of the time savings would not be from faster trains but from a reroute of trains over a shorter line in the Tacoma area.⁹⁵ The new line opened on December 18, 2017. Unfamiliar with the new route, the engineer of the very first train missed a sign telling him to slow down, and the train derailed from an overpass onto Interstate 5, killing three people.⁹⁶ The accident could have been prevented by the installation of positive train control, which Congress had required, but neither the state of Washington nor Amtrak had bothered to do so.

After the accident, Amtrak returned to the old schedule and still operates the same number of trains per day at the same speeds. **Result: \$809 million wasted.**

“Washington State spent more than \$800 million to save 10 minutes on Seattle–Portland trips, but the very first train crashed due to excessive speeding, and the schedules were returned to the slower speeds.”

“New York spent \$220 million to ‘decrease trip time’ between New York City and Buffalo; instead, average speed declined.”

Charlotte–Raleigh Service

In 2009, the state of North Carolina subsidized part of the cost of operating one of the two trains a day between Charlotte and Raleigh, the other one of which continued north to New York City. The trains took 3 hours and 12 minutes for an average speed of 54.1 mph.⁹⁷

North Carolina received \$719 million to improve this service.⁹⁸ As of 2019, the state subsidized three trains a day on top of the one that continued to New York with schedules sped up by 2 minutes, for an average speed of 54.6 mph. While this represented a modest increase in service, it hardly seems worth \$719 million, especially since a doubling of service resulted in less than a 50 percent increase in ridership between 2009 and 2019.⁹⁹

Result: *A small benefit for the \$719 million cost.*

Chicago–Detroit

Amtrak actually owns some of the tracks that it uses between Chicago and Detroit, the only place outside the Northeast where it owns its own infrastructure. In 2009, Amtrak operated four trains a day between Chicago and Detroit that went as fast as 56 mph, making the trip in 4 hours and 59 minutes.¹⁰⁰ Michigan received \$598 million in high-speed rail funds, plus \$4 million in other funds, to speed up trains in this corridor.¹⁰¹

Ten years later, Amtrak still operates four trains a day between Chicago and Detroit that go the same speeds they went in 2009.¹⁰²

Result: *\$602 million wasted.*

The Vermonter

With the help of subsidies from the state of Vermont, Amtrak runs one train a day from Washington, DC, to the town of St. Albans, whose population is less than 7,000. Within the state of Vermont (St. Albans to Brattleboro), the southbound train took 4 hours and 1 minute for an average speed of 45.1 mph southbound.¹⁰³ Vermont received a \$316 million high-speed rail grant plus \$18 million in other federal funds.¹⁰⁴ This allowed it to reduce the travel time by 14 minutes, increasing the

average southbound speed to 47.8 mph.¹⁰⁵

Result: *A trivial benefit for the \$334 million cost.*

Chicago–Quincy–Iowa City

In 2009, Illinois and Iowa received \$231 million in federal high-speed rail funds plus \$13 million in other federal funds to speed up trains between Chicago and Quincy and start new service from Chicago to Iowa City.¹⁰⁶ At the time, there were two trains a day between Chicago and Quincy, which required 4 hours and 23 minutes to make the 258-mile journey, an average of 58.9 mph.¹⁰⁷

Today, the two trains to Quincy average 59.3 mph, knocking a whole two minutes off their trip. The trains from Quincy to Chicago are one minute faster than in 2009. There are still no trains to Iowa City.¹⁰⁸ **Result:** *A trivial benefit for \$244 million.*

New York–Buffalo

With the help of subsidies from the state of New York, Amtrak runs four trains a day between New York City and Buffalo/Niagara Falls. In 2009, the fastest train in the 460-mile corridor took 8 hours and 35 minutes, for an average speed of 53.6 mph.¹⁰⁹

New York received \$187 million in high-speed rail funds plus \$33 million in other federal funds to “improve reliability and decrease trip times.”¹¹⁰ Today, the fastest train in the corridor takes 8 hours and 41 minutes, reducing average speeds to 53 mph. **Result:** *\$220 million wasted.*

The Downeaster

With the help of subsidies from Massachusetts and Maine, Amtrak runs five trains a day between Boston and Portland. In 2009, the trains took 2.5 hours to go 116 miles, for an average speed of 46.4 mph.¹¹¹

Maine received \$60 million in high-speed rail funds plus \$11 million in other funds to extend service north to the small towns of Brunswick (population: about 20,000) and Freeport (population: about 7,000).¹¹² The trains weren’t any faster in 2020 than they were in 2009.¹¹³ Amtrak says that

about 151 people a day got on or off the trains in Brunswick and Freeport in 2019.¹¹⁴
Result: *A trivial benefit for \$71 million.*

Where Did the Money Go?

After spending \$10.1 billion in federal high-speed rail funds, plus billions more in other federal, state, and local funds, the only train that was sped up by more than 2 mph serves the second-least populated state in the nation. Only one route saw an increase in frequencies, and that route gained only 33 percent more riders despite doubling from two to four trains a day. It would be hard for anyone to argue that any of this money was well spent.

THE REAL GAP

With growing recognition that China has become the United States' main economic and political competitor, many people point to China's high-speed rail system as evidence that the United States is "lagging behind."¹¹⁵ But the real transportation gap between China and the United States is not high-speed rail; it is freeways. China has about the same number of motor vehicles as the United States. But where the United States has about 67,000 miles of freeways and is adding fewer than 800 miles per year, China has 93,000 miles of freeways and is growing its system by more than 5,000 miles a year.¹¹⁶

China began building freeways before it began building high-speed rails, and it has built more miles each year and spent more money on new freeway construction (though less per mile) than on high-speed rail. Highway travel has grown faster than rail travel, and the highway system has become particularly important for freight, as it moves about 2.5 times as many ton-miles as rail lines.

The Value of Freeways

In 2007, an independent analysis calculated that the United States' Interstate Highway System that was built between 1956 and 1992 generated \$6 in economic productivity for every dollar that it cost, vastly increased personal

mobility, and saved the lives of around 5,000 people per year by taking traffic away from more dangerous local roads. For these reasons, it has been called "the best investment the nation ever made."¹¹⁷ Unlike many urban transit projects, whose goal is to get people to use one mode of travel instead of another, the interstate highways did more than simply get people to travel by one road instead of another road: the system produced new travel that wasn't taking place before the highways were built. Before the first interstates, Americans drove an average of about 4,000 miles per year. After the original system was substantially completed in 1980, Americans drove an average of 1,300 miles a year on the interstates plus 5,400 miles a year on other roads.¹¹⁸ That new travel represents people accessing more affordable homes, better jobs, a broader range of consumer goods, and increased social and recreational activities.

Unfortunately, auto opponents have demonized those economic benefits, calling them "induced demand," implying that new roads somehow force people to unwillingly drive on them.¹¹⁹ Even as they insist that spending money on transit or intercity trains will produce the same \$6 in benefits for every dollar spent, they object to new roads precisely because they produce such economic returns.

To be fair, since the United States already has 67,000 miles of freeways, there are probably diminishing returns to each additional mile. But even if those returns are only twice the cost of the roads, they are worth generating if the roads themselves can be financed by highway user fees. In contrast, no one expects transit projects or high-speed rail lines to pay for themselves, suggesting that they are not likely to return more economic benefits than their costs.

China's Expressways

At 3.7 million square miles, China is about the same size as the United States, which is 3.8 million square miles.¹²⁰ As recently as 1997, China's transportation network was largely undeveloped. Where the United

“After spending \$10.1 billion in high-speed rail funds on 10 corridors, the only train that was sped up by more than 2 miles per hour serves the second-least populated state in the nation.”

“China has about the same land area and same number of motor vehicles as the United States, yet it has built 40 percent more miles of freeways and is building new ones five times faster than the United States.”

States in 1900—before widespread auto ownership—already had 2.3 million miles of roads, China in 1997 had only 765,000 miles of road, 64,000 miles of which were unpaved. Fewer than 3,000 miles of the roads in China were freeways or expressways in 1997, both terms meaning limited access roads of four or more lanes.¹²¹

In a plan that was directly inspired by the economic success of America’s Interstate Highway System, China’s Ministry of Transport decided in 1995 to build 22,000 miles of expressways.¹²² The first ones opened in 1998, and China achieved the 22,000-mile target in 2005. Convinced that highways were driving the country’s economic growth, China increased the goal.¹²³ By 2014, China’s freeway miles exceeded those in the United States, and China continues to build new ones.¹²⁴

China will not stop building freeways anytime soon. The government’s latest plan calls for building 31,000 miles of new expressways by 2035.¹²⁵ Freeways aren’t the only roads China is building: by the end of 2019, the country had more than 3.1 million miles of roads of all types, a quadrupling since 1997.¹²⁶ This compares with 4.1 million miles of roads in the United States.¹²⁷

The urban road network around Beijing surpasses that of any American urban area. China has built seven expressways radiating from the city center and supplemented them with seven ring roads around the city—no urban area in America has more than four. The outermost ring around Beijing is more than 600 miles long.¹²⁸ In contrast to American highway critics who say that new roads merely induce more traffic, the Chinese more accurately see that the new roads enable more economic activity.

China may have more miles of high-speed rail lines than the rest of the world combined, but it has more miles of expressways than the mileage of all the railroads in the country and four times as many miles of expressways as miles of high-speed rail.¹²⁹ China pays for road construction with tolls and new vehicle taxes, while it divides fuel taxes between road

maintenance and non-transportation-related activities.¹³⁰ Meanwhile, it pays for its high-speed rail lines out of deficit spending. By the end of 2019, China’s State Railway Group Company had debts of nearly \$850 billion because of the cost of building and operating money-losing rail lines.¹³¹ As a result, many argue that the country should slow or halt construction of new high-speed rail lines.¹³²

The United States’ Freeway Shortage

The United States should not build more freeways simply because China has more. But there are several reasons why this country has a shortage of freeways. These include congestion, safety, and finance.

The Texas A&M Transportation Institute estimates that congestion in America’s 494 urban areas wasted 8.8 billion hours of travelers’ time and 3.3 billion gallons of fuel and cost \$179 billion in 2017.¹³³ In the post-pandemic world, increased numbers of people working at home will reduce morning congestion. However, one study found that telecommuters drive more miles per day than people who drive to work.¹³⁴ Since they tend to do this driving in the afternoons, the number of hours of congestion in the afternoons may grow.

Safety is an issue because urban freeways are the safest of all roads to drive on, and rural freeways are the safest rural roads. Highway engineers classify roads as *arterials*, *collectors*, and *local* roads and streets. Freeways are arterials, but so are other major roads, generally including roads with speed limits of 45 mph or more.

In 2019, 4.5 people in the United States died in traffic accidents for every billion vehicle-miles traveled on urban freeways, while 7.9 people died per billion miles on rural freeways. Non-freeway arterials, however, are some of the most dangerous roads in the country: 14.4 people died per billion miles in urban areas and 19.8 people in rural areas in 2019. Converting 1,000 miles of urban non-freeway arterials to freeways would save about 70 lives per year, while converting 1,000 miles of rural non-freeway arterials to freeways would save about 30 lives per year.¹³⁵

The financial reason to build new freeways is simple: new freeways, if located in the right places and priced properly, can pay for themselves. This is unlike high-speed rail or any passenger rail in the United States, which require both operating and capital subsidies. For the government to refuse to build new roads that can pay for themselves is to act as a monopolist with all the negative connotations that implies.

The main argument against building more roads is that such roads supposedly increase driving and so fail to relieve congestion. This argument assumes that the highway industry can generate more customers simply by building more roads, ad infinitum. That's obviously not possible. What is true is that new transportation facilities can create economic opportunities. If people take advantage of those opportunities, it generates economic growth. Somehow, roads are demonized for doing this while rail advocates insist we run trains that are half empty.

Highway opponents argue that making cities more compact and improving transit and intercity rail service will give people access to the resources they need without as much auto travel.¹³⁶ But this is a pipe dream. According to the University of Minnesota's Accessibility Observatory, even in New York, one of the most compact urban areas with the best transit service in America, the average resident can reach four or more times as many jobs in a 60-minute-or-less auto drive as a transit trip of the same length.¹³⁷

One argument against allowing more travel is that it uses energy and produces greenhouse gas emissions. But compact cities tend to be more congested cities, and that congestion wastes more fuel. According to the Department of Energy, people who live in densities of 10,000 to 25,000 people per square mile (densities found in such places as Chicago and San Francisco) drive about 16 percent fewer miles than people who live in densities of 1,000 to 2,000 people (typical of low-density suburbs). But the vehicles in the denser areas average about 17 mph while lower-density vehicles move about 26 mph. The department

also says that vehicles moving at 25 mph use 25 percent less fuel per mile as vehicles moving at 15 mph.¹³⁸ Thus, people living in denser areas may actually use more fuel than people in low-density areas. Since greenhouse gas emissions are proportional to petroleum fuel consumption, people in the denser areas also emit more greenhouse gases.

Aside from the arguments from anti-highway groups, the main obstacle to building new freeways or converting non-freeway arterials to freeways is an obsolete system of paying for roads. Fuel taxes made sense in 1956 because the costs of tolling were very high. Today's electronic tolling systems are almost as economical as fuel taxes and have several major advantages.

First, fuel taxes don't automatically adjust for inflation, and raising those taxes is always a political battle. Fuel taxes also fail to adjust for electric or other more fuel-efficient vehicles. In addition, existing fuel taxes go mainly to the states, while local governments rely heavily on property and other taxes to pay for road and street maintenance. Most importantly, fuel taxes fail to send appropriate signals to drivers about which roads are more expensive to drive on and similarly fail to send signals to highway agencies about where more road capacity may be needed.

Sending the right signals can help relieve congestion. Highways that use congestion pricing guarantee that travelers enjoy free-flowing traffic at any time of the day. Such congestion pricing should not be confused with cordon pricing, which is sometimes called congestion pricing, that simply charges a fee for crossing a line into a city or downtown area. Cordon pricing is a fundraising tool that doesn't really relieve congestion.

If fees are set to ensure that roads don't become congested, then roads that generate more fees than are needed to recover the costs of building and maintaining those roads send a signal that more roads could and should be built in that corridor out of the excess fees.

One way to build new freeways is to make them all toll roads. But if existing roads

“Roads are demonized for generating economic growth while rail advocates insist we run trains that are half empty.”

“High-speed trains are slower than flying, less convenient than driving, and more expensive than both.”

remain untolled, some people will avoid toll roads, thinking they can save money. A much better system would be to completely replace existing gas taxes, vehicle-registration fees, and tolls with a mileage-based user fee system. Such a system would allow all owners of roads—federal, state, county, city, or private—to charge fees to the people who use them. Oregon and other states are beginning to implement mileage-based user fees systems that protect people’s privacy even as the systems earn revenue to pay for roads.¹³⁹

If Secretary Buttigieg or members of Congress want to make the United States a world leader in transportation, they should focus on highways, not high-speed rail. One way to do so would be for Congress to adjust the formula for distributing highway

funds to the states to give a bonus to states that convert from fuel taxes to mileage-based user fees, provided that those user fees are dedicated to the roads.

CONCLUSION

High-speed rail is a costly and obsolete technology. It is slower than flying, less convenient than driving, and more expensive than both. Its environmental benefits are questionable at best, especially since both cars and airliners are becoming more fuel-efficient and less polluting every year. The United States does not need an expensive new infrastructure system that will take decades to build, carry relatively few passengers, and provide no improvements to freight service.

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