

## High-Speed Rail

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June 2010

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### Overview

High-speed passenger rail has received increasing interest by policymakers in recent years. President Barack Obama is a strong supporter of high-speed rail, and Congress included \$8 billion in high-speed rail funding in the 2009 economic stimulus legislation. Congress appropriated an additional \$2.5 billion for 2010, and the president is proposing \$1 billion annually in high-speed rail funding over the next several years.<sup>1</sup>

Under the Obama administration's 2009 national high-speed rail plan, about 8,500 route-miles of high-speed trains would connect cities in 33 states.<sup>2</sup> In an example of budget creep, however, the administration's updated plan in 2010 included more than 12,800 route-miles in 42 states.<sup>3</sup>

As federal funding gets underway, various states have also launched high-speed rail initiatives. In 2008, for example, California voters gave the green light for the state to issue nearly \$10 billion of bonds to partly fund a high-speed rail line from San Francisco to Los Angeles.

Rail supporters have dreams of an American high-speed train revolution in the years ahead, but this essay takes a more sober view by looking at the actual costs and benefits of such a system. The reality is that high-speed rail systems are extraordinarily expensive and serve only a small and elite group of people even in those nations that have the longest experience with them.

High-speed rail is not a grand solution to America's congestion and mobility problems, as it is often alleged to be. While high-speed trains in Europe and Japan are technologically impressive, nearly all the routes in those jurisdictions lose money and need large subsidies to stay afloat. America's geography is even less suited for a successful high-speed rail system than Europe or Japan because our cities are less dense and spaced farther apart.

The federal government should withdraw its support for high-speed rail, and instead focus on major **aviation** and **highway** reforms to improve the nation's mobility. America faces major transportation challenges, but throwing taxpayer funds down a high-speed rail money pit will not solve them.

### High Costs of High-Speed Rail

While the Obama administration has started funding high-speed rail, it has no detailed financial plan, no cost estimates for the proposed system, no source of long-term funding, and no expectation that passenger fares will cover all of the operating costs or any of the capital costs. Only two high-speed rail routes in the world, Tokyo-Osaka and Paris-Lyon, earn enough revenues to cover capital and operating costs.<sup>4</sup>

The Federal Railroad Administration (FRA) plan, upon which the Obama administration is basing its high-speed rail ideas, could more accurately be titled "moderate-speed rail."<sup>5</sup> For the most part, it calls for trains running no faster than 110 miles per hour, which high-speed rail aficionados do not even consider to be true high-speed rail.

Such trains would hardly be innovative: starting in the 1930s, several American railroads regularly operated passenger trains at top speeds of 110 miles per hour or more. Yet those fast trains did not stop the decline of passenger trains after World War II. Amtrak today runs trains at top speeds of 100 miles per hour or more in several corridors, but top speeds are far greater than average speeds. For example, the average speed in the Boston-to-Washington corridor is less than 85 miles per hour.

The Obama administration has two reasons for focusing on moderate-speed rail instead of true high-speed rail. First, a complete network of true high-speed rail lines would be "prohibitively expensive," according to Amtrak's president.<sup>6</sup> Thus, Obama's plan calls for running 110-mile-per-hour passenger trains on existing tracks shared with freight trains. For safety reasons, faster trains would require the construction of an entirely new rail system. It is much less expensive to upgrade existing tracks to support 110-mile-per-hour trains than to build brand-new tracks.

Second, the administration wants to aid private freight railroads at the same time it builds the new passenger rail system. President Obama hopes that upgrading freight lines to run faster passenger trains will also allow the railroads to increase their freight speeds and capacities, thus capturing traffic from truckers. Historically, the freight railroads have received very little federal aid: only 18,700 of 350,000 miles of rail lines built in the United States received federal subsidies.<sup>7</sup> Adding new federal subsidies at a time of massive federal budget deficits is not a good idea, and it could lead to the reregulation of the freight railroads, which were deregulated in 1979.<sup>8</sup>

Even though moderate-speed passenger trains are less expensive than true high-speed trains, they are still very expensive. Upgrading the 12,800 miles of track in the administration's plan to moderate-speed rail standards would cost far more than the \$14.5 billion the president has proposed to spend so far. The entire 12,800-mile Obama-FRA system would cost at least \$50 billion.<sup>9</sup> Rather than build the entire system, Obama's plan really just invited states to apply for funds to pay for small portions of the system.

For example, the administration granted close to \$1 billion to Wisconsin to upgrade existing tracks from Milwaukee to Madison to 110-mph standards. This 85-mile line is only a tiny portion of the eventual planned route from Chicago to Minneapolis, and no one knows who will pay the billions necessary to complete that route.

One cautionary note on high-speed rail costs comes from California. In November 2008, California voters agreed that the state should sell nearly \$10 billion worth of bonds to start constructing a 220-mile-per-hour high-speed rail line from San Francisco to Los Angeles. The state's estimated cost for the entire system jumped from \$25 billion in 2000 to \$45 billion by 2008.<sup>10</sup> However, one independent analysis concluded that the rail line would cost up to \$81 billion.<sup>11</sup>

Thus, the costs of a true high-speed rail system would be far higher than the costs of a medium-speed system on existing tracks, as envisioned by the Obama administration. To build a 12,800-mile system of high-speed trains would cost close to \$1 trillion, based on the costs estimates of the California system.<sup>12</sup> It is unlikely that the nation could afford such a vast expense, particularly since our state and federal governments are already in huge fiscal trouble.

Also, consider how the costs would rise even higher once a new rail system gets underway. The 12,800-mile FRA network reaches only 42 states and only a handful of cities in those states. Every excluded state and city is represented by senators and representatives who will wonder why their constituents have to pay for a rail system that only serves other areas. And even in the 42 states in the plan, routes are discontinuous, with no high-speed links between many pairs of major cities such as New York and Chicago. Groups representing all the excluded routes would lobby for rail lines, and overall costs would balloon over time. And the costs mentioned are only the capital costs. Most high-speed rail lines wouldn't cover their operating costs, so there would have to be billions of dollars in ongoing subsidies to the system.

If the ridership on an expensive new rail system was very large, the high costs would seem more reasonable. But, unlike the interstate highway system, which is heavily used by almost all Americans, only a small elite would use high-speed rail. In 2007, the average American traveled 4,000 miles and shipped 2,000 ton-miles of freight over the interstate highways.<sup>13</sup> By comparison, total annual use of a high-speed rail system would not likely be much more than 100 miles per person. And considering the premium fares charged to ride high-speed rail, most users would likely be higher-income white-collar workers.

## Japanese Experience

Probably no country in the world is better suited to high-speed rail than Japan. From Greater Tokyo, one of the world's largest and densest metropolitan areas, rail lines travel to chains of other large, dense cities typically located 25 to 50 miles apart.

As of 1949, most rail lines in Japan were owned by Japanese National Railways (JNR), a government corporation. Although nationalized, JNR was not subsidized and had earned a profit, or at least broken even, every year until it began building high-speed rail lines. As of 1960, Japanese rail lines carried conventional trains at conventional speeds. In that year, autos accounted for just 5 percent of Japanese travel, while rails carried 77 percent.

Then construction began on the *Shinkansen*, the world's first high-speed rail system. The first bullet train between Tokyo and Osaka proved highly profitable, and it has carried more people than all other high-speed rail trains in the world combined.

Once this line was built, however, Japanese politicians demanded bullet trains for their own cities and prefectures. With one exception, all lines built since the first one have lost money.<sup>14</sup> Japan's experience shows that once a nation starts building high-speed rail, political forces make it hard to stop. Despite the need for huge subsidies that Japan cannot afford, the nation's taxpayers are forced to pay for high-speed lines into the prefectures of every powerful politician in the country.

These and other political factors have driven up bullet train costs, and caused Japanese National Railways to switch from a profit-making venture, before 1964, to a money loser ever since.<sup>15</sup> JNR raised passenger fares, but that only pushed more people off the trains and into automobiles. Total automobile travel surpassed rail travel in 1977 and has kept on growing. Between 1965 and 2005, per capita driving increased by more than 900 percent, while per capita rail travel increased only 19 percent.<sup>16</sup>

By 1987, expansion of bullet-train services and other below-cost operations had swelled JNR's debt to more than \$350 billion.<sup>17</sup> That high debt load led to a financial crisis, which significantly contributed to the nation's economic woes of the last two decades. The government was forced to absorb JNR's debt and privatize the railways.

As of 2007, rail's share of Japanese passenger travel had declined to 29 percent, which may still be more than in any other country in the world. And the average Japanese person travels about 1,950 miles per year by train, which is definitely more than people in any other country. But only about 20 percent of those rail miles are by high-speed rail.<sup>18</sup> Automobiles carry 60 percent of passenger travel, and the remainder is divided between bus and domestic air.

After adjusting for inflation, Japan has spent about the same amount of money per capita on high-speed rail as the United States has spent on the interstate highway system.<sup>19</sup> Yet the returns to Japan's mobility from its investment are far smaller: the average American travels 10 times as many miles on the interstates as the average Japanese travels by high-speed rail.

A final interesting feature of the Japanese government's emphasis on passenger rail is that it has had a detrimental effect on freight rail. Rail carries only about 4 percent of Japanese freight, while highways carry 60 percent. By contrast, more than a third of freight goes by rail in the United States, while highways carry a little more than one-fourth.

## European Experience

Europe's experience with high-speed rail provides another cautionary tale for the United States. As in Japan, high-speed rail in Europe is a money loser and it carries relatively few passengers. Italy introduced high-speed trains to Europe in 1978, and France followed with the Paris-Lyon *train à grande vitesse* (TGV) in 1981. Germany and other countries followed a few years after that.

France has been the European leader in high-speed rail. French trains carry 54 percent of Europe's high-speed rail passenger-miles, followed by Germany at 26 percent, and Italy at 10 percent. More than half of all rail travel in France is on high-speed trains, but in the overall European Union, nearly four out of five rail passengers still travel at conventional speeds.<sup>20</sup>

When operating at high speeds, the French TGVs run on dedicated tracks. But TGV trains also operate on conventional tracks at normal speeds. In fact, while TGV trains may be seen throughout France, they only operate at high speeds between Paris and a few other cities. Germany's high-speed intercity express trains operate at their highest speeds only on selected routes, such as Berlin-Hamburg.

High-speed rail has done little to change European travel habits. In 1980, intercity rail accounted for 8.2 percent of passenger travel in the 15 countries in the European Union at the time.<sup>21</sup> By 2000, the share in those countries had declined to 6.3 percent, and it has fallen further since then.<sup>22</sup> Meanwhile, automobiles have modestly gained market share in recent decades. But the real challenge to high-speed rail has come from low-cost airlines. Thanks to deregulation of European airlines, the domestic airline share of passenger travel has more than doubled.<sup>23</sup>

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 the automobile's share of travel in both France and Germany is also higher than in the rest of Europe. The average French resident travels 7,600 miles per year by auto.<sup>24</sup> By comparison, the average French resident travels about 400 miles per year on high-speed trains. In the European Union as a whole, the average is only about 100 miles per year.<sup>25</sup> Rail's higher share in France and Germany comes at the expense of bus travel, not auto driving.

Rail's declining importance in Europe has come about despite onerous taxes on driving. Much of the revenue from those taxes is effectively used to provide large subsidies to rail. French economist Rémy Prud'Homme estimates that taxpayers "pay about half the total cost of providing the service."<sup>26</sup>

And because of the limited ridership on high-speed rail, it has done little to 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.<sup>27</sup>

Europe's passenger-travel mix is similar to that of the United States. The big difference is that European intercity rail carries a 5.8 percent share of the travel market compared with Amtrak's 0.1 percent. The massive subsidies Europe pours into high-speed rail may not even explain this difference, given that the European percentage is steadily declining despite those subsidies. Instead, the answer may be that Europe's lower incomes and high taxes on autos and fuel have simply slowed the growth of driving. European planners predict that rail and bus's combined share will continue to decline.<sup>28</sup>

As in Japan, Europe's emphasis on passenger rail has had a profound effect on freight rail. While a little more than one-fourth of American 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. Moreover, rail's share of freight movement is declining in Europe—it was 22 percent in 1980—but it increased in the United States from 27 percent in 1980 to 39 percent in 2007.<sup>29</sup>

Rail's low share in carrying freight in both Japan and Europe suggests that the Obama administration's hope of getting both people and freight off the highways and onto trains may be a pipedream: a country or region can apparently use its rail system for passengers or freight, but not both.

The fact that American freight railroads are profitable while European passenger lines are not suggests that freight, not passengers, is the highest and best use of a railroad system in most places. Thus, a government initiative to spend tens of billions of dollars on passenger rail in the United States might get a small percentage of cars off the road, but a consequence may be to increase the number of trucks on the road.

## Dubious Claims for High-Speed Rail

Proponents of high-speed rail in the United States make numerous questionable claims and assumptions regarding the technology's costs and benefits. The following are some of the aspects of rail where dubious claims are often made:

**1. Costs and Ridership.** Proponents of high-speed rail projects tend to overstate their benefits and understate their costs. Danish planning professor Bert Flyvbjerg has studied hundreds of government megaprojects, and he argues that project supporters suffer from "optimism bias" regarding the merits of projects, and that they often "strategically misrepresent" project details in order to gain support.<sup>30</sup>

No high-speed rail line has been built from scratch in the United States. But historically, urban passenger rail projects have, on average, gone 40 percent over their projected costs. At the same time, U.S. passenger rail planners typically overestimate ridership by an average of about 100 percent.<sup>31</sup>

California's high-speed rail authority is projecting that the San Francisco to Los Angeles line will be carrying two to three times more passengers by 2020 than Amtrak's entire Boston to Washington corridor currently carries.<sup>32</sup> A Reason Foundation review of the state rail authority's plan called the ridership projections "the most unrealistic projections produced for a major transport project anywhere in the world."<sup>33</sup> A report on the California project from the state's Senate Transportation Committee pointed to many major risks of the project, including inaccurate forecasting, uncertainty regarding rights-of-way, and substantial safety issues.<sup>34</sup>

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 rail lines is measured in decades. A seemingly minor forecasting error—or a deliberately optimistic estimate—can turn what appears to be a sound investment into an expensive white elephant.

**2. Environmental Benefits.** The environmental benefits of high-speed rail would be negligible at best. President Obama's moderate-speed trains are expected to be powered by diesel locomotives, which burn petroleum and emit pollutants and greenhouse gases. Even electrically powered, true high-speed rail is unlikely to be clean. California rated its proposal as environmentally sound only by projecting impossibly high ridership numbers and unrealistically assuming that future automobiles and airplanes would be no more energy-efficient than they are today.

In 2005, Florida's High-Speed Rail Authority proposed a 125-mph rail line between Tampa and Orlando. The environmental impact statement for the proposal estimated that the trains would produce more nitrogen oxide pollution and volatile organic compounds than would be saved by the automobiles taken off the road.<sup>35</sup> It also calculated that operating and maintaining the gas-turbine locomotives would consume 3.5 to 6.0 times as much energy as would be saved by the cars replaced.<sup>36</sup> The statement concluded that "the environmentally preferred alternative is the No Build Alternative" because it "would result in less direct and indirect impact to the environment."<sup>37</sup>

The Tampa-Orlando proposal was subsequently killed, only to be revived by the Obama administration. In January, the Department of Transportation announced that Florida will receive \$1.25 billion of the \$8 billion in high-speed rail stimulus funding for the route.<sup>38</sup>

**3. Automobile and Airplane Assumptions.** In considering the costs and benefits of high-speed rail, fast trains should be compared not to today's cars and planes, but to tomorrow's more efficient cars and planes. If automakers are able to meet the administration's latest fuel-economy targets, and consumers continue to replace the nation's auto fleet at the usual rate, cars and light trucks on the road in 2020 will be almost 25 percent more energy efficient than they are today, on average, and by 2030 they will be 38 percent more fuel-efficient.

Meanwhile, the energy efficiency of air travel has increased an average 2 percent per year since 1980.<sup>39</sup> Boeing promises that its 787 plane will be 20 percent more fuel efficient than comparable planes today.<sup>40</sup> Jet engine makers have set a goal of doubling fuel efficiency by 2020.<sup>41</sup>

The California high-speed rail authority claims that high-speed trains will produce large energy savings.<sup>42</sup> Yet the authority's own environmental impact statement (EIS) reveals that the benefits will be negligible. The EIS projects that the energy savings from operating high-speed rail will repay the energy cost of construction in just five years.<sup>43</sup> But the EIS assumes that the energy efficiency of autos and planes won't improve.<sup>44</sup> But if, over the lifetime of a high-speed rail project, autos and planes become 30 percent more fuel efficient, then the energy payback period for high-speed rail rises to 30 years. Since rail lines require expensive (and energy-intensive) reconstruction about every 30 years, high-speed rail is not likely to save energy at all.

Steven Polzin, of the University of South Florida's Center for Urban Transportation Research, points out that automobiles and buses have relatively short life cycles, so they can readily adapt to the need to save energy or reduce pollution. By contrast, he says rail systems "may be far more difficult or expensive to upgrade to newer, more efficient technologies."<sup>45</sup> The American auto fleet completely turns over every 18 years, and the airline fleet turns over every 21 years, so both can quickly become more fuel-efficient. With rail lines, however, we are stuck for at least three to four decades with whatever technology is selected.

**4. Importance of Downtowns.** The assumption that people will want to go where new high-speed train lines would go is a big risk. New rail lines would likely go from downtown to downtown, but downtowns have been losing their importance as job centers for decades. While many people travel between, say, the San Francisco and Los Angeles areas, that does not mean that they travel between downtowns, which will be the primary points 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 is less than 5 percent.<sup>46</sup> Even when suburban downtowns are counted—only a small fraction of which would be served by high-speed rail—the total is still only 30 to 40 percent.<sup>47</sup> That means that most people won't find high-speed rail convenient for business travel.

**5. Mobility Benefits.** The mobility benefits of high-speed rail are negligible. Despite huge subsidies, the average residents of France and Japan ride their TGVs and bullet trains just 400 miles a year. With slower trains connecting lower-density cities and regions, the Obama administration's proposed high-speed rail system would be lucky to reach even 100 miles per capita of travel. Even a much more comprehensive, truly high-speed network is unlikely to approach 400 miles per capita because, unlike Europe and Japan, the United States has few major city pairs located close enough for high-speed trains to compete with airlines.

High-speed rail's inability to draw more riders should be no surprise considering rail's inherent disadvantages compared with driving and air travel. Driving offers point-to-point convenience, while rail drops most travelers miles from their final destinations. Air service is at least twice as fast as the fastest trains and—since most Americans no longer live or work downtown—leaves average travelers no farther from their destinations than downtown train stations. Though high-speed rail is somewhat competitive on trips of 200 miles or so, it is not the optimal transportation mode at any distance.

In sum, a cost-effective high-speed rail system is a fantasy. Modern airliners go much faster than the fastest trains and they do not require expensive infrastructure along their entire routes. Even with a massive government investment, high-speed rail would not likely capture more than about 1 percent of the nation's market for passenger travel. High-speed rail should be killed before it diverts tens of billions of transportation dollars into a black hole, producing negligible benefits.

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<sup>1</sup> *Budget of the U.S. Government, Fiscal Year 2011, Appendix* (Washington: Government Printing Office, 2010), p. 964.

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- <sup>3</sup> The updated route plan is available at [www.fra.dot.gov/Pages/2243.shtml](http://www.fra.dot.gov/Pages/2243.shtml).
- <sup>4</sup> David Randall Peterman et al., "High Speed Rail (HSR) in the United States," Congressional Research Service, December 8, 2009, p. 19.
- <sup>5</sup> Federal Railroad Administration, "Vision for High-Speed Rail in America," April 2009, p. 6, [www.fra.dot.gov/downloads/rdev/hsrstrategicplan.pdf](http://www.fra.dot.gov/downloads/rdev/hsrstrategicplan.pdf). See also Federal Railroad Administration, "Preliminary National Rail Plan," October 2009, [www.fra.dot.gov/downloads/railplanprelim10-15.pdf](http://www.fra.dot.gov/downloads/railplanprelim10-15.pdf).
- <sup>6</sup> Jon Hilkevitch, "Amtrak: True High-Speed Rail Unrealistic, Amtrak Boss Says," *Chicago Tribune*, May 12, 2009.
- <sup>7</sup> "Railroad Land Grants: Paid in Full," Association of American Railroads, February 2008.
- <sup>8</sup> Elise Hamner, "Railroad Closes Coos Bay Line," *The World*, September 21, 2007.
- <sup>9</sup> Based on the estimate in Randal O'Toole, *Gridlock: Why We're Stuck in Traffic and What to Do about It* (Washington: Cato Institute, 2009), p. 86.
- <sup>10</sup> Liam Julian, "The Trouble With High-Speed Rail," Hoover Institution *Policy Review* 160, (April/May 2010).
- <sup>11</sup> Wendell Cox and Joseph Vranich, "The California High-Speed Rail Proposal: A Due Diligence Report," Reason Foundation, September 2008.
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- <sup>13</sup> See *Highway Statistics 2008* (Washington: Department of Transportation, December 2009), Table VM-1, [www.fhwa.dot.gov/policyinformation/statistics/2008/vm1.cfm](http://www.fhwa.dot.gov/policyinformation/statistics/2008/vm1.cfm). And see *National Transportation Statistics 2010* (Washington: Department of Transportation, 2010), Table 1-46b, [www.bts.gov/publications/national\\_transportation\\_statistics/html/table\\_0....](http://www.bts.gov/publications/national_transportation_statistics/html/table_0....)
- <sup>14</sup> Mamoru Taniguchi, *High Speed Rail in Japan: A Review and Evaluation of the Shinkansen Train* (Berkeley: University of California Transportation Center, 1992), p. 19.
- <sup>15</sup> Mitsuhide Imashiro, "Changes in Japan's Transport Market and Privatization," *Japan Railway and Transport Review* (September 1997), pp. 51–52.
- <sup>16</sup> All data on Japanese passenger and freight travel by mode from "Summary of Transportation Statistics," Ministry of Land, Infrastructure and Transport, 2008.
- <sup>17</sup> "Company History," East Japan Railway Company, Tokyo, 2005.
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- <sup>19</sup> Randal O'Toole, *Gridlock: Why We're Stuck in Traffic and What to Do About It* (Washington: Cato Institute, 2009), p. 89.
- <sup>20</sup> *Panorama of Transport* (Brussels: European Commission, 2007), pp. 107, 110.
- <sup>21</sup> Randal O'Toole, *Gridlock: Why We're Stuck in Traffic and What to Do About It* (Washington: Cato Institute, 2009), p. 91.
- <sup>22</sup> Rail's share of travel in the larger 25-nation EU declined from 6.2 percent in 2000 to 5.8 percent in 2004.
- <sup>23</sup> *Key Facts and Figures about the European Union* (Brussels: European Commission, 2004), p. 52.
- <sup>24</sup> *Panorama of Transport* (Brussels: European Commission, 2007), p. 106.
- <sup>25</sup> *Panorama of Transport* (Brussels: European Commission, 2007), pp. 107, 110.
- <sup>26</sup> Remy Prud'Homme, "The Current EU Transport Policy in Perspective," paper presented at a conference on European Transport Policy, European Parliament, Brussels, July 12, 2005.
- <sup>27</sup> Ari Vatanen and Malcolm Harbour, "Strangling or Liberating Europe's Potential?" paper presented at a conference on European Transport Policy, European Parliament, Brussels, July 12, 2005, p. 6.
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- <sup>29</sup> *Key Facts and Figures about the European Union* (Brussels: European Commission, 2006), p. 53. And see *National Transportation Statistics 2010* (Washington: Department of Transportation, 2010), Table 1-46b.
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- <sup>31</sup> Bent Flyvbjerg, Mette K. Skamris Holm, and Søren L. Buhl, "How (In)accurate Are Demand Forecasts for Public Works Projects?" *Journal of the American Planning Association* 71 (2): 131–46.
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- <sup>43</sup> *California High-Speed Train Business Plan* (Sacramento: California High-Speed Rail Authority, 2008), pp. 3.5-19–3.5-20.
- <sup>44</sup> *California High-Speed Train Business Plan* (Sacramento: California High-Speed Rail Authority, 2008), p. 3.5-16.
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