

Policy Analysis

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High-Speed Rail The Wrong Road for America

by Randal O'Toole

Executive Summary

In the face of high energy prices and concerns about global warming, environmentalists and planners offer high-speed rail as an environmentally friendly alternative to driving and air travel. California, Florida, the Midwest, and other parts of the country are actively considering specific high-speed rail plans.

Close scrutiny of these plans reveals that they do not live up to the hype. As attractive as 110- to 220-mile-per-hour trains might sound, even the most optimistic forecasts predict they will take few cars off the road. At best, they will replace for-profit private commuter airlines with heavily subsidized public rail systems that are likely to require continued subsidies far into the future.

Nor are high-speed rail lines particularly environmentally friendly. Planners have predicted that a proposed line in Florida would use more energy and emit more of some pollutants than all of the cars it would take off the road. California planners forecast that high-speed rail would reduce pollution and greenhouse gas emissions by a mere 0.7 to 1.5 percent—but only if ridership reached the high end of projected levels. Lower ridership would nullify energy savings and pollution reductions.

These assessments are confirmed by the actual

experience of high-speed rail lines in Japan and Europe. Since Japan introduced high-speed bullet trains, passenger rail has lost more than half its market share to the automobile. Since Italy, France, and other European countries opened their high-speed rail lines, rail's market share in Europe has dwindled from 8.2 to 5.8 percent of travel. If high-speed rail doesn't work in Japan and Europe, how can it work in the United States?

As megaprojects—the California high-speed rail is projected to cost \$33 to \$37 billion—high-speed rail plans pose serious risks for taxpayers. Costs of recent rail projects in Denver and Seattle are running 60 to 100 percent above projections. Once construction begins, politicians will feel obligated to throw good taxpayers' money after bad. Once projects are completed, most plans call for them to be turned over to private companies that will keep any operational profits, while taxpayers will remain vulnerable if the trains lose money.

In short, high-speed rail proposals are high-cost, high-risk megaprojects that promise little or no congestion relief, energy savings, or other environmental benefits. Taxpayers and politicians should be wary of any transportation projects that cannot be paid for out of user fees.

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Few people live or work downtown, so even a 200-mph downtown-to-downtown train won't take more than 3 or 4 percent of cars off the highways it parallels.

Introduction

Imagine walking a few blocks from your downtown San Francisco office and boarding a sleek, electrically powered train. Within a few moments, your train departs, on time, whisking you and hundreds of other passengers away at more than 200 miles per hour.

On board, you can have a drink in the bar car, chat with other passengers, or plug in your laptop and wirelessly surf the web. In barely more than two-and-a-half hours, after a journey of nearly 400 miles, you can disembark from the train in downtown Los Angeles.

This attractive fantasy is the picture that high-speed rail advocates want you to have in mind when you consider their proposals in California, Florida, the Midwest, and many other parts of the country. Viewed from a slightly different perspective, however, and fantasy looks more like a nightmare.

Imagine spending \$25 billion of public money building a high-speed rail line—not counting the interest on bonded debt or cost overruns, which together will quite probably double the cost to the public. When the line is completed, it is turned over to a private company that put up a relatively small amount of money—say, \$5 billion. If they can run it at a profit, they get all the profits. If they lose money, it will be up to the public to make up the difference so as not to waste the initial \$25 (or \$50) billion expense.

Taxes will be diverted to pay off the debt for some 30 years, after which the taxpayer might seem to be off the hook. But one of the dirty little secrets of passenger rail transportation is that most of the infrastructure—the trains, the rails, the electrical facilities, and the stations—must be completely replaced, rebuilt, or rehabilitated every 30 years. Of course, the private company running the trains won't have the money to do that, so it will be up to the public to find the money or suffer complaints about delayed trains and other mishaps.

Contrary to the apparent attraction of fast downtown-to-downtown travel times, the truth is that few people live or work in down-

towns anymore. As a result, even a 200-mile-per-hour train won't take more than 3 or 4 percent of cars off the highways it parallels. Instead, the main effect of this heavily subsidized train will be to put struggling (and relatively unsubsidized) short-haul airlines out of business.

Although the electrically powered train might be somewhat more energy-efficient and (if the electricity does not come from fossil fuels) less polluting than airplanes, the energy and pollution cost of constructing the rail line (which will require huge amounts of fossil fuels) will be so great that it will take decades of operational savings to pay back that cost. And, soon after those decades are finally up, it will be time to completely rebuild the line—at a high energy as well as fiscal cost.

In short, high-speed rail will require a huge amount of public money to build. The decision to build carries a huge risk both that the ultimate cost will be much greater than predicted, and that the ridership and other benefits will be lower—especially since the consulting firms hired to forecast those benefits expect to profit from rail construction. Once built, the environmental benefits will be miniscule and the main effect will be to reduce the availability of private, relatively unsubsidized modes of transportation.

From this perspective, high-speed trains look a lot less attractive than the architects' drawings featured on every rail brochure. The tens of billions of dollars that will be required to build all of the proposed high-speed rail lines in the United States could be much more effectively spent on things like schools, New Orleans levees, paying down the national debt, or—perhaps best of all—left in the taxpayers' pockets.

The Status of U.S. High-Speed Rail

Amtrak runs its Acela trains at speeds up to 135 miles per hour in the northeast corridor between New York City and Washington, DC. In one 35-mile stretch between New York and

Boston they speed up to 150 miles per hour.¹ Segments of Amtrak's *Southwest Chief*, between Chicago and Los Angeles, and its *Surfliners*, between Los Angeles and San Diego, reach speeds of 90 miles per hour.

Otherwise, the maximum speed for passenger trains throughout the United States is 79 miles per hour—and then only on routes with proper train control systems and whose grade crossings are fully protected by crossing signals and gates. Without these features, the maximum speed is no more than 59 miles per hour.

Rail advocates point to the much higher speeds attained by trains in other nations as evidence that the United States is “behind the times.” The train between Beijing and Tianjin, China, reaches speeds of nearly 220 miles per hour.² Starting in 2011, Japan plans to operate trains as fast as 200 miles per hour.³ Trains in France go faster than 185 miles per hour, while trains in Germany and Britain are nearly that fast.⁴

The Federal Railroad Administration sets national standards for regulating the maximum speeds on all rail lines in the nation according to the quality of the track and the sophistication of the train signaling systems. To go at successively higher speeds, rails must be maintained to increasingly strict standards.⁵

Most rail lines have signals that inform train crews if there are other trains ahead of them. Passenger trains on lines that have no signals are limited to 59 miles per hour. With signals, trains can go 79 miles per hour. Trains can only go faster if the railroad has installed automatic systems that will stop the train when necessary—even if the crew fails to stop the train.⁶

FRA rules also limit speeds based on grade crossings. For trains to go up to 110 miles per hour, crossings must have signals and gates. From 110 to 125 miles per hour, crossings are only allowed if they include an “impenetrable barrier” when trains approach. Above 125 miles per hour, no crossings are allowed.⁷

In 1991, Congress asked the FRA to designate up to five high-speed rail corridors, expanded to eleven in 1998.⁸ These corridors

are eligible for federal funding for planning and improvements such as the installation of grade crossing signals and guards, though the \$30 million available for such grants in 2008 will not go very far.⁹ The 11 “corridors”—one of which looks more like a spider web than a corridor—total more than 9,000 miles in length (Table 1).

In most of these corridors, the FRA has set a target top speed of 110 miles per hour. While this is more than the 59- to 79-mile-per-hour current limit in most corridors, high-speed rail aficionados do not consider 110 miles per hour, or even 125 miles per hour, to be true “high-speed rail.” The California legislature has defined *high-speed rail* as rail lines with a top speed greater than 125 miles per hour. “The reason for the 125 miles per hour threshold,” says the California Senate Transportation Committee, “is that existing passenger rail equipment can operate at this speed if the appropriate signaling technology is installed and the right-of-way meets a variety of design and safety standards.”¹⁰

The problem with increasing existing track speeds from 79 to 110 miles per hour or more is that the rails in nearly all of these corridors are privately owned by freight railroads such as BNSF, CSX, Norfolk Southern, and Union Pacific. Nominally, the railroads would benefit from such improvements, but since their freight trains would rarely need to go more than 79 miles per hour—60 is more typical—they see no reason to help pay for the expensive signaling and track maintenance required for the higher speeds. Moreover, a rail line running both 110-mile-per-hour (or faster) passenger trains and 60-mile-per-hour freight trains presents major operational problems that are not welcomed by the freight railroads.

Although the FRA has designated these corridors, the actual work of planning the high-speed rail lines is done by the states. State planners have taken two different approaches to rail service. In some cases, they have confined their work to improving grade crossings and keeping track of the up to 79-mile-per-hour standards or, in the Midwest, to boosting speeds on existing tracks to 110

High-speed rail aficionados define true high-speed rail as rail lines with a top speed greater than 125 miles per hour.

Table 1
FRA-Designated High-Speed Rail Corridors

Corridor	Endpoint Cities	Miles	Top Speed
California	Sacramento-San Diego	680	ns
Empire	New York-Buffalo	439	125
Florida	Tampa-Orlando-Miami	356	120
Gulf Coast	Houston-Atlanta with New Orleans-Mobile branch	1,022	110
Keystone	Philadelphia-Pittsburgh	349	110
Midwest	Chicago-Minneapolis, Chicago-Detroit, Chicago-Cleveland, Chicago-Cincinnati, Chicago-St. Louis St. Louis-Kansas City Indianapolis-Louisville	1,920 283 111	110 90 79
New England	Portland-Boston-Montreal	489	110
Northeast	Boston-Washington, DC	456	150
Pacific Northwest	Eugene-Vancouver, BC	466	110
South Central	San Antonio-Tulsa with Dallas-Little Rock branch	994	ns
Southeast	Washington, DC-Atlanta- Macon with Richmond-Hampton Roads branch	874	110

Source: "High-Speed Rail Corridor Designations," Federal Railroad Administration, 2005, tinyurl.com/6s94zd.
Note: ns = not specified.

miles per hour. The other approach, taken by planners in California and Florida, is to plan an entirely new rail network on which high-speed passenger trains would operate on separate tracks from freight trains.

Midwest Rail Initiative

In the late 1930s and early 1940s, steam-powered trains of the Milwaukee Road regularly operated at speeds of 100 to 110 miles per hour on portions of their trip between Chicago and St. Paul.¹¹ The Milwaukee and its competitors the Chicago & Northwestern and the Chicago, Burlington & Quincy each offered at least two trains a day that covered the length of this journey in six-and-one-half hours. Today, Amtrak trains take more than

eight hours over the same route. A rail network proposed by the Midwest Regional Rail Initiative would cut the Chicago-St. Paul trip times down to five-and-one-half hours.

State departments of transportation in nine Midwestern states formed the Midwest Regional Rail Initiative in 1996 in order to plan several high-speed rail lines. In 2004, these states published a report proposing a network of trains operating in eight major corridors with several branches.

Although the cover of the Midwest rail report features a photo of an electrically powered high-speed train in Europe, the report itself proposes conventional diesel-powered trains operating at speeds comparable to the 1930s Milwaukee Road trains. Specifically, the report proposed 110-mile-per-hour lines radiating from Chicago to Minneapolis, Green

The Midwest rail plan calls for incremental improvements to existing rail lines to boost speeds to as high as 110 miles per hour.

Bay, Detroit, Cleveland, Cincinnati, and St. Louis; 90-mile-per-hour lines from Chicago to Carbondale and Quincy and from St. Louis to Kansas City; and 79-mile-per-hour branches to Port Huron, Grand Rapids/Holland, and Omaha.¹²

The report estimated that it would cost about \$6.6 billion, or \$2.1 million per mile, to upgrade about 3,150 miles of track to the above speed standards. About \$1.1 billion more would be used to purchase 63 train sets that would cost between \$450 and \$500 million per year to operate.¹³

With stops, the proposal called for running trains an average of about 74 miles per hour, or about 40 to 45 percent faster than current Amtrak speeds.¹⁴ The plan also called for increasing the number of trains per day on all routes by three to six times.¹⁵

In return for this \$7.7 billion investment, the report projects that the Midwest rail system would carry about 13.6 million passengers per year, or about four times what the existing passenger rail system would carry.

The proposal also called for feeder buses that would connect such places as Staples, Minnesota; Sioux City, South Dakota; and Louisville, Kentucky to the rail system, the goal being to have 90 percent of the Midwest's population within an hour of a rail station or a half hour of a feeder bus station.¹⁶ However, the report did not estimate the costs of this bus service.

Although the proposal calls for charging fares of about 50 percent more than Amtrak's fares, it projects that many of the routes will not be able to cover their operational expenses until 2025. The report proposes to cover initial operating losses with a 35-year federal loan that would be repaid out of operating surpluses after 2025.¹⁷ The initial capital costs would have to be covered by federal and state funds with no expectation that they would ever be repaid out of passenger fares.¹⁸

Unlike the Florida and California plans reviewed below, the Midwest plan is not accompanied by a detailed environmental analysis, so it is hard to state whether or not the benefits of the rail lines justify the costs.

It is worth noting that Amtrak carries only a tiny share of travel in these corridors, so a quadrupling of Amtrak's numbers will do little to reduce driving or congestion.

For example, in 2007 Amtrak carried fewer than 450,000 passengers on its trains in the Chicago-Detroit-Port Huron corridor (not all of whom went the entire distance).¹⁹ By comparison, the Michigan Department of Transportation recorded 9 million vehicles on the least-used segment of Interstate 94—which parallels the Amtrak route—and four to six times that many vehicles on more heavily used segments.²⁰ In the unlikely event that every rail rider would otherwise have gone by auto over the least-used segment of the route, a quadrupling of rail ridership would take only 9 percent of cars off of this segment.

Just how cost-effective is the Midwest rail proposal? The total cost of \$7.7 billion (including trains) averages about \$2.4 million per mile of track. By coincidence, this is approximately the cost per lane mile of building rural freeways. For example, the Ft. Bend (Texas) Tollroad Authority recently completed a 6.2-mile four-lane highway, including on- and off-ramps, overpasses, and underpasses, for \$60 million, or about 2.4 million per lane mile.²¹

The average Midwest corridor is about 350 miles, so it is generous to assume that the average trip will be about 300 miles long. If there are 13.5 million trips per year, that's about 4 billion passenger miles over 3,150 miles of track. That represents about 1.3 million passenger miles per mile of track each year, or about \$1.85 of capital investment per annual passenger mile.

By comparison, the average rural interstate freeway in Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio, and Wisconsin moved 3.5 million people per lane mile in 2006, or about \$0.68 of capital investment per annual passenger mile.²² That makes highway construction almost three times as cost effective as rail improvements. In addition, properly tolled highways can pay for themselves, while the Midwest rail initiative requires billions in subsidies, making new highways much more cost effective, from a taxpayer's point of view, than rail lines.

New highways are, at the very least, three times more cost-effective at moving people than the Midwest high-speed rail.

The Florida High-Speed Rail Authority concluded that the “environmentally preferred alternative” was not to build a high-speed rail line.

The Florida High-Speed Rail Proposal

Florida voters passed an amendment to the state’s constitution in 2000 mandating the construction of a high-speed rail system capable of running trains faster than 120 miles per hour. In response, the Florida legislature created a High-Speed Rail Authority in 2002. However, the 2000 ballot measure provided no funding for the system, and when voters realized how expensive it might be, they repealed the measure in 2004.²³

Despite the 2004 vote, the state high-speed rail authority continued to plan for an initial 92-mile rail line between Orlando and Tampa. A 2005 environmental impact statement (EIS) estimated that this line would cost between \$2.0 and \$2.5 billion, or about \$22 to \$27 million per mile.²⁴ The line was projected to carry about 4 million passengers a year. In the unlikely event that all 4 million went the entire 92-mile route, the line would carry about 368 million passenger miles a year. That represents a minimum capital investment of \$5.40 per annual passenger mile.

The EIS considered several different routes and two different rail technologies: electric and gas/turbine. Electric trains could achieve maximum speeds of 160 miles per hour, while gas/turbine could only reach 125 miles per hour. Because of intermediate stops, the electric trains would only be five minutes faster (55 vs. 60 minutes) than gas turbine.²⁵ The gas turbine also cost less, so the state high-speed rail authority selected it as the preferred alternative.²⁶ The authority expected to contract out actual operation of the rail line to a company like Virgin Trains, a part of Richard Branson’s Virgin business group, which operates passenger trains in England and Scotland.²⁷

Planners estimated that the rail line would divert 11 percent of people who would otherwise drive between Orlando and Tampa.²⁸ Since most of the traffic on Interstate 4 between the two cities has other origins or destinations, the train would remove only about 2 percent of cars from the least-busy segment of

I-4, and smaller shares from busier segments.²⁹ Traffic on I-4 is growing by more than 2 percent per year, so the rail line would provide, at most, about one year’s worth of traffic relief. As the EIS itself noted, the traffic “reduction would not be sufficient to significantly improve the LOS [levels of service] on I-4, as many segments of the roadway would still be over capacity.”³⁰

The EIS also estimated that either the electric or turbine trains would produce more nitrogen oxide pollution than the cars they would take off the road. The gas turbine trains in the preferred alternative would also produce more volatile organic compounds than the cars they would take off the road.³¹

Further, planners calculated that operating and maintaining gas turbine trains would consume six times more energy, while maintaining electric trains would consume three-and-a-half times more energy, than would be saved if the cars were taken off the road.³² The EIS did not estimate the effects of the trains on greenhouse gas production. Since greenhouse gas emissions from fossil fuels are roughly proportional to energy consumption, and Florida gets more than 80 percent of its electricity from fossil fuels, either the turbine or electrically powered rail line would produce far more greenhouse gases than the cars it would take off the road.

The EIS concluded that “the environmentally preferred alternative is the No Build Alternative” because it “would result in less direct and indirect impact to the environment.”³³ The state high-speed rail authority has disbanded and the project is now mainly promoted by the Florida Transportation Association, which seems to be a consortium of consultants (such as Wilbur Smith Associates), contractors, and manufacturers (including Fluor and Bombardier) that would profit from rail construction.³⁴

California High-Speed Rail

The California high-speed rail proposal is the most ambitious government-endorsed

plan in the United States. Not content with either the FRA's 110-mile-per-hour plan or Florida's 125-mile-per-hour turbine trains, California is proposing 220-mile-per-hour electric trains, with service extending roughly 700 miles from Sacramento and San Francisco to San Diego.

The California legislature created a high-speed rail authority in 1996, and that authority published what it called a business plan in 2000, followed by an environmental impact statement in 2005. It has since published a more specific EIS for the San Francisco Bay Area segment of the line in 2008. To date, the authority has spent nearly \$58 million planning the project.³⁵

The 2005 EIS estimated that "the costs could range from \$33 to \$37 billion," or about \$47 to \$52 million per mile.³⁶ That is twice the per-mile cost of the Florida plan because of the higher speeds, the electrical infrastructure, and California's more mountainous terrain.

The business plan projects that passenger revenues will cover operating costs with enough left over to repay a small portion of the capital costs. The authority initially proposed to pay for the remaining capital costs with a quarter-cent sales tax.³⁷ But the California constitution requires a two-thirds supermajority to impose tax increases, and few thought this would be possible. So the authority's current plan calls for a combination of federal, state, local, and private funds.

In 2004, the authority proposed to ask voters to approve the sale of nearly \$10 billion in general obligation bonds to fund part of the project. Due to the state's budget problems, this vote was postponed to 2006, and then to 2008. California's budgetary problems are far from solved, but high-speed rail is on the ballot in November, 2008.³⁸

Even if voters approve these bonds, completion of the high-speed rail depends on getting additional funds from the federal government, private investors, and other sources. The federal government has its own deficits to deal with, and Congress does not have any sort of high-speed rail fund. Yet the authority hopes Congress will match or even slightly

exceed the state's investment in high-speed rail.

Private funds are even more uncertain. The authority hopes it can entice investors into providing \$5 to \$7.5 billion—slightly more than half the federal and state shares—in exchange for a contract to operate the rail system that would allow the private investors to keep all operating revenues.³⁹ This is a "public-private partnership" in the sense that the public puts up most of the money and the private partners get all of the operating profits. Of course, the private investors risk losing their share of the capital cost, but once built, if the rail lines end up losing money, the state is likely to feel obligated to cover the operating losses.

In terms of cost effectiveness, the California high-speed rail system is estimated to carry about 14.4 billion passenger miles per year.⁴⁰ At a minimum of \$33 billion in capital investment, that represents about \$2.30 of investment per annual passenger mile—well over three times the cost of rural freeway lanes.

One cost that is rarely, if ever, mentioned by promoters of passenger rail transportation is that of reconstructing and rehabilitating rail lines, which is needed about every 30 years. This cost has come to haunt the transit agencies that operate older urban rail systems throughout the country. In 2002, the Washington Metropolitan Area Transit Authority (WMATA) estimated that it needed \$12.2 billion—roughly the original cost of constructing Washington's Metrorail system—to rehabilitate the system.⁴¹ There is no money available to do this work, with the result that the system is experiencing frequent breakdowns and service delays.⁴²

Rail transit systems in Chicago, New York, and San Francisco also face fiscal crises. The Chicago Transit Authority is reputedly "on the verge of collapse," as it needs \$16 billion it doesn't have in order to rehabilitate its tracks and trains.⁴³ New York's Metropolitan Transportation Authority has a \$17 billion shortfall in its funding for rail rehabilitation.⁴⁴ Similarly, the San Francisco BART system faces a \$5.8 billion shortfall to replace worn-out equipment.⁴⁵

The California plan is a "public-private partnership" in the sense that the public puts up most of the money and the private partners get any and all operating profits.

The California plan made the unrealistic assumption that cars will be no more energy-efficient in 2030 than they are today.

California's business plan and EIS are characteristically silent on the question of who will pay for future rehabilitation costs: the public or the private investors that have (presumably) profited from the lines. In fact, neither plan even mentions that anyone will ever have to pay such costs—as far as readers can tell, once built, the rail lines and trains will last forever.

The 2005 EIS describes the benefits that federal and state taxpayers can expect from the \$25 billion or more they will be asked to pay for building this project. First, high-speed rail will take an average of 3.8 percent of cars off of the California highways that parallel the rail routes.⁴⁶ This means high-speed rail will do little to relieve highway congestion. If high-speed rail is not built, the EIS projects that 45 segments of major highways along the rail routes will be regularly congested to "level of service F" (meaning stop-and-go traffic); building rail will still leave 41 of those segments at level of service F.⁴⁷

For comparison purposes, the EIS includes an alternative that concentrates on building more highways and expanding airports instead of high-speed rail. This alternative, the authority notes, would cost more than twice as much as building high-speed rail.⁴⁸ But it also does more than five times as much to relieve traffic congestion as the rail alternative: while the rail alternative reduces congestion by 3.8 percent, the highway-air alternative reduces congestion by 20.6 percent.⁴⁹

The EIS's alternative plan is really a straw man. It is designed to be unpopular due to its expense, but the alternative does not provide either a fair or realistic comparison. To be fair, the authority could have developed a highway-air alternative that cost the same as high-speed rail to see how cost-effective rail is in comparison with highway and air improvements. To be realistic, the EIS should have recognized that, even if high-speed rail is built, California will still need to spend tens of billions of dollars to relieve highway congestion.

While high-speed rail does little to reduce highway traffic, it decimates California's in-state airline service. The EIS projects that, under its high-end rail ridership projections,

in-state air travel would decline by two-thirds.⁵⁰ The EIS says that the rail service would have only minor effects on connecting air travel—people flying in and out of California and connecting to or from a local in-state destination—but the airlines may not consider such service to be economically viable after losing two-thirds of their local customers.

High-speed rail has a negligible effect on energy consumption. The EIS estimates that construction of the high-speed rail lines will consume more than 150 trillion BTUs of energy.⁵¹ But the energy saved in operations is supposed to pay back this cost in just five years.⁵²

The EIS's energy analysis is flawed, however, by an assumption that autos and airplanes will be as energy intensive in the future as they are today.⁵³ In fact, under the Energy Independence and Security Act of 2007, cars on the road in 2020 will be 21 percent more fuel-efficient than they are today, and by 2030 they will be 33 percent more fuel-efficient. If fuel prices remain high, these projections may end up being conservative.

It is also reasonable to assume that airplane manufacturers will respond to high fuel prices by making planes more energy-efficient. Boeing, for example, promises that its 787 plane will be 20 percent more fuel-efficient than comparable planes are today.⁵⁴

If autos and airplanes become, over the life of the high-speed rail project, an average of 20 percent more fuel-efficient than they are today, then the payback period for high-speed rail rises to 25 years. This payback period also crucially depends on high-speed rail attracting the high number of riders that the authority has estimated. If ridership is lower, the payback period will be longer. And, since rail lines require expensive and energy-intensive reconstruction and rehabilitation about every 30 years, it is quite possible that high-speed rail will save no energy at all.

Steven Polzin, of the University of South Florida's Center for Urban Transportation Research, points out that autos and buses have relatively short life cycles, so they can readily adapt to the need to save energy or reduce pollution. "Modes where the vehicles and guide-

ways are integrated systems”—meaning rail—“may be far more difficult or expensive to upgrade to newer, more efficient technologies,” Polzin adds.⁵⁵ In other words, while the U.S. auto fleet completely turns over every 18 years and so can quickly become more fuel-efficient, builders of rail lines are stuck with whatever technology they select for decades.

The EIS’s projections of other environmental benefits of high-speed rail are similarly problematic. The EIS estimates, for example, that rail will reduce California’s transportation-related air pollution, relative to the no-build alternative, by 0.7 percent (for particulates) to 1.5 percent (for nitrogen oxides), with other pollutants in between. Unlike energy, this does take into account improvements in pollution control technology. For example, the EIS reported that in 1997, cars, planes, trains, and electric utilities emitted more than 9,700 metric tons of carbon monoxide. Under the no-build alternative, the EIS projects that by 2020 the emissions will decline to 3,101 metric tons. High-speed rail would further reduce carbon monoxide emissions to 3,074 metric tons.

Note that modest improvements in relatively low-cost pollution technologies are projected to reduce carbon monoxide pollution by nearly 70 percent, despite the growth in population and travel. By comparison, at a cost of at least \$33 to \$37 billion, high-speed rail reduces carbon monoxide pollution by a mere 0.9 percent. As a pollution-control device, high-speed rail is spectacularly cost ineffective.

Similarly, the EIS projects that high-speed rail would reduce greenhouse gas emissions by 1.4 percent. In this case, however, the EIS failed to account for improvements in auto and airplane energy efficiency or for the possibility of the widespread adoption of electric cars. For example, by substituting plug-in hybrid electric cars for some of their regular cars and relying on electric charges for just 1.5 percent of their driving, California drivers could reduce greenhouse gas emissions more than high-speed rail.

All of the benefits of California’s high-speed rail plan depend on the rail authority’s optimistic projections of 32 to 58 million riders per

year in 2020.⁵⁶ By comparison, Amtrak’s Boston-to-Washington, DC, corridor, which has more people today than the California corridor is projected to house in 2020, carried just 10 million riders in 2007.⁵⁷

The authority’s projection appears highly unrealistic. On one hand, the California trains are projected to travel faster than Amtrak’s trains. But on the other hand, most of the people in the California corridor are located at the ends of the corridor, while the Northeast corridor has tens of millions of people living in intermediate metro areas, including Providence, New York, Philadelphia, and Baltimore. High-speed rail’s time advantage over air travel is greatest for shorter trips, so the California corridor will have difficulty meeting, much less greatly exceeding, the levels of ridership that are present in the Northeast corridor.

A more realistic ridership assessment would probably discourage any private party from investing in the California project even if it were promised 100 percent of the profits. In short, it appears almost certain that California high-speed rail will cost taxpayers tens of billions of dollars more than was promised and will produce even fewer benefits than the tiny amounts of congestion and pollution reductions projected in the EIS.

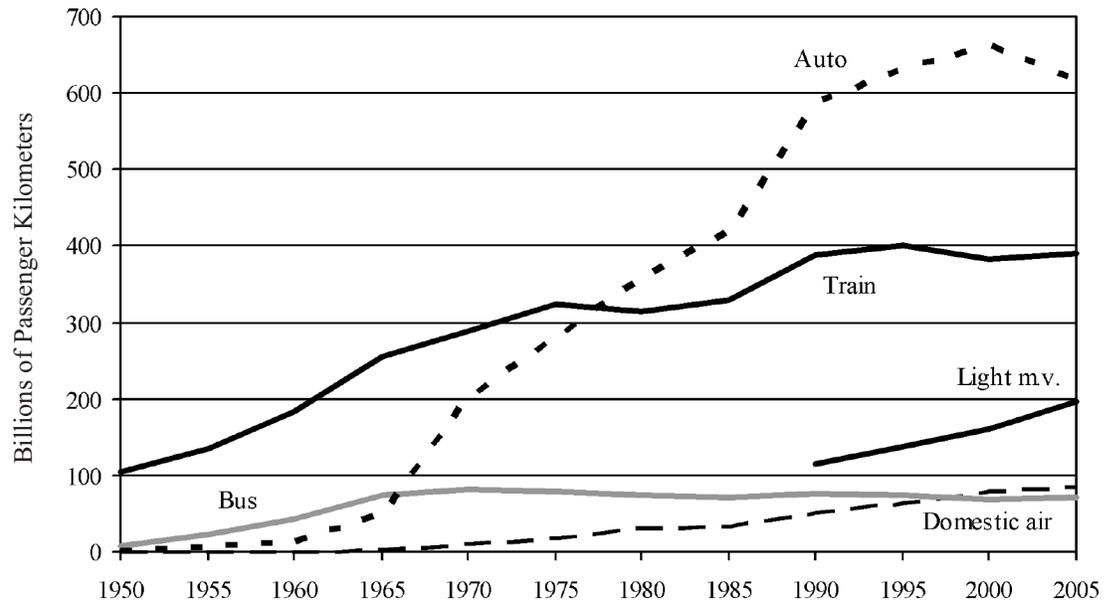
If voters approve the high-speed rail bonds this November, the California High Speed Rail Authority may decide to start building the line even without federal or private matching funds. Unfortunately, the \$9 billion in the bond measure that is dedicated to high-speed rail is barely enough to build from San Francisco to San Jose, with a little left over for right-of-way purchases elsewhere. California voters will then be confronted with the question of whether they are satisfied with only a 50-mile-long high-speed rail line, or if they are willing to spend another \$30 to \$50 billion to complete the system.

High-Speed Rail in Japan

One way to see how well high-speed rail might work in the United States is to exam-

As a pollution-control device, high-speed rail is spectacularly cost ineffective.

Figure 1
Japanese Passenger Transport



Source: Japan Ministry of Transport.

Note: Auto driving took off in 1965, right after the first Japanese bullet train began operating. When light-motor vehicles are counted, autos today move 60 percent of Japanese passenger travel, whereas trains move only 29 percent.

ine the experiences in other countries. The natural place to start is Japan, which opened the world's first high-speed rail line, the 130-mile-per-hour *Shinkansen* (or bullet trains), in 1964. Newer trains go as fast as 185 miles per hour. These trains had a significant impact on Japan's national prestige, yet they did little to stop the growth of automobile traffic.

In 1950, railroads were practically the only mechanized way of getting around Japan and accounted for more than 92 percent of all passenger travel, with most of the rest being bus travel. By 1960, when construction began on the *Shinkansen*, autos still accounted for less than 5 percent of Japanese travel, whereas rails made up 77 percent. But auto driving greatly accelerated after the *Shinkansen* opened, whereas the growth in train travel slowed and, after 1975, leveled off (see Figure 1).⁵⁸

The state-owned Japanese National Railways had earned a profit every year since it had been formed in 1949. But it went into the red after the *Shinkansen* opened. Raising fares to

cover its costs only accelerated the loss in passengers to highway and air travel. On top of that, it was pressured by politicians from cities not on the *Shinkansen* line to extend high-speed rail service to their prefectures, which only added to the company's debt and annual losses.⁵⁹

By 1987, expansion of bullet-train service had increased Japanese National Railways' debt to more than \$200 billion. Facing a financial crisis, the government absorbed the debt and privatized the railway. Today, private operators earn a profit running the *Shinkansen* and other Japanese trains, but they do not have to repay the capital costs—and further capital expansions of high-speed rail service continue to receive extensive government subsidies.⁶⁰

Privatization may have boosted ridership in the late 1980s, but it leveled off again after 1990. Meanwhile, driving continued to grow rapidly and surpassed rail as the predominant form of passenger travel around 1977.

High-speed rail put the previously profitable Japanese National Railways into virtual bankruptcy and forced the government to absorb \$200 billion in high-speed debt.

Due to a recession and high fuel prices, auto driving in Japan has declined since 1999. Rail travel made up for only a small portion of this decline. The rest has been made up for by the rapid growth in motorbikes and *light motor vehicles*, a special class of Japanese autos with engines smaller than 660 cubic centimeters (about 40 cubic inches). In other words, even in the face of high fuel prices, the Japanese continue to rely primarily on personal motorized transport rather than high-speed trains or other forms of mass transportation.

As of 2007, trains carry 29 percent of passenger travel whereas autos, including light motor vehicles, carry 60 percent. The remainder is about equally divided between bus and domestic air.

The tracks for Japan's high-speed trains are a different width (gauge) than for its conventional trains, so there is no question of high-speed passenger trains interfering with freight traffic. Yet rails carry only about 4 percent of Japanese freight. Highways carry 60 percent and coastal shipping carries 36 percent.

High-Speed Rail in Europe

Europe's experience with high-speed rail is even more instructive. Italy introduced the high-speed train to Europe with its 160-mile-per-hour *Direttissima* between Rome and Florence in 1978. France followed with the Paris-Lyon *train à grande vitesse* (TGV) of the same speed in 1981. Germany and other countries followed a few years later.

Since then, France has been the European leader of the high-speed rail movement. French trains now carry 54 percent of Europe's high-speed rail passenger-kilometers, followed by Germany at 26 percent, and Italy at 10 percent. No other country carries even 5 percent of Europe's high-speed rail travelers.

Today's French rail lines operate as fast as 185 miles per hour and extend into Belgium, Germany, Italy, and—through the Channel tunnel—Great Britain. Other European nations—including Austria, Finland, Norway, Portugal,

Russia, Spain, and Sweden—have some form of high-speed rail, though most of these trains are only in the 125–135 mile-per-hour range.

When operating at high speeds, the TGVs run on dedicated tracks. But TGVs also operate on conventional tracks at normal speeds. In fact, while TGVs may be seen throughout France, they only operate at high speeds between Paris and a few other cities, including Marseille, Le Mans, St. Pierre des Corps, London, and Brussels. Similarly, Germany's high-speed Inter-City Express (ICE) trains operate at their highest speeds of about 200 miles per hour only on selected routes, such as Berlin-Hamburg and Munich-Augsburg, and run at lower speeds (but still above 125 miles per hour) on other routes and at conventional speeds (below 125 miles per hour) on still other routes.

While high-speed rail is convenient for tourists who want to travel through Europe without the expense of renting a car, it has done little to change European travel habits. In 1980, intercity rail accounted for 8.2 percent of passenger travel in the EU-15 (the 15 countries that were members of the European Union as of 2000). By 2000, intercity rail had declined to 6.3 percent. Auto driving gained almost exactly the same market share that rails lost in this time period, growing from 76.4 to 78.3 percent. This is a coincidence, as the real challenge to high-speed rail has come from low-cost airlines. Thanks to Europe's "open skies" policies, domestic air travel increased from 2.5 percent of travel in 1980 to 5.8 percent in 2000. Intercity buses and urban transit both lost shares.⁶¹

Rail has continued to lose importance since 2000. In the EU-25 (the 25 members in the European Union as of 2005), rail's share of travel declined from 6.2 percent in 2000 to 5.8 percent in 2004, while air's share increased from 7.7 to 8.0 percent and autos' share (including motorcycles) increased from 75.5 to 76.0 percent.⁶² At best, high-speed rail has slowed the decline of rail's importance in passenger travel.

Because of the prominence of high-speed rail in France and Germany, rail has a higher share of passenger travel in those countries than in the rest of Europe. But this is at the

While convenient for tourists, high-speed rail has done little to change European travel habits, as rail's share of travel is steadily declining.

Table 2
Passenger Travel Mix in 2004

	EU-25 (%)	United States (%)
Air	8.0	10.9
Auto	76.0	85.3
Bus	8.3	3.2
Intercity rail	5.8	0.1
Urban rail	1.2	0.5

Source: *National Transportation Statistics* (Washington: Bureau of Transportation Statistics, 2008), Table 1-37; *Panorama of Transport* (Brussels: European Commission, 2007), p. 102.

Note: *Auto* includes motorcycles; bus includes both intercity and urban buses.

Table 3
Freight Travel Mix in 2004

	EU-25 (%)	United States (%)
Air	0.1	0.4
Highway	72.5	28.7
Rail	16.5	36.8
Pipeline	5.5	20.5
Waterway	5.4	13.6

Source: *National Transportation Statistics* (Washington: Bureau of Transportation Statistics, 2008), Table 1-46b; *Panorama of Transport* (Brussels: European Commission, 2007), p. 69.

Note: Water includes inland waterways but not ocean shipping.

expense of bus travel; the automobile's share of travel in both France and Germany is higher than in the rest of Europe.⁶³

Rail's declining importance in Europe has come about despite onerous taxes on driving and huge subsidies to rail transportation. European nations impose 300 to 400 percent taxes on motor fuel, and much of the revenue is effectively transferred to rail subsidies.

"Rail is heavily subsidized," says University of Paris economist Rémy Prud'Homme. "Users pay about half the total cost of providing the service." Prud'Homme estimates that rail service in the EU-15 receives about 68 billion euros—or about \$100 billion—of subsidies each year.⁶⁴

Nor has the introduction of new high-speed rail service helped relieve highway congestion. "Not a single high-speed track built to date has had any perceptible impact on the

road traffic carried by parallel motorways," says Ari Vatanen, a member of the European Parliament, in his summary of a 2005 conference on European transport.⁶⁵ However, the introduction of subsidized high-speed rail has caused some airlines to end service that parallels rail routes.⁶⁶

Europe's passenger travel mix is not much different from that of the United States (Table 2). European intercity rail carries a 5.7 percent larger share of the travel market than Amtrak. But it is not even clear that this is the result of the massive subsidies Europe is pouring into high-speed rail, since this percentage is steadily declining. European planners predict that rail and bus's combined share will continue to decline between now and 2030.⁶⁷

On the other hand, Europe's emphasis on using rails for moving passengers has had a

Not a single high-speed track in Europe has had any perceptible impact on road traffic.

profound effect on the movement of freight. While a little more than one-fourth of U.S. freight goes on the highway and more than a third goes by rail, nearly three-fourths of European freight goes on the road and just a sixth goes by rail (Table 3). Moreover, rail's share of freight movement is declining in Europe, but increasing in the United States.

Rail's poor performance at carrying freight in both Japan and Europe suggests that a country or region can use its rail system for passenger or freight, but not both. Spending \$100 billion a year on passenger rail might get a small percentage of cars off the road—but one possible consequence is to greatly increase the number of trucks on the road.

High-Speed Risks

Japanese and European cities are much denser than American cities, and most of them are served by much denser transit systems that rail passengers can rely on when they get to their destinations. If high-speed rail cannot capture or even maintain rail's share of passenger travel from the automobile in Europe and Japan, how can it work in the United States? High-speed rail must be considered highly risky.

A recent oversight report on the California high-speed rail project from that state's Senate Transportation Committee pointed to many specific risks of high-speed rail, including forecasting, rights-of-way, and safety risks.⁶⁸ Unlike running a bus system or even an airline, building a rail line requires accurate long-range forecasting. Planning and construction can take many years, and the service life of the rail line is measured in decades. A seemingly minor forecasting error can turn what appears to be a productive asset into an expensive white elephant.

The most obvious forecasting issue is cost. All of the cost estimates for the Midwest, Florida, and California rail projects were made before 2005. Since then, the prices of steel, concrete, and energy have risen dramatically. As a result, it is likely that projected costs need to be adjusted upwards by 50 percent or more.

Denver's 120-mile FasTracks rail project, which was planned at the same time as the Florida and California high-speed rail projects, is now estimated to cost 68 percent more than was projected in 2004.⁶⁹ This is not unusual: according to a 2006 study by researchers at Northeastern University, U.S. rail transit costs average 40 percent more than their original approved budgets.⁷⁰

The other forecasting problem, of course, has to do with ridership and other benefits. Danish planning professor Bent Flyvbjerg notes that U.S. rail projects typically overestimated ridership by an average of 100 percent.⁷¹ He also notes that "rail forecasts are substantially more inaccurate and biased than road forecasts."⁷²

Some of the questionable assumptions made in the Florida and California estimates of future ridership and other benefits include the following:

1. Cars and planes will not become more fuel-efficient in the future.
2. Airports will not become more efficient at moving people.
3. Cars that use alternative fuels will not become feasible or popular.
4. Downtowns will remain or be restored as preeminent job centers.
5. No new technologies will help reduce highway congestion.
6. People will want to go where the trains go.

Assumptions 1 and 4 are clearly wrong: as previously noted, cars are likely to be at least 33 percent more fuel-efficient by 2030, and downtowns have been losing their importance as job centers since at least 1950. Many of the other assumptions are also likely to be wrong. Any forecasts of high-speed rail ridership, energy savings, and other benefits based on these assumptions are likely to be greatly overestimated.

The last assumption—that people will want to go where the trains go—may be the riskiest of all. While many people travel between, say, San Francisco and Los Angeles, that does not mean

If high-speed rail cannot capture or even maintain rail's share of passenger travel in Europe, how can it work in the United States?

The fact that rail is costly to reroute forces rail agencies to become land-use czars, demanding high-density projects using tools that intrude on property rights and make housing less affordable.

that they travel from downtown to downtown, which will be the areas served by rail. Jobs and people are spread throughout modern cities in a fine-grained pattern. As economist William Bogart observes, only about 10 to 15 percent of metropolitan jobs are located in central city downtowns. In Los Angeles, it's less than 5 percent. Even when the suburban downtown areas are counted—only a small fraction of which would be served by high-speed rail—the total is still only 30 to 40 percent.⁷³ That means most people will rarely, if ever, find high-speed rail to be convenient.

This is particularly apparent with China's Shanghai magnetic levitation (maglev) train, which travels 19 miles between Pudong Airport and downtown Shanghai. Reaching speeds of nearly 270 miles per hour, it is the fastest regularly scheduled train in the world. Yet ridership is well below expectations; rarely are more than one out of four seats filled. When the *New York Times* asked air travelers why they don't use the train, they say it doesn't go where they want to go. "It may take longer, but the taxi is more convenient," says one. "Once you get to the train station, I'd just have to get a taxi there," says another, "and I don't want to change cars again."⁷⁴

Unlike bus or airline routes, rail is extremely costly to reroute in response to changing travel patterns. This has led many rail transit agencies to become land-use czars, demanding that developers build high-density projects near their rail stations and discouraging low-density jobs and housing elsewhere. Such policies intrude on people's property rights, make housing less affordable, and create unfriendly business environments.⁷⁵

The January 2008 oversight report from the California senate committee pointed to a risky assumption that the California High-Speed Rail Authority would be able to build high-speed lines in the rights-of-way owned by private railroads such as BNSF and Union Pacific.⁷⁶ The questionability of this assumption was confirmed by a May 2008 letter from the Union Pacific Railroad to the High-Speed Rail Authority explicitly denying the authority the right to use any of its right-of-way.

"Union Pacific has carefully evaluated

CHSA's project," says the letter, and "does not feel it is in Union Pacific's best interest to have any proposed alignment located on Union Pacific rights-of-way. Therefore, as your project moves forward with its final design, it is our request that you do so in such a way as to not require the use of Union Pacific operating rights-of-way or interfere with Union Pacific operations."⁷⁷

One reason why the freight railroads may not want high-speed rail in their rights-of-way is safety. The California High-Speed Rail Authority presumed that it would use European-style rail equipment, which is very lightweight, in order to save energy. European and Japanese rail safety is based on an *accident avoidance* standard, that is, everything is very highly engineered to prevent accidents. This standard has worked well: there has only been one fatal high-speed rail accident, which turned out to be due to poorly engineered wheels. However, partly because of the lightweight equipment, that accident caused the deaths of more than 100 people.⁷⁸

In contrast, American safety standards are based on *accident survivability*. This means American rail equipment is much heavier than foreign high-speed trains. The California senate oversight report worried that this would create a regulatory problem: the Federal Railroad Administration would refuse to allow the use of the lightweight trains that the California High-Speed Rail Authority had in mind.⁷⁹ But mixing American and European trains in the same rights-of-way, even if not on the same tracks, would also create a special liability problem for the railroads, as a derailment of a heavy American train could easily kill many people on an adjacent lightweight high-speed train. Indeed, many of the graphics on California's official high-speed rail website show high-speed trains passing just a few feet away from standard freight and passenger trains.⁸⁰

Incremental Improvements vs. Megaprojects

There is an important qualitative difference between the Midwest rail plan and the

California and Florida projects. The Midwest rail initiative uses off-the-shelf equipment and can be applied incrementally: one line at a time; one mile at a time; even one grade crossing at a time. Every little improvement will produce some benefit, making rail travel a little speedier, safer, or more convenient.

In contrast, the California and Florida proposals are megaprojects. This means, to a large degree, they can only be done as a whole. It will do little good to build a high-speed rail line halfway from Orlando to Tampa, or from Stockton to Merced with no connections to San Jose, San Francisco, or Los Angeles.

Incremental projects and megaprojects each have their own dangers and pitfalls. The problems with megaprojects have been well described by Bent Flyvbjerg and his colleagues in their book, *Megaprojects and Risk*.⁸¹ Large projects take years to implement and thus require long-term forecasting of costs, demand, and other benefits. The people doing the forecasting too often become advocates for the project and thus fall prey to *optimism bias*—the systematic tendency to be overly optimistic about the benefits and costs—and *strategic misrepresentation*—the tendency to distort or misstate facts in order to promote the project.

One example of optimism bias in the California high-speed rail plan is in the use, or misuse, of *sensitivity analyses*. Long-term plans are necessarily based on many assumptions, and sensitivity analyses can determine how crucial those assumptions are. To do the analysis, one of the variables is changed and the forecast is recalculated. A significantly different result is a signal that the planners need to obtain more reliable data regarding that variable.

The California High-Speed Rail Authority conducted a sensitivity analysis for its ridership and revenue forecasts. For the analysis, it assumed that all of the assumptions it had made for its forecasts were as cautious as possible. When it made any of the assumptions more liberal, the result was naturally an increase in the forecast ridership and revenues. The authority never considered the possibility that any of its assumptions should be made more conservative, which would have reduced

the ridership and revenue forecasts.⁸² If, contrary to the plan's assumption, automobiles become more fuel-efficient—and thus, less expensive to drive—ridership is likely to be lower than projected.

Many examples of strategic misrepresentation in the California high-speed rail proposal have been mentioned above: the emphasis on the fact that the highway-airport straw-man alternative described in the EIS costs twice as much as the rail alternative, while barely mentioning that it also produces five times the benefits; using the “high” ridership projections in the energy analysis; and the assumption that future cars and planes will be no more energy-efficient than they are today.

Denver's “FasTracks” rail plan illustrates the dangers of megaprojects. This plan called for connecting Denver to its suburbs with six new rail lines. Suburban officials worried that, if the rail lines were built sequentially, cost overruns would delay or make impossible the completion of every line. So that no suburb would have to go without its rail connection, they insisted that the lines all be built simultaneously. To gain popular support, the transit agency promised it could build the project on time and on budget.

The project was approved in 2004 at a projected cost of \$4.7 billion. Since then, the estimated cost has risen by 68 percent to \$7.9 billion. The sales taxes that were supposed to pay for the project are now projected to fall short of expectations by \$2.8 billion.⁸³ Instead of completing all the rail lines by 2017, as promised, the regional transit district now says completion may be delayed until 2034.⁸⁴ In the meantime, important but low-cost transportation improvements, such as traffic signal coordination, go unfunded because most of the region's transportation funds are tied up in a project that will not see a single wheel turn for many years, if ever.

The problems associated with incremental projects are subtler but no less real. Although total costs may be high, the incremental costs are low, so government agencies can spend money with little public scrutiny. The major document describing the Midwest program,

Megaproject planners too often fall prey to optimism bias, where they delude themselves, and strategic misrepresentation, where they delude the public, about the benefits and costs of the project.

The real beneficiaries of high-speed rail are not the people who will ride the trains but the companies that will design and build them.

Midwest Regional Rail System: Executive Report, does not even bother to describe any benefits of rail.⁸⁵ The website of the Midwest High Speed Rail Association claims that rail is efficient and clean, but offers little evidence that this is true.⁸⁶ Considering that the detailed analysis for the Florida project found that the opposite is true, there is little reason to take such statements on faith.

In contrast to Denver's 120-mile FasTracks plan, Seattle's Link light rail might be considered an incremental plan. When it was approved by voters in 1996, the 21-mile project was supposed to cost \$1.7 billion.⁸⁷ By 2001, the project had shrunk to 14 miles with a projected cost of \$2.1 billion.⁸⁸ By 2007, the uncompleted project was estimated to cost \$2.4 billion, meaning the cost per mile had more than doubled.⁸⁹

At first glance, the way to prevent overspending on either megaprojects or incremental projects is to require rigorous analyses and testing of claimed benefits and projected costs. Performance standards questions that might be asked include

- Are the proposed rail lines cost-effective at moving people, relative to other transportation investments? This paper suggests that the three projects discussed above are not. While dollar of capital investment per annual passenger mile is a crude measure of cost-effectiveness, it is easily calculated with available data. Rural freeway lanes cost \$0.68 per annual passenger mile, while Midwest rail costs \$1.85, California high-speed rail costs \$2.30, and Tampa-Orlando rail costs \$5.40 per annual passenger mile.
- Are the proposed rail lines cost-effective at saving people's time, relative to other investments? Since rail lines are potentially faster than highways, the time saved may be worth the added cost per annual passenger mile. But then the comparison needs to be made with flying, and it is possible that alternatives, such as streamlined airport security systems, could save as much time for far less money.
- Are the proposed rail lines cost-effective

at saving energy, reducing air pollution, and achieving other environmental and social goals? The EIS for the Florida project frankly admits that it is not, while the California project produces relatively insignificant environmental benefits at a very high cost.

The problem with the performance-standards approach is that the political momentum behind multi-billion-dollar projects is often enough to override even an accurate analysis that shows that the costs will exceed the benefits. The real beneficiaries in such projects are not the people who will eventually ride the trains, but the companies that will design and build them. These companies are obviously willing to spend hundreds of thousands of dollars in order to earn the tens of millions of dollars in profits that are likely to be involved in such projects.

For example, when Denver's FasTracks rail plan was on the ballot in 2004, Siemens Transportation, which makes light-rail cars, contributed more than \$100,000 to the election campaign. It also contributed money to the campaigns of transit agency board members and other elected officials who supported rail construction.⁹⁰ In return, Denver's transit board gave Siemens a \$187-million, no-bid contract for light-rail cars, one of the largest contracts for light-rail equipment ever.⁹¹

This political momentum becomes even stronger after the first rail lines are built. No matter how poorly those lines perform, the consultants that designed them and the contractors that built them have a powerful incentive to promote more lines in order to keep the tax dollars flowing. Rail construction becomes an end in itself, no matter what the cost to taxpayers and no matter how negligible the benefits to users.

The Ultimate Performance Standard

The only way to make sure that the benefits of high-speed rail and other transporta-

tion projects exceed the costs is to build them without tax subsidies. If private parties are not willing to put up their own money to build such facilities with the expectation of earning a profit, why should the public surrender their tax dollars with the expectation of earning a loss?

One oft-given answer is that rail is more environmentally friendly than autos and highways. But this is not supported by the facts. Not only does rail use as much energy and emit as much of most pollutants as autos, it is extremely land intensive. Forget about claims that one rail line can move as many people as an eight-lane freeway. In actual practice, very few rail lines come close to moving as many people as even one freeway lane. If moving the maximum number of people is the goal, an exclusive bus lane packed with 10 to 20 buses per minute can move far more people than just about any rail line.

Another answer is that the United States has subsidized highways for many years, so rail needs subsidies to catch up. But subsidies to highways have actually been very minor—around one-half to one penny per passenger mile.⁹² By comparison, subsidies to Amtrak are around 22 cents per passenger mile and subsidies to public transit are around 61 cents per passenger mile.⁹³

When considering megaprojects like high-speed rail, it is useful to consider the experience of one megaproject that was successful: the Interstate Highway System. Interstate highways make up only 2 percent of rural lane miles and less than 4 percent of urban lane miles, yet they carry 25 percent of both rural and urban auto travel.⁹⁴ Because they are some of the safest roads in America, and they attract traffic away from other roads, they have greatly contributed to the 70 percent reduction in highway fatality rates, per billion vehicle miles, since 1960.⁹⁵

The key to the success of the Interstate Highway System is that it was built entirely from user fees, mainly federal and state gasoline taxes. Gas taxes are not the most efficient user fee, but like all user fees they impose a discipline on those who collect and spend the

money: if they fail to build facilities that people will use, they will receive little or no user fees. In contrast, when transportation facilities are funded out of tax dollars, the taxes keep rolling in no matter how much the money is wasted.

Funding transportation out of user fees thus becomes the most effective possible performance standard. Direct user fees, such as tolls and transit fares, are more effective than indirect fees, such as gas taxes. But any user fees at all are more effective than general taxes, which merely encourage pork-barreling and wasteful spending.

If any high-speed rail lines can meet the user-fee test in the United States, they will certainly make an interesting and useful contribution to the nation's transportation system. But taxpayers should not be asked to bet billions of dollars that high-speed rail will become anything more than heavily subsidized operations that are used by a small minority of people at everyone else's expense.

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At first glance, performance standards are the way to prevent overspending on transportation projects, but the best performance standard is simply to fund transportation out of user fees.

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