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HIGH-SPEED PASSENGER RAIL

Preliminary Assessment of California's Cost Estimates and Other Challenges

Statement of Susan A. Fleming, Director
Physical Infrastructure Issues

December 6, 2012

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Preliminary Assessment of California's Cost Estimates and Other Challenges

GAO Accountability * Integrity * Reliability

Highlights

Highlights of GAO-13-163T, a testimony before the Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

The California high-speed rail project is the single largest recipient of federal funding from the Federal Railroad Administration's (FRA) High Speed Intercity Passenger Rail (HSIPR) grant program. The 520-mile project (see map) would link San Francisco to Los Angeles at an estimated cost of $68.4 billion. Thus far, FRA has awarded $3.5 billion to the California project. The Authority has to continue to rely on significant public-sector funding, in addition to private funding, through the project's anticipated completion date in 2028. This testimony is based primarily on GAO's ongoing review of the California high-speed rail project and discusses GAO's preliminary assessment of (1) the reliability of the project's cost estimates developed by the Authority and (2) key challenges facing the project.

As part of this review, we obtained documents from and conducted interviews with Authority officials, its contractors, and other state officials. GAO analyzed the extent to which project cost estimates adhered to best practices contained in GAO's *Cost Estimating and Assessment Guide (Cost Guide)*, which identifies industry best practices to ensure cost estimates are comprehensive, accurate, well documented, and credible—the four principal characteristics of a reliable cost estimate. GAO also reviewed project finance plans as outlined in the Authority's April 2012 revised business plan. To identify key challenges, GAO reviewed pertinent legislation, federal guidelines and best practices related to ridership and revenue forecasting, and interviewed, among others, federal, state, and local officials associated with the project.

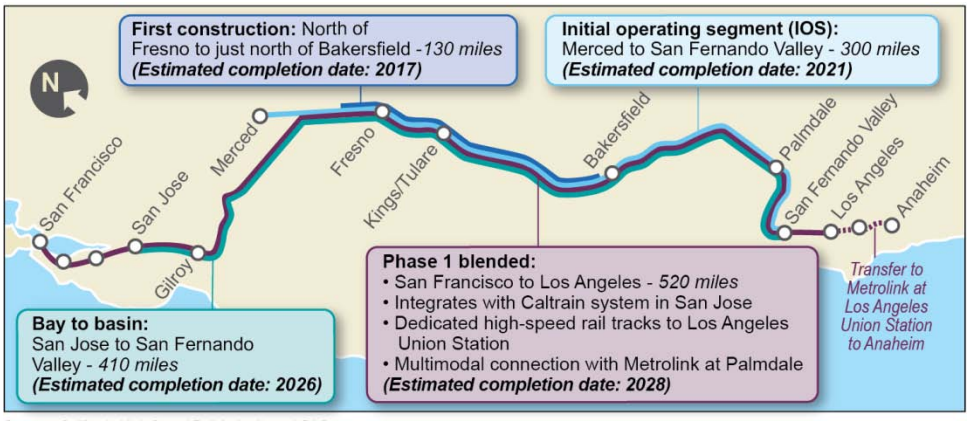
View GAO-13-163T. For more information, contact Susan A. Fleming at (202) 512-2834 or flemings@gao.gov.

What GAO Found

Based on an initial evaluation of the California High Speed Rail Authority's (Authority) cost estimates, GAO found that they exhibit certain strengths and weaknesses when compared to best practices in GAO's *Cost Guide*. Adherence with the *Cost Guide* reduces the risk of cost overruns and missed deadlines. GAO's preliminary evaluation indicates that the cost estimates are comprehensive in that they include major components of construction and operating costs. However, they are not based on a complete set of assumptions, such as how the Authority expects to adapt existing high-speed rail technology to the project in California. The cost estimates are accurate in that they are based on the most recent project scope, include an inflation adjustment, and contain few mathematical errors. And while the cost estimates' methodologies are generally documented, in some cases GAO was unable to trace the final cost estimate back to its source documentation and could not verify how certain cost components, such as stations and trains, were calculated. Finally, the Authority evaluated the credibility of its estimates by performing both a sensitivity analysis (assessing changes in key cost inputs) and an independent cost estimate, but these tests did not encompass the entire cost estimate for the project. For example, the sensitivity analysis of the construction cost estimate was limited to 30 miles of the first construction segment. The Authority also did not conduct a risk and uncertainty analysis to determine the likelihood that the estimates would be met. The Authority is currently taking some steps to improve its cost estimates.

The California high-speed rail project faces many challenges. Chief among these is obtaining project funding beyond the first 130-mile construction segment. While the Authority has secured $11.5 billion from federal and state sources, it needs almost $57 billion more. Moreover, the HSIPR grant program has not received federal funding for the last 2 fiscal years, and future federal funding is uncertain. The Authority is also challenged to improve its ridership and revenue forecasts. Factors, such as limited data and information, make developing such forecasts difficult. Finally, the environmental review process and acquisition of necessary rights-of-way for construction could increase the risk of the project's falling behind schedule and increasing costs.

Map of Planned California High-Speed Rail System and Construction Timeline



Sources: California High Speed Rail Authority and GAO.

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Chairman Mica, Ranking Member Rahall, and Members of the Committee:

Thank you for the opportunity to be here today as the committee examines the Department of Transportation's (DOT) High Speed Intercity Passenger Rail (HSIPR) program.[1] As you know, this program was established to provide grant funds to states and others to develop high-speed intercity passenger-rail corridors and projects. HSIPR is administered by the Federal Railroad Administration (FRA), and, as of October 2012, almost $10 billion has been obligated for 150 projects under this program, though it has received no appropriations since fiscal year 2010. The projects range from multibillion dollar high-speed rail systems, like that in California, to smaller projects designed to improve speeds, frequency, and reliability of conventional intercity passenger-rail service.

My statement today will discuss our ongoing examination of the California high-speed rail project—the largest recipient of HSIPR grant funds to date. We are providing preliminary observations based on our work to date, particularly related to the California High Speed Rail Authority's (Authority) project cost estimates. We also identify some of the key challenges facing the project. Our ongoing review, which this committee and other Members of the House requested, focuses on assessing the reliability of the project's cost estimates and financing plans, evaluating the reasonableness of ridership and revenue forecasts, and examining the comprehensiveness of potential project economic impacts. As such, we are assessing the quality of the information used by policymakers and not evaluating the merits of the project itself, which should be considered in light of whether this project best meets the transportation needs of the estimated 51 million Californians in 2050.

This testimony is based on our preliminary assessment of the first phase of the project's cost estimates using GAO's *Cost Estimating and Assessment Guide*[2] (*Cost Guide*). While FRA did not require HSIPR grant

[1]The program was authorized under the Passenger Rail Investment and Improvement Act of 2008 (PRIIA). Pub. L. No. 110-432, Div. B (Oct. 16, 2008).

[2]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: March 2009).

applicants to follow the *Cost Guide*, the *Cost Guide* identifies best practices that help ensure cost estimates are well documented, comprehensive, accurate, and credible. The *Cost Guide* has been used to evaluate cost estimates across the government, including infrastructure projects. We also assessed the Authority's analysis of the project's finance plans as outlined in the Authority's April 2012 revised business plan. We analyzed the extent to which the project's cost estimates adhered to the best practices contained in the *Cost Guide* and interviewed Authority officials, its contractors, and other federal officials. To identify key challenges, we reviewed pertinent legislation, federal guidelines and best practices related to ridership and revenue forecasting, prior GAO reports on the topic of high-speed passenger rail and reports published by the DOT's Office of Inspector General (OIG). In addition, we interviewed federal, state, and local officials associated with the project as well as members of the ridership and revenue peer review panel established by the Authority. We also reviewed the status of the project's environmental reviews and sought to identify legal challenges to the project as well as interviewed officials from the Authority, the California Department of Transportation, and other state officials about right-of-way acquisition.[3] We conducted our work in accordance with generally accepted government auditing standards. We plan to report the final results of our work in early 2013.

Background

While high-speed passenger rail has been in operation in Europe and Asia for several decades, it is in its relative infancy in the United States. The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) called for development of high-speed rail corridors in the United States and led to establishment of the HSIPR program. FRA administers the HSIPR program as a discretionary grant program to states and others. This program was appropriated $8 billion in funding from the American Recovery and Reinvestment Act (Recovery Act) in 2009 and an additional $2.5 billion in funding from the fiscal year 2010 DOT Appropriations Act.[4] According to FRA, as of October 2012, about $9.9 billion has been

[3]This project will construct new rail right of way to provide service, some of which may require acquisition of privately owned land.

[4]Pub. L. No. 111-5, 123 Stat. 208 (Feb. 17, 2009); Pub. L. No. 111-117, 123 Stat. 3056 (Dec. 16, 2009). For fiscal years 2011 and 2012, no appropriations were made to the program. For fiscal year 2011, $400 million in unobligated funds were rescinded. Pub. L. No. 112-10, § 2222 (Apr. 15, 2011).

obligated for 150 projects.[5] The California high-speed rail project is the largest recipient of HSIPR funds, with approximately $3.5 billion (about 35 percent of program funds obligated). We have previously reported on high-speed rail and the HSIPR program. For example, in March 2009 we reported on the challenges associated with developing and financing high-speed rail projects. These included securing the up-front investments for such projects and sustaining public and political support and stakeholder consensus.[6] We concluded that whether any high-speed rail proposals are eventually built hinges on addressing the funding, public support, and other challenges facing these projects. In June 2010, we reported that states would be the primary recipients of Recovery Act funds for high-speed rail, but many states did not have rail plans that would, among other things, establish strategies and priorities of rail investments in a particular state.[7]

California's high-speed rail project is poised to be the first rail line in the United States designed to operate at speeds greater than 150 miles per hour.[8] The planned 520-mile line will operate between San Francisco and Los Angeles at speeds up to 220 miles per hour (see fig.1). At an estimated cost of $68.4 billion,[9] it is also one of the largest transportation infrastructure projects in the nation's history. The project's planning began in 1996 when the Authority was created but began in earnest after initial funding was approved in 2008 with the passage of Proposition 1A, which authorized $9.95 billion in state bond funding for construction of the high-speed rail system and improvements to connections (see fig. 2). Construction is expected to occur in phases beginning with the 130-mile first construction segment from just north of Fresno, California, to just north of Bakersfield, California. In July 2012, the California legislature appropriated $4.7 billion in state bond funds. The process of acquiring

[5]Five of these projects were pending obligations.

[6]GAO, *High Speed Passenger Rail: Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role*, GAO-09-317 (Washington, D.C.: Mar. 19, 2009).

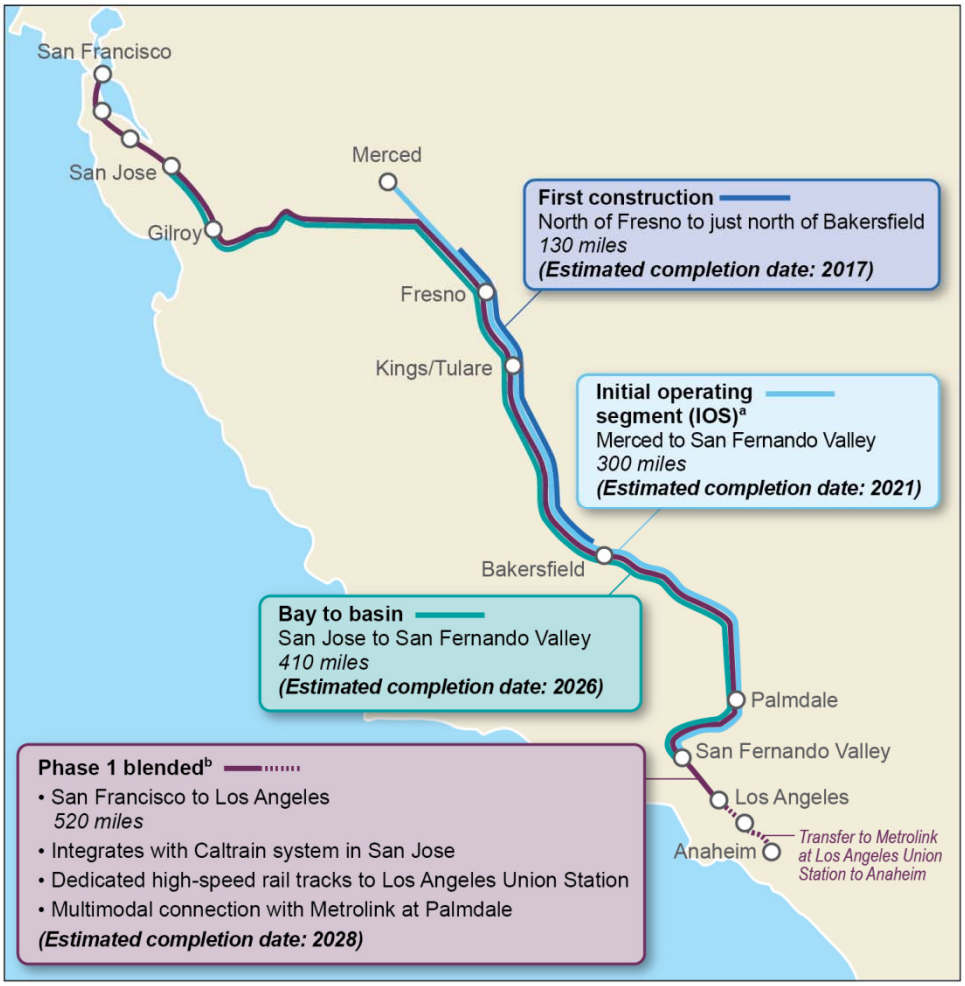
[7]GAO, *High Speed Rail: Learning From Service Start-Ups, Prospects for Increased Industry Investment, and Federal Oversight*, GAO-10-625 (Washington, D.C.: June 17, 2010). California has a state rail plan that is in the process of being updated.

[8]Amtrak's *Acela* service is capable of operating at speeds greater than 150 miles per hour but is not currently authorized by FRA to do so.

[9]All costs are in year-of-expenditure dollars unless otherwise noted.

property for the right-of-way and construction is expected to begin soon. Request for proposals to select construction contractors and right-of-way acquisitions were issued in March and September 2012, respectively. According to the Authority, a design-build contract for the first construction segment is expected to be awarded in June 2013 with construction potentially commencing no earlier than summer 2013.

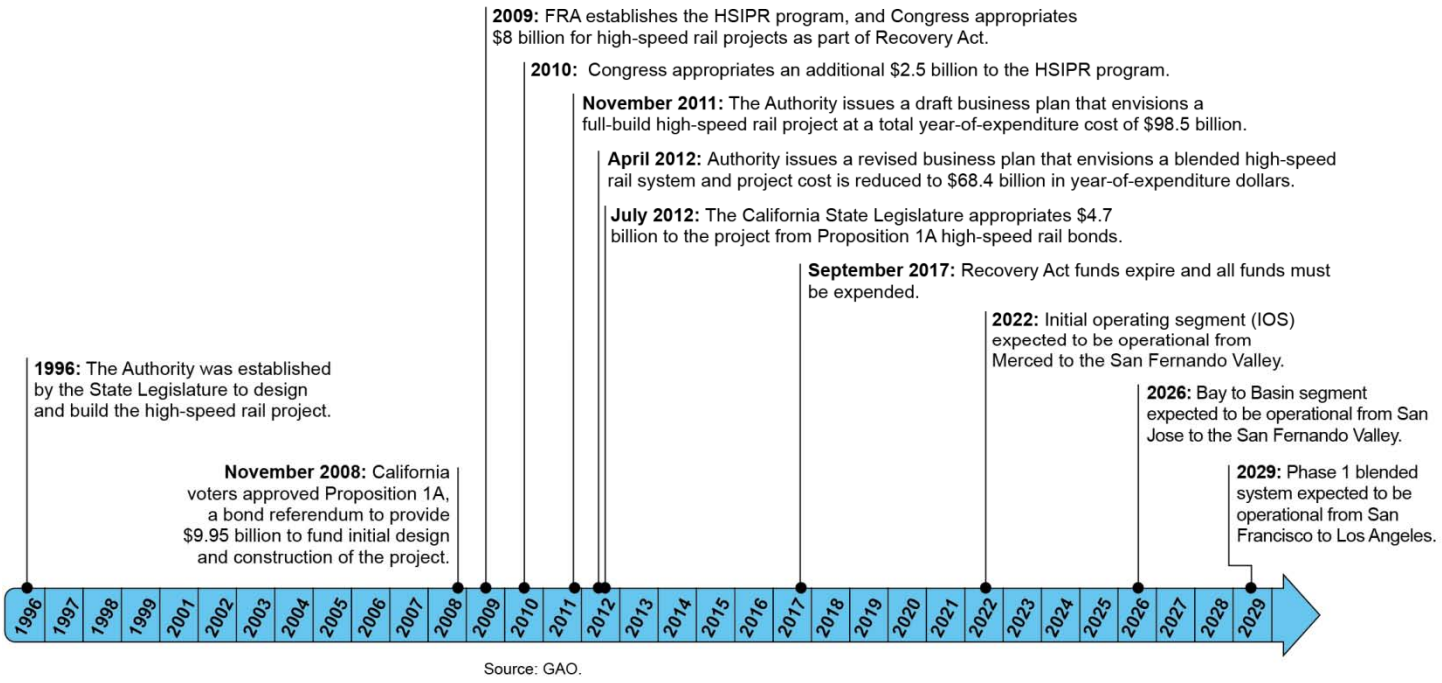
Figure 1: Map of Planned California High-Speed Rail System and Construction Timeline



Sources: California High Speed Rail Authority and GAO.

[a]The IOS includes the first construction segment. The construction southward of the IOS will continue as funding becomes available (anticipated after 2015).
[b]Early investments will be made in the bookends of the system (San Francisco peninsula and in the Los Angeles basin) beginning in 2013.

Figure 2: Timeline of California High Speed Rail Project



Source: GAO.

The project underwent substantial revision earlier this year after the Authority issued its November 2011 draft business plan in response to the initial high cost and other criticisms. Most significantly, the Authority scaled back its plans to build dedicated high-speed rail lines over its entire length. Instead, the April 2012 revised business plan adopted a "blended" system in which high-speed rail service would be provided over a mix of dedicated high-speed lines and existing and upgraded local rail infrastructure (primarily at the bookends of the system on the San Francisco peninsula and in the Los Angeles basin). This change was made, in part, to respond to criticism that the cost of the full-build system contained in the November 2011 draft business plan—$98.5 billion—was too high. The revised cost in the April 2012 plan was $68.4 billion. In addition, the ridership and revenue forecasts in the April 2012 revised business plan reflected a wider uncertainty range than the forecast

presented in the November 2011 plan.[10] For example, in the November 2011 draft business plan, the Authority estimated 2030 ridership to be between 14.4 million and 21.3 million passengers and annual revenues of the high speed rail system to be between $1.05 billion and $1.56 billion.[11] This range increased in the April 2012 revised business plan, to between 16.1 million and 26.8 million passengers and annual revenues to be between $1.06 billion and $1.81 billion.[12] The Authority attributed the increase in the uncertainty range to additional conservatism in the low ridership estimate and the ridership changes to several factors such as the adoption of the blended approach which, among other things, allows one-seat service from San Francisco to Los Angeles to begin sooner than the original full-build approach. However, over time ridership forecasts under the blended approach are less than the original full-build approach.

To date, the state of California and the federal government have committed funding to the project. In July 2012, the California state legislature appropriated approximately $4.7 billion dollars in Proposition 1A bond funds, including $2.6 billion for construction of the high-speed rail project and $1.1 billion for upgrades in the bookends.[13] The federal government has also obligated $3.3 billion in HSIPR grant funds.[14] Most of the HSIPR money awarded to the project was appropriated under the Recovery Act and in accordance with governing grant agreements must be expended by September 30, 2017. In addition, approximately $945 million in fiscal year 2010 funding was awarded to the project by FRA and is to remain available until expended.

[10]The Authority retained Cambridge Systematics—a transportation consulting firm that provides ridership forecasting and modeling services—to develop a travel-demand model that was used to generate the November 2011 ridership and revenue forecasts. Cambridge Systematics also prepared the updated ridership and revenue forecasts that were included in the April 2012 revised business plan.

[11]These revenue forecasts are in 2010 dollars.

[12]These revenue forecasts are in 2011 dollars.

[13]An additional $819.3 million was appropriated by the state legislature for connectivity projects and about $252.6 million for environmental, system design, and preliminary engineering work.

[14]Approximately $231 million in additional HSIPR grants have also been awarded primarily for environmental review and preliminary engineering work. In addition, $400 million was awarded to the Transbay Joint Powers Board for construction of a train box at the Transbay Transit Center in San Francisco. The Transbay Transit Center is the expected northern terminus of the California high speed rail line.

Preliminary Assessment of California's Cost Estimates

The Authority estimates that the high-speed rail project in California will cost $68.4 billion to construct and hundreds of millions of dollars to operate and maintain annually. Since the project is relying on significant investments of state and federal funds—and, ultimately private funds—it is vital that the Authority, FRA, and Congress be able to rely on these estimates for the project's funding and oversight (see table 1 below for a summary of the sources of funding). GAO's *Cost Guide* identifies best practices that help ensure that a cost estimate is comprehensive, accurate, well documented, and credible.

- A comprehensive cost estimate ensures that costs are neither omitted nor double counted.
- An accurate cost estimate is unbiased, not overly conservative or overly optimistic, and based on an assessment of most likely costs.
- A well-documented estimate is thoroughly documented, including source data and significance, clearly detailed calculations and results, and explanations for choosing a particular method or reference.
- A credible estimate discusses any limitations of the analysis from uncertainty or biases surrounding data or assumptions.

These four characteristics help minimize the risk of cost overruns, missed deadlines, and unmet performance targets. Our past work on high-speed rail projects around the world has shown that projects' cost estimates tend to be underestimated.[15] As such, it is important to acknowledge the potential for this bias and ensure that cost estimates are as reliable as possible.

Based on our ongoing review, we have found that the Authority's cost estimates exhibit strengths and weaknesses. The quality of any cost estimate can always be improved as more information becomes available. And based in part on evaluations from the Peer Review Group, the Authority is taking some steps to improve the cost estimates that will be provided in the 2014 business plan.

[15]GAO-09-317.

The Authority followed best practices in the *Cost Guide* to ensure comprehensiveness, but also exhibited some shortcomings. The cost estimates include the major components of the project's construction and operating costs.[16] The construction cost estimate is based on detailed construction unit costs that are, in certain cases, more detailed than the cost categories required by FRA in its grant applications. However, the operating costs were not as detailed as the capital costs, as over half of the operating costs are captured in a single category called Train Operations and Maintenance. In addition, the Authority did not clearly describe certain assumptions underlying both cost estimates. For example, Authority officials told us that the California project will rely on proven high-speed rail technology from systems in other countries, but it is not clear if the cost estimates were adjusted to account for any challenges in applying the technology in California.

The Authority took a number of steps to develop accurate cost estimates consistent with best practices in the *Cost Guide*. The estimates have been updated to reflect the new "blended" system which will rely, in part, on existing rail infrastructure; they are based on a dataset of costs to construct comparable infrastructure projects; they contain few, if any, mathematical errors; and they have been adjusted for inflation. For example, the Authority's contractor used a construction industry database of project costs supplemented with actual bid-price data from similar infrastructure projects. However, the cost estimates used in the April 2012 revised business plan do not represent final design and route alignments, and the estimates will change as the project moves into construction and operation. The Authority did not produce a risk and uncertainty analysis of its cost estimates that would help anticipate the impact of these changes. The *Cost Guide* recommends conducting a risk and uncertainty analysis to determine the primary risk factors and assess the likelihood that they may occur, helping to ensure that the estimate is neither overly conservative nor optimistic.

The Authority followed some, but not all, best practices in the *Cost Guide* to ensure that the cost estimate is well documented. In many cases, the methodologies used to derive the construction cost estimates were well documented, but in other cases the documentation was more limited. For example, while track infrastructure costs were thoroughly

[16]Operating costs include maintenance costs.

documented, costs for other elements, such as stations and trains, were supported with little detail or no documentation. Additionally, in some cases where the methodologies were documented, we were unable to trace the estimates back to their source data and recreate the estimates using the stated methodology. For example, we were unable to identify how the operating costs from analogous high-speed rail projects were adjusted for the California project.

The Authority took some steps consistent with our *Cost Guide* to ensure the cost estimates' credibility, but not with respect to some best practices. In order to make cost estimates credible, GAO's *Cost Guide* recommends:

- testing such estimates with sensitivity analysis (making changes in key cost inputs),
- a risk and uncertainty analysis (discussed above), and
- an independent cost estimate conducted by an unaffiliated party to see how outside estimates compare to the original estimates.

While the Authority performed a sensitivity analysis for the first 30 miles of construction and an independent cost estimate for the first 185 miles of construction in the Central Valley, neither covered the entire Los Angeles to San Francisco project. For the operating-cost estimate, the Authority conducted a sensitivity test under various ridership scenarios; however, this test was designed to measure the ability of the system to cover operating costs with ticket revenues and not to determine the potential risk factors that may affect the operating-cost estimate itself. The Authority also did not compare their operating-cost estimate to an independent cost estimate. Finally, as noted above, the Authority did not perform a risk and uncertainty analysis, which would improve the estimates' credibility by identifying a range of potential costs and indicating the degree of confidence decision-makers, can place on the cost estimates.

The Authority is taking steps to improve its cost estimates. To make its operating-cost estimate more comprehensive and better documented, the Authority has contracted with the International Union of Railways to evaluate the existing methodology and data and help refine its estimates. In addition, to improve the construction cost estimates, the Authority will have the opportunity to validate and enhance, if necessary, the accuracy of its cost estimates once actual construction package contracts are

awarded for the initial construction in the Central Valley in 2013. The bids for the first 30-mile construction package are due in January 2013 and will provide a check on how well the Authority has estimated the costs for this work as well as provide more information on potential risks that cost estimates of future segments may encounter.

California High-Speed Rail Project Faces Financial and Other Challenges

In addition to challenges in developing reliable cost estimates, the California high-speed rail project also faces other challenges. These include obtaining project funding beyond the first construction segment, continuing to refine ridership and revenue estimates beyond the current forecasts, and addressing the potential increased risks to project schedules from legal challenges associated with environmental reviews and right-of-way acquisitions.

Challenges To Securing Project Funding

One of the biggest challenges facing California's high-speed rail project is securing funding beyond the first construction segment. While the Authority has secured $11.5 billion from federal and state sources for project construction, almost $57 billion in funding remains unsecured. A summary of funding secured to-date can be found in Table 1.

Table 1: Funding Secured for Constructing the High-Speed Rail Project

(Dollars in billions)	
State high speed rail bonds	$8.2[a]
Federal HSIPR grants	3.3 [b]
Total secured funding	**$11.5**

Source: GAO analysis of FRA grant information and the California High Speed Rail Authority April 2012 Revised Business Plan.

[a]The Authority expects approximately $8.2 billion in proceeds from the $9.95 in authorized Proposition 1A high-speed rail bonds to be available for construction of high-speed rail. The remainder is for connectivity projects and engineering and environmental work.

[b]Approximately $3.3 billion of $3.5 in obligated HSIPR grants is available for construction of high-speed rail project. The remainder is for engineering and environmental work.

As with other large transportation infrastructure projects, including high-speed rail projects in other countries, the Authority is relying primarily on public financial support, with $55 billion or 81 percent of the total construction cost, expected to come from state and federal sources. A summary of the Authority's funding plan can be found in table 2.

Table 2: California's Funding Plan for Construction of the High-Speed Rail Project, according to the April 2012 Revised Business Plan

(Dollars in billions)

Funding source	First construction	Initial operating segment	Bay-to-Basin	Phase 1 blended	Total	
Federal	$3.3	$20.3	$8.4	$10.0	$ 42.0	(61%)
State high-speed rail bond	2.7	4.4	0.0	1.1	8.2	(12)
Locally generated	0.0	0.7	1.2	3.1	5.0	(7)
Subtotal public	**6.0**	**25.4**	**9.6**	**14.2**	**55.2**	(81%)
Private investment	0.0	0.0	10.1	3.0	13.1	(19)
Operating cash flow	0.0	0.0	0.2	0.0	0.2	(0)
Subtotal private investment and operating cash flow	**0.0**	**0.0**	**10.3**	**3.0**	**13.3**	(19%)
Total	**$6.0**	**$25.4**	**$19.9**	**$17.2**	**$68.5**	(100%)

Source: GAO analysis of California High Speed Authority's April 2012 revised business plan.

Of the total $55 billion in state and federal funding, about $38.7 billion are uncommitted federal funds, an average of over $2.5 billion per year over the next 15 years. Most of the remaining funding is from unidentified private investment once the system is operational—a model that has been used in other countries, such as for the High Speed One line in the United Kingdom. As a result of the funding challenge, the Authority is taking a phased approach—building segments as funding is available. However, given that the HSIPR grant program has not received funding for the last 2 fiscal years and that future funding proposals will likely be met with continued concern about federal spending, the largest block of expected funds is uncertain. The Authority has identified revenues from California's newly implemented emissions cap and trade program in the event other funding is not made available, but according to state officials, the amounts and authority to use these funds are not yet established.[17]

[17]California's Legislative Analyst's Office has evaluated the risks of applying cap and trade revenues to the high-speed rail project. See Legislative Analyst's Office, *The 2012-2013 Budget: Funding Requests for High Speed Rail* (Sacramento, CA: Apr. 17, 2012).

Challenges to Developing Ridership and Revenue Forecasts

Developing reliable ridership and revenue forecasts is difficult in almost every circumstance and for a variety of reasons. Chief among these are (1) limited data and information, (2) risks of inaccurate assumptions, and (3) accepted forecast methods vary. Although forecasting the future is inherently risky, reliable ridership and revenue forecasts are still critical components in estimating the economic viability of a high-speed rail project and in determining what project modifications, if any, may be needed. For example, the financial viability of California's high-speed rail project depends on generating sufficient ridership to cover its operating expenses. Ridership and revenue forecasts enable policymakers and private entities to make informed decisions on policies related to the proposed high-speed rail system and to determine the risks associated with a high-speed rail project when making investment decisions. Addressing these challenges will be important for the Authority as it works toward updating its ridership and revenue forecasts for the 2014 business plan.

Limited data and information, especially early in a project before specific service characteristics are known, make developing reliable ridership and revenue forecasts difficult. And to the extent early stage data and information are available, they need to be updated to reflect changes in the economy, project scope, and consumer preferences. For example, in developing the ridership and revenue forecasts for the April 2012 revised business plan, the Authority updated several assumptions and inputs used to develop the initial ridership and revenue forecasts that were presented in the November 2011 draft business plan. Authority officials said this update was done, in part, to build in additional conservatism in the ridership forecasts, in particular in the low scenario, and to avoid optimism bias. Among other updates, the Authority revised model assumptions to reflect changes in current and anticipated future conditions for airfares and airline service frequencies, decreases in gasoline price forecasts, and anticipated declines in the growth rates for population, number of households, and employment. Peer review groups, such as the Ridership and Revenue Peer Review Panel (Panel) established by the Authority, and academic reviewers have examined the Authority's ridership and revenue forecast methodology. These reviewers

recommended additional improvements to the model going forward.[18] For example, in developing the forecasts used for the April 2012 revised business plan, the Authority relied on data from a 2005 survey that was conducted at airports, rail stations, and by telephone from August to November 2005.[19] In a May 2012 report to the Authority, the Panel pointed out limitations with this data source and recommended that new data be collected to supplement the existing data for model enhancement purposes. Authority officials stated that they are currently developing a new revealed-preference and stated-preference survey to update the 2005 survey data and that they plan to begin collecting this new survey data in December 2012.[20] Portions of the new 2012 data will be used to re-estimate and re-calibrate the ridership model to develop updated ridership and revenue forecasts for the 2014 business plan. The Authority also plans to develop a new version of the model that will make full use of the new 2012 survey data; however, the new model is not expected to be developed in time for the 2014 business plan. It will be important to complete these future model improvements as the project is developed.

Risks of inaccurate forecasts are a recurring challenge for sponsors of the project. Research on ridership and revenue forecasts for rail infrastructure projects have shown that ridership forecasts are often overestimated and actual ridership is likely to be lower. For example, a recent study examined a sample of 62 rail projects and found that for 53 of them, the demand forecasts were overestimated and that actual demand was lower than forecasted demand.[21] According to the Authority, the ridership and

[18]Several groups have examined the Authority's ridership and revenue forecast methodology including the Ridership and Revenue Peer Review Panel—a panel convened by the Authority to conduct an independent review of the Authority's ridership- and revenue-forecasting process and outcomes. In addition, academic experts from the University of California Berkeley's Institute of Transportation Studies conducted a review of ridership and revenue forecast models used to develop forecasts in June 2010.

[19]This survey data included revealed-preference and stated-preference mode choice data from air, rail, and auto trip passengers. These data were used to construct a model of travelers' choices among different modes of travel, including high-speed rail, for different segments of the market.

[20]In addition, the Authority conducted a supplemental trip-frequency survey in May 2011. These survey data were not used to replace the 2005 survey data but were used to enable recalibration and validation to more recent conditions.

[21]Bent Flyvbjerg, "*Quality Control and Due Diligence in Project Management: Getting Decisions Right by Taking the Outside View,*" *International Journal of Project Management* (November 2012), http://dx.doi.org/10.1016/j.ijproman.2012.10.007.

revenue forecasts, in its April 2012 revised business plan, include a wider range of ridership and revenue forecasts and lower ridership and revenue forecasts compared to earlier forecasts, to help mitigate the risks of optimism bias. In addition, the Authority performed a sensitivity analysis of an extreme downside scenario to test the ridership and revenue implications of a series of downside events coinciding, such as increased average rail-travel time from Merced to the San Fernando Valley and lower auto-operating costs. Based on this analysis, the Authority determined that an extreme downside scenario would be expected to reduce ridership and revenue forecasts by 27 percent and 28 percent, respectively, below that shown for the low forecasts in the April 2012 revised business plan. According to the Authority, these forecasts would still be sufficient to cover the Authority's estimated operating costs and would not require a public operating subsidy. Authority officials stated that they intend to conduct additional sensitivity analyses going forward.

Finally, accepted forecasting methods vary, and FRA has not established guidance on acceptable approaches to the development of reliable ridership and revenue forecasts. Industry standards vary, and FRA has established minimal requirements and guidance related to information HSIPR grant applicants must provide regarding forecasts. As we have previously reported, different ridership-forecasting methods may yield diverse and therefore uncertain results.[22] As such, we have recommended that the Secretary of Transportation develop guidance and methods for ensuring reliability of ridership forecasts. Similarly, the DOT OIG has also recommended that FRA develop specific and detailed guidance for the preparation of HSIPR ridership and revenue forecasts.[23] Best practices identified by various agencies and transportation experts have identified certain components of the ridership- and revenue-forecasting process that affect results more than others and that are necessary for developing reasonable forecasts. Among others, key components include processes for developing *trip tables*,[24] developing a

[22]GAO-09-317.

[23]DOT OIG, *FRA Needs to Expand Its Guidance on High Speed Rail Project Viability Assessments*, CR-2012-083, (Washington, D.C.: Mar. 28, 2012).

[24]*Trip tables* are estimates of numbers of trips taken between specific locations. Trip tables, in conjunction with mode-choice models, provide the foundation for ridership forecasts.

mode-choice model,[25] conducting sensitivity analyses, and conducting validation testing. The Authority's forecasts included each of these key components in developing the ridership and revenue forecasts for the April 2012 revised business plan.[26] While addressing these components does not assure ridership and revenue forecasts are accurate, it does provide greater assurance that the Authority's processes for developing these forecasts are reasonable. In our ongoing review of the California high speed rail project, we are evaluating the extent to which the Authority's ridership and revenue forecasts followed best practices when completing each of these tasks. We will present the results of our assessment of the Authority's process in our 2013 report on this subject.

Environmental Review and Right-of-Way Acquisitions May Increase Risk of Project Delays

Among the other challenges facing the project, which may increase the risk of project delays, are potential legal challenges associated with the environmental laws. Under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA),[27] government agencies funding a project with significant environmental effects are required to prepare environmental impact statements or reports (EIS/EIR) that describe these impacts.[28] Under CEQA, an EIR must also include mitigation measures to minimize significant effects on the environment. The Authority is taking a phased approach to comply with NEPA and CEQA by developing EIS/EIRs for both the project as a whole as well as for particular portions of the project. To date, program level EIS/EIRs have been prepared for the project as a whole (August 2005) and for the Bay Area to Central Valley (initial certification by the Authority in July 2008 and a revised final EIS/EIR issued in April 2012). Project level EIS/EIRs have been prepared for the Merced-to-Fresno portion of the project (issued April 2012), and a draft EIS/EIR has been prepared for the Fresno-to-Bakersfield portion of the project (initial draft issued in August 2011 and revised final issued July 2012). Environmental concerns have been the subject of legal

[25]*Mode-choice models* estimate how many travelers would choose the high-speed rail option versus other available modes of travel.

[26]This includes validation testing of the ridership model, testing that, according to the Authority, was performed in January 2012 through a comparison of actual ridership (2008) and 2030 forecasts on Amtrak's *Acela* service on the Northeast Corridor.

[27]42 U.S.C. § 4321 et seq. (NEPA); Cal. Pub. Res.Code § 21000 et seq. (CEQA).

[28]Under NEPA, the document is referred to as an EIS, while under CEQA it is called an EIR.

challenges. For example, a lawsuit was filed in October 2010 against the Authority challenging the decision to approve the Bay Area to Central Valley segment based on an EIR alleged to be inadequate. Several lawsuits have been filed and these cases are still pending.

The project also faces the potential challenge of acquiring rights-of-way. Timely right-of-way acquisition will be critical since some properties will be in priority construction zones. Property to be acquired will include homes, businesses, and farmland. Not having the needed right-of-way could cause delays as well as add to project costs. Acquisition of right-of-way will begin with the first construction segment, which has been subdivided into 4 design-build construction packages. There are a total of approximately 1,100 parcels to be acquired for this segment; all of which are in California's Central Valley. In September 2012, the Authority issued a *Request for Proposals* to obtain the services of one or more contractors to provide right-of-way and real property services. The Authority estimated in its April 2012 revised business plan that the purchase or lease of real estate for the phase I blended system will cost between $3.6 billion and $3.9 billion (in 2011 dollars). According to the Authority, the schedule for right-of-way acquisition will be phased, based on construction priorities with delivery of all required parcels in the Central Valley no later than spring 2016. Acquisition is anticipated to begin in February 2013. The timely acquisition of rights-of-way may be affected by *at-risk* properties—that is, those properties that the Authority considers at-risk for timely delivery to design-build contractors for construction.[29] There could be a significant number of at-risk properties. For example, Authority officials told us there are about 400 parcels in the first construction package, about 200 of which are in priority construction zones. Of these, about 100 parcels (50 percent) are considered to be potentially at-risk for timely delivery. Since right-of-way acquisition has not yet begun, the extent that at-risk properties will ultimately affect project schedules or cost is not known. However, there may be an increased risk given the initial high percentage of at-risk parcels.

[29]There could be a number of reasons why a property is deemed *at-risk*, including instances where a property owner is contesting a property valuation or a property owner has not yet vacated a property.

Chairman Mica, Ranking Member Rahall, this concludes my prepared remarks. I am happy to respond to any questions that you or other Members of the Committee may have at this time.

GAO Contacts and Staff Acknowledgments

For future questions about this statement, please contact Susan Fleming, Director, Physical Infrastructure, at (202) 512-2834 or flemings@gao.gov. In addition, contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals who made key contributions to this statement include Paul Aussendorf, (Assistant Director), Russell Burnett, Delwen Jones, Richard Jorgenson, Jason Lee, James Manzo, Maria Mercado, Josh Ormond, Paul Revesz, Max Sawicky, Maria Wallace, and Crystal Wesco.