HIGH-SPEED RAIL: FEDERAL (HSIPR) PROGRAM AND POLICY ANALYSIS

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EXECUTIVE SUMMARY

During his presidential campaign, President-elect Joe Biden talked about a "rail revolution" that would include large increases in Amtrak funding and potentially coast-to-coast high-speed rail (HSR) service. If the Senate remains in Republican hands, there may be serious resistance to the fiscal and budgetary impacts of major increases in federal funding of passenger rail.

But beyond the federal spending aspects is the question of how much value would be produced by such funding. Consequently, this report offers a detailed review of the most recent attempt to boost passenger rail by funding HSR projects and improving service in Amtrak corridors. In 2009 the new Obama administration proposed, and Congress enacted, legislation that authorized the High-Speed Intercity Passenger Rail (HSIPR) program. The program offered grants to four states to develop and implement new HSR corridors, but only one (California) was accepted. It also offered many grants to improve the performance of individual Amtrak corridors.

This report draws on many sources to assess the results of the seven projects that accounted for 98% of the HSIPR program. The results suggest caution in attempting a similar program during the new administration.

- **California High-Speed Rail:** *HSIPR funding of $3.9 billion for the 520-mile planned Phase 1 from San Francisco to Los Angeles.* This project included the 119-mile initial construction segment (ICS) in the Central Valley and the high-speed rail infrastructure component of the new Transbay Transit Center. High-speed rail service would cover the entire Phase 1 route (from Los Angeles to San Francisco) by 2020. Since the grant awards, both Phase 1 and the ICS have doubled in cost and decreased in scale, with portions now expected to operate in "blended" service with commuter trains. Service operation dates have been delayed by at least seven years on the ICS and at least 13 years for Phase 1. Cost projections for Phase 2 have not been updated. The overall federal commitment equaled nearly one half of the $8.1 billion spent on HSIPR corridor grants nationally. The Federal Railroad Administration (FRA) is seeking to reclaim some grant funding from this project.

- **Northeast Corridor:** *HSIPR funding of $0.75 billion for two major projects to improve operations in New Jersey and through the city of New York.* The New Jersey project will allow operation of Acela trains at 160 mph over a 23-mile segment. Slated for completion by 2017, the New Jersey project has been delayed to 2020. The New York City project, an Amtrak bypass through a busy rail junction seeking to reduce travel delay, is to be completed by 2022.

- **Seattle-Portland Corridor:** *HSIPR funding of $0.75 billion for upgrading infrastructure.* This project aimed to reduce travel time by 10 minutes on this trip that took between 3:20 and 3:30, and to add two daily round trips. The infrastructure was completed and the two new trains were scheduled to begin operating on December 17, 2017. Tragically, a fatal derailment approximately 50 miles into the first trip of a new Seattle-to-Portland train halted the service expansion. The National Transportation Safety Board (NTSB) cited positive train control, which was not operational, as one factor that might have prevented the accident. Restoration of additional service is pending the NTSB report.

- **Chicago-St. Louis Corridor:** *HSIPR funding of $1.34 billion.* This project upgrades infrastructure with new locomotives and passenger cars to reduce travel time by 45 minutes on a five hour and 20 minute (5:20) to five hour and 40 minute (5:40) trip. No additional service was to be added. Incomplete critical safety improvements (positive train control) have precluded achieving travel time reductions. While the new locomotives are in operation, the original manufacturing contract for the new passenger cars has been canceled due to testing safety failures.

- **Chicago-Detroit Corridor:** *HSIPR funding of $0.6 billion for upgrading infrastructure.* This project aims to reduce travel time by 30 minutes on this trip that took between 5:05 and 5:35 without adding additional service. With a top operating speed of 110 mph, this project has substantially achieved its intended travel time improvement. As with the Chicago-St. Louis Corridor, new locomotives are in operation, but the new passenger cars have not been delivered due to testing safety failures that led to cancellation of the original manufacturing contract.

- **Charlotte-Raleigh Corridor:** *HSIPR funding of $0.52 billion*. This project aimed to improve safety (largely by upgrading infrastructure that eliminated grade crossings) and to add two daily round trips. The infrastructure improvements were completed on schedule and one additional train is in operation, with a second train scheduled for 2019, though a start date has not occurred in 2020.
- **Chicago-Iowa City Corridor:** *HSIPR funding of $0.23 billion*. This project sought to upgrade infrastructure to re-establish service, which would operate at a maximum speed of 79 mph. After grant award, Illinois and Iowa suspended the corridor improvements citing cost escalation and operating subsidies problems. Illinois recently announced that it would begin work, though Iowa continues to suspend its portion of the project.

From the perspective of value for taxpayers' money, this report finds inconsistencies between project objectives and the assumptions on which public policies have been adopted. For example, none of the five major conventional corridor HSIPR projects had a significant share of rail travel in their respective corridors. As a result, none of the projects would materially reduce the market shares of the dominant modes in their respective corridors, even if all project objectives were met.

Another concern for taxpayers is cost overruns, which are endemic in high-speed rail projects. Around the world, publicly funded high-speed rail systems have incurred large cost overruns relative to forecasts at the time of project approval, as documented in comprehensive research by European academics. Specifically, the California high-speed rail project and Great Britain's HS2 project have incurred some of the most egregious cost overruns, a decade or more before there could be any prospect of complete service operation. This unfortunate experience seems likely to continue until there is effective and successful reform of high-speed rail planning and management approaches.

Even after construction is complete, financing operations has proved challenging. The international experience strongly suggests that the U.S. has little potential for financially successful high-speed rail projects. Out of the many high-speed rail lines that have been developed in the world, only three have covered their capital and operating costs from commercial sources, especially passenger fares. Each of these corridors had substantial pre-existing rail ridership, which is an advantage shared only by the Northeast Corridor in the United States.

High-speed rail is especially expensive in the United States compared to other nations. This makes the probability of financial success even more remote. Additionally, the United States has little potential for airline passengers and auto drivers to travel instead by high-speed rail in numbers that would transform travel markets.

With these challenges in mind, developing public policy that efficiently serves the taxpayers requires that decisions are made based on the best possible information. The data and analysis available at the time of project authorization should provide a reliable basis for informed decision making. This has not been the case in passenger rail, as substantial post-authorization cost escalation has been typical.

It is unfortunate enough when cost escalation occurs on a *critical* megaproject—one that is an important part of the *existing* transportation system, without which a city may be severely affected. It is particularly unfortunate when the cost-escalation occurs in a *non-critical* project—those not required for the continued operation of the transportation system. These projects are additions to the existing system. Until megaproject planning and management functions sufficiently reliably, taxpayers would be better served by *not* developing megaprojects that are not critical, such as high-speed rail.

Some high-speed rail and other intercity rail niche markets could be commercially developed by the private sector and operated commercially (without subsidy). Such systems would have the advantage of switching unforeseen risk for cost overruns away from the taxpayers to private investors. Moreover, the private sector would likely choose projects with a high likelihood of financial sustainability over those without. But private businesses must also consider the relatively high cost of permitting and regulation involved in such projects.

This policy analysis concludes with the following recommendations:

- Given the tendency for gross underestimation of costs that has occurred among government-sponsored high-speed rail projects, taxpayers should not be “on the hook” for the success of a project. The federal government should not provide funding or loans for new high-speed rail projects.

- The federal government should support commercial passenger rail development with regulatory assistance in the form of simplified environmental reviews, expedited permitting, and expansion of tax-exempt private activity bonds, backed by revenues from the commercial company.

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PART 1

BACKGROUND AND PROGRAM ANALYSIS: THE HSIPR MAJOR CORRIDOR GRANTS

Shortly after taking office, the new administration of President Barack Obama proposed an unprecedented federal commitment to an intercity passenger rail program. The resulting High-Speed Intercity Passenger Rail (HSIPR) program—part of the 2009 American Recovery and Reinvestment Act (ARRA)—sought to stimulate the U.S. economy, then suffering from the steepest economic decline since the Great Depression. President Obama signed the bill into law on February 17, 2009, less than one month after his inauguration.

In testimony to the House Committee on Transportation and Infrastructure Subcommittee on Railroads, Pipelines, and Hazardous Materials in Chicago in April 2009, Federal Railroad Administrator James C. Szabo outlined the objectives of the HSIPR.[1]

> *Over time, our goal is for a number of regional routes to link cities and regions together, creating a seamless network that offers Americans a real transportation alternative. This will reduce congestion that everyone expects will grow worse in the coming decades.*

Administrator Szabo also referred to the job-creating stimulus impacts, the other principal purpose of the $800 billion ARRA program. Priority was placed on projects that could be quickly undertaken, or “shovel ready.”[2]

In 2009, Congress appropriated $10.6 billion for the HSIPR program under the ARRA and the subsequent FY 2010 Department of Transportation Appropriations Act. The Administration further announced its intention to commit another $1 billion annually to the program.

Since that time, no funding has been added to the HSIPR, and in 2011, Congress rescinded $400 million of the 2010 appropriation. Meanwhile, Florida ($2.4 billion),[3] Ohio ($400 million) and Wisconsin ($810 million) declined grants that had been announced, indicating concerns about capital cost escalation and the need for state capital and operating subsidies. The Florida line (Tampa to Orlando) was to operate at international state-of-the-art speeds. Any such costs would have been the financial responsibility of the states. FRA expeditiously reallocated the rejected funds to other major projects.

1.1 HIGH-SPEED RAIL: INTERNATIONAL CONTEXT

The International Union of Railways considers the principal criterion for high-speed rail to be operation at 155 mph or more (250 km per hour).[4] High-speed rail typically operates on dedicated tracks, not mixing with freight or other passenger trains. This permits long stretches of sustained operation at top speeds. Approaches to the largest urban cores may be over shared tracks or rights of way (such as in Paris or Tokyo).

Generally, the first high-speed rail line is considered to have been Japan’s Shinkansen, operating from Tokyo through Nagoya to Osaka. When it opened in 1964, the top operating speed was 130 mph (210 kph). Speeds in Japan and France now reach 199 mph (320 kph).[5] France began a high-speed line between Paris and Lyon in 1981, which eventually operated at a top speed of 186 mph (300 kph). Now there are high-speed rail lines in a number of countries.

China has developed by far the largest HSR system, due to reach 18,600 miles (30,000 km) in 2019. This is more than two-thirds of the world’s high-speed rail mileage.[6] Top operating speeds have recently increased to 217 mph (350 kph), the highest in the world.[7]

1.2 HIGH-SPEED RAIL IN THE UNITED STATES

The U.S. Department of Transportation (USDOT) has developed classifications for high-speed rail and other passenger rail services as follows. Corridor lengths are approximate; slightly shorter or longer intercity services may still help meet strategic goals in a cost-effective manner.[8]

High-Speed Rail – Express: Frequent express service between major population centers 200–600 miles (320–965 km) apart, with few intermediate stops. Top speeds of at least 150 mph (240 km/h) on completely grade-separated, dedicated rights-of-way (with the possible exception of some shared track in terminal areas). Intended to relieve air and highway capacity constraints.[9]

High-Speed Rail – Regional: Relatively frequent service between major and moderate population centers 100–500 miles (160–800 km) apart, with some intermediate stops. Top speeds of 110–150 mph (201–240 km/h), grade-separated, with some dedicated and some shared track (using positive train control technology). Intended to relieve highway and, to some extent, air capacity constraints.

Emerging High-Speed Rail: Developing corridors of 100–500 miles (160–800 km), with strong potential for future HSR regional and/or express service. Top speeds of up to 90–110 mph (145–177 km/h) on primarily shared track (eventually using positive train control technology), with advanced grade crossing protection or separation. Intended to develop the passenger rail market and provide some relief to other modes.

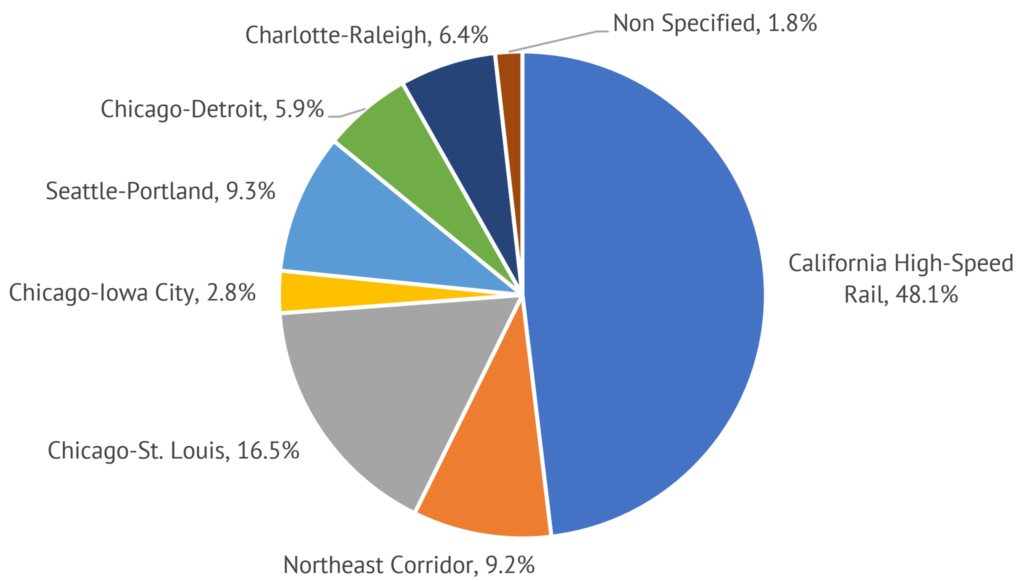
Conventional Rail: Traditional intercity passenger rail services of more than 100 miles with as little as one to as many as 7–12 daily frequencies; may or may not have strong potential for future high-speed rail service. Top speeds of up to 79 mph (127 km/h) to as high as 90 mph (140 km/h) generally on shared track. Intended to provide travel options and to develop the passenger rail market for further development in the future.

1.3 SUMMARY OF THE HSIPR GRANTS

Virtually all of the HSIPR funding has been awarded. Approximately 80% of the $10.1 billion in grants was for major corridors (Figure 1).

FIGURE 1: DISTRIBUTION OF HSIPR GRANTS: MAJOR CORRIDORS

80% OF HSIPR FUNDING WAS FOR MAJOR CORRIDORS



Source: Adapted from Congressional Research Service, 2016.

The Congressional Research Service (CRS) noted that "high-speed rail grabbed the headlines." However, only two of the grants were for systems that would operate on exclusive tracks and highest speeds: the California High-Speed Rail program and Florida's subsequently canceled project. The other major corridor projects were either emerging high-speed rail projects under the U.S. Department of Transportation terminology or conventional rail sharing track with freight trains and commuter trains. These included one world-class high-speed rail project (California high-speed rail) and upgrades to the nation's busiest and fastest operating line (Northeast Corridor).

Five other projects were intended to upgrade existing rail infrastructure for higher-speed operations (Chicago-St. Louis, Seattle-Portland, Chicago-Detroit, Charlotte-Raleigh and Chicago-Iowa City). State transportation departments, in partnership with private railroads, largely administered these projects. Systems intended to operate at more than 79 mph were under a deadline obligation to install "positive train control," which is "a risk mitigation system that could prevent train accidents by automatically stopping trains when a collision or derailment is imminent."[10]

In all, grants were awarded for projects in 32 states and the District of Columbia. According to CRS, 78% of the number of the HSIPR grants were for projects outside the major corridors, but only constituted 20% of the total funding. These projects were generally smaller and largely intended to be completed within two years. [11] Much of the short-term job creation impact was expected from these less complex projects, which were most likely to be “shovel ready,” which was of particular political interest in the aftermath of the Great Financial Crisis.

PART 2

SUMMARIES AND ASSESSMENTS OF THE HSIPR PROJECTS

2.1 CALIFORNIA HIGH-SPEED RAIL SUMMARY

In 2009, intercity rail services in San Francisco Bay Area and Sacramento corridors to Los Angeles and San Diego included "San Joaquin" trains from Bakersfield to the San Francisco Bay Area (Oakland) and Sacramento, "Pacific Surfliner" trains between San Diego and Los Angeles (which ran as far north as San Luis Obispo, the long-distance "Coast Starlight," which operated from Los Angeles to the San Francisco Bay Area (San José and Oakland) and on to Seattle, and the "Capitols," which operate between the San Francisco Bay Area and Sacramento. All of these services are operated by Amtrak. The state provides financial support to all of the services except the "Coast Starlight."

California has the most extensive and advanced high-speed rail plans in the nation, which date back more than a decade before enactment of ARRA. The California high-speed rail system was conceived to extend approximately 800 miles, operating at top speeds of 220 mph (350 kph). The trains would approximate the fastest current operation in the world, which is in China (see earlier discussion). All of California's largest markets (metropolitan areas) would be served.[12]

In 1996, the state legislature established the California High-Speed Rail Authority (CHSRA) to oversee development of the proposed high-speed rail system. The California high-speed rail system was intended to operate from San Diego through Los Angeles to Sacramento and San Francisco. This system was projected to cost $25.0 billion (1999$), approximately $38 billion in 2018$. The core of the system (now called "Phase 1"), from San Francisco[13] to Los Angeles Union Station, was estimated to cost $15 billion (1998$), or $22 billion in 2018$.[14]

Proposition 1A was placed on the statewide 2008 ballot to authorize $9.95 billion in bonds for the system including $1.0 billion for connecting services. The voters' pamphlet indicated that the total cost to develop and construct the high-speed train system including Phase 2 (the San Diego and Sacramento extensions) would be about $45 billion (2006$), or $57 billion in 2018$. This was based upon a CHSRA estimate of $45.4 billion, which included $30.7 billion for Phase 1 and $14.7 billion for Phase 2.[15]

Proposition 1A required that the system use trains capable of sustained operation at speeds no less than 200 mph, achieve nonstop travel times of no more than 2:40 between Los Angeles Union Station and San Francisco[16] and "will not require a local, state, or federal operating subsidy."[17] Proposition 1A was approved, with 52.6% in favor and 47.4% opposed.

By 2009, the California High-Speed Rail Authority began to focus principally on Phase 1, which would operate from Los Angeles (Anaheim[18]) to San Francisco's Transbay Transit Center, the route's northern terminus. In a December 2009 report to the legislature, CHSRA estimated the cost of Phase 1 would be $35.7 billion (2009$), or $41.8 billion in 2018$.[19] The report cited an "ideal timeline" of 2020 for service along the entire Phase 1 corridor. Construction on the Sacramento corridor was to begin no sooner than 2015 and no sooner than 2017 on the San Diego corridor.

A principal CHSRA argument in favor of the high-speed rail project was that it was less expensive than the alternatives. The California state Legislative Analyst's Office considered this CHSRA's assessment an exaggeration:[20]

> *The draft [2012] business plan compares the estimated $99 billion to $118 billion cost of constructing high speed rail with an estimated $170 billion cost of adding equivalent capacity to airports and highways. This comparison is very problematic because $170 billion is not what the state would otherwise spend to address the growth in inter-city transportation demand.*

The California high-speed rail project dwarfed the resources of the HSIPR. The California project's Phase 1 cost forecast in 2009 was nearly four times the size of the new federal program.[21] The Phase 1 costs were to rise to nearly eight times the total HSIPR funding. Thus, there were practical and political limits to the extent of federal funding California could expect to receive.

2.1.1 CALIFORNIA HSIPR PROJECTS

In October 2009, the state of California applied for federal funding of $4.7 billion. In January 2010, the White House announced a $2.35 billion grant for the project. Ultimately, $3.5 billion was made available for the initial construction segment (ICS) in the San Joaquin Valley (Central Valley). Another $400 million was granted for high-speed rail improvements for the soon-to-be-constructed Transbay Transit Center in San Francisco, contributing to a much larger market serving local and metropolitan transit systems. The federal funding total of $3.9 billion was equal to nearly half of the $8.1 billion spent on HSIPR corridor grants nationally.[22]

Consistent with CHSRA plans at the time,[23] the White House indicated in its January 2010 fact sheet that the completed system would operate more than 300 trains per day, with a top speed of 220 mph.[24] According to the White House, the San Francisco to Los Angeles corridor would be open by 2020, while the balance of the system to Sacramento and San Diego would be completed by 2026. The system would also provide "a travel time between Los Angeles and San Francisco stations of under two hours and forty minutes" (2:40), as required by the bond measure approved by California voters.

2.1.2 DEVELOPMENTS SINCE THE HSIPR GRANTS

Between 2009 and 2012 there was significant cost escalation. In 2012, CHSRA's Business Plans indicated that costs for the Anaheim to San Francisco line had increased substantially. The cost projection rose from $36.4 billion (2010$) to a range of from $65.4 billion to $75.4 billion (2010$).[25] CHSRA indicated that the principal elements in the cost increase were viaducts and bridges, tunnels, trenches and walls, and grade separations. In addition, part of the higher costs concerned alignment (route) changes.[26]

According to the CRS 2013 report: "The doubling or near doubling of estimated costs for phase one, depending on the proposed system, led to renewed calls for the project to be reexamined or abandoned." The CHSRA *Revised 2012 Business Plan*, dropped the full high-speed rail system scenario as too costly. It provided a revised estimate for the system at between $53.4 billion and $62.3 billion (in 2011 dollars).[27]

CHSRA's 2012 *Revised Business Plan* adopted an initial operating segment from Merced to the San Fernando Valley. High-speed rail trains would operate over conventional rail rights of way between San Francisco and San José and between the San Fernando terminus and Los Angeles and Anaheim, with completion in 2028.[28]

In a report requested by the legislature, the state auditor made what might be characterized a damning assessment: "the Authority's flawed decision making regarding the start of high-speed rail system construction in the Central Valley and its ongoing poor contract management for a wide range of high-value contracts have contributed to billions of dollars in cost overruns for completing the system."[29]

The state auditor described the new approach:

> *Most notably, in its 2012 revised business plan, the Authority introduced the concept of blending—the practice of sharing existing infrastructure with other rail operators instead of constructing dedicated infrastructure for high-speed trains— which partially offset the system's rising cost estimates.*[30]

This would eliminate construction of high-speed rail infrastructure on the San Francisco Peninsula between San Francisco and San José. High-speed rail trains would share tracks with Caltrain, the commuter railway. This would require reducing service planned by two-thirds (from 12 hourly high-speed rail trains to only four). Maximum corridor operating speeds would be dropped from 125 mph to 110 mph. Eventually, local high-speed rail would share infrastructure with commuter rail and *freight trains* over another 30 miles to Gilroy.[31] Similar track sharing was also planned for Burbank to Los Angeles Union Station.[32]

These system revisions may not permit the system to perform as had been planned before 2012: "The extent to which blending will negatively affect rail service will not be known until a private sector operator, which will ultimately run the system for the Authority, makes service decisions, such as how fast and frequently to operate the trains," concluded the state auditor.[33]

As CRS put it, "At the time Proposition 1A was approved, California assumed a level of federal and private sector support that ultimately never materialized."[34] With no firm funding to complete high-speed infrastructure into San Francisco, the federal funding to adapt the new Transbay Transit Center for *high-speed* operations may turn out to have been unnecessary. Financial difficulties continued to plague CHSRA, despite being given access to a dedicated stream of funding from California's "cap and trade" program (25%).[35] CHSRA also faced legal challenges.

The state auditor also noted that despite the extension of the federal initial construction segment (ICS) completion deadline from 2017 to 2022:

> *...the Authority could miss the new deadline unless Central Valley construction progresses twice as fast as it has to date. Missing the deadline could expose the State to the risk of having to pay back as much as $3.5 billion in federal funds.*

2.1.3 GOVERNOR NEWSOM'S ANNOUNCEMENT

In his first State of the State address address (February 2019), new Governor Gavin Newsom announced that there "simply isn't a path" to complete the system without substantial additional funding.[36] According to CRS, "He later clarified that his comments were not intended to convey that the project was canceled; the section under construction is expected to result in improved passenger rail service in the Central Valley, and may still result in improved connections to San Francisco once other infrastructure projects are complete."[37]

2.1.4 2019 STATUS OF THE CALIFORNIA HSIPR PROJECTS

The ICS was estimated to be 130 miles in 2012,[38] but was later reduced to 119 miles[39] from north of Bakersfield to south of Madera. The cost was estimated at $5.2 billion in 2010$ ($5.8 billion in 2018$).[40] This was also expressed as $6.0 billion in year of expenditure (YOE) dollars.[41] The Fresno to Bakersfield section was to be completed by 2017, and the Fresno to Merced section by 2021.[42]

CHSRA has begun construction on the ICS. However, costs have escalated substantially, and the schedule for starting passenger service has been extended. By 2019, costs of the ICS had risen to $12.4 billion (YOE),[43] or $12.0 billion in 2018$,[44] approximately double the original projection. The ICS cost escalation, at $6 billion, is far greater than the $3.5 billion in HSIPR funding made available. The cost of the ICS is now over $100 million per mile.

According to the May 2019 report to the legislature, CHSRA indicates that construction and testing would be complete for the ICS from Merced to Bakersfield by the end of 2028, after which service would commence. The report also indicates that the Phase 1 "blended" system—not a high-speed rail system infrastructure, but one that shares track with other, slower trains, causing a decrease in speed—could be completed by 2033. Even so, this Phase 1 system would be a blended service from San Francisco to Gilroy and from Burbank to Anaheim. Since this is unfunded, the high-speed rail line might be delivered less expensively by blending with Metrolink commuter trains from Lancaster to Los Angeles. Both target dates assume restoration of FRA engagement in the project (see next section: "The Federal Railroad Administration—California Dispute").[45]

At the same time, CHSRA is recommending that the ICS be lengthened to 171 miles, from Bakersfield to Merced. When service begins, it is planned that Central Valley passengers (from as far south as Bakersfield) will be able to transfer to an extended ACE commuter line at Merced and travel to San José. The cost of the ICS would now be $20.4 billion.[46]

CHSRA projects that there will be enough funding to complete the Bakersfield to Merced line. However, CHSRA cautions that there are funding risks.[47]

More than $900 million in federal grant funding has not been spent, according to CRS.[48] The state auditor has also voiced concern on the spending rate, indicating that CHSRA "must finish the Central Valley construction by December 2022 to avoid violating its federal grant agreements," further noting that "Violating the grant agreements could require the Authority to repay this $3.5 billion in federal grant funds, $2.6 billion of which it reports it has now spent."[49]

Exacerbating financial problems are concerns that further cost escalation could occur,[50] both in the ICS and the eventual extensions to Gilroy (San José) and the Los Angeles area. The ICS, on which the substantial cost escalation of the last decade has occurred, is largely flat, requires little or no tunneling, and is probably the least-costly segment of the route. Yet, as construction has proceeded, costs have doubled. There are considerably more challenging segments, the costs of which could rise substantially as preliminary engineering moves toward final engineering. Subsequent longer-term sectors, such as mountainous Tehachapi Pass and Pacheco Pass, could result in even more cost escalation.[51] The Early Train Operator (Deutsche Bahn, the German national railway) selected by CHSRA is reported to have "recommended that the HSRA performs supplemental geotechnical investigations and that it reviews the tunnel design criteria, to potentially reduce overly conservative construction cost estimates commonly associated with the unidentified risks of underground construction."[52]

The HSIPR-supported Transit Center in San Francisco opened in 2017, but closed for at least a year in 2018 due to construction defects. It is reported that, including the transit and high-speed rail elements, the Transit Center project cost escalated from $1.6 billion to as much as $2.2 billion.[53] The additional costs did not increase federal taxpayer obligations, but are the responsibility of state and local taxpayers.

Meanwhile, support has been reported among state legislators for diverting high-speed rail funding from the Central Valley to local rail projects in the San Francisco and Los Angeles metropolitan areas.[54]

2.1.5 THE FEDERAL RAILROAD ADMINISTRATION-CALIFORNIA DISPUTE

Recently, FRA, took “steps to reclaim federal grant money awarded to the project.”[55] FRA claims that CHSRA “has repeatedly failed to comply with the terms of the” grant agreement and “has failed to make reasonable progress on the Project.” A $929 million grant agreement on which funds had not been disbursed has been terminated by FRA. Further, as the FRA indicated:

> *California has abandoned its original vision of a high-speed passenger rail service connecting San Francisco and Los Angeles, which was essential to its applications for FRA grant funding. FRA continues to consider all options regarding the return of $2.5 billion in American Recovery and Reinvestment Act (ARRA) funds awarded to CHSRA.*[56]

California is legally challenging the FRA grant money reclamation actions.[57]

2.1.6 ASSESSMENT OF THE CALIFORNIA GRANTS

According to CRS, the California HSIPR projects aimed to construct the 119-mile ICS and to fund high-speed rail infrastructure in the larger Transbay Transit Center.[58] The ICS was to have been completed by 2017. Moreover, at the time of federal grant approval, service over the ICS and the entire Phase 1 high-speed rail corridor from San Francisco to Los Angeles was to have been in operation by 2020, and the Phase 2 system with service to the Riverside-San Bernardino, San Diego and Sacramento metropolitan areas was to be in operation by 2026. But these objectives are far from having been met.

- No service will be available to passengers in 2020, as had been anticipated. At present, service is not planned to begin on the ICS until after completion at the end of 2028, eight years after service over the entire Phase 1 system was anticipated as recently as 2012. This assumes restoration of Federal Railway Administration funding. Improvements necessary to handle Los Angeles to San Francisco trains would not be complete until 2033.

- ICS costs have virtually doubled. Construction is proceeding at a pace that could be too slow to achieve the federal completion deadline. This cost experience mirrors that of the full Phase 1 system as planned in 2009.

- The Transbay Transit Center high-speed rail infrastructure was completed. The overall cost of the project (of which high-speed rail is a part) escalated more than 35%, though the extent of any high-speed rail contribution is unknown. Funding for the necessary *high-speed* route to San Francisco's Transbay Transit Center has not materialized and could render this project a stranded asset.

The California high-speed rail project will not meet its HSIPR customer service objectives, with service now delayed at least eight years. The larger overall project (Phase 1 and Phase 2), as well as the ICS, will fall considerably short of its promises. There are no firm plans for completion of the full system as described to voters before the 2008 referendum and as described in the White House grant announcement (see section 2.1.1).

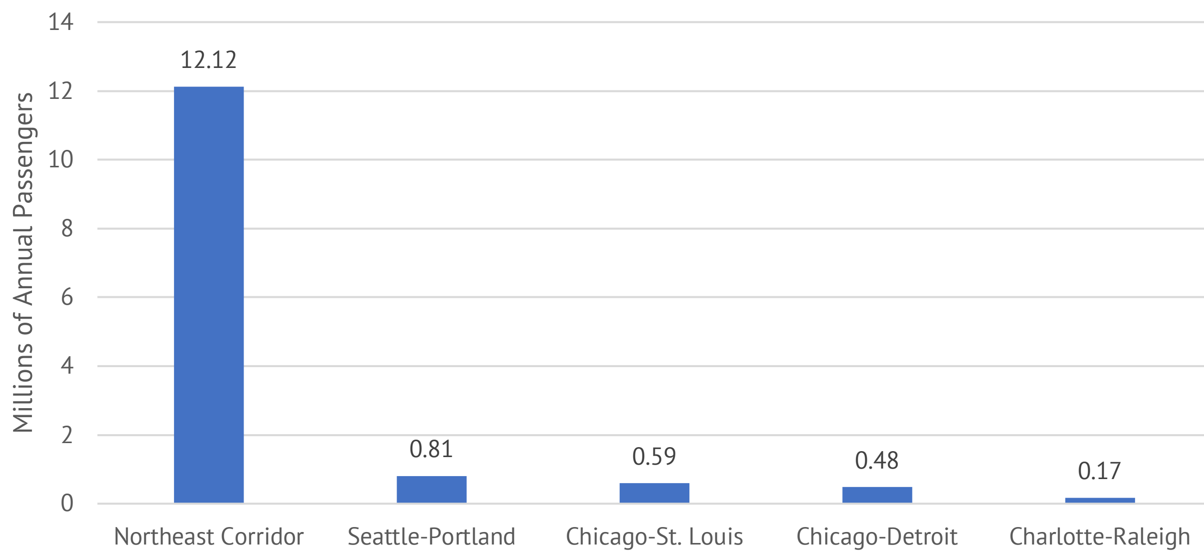
2.2 NORTHEAST CORRIDOR IMPROVEMENTS

Amtrak's Northeast Corridor stretches from Washington, D.C. through New York City to Boston over a distance of 457 miles. Amtrak owns approximately 80% of the route. The balance is owned by the state of Massachusetts, the Connecticut Department of Transportation and New York's Metro-North Railroad.

The Northeast Corridor has the only passenger rail service in North America reaching a speed of 150 mph. The premium *Acela* service operates at this speed over segments totaling 35 miles between Boston and New York City, specifically between Boston and New Haven. Speeds of 135 mph are reached on a portion of the Washington, D.C. to New York City segment.[59] By operating at 150 mph, *Acela* reaches the minimum USDOT standard for high-speed rail.

The Northeast Corridor carries approximately six times the number of passengers annually that are carried in the other four HSIPR major corridor projects *combined* currently in operation (Figure 2).

FIGURE 2: RIDERSHIP: HSIPR MAJOR CORRIDOR TRAINS (FISCAL YEAR 2018)



Source: Derived from Amtrak Monthly Performance Report: YTD September FY 2018.

Because of infrastructure limitations and sharing the right of way with commuter rail service provided by regional transit authorities and freight trains, *average* speeds are 62 mph between New York City and Boston and 79 mph between Washington, D.C. and New York City.[60] Approximately 90% of the passenger trains on the Northeast Corridor are commuter trains.[61] Amtrak also shares the corridor with its own Northeast Regional services.

The travel time and speed contrast between the high-speed *Acela* Northeast Corridor service and the fastest international high-speed rail lines owes principally to the latter's ability to maintain top speeds for longer distances as a result of having exclusive rights of way and very broad curves that were specifically constructed to support high-speed passenger train operations. This can be illustrated by comparing the maximum speeds with the average speeds of the fastest trains, terminal to terminal:

- China's 818-mile Beijing to Shanghai corridor's fastest average speed (190 mph) is only 12% less than its top operating speed (217 mph).

- Spain's 386-mile Madrid to Barcelona corridor's fastest average speed (154 mph) is 20% less than its top operating speed (193 mph).
- Amtrak's 226-mile Washington, D.C. to New York City corridor's fastest average speed (82 mph) is 39% less than its top operating speed (135 mph).
- Amtrak's 232-mile New York City to Boston corridor's fastest average speed (62 mph) is 61% below its maximum speed (150 mph).

Despite its much lower speeds, Amtrak's Northeast Corridor trains dominate the combined air-rail market. Amtrak reports that the Northeast Corridor trains have a 70% combined air-rail market share in the Washington, D.C.-New York City corridor and a 60% share[62] in the New York City to Boston corridor.[63] From 2010 to 2018, Northeast Corridor ridership has increased 16.9%. The largest increase has been in the Northeast Regional services, at 21.5%, while the *Acela* service has gained 6.8%. Substantial upgrades to the route have been underway for more than 40 years.[64] Yet, even with its incomparable rail service (for the United States), the corridor is dominated by auto travel. Rail travel (principally Amtrak) accounts for only 11.6% of intercity travel between the markets along the *Acela* Northeast Corridor route. This compares to 2.4% for airlines, 4.9% for buses and 81.1% by automobile trips of at least 30 miles, as evidenced by using electronic tolling transactions. [65]

FRA has proposed upgrading to 160 mph speeds on much of the Northeast Corridor, though not to the 200 mph and greater speeds being operated elsewhere. This project is unfunded.

2.2.1 THE NORTHEAST CORRIDOR HSIPR PROJECTS

Approximately $875 million in HSIPR grants were applied to improve service on the Northeast Corridor,[66] which included two large projects totaling approximately $750 million in federal grants.

The New Jersey High-Speed Rail Improvement Program landed a $450 million grant to allow trains to operate at 160 mph over a 23-mile section between Trenton and New Brunswick. This will also permit an increase in train frequencies.[67] In 2014, Amtrak indicated a target construction completion date of 2017.[68]

A federal grant of $295 million was awarded to support building the Harold Interlocking Amtrak Bypass[69] in Queens (in the city of New York), a project with a total cost of over $1 billion.[70] The grantee New York Department of Transportation and sub-grantee Metropolitan

Transportation Authority (MTA) are constructing a new two-mile route for Amtrak trains using tunnels that will circumvent the congestion and delays that are caused by having to traverse the nation's busiest rail junction. The project is a part of the larger MTA East Side Access project that will permit Long Island Railroad commuter trains to operate into Grand Central Station, in addition to Pennsylvania Station.[71] The Harold Interlocking project is to be completed and available for service to the public during 2022.[72]

2.2.2 2019 STATUS OF THE HSIPR PROJECTS

Construction is underway on both projects. The New Jersey project is now expected to be completed in 2020.

The East Side Access project has reportedly experienced substantial cost escalation over its more than 15-year life.[73] In 2018, the MTA claimed that insufficient cooperation from Amtrak had resulted in $340 million of cost overruns. Amtrak reportedly responded that it had been hampered by "its involvement in other projects in and around Penn Station."[74]

2.2.3 ASSESSMENT OF NORTHEAST CORRIDOR HSIPR PROJECTS

No passenger impacts were expected by mid-2019, since construction on both projects was expected to be continuing at this time. CRS summarized the objectives of the Northeast Corridor projects.

First, the New Jersey High-Speed Rail Improvement Program aims to "Increase top speed to 160 mph, increase frequencies of trains, and improve reliability of infrastructure."[75] According to Amtrak, the target completion date was 2017.

- The current completion date of 2020[76] is three years behind Amtrak's earlier projection.

Second, the New York Harold Interlocking Amtrak Bypass aims to: "Reduce trip times and improve schedule reliability by reducing delays at Harold Interlocking." It is to be complete by 2022.

- The current completion date is 2022.
- Allegedly, Amtrak overran projected cost on the larger project, though it is unknown if this relates to the HSIPR project.

The Northeast Corridor appears likely to meet its HSIPR customer service objectives.

2.3 THE SEATTLE TO PORTLAND CORRIDOR

Before the HSIPR program, there were four “Cascade” trains operating between Seattle and Portland, with fewer train frequencies continuing to Vancouver, B.C. and through Oregon’s Willamette Valley to Eugene. These trains are supported by the states of Washington and Oregon. The “Cascades” are operated with Talgo railcars, the only such equipment in the Amtrak system. The Seattle to Portland segment is 187 miles, and the entire Vancouver to Eugene corridor is 467 miles. A long distance train, the “Coast Starlight,” also operates daily in each direction along the corridor from Seattle to Eugene and continues to Los Angeles.

2.3.1 THE SEATTLE TO PORTLAND HSIPR PROJECT

The Washington State Department of Transportation (WSDOT) administers the Pacific Northwest Rail Corridor Improvement Program (PNWRC). This project includes major improvements on the Seattle to Portland and Vancouver route. The route is a part of the federally designated Northwest High-Speed Rail Corridor.

Federal grants of approximately $750 million were obtained through HSIPR. Most of the funding aimed to upgrade the route between Seattle and Portland to improve travel times slightly, from 3:30 to 3:20. Upon completion of the work, scheduled for 2017, two trains were to be added to the Seattle to Portland schedule, bringing the number of round trips to six daily. On-time performance was intended to be improved to 88%.

According to WSDOT, “Currently rail provides only a fraction of intercity travel demand along the I-5 corridor.” WSDOT anticipates a 50% increase in ridership in its first two decades of project operation.[77]

In addition to the HSIPR project, the state of Washington plus Oregon and British Columbia are considering an up to 250 mph (400 kph) high-speed rail line in the Portland-Seattle-Vancouver corridor. This is considerably faster than China’s top speed of 217 mph. Initial reports indicate that alternatives could cost from $24 billion to $42 billion.[78]

2.3.2 STATUS OF THE SEATTLE TO PORTLAND HSIPR PROJECT

The improvements were completed in 2017 and the two additional trains between Seattle and Portland were scheduled to begin operating on December 18, 2017. The travel times, according to the Amtrak schedule were to remain at the current 3:30. That morning, the first southbound train operating from Seattle to Portland suffered a derailment at a 30-mph curve on the newly opened Point Defiance bypass in DuPont (south of Tacoma), approximately 50 miles into its trip. The Point Defiance bypass had been completed as a part of the project. There were three fatalities on the train and multiple injuries, some to highway passengers on the viaduct over Interstate 5. Service on the Point Defiance bypass was temporarily discontinued. The new trains were discontinued and travel time has reverted to 3:30 according to the current timetable.

As a result of the accident, WSDOT announced that it would not restore service along the Point Defiance bypass until "(1) Positive Train Control was activated in the corridor and the (2) National Transportation Safety Board (NTSB) had completed its investigation."[79]

The final NTSB "Accident Report," published May 21, 2019, found no human error, but faulted public agencies involved in the project. Sound Transit (the Seattle metropolitan area multi-county transit agency) was faulted for failing to "provide an effective mitigation for the hazardous curve without positive train control in place." WSDOT was faulted for "starting revenue service without being assured that safety certification and verification had been completed to the level determined in the preliminary hazard assessment." The Federal Railroad Administration was faulted for permitting the Talgo railcars "that did not meet regulatory strength requirements to be used in revenue passenger service...," which resulted in "injuries and fatalities."[80]

2.3.2 ASSESSMENT OF THE SEATTLE TO PORTLAND HSIPR PROJECT

According to CRS, the objectives of the Seattle to Portland project were to "Reduce travel time by 5% (from 210 to 200 minutes) between Seattle and Portland; add two daily round-trips between Seattle and Portland, bringing the total to seven; increase on-time performance to 88%." These results were to have been achieved by 2017.[81]

- The new trains are not in service, and improved travel times have not been achieved. The additional trains began to run, but were quickly canceled due to the Point Defiance crash.

- The upgraded infrastructure appears to have been completed within budget and on time (no indication of cost overruns was identified).

The Seattle-Portland corridor has not met its HSIPR customer service objectives, due to the Point Defiance train crash.

2.4 THE CHICAGO-ST. LOUIS CORRIDOR

In 2009, the 285-mile Chicago to St. Louis route had four daily corridor trains in each direction (the “Lincolns”). The travel time between route terminals ranged from 5:20 to 5:40. These trains receive financial support from the state of Illinois. In addition, the long-distance “Texas Eagle” operates over the route, continuing to San Antonio and Los Angeles. Amtrak operates all of these trains as part of the federally designated Chicago Hub High-Speed Rail corridor.

2.4.1 THE CHICAGO-ST. LOUIS HSIPR PROJECT

The Illinois Department of Transportation (IDOT) applied for funding under the HSIPR and has received $1.34 billion in federal grants to improve travel times and service reliability on this route. No additional trains were planned.

The entire route from Chicago to St. Louis would be upgraded to allow for speeds up to 110 mph. This increase would occur on 92% of the route (262 miles) from the previous maximum of 79 mph. Travel times were to shorten from 340 minutes (5:40) to 285 minutes (4:45).[82] The project was to be complete by 2014.[83]

This would be accomplished by adding second tracks, sidings, and grade crossing improvements that would reduce the potential for train-highway vehicle crashes. Eight stations would be renovated or constructed. IDOT also projected nearly halving delay times as a result of the project.[84]

The project was also to receive new locomotives and passenger cars (see Text Box: Passenger Car Order) through the Midwest Equipment Pool, along with the Chicago-Detroit corridor project.

Passenger Car Order: Chicago-St. Louis and Chicago-Detroit

The Chicago-St. Louis and Chicago-Detroit projects included new passenger cars. Specifications for new bi-level passenger cars were developed by the Next Generation Corridor Equipment Pool Committee (NGEC), which was mandated by the Passenger Rail Investment and Improvement Act of 2008. The NGEC is composed of the FRA, states, Amtrak and the railroad industry.[85]

The state of California led the contract for 130 passenger cars, in cooperation with the states of Illinois, Michigan, Missouri, Wisconsin, Oregon and Washington in these procurements. According to IDOT, delivery of double-deck cars would begin in 2015.[86] Cars would be produced for the Chicago-St. Louis corridor and the Chicago-Detroit corridor (as well as others not included in this report).

Nippon-Sharyo set up a new Illinois factory to build the double-deck passenger cars for the new service.[87]

However, a Nippon-Sharyo "prototype body shell failed a mandatory crash safety test,"[88] which led to cancellation of the contract. Siemens has been awarded the replacement contract to fulfill the order and delivery is expected between 2020 and 2023.[89] The new passenger cars will be single-deck rather than double-deck. The Nippon-Sharyo plant has closed.

Passenger rail's share of all trips made in the Chicago to St. Louis corridor was estimated to be 1.3% in 2010.[90] In the 10th year of the project's operation, rail ridership in the corridor would rise to 833,000 annually, a 30% increase over the 2010 figure of 642,000. Even if this level of ridership is reached, passenger rail's market share would remain small, at below 2%, even if overall travel does not increase.

2.4.2 2019 STATUS OF THE CHICAGO TO ST. LOUIS HSIPR PROJECT

The projected travel time improvements have not occurred. The Illinois Department of Transportation (IDOT) cites a new federal requirement that passenger trains operate no faster than 79 miles per hour where there is not "positive train control" as the reason for the slower than anticipated operation. An IDOT spokesperson told the press that 90 mph operation would begin on portions of the route in 2019, but the 110 mph operation has not been achieved. The latest timetables show the same travel times as in 2018.[91]

The new locomotives are in operation,[92] but delivery of the passenger cars has been significantly delayed due to manufacturing difficulties (see Text Box: Passenger Car Order).

2.4.3 ASSESSMENT OF THE CHICAGO TO ST. LOUIS CORRIDOR PROJECT

According to CRS, the objectives of the Chicago to St. Louis project were to: "Increase top speed from 79 mph to 110 mph on 92% (262miles) of the corridor; reduce trip time by 15% (340 to 285minutes);"[93] and "improve on-time performance and reliability." According to IDOT, the project was to be completed by 2014.

- By the end of 2017, the faster travel times had not been achieved. Following the WSDOT train accident (section 2.3.2), IDOT indicated that it would not implement the higher operating speeds until positive train control was fully implemented on the corridor. Dates for higher-speed operation have not been announced.
- The upgraded infrastructure appears to have been completed within budget (no indication of cost overruns was identified), though CRS reported a 2017 completion date, a delay from 2014.[94]
- The new locomotives have been delivered and are in service.
- The new passenger cars are delayed until between 2020 and 2023 (see Text Box: Passenger Car Order).

The Chicago-St. Louis Corridor has not yet achieved its customer service objectives. The higher speeds will require completion of positive train control and delivery of the new passenger cars.

2.5 THE CHICAGO-DETROIT CORRIDOR

Before the HSIPR program there were three daily "Wolverine" trains operating in each direction along the 304-mile Chicago to Detroit and Pontiac[95] route. The distance between Chicago and Detroit is 285 miles. Another train, the "Blue Water," also operates once daily in each direction between Chicago and Port Huron, Michigan, using the same route as the Wolverine between Chicago and Kalamazoo. In addition, the "Pere Marquette" operates a daily round trip from Chicago to Grand Rapids using the "Wolverine" corridor from Chicago to Michigan City, Indiana.

These Michigan corridor services are operated by Amtrak and supported by the Michigan Department of Transportation (MDOT). Amtrak owns 110 miles of right of way between Porter, Indiana and Kalamazoo, constituting much of the western portion of the route. Amtrak has been increasing speeds along this alignment, and upgraded its infrastructure with HSIPR funding for 110 mph operation, which began in 2012. This was the first USDOT defined high-speed rail service in the nation outside the Northeast Corridor (see section 2.2). In 2009, the Norfolk Southern Railway owned much of the eastern portion of the route, a 135-mile segment between Kalamazoo and Dearborn.

2.5.1 THE CHICAGO-DETROIT HSIPR PROJECTS

A total of $600 million in federal funding was granted for improvements to the Chicago to Detroit corridor.[96] The project is within the federally designated Chicago Hub High-Speed Rail Corridor.

MDOT received $347 million from the Federal Railroad Administration to improve travel times along the corridor. The elements of the program included purchase of the Kalamazoo to Dearborn right of way from Norfolk Southern and improvements on that section of the route. MDOT was to improve the infrastructure for the increase to 110 mph operations in this segment.

Further, Amtrak used ARRA funds to improve the infrastructure it owns between Porter and Kalamazoo to accommodate top speeds of 110 mph.[97]

Overall, train operating speeds were to increase from 79 mph to 110 mph over 77% (235 miles) of the route between Chicago and Detroit, reducing travel times between Chicago and Detroit from 335 minutes to 305 minutes and improving on-time performance. The 30-minute travel time reduction would improve travel times by approximately 9%.

In addition, an FRA grant supported building the Englewood Flyover on Chicago's South Side, to allow passenger trains to bypass the grade-level Englewood interlocking and to reduce travel time. This was a part of the much larger $4.6 billion CREATE project (Chicago Region Environmental and Transportation Efficiency Program) to expedite freight and passenger rail operations in the Chicago area and improve highway travel times. The

Federal Railway Administration, the state of Illinois, Cook County, the city of Chicago, Metra (commuter rail operator), Amtrak, and freight railroads cooperatively implement CREATE.[98]

According to the Congressional Research Service, "additional investments will likely be needed to further reduce trip times and increase train frequencies."[99]

The Chicago to Detroit corridor project, along with the Chicago-St. Louis project, was to receive new locomotives and passenger cars through the Midwest Equipment Pool (see Text Box: Passenger Car Order).

The travel time improvements were expected to increase "Wolverine" ridership approximately 60%, from 437,700 annual riders to 705,000 in the first year. By the 10th year, ridership was projected to reach 790,000.[100] Passenger rail's share of Chicago-Detroit travel would remain small, at less than 1.5%.[101]

2.5.2 STATUS OF THE CHICAGO-DETROIT CORRIDOR HSIPR PROJECTS

MDOT has purchased the Kalamazoo to Dearborn trackage from the Norfolk Southern Railroad and the right of way improvements are complete. The Wolverine operating speeds now reach up to 110 mph on the newly purchased alignment. The "Wolverine" corridor travel time has improved as a result of the project. The fastest train operates at under five hours westbound from Detroit to Chicago (4:59). The new locomotives, purchased in connection with the Midwest equipment pool, are now in operation,[102] but delivery of the passenger cars has been significantly delayed due to manufacturing difficulties (see Text Box: Passenger Car Order).

2.5.2 ASSESSMENT OF THE CHICAGO-DETROIT CORRIDOR

According to CRS, the Chicago to Detroit project aimed to "Increase top speed from 79 mph to 110 mph for 77% (235 miles) of the corridor; reduce trip time by 9% (335 to 305 minutes); and increase on-time performance and reliability." These objectives were to have been achieved by 2016.[103] In addition, new locomotives and passenger cars were to be delivered by 2017.

- Travel times have improved by an average of 29 minutes,[104] virtually equaling the travel time improvement objective.
- The higher speeds were implemented in 2019, delayed from 2016.

- The upgraded infrastructure appears to have been completed within budget (no indication of cost overruns was identified).
- The new locomotives have been delivered and are in service.
- The new passenger cars are delayed until between 2020 and 2023 (see Text Box: Passenger Car Order).

The Chicago-Detroit corridor is meeting its HSIPR customer service objectives, with the exception of the delayed new passenger cars.

2.6 THE CHARLOTTE-RALEIGH CORRIDOR

In 2009, two-state supported, Amtrak-run round-trip daily trains operated over the 173-mile route between Raleigh and Charlotte, a "Carolinian" and a "Piedmont." Amtrak added another "Piedmont" to the schedule in 2010. The route is a part of the federally designated Southeast High-Speed Rail Corridor.[105]

2.6.1 THE CHARLOTTE-RALEIGH HSIPR PROJECT

The North Carolina Department of Transportation (NCDOT) obtained $520 million to improve service between Raleigh and Charlotte. The Piedmont Improvement Program[106] aimed to add two additional daily "Piedmont" round trips[107] between Raleigh and Charlotte by 2017,[108] to improve on-time performance and to improve safety. No travel time reduction was planned. In the last year before adding the first train (2017), the "Piedmonts" had an on-time performance of 64.8%.[109] The improvements sought to raise on-time performance to 70% in the first year of operation and 80% in the fifth through 10th years.

The project involved construction of a second track, sidings, grade crossings, train station renovations and rail car improvements.

2.6.2 STATUS OF THE CHARLOTTLE-RALEIGH HSIPR PROJECT

The Piedmont Improvement Program construction was completed in 2017.[110] One of the two additional planned "Piedmont" trains began service in June 2018. The second additional train is to be added to service in 2019,[111] though it was not indicated in the timetable as of mid-2019.

Six months into the 2019 fiscal year, ridership on the three Piedmont round-trip trains increased 36% compared to two previous round trips in the first six months of 2018.[112]

2.6.3 ASSESSMENT OF THE CHARLOTTE-RALEIGH CORRIDOR

According to CRS, the objectives of the Charlotte to Raleigh project were to "Enable two additional trains daily between Charlotte and Raleigh; increase safety." This was to be completed by 2017.[113] According to NCDOT, the program was also intended to improve on-time performance.

- The first new train was added in 2018. NCDOT indicated that the second new train would begin operations in 2019, but this has not occurred as of 2020.
- The upgraded infrastructure appears to have been completed on time and within budget (no indication of cost overruns was identified).
- The safety improvements have been made as a part of construction.

The Charlotte-Raleigh corridor has not yet met its HSIPR customer service objectives, with one additional train left to be added.

2.7 THE CHICAGO-IOWA CITY CORRIDOR

There was no train service in the Chicago-Iowa City corridor in 2009.

2.7.1 THE CHICAGO-IOWA CITY HSIPR PROJECT

Illinois and Iowa were granted a total of $230 million in 2011 to establish service and upgrade the line for 79 mph service.

2.7.2 STATUS OF THE CHICAGO-IOWA HSIPR PROJECT

According to the Congressional Research Service, "Each state put its share of the project on hold following the inauguration of new governors, each of whom had concerns about potential cost overruns and the need to provide operating subsidies. Iowa completed preliminary engineering but did not provide matching funds to begin construction, while Illinois put its share of the project—already under construction in some places—on hold.[114]

In early 2019, however, Illinois appropriated matching state funding and indicated that construction would begin on the Chicago to Moline segment. The state of Iowa has indicated that the federal funding is insufficient to complete the Moline to Iowa City segment.[115]

2.7.3 ASSESSMENT OF THE CHICAGO-IOWA CORRIDOR

According to CRS, the objective of the project was "To reestablish 79-mph passenger rail service between Chicago and Iowa City."

- The infrastructure improvements necessary to re-establish the service have not been undertaken.
- Both states suspended efforts on the project, though in 2019 Illinois indicated that it will now proceed with work within the state.

The Chicago-Iowa City corridor has not met its HSIPR customer service objectives.

2.8 HSIPR PROGRAM EVALUATION

The following results relative to program objectives have been observed among the major corridors (as of September 2019). Table 1 provides a summary of the evaluations.

One genuine megaproject has massively failed: the California high-speed rail project. The Chicago-Detroit corridor is meeting its customer service objectives with the exception that the new passenger cars are not yet available.

All the other projects seek to provide improved service on upgraded conventional rights of way, but have not achieved their customer service objectives, except for one (New York City), which has reached its projected completion date. Each of the other projects, however, has a potential to achieve its customer service objectives in time.

- The California high-speed rail project will fall far short of its HSIPR customer service objectives. Service on the ICS is projected to begin by 2028, at least eight years late. The ICS has doubled in cost, an amount greater than the federal grants. The state auditor expresses concern that a potential failure to complete the project on time could result in the necessity to repay $3.5 billion in federal grant funding. This is in the context of an overall project that has been substantially scaled back, experienced a doubling of costs since the federal grants were approved, and which lacks sufficient funding to complete.

- The Northeast Corridor New Jersey project could meet its customer service objectives after delayed completion of the new infrastructure. A timely 2022 completion could allow the New York City project to meet its customer service objectives.
- The Seattle-Portland corridor project did not meet its customer service objectives due to suspension of service brought on by the Point Defiance train crash. In time, the objectives could be met with the addition of positive train control and restoration of the canceled trains.
- The Chicago-St. Louis project could meet its customer service objectives after completion of positive train control and delivery of the new passenger cars.
- The Chicago to Detroit corridor is meeting its objectives, with the exception of the new passenger cars, which are not yet available.
- The Charlotte-Raleigh corridor could meet its customer service objectives in time, with the addition of one more train.
- The Chicago-Iowa City corridor has not met its HSIPR customer service objectives and has no plan for achievement.

TABLE 1: SUMMARY OF PROJECT PERFORMANCE: HSIPR GRANTS

PROJECT & GRANT $	HSIPR GRANT OBJECTIVES	STATUS (SEPTEMBER 2019)
California High-Speed Rail ($3.9 billion)	(1) Construct the 119-mile initial construction segment (ICS), to be completed by 2017. (2) Provide service over the ICS by 2020. (3) Complete the high-speed rail infrastructure within the Transbay Transit Center (in San Francisco). (4) Provide service over Phase 1 from Los Angeles MSA (Anaheim) to San Francisco over high-speed rail infrastructure by 2020 and Phase 2 (as outlined in the 2010 White House grant announcement).	(1) The deadline for completion of the ICS has been extended to 2022. The state auditor expressed concern about meeting the deadline, indicating that the state may have to repay the $3.5 billion in federal grants. ICS costs have virtually doubled. (2) Service delayed until after construction ending in late 2028. This assumes restoration of funding by the Federal Railroad Administration. (3) The Transbay Transit Center high-speed rail infrastructure was completed, though funding is not available to extend service to the facility *ASSESSMENT* *The California High-Speed Rail project will not meet its HSIPR customer service objectives. Service will start no less than eight years late. The ICS has doubled in cost, an amount greater than the federal grants. The state auditor expresses concern that a potential failure to complete the project on time could result in the necessity to repay $3.5 million in federal grant funding.* *This is in the context of an overall project that has been substantially scaled back, experienced a doubling of costs since the federal grants were approved, and for which there is not sufficient funding to complete.*
Northeast Corridor ($0.75 billion)	(1) The New Jersey project was to increase top speed to160 mph, increase service frequency, and improve reliability The target completion date was 2017. (2) The New York project was to reduce trip times and improve reliability at Harold Interlocking. Completion date was 2022.	(1) The current completion date of 2020 is three years behind Amtrak's earlier plan for the New Jersey project. Service is not operating at the higher speed. The higher speeds may be attained at a later date. (2) It is too early to assess the New York project.
Chicago-St. Louis ($1.34 billion)	Increase top speed from 79mph to 110 mph on 92% (262miles) of the corridor. Reduce trip time by 15% (340 to 285minutes) Complete project by 2014. Improve on-time performance and reliability New locomotives and passenger cars were to be delivered by 2017.	By the end of 2017, the faster travel times had not been implemented. Following the WSDOT train accident (Part 2.4), IDOT indicated that it would not implement the higher operating speeds until positive train control is fully implemented on the corridor. The upgraded infrastructure appears to have been completed within budget (no indication of cost overruns was identified), though CRS reported 2017 completion date, a delay from 2014. The new locomotives have been delivered and are in service. The new passenger cars are delayed until between 2020 and 2023. *ASSESSMENT*

PROJECT & GRANT $	HSIPR GRANT OBJECTIVES	STATUS (SEPTEMBER 2019)
		The Chicago-St. Louis Corridor has yet to achieve its HSIPR customer service objectives. The higher speeds will require completion of positive train control and delivery of the new passenger cars. The improved travel times may be attained at a later date.
Seattle To Portland ($0.75 billion)	Reduce travel time by 5% (from 210 to 200 minutes between Seattle and Portland by 2017. Add two daily round-trips between Seattle and Portland Improve on-time performance	The new trains are not in service and improved travel times have not been achieved. The additional trains began to run in late 2017 with the faster travel time, but were quickly canceled and the previous slower travel times were restored due to the Point Defiance train crash. The upgraded infrastructure appears to have been completed within budget and on time (no indication of cost overruns was identified) *ASSESSMENT* *The Seattle-Portland corridor has not met its HSIPR customer service objectives, due to the Point Defiance train crash. In time, the objectives could be met with completion of the safety improvements and restoration of the cancelled trains.*
Chicago-Detroit ($0.6 billion)	Increase top speed from 79 mph to 110 mph for 77% (235 miles) of the corridor by 2016. Reduce trip time by 9% (335 to 305 minutes) Improve on-time performance and reliability. New locomotives and passenger cars were to be delivered by 2017.	Travel times have been improved by 29 minutes, virtually equaling the travel time improvement objective. The improved speed was achieved in 2019. The upgraded infrastructure appears to have been completed within budget (no indication of cost overruns was identified). The higher, 110 mph speeds are being operated on both the Michigan- and Amtrak-owned sections of the route. The new locomotives have been delivered and are in service. The new passenger cars are delayed until between 2020 and 2023. *ASSESSMENT* *The Chicago-Detroit corridor has achieved its customer service objectives, with the exception of placing the new passenger cars in service.*
Charlotte-Raleigh ($0.52 billion)	Two additional trains daily between Charlotte and Raleigh by 2017 Improve safety and on-time performance	The first new train was added in 2018. The upgraded infrastructure appears to have been completed within budget (no indication of cost overruns was identified). The safety improvements have been made as a part of construction. *ASSESSMENT* *The Charlotte-Raleigh corridor has not met its HSIPR customer service objectives. The objectives may be met in the future, with one additional train.*
Chicago-Iowa City ($0.23 billion)	Establish 79-mph passenger rail service between Chicago and Iowa City	Both states suspended efforts on the project. *ASSESSMENT* *The Chicago-Iowa City corridor has not met its HSIPR customer service objectives. In 2019 Illinois indicated that it would proceed with work within the state.*

PART 3

POLICY ANALYSIS: HIGH-SPEED RAIL IN THE UNITED STATES

Part 3 is a policy analysis in contrast to the program analysis in Part 2. The policy analysis is based on a taxpayer perspective: Taxpayers should receive value for the money they have provided, consistent with the assumptions on which public policies have been adopted. Part 3.1 considers HSIPR policy issues. Part 3.2 examines the broader policy issues of high-speed rail[116] in the United States.

3.1 POLICY ANALYSIS: HSIPR MAJOR GRANTS

3.1.1 HIGHER-SPEED RAIL ON CONVENTIONAL INFRASTRUCTURE

Five of the seven major HSIPR projects sought to develop higher-speed rail operating over upgraded conventional rail rights of way.

- In the Chicago to St. Louis corridor, more than $1.3 billion in federal funding was granted. Shortened travel times are promised, but the project did not include additional trains. Projections indicate little diversion from the dominant automobile mode in the corridor.

- In the Seattle to Portland corridor, $750 million in federal grants was provided to achieve a travel time improvement of 10 minutes on a trip that now takes 3:30. Two additional trains are to be added, once the suspended service is restored. It is projected that rail ridership will increase, but not enough to materially reduce the market share of the dominant automobile mode.
- In the Chicago to Detroit corridor, $600 million in federal funding was granted to achieve a 30-minute travel time savings on trips that previous took approximately 5:30, while service levels were to remain the same. The projected increases in ridership would not materially reduce the dominant market share of the automobile.
- In the Charlotte to Raleigh corridor, more than $500 million in federal funds were granted to add two additional trains, and implement safety improvements. With a small share of the intercity market, the additional trains would not attract meaningful numbers of drivers from cars.
- In the Chicago to Iowa City corridor, there is no passenger rail service. The new rail service would not materially reduce the dominant automobile market share in the corridor.

Before HSIPR, none of the five major conventional corridor projects had more than an insignificant share of travel in their respective corridors. Nor would any of the projects materially reduce the market shares of the dominant modes in their respective corridors, even if all project objectives were met. A recent Transportation Research Board (TRB) report indicated that 90% of interregional trips between 100 and 500 miles outside the Northeast Corridor and California are by car. This makes it nearly impossible for rail improvements to materially alter travel patterns in such corridors.[117]

3.1.2 THE NORTHEAST CORRIDOR

The Amtrak Northeast Corridor is by far the most important passenger rail corridor in the nation. It reaches 150 mph and has a commanding share of the combined rail-air market.[118] A TRB report noted that the Northeast Corridor: “is the only interregional corridor having train frequencies and schedule times that can compete successfully for market share.”[119]

The Federal Railroad Administration’s “NEC Future” proposed improvements that would require funding of $123 billion to $128 billion.[120] Even this large amount would not upgrade the line to state-of-the-art international high-speed rail operation. In addition, it is likely that the cost would escalate materially, consistent with the experience in California and as documented in international research.[121]

Given past experience, it is unlikely that federal taxpayers will supply such funding. To achieve the improved service, the states and the District of Columbia along the corridor may want to assume responsibility for the route. Commuter rail lines that use the Northeast Corridor serve each of these jurisdictions. The states and D.C. could consider a range of options, such as a self-sustaining government enterprise or privatization. The California high-speed rail project is considered in section 3.2.4.

3.1.3 NET FEDERAL TRANSPORTATION EXPENDITURES IN CONTEXT

Finally, all of this is in the context that net federal expenditures on passenger rail have been far more than that of other modes based on customer usage.

Passenger rail has been particularly expensive for federal taxpayers. Reports by U.S. DOT[122] and the Heritage Foundation[123] have found passenger rail to be the most subsidized mode at the federal level. (The Heritage report updated the previous DOT analysis.) The federal subsidy (net expenditure) for passenger rail per 1,000 passenger miles was more than 50 times that of commercial airlines and more than 150 times that of buses. The federal government actually earned net revenue on automobiles and vans. (There have been changes to federal programs since 2006. However, these changes are not likely to have materially closed the gap between the net subsidies to passenger rail and the other less-subsidized modes.) Moreover, a large share of federal revenues for automobiles, vans, buses and airlines has been covered by passenger revenues. With the more recent use of some general fund monies to augment the federal Highway Trust Fund, it is likely that there is now a modest net federal subsidy to automobiles and vans, per 1,000 passenger miles.

3.2 POLICY ANALYSIS: PUBLICLY FUNDED HIGH-SPEED RAIL PROSPECTS

The development of public policy that efficiently serves the taxpayers requires that decisions be made on the basis of the best possible information. This is especially important because a number of current presidential candidates have expressed a renewed interest in a comprehensive high-speed rail system for the United States.

3.2.1 EFFECTIVENESS OF HIGH-SPEED RAIL PLANNING: MEGAPROJECT RESEARCH

This part examines the final project costs of high-speed rail megaprojects in relation to the cost forecasts that supported the decision to proceed with such projects.

The leading international research was led by Oxford University Professor Bent Flyvbjerg, with Nils Bruzelius of the University of Stockholm and Werner Rothengatter, head of the Institute of Economic Policy and Research at the University of Karlsruhe in Germany (who has served as president of the World Conference on Transport Research Society).[124] In an extensive examination of 258 transportation infrastructure "megaprojects"[125] over 70 years in North America, Europe and elsewhere, they found that capital cost escalation on passenger rail megaprojects from the time of project approval to completion date averages 45%, with some cases of 100% or more.[126] Moreover, they found that capital cost overruns were pervasive, occurring in nine out of 10 projects.[127]

In addition, they found over-projection of ridership and revenue and revenue errors, noting that the "consequence is projects that are risky to the second degree."[128] Revenue shortfalls result in greater taxpayer subsidies.

The researchers found that there has been little or no improvement in forecast accuracy in recent years. Flyvbjerg characterized some of the inaccurate forecasts as exhibiting "strategic misrepresentation," which he has characterized as "lying."[129] He cites studies showing that project promoters underestimated costs and overestimated benefits to obtain project approvals, suggesting that this has resulted in:

> *... an inverted Darwinism, i.e. the "survival of the unfittest." It is not the best projects that get implemented, but the projects that are artificially and misleadingly made to look best on paper. And such projects are the projects with the largest cost underestimates and benefit overestimates, other things being equal. But these are the worst, or "unfittest," projects in the sense that they are the very projects that will encounter most problems during implementation in terms of the largest cost overruns, benefit shortfalls, and risks of non-viability.*[130]

Flyvbjerg et al also cite optimism bias (non-intentional) for project overselling.

Concerns such as these were expressed in the Florida, Ohio and Wisconsin project cancellations. CRS reported that the funds were "declined by the newly elected governors of those states, who expressed concern that the construction and operating costs for their rail projects might exceed initial estimates and ultimately require additional state funding."[131]

3.2.2 CURRENT HIGH-PROFILE PROJECTS

The European research was published more than 15 years ago. Yet, for example, two high profile high-speed rail systems that have been approved at least five years later have seen their capital costs escalate well beyond the typical projects analyzed by Flyvbjerg et al.

California High-Speed Rail: In the first project, California voters approved a bond referendum that they were told would deliver an international standard high-speed rail system, operating at sustained speeds of 220 mph. Service would be operated over 800 miles, connecting the state's largest metropolitan areas: San Francisco, San José, Fresno, Los Angeles, Riverside-San Bernardino, San Diego and Sacramento. The capital costs of the Phase 1 project (Los Angeles to San Francisco) have escalated nearly 100% since the HSIPR grant approvals.[132] The initial construction segment (ICS) cost escalation alone has exceeded the amount of federal grants to this segment. This led to a substantial reduction in the project scope. Moreover, the cost of Phase 1 has virtually tripled from its original projection in 2000 (in 2018$). The comparatively simple Central Valley ICS segment has also doubled in cost since 2010 (section 2.8). Some doubt whether the system will ever be completed, or operate at the promised speeds. Support is building for diversion of funding to conventional regional rail (commuter rail) projects. The project has long been criticized for having overestimated benefits and underestimating costs (including by this author).[133] The project has also been opposed by various organizations.[134]

HS2: The second project is "HS2." This London to Birmingham high-speed rail line would divide into two routes, one to Manchester and another to Leeds and Sheffield. The project could now cost £106 billion, approaching three times the £33 billion announced in 2012 (inflation adjusted).[135] HS2 could well be going through a scaling back as has already happened with the California high-speed rail project. A review of the already under construction project has been initiated. Concerns have been expressed that the line to Leeds and Sheffield may be eliminated from the project.[136] As in California, throughout its history HS2 has been opposed by a number of organizations. The more frequently occurring criticisms have asserted that project benefits have been exaggerated and its costs underestimated.[137]

This kind of cost escalation is likely to be repeated in new U.S. high-speed rail lines unless remedied by successful reforms to project management and forecasting.

3.2.3 INTERNATIONAL HIGH-SPEED RAIL AND THE UNITED STATES

Despite often rosy projections, only two comparatively short high-speed rail parts of their respective national networks have paid for both their capital and operating costs from commercial revenues, according to the International Union of Railways: Tokyo to Osaka in Japan and Paris to Lyon in France).[138] In both of these countries, the Transportation Research Board report indicates that high-speed rail lines have typically been built in corridors that already had strong rail ridership.[139]

New high-speed rail routes in the U.S. that have been most seriously proposed have had no such ridership base to draw upon, such as the California high-speed rail projects and earlier proposed projects in Florida (two projects), Texas (two projects) and Las Vegas to Victorville, California. As a result, new U.S. projects would be denied the advantage of already demonstrated strong markets, with higher subsidies the likely result.

China's Beijing to Shanghai corridor has recently been added as a third profitable route.[140] This is the core of China's high-speed rail system, with ridership and route length far greater than all other world high-speed rail systems.

Each of these three profitable high-speed lines had substantial rail ridership on the conventional rail systems that preceded them.[141]

3.2.4 HIGH-SPEED RAIL USAGE IN HIGH-INCOME NATIONS

High-speed rail may be perceived as the mode of choice for intercity travel where it operates. This is not the case in Europe with its extensive high-speed rail systems. With its shorter travel distances (covering about one-half the land area of the "lower 48" U.S. states), Europe can be more effectively served by rail than the United States. Yet, European Union high-speed rail usage is only one-sixth that of domestic commercial airlines. Airline patronage has risen faster than high-speed rail, from slightly below that of all forms of rail travel in 1995 to nearly 60% greater in 2016. Commercial air's market share has risen to six times that of high-speed rail.[142]

Moreover, despite the impression that Europeans rely on cars substantially less than Americans, European Union automobile market shares are nearly as high as in the United States (72.4% versus 78.8%).[143]

In context, even the largest high-speed rail systems in the high-income world have not materially changed national travel behavior. It seems likely that for a high-speed rail line to be profitable, a necessary but not sufficient requirement is that there was a strong pre-existing rail market in the corridor, combined with a strong pre-existing air market. Neither of these conditions is present outside the Northeast Corridor in the United States.

3.2.5 U.S. HIGH-SPEED RAIL IS MORE EXPENSIVE

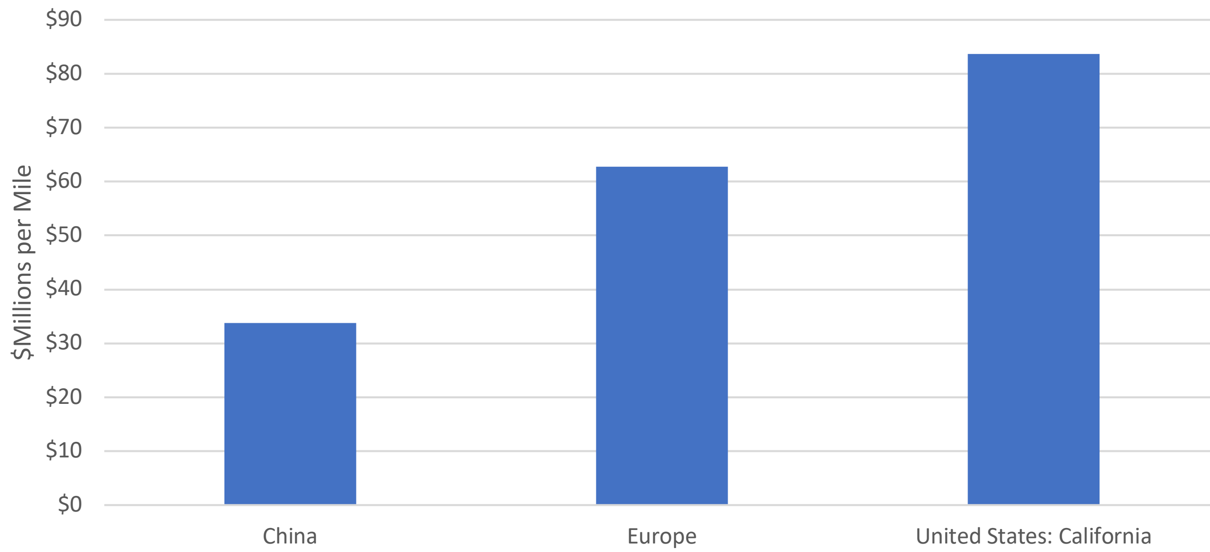
High-speed rail is exceedingly expensive in the United States. For example, the Federal Railroad Administration estimates that a new, dedicated 220 mph Northeast Corridor high-speed line from Washington, D.C. to Boston would cost between $266 billion and $308 billion (2014$), an average cost per mile of more than one-half billion dollars.[144] This is more than five times as high as the nearly $100 million per mile cost of the initial Central Valley construction in California. It is also, at FRA's high-end ($308 billion), double the projected cost of a 220 mph Northeast Corridor system proposed in 2012 by Amtrak, at $151 billion,[145] further indicating the volatility of high-speed rail capital cost projections.

The taxpayer cost per U.S. household for such a Northeast Corridor line could be as much as $2,500. This would be just for one line of the many proposed under utopian visions such as the "Green New Deal." Moreover, the FRA projections are at an early stage of engineering. As with the California high-speed rail project, actual costs could virtually double, or like HS2, even triple in cost as engineering proceeds into later stages. It can be expected that the final cost of any *national* system would be many times that of a new Northeast Corridor.

World Bank research has estimated U.S. high-speed rail construction costs at one-third higher per mile than in Europe and nearly 150% higher than in China. This was based on California high-speed rail projections, and *before* the recently announced capital cost escalation (Figure 3).[146] One source indicates that China's first 15,600 miles (25,000 kilometers) of high-speed rail were to have cost $300 billion.[147] This is within the range estimated for building a *single* new 220 mph line between Washington, D.C. and Boston, which is less than 460 miles ($266 billion to $308 billion[148]), less than 1/30th that of China.

FIGURE 3: HIGH-SPEED RAIL COSTS PER MILE: CHINA, EUROPE AND UNITED STATES (TOP OF COST RANGE)

DATA FROM BEFORE LATEST CALIFORNIA COST ESCALATION. EXCLUDES LAND ACQUISITION.



Source: Derived from Ollivier, Gerald, Jitendra Sondhi and Nanyan Zhou. 2014. "High-Speed Railways in China: A Look at Construction Costs." The World Bank.

3.2.6 REALISTIC POTENTIAL FOR ATTRACTING TRAVEL FROM OTHER MODES

The expectation that high-speed rail can attract a substantial share of automobile drivers or airline passengers is problematic.

According to CRS: "Even in heavily congested areas, HSR may be a more costly way of relieving air traffic congestion on a per-passenger basis than some combination of measures such as expanding airport capacity, applying congestion pricing to takeoff and landing slots, and implementing an enhanced air traffic control system."[149] In China, which has developed by far the world's most extensive HSR system, air travel increased faster than high-speed rail. From 2007 (the year before service began), air travel *grew* 16% faster.[150]

Given their generally unprofitable nature, new high-speed rail lines would likely require taxpayer subsidies. According to CRS, "Very high speed rail competes primarily with commercial aviation, which receives relatively little support from general Treasury funds compared to the level of funding which would likely be required to develop and operate a high speed rail network."[151]

Furthermore, there may be little potential for replacing intercity automobile travel with high-speed rail. CRS reports that "With respect to highway congestion relief, many studies estimate that HSR will have little positive effect because most highway traffic is local and the diversion of intercity trips from highway to rail will be small." Further, research was cited indicating that a one-hour time savings on the train between New York City and Boston or New York City and Washington, D.C. would reduce highway automobile usage by less than 1%.[152]

3.2.7 GOVERNMENT ACCOUNTABILITY OFFICE ANALYSIS

The U.S. Government Accountability Office offered this assessment of high-speed rail's potential in the United States.

> *Factors affecting the economic viability of high speed rail lines include the level of expected riders, costs, and public benefits (i.e., benefits to non-riders and the nation as a whole from such things as reduced congestion), which are influenced by a line's corridor and service characteristics. High speed rail tends to attract riders in dense, highly populated corridors, especially where there is congestion on existing transportation modes. Costs largely hinge on the availability of rail right-of-way and on a corridor's terrain. To stay within financial or other constraints, project sponsors typically make trade-offs between cost and service characteristics. While some U.S. corridors have characteristics that suggest economic viability, uncertainty associated with ridership and cost estimates and the valuation of public benefits makes it difficult to make such determinations on individual proposals. Research on ridership and cost forecasts has shown they are often optimistic, and the extent that U.S. sponsors quantify and value public benefits varies.*[153]

The megaproject research and the current California high-speed rail and HS2 projects provide important lessons for consideration in new U.S. high-speed rail initiatives. Projects are likely to cost far more than promised, they are highly likely to require taxpayer subsidies, and there is little prospect for attracting sufficient numbers of drivers from cars or passengers from airlines to avoid large operating subsidies.

3.2.8 HIGH-SPEED RAIL MEGAPROJECTS AND TAXPAYERS

The development of public policy that efficiently serves the taxpayers requires that decisions be made on the basis of the best possible information. As indicated above, financial control over megaprojects has typically been lost. Cost forecasts have all too often been the equivalent of a platform for cost increases that governments are *virtually forced to accept*, contrary to the information on which project authorization was based. This indicates a breakdown in democratic processes—that the people, through their elected officials, have lost financial control.

The data and analysis available at the time of project authorization should provide a reliable basis for informed decision making. This has not been the case in passenger rail. There is an urgent need to remedy this failure. The cost escalation in the California high-speed rail and HS2 projects indicate the continuing unreliability of information available at the time of project approval.

A cost-benefit analysis indicating positive results *does not* remain appropriate if the final cost is much higher. The international research indicates that passenger rail costs rise 45% on average, and even more than 100% on some passenger rail projects. When this occurs, policy-driven expenditure priorities, determined through transparent processes, are distorted. The additional funding that such a planning failure consumes is not available for other important public programs, and it is not available to the taxpayers for their own use. This represents a failure of the democratic process and requires correction.

It is unfortunate enough when mammoth cost escalation occurs on a *critical* megaproject. For example, a project might be required for the *continued* operation of a major link in the *existing* transportation system (e.g., replacing a worn-out major bridge or tunnel). Without such a megaproject, a metropolitan area, for example, might suffer economically from an immediate and substantial loss in personal and commercial mobility.

It is even more unfortunate when the cost-escalation occurs in a *non-critical* project. In the United States, high-speed rail projects are not critical—they are not required for the *continued* operation of the transportation system. They are additions to the system.

Governments have a duty to get planning right, especially on the most significant projects. There is a need for megaproject planning reform that substantially improves the disconnect between today's unreliable cost projections and the typically occurring cost overruns. This change is needed for both critical and non-critical megaprojects. Until megaproject planning and management become sufficiently reliable, taxpayers would be better served by *not* developing megaprojects that are not critical, such as high-speed rail. In some places, a new form of cost forecasting has been adopted, which is referred to as "reference class forecasting," (RCF) which principally relies on the experience of similar projects for projecting costs. One study described the partial adoption of this method:

> *Supporting the argument that RCF mitigates against optimism bias and strategic misrepresentation, this study finds that a hybrid approach, which blends components of RCF and the conventional contingency approach, produces estimation accuracy significantly better than historical results reported in literature.*[154]

What is certain is that the conventional approach to forecasting the costs of megaprojects does not comport with the interests of taxpayers.

3.3 PRIVATE INVESTMENT COULD TRANSFORM THE INCENTIVES

It may be possible for some high-speed rail and other intercity rail niche markets to be commercially developed by the private sector and operated commercially (without subsidy). Such systems are additions to the existing transportation systems and are thus non-critical (section 3.2.8). They have the advantage of shifting unforeseen risk for cost overruns away from the taxpayers, whose participation is mandatory, to investors, whose participation is voluntary. Private development radically changes the incentives that have led to "strategic misrepresentation" and "optimism bias," because those participating financially do so with their own financial resources, not those of others (taxpayers).

High- or higher-speed rail is the best fit for routes of between 200 and 400 miles where the train is significantly faster than driving, less hassle than flying, and where frequency of service offers a convenient alternative over driving.

One such system began operations on part of its intended route from downtown Miami to Orlando International Airport. Brightline Rail (formerly branded as All Aboard Florida) is relying on completely private financing, which will require fare and other commercial revenues to be sufficient to earn a profit. Service that was operating between Miami and West Palm Beach has been suspended during the COVID-19 pandemic. But construction is proceeding on the West Palm Beach to Orlando segment, which is due to be completed by 2022.

The private developer had applied for federal Railroad Revitalization and Improvement Financing (RRIF) loans, which are backed by the U.S. Treasury. This would have exposed federal taxpayers to potential losses in the case the project failed. Responding to public pressure to not impose such a risk, the developer instead substituted financing through private activity bonds (PABs) that have no government guarantee. PABs are tax-exempt bonds that rely on a defined project revenue stream. They were authorized by Congress in 2005 and have been used to finance several dozen toll road and several transit projects developed as long-term public-private partnerships (P3s).

Reason Foundation Director of Transportation Policy Robert Poole examined[155] the Miami-Orlando project and concluded that its business case appears plausible. Poole identified six likely success factors, that should be guidelines for other privately funded rail projects, as follows:

1. Selecting a route of appropriate length between major metro areas (235 miles in this case);
2. Providing express service, without stops at low-population stations (as in the government-funded California high-speed rail project);
3. As much as possible, using existing railroad right of way, in cooperation with the incumbent freight railroad;
4. Choosing higher-speed rather than true high-speed rail, to reduce both capital investment costs and operating costs, in this case 125 mph top speed vs. 200 mph for true HSR;
5. Benefiting from new real estate revenues developed around stations; and,
6. Offering two classes of service and airline-type pricing to maximize both ridership and revenue.

A public policy advantage cited by Poole is that the Florida system relies on neither taxpayer funding nor on taxpayer-guaranteed loans. Poole contrasts the financial arrangements with that of the canceled government-funded Tampa to Orlando High-Speed Rail line:

> *... any and all cost overruns on the Tampa-Orlando project would have been borne by Florida taxpayers. Given the global track record of nearly all passenger rail systems—HSR or otherwise—requiring operating subsidies, the odds were high that Tampa-Orlando (a line too short for HSR) would have needed them too.*

A different privately sponsored system of similar length would operate between Houston and Dallas-Fort Worth. The Texas Central Railway is planning a full high-speed rail line (maximum speed 205 mph) that would operate on mostly new elevated track between the two metro areas. With an estimated capital cost of $30 billion, Texas Central indicates that it will investigate federal loan funds, such as RRIF, with the accompanying taxpayer guarantee, for financing.[156] With the funding still uncertain, Baruch Feigenbaum, Reason Foundation's assistant director of transportation policy, expressed concern that Texas Central costs may be underestimated and ridership over-estimated,[157] which might lead to a taxpayer bailout.[158] Reason Foundation has recommended that RRIF be amended with provisions to provide taxpayer protections.[159]

Given the tendency for gross underestimation of costs that has occurred among government sponsored high-speed rail projects, Poole suggests a guiding principle, that taxpayers should not be "on the hook" for the success of high-speed rail projects:

> *...the most significant point of difference between HSR projects and [Brightline] is that investors are the ones on the hook for the success of the project—not taxpayers. If there are cost overruns on this project, they will be borne by [Brightline] and its investors.*

At the same time, governments should make non-financial incentives available, since this would not expose taxpayers to material losses. This could include measures such as streamlined permitting and regulatory relief to expedite commercial passenger rail projects. In addition, the successful PABs program should be expanded beyond the $15 billion total that Congress authorized (and which has nearly all been allocated) to at least double that size. These tax-exempt revenue bonds enable private-sector developers of toll roads and rail projects to compete with tax-exempt revenue bonds issued by government toll roads and rail projects. Debt service on PABs is the responsibility of the company; there are no government guarantees.

3.4 POLICY RECOMMENDATIONS

In the environment of recurring substantial underestimation of project costs, protection of taxpayer interests requires that non-critical megaprojects, such as high-speed rail, not be supported with public funding. It is recommended that:

- The federal government should not provide funding or loan financing to new high-speed rail projects.

- The federal government should support commercial passenger rail development with regulatory assistance in the form of simplified environmental reviews, expedited permitting and expansion of the Private Activity Bond program.

ABOUT THE AUTHOR

Wendell Cox is principal of Demographia.com (St. Louis, MO-IL). He is a Senior Fellow at the Center for Opportunity Urbanism in Houston, and Senior Fellow for Municipal Policy and Housing Affordability at the Frontier Centre for Public Policy in Winnipeg.

He served as a visiting professor at the Conservatoire National des Arts et Metiers in Paris. He has presented guest lectures on demographics and transport at the University of Paris (the Sorbonne), Tonji University (Shanghai), Cairo University, the University of Sydney and the University of Toronto on urban policy and transport. He served as vice-president of CODATU, a Lyon, France based organization dedicated to improving mobility in developing world urban areas.

Wendell Cox has authored a number of studies for Reason Foundation on transportation and related environmental issues, specifically, authoring or co-authoring studies on the California high-speed rail project and the Tampa to Orlando high-speed rail proposal, and the Desert Express Victorville to Las Vegas high-speed rail project.

He is co-author of the *Demographia International Housing Affordability Survey*, which in its 16th annual edition covers more than 300 markets in eight countries and which is widely quoted internationally. He is also author of *Demographia World Urban Areas*, the only regularly published compendium of population, land area and urban density for the more than 1,000 areas with more than 500,000 population.

Wendell Cox designed the *City Sector Model*, which permits more-detailed analysis of the urban form in metropolitan areas, at a small area level, which in turn permits more-precise analysis within metropolitan areas than is possible at the municipal level.

He was appointed to three terms on the Los Angeles County Transportation Commission by Mayor Tom Bradley and to the Amtrak Reform Council by Speaker of the House Newt Gingrich. He earned a BA in government from California State University, Los Angeles and an MBA from Pepperdine University, Los Angeles.

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