



Connecting California

2014 BUSINESS PLAN

APRIL 30, 2014





The California High-Speed Rail Authority (Authority) is responsible for planning, designing, building and operating the first high-speed rail system in the nation. California high-speed rail will connect the mega-regions of the state, contribute to economic development and a cleaner environment, create jobs and preserve agricultural and protected lands. By 2029, the system will run from San Francisco to the Los Angeles basin in under three hours at speeds capable of exceeding 200 miles per hour. The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations. In addition, the Authority is working with regional partners to implement a statewide rail modernization plan that will invest billions of dollars in local and regional rail lines to meet the state's 21st century transportation needs.



2014 Business Plan:

http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html

Board of Directors

Dan Richard
Chair

Thomas Richards
Vice Chair

Jim Hartnett
Vice Chair

Richard Frank

Patrick W. Henning, Sr.

Katherine Perez-Estolano

Michael Rossi

Lynn Schenk

Thea Selby

Jeff Morales
Chief Executive Officer

California High-Speed Rail Authority

770 L Street, Suite 800
Sacramento, CA 95814

(916) 324-1541

info@hsr.ca.gov

www.hsr.ca.gov

History of High-Speed Rail in California

California has evaluated the potential for high-speed rail for several decades. It first pursued the idea of a Southern California high-speed rail corridor working with Japanese partners in 1981. In the mid-1990s, planning began in earnest as it became clear that California's growing population was putting an increasing strain on its highways, airports and conventional passenger rail lines. At the federal level, as part of the High-Speed Rail Development Act of 1994, authored by then-Representative Lynn Schenk, California was identified as one of the five corridors nationally for high-speed rail planning. In that same timeframe, the California Legislature created the Intercity High-Speed Rail Commission and charged it with determining the feasibility of a system in California. In 1996, the Commission issued a report that concluded that such a project was indeed feasible.

That same year, the California High-Speed Rail Authority was created by the Legislature and was tasked with preparing a plan and design for the construction of a system to connect the state's major metropolitan areas. In 2002, following the release of the Authority's first business plan in 2000, Senate Bill (SB) 1856 (Costa) was passed that authorized a \$9.95 billion bond measure to finance the system. Submission of that measure to the state's voters was delayed several years. In the interim, the Authority, together with its federal partner, the Federal Railroad Administration (FRA), issued a Draft Program-Level Environmental Impact Report/Environmental Impact Statement (EIR/EIS) that described the system and its potential impacts on a statewide scale. Through that process, the Authority received and reviewed more than 2,000 public and government agency comments on the draft document, which was then used to determine the preferred corridors and stations for the system.

In November 2008, the bond measure (Proposition 1A) was approved by the state's voters, making it the nation's first ever voter-approved financing mechanism for high-speed rail. In 2009, \$8 billion in federal funds was made available nationwide as part of the American Recovery and Reinvestment Act (ARRA), which was passed to help stimulate the economy, create new jobs, and foster development of new rail manufacturing enterprises. This funding demonstrated a new commitment to the development of high-speed rail in the United States as embodied in a plan issued by the U.S. Department of Transportation: "A Vision of High-Speed Rail in America."

California sought and successfully secured \$3.3 billion in ARRA funds and other funds made available through federal appropriations and grants for planning and environmental work, as well as construction of the first construction section in the Central Valley, which is underway.

In 2012, Governor Edmund G. Brown, Jr. highlighted the benefits of this system in his State of the State address and declared that high-speed rail was a priority for his Administration, continuing his predecessor, Governor Schwarzenegger's, support for a high-speed rail system.

Also in 2012, the Authority adopted its 2012 Business Plan that laid out a new framework for implementing the California high-speed rail system in concert with other state, regional and local rail investments, as part of a broader statewide rail modernization program. In that same year, the Legislature approved – and Governor Brown signed into law – SB 1029 (Budget Act of 2012) approving almost \$8 billion in federal and state funds for the construction of the first high-speed rail investment in the Central Valley and 15 bookend and connectivity projects throughout the state. Work is underway on these major investments in California's transportation infrastructure. This is the Authority's 2014 Business Plan. It builds on and updates the 2012 Business Plan, implements requirements of SB 1029, identifies progress to date and describes the next major decisions and milestones that lie ahead.

Table of Contents

Statutory Requirements	6
Executive Summary	9
Section 1: Connecting California	15
Section 2: Business Model	29
Section 3: Capital and Lifecycle Costs	33
Section 4: Ridership and Revenue Forecasts	39
Section 5: Operations and Maintenance	47
Section 6: Financial Analysis and Funding	51
Section 7: Economic Impact	57
Section 8: Systems Assurance/Risk Management	63
<i>Acronyms & Abbreviations</i>	74
<i>Footnotes</i>	76
<i>Appendix</i>	79

Statutory Requirements for a Business Plan

The 2012 Business Plan serves as the Authority's foundation document for implementing the state's high-speed rail system. This 2014 Business Plan builds on the 2012 Business Plan. Specifically, it summarizes the progress we have made over the last two years, updates information and forecasts that were presented in the 2012 Business Plan and identifies key milestones and decisions we anticipate making over the next few years.

The Authority's governing statutes are established in the California Public Utilities Code sections 185000-185038; Section 185033, as amended by Assembly Bill (AB) 528 (Lowenthal, Chapter 237, Statutes of 2013), laying out the requirements for the 2014 Business Plan and they are as follows:

185033.¹ (a) The authority shall prepare, publish, adopt, and submit to the Legislature, not later than May 1, 2014, and every two years thereafter, a business plan. At least 60 days prior to the publication of the plan, the authority shall publish a draft business plan for public review and comment. The draft plan shall also be submitted to the Senate Committee on Transportation and Housing, the Assembly Committee on Transportation, the Senate Committee on Budget and Fiscal Review, and the Assembly Committee on Budget.

(b) (1) The business plan shall include, but need not be limited to, all of the following elements:

- (A) A description of the type of service the authority is developing and the proposed chronology for the construction of the statewide high-speed rail system, and the estimated capital costs for each segment or combination of segments.
- (B) A forecast of the expected patronage, service levels, and operating and maintenance costs for the Phase 1 corridor as identified in paragraph (2) of subdivision (b) of Section 2704.04 of the Streets and Highways Code and by each segment or combination of segments for which a project level environmental analysis is being prepared for Phase 1. The forecast shall assume a high, medium, and low level of patronage and a realistic operating planning scenario for each level of service.
- (C) Alternative financial scenarios for different levels of service, based on the patronage forecast in subparagraph (B), and the operating break-even points for each alternative. Each scenario shall assume the terms of subparagraph (J) of paragraph (2) of subdivision (c) of Section 2704.08 of the Streets and Highways Code.
- (D) The expected schedule for completing environmental review, and initiating and completing construction for each segment or combination of segments of Phase 1.
- (E) An estimate and description of the total anticipated federal, state, local, and other funds the authority intends to access to fund the construction and operation of the system, and the level of confidence for obtaining each type of funding.

- (F) Any written agreements with public or private entities to fund components of the high-speed rail system, including stations and terminals, and any impediments to the completion of the system.
 - (G) Alternative public-private development strategies for the implementation of Phase 1.
 - (H) A discussion of all reasonably foreseeable risks the project may encounter, including, but not limited to, risks associated with the project's finances, patronage, right-of-way acquisition, environmental clearances, construction, equipment, and technology, and other risks associated with the project's development. The plan shall describe the authority's strategies, processes, or other actions it intends to utilize to manage those risks.
- (2) To the extent feasible, the business plan should draw upon information and material developed according to other requirements, including, but not limited to, the preappropriation review process and the preexpenditure review process in the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century pursuant to Section 2704.08 of the Streets and Highways Code. The authority shall hold at least one public hearing on the business plan and shall adopt the plan at a regularly scheduled meeting. When adopting the plan, the authority shall take into consideration comments from the public hearing and written comments that it receives in that regard, and any hearings that the Legislature may hold prior to adoption of the plan.

¹ Source: Public Utilities Code Section 185033

http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=19.5.&title=&part=&chapter=3.&article

Additionally, the SB 1029 (Budget Act of 2012) added other requirements specific to the 2014 Business Plan as follows:

The High-Speed Rail Authority shall, as part of its [May] 1, 2014, Business Plan, include: a proposed approach for improving (a) demand projections, (b) operations and maintenance cost models, and (c) benefit-cost analysis as applied to future project decisions. The authority shall also submit a copy of the study by the Union Internationale des Chemins de Fer (the international union of railways)² examining how the authority's estimated operating costs for high-speed rail compare to high-speed rail systems in other countries. These business plan components approved, as consistent with the criteria in this provision, by the Secretary of Business, Transportation and Housing shall be based on recommendations of the authority's peer review panel, advice from the domestic and international rail community, and external academic review.³

² Source: UIC Peer Review of Operating & Maintenance Costs of the California High-Speed Rail Project – May 17, 2013

http://www.hsr.ca.gov/docs/about/legislative_affairs/LR_UIC_Peer_Review_Operating_Maintenance_Costs_May_17_2013.pdf

³ Source: SB 1029 (Budget Act of 2012-13)

http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_1001-1050/sb_1029_bill_20120718_chaptered.pdf

All of these requirements are addressed in this 2014 Business Plan. The Appendix includes a listing of the plan sections that correspond to each of these requirements.

Executive Summary

The California High-Speed Rail Authority's 2012 Business Plan serves as the Authority's foundation document for implementing the state's high-speed rail system. The plan called for the system to be delivered, "Better. Faster. Cheaper." To further that goal, it laid out a roadmap for how the Authority plans to build the 520-mile (Phase 1) system connecting the San Francisco Bay Area to the Los Angeles Basin through a series of phases – starting with construction of the system's backbone in the Central Valley. The 2012 Business Plan created the foundation for a statewide rail modernization program with high-speed rail at its core, and with parallel investments in urban, commuter and intercity rail systems that together will significantly improve mobility and connectivity throughout the state. It established a key principle, to which the Authority remains committed, to evaluate new opportunities and adapt to changing circumstances so that we can deliver to California a cost-effective, high quality system as quickly and efficiently as possible. It presented a coherent but flexible business model and a funding strategy that reflects and supports the Authority's phased implementation plan. Cost estimates, ridership and revenue forecasts, financial analyses and economic impact analyses were prepared and presented consistent with the phased development plan. Key risks were identified along with a summary of the risk mitigation and management approach that the Authority is applying to each of those risks.

The adoption of the phased and blended implementation strategy that was laid out in the 2012 Business Plan does not in any way change the end goals for the system; it was designed to fulfill all of the commitments made to the citizens of California through the passage of Proposition 1A in 2008. As is the case with virtually any major program, the path to completion may likely evolve, but the target remains the same. The system is being designed so that when the Phase 1 system – between San Francisco and Los Angeles/Anaheim – is complete, it will be capable of achieving the maximum nonstop travel times spelled out for each specific corridor, including a run time between the Transbay Transit Terminal and Los Angeles Union Station of two hours, forty minutes. The trainsets we are procuring will be capable of sustained revenue operating speeds of at least 200 miles per hour where conditions permit those speeds. Further, we are developing it so that each phase of the system that is implemented will not require an operating subsidy, as defined in Proposition 1A, including the "end state" Phase 1 system.

THIS IS THE AUTHORITY'S 2014 BUSINESS PLAN

This 2014 Business Plan builds on and updates the 2012 Business Plan. It complies with the statutory requirements originally established for preparing a business plan every two years and it addresses the new requirements established in SB 1029 (Budget Act of 2012). The Authority issued a draft plan on February 7, 2014 and sought and received public comment through a variety of means including mail, a dedicated email address, phone, the Authority's Draft 2014 Business Plan website and at the Authority's February, March and April Board meetings.⁴ The Authority also participated in three legislative hearings, and engaged with a range of stakeholders to review the draft plan, to seek comments, and respond to questions. The Board of Directors considered all of the comments it received on the draft plan as it adopted the 2014 Business Plan to submit to the California Legislature.

This 2014 Business Plan reports the progress we have made with our federal, state, regional and local partners over the last two years and highlights some of the milestones that lie ahead. It presents updated cost estimates and ridership and revenue forecasts, all of which have been informed by and improved through rigorous scrutiny and review by a range of external experts and academics. These new forecasts serve as the basis for the updated financial analysis – which continues to show

that the program is financially viable and which, in turn, confirms that the private sector will regard this as an attractive investment opportunity. Following the recommendations offered by the Legislative Peer Review Group (PRG)⁵ and the United States Government Accountability Office (GAO), the Authority also applied an analytic technique designed to quantify and better understand the risks associated with its forecasts, which is described in relevant sections of the document. This 2014 Business Plan also includes an updated analysis of the economic impacts of the system that also reflects GAO recommendations. Lastly, a summary of potential risks and the process the Authority uses to monitor, mitigate and manage those risks has been updated and is presented here.

WE HAVE MADE SIGNIFICANT PROGRESS SINCE 2012

Since 2012, the Authority has filled a number of organizational gaps and developed processes and systems necessary to effectively manage a large-scale infrastructure program. All of the Board of Director positions have been filled and the Board can now fully provide leadership, policy direction and oversight. A high-caliber management team has been put in place to lead and manage the program. Funding for the initial investments in the statewide rail modernization program has been approved and work on all areas of the statewide rail modernization program is underway. As a result of a bipartisan Congressional request, the Authority has undergone the most extensive review of its cost estimates, ridership and farebox revenue forecasting methodologies, and economic analysis to date by the GAO. New and more constructive relationships have been established with affected communities and concerned stakeholders. We have been engaging with global infrastructure investors and developers to explore the private sector's interest and level of participation for investing in the high-speed rail system. In early 2014, Governor Jerry Brown submitted his 2014-15 Proposed Budget to the Legislature, proposing to invest Cap and Trade⁶ proceeds to help fund the program. Additionally, work is underway on the first section of the Initial Operating Section (IOS) in the Central Valley, as well as on the electrification of the Caltrain corridor and early work in Southern California.

Even with the progress we have made, the high-speed rail system is facing – and will continue to face – many challenges. Big, bold infrastructure investments such as these have never been easy and are typically fraught with controversy. The Golden Gate Bridge, the Bay Area Rapid Transit (BART) system, California's State Water Project, and the University of California System all faced early skepticism and significant, organized opposition. Funding for these multi-generational investments spanned several decades, and California is still investing in them for the benefit of future generations still to come. Now, however, it is impossible to imagine California without these transformational investments. Mindful of these challenges, the Authority is staying focused on delivering its commitment to implement a statewide high-speed rail system that will tie together Northern, Central and Southern California cities in a way that they have never been connected before.

WHAT IS AN INITIAL OPERATING SEGMENT?

The Safe, Reliable High-Speed Passenger Train Bond Act (Bond Act) for the 21st Century establishes that Phase 1 of the high-speed rail system is the corridor between San Francisco's Transbay Terminal and Los Angeles Union Station and Anaheim. The Bond Act also defines a Usable Segment as a portion of that corridor that includes at least two stations.

As part of its development of the 2012 Business Plan, the Authority laid out a plan to implement the system in a series of phases, starting with an Initial Operating Segment (IOS). The term Initial Operating Segment is not defined in statute, and its identification is not a requirement of the Bond Act. It was adopted as part of the Authority's implementation strategy, and identifies the segment over which the Authority plans to initiate revenue high speed rail service, based on best available data and forecasts and other factors. The determination of an IOS is based on elements that are in statute, such as the requirement that it be a usable segment and that operations not require a subsidy, and also on factors including ridership, fare box revenue and operations and maintenance forecasts and the potential of private sector participation to help determine the best business case for initiating operations.

In November 2011, the Board of Directors evaluated potential usable segments on the Phase 1 Corridor against a range of criteria, including an unsubsidized high-speed rail service, and selected two Initial Operating Segments for high-speed rail service, both of which are comprised of multiple stations:

- IOS-North is the portion of the Phase 1 corridor from a San Jose station to a Bakersfield station; and
- IOS-South is the portion of the Phase 1 corridor between a Merced station and a San Fernando Valley station.

Both the IOS-North and IOS-South include the 130-mile first construction section in the Central Valley.

Subsequently, in adopting the 2012 Business Plan, the Authority selected the IOS-South to advance as the Initial Operating Section as part of its phased implementation strategy. This decision was based on a number of factors, including the high priority given to closing the rail gap between Northern and Southern California and providing an early connection into the Los Angeles Basin through a high-speed rail/Metrolink connection at Palmdale. Consistent with the principles established in the 2012 Business Plan to advance the program in a flexible manner – and to deliver a high quality project as early as possible at the lowest possible cost and leveraging private sector participation – the Authority will continue to evaluate what is the optimum IOS.

In June 2012 the Office of Legislative Counsel (a nonpartisan public agency that provides legal services to the Legislature and others) determined that the initial 130-mile section of the high-speed rail line in the Central Valley qualifies as a 'useable segment' under the Bond Act. In July 2012, the California Legislature approved – and the Governor signed into law – Senate Bill (SB) 1029 (Budget Act of 2012) which appropriated almost \$8 billion in federal and state funds to construct the first high-speed rail segments in the Central Valley and fund bookend and connectivity projects throughout California.

ADVANCING OUR PROGRAM THROUGH IMPROVED MODELING AND FORECASTS

In 2011, Authority leadership began a focused effort to improve the rigor and reliability of our modeling and estimating tools. To carry out the commitments we made, which were embodied in legislative requirements, the Authority has worked diligently to continue to improve and refine its models and forecasts, including incorporating recommendations from the PRG, the Ridership Technical Advisory Panel⁷ (RTAP), the International Union of Railways⁸ (UIC), and the GAO.

The ridership and farebox revenue model has incorporated new data and improved overall model functionality with external academic input and review. The operations and maintenance (O&M) and lifecycle cost forecasts have been upgraded to be considerably more robust and comprehensive, breaking the costs into greater levels of detail and incorporating more contingency. Following the adoption of the 2012 Business Plan, the PRG recommended that we continue to evolve our understanding and quantification of the risks associated with our cost and farebox revenue forecasts; similarly, the GAO suggested that we aim to quantify risks in order to better understand the uncertainty in our forecasts. Following these recommendations, we applied Monte Carlo simulations in updating our farebox revenue, O&M and lifecycle cost forecasts and our breakeven analysis.

The preliminary results of these analyses were discussed with the PRG in July 2013 and in its letter dated August 14, 2013, the PRG commented (*this letter in its entirety is available in the Appendix of the 2014 Business Plan*):

“We believe that the Authority has made manifest progress in all areas of planning and management since the Revised 2012 Business Plan. This assessment applies to risk management, demand forecasting, (O&M) cost modeling and the analysis of the impact of HSR on California’s greenhouse gas emissions. We particularly compliment the inclusion in all of the upcoming financial and economic analyses of probabilistic assessments based on Monte Carlo simulation techniques so that future reports will more accurately report the range and likelihood of potential outcomes.”

Our updated forecasts and analyses – and the steps we took to improve them – are discussed in more detail in the relevant sections of this 2014 Business Plan. Below are highlights of these changes and the results:

- **Ridership and Farebox Revenue Forecasts** – The enhanced model that has been developed for the 2014 Business Plan represents a major upgrade of all model components, incorporates new and re-analyzed data and reflects a range of potential outcomes. It has been updated with rigorous scrutiny by academics on the RTAP. The updated forecasts show higher ridership than projected in the 2012 Business Plan and 25 percent higher in the Medium scenario. They also show lower farebox revenues than projected in the 2012 Business Plan, ranging from 5 percent lower in 2025 to 10 percent lower in 2040 (adjusted for inflation and excluding ancillary revenues). The new results reflect recent data that projects an increase in the total number of trips people will take, but also a reduction in the average length of their trips compared to the data used for the 2012 Business Plan forecasts. As a result, the ridership forecasts have increased, but reflecting the increase in the number of shorter trips, with lower fares, farebox revenues are somewhat lower. In many ways, the results demonstrate that a private operator would implement strategies to optimize the farebox revenues and O&M costs by adapting service levels and fare structures. Such an optimization is work the Authority is planning to undertake as an on-going refinement. In addition, other non-farebox revenues factor into the overall financial performance, as discussed in Section 6.
- **Operations and Maintenance Cost Estimates** – A new O&M cost model has been developed for the 2014 Business Plan. The new model design was designed to follow the guidance by the U.S. Department of Transportation (USDOT) Office of the Inspector General and previous recommendations from the PRG, the GAO and the UIC. It includes more detailed cost categories and up-to-date unit costs for each category. Before accounting for changes to service plans, the total O&M cost had relatively little change; however, due to the increase in the number of riders, as discussed above, more train trips are needed. The updated estimates for the 2022 through 2060 analysis period show an approximately 14 percent increase from the cost estimates shown in the 2012 Business Plan, which is largely attributed to changes in the service plans – specifically the higher levels of service – that serve as input to the O&M cost model. The service plans underwent a thorough evaluation by the Authority for the 2014 Business Plan and were adjusted to reflect the results of the ridership forecasts.

- **Lifecycle Cost Forecasts** – A new and more robust model and approach for forecasting lifecycle costs was developed for the 2014 Business Plan following methodologies established by the European Union’s research arm that seeks to capture all costs involved throughout the life of an asset. It includes added contingency and adjustments for risk based on the results of the Monte Carlo analysis. This more comprehensive methodology represents a substantial step forward and yielded a more refined understanding of the system’s potential future lifecycle costs. The 2012 estimate projected that, relative to the amount of the original capital investment in the Phase 1 system, approximately 4 percent of the system would require replenishment between 2022 and 2060. The updated 2014 estimate projects that approximately 13 percent of the original capital investment would need to be replenished over that same timeframe, with the majority of that investment occurring after 2050. Replacement costs will be funded from future ticket revenues well after the system has reached maturity and does not affect the amount of funding needed from government sources or the overall operational viability of the system.
- **Cash Flow/Operational Viability Analysis** – The Authority used the same approach as was used in the 2012 Business Plan to estimate the net cash flow from operations (calculated as projected revenues minus O&M expenses). As with the 2012 Business Plan, three alternative financial scenarios were analyzed based on High, Medium and Low farebox revenue and O&M cost forecasts. As described above, the farebox revenue and cost projections for the 2014 Business Plan have been significantly reanalyzed and remodeled based on input from industry and outside experts and have undergone a risk analysis to provide greater confidence in their reliability. The resulting updated projections continue to show that the system will not require an operating subsidy as defined in Proposition 1A and consistent with other systems around the world. The statistical risk analysis performed shows that the probability of these outcomes is extremely high.

The updated forecasts and analyses continue to show that as the system develops over time, it will generate financial value through positive net operating cash flow. Once the IOS begins operation, allowing high-speed passenger service revenue forecasts to be demonstrated, the IOS is projected to have a material value to a potential private sector investor as a stand-alone service and to generate interest in investing in the future phases of the system.

LOOKING TO THE FUTURE

We will continue to work with the PRG, the RTAP, the UIC and other experts and academics, both national and international, to advance our modeling, estimating and forecasting methods and continue to improve the reliability of our forecasts.

While we continue to stay focused on building the first construction section in the Central Valley, we will also continue to focus on our next priority – closing the state’s single largest rail gap between Northern and Southern California through the Tehachapi Mountains. This critical link will tie Northern California to Southern California at Palmdale, where Metrolink commuter rail service can then provide connections throughout the Los Angeles Basin. The commitment of an ongoing, stable source of funds, such as the Governor’s 14-15 budget proposal, would allow concurrent progress on multiple usable segments – delivering benefits to Californians sooner and more cost-effectively.

To realize this goal, we will continue working with communities and stakeholders all along the route to ensure that the system will address local, regional and state needs and priorities. We will continue to evaluate options for matching remaining Proposition 1A funds with Cap and Trade, federal, state and/or local funds. And we will continue consulting with infrastructure investors and developers to evolve our business model and further engage the private sector in the development of the nation's first high-speed rail system.

High-Speed Rail: Connecting California



Section 1: Connecting California

BUILDING CALIFORNIA'S FUTURE: WORK IS UNDERWAY

Since 2012, work has gotten underway in the Central Valley, building the backbone of the first high-speed rail system in the United States. At the same time, work has advanced on a number of related connectivity and bookend projects, including environmental clearance of the proposed electrification of the Caltrain corridor, construction of the Central Subway project in San Francisco, and the identification and advancement of a number of projects in Southern California, including the Regional Connector in Los Angeles and improvements to San Diego's Blue Line Transit System.

In its 2012 Business Plan in April 2012, the Authority laid out a roadmap for implementing the system – which was approved by California voters in 2008 with the passage of Proposition 1A – in a series of phases.⁹ A central principle established in the 2012 Business Plan, and reaffirmed here, is that each phase must have independent value; specifically, it must be a usable segment and all funds required for its completion must be identified before construction begins.

The 2012 Business Plan also laid the foundation for a statewide rail modernization program with high-speed rail at its core, and parallel investments in urban, commuter and intercity rail systems, that together will significantly improve mobility and connectivity throughout the state. This implementation strategy is designed to not only yield immediate benefits but to also meet California's 21st century transportation needs. Ultimately, the strategy envisions implementing the Phase 1 and Phase 2 systems so that economic centers in the Bay Area and Northern California – including San Francisco, San Jose, and Sacramento – have fast and direct rail connections to Southern California cities – including Los Angeles, Anaheim and San Diego – through the rapidly-growing communities in the Central Valley, such as Merced, Fresno and Bakersfield.

In July 2012, the California Legislature approved – and Governor Jerry Brown signed into law – Senate Bill (SB) 1029 (Budget Act of 2012). SB 1029 approved almost \$9 billion in federal and state funds to construct the first high-speed rail segment in the Central Valley and fund 15 bookend and connectivity projects throughout California. In the near term, these projects will strengthen and improve existing rail networks, which will yield early mobility benefits throughout California. As the high-speed rail system is eventually phased in throughout the state, these completed projects will enhance the high-speed rail system's utility by providing seamless connections with local and regional rail systems. More information about these projects can be found in the Authority's Connectivity and Bookend Fact Sheet.¹⁰

To further advance the statewide rail modernization program, Governor Brown's 2014-15 Proposed Budget, submitted to the Legislature in January 2014, proposes to use \$250 million in Cap and Trade proceeds for high-speed rail and, \$50 million for urban, commuter and intercity rail projects. The Governor also proposed an ongoing state commitment of Cap and Trade proceeds to facilitate closing the state's north to south rail gap through the Tehachapi Mountains and implement the IOS. High-speed rail has been a priority investment for state Cap and Trade funding for several years, as described in the Authority's 2012 Business Plan and the California Air Resources Board (ARB) 2008 Scoping Plan and recent investment plan.

Exhibit 1.1 on the next page describes the implementation phases and shows the planning schedule used by the Authority for projecting key performance data – including ridership forecasts – and for assessing costs in year of expenditure dollars (YOES).



We are divided in many respects, north and south, coast and the center of the state. We have to pull together to form a greater community. The high-speed rail services all of those functions and that's why I think it's in the public interest. And using the money from cap and trade, which is the result of deterring greenhouse gases is very appropriate...it's coming right from sources of pollution and going right to reduce pollution.



Governor Jerry Brown

INVESTING IN CALIFORNIA'S FUTURE

As the state continues to grow, the high-speed rail system will facilitate connections for people, services and goods across California and will serve as a tool for furthering our environmental and economic development goals. We are currently home to seven of the top ten most polluted cities in the nation.¹¹ Six of the 30 most congested urban areas in the nation are located in California. Los Angeles to San Francisco is the busiest short-haul air market in the country, where approximately one in four flights is delayed by about an hour. While the state unemployment rate is dropping as the state recovers from the recession, it is still a major concern in the Central Valley where it remains well over 10 percent. The high-speed rail system will help reduce congestion on the state's highways and at its airports, will help the state improve air quality and meet its greenhouse gas reduction goals, and put thousands of people back to work.

EXHIBIT 1.1 SUMMARY OF PHASED IMPLEMENTATION

SECTION	LENGTH (APPROX)	ENDPOINTS	SERVICE DESCRIPTION	PLANNING SCHEDULE	CUMULATIVE COST (YOES\$, BILLIONS)
Initial Operating Section (IOS)	300 miles	Merced to San Fernando Valley	<ul style="list-style-type: none"> → One-seat ride from Merced to San Fernando Valley. → Closes north-south intercity rail gap, connecting Bakersfield and Palmdale and then into Los Angeles Basin. → Begins with construction of up to 130 miles of high-speed rail track and structures in Central Valley. → Private sector operator. → Ridership and revenues sufficient to attract private capital for expansion. → Connects with enhanced regional/local rail for blended operations with common ticketing. 	2022	\$31
Bay to Basin ¹²	410 miles	San Jose and Merced to San Fernando Valley	<ul style="list-style-type: none"> → One-seat ride between San Francisco and San Fernando Valley.¹³ → Shared use of electrified/upgraded Caltrain corridor between San Jose and San Francisco Transbay Transit Center. → First high-speed rail service to connect the San Francisco Bay Area with the Los Angeles Basin. 	2026	\$51
Phase 1	520 miles	San Francisco to Los Angeles/ Anaheim	<ul style="list-style-type: none"> → One-seat ride between San Francisco and Los Angeles/ Anaheim.¹³ → Dedicated high-speed rail infrastructure between San Jose and Los Angeles Union Station. → Shared use of electrified/upgraded Caltrain corridor between San Jose and San Francisco Transbay Transit Center. → Upgraded Metrolink corridor from LA to Anaheim. 	2028	\$68

¹² The Bay to Basin phase of the system is envisioned to create a connection between the high-speed rail system and the Caltrain corridor that would allow for a seamless one seat-ride to the Transbay Transit Center in downtown San Francisco. The Authority is currently working with its partners on how to develop and design this connection with a number of decisions still to be made. Because of that, in order to be conservative in preparing the ridership and revenue forecasts, a transfer to Caltrain has been assumed instead. The planned one-seat ride connection between the two systems will generate higher ridership and revenue than is shown in the current forecasts.

¹³ One-seat ride means that passengers do not need to switch trains, even if the train operates over two systems (e.g., moving north on dedicated high-speed rail infrastructure and then moving onto Caltrain tracks at San Jose, assuming electrification of Caltrain corridor by 2019 as proposed by Caltrain)

*BY 2050, CALIFORNIA IS PROJECTED TO GROW FROM TODAY'S 38 MILLION TO 50 MILLION PEOPLE*¹⁴

Leaders in California recognize the need to make critical infrastructure investments to accommodate that growth, as well as the millions of people from around the world who come here for business and tourism. Demographic shifts are also projected to drive demand for alternative modes of transportation, including high-speed rail.

CALIFORNIA'S TRANSPORTATION SYSTEMS ARE AT OR NEAR CAPACITY AND WITHOUT MAJOR NEW INVESTMENTS THE STATE WILL CHOKER ON TRAFFIC

There is already significant demand for intercity travel by car, rail and air – and this demand is growing. California has some of the nation's busiest roadways with auto congestion draining approximately \$19.5 billion in wasted time and fuel every year.¹⁵ Meanwhile, California's intercity rail lines: the Pacific Surfliner, Capitol and San Joaquin corridors (Amtrak), rank second, third and fifth in the nation respectively, and ridership on these three lines grew by 256 percent (Capitol Corridor), 66 percent (San Joaquin), and 61 percent (Pacific Surfliner), between 1997 and 2012.¹⁶

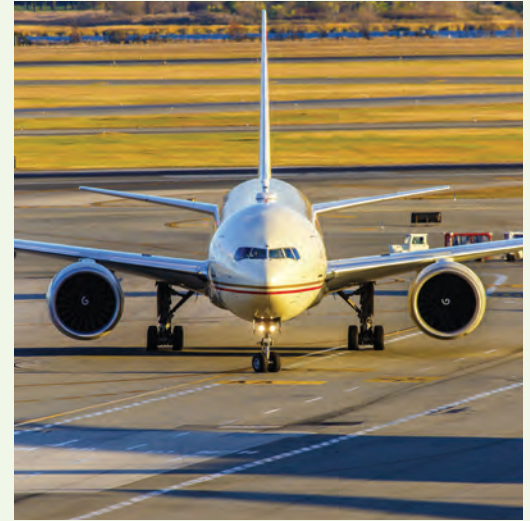
California's major airports are also hitting their capacity limits. More than eight million passengers per year fly between the Bay Area and Los Angeles area airports.¹⁷ In 2012, about 62 million passengers passed through Los Angeles International Airport (LAX), which is currently facing capacity constraints and has few expansion options. The Los Angeles World Airports expects to reach its documented threshold of 78.9 million passengers per year in 2022.

San Francisco International Airport (SFO) is the largest airport serving the Bay Area and northern California. In 2010, just over 42 million passengers moved through SFO, with over 100 million passengers projected by 2035.¹⁸ However, its location by the environmentally sensitive San Francisco Bay makes adding an additional runway highly unlikely. In evaluating various demand management techniques, SFO found that high-speed rail was the most effective measure for optimizing its capacity.

FAST CONNECTIONS BETWEEN ECONOMIC CENTERS WILL ENHANCE CALIFORNIA'S ECONOMIC COMPETITIVENESS IN THE GLOBAL MARKETPLACE

California is an economic powerhouse. If it were a country, and size measured solely by Gross Domestic Product (GDP), California would be the eighth largest economy in the world. It is home to a range of small and large businesses and economic clusters, world-renowned universities and cutting-edge start-ups. Connecting these economic clusters with fast, direct downtown-to-downtown service will help spur even greater collaboration and innovation.

Flights between Los Angeles and the Bay Area – the busiest short-haul market in the nation – are also among the most delayed in the country. Shifting more travelers from these short-haul flights to high-speed rail will allow airlines operating out of the state's international airports – such as SFO and LAX – to use constrained airport capacity for transnational and international flights, where demand is also growing. This is critical to California's ability to continue conducting business in a globalized economy.



THE CENTRAL VALLEY CONTINUES TO LAG BEHIND OTHER PARTS OF THE STATE

While the Central Valley is blessed with some of the richest agricultural land in the world, unemployment remains stuck in the double digits. Air quality is a major concern, with every major city in the San Joaquin Valley having some of the most polluted air in the U.S. and where asthma rates among children are higher than anywhere else in the state.¹⁹ Connecting the Central Valley to the broader state economy with a clean transportation system will support both economic diversification and efforts to reduce pollution.

THOUSANDS OF JOBS WILL BE CREATED AND HELP CALIFORNIA'S ECONOMIC RECOVERY

Building and operating the high-speed rail system will directly employ thousands of Californians, while indirectly generating tens of thousands more jobs throughout the larger economy. Construction on the first segment between Madera and Bakersfield is projected to create thousands of jobs over the next five years. Also, permanent jobs – train operators, maintenance yard workers, stations managers and others – will be created to operate and maintain the system. For example, according to the bottom-up estimate of the labor required in the O&M estimates to run the system, the Initial Operating System between Merced and the San Fernando Valley is expected to directly employ almost 1,500 people full time in operations.

THE AUTHORITY IS COMMITTED TO SUSTAINABLE OPERATIONS AND GREEN PRACTICES.

This includes a commitment to use renewable energy for powering the system, net zero greenhouse gas (GHG) emissions in construction, and recycling 100 percent of the steel scrap and concrete refuse generated in project construction. This commitment already has been put into practice with the Construction Package 1 (CP 1) design-build contract. Net-zero energy operations can be achieved by procuring or producing enough renewable energy to offset the amount of energy the system takes from the state's power grid to operate trains and facilities. The combined result of green practices and the resulting shift from autos and planes to the high-speed rail system means that the system is projected to save 1.7 million barrels of oil annually starting in 2030, which is the equivalent of all of the electricity used in over 1 million homes in a month. Prior to 2020, Proposition 1A investments in urban transit systems and rail modernization projects like the Caltrain electrification project will result in tens of thousands of tons of reductions in GHG emissions. California leads the nation in establishing policies to reduce GHG emissions. In 2005, former Governor Schwarzenegger signed an Executive Order directing that GHG emissions be reduced by 80 percent of 1990 levels by 2050 and in 2006, the Legislature passed AB 32, the Global Warming Solutions Act, which further directs the state to reduce statewide emissions to 1990 levels by 2020. Since ARB's 2008 Scoping Plan, the high-speed rail system has been listed as a measure to achieve the state's GHG emission reduction goals.



We need to be connected to the rest of the state. We are an island in ourselves...trying to get from Fresno to anyplace else in the state is tough...my kids can't breathe there...my grandchildren can't breathe there...we have to make sure we have jobs...and that we can have a good livelihood for our kids and our grandkids... The people in Paris, the people in Spain say, 'This is your opportunity now.' The whole world is looking at what we're doing and I need – and we all need – in the Central Valley something to hold onto to change this. And right now this is the opportunity of a lifetime.



*Lee Ann Eager,
President/CEO,
California Central Valley Economic
Development Corporation*

MILLENNIALS ARE DRIVING DEMAND FOR NEW TRAVEL OPTIONS

The U.S. population is in the middle of a demographic shift. The Millennials, or Generation “Y,” born between 1983 and 2000, comprise the largest generation in the nation with over 79 million people. Millennials have grown up during an era of rapid technological advances and urban growth and their preferences are increasingly driving larger cultural, consumption, and travel trends.

Millennials are opting for urban, walkable neighborhoods and apartments or condos. Instead of relying on cars for all or most of their trips, Millennials are taking public transit, riding Amtrak, biking, walking, and using other services. A recent study on Millennials and mobility, conducted by the American Public Transportation Association (APTA), found that they are attracted to communities that offer a variety of transportation choices.

Millennials are the first generation to have grown up with smart phones and mobile devices that make it easier to plan trips, obtain real-time travel information, and even pay fares.²⁰ Technology allows Millennials to use the time they spend waiting for or traveling on planes or trains more productively.

All of these factors underscore the fact that **Millennials are driving less than previous generations and are choosing to use public transit and other non-auto modes for some or all of their trips.** Per capita vehicle-miles traveled by 16-34 years olds has decreased by almost 25 percent between 2001 and 2009 (from 10,300 miles to 7,900 miles per capita). The vehicle miles traveled per person in 2011 in California was 8,511 miles, a 6.7 percent decrease from 2005 (although this is also in part attributed to the recession).²¹ This reflects and is consistent with large increases in rail ridership, nationwide and in California. Between 2011 and 2012, ridership increased by 18.5 percent on LA Metro’s light rail system, by 7.8 percent on BART’s heavy rail system and by 13 percent on Caltrain in the Bay Area.

These trends mean that **California High-Speed Rail will be coming online when demand for rail will be at its highest in decades and continuing to grow.** In a 2012 APTA poll on high-speed trains, 74 percent of respondents between 18-24 years old stated they were likely to use high-speed rail service for business or leisure travel.²² As high-speed rail becomes part of California’s transportation network over the next several decades, the largest and most public transit-oriented generation will be getting into its prime traveling years.

²⁰ Source: Dutzik, T., & Baxandall, P. (2013). *A New Direction Our Changing Relationship with Driving and the Implications for America's Future*. U.S. PIRG Education Fund, Frontier Group.

²¹ Source: Baxandall, P. (August 2013). *Moving off the Road: A State-by-State Analysis of the National Decline in Driving*. U.S. PIRG Education Fund.

²² Source: American Public Transportation Association. (May 2012). *APTA High-Speed Train Survey*.



Using California ARB and U.S. Environmental Protection Agency data sets, models, and methodologies, the Authority estimates that:

- In 2022, when the IOS is up and running, the resulting GHG reductions will be over 130,000 metric tons of carbon dioxide in the first year, which is the equivalent of over 23,000 personal vehicles taken off the road.
- Between 2022 and 2040, the cumulative reduction of carbon dioxide is estimated to be over 10 million metric tons.
- Prior to 2020, investments in early rail modernization projects will yield reduced GHG emissions, including, for example, Caltrain electrification, which will result in at least 68,000 tons of reductions.

In addition, the CARB and other state planning agencies view high-speed rail as an investment that can be a catalyst to effective land use planning and transit oriented development, which will provide enormous additional savings of GHGs.

NOTE: These numbers represent an update to the 2013 GHG Report based on updated inputs for the baseline scenario of the ridership model. The 2013 GHG Report is available on the Authority's website at http://www.hsr.ca.gov/docs/about/legislative_affairs/HSR_Reducing_CA_GHG_Emissions_2013.pdf

MAJOR PROGRESS HAS BEEN MADE ON A NUMBER OF FRONTS

In 2008, the Legislature and the voters approved Proposition 1A, providing \$9 billion to help fund a \$45 billion (year of expenditure (YOES)) program. At that juncture, no federal funds had been provided or anticipated, and there was no clear plan for how to implement the program. Since then, the Authority has secured \$3.3 billion in federal funds and has developed an implementation plan that allows for phased development, an approach consistent with all major national and international transportation programs. New leadership is in place, new partnerships have been established and work is underway on the first construction section in the Central Valley. Challenges clearly exist, but real progress has been made. Below is a snapshot of the Authority's progress since the adoption of the 2012 Business Plan.

SINCE BOARD ADOPTION OF THE 2012 BUSINESS PLAN, THE AUTHORITY HAS ACCOMPLISHED THE FOLLOWING:

ESTABLISHED A NEW LEADERSHIP TEAM WITH PROVEN EXPERIENCE IN INFRASTRUCTURE PROJECT MANAGEMENT AND DELIVERY

Since 2012, the Authority has successfully recruited a number of highly qualified individuals with proven records in implementing complex infrastructure projects and filled all of the positions on its executive management team. Three Regional Directors and regional staff have been brought aboard to ensure a strong presence across the state and in local communities. In July 2013, the Authority joined the California State Transportation Agency (CalSTA), a newly-formed state agency focusing on coordinating the programs of various transportation enti-

ties. Through this change, the Authority has gained additional oversight not previously in place and greater access to transportation experts at the California Department of Transportation (Caltrans).

ADDRESSED ORGANIZATIONAL DEFICIENCIES AND DEVELOPED PROCESSES AND SYSTEMS NECESSARY TO EFFECTIVELY MANAGE A LARGE-SCALE CONSTRUCTION PROJECT

In a letter issued to the California Legislature in February 2013, the California Bureau of State Audits (BSA) noted the manifest progress the Authority has made to address organizational deficiencies and to develop the processes and systems necessary to effectively manage the development of the high-speed rail system. Of the 23 recommendations made to the Authority (on issues ranging from the Authority's business plan, risk management, staffing, oversight, and conflict of interests in the BSA's April 2010 audit report and January 2012 follow-up report) the Authority had fully implemented 17 recommendations, while partially implementing another 4. In a presentation to the Joint Legislative Audit Committee in March 2013, the California State Auditor, noted that the number of recommendations fully implemented had risen to 18 with the hiring of the Authority's Chief Financial Officer.

SECURED \$6 BILLION IN FEDERAL AND STATE FUNDS TO BEGIN CONSTRUCTION IN THE CENTRAL VALLEY

In July 2012, with the passage of SB 1029, the California Legislature appropriated \$6 billion in federal and state funds for the project. Of this, \$2.6 billion in state bond funds and \$3.2 billion in federal funds are funding construction of the first section of high-speed rail in the Central Valley. The remaining \$252 million is being used for continued statewide system design and planning.

FORGED PARTNERSHIPS TO INVEST ALMOST \$2 BILLION IN PROPOSITION 1A FUNDS FOR BOOKEND AND CONNECTIVITY PROJECTS

SB 1029 also appropriated \$2 billion – that will leverage approximately \$5 billion in additional funding – for bookend and connectivity projects. The Authority is collaborating with our state and regional partners to begin implementing these critically important projects that will provide early benefits before they are eventually integrated with high-speed rail. At its April 2012 Board meeting, along with adopting the 2012 Business Plan, the Authority Board also approved Memoranda of Understanding (MOUs) with local transit partners in Southern California and Northern California. The goal of the MOUs was to advance statewide rail modernization by starting to invest in local rail systems on the bookends that would eventually be part of or connect to the statewide high-speed rail system. Since then, the Authority has continued to work hard to help advance the projects laid out in the MOUs. The status of several of these projects is described on Page 24 of the Business Plan, while all of the projects are described in the Authority’s Connectivity and Bookends Fact Sheet available at <http://www.hsr.ca.gov/docs/newsroom/fact%20sheets/High-Speed%20Rail%20Connectivity%20and%20Bookends.pdf>.

RECEIVED A RECORD OF DECISION FROM THE FEDERAL RAILROAD ADMINISTRATION ON THE MERCED TO FRESNO PROJECT SECTION, CLEARING THE PATH FOR CONSTRUCTION TO BEGIN

In September 2012, the Federal Railroad Administration (FRA) issued a Record of Decision (ROD) approving the “Hybrid Alternative” alignment for the Merced to Fresno project section, which was selected by the Authority's Board of Directors in May 2012. We are also continuing to work with stakeholders along the Fresno to Bakersfield project section, which is also part of the first construction segment, and anticipate environmental clearance and final decisions about alignments and station locations by the end of 2014. The Final EIR/EIS for the Merced to Fresno project section, which further describes

FUNDING APPROVED IN SENATE BILL 1029

California High-Speed Rail

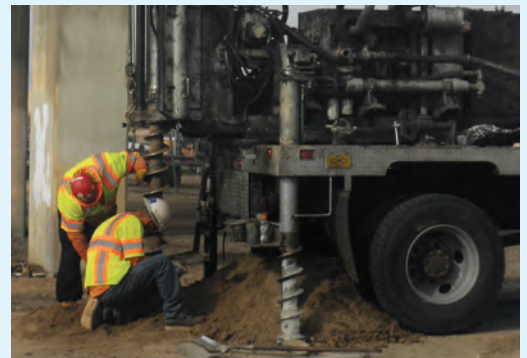
- \$2.6 billion (Proposition 1A) and \$3.2 billion (federal) to build the first section from Madera to Bakersfield.
- \$252 million in federal funds and state Proposition 1A funds for designing and planning the Phase 1 and Phase 2 system.

15 Connectivity and Bookend Projects

- \$819 million for connectivity projects statewide.
- \$705 million to modernize Caltrain in the Bay Area.
- \$500 million to upgrade rail systems in Southern California.

WORK IS UNDERWAY

In August 2013, the Authority executed its first design-build contract, known as Construction Package 1 (CP 1). This 29-mile segment runs from Avenue 17 in Madera south to East American Avenue in Fresno. The contractor has opened offices in downtown Fresno, is hiring workers, completing design, preparing management plans and schedules, conducting field work and finalizing third-party agreements. In April 2014, the Authority released the Request for Proposal to five world-class teams, inviting them to submit formal proposals for the design-build contract for Construction Package 2-3 (CP 2-3). CP 2-3 covers the next 60 miles from Fresno south to 1 mile north of the Tulare–Kern County line near Bakersfield. The Authority anticipates awarding that contract in late 2014.



REACHING OUT TO SMALL BUSINESSES

The Authority's Small Business Advocate is conducting a robust and inclusive outreach program to increase small business participation and support small businesses through free workshops and technical assistance. Under the guidance of the Advocate, the Authority has held 15 workshops since April 2013 to provide small businesses with hands-on technical assistance, yielding hundreds of small business certifications.



the Hybrid alternative is available at http://www.hsr.ca.gov/Programs/Environmental_Planning/final_merced_fresno.html.

RECEIVED APPROVAL FROM THE SURFACE TRANSPORTATION BOARD, A FEDERAL AGENCY WITH JURISDICTION OVER THE PROJECT

In June 2013, the Surface Transportation Board (STB), an independent federal regulatory agency with exclusive jurisdiction over the nation's interstate rail system, ruled that it has jurisdiction over the California high-speed rail project. Therefore, STB became a cooperating federal agency in the environmental review process for the development of the system. In addition, the STB authorized the Authority to begin construction of the Merced to Fresno project section and exempted the Authority from its full application process for this project section.

STARTED WORK ON THE FIRST SEGMENT OF HIGH-SPEED RAIL

Starting in the Central Valley will allow the Authority to test and certify the first high-speed rail equipment in the United States even as it completes construction of the IOS. Building this first section will involve multiple construction packages with work to be completed in 2018. Even as we build this section, we are working to advance the IOS to close the north-south rail gap through the Tehachapis. We also continue to evaluate the potential for interim service, potentially with

Amtrak San Joaquin trains, on the first construction segment with our federal, state and local transportation partners, consistent with the principle that each program phase can stand alone and have independent utility.

FOCUSED ON BUILDING NEW AND BETTER RELATIONSHIPS WITH AFFECTED STAKEHOLDERS AND COMMUNITIES

In the last two years, we have committed to more openness and transparency and to improving relationships with the communities that will be affected by the construction and operation of the system. We have focused on reaching out to the public and on establishing partnerships with communities to help build the project. A robust outreach and stakeholder engagement effort is underway with the Central Valley. This includes ongoing meetings with elected officials, business and property owners, the public and in the establishment of a "One-Stop Shop" in Fresno City Hall that assists impacted property and business owners and streamlines their interactions with the city and the Authority.

ENTERED INTO MAJOR AGREEMENTS TO PRESERVE IMPORTANT FARMLANDS

In April 2013, the Authority and several Central Valley farm bureaus and stakeholders entered into a series of agreements to preserve farmland and mitigate the effects of high-speed rail construction on agricultural operations. These agreements resulted in the creation of a \$4 million Agricultural Mitigation Fund that will be used to protect Important Farmland in perpetuity. In June 2013, the Authority entered into a contract with the California Department of Conservation that represented the culmination of an agreement between the Authority and the agricultural interests in the Central Valley. This agreement will preserve Important Farmland by identifying suitable agricultural land for mitigation of project impacts and by purchasing agricultural easements from willing sellers. For every acre impacted, at least one acre will be preserved in perpetuity.²³

PARTNERED WITH AMTRAK TO JOINTLY PROCURE HIGH-SPEED TRAINSETS THAT WILL BE MANUFACTURED IN THE UNITED STATES

The Authority and Amtrak have joined forces in the search for high-speed trainsets for both California and the Northeast Corridor. This approach will increase industry interest and competition, reduce administrative and capital costs associated with procurement, and is designed to encourage manufacturers to locate in the U.S. and help achieve Buy America objectives. In January 2014, a joint request for proposals (RFP) was issued for trainsets that are currently being manufactured and in commercial service that are capable of operating safely at speeds up to 220 mph.

EXPANDED OPPORTUNITIES TO PUT AMERICANS BACK TO WORK AND IMPLEMENTED AN AGGRESSIVE SMALL BUSINESS PROGRAM

In 2012, the Authority Board of Directors approved a Small Business Program that has an aggressive 30 percent goal for small business participation, including Small Business, Disadvantaged Business Enterprises (DBE), Disabled Veteran Business Enterprises (DVBE), and Micro-Businesses (MB). The overall small business goal also includes a 10 percent DBE participation goal and a 3 percent DVBE participation goal.

Additionally, the Authority Board of Directors has approved a Community Benefits Policy that sets the target will ensure that 30 percent of the hours will be performed by National Targeted Workers and that 10 percent of the hours will be per-

ENSURING THAT FUTURE CAP AND TRADE FUNDS WILL BENEFIT DISADVANTAGED COMMUNITIES

Investment of Cap and Trade revenues will support the objectives of SB 535²⁴ – to ensure that disadvantaged communities benefit from the use of Cap and Trade funds – in building the IOS by:

- **Creating new jobs** – High-speed rail construction will create thousands of jobs along the IOS corridor including in communities of the Central Valley, which has some of the highest unemployment rates in the country. Using Cap and Trade funds for construction of the IOS will create direct construction-related jobs as well as indirect jobs and related economic development benefits in these communities. The Authority has taken steps to help achieve these outcomes through its Targeted Worker Program and its aggressive Small Business Program.
- **Improving/mitigating air quality** – Air quality is one of the most significant environmental concerns for communities along the IOS corridor and in the Central Valley in particular who live with some of the poorest air quality in the nation. During construction, we are requiring our contractors to use equipment with the cleanest engines available or to retrofit older equipment to achieve air pollutant reductions. We are also working with the San Joaquin Air Pollution Control Board to replace polluting agricultural and hauling equipment with new, clean tractors, pumps, or engines. This equipment will stay in the Valley, continuing to improve local air quality in communities that are suffering from the highest rates of asthma and respiratory disease in the country.
- **Providing new connections to economic centers** – As the system is implemented, it will help connect the Central Valley communities to the economic centers of the Bay Area and Los Angeles and support greater economic development and diversification. We have already identified \$4.5 million (federal funds) to go to station communities to update land use plans and zoning codes and create new compact, walkable development around the stations. Central Valley communities will benefit from this sustainable community planning work and from the connectivity that will be offered to the Los Angeles Basin once the IOS is completed.
- **Supporting investments in local/regional transit** – Throughout the state, the Authority is working to provide funding to its transit partners so that local transit is improved now for the benefit of communities who rely on transit, and to attract more riders to these systems. This will build up an interconnected, modern, statewide rail system with high-speed rail serving as the backbone. This funding and partnership includes the Statewide Rail Modernization Program which is making commuter and inter-city rail more convenient and practical for communities throughout the state.

²⁴ Source: http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0501-0550/sb_535_bill_20120930_chaptered.pdf

HIGHLIGHTS OF PROGRESS TO DATE ON CONNECTIVITY AND BOOKEND PROJECTS



Caltrain Corridor

SB 1029 allocated \$705 million to help fund \$1.45 billion in improvements to the corridor between San Francisco and San Jose. The Authority is collaborating with the Peninsula Corridor Joint Powers Board on developing an approach to blended system operations. The Peninsula Corridor Electrification Project Draft Environmental Impact Report was released on February 28, 2014. SB 1029 also provided \$42 million for advanced signaling and communication systems and the Authority is working closely with Caltrain's partner agencies on completing the systems (Positive Train Control and Communications Based Overlay Signal System) that will meet federal requirements and allow trains to operate more safely.



BART

SB 1029 provides \$145 million to lengthen track at the Millbrae Station to provide a cross platform connection to high-speed rail and for the purchase of new BART cars. The state investment will be matched by other funding, including a BART contribution of \$38 million. A multi-agency effort is underway to upgrade the Millbrae Station, which is a regionally important multimodal station serving BART, Caltrain, and Samtrans systems today and high-speed rail service in the future. This effort also includes advancing transit oriented development on the surrounding station property, and an Access Plan that will identify access improvements and on-site circulation for all modes, as well as opportunities to improve transfers among BART, Caltrain, buses, airport shuttles, and future high-speed rail.



Altamont Corridor Express

In October 2012, the California Transportation Commission (CTC) approved the release of \$10.9 million of Proposition 1A funds (SB 1029 funds) for the Altamont Corridor Express (ACE) Stockton Passenger Track Extension (Gap Closure) project in San Joaquin County. The funds will be used to extend an existing ACE platform so Amtrak passengers have direct access to it. The project will also provide additional track work for a new ACE maintenance facility. This investment brings the total to \$25 million, with other matching funds.



Los Angeles Regional Rail Connector

SB 1029 provides \$115 million (and leverages \$1.4 billion in funding) to help construct a two-mile light-rail connection between Metro Gold, Metro Blue and Metro Exposition light-rail transit systems through downtown Los Angeles. This will provide a one-seat ride from throughout Los Angeles County to Union Station, where connections can be made to the high-speed rail system. Environmental review has been completed, a Record of Decision was issued in 2012, and work has begun.



San Diego Metropolitan Transit System (Trolley) Blue Line Light Rail Improvements

SB 1029 provides \$58 million to rehabilitate grade crossings, track, signaling and other improvements to improve frequency and reliability. This investment helps bring a total investment of \$152 million to the project. The last phase of construction is underway and will continue through late 2015.

NOTE: More information and highlights regarding all Connectivity and Bookend Projects can be found in the Authority's Connectivity and Bookends fact sheet at: <http://www.hsr.ca.gov/docs/newsroom/fact%20sheets/High-Speed%20Rail%20Connectivity%20and%20Bookends.pdf>

formed by disadvantaged workers. According to the National Targeted Hiring Initiative, disadvantaged workers either live in an Economically Disadvantaged Area or face specific barriers to employment.²⁵ The impact of the Authority's policy will be most strongly felt in the Central Valley where the design-build contractors will be required to fulfill these requirements and where the majority of workers will qualify as disadvantaged workers. At the same time, the Fresno Regional Workforce Investment Board received a \$1.5 million grant to train hundreds of people for jobs in constructing the project.

RECEIVED SOLID MARKS FROM THE GAO REVIEW OF OUR COST, RIDERSHIP AND REVENUE FORECASTS

In 2012 and 2013, as a result of a bipartisan Congressional request, the GAO spent more than a year taking the most comprehensive look to date at the forecasts that were presented in the Authority's 2012 Business Plan. The forecasting methodologies were confirmed by the GAO and other external reviews as being consistent with industry best practices.

CONTINUED TO IMPROVE THE RIGOR AND RELIABILITY OF ITS MODELING AND ESTIMATING TOOLS

The Authority has worked diligently to continue to improve and refine its models and forecasts, incorporating recommendations from the PRG, the RTAP, the UIC and the GAO. These improvements are discussed in several sections of this 2014 Business Plan.

DEVELOPED A COMPREHENSIVE RISK MANAGEMENT PROGRAM INCORPORATING RIGOROUS QUANTITATIVE RISK ANALYSIS

Since 2012, the Authority has made a number of modifications and improvements to its risk management program and processes. The improvements are both organizational and process-related. Organizationally, the Authority appointed a Risk Manager who oversees and directs risk management efforts at both the program and regional level, ensuring a uniform and proactive process. The process itself, as described in the Authority's revised Risk Management Plan issued in 2013, has been significantly improved to better define and systematize risk management efforts and objectives, address SB 1029 requirements and quantify the program's operating financial risk exposure.²⁶

The products of this effort include quantitative determinations of risk exposure and risk-adjusted estimates for its O&M and lifecycle cost estimates, its ridership and farebox revenue forecasts and its breakeven analysis. The Authority has also deployed these tools to develop risk-informed contingency recommendations for CP 1, as well as schedule analysis for CP 1 and CP 2-3.

APPLYING MONTE CARLO RISK ANALYSIS

Monte Carlo simulations are an analytic technique used by many decision-makers, both public and private. The goal of a Monte Carlo simulation is to quantify the chances that risks that might impact future costs, revenues or other aspects of a program will occur and, if they did occur, what their impact would be. This allows decision-makers to make informed choices and/or develop strategies and plans to prevent, manage, or mitigate potential future risks.

Monte Carlo analysis involves running thousands of simulations where each of the risks may occur with a given probability; the simulation develops an overall probability distribution of potential cost or schedule outcomes. This distribution can be used to describe how likely it is that any given outcome might happen and what the chances are for the results to be above or below a given threshold. This allows decision-makers to thoroughly understand the level of confidence associated with a specific forecast.

These methods are used for a variety of purposes. For example, the banking and finance sector uses Monte Carlo simulations to help make investment decisions in an uncertain environment where risks have been identified and estimated. The decision reflects how much risk the financial institution is willing to take and how costly the risk would be based on the probability that this risk could actually occur.

NEXT MILESTONES

Over the coming months, the Authority will build on the progress we have made to date, including focusing on building the high-speed rail backbone in the Central Valley and working closely with communities and stakeholders along the route. Major milestones will include completing the environmental review for the Fresno to Bakersfield project section, receiving approvals from the FRA and the STB, and advancing procurement of the remaining construction packages for the Central Valley's first construction section and for rolling stock. More specifically, the Authority will:

ADVANCE COMPLETION OF ENVIRONMENTAL REVIEWS

Implementation of the blended system and integration of the state rail modernization program have resulted in some changes in the environmental schedule to accommodate work with strategic stakeholders on the bookends (the San Francisco Bay Area and the Los Angeles Basin) and on connectivity projects. These new timelines will allow additional time for community outreach and stakeholder input. The Authority continues to make progress and is prepared for additional schedule changes if necessary.

- The Authority extended the comment period on the Fresno to Bakersfield Revised Draft Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/EIS) from the required 45 days to 90 days, allowing more time for public comment and stakeholder involvement. The public comment period concluded on October 19, 2012, which shifted the anticipated date for the ROD from January 2013 (as projected in the 2012 Business Plan) to fall 2013. In November 2013, the Board of Directors concurred with a staff-recommended preferred alternative for this section for purposes of preparing a Final EIR/EIS. To address stakeholder concerns, as well as additional comments from the reviewing agencies, the date for the Fresno to Bakersfield ROD has been extended to the spring of 2014. Once the ROD has been issued and authorization has been obtained by the STB for this section, the Authority will then begin acquiring right-of-way and start construction.

EXHIBIT 1.2 SHOWS COMPLETED AND PROJECTED MILESTONES FOR THE ENVIRONMENTAL REVIEW PROCESS BY PROJECT SECTION

SECTION	ANTICIPATED RECORD OF DECISION
San Francisco to San Jose*	Summer 2017
San Jose to Merced	Fall 2016
Merced to Fresno	Completed
Fresno to Bakersfield	Spring 2014
Bakersfield to Palmdale	Fall 2015
Palmdale to Los Angeles	Summer 2015
Los Angeles to Anaheim	Spring 2016
Los Angeles to San Diego (Phase 2)	TBD
Merced to Sacramento (Phase 2)	TBD

* Caltrain's Peninsula Corridor Electrification Project environmental review is anticipated to be completed by the end of 2014.

Exhibit 1.2 above shows the projected schedule for completing the environmental reviews for all project sections.

The Central Valley Wye is a key project element associated with allowing service from the south to travel west into the San Francisco Bay Area and north to Merced and Sacramento. The Authority shifted this project element from the San Jose to Merced project section to the Merced to Fresno project section and is preparing a supplemental environmental document on it which will enable us to accelerate the extension to Merced more quickly if circumstances present themselves.

AWARD CONTRACT FOR CONSTRUCTION PACKAGE P 2-3 (CP 2-3)

In October 2013, the Authority released an Request for Qualifications (RFQ) for design-build work for CP 2-3 running south from Fresno to one mile north of the Tulare-Kern County line. We received five Statements of Qualifications from potential bidders in January 2014. This contract – estimated at \$1.5 to \$2 billion – will bring more jobs to the Central Valley. The team that the Authority ultimately selects will be responsible for all work required to design and construct this section. Teams will be evaluated based on experience, technical competency, ability to perform and other factors. On April 3, 2014, the Authority released the Request for Proposal (RFP) to five world-class teams, inviting them to submit formal proposals for the design-build contract for CP 2-3. As with the procurement for CP 1, the contract will be awarded based on both technical and cost factors. Bids are due September 2, 2014 and, the Authority anticipates awarding this contract by the end of 2014. Also, on April 3, 2014, the Authority released the RFQ for Project and Construction Management (PCM) services for CP 2-3. The firm selected for this work will ensure that technical and contract requirements, including costs, are being met. Statements of Qualifications from interested firms must be submitted to the Authority by May 16, 2014. On April 8, the Authority hosted an Industry Forum and Pre-Bid Conference event in Visalia. The Industry Forum provided an opportunity for small businesses to meet with the qualified firms eligible to submit proposals for the design-build RFP CP 2-3. The Pre-Bid Conference for the Project and Construction Management (PCM) Request for Qualifications (RFQ) for CP 2-3 provided a networking opportunity between prime and subcontractors. Both events saw heavy attendance from interested parties.

PROCURE CONSTRUCTION PACKAGE 4 (CP 4) AND CONSTRUCTION PACKAGE 5 (CP 5)

Immediately upon the conclusion of that process, procurement for CP 4 and CP 5 will commence. CP 4 will complete the civil work associated with the first construction section, and CP 5 will comprise the trackwork.

CONTINUE TO UPGRADE AND REFINE RIDERSHIP AND REVENUE, O&M, AND LIFECYCLE COST MODELING

The Authority will continue working with the PRG, the RTAP, the UIC and other external and academic experts to advance its modeling, estimating, and forecasting efforts. As new data and more information on the system's design, implementation and eventual operations becomes available, the reliability of the forecasts will continue to improve.

COLLABORATE WITH COMMUNITIES ON STATION AREA PLANNING

The Authority will continue to work with local government entities to develop station area plans around the future high-speed rail stations. The Authority, in partnership with FRA, has dedicated funding to support station cities in the development of station area plans that are consistent with and supportive of local and regional planning efforts required by SB 375 and the Authority's Station Area Development Policies. This funding will support local planning and land use decision-making for the station area site and conceptual station envelope design, surrounding infill development, transportation connectivity, parcel economic development analysis and/or station site financing and phasing plans. These planning efforts will focus on a range of activities appropriate to the unique local context to create a high-speed rail station that can serve as a new city "gateway" or hub for community development. It will also include working with regional and local transit providers to enhance connectivity to high-speed rail stations, plan for intensified development around stations, facilitate adoption or amendment to general plans and zoning codes, and developing a financing/phasing plan to support the station area plan including tools to attract private investment.

ACHIEVING BROADER PUBLIC BENEFITS

As has been noted by legislative committees, the California Public Utilities Commission (PUC), and other state agencies, the development of a statewide dedicated right of way has the potential to provide significant public benefit beyond the transportation provided by the system. For example, the fiber optic lines and communications equipment that will be installed as part of the high-speed rail program potentially can be tapped to provide other benefits, especially in areas that are now not served or are underserved. Those benefits could range from education to agriculture to public safety. The Authority will continue to work with the PUC and the California Office of Technology Services on evaluating the potential for the utilization of the 500-mile contiguous high-speed rail right-of-way from the Bay Area to Southern California for cabling pathways and structures including antennas and other equipment. Other opportunities including those with the private sector may be considered at a later date as the project moves forward.

CONTINUE TO COLLABORATE WITH OUR PARTNERS TO DELIVER EARLY BENEFITS WITH THE CONNECTIVITY AND BOOKEND PROJECTS AND TO DEVELOP THE BLENDED SYSTEM

The Authority will also continue to work with our local and regional partners on further development of the connectivity and bookend projects that have already received funding through SB 1029. This will include collaborating in project development, design, environmental reviews and working with stakeholders on how these projects – together with high-speed rail – will enhance connections throughout the state. We will continue to collaborate with the Peninsula Corridor Joint Powers Board on the improvements being made to support blended operations in the Caltrain corridor between San Jose and San Francisco, and with the Southern California Regional Rail Authority and other stakeholders to evaluate options for a cost-effective one-seat ride from San Francisco to Anaheim via Los Angeles.

EVALUATE WAYS TO IMPLEMENT THE SYSTEM AS QUICKLY, EFFICIENTLY AND COST-EFFECTIVELY AS POSSIBLE

The Authority will continue to be flexible and adaptive as it monitors and evaluates changing circumstances and new opportunities that might allow it to fund and deliver the system, or elements of it, in a better way, at a lower cost, or more quickly than currently projected in the 2014 Business Plan. We will do so in collaboration with our partners, stakeholders, and communities along the route and in a manner that is consistent with all of the requirements associated with Proposition 1A.

FUTURE MILESTONES

Building large, complex infrastructure projects typically spans several decades and full funding is rarely secured from the beginning. The Authority is following the same approach taken to investing in other projects of comparable magnitude and long-term benefits. That is, we are advancing and funding the system in a series of logical phases, with each phase supported by committed funding. And like other major infrastructure investments that yield significant benefits to future generations, it is reasonable and appropriate for those future generations to also help pay for it.

As we move forward, we will continue to identify ways to secure both public and private funding to implement the system as quickly as possible. We will remain focused on delivering the program that the voters approved in 2008, while also being flexible and opportunistic, just as we were when the American Recovery and Reinvestment Act (ARRA) of 2009 passed and we quickly applied for and secured more funding than any other state.

Transportation projects around the nation have historically faced uncertainty with reauthorization of federal surface transportation programs; the expiration of MAP-21 in 2014 is no exception. Despite that uncertainty, we will continue to seek more federal funding and/or financing to augment the federal funds we have already received. We will also continue to seek stable funding through state Cap and Trade funds, to optimize ancillary revenues and to leverage private investment to help deliver the program.

Section 2: Business Model

This chapter describes the Authority’s business model from the 2012 Business Plan, the progress that has taken place to implement the Authority’s business model since 2012, and the plan for 2014 and beyond.

INTRODUCTION

In the 2012 Business Plan, the Authority adopted a business model that aligns with the role of government and the private sector in the project. The business model will be implemented over time as project phases are completed and as organizational relationships mature. It is designed to assign responsibilities and risk to the parties – both public and private sector – best able to manage them. While the private sector will be relied upon for construction and operation of the system, the Authority will retain all governance, ownership and policy responsibilities.

Since the 2012 Business Plan, the Authority has made significant progress in refining and implementing its business model, which continues to be driven by five fundamental assumptions:

- **Shared responsibility between public and private sector** – The high-speed rail system will neither be entirely a public works project nor will it be a fully privatized system. It will be a partnership between the public sector (federal, state, and local) and the private sector.
- **Implement and evolve over time** – The partnership between the public and private sectors will evolve as the system is developed, moving from service and construction contracts to complex long-term concession agreements with underlying private capital investment.
- **Competition and innovation reduce costs** – Competition and innovation in procurement is one of the strongest drivers of value and cost management available to the state.
- **Drive local job growth** – Consistent with federal and state requirements, the system and its key components will be built in the United States while leveraging international technology and experience. This translates into employment opportunities for Californians. To support that, the Authority has established a 30 percent goal for contracting with small and disadvantaged businesses.
- **Securing necessary approvals and agreements attracts the private sector** – Successfully establishing the required intergovernmental agreements will promote private-sector confidence that translates into additional value and reduced costs.

PROGRESS SINCE THE 2012 BUSINESS PLAN

The Authority has begun to implement its business model as it transitions to an agency focused on project delivery, implementation and oversight. In addition to the major milestones discussed in Section 1, the Authority has also advanced other milestones associated with implementing its business model:

- **Engaged private sector investors** – In 2013, we held a market sounding and outreach initiative with the purpose of engaging an audience comprised of global infrastructure investors and developers. During a series of meetings, we

solicited feedback on the private sector's interest and level of participation for investing in California's high-speed rail system. The feedback received through this outreach confirmed the key tenets of our business strategy.

- **Began developing non-ticket revenue and transit-oriented development options** – We are continuing to refine our analysis of the potential for non-ticket (ancillary) revenue generation. International experience has shown the enormous potential for ancillary revenues from such things as on-board sales, advertising, asset and right-of-way utilization, and transit-oriented development (TOD) opportunities. A joint-planning exercise is underway with several state agencies to develop options for a combined technology and telecommunications strategy to support the state's data needs using infrastructure that will be built to support the project, (e.g., installing fiber optic cable along the system alignment.)
- **Approved an unsolicited proposal policy** – In October 2013, the Board of Directors approved an unsolicited proposal policy for inviting the private sector to submit unsolicited proposals for innovative ideas for developing and investing in the California high-speed rail system. The Authority sees immense benefit in an unsolicited proposal policy as it provides the private sector with a platform to offer their expertise and innovative ideas.

THE PLAN FOR 2014 AND BEYOND

Consistent with the strategy in the 2012 Business Plan, the Authority will continue to move forward with its phased business model that focuses on engaging the private sector while maintaining oversight and control of the program.

THE PRIVATE SECTOR WILL PLAY AN INTEGRAL ROLE IN DELIVERING AND OPERATING THE SYSTEM

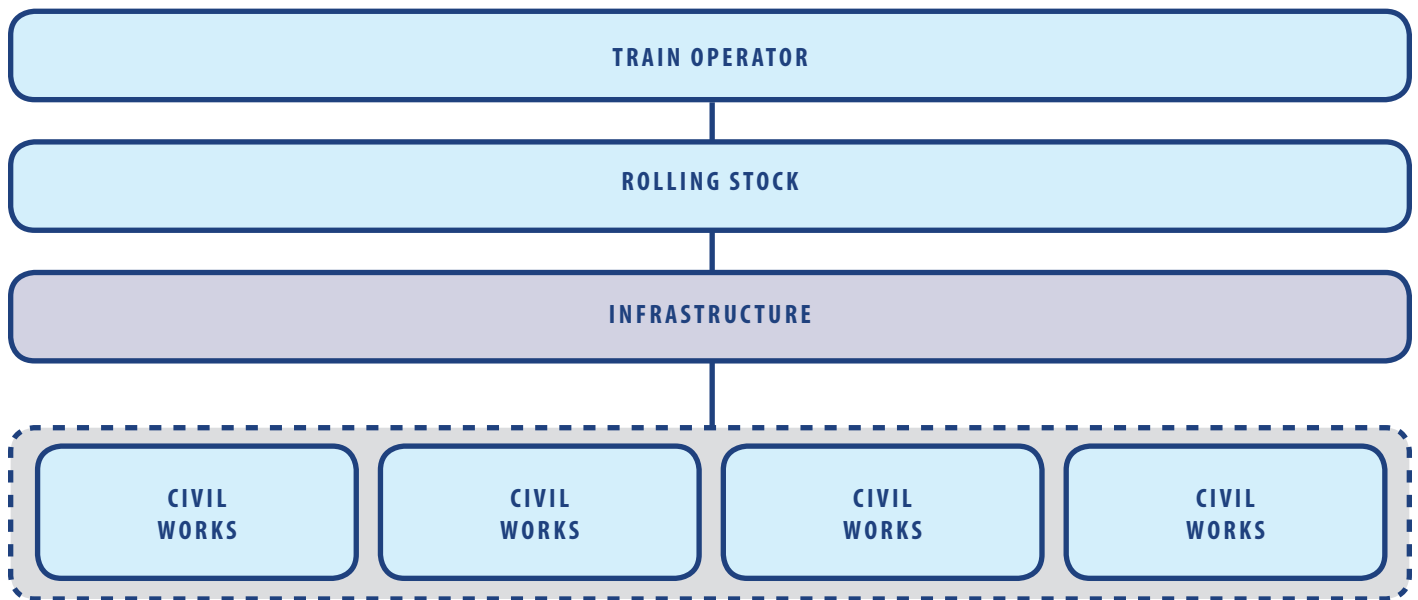
Many high-speed rail systems across the globe rely on the private sector to design, construct, operate, and maintain the system. In addition, many other high-speed rail systems also depend on a level of private-sector investment to fund the project. The business model outlined in the 2012 Business Plan follows this approach.

The Authority's delivery strategy is based on leveraging private sector innovation and expertise in the delivery of the IOS and the remainder of the system. The Authority recognizes the need to create significant partnership with the private sector that features balanced risk transfer, early planning input for innovation and cost reduction, and private sector investment. A key goal of the commercial approach will be incentives and strategies designed to support an excellent service while reducing the costs of developing and operating the system.

The civil works activities on the IOS will be primarily delivered through a series of design-build contracts and funded through a combination of federal, state and local funds. The Authority has already contracted with the private sector on the first design-build contract in the Central Valley and plans to continue to do so to build out the remaining substructure of the IOS.

The Authority will also rely on the private sector for the delivery and maintenance of the remaining elements of the infrastructure (e.g., track, systems, and power). Engaging the private sector early will aid in developing innovative ideas and proposals on how best to deliver these critical elements of the project. The Authority will seek input from major infrastructure developers and interested financial investors on a strategy to procure the design, build, operation and maintenance of the IOS infrastructure (systems, power, and track) under a combined contract that includes private financing. An infrastructure provider could also potentially maintain the civil works along the IOS and play an integrator role to ensure that the integration of the civil works, infrastructure, rolling stock, and operations is seamless. The Authority will further define the approach, structure and timing for procuring an infrastructure partner for the IOS over the next 12 months including input from the private sector.

EXHIBIT 2.1 POTENTIAL DELIVERY MODEL WHERE THE INFRASTRUCTURE PROVIDER IS INTEGRAL TO SYSTEM DELIVERY AND A KEY LONG-TERM PARTNER



A potential role of an infrastructure partner is illustrated on Exhibit 2.1.

The Authority views the infrastructure provider as a potential long-term partner and is considering engaging one early in the planning process to incorporate innovation and cost reduction benefits into the delivery of all of the components of the system.

The role of the train operator spans two distinct phases of operations – (1) planning and early operations during ramp-up and (2) mature operations after ridership has been proven. The Authority plans to procure a high-speed rail operator, even before the construction of the IOS is complete, to help launch and then operate the high-speed rail service. During the planning and early operations phases, the operator would perform a range of activities designed to generate a strong sense of anticipation and demand for the high-speed rail service before it starts, and build ridership during the ramp-up period. Based on feedback from experienced operators, this early phase will likely be a form of management contract. This initial operating contract would be structured to support the Authority’s plan for granting a future, longer-term operating concession after the IOS has become a mature operation and early ridership is proven. The business model will evolve over time as the project moves from its early stages (e.g., construction of the IOS) to more advanced stages (e.g., service commencement and system maintenance). While the business model will evolve, the objective remains the same – stimulate innovation, reduce costs, transfer risk and attract investment.

THE AUTHORITY WILL RETAIN OVERSIGHT AND BE SUPPORTED BY A NUMBER OF PUBLIC SECTOR PARTNERS

While the Authority will rely heavily on the private sector to bring innovation and investment into the project, the state will maintain its lead organizational role, retaining ownership and governance functions.

While the Authority will control and oversee the high-speed rail system, regional authorities will continue to be responsible for commuter rail systems whose tracks may be used by high-speed operators. Over time, a series of agreements will be executed to align the Authority with its public-sector partners in a manner that will foster innovative and efficient development and operation of the system by the private sector.

FOCUS ON ECONOMIC STIMULUS AND JOB GROWTH WILL CONTINUE

We are committed to making certain that the benefits of this program reach throughout California. Accordingly, a key element of the Authority's business model remains local job creation, including working to ensure that small and disadvantaged businesses have opportunities to participate in the system. The Authority understands the importance of diversity and its benefits to the California economy. For example, the Authority signed an assurance that it will follow the best practices of the USDOT Disadvantaged Business Enterprises Program and the Civil Rights Act, and actively manages a Small and Disadvantaged Business Program.

Additionally, in November 2012, as previously noted, the Authority created and subsequently adopted a policy to diversify the types of firms involved in developing the high-speed rail system. The policy aims to provide work to small and disadvantaged businesses in the amount of at least 30 percent of the total price for a given contract. The Authority has partnered with the following organizations:

- Strategic Agreement with the California Department of Veterans Affairs (CalVet) to bolster participation of small business, particularly those owned by disabled veterans.
- Partnership with U.S. Minority Business Development Agency to expand outreach and marketing in support of minority-owned businesses and small business participation.
- Partnership with the U.S. Small Business Administration to expand outreach and marketing in support of small business utilization in the Central Valley.

Qualified firms in any combination and at any tier level who are certified as small businesses inclusive of DBEs, DVBEs, and MBs are encouraged to participate.

Section 3: Capital and Lifecycle Costs

INTRODUCTION

This section presents the updated capital cost estimates for the Phase 1 high-speed rail system connecting San Francisco and Merced with Los Angeles/Anaheim through the phased and blended implementation of a one-seat ride adopted by the Authority in the 2012 Business Plan. This section also presents lifecycle cost estimates based on a detailed analysis of projected future high-speed rail system component rehabilitation and replacement requirements.

EXTERNAL REVIEWS OF THE CAPITAL COST ESTIMATES

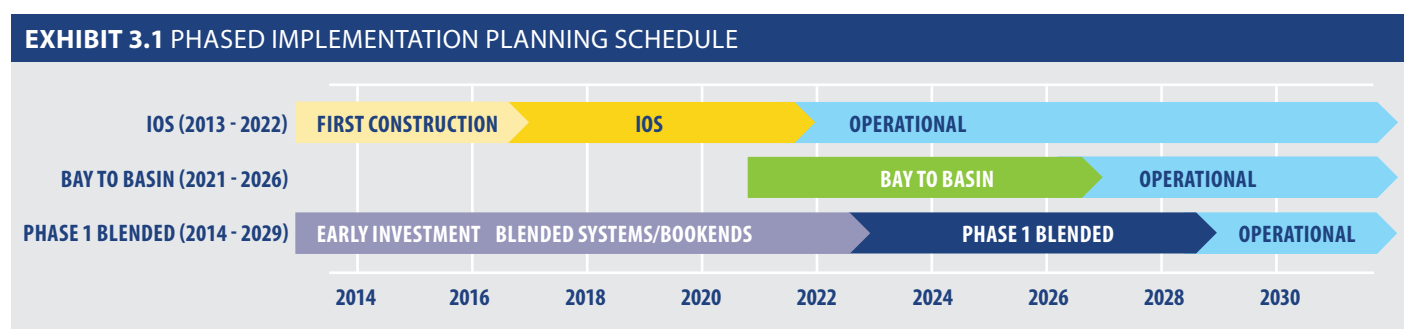
Given the importance of accurate cost forecasting, a bipartisan request from members of the U.S. Congress initiated a review of the Authority’s cost and ridership projections by the GAO. After an extensive review of the 2012 Business Plan cost estimates, the GAO found that the Authority’s cost estimates met all applicable guidance from the FRA and the USDOT.

PRESENTATION OF CAPITAL COSTS

The capital costs for the high-speed rail system are presented in this chapter in two ways:

- **Constant Dollars** – Estimates are provided in constant 2013 dollars to serve as a baseline for conversion to year-of-expenditure (YOE) dollars.
- **Year-of-Expenditure Dollars** – The baseline cost estimates are then converted into YOE dollars by using the baseline 2013 costs and projecting them into the future, using the phased implementation approach and schedule described in the 2012 Business Plan (IOS, Bay to Basin and Phase 1) and shown in Exhibit 3.1.

Exhibit 3.1 below shows the planning schedule used by the Authority for converting constant dollars into year of expenditure dollars and for projecting key performance data, including ridership forecasts.



A cost estimate has been developed for each phase of the program. Until final environmental approval of all preferred alignments, stations and maintenance facilities is received, a number of key decisions remains to be made by the Authority. When the Authority finalizes those decisions, the final costs also will be determined. Further, as we advance the design of the project, we will continually strive to ensure that we are delivering both a high quality and cost-effective system. This will be achieved through conducting value engineering and best value assessments at appropriate milestones. A fundamental objective of these assessments will be to identify ways to further reduce the capital cost of constructing the system.

The cost estimates are broken out by FRA cost category in 2013 dollars. A contingency of between 10 and 25 percent is included in each infrastructure-related cost category to protect against material cost increases, use of different component parts and minor quantity changes, depending on the category. A separate and additional “Unallocated Contingency” value of five percent is included as a general reserve to address unanticipated changes. The cost for each program phase represents a project total for that phase and includes the cost for constructing prior sections. For example, the Bay to Basin estimate includes the cost of the IOS.

CAPITAL COST ESTIMATES IN 2013 DOLLARS

The phases shown in Exhibit 3.2, 3.3 and 3.4 below, are consistent with those shown in the 2012 Business Plan.

EXHIBIT 3.2 INITIAL OPERATING SEGMENT	
<i>Cost to construct IOS – Central Valley to San Fernando Valley (base year 2013 dollars) (includes cost of first construction section)</i>	
FRA STANDARD COST CATEGORIES	COST ESTIMATE (MILLIONS)
10 – Track structures and track	\$14,966
<i>Civil (10.04–10.06, 10.08, 10.18)</i>	\$1,538
<i>Structures (10.01–10.03, 10.07)</i>	\$12,163
<i>Track (10.09, 10.10, 10.14)</i>	\$1,263
20 – Stations, terminals, intermodal	\$630
30 – Support facilities: yards, shops, administrative buildings	\$442
40 – Sitework, right-of-way, land, existing improvements	\$4,881
<i>Purchase or lease of real estate (40.07)</i>	\$1,798
50 – Communications and signaling	\$529
60 – Electric traction	\$1,733
70 – Vehicles	\$889
80 – Professional services (applies to categories 10–60)	\$2,750
90 – Unallocated contingency	\$955
100 – Finance charges	-
TOTAL	\$27,775
<i>Subtotals for information only. Figures may not sum due to rounding.</i>	

EXHIBIT 3.3 BAY TO BASIN*Cost to construct Bay to Basin – (base year 2013 dollars) (includes cost of IOS)*

FRA STANDARD COST CATEGORIES	COST ESTIMATE (MILLIONS)
10 – Track structures and track	\$22,076
<i>Civil (10.04–10.06, 10.08, 10.18)</i>	\$2,406
<i>Structures (10.01–10.03, 10.07)</i>	\$17,909
<i>Track (10.09, 10.10, 10.14)</i>	\$1,759
20 – Stations, terminals, intermodal	\$1,158
30 – Support facilities: yards, shops, administrative buildings	\$481
40 – Sitework, right-of-way, land, existing improvements	\$8,204
<i>Purchase or lease of real estate (40.07)</i>	\$2,260
50 – Communications and signaling	\$706
60 – Electric traction	\$2,296
70 – Vehicles	\$1,873
80 – Professional services (applies to categories 10–60)	\$4,271
90 – Unallocated contingency	\$1,456
100 – Finance charges	-
TOTAL	\$42,521

*Subtotals for information only. Figures may not sum due to rounding.***EXHIBIT 3.4 SAN FRANCISCO TO LOS ANGELES/ANAHEIM PHASE 1***Cost to construct Phase 1 – (base year 2013 dollars) (includes cost of Bay to Basin)*

FRA STANDARD COST CATEGORIES	COST ESTIMATE (MILLIONS)
10 – Track structures and track	\$24,431
<i>Civil (10.04–10.06, 10.08, 10.18)</i>	\$3,170
<i>Structures (10.01–10.03, 10.07)</i>	\$19,292
<i>Track (10.09, 10.10, 10.14)</i>	\$1,967
20 – Stations, terminals, intermodal	\$3,273
30 – Support facilities: yards, shops, administrative buildings	\$779
40 – Sitework, right-of-way, land, existing improvements	\$12,301
<i>Purchase or lease of real estate (40.07)</i>	\$3,989
50 – Communications and signaling	\$879
60 – Electric traction	\$2,879
70 – Vehicles	\$3,276
80 – Professional services (applies to categories 10–60)	\$5,251
90 – Unallocated contingency	\$1,825
100 – Finance charges	-
TOTAL	\$54,894

Subtotals for information only. Figures may not sum due to rounding.

CAPITAL COSTS IN YEAR-OF-EXPENDITURE DOLLARS

The previous section showed the capital cost estimates by phase in 2013 dollars. This section converts the 2013 estimates to their YOE estimates using the planning schedule shown in Exhibit 3.1 and assumptions regarding inflation. In this 2014 Business Plan, costs are inflated by applying an inflation rate for each year beyond the 2013 baseline. Inflation for 2014 through 2016 is assumed to be 2 percent per year, and inflation for 2017 and beyond is assumed to be 3 percent per year. The actual cumulative inflation rate for the years 2010 through 2013 was 4.3 percent, for an average of just over 1 percent per year.

Exhibit 3.5 shows cost estimates in 2013 and YOE dollars for the cost estimates previously shown in Exhibits 3.2, 3.3 and 3.4. The YOE cost estimates are essentially unchanged since 2012, down by less than one percent.

EXHIBIT 3.5 YEAR-OF-EXPENDITURE COST ESTIMATES					
SECTION	INCREMENTAL CAPITAL COST (BILLIONS 2013\$)	CUMULATIVE CAPITAL COST (BILLIONS 2013\$)	COMPLETION OF SECTION	INCREMENTAL CAPITAL COST (BILLIONS YOES)	CUMULATIVE CAPITAL COST (BILLIONS YOES)
IOS	27.8	27.8	2022	31.2	31.2
Bay to Basin	14.7	42.5	2026	19.5	50.7
Phase 1	12.4	54.9	2028	16.9	67.6

Subtotals for information only. Rounded.

LIFECYCLE COSTS

The Authority developed an updated estimate of system lifecycle costs for the 2014 Business Plan, based on detailed analysis of system component rehabilitation and replacement requirements. The Authority developed an analysis that projected lifecycle costs over a 50-year analysis period, from 2022 through 2070. To support and be consistent with the financial analysis prepared for this 2014 Business Plan, which is discussed in Section 6, the lifecycle costs are presented here for the period from 2022 through 2060.

As with any transportation system, lifecycle costs are distinct from day-to-day O&M costs. O&M costs are routine maintenance and inspection costs required for the day-to-day operation of the system and regular upkeep to meet regulatory requirements and to address any unanticipated issues that may come up over time. In contrast, lifecycle costs only include rehabilitation and replacement costs to replenish capital assets.

To prepare this more comprehensive and robust lifecycle cost forecast, a model was developed that drew upon international best practice and that factors in the second-level cost categories associated with the FRA standard cost categories used in the capital cost estimates. For each second-level cost category, appropriate rehabilitation and replacement costs based on the asset's design life and upkeep requirements were applied to calculate the lifecycle costs for those assets over a 50-year analysis period. Assets that did not require rehabilitation or replacement during that analysis period did not contribute any costs in the analysis.

Rehabilitation Costs are major, non-routine scheduled upkeep activities required throughout an asset's useful life for the asset to reach its design life. This may include replacing some of the components that have reached the ends of their useful lives within a larger asset whose overall useful life has not been reached.

Replacement Costs are the costs to fully replace the asset or major components of the asset (as appropriate) upon the end of its design or useful life.

METHODOLOGY FOR ESTIMATING LIFECYCLE COSTS

The 2014 lifecycle cost model methodology is based on research and best practices established by a part of the European Union-funded research program called MAINLINE. The MAINLINE methodology seeks to capture all costs involved throughout the life of an asset, including construction, operations and maintenance costs.²⁷ The 2014 lifecycle model also draws from lifecycle guidance by the UIC and the European Investment Bank (EIB), based on their experience with developing and funding existing high-speed rail systems around the world.

The first 39 years of system operations (2022 – 2060) were analyzed for the financial analysis in Section 6 and included all of the expected rehabilitation and replacement costs over that timeframe. The lifespans of system components were based on their design lives, experience with high-speed rail systems internationally, and with domestic conventional/freight rail systems (where appropriate). What this means is that the rolling stock will need to be reprocedured once (after approximately 30 years) while some of the major civil works (tunnels, bridges, etc.) will still have significant portions of their useful lives remaining. Other components, such as some elements of the signaling and communications systems, will need to be replaced more than once during the 50-year analysis period. The lifecycle cost estimates are documented in the 2014 Business Plan *50-Year Lifecycle Capital Cost Model Documentation*, available on the Authority’s website at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html.

To better understand the risks and uncertainties in the lifecycle cost estimate, the Authority has run a Monte Carlo analysis on the lifecycle cost model. The analysis used reference cases for O&M and capital expenditures to develop a lower and an upper bound for the lifecycle cost risk exposure curve. The resulting shape of the lifecycle risk curve was applied to the lifecycle cost base model estimates and served as the input to the Monte Carlo analysis. The Monte Carlo procedure takes this information and simulates thousands of possible outcomes, allowing the Authority to quantify and analyze the resultant potential variability in the estimate and determine the probability of different cost outcomes. As with other analyses, further advances in system design and understanding will likely reduce uncertainty and narrow the ranges of possible costs.

LIFECYCLE COST ESTIMATES

Over the analysis period, the major driver of future lifecycle costs is rolling stock replacement, which occurs in the 2050's and accounts for over one-third of total lifecycle costs. Meanwhile, many of the system assets that have higher front-end construction costs, such as tunnels and viaducts, have design lives that stretch well beyond the analysis period, so they are not a major component of the lifecycle cost estimate. Besides rolling stock, the other major cost components are generally ones that have short useful lives or require frequent rehabilitation (e.g. electronics, signaling systems, etc.).

For the lifecycle cost estimates, the Authority developed High, Medium, and Low lifecycle cost scenarios. The scenarios were developed based on the results of the Monte Carlo simulations with the High and Low scenarios bracketing the Medium scenario. These results are presented in Exhibit 3.6 and Exhibit 3.7. As can be seen in Exhibit 3.7, there are no lifecycle costs during the first 10 years of system operations and the annual totals are under \$100 million per year through the 2030s and into the 2040s. For the financial analysis described in Section 6, lifecycle costs through 2060 are used as an input, consistent with the other inputs to that analysis.

The methodology followed by the Authority to develop the 2014 Business Plan lifecycle cost estimates is much more robust and comprehensive than the approach used for the 2012 Business Plan. While the 2012 estimate was essentially an order of magnitude approximation based on U.S. railroad practices, the new approach, based on European experience and expertise, provides far more insight in terms of asset quality and asset performance to keep the system in a state of good repair, allow assets to reach their full design life, and achieve

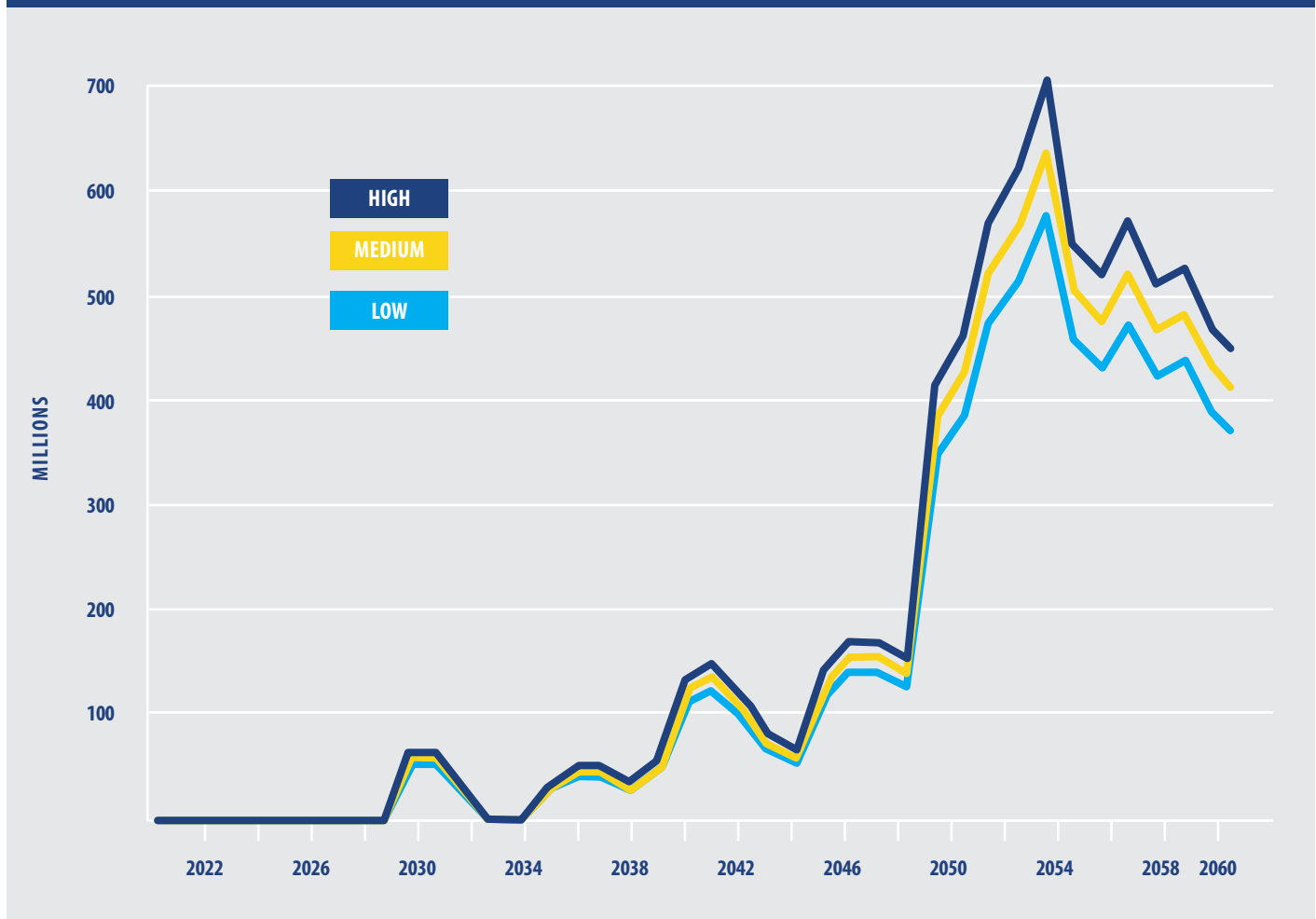
SCENARIO	LIFECYCLE COSTS (IN MILLIONS OF 2013 DOLLARS)
Low	\$6,376
Medium	\$7,029
High	\$7,656

system reliability targets. For example, the lifecycle cost estimates include many more asset categories and more detailed plans for their renewal and rehabilitation within the period of the financial analysis.

This new approach is fundamentally different from that used in 2012, and represents a much more comprehensive methodology. Over the period used for the cash flow analysis (through 2060), the total projected expenditure for system rehabilitation and renewal has increased by \$3.1 billion (2013\$) excluding \$1.7 billion from added contingencies and adjustments for risk based on the result of the Monte Carlo analysis. To compare the estimated lifecycle costs relative to the amount of the initial investment in the Phase 1 system that has to be replenished over that period, the 2012 forecast projected that 4 percent of the system would require replenishment; the 2014 forecast projects that 13 percent of the \$54.9 (2013\$) billion initial Phase 1 system would require replenishment.

These new estimates for the 2014 Business Plan will now serve as a new benchmark for future refinements in consultation with international experts.

EXHIBIT 3.7 HIGH, MEDIUM, AND LOW LIFECYCLE COSTS 2022-2060 (IN MILLIONS OF 2013 DOLLARS)



Section 4: Ridership and Revenue Forecasts

INTRODUCTION

The ability to attract riders will ultimately drive both the high-speed rail system's financial performance and its environmental benefits, and the Authority has continued to refine, improve and update its ridership and farebox revenue forecasts. Since 2010, the Authority has subjected the work of its consultants to rigorous scrutiny by a RTAP comprised of international and academic experts in travel demand forecasting. The Panel has spent the last two years reviewing the model, as well as the inputs and assumptions that have gone into the forecasts. More recently, as previously noted, the GAO spent more than a year taking the most comprehensive look to date at the cost estimates, ridership and farebox revenue forecasts, and economic impact analyses that were presented in the 2012 Business Plan. The GAO found the ridership forecasts to be based on sound methods and that they were reasonable.

In July 2012, SB 1029 appropriated state and federal funds to start construction of the high-speed rail system. SB 1029 also directed the Authority to continue upgrading the ridership demand models. Specifically, SB 1029 stated: "The High-Speed Rail Authority shall, as part of its...2014 Business Plan, include: a proposed approach for improving (a) demand projections, [...]."

The enhanced model that has been developed for the 2014 Business Plan represents a major upgrade of all model components, incorporates new and re-analyzed data and reflects a range of potential outcomes. This section discusses the enhancements made to the ridership demand model, the approach to developing the forecasts for the 2014 Business Plan and the forecasts themselves. For more in-depth information on the ridership and revenue forecasts, see the 2014 Business Plan *Ridership and Revenue Technical Memorandum* at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html.

MODEL ENHANCEMENT

The enhanced model developed for the 2014 Business Plan ridership and farebox revenue forecasts incorporated the following enhancements:

- New analysis of previously collected data, including the recent California Household Travel Survey, to re-estimate the components of the model, addressing suggestions made previously by the RTAP.
- New data collection (surveys, socioeconomic, etc.).
- Revisions to make the model run faster, permitting for more model runs and sensitivity tests that allow for better risk analysis.
- Technical refinements, including a consistent modeling approach for all long-distance trips (e.g., more than 100 miles).
- Calibration of the model to 2010 observed traffic data (all modes).
- Additional validation of the model by "backcasting" to 2000 traffic data.
- Extensive sensitivity testing to make sure the model behaves appropriately to changes in assumptions.

- Independent analysis of population and employment forecasts, reflecting the most current research available and allowing forecasts for horizon years matching the phased implementation schedule of the system.
- Revisions to assumed transportation network improvements.

The 2014 enhanced ridership and farebox revenue model was developed in concert with the Authority's rail and transit partners, which enhanced consistency among travel demand models in California. In particular, the Authority was able to utilize inputs from the new Caltrans California Statewide Demand Model.

NEW DATA

While new data have been added to the model, it is built on previous datasets offering a wider range of views and perspectives. The benefit of using multiple datasets covering a longer range in time is to reduce the risk of optimism bias that could be associated with a single data source. Four main sources of data were updated to develop the 2014 ridership forecast.

2013 Revealed/Stated Preference Survey

A new 2013 Revealed/Stated Travel Preference survey has been conducted in California which gathered information through 4,500 questionnaires at main airports, on conventional rail and long distance automobile users. This data has been critical to determine and verify model components that were used in the 2014 forecasts. Use of this data will continue as further enhancements are built into the models.

California Household Travel Survey

Caltrans conducts the California Household Travel Survey every 10 years to obtain detailed information about the socioeconomic characteristics and travel behavior of households statewide. Results from the latest survey conducted throughout 2012 were incorporated in the enhanced model to provide the most recent view on regional trip activities and long distance trips. This data was then used for the estimation and calibration of the main mode choice, destination choice and trip frequency models.

Survey results are available on the Caltrans website at http://www.dot.ca.gov/hq/tsip/otfa/tab/chts_travelsurvey.html.

The 2014 Business Plan *Ridership and Revenue Technical Memorandum* available at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html describes how the data was used in the 2014 Business Plan ridership forecasts.

Network Data

Network highway and transit data were updated to ensure the most recent available data were incorporated in the models. The data were initially developed for use in the California Statewide Travel Demand model and were adapted to the Authority model. The use of these data guarantees consistency with other statewide current and future modeling efforts.

Socioeconomic Data

As with other data sources, socioeconomic input (e.g., population, number of households, employment, car ownership, etc.) were updated and used for the model estimation. This was a critical step to reflect the recent changes in demographic forecasts in California. The model has been developed using the same socioeconomic data as the Caltrans California Statewide Demand Model. This new dataset provides a significant benefit as it includes forecasts for 2010 (base), 2015, 2020, 2035, 2040 and 2050.

Several additional data sources were analyzed (California Department of Finance, Moody's, University of Southern California Price School) to develop a range of forecasts and probability distributions to be used in the risk analysis. One of the most important components of the ridership and revenue forecasts relates to expected population and employment growth in California. The Authority's consultants reviewed the most recent research on this topic and developed a range of forecasts.

FORECAST APPROACH

The ridership and farebox revenue forecasts developed for the Authority' reflect a reasonable range of potential outcomes and are expressed in terms of their probability of occurring using the following approach:

- Ridership and farebox revenue forecasts were developed for the opening year of each implementation phase of the system (IOS, Bay to Basin, Phase 1) as well as a horizon year of 2040.
- The Authority's consultants considered a wide range of factors that could influence the ridership and revenue forecasts and developed a shorter list of those they believed represented the largest risks based, in part, on their sensitivity testing while building the enhanced model. They found the main risk factors to be as follows:

- * Statewide household growth
- * Spatial distribution of housing and employment
- * Automobile fuel costs
- * Airline ticket prices
- * Overall amount of long-distance travel
- * The constant that is applied to the high-speed rail model that influences how attractive high-speed rail appears to travelers

For each risk factor, the Authority's consultants developed a range of inputs, ranging from low risk to high risk, and developed assumed distributions on the probability of each risk factor occurring. They ran the model 47 times for each analysis year and developed models of the outcomes that portray the effect of each assumption on the results. Using Monte Carlo simulation methods, they tested approximately 5,000 combinations of scenarios for each analysis year. Analyzing these results led to the probabilities of achieving different forecast lev-

Comparison of Ridership with Acela Express in the Northeast Corridor (NEC)

Similar to the analysis conducted in the 2012 Business Plan, the Authority's consultants compared the updated ridership forecasts with the observed Acela system ridership on the Northeast Corridor. This sensitivity analysis tested the California high-speed rail model with Acela Express service characteristics (higher fares, lower frequencies of service, and slower speeds). The California model forecasts 9.4 million riders on the California high-speed rail system with Acela-like service in 2010, which is 83 percent of the ridership on the Northeast Corridor. The primary cause of the difference is the greater population in the Northeast Corridor.

Assumptions on Fares and Service Types for Ridership and Revenue Forecasting

To update the ridership and revenue forecasts for the 2014 Business Plan, we have applied similar assumptions for trip times and fares as those used in the 2012 Business Plan. More specifically, we modeled select service patterns and average fares in order to project potential outcomes and evaluate the system's financial feasibility. In the future, actual service offerings and fare structures will be developed by a private operator based on overall guidance from the Authority. International high-speed rail systems typically offer a range of services, such as express, semi-express, local/all-stop trains, and use yield management techniques to maximize ridership and revenues. These same techniques are used by U.S. airlines, which might offer different services such as the choice of a nonstop or connecting flight and a variety of fares where an economy seat purchased three months ahead of time will have a significantly lower fare than a first class ticket for the same trip purchased at the last minute. The average fares and trip times used in the 2014 forecasts are designed to be achievable, reasonable and conservative. Ultimately, final decisions on what types of service to run and how much to charge customers will be made in the future when the Authority and operator approach the start of operations on the system.

els described below. The detailed results of the risk analysis performed on the ridership and farebox revenue projections are presented in the 2014 Business Plan *Ridership and Revenue Technical Memorandum* available at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html.

RIDERSHIP AND FAREBOX REVENUE FORECASTS

For the purpose of the 2014 Business Plan, the Authority's consultants developed three sets of forecasts representing a High, Medium, and Low scenarios. Each set was determined by the probabilistic analysis described above. Based on the results of the analysis, the Medium outcome listed below is the expected ridership for each of the given years. The High and the Low cases were selected from the distribution of possible outcomes around the Medium scenario, representing a lesser and higher risk respectively.

EXHIBIT 4.1 RIDERSHIP, IOS THROUGH PHASE 1 (IN MILLIONS)								
SCENARIO	2025	2030	2035	2040	2045	2050	2055	2060
High Ridership	14.0	31.7	41.4	45.0	47.3	49.7	52.2	54.9
Medium Ridership	10.4	24.4	32.1	34.9	36.7	38.5	40.5	42.5
Low Ridership	7.4	18.1	24.1	26.1	27.5	28.9	30.3	31.9

RIDERSHIP FORECASTS

Exhibit 4.1 and Exhibit 4.2 show the projected ridership for the High, Medium and Low cases in millions of riders from IOS through Phase 1. A five-year ramp-up assumption was assumed when each segment opens to revenue service according to the following schedule:

- 40 percent of the long-term ridership potential is achieved in year 1
- 55 percent in year 2
- 70 percent in year 3
- 85 percent in year 4
- 100 percent in year 5

Purpose of 2014 Business Plan Ridership Forecasts and Why They Differ from Fresno to Bakersfield EIR/EIS

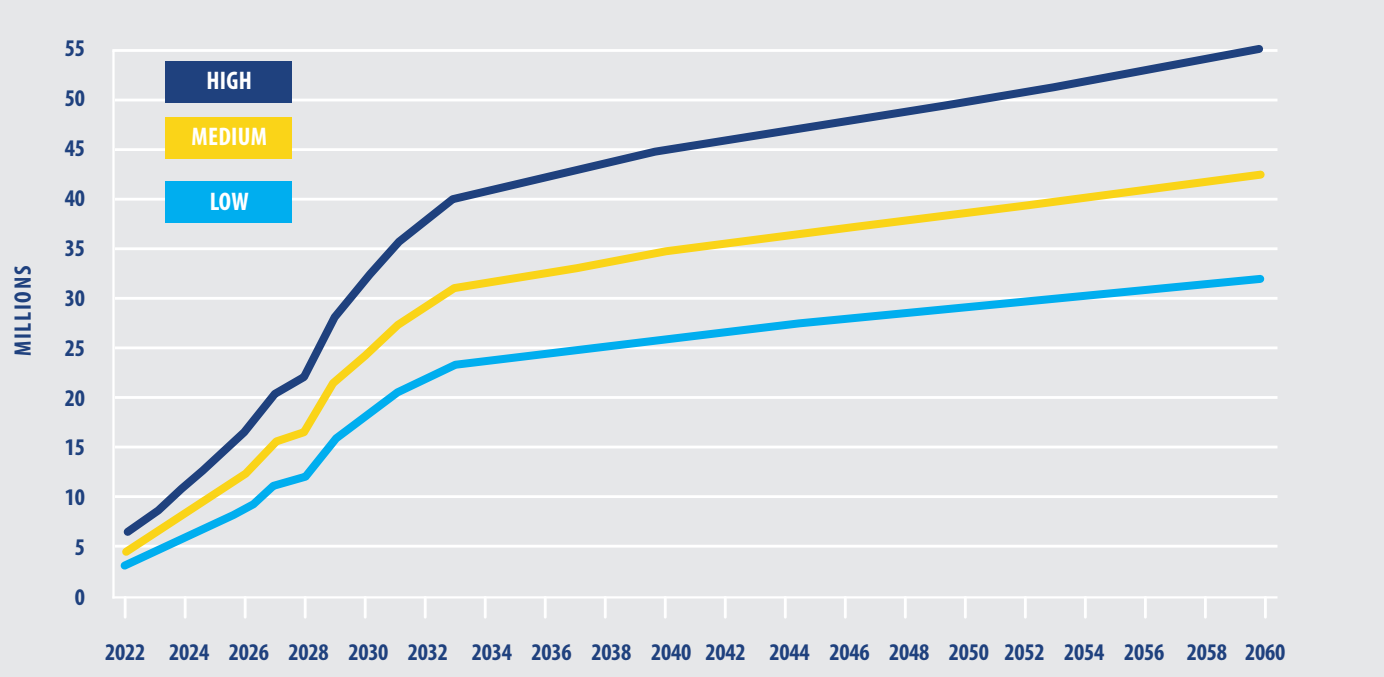
Ridership Forecasts

As discussed in the 2012 Business Plan, the sets of ridership forecasts developed for the Fresno to Bakersfield EIR/EIS and those developed for the Authority's 2014 Business Plan differ because they are developed for distinct purposes and are based on different assumptions.

The ridership forecasts for the 2014 Business Plan support the state's financial and investment planning for the system. Most importantly, the orientation of the Business Plan is to assess potential positive cash flow from the operation of the system to help estimate private-sector investment. The assumptions used for this purpose are conservative.

The Fresno to Bakersfield EIR/EIS ridership forecasts support the Authority's environmental analysis. The orientation of the EIR/EIS forecasts is to identify reasonable, higher levels of ridership to ensure the environmental documents adequately identify and disclose potential environmental impacts and identify mitigation measures. The EIR/EIS forecasts also consider a lower level of ridership for identifying potential project benefits. The EIR/EIS forecasts therefore provide a conservative assessment of both environmental impacts and benefits to inform the public and project decisions, but do so in a manner distinct from that developed for the business plan.

**EXHIBIT 4.2 YEAR HIGH, MEDIUM AND LOW RIDERSHIP PROJECTIONS, IOS THROUGH PHASE 1
(IN MILLIONS OF RIDERS)**



The Medium outcome for the ridership forecast shows an overall ridership greater than 10 million trips in 2025, rising to 35 million trips in 2040 once the market has reached maturity and is fully ramped-up, 11 years after the completion of Phase 1.

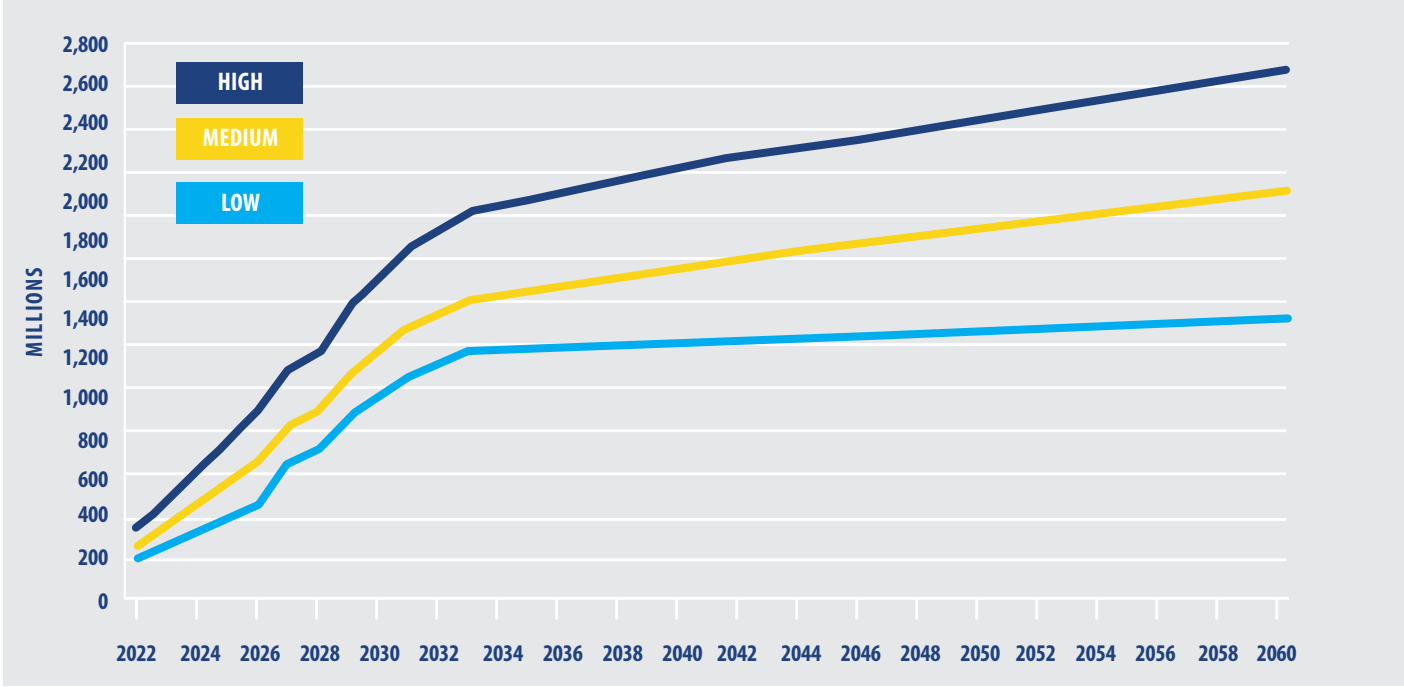
FAREBOX REVENUE FORECASTS

The revenues presented in Exhibit 4.3 and Exhibit 4.5 are direct farebox revenues (presented in 2013 dollars and year of expenditure dollars respectively). They do not include ancillary income from stations or other commercial activities. Typically, such revenues will add between 2 to 30 percent over and above farebox revenues. The ancillary revenue assumptions are discussed separately below but are not reflected in the results in this section. Instead, ancillary revenue estimates are included in the financial planning case in Section 6. The consultants have assumed the same high-speed rail fare structure as assumed in the 2012 Business Plan forecasts and presented in the 2014 Business Plan *Ridership and Revenue Technical Memorandum* available at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html. In developing these forecasts, the Authority’s consultants have not assumed any revenue optimization that would result from adjusting fares to optimize yields on specific markets such as short distance and commuter trips either in the San Francisco Bay Area and/or in the Los Angeles Basin.

EXHIBIT 4.3 FAREBOX REVENUE, IOS THROUGH PHASE 1 (2013 \$ IN MILLIONS)

SCENARIO	2025	2030	2035	2040	2045	2050	2055	2060
High Ridership	\$773	\$1,571	\$1,943	\$2,110	\$2,218	\$2,331	\$2,450	\$2,575
Medium Ridership	\$578	\$1,225	\$1,521	\$1,652	\$1,736	\$1,825	\$1,918	\$2,016
Low Ridership	\$417	\$915	\$1,149	\$1,248	\$1,312	\$1,379	\$1,449	\$1,523

EXHIBIT 4.4 YEAR HIGH, MEDIUM AND LOW REVENUE PROJECTIONS, IOS THROUGH PHASE 1
(2013 \$ IN MILLIONS)



All farebox revenues were provided in 2013 dollars. Inflation for 2014 through 2060 was applied to estimate the revenue projections in YOE presented in Exhibit 4.5. These projections are required for the financial planning case presented in Section 6. Inflation for 2013 through 2016 is assumed to be 2 percent, then 3 percent per annum is used for 2017 onward.

In the IOS Medium scenario, the projected revenues are \$801 million in 2025, representing the fourth year after completion of the IOS. Revenues rise to just under \$3 billion for Phase 1 in 2035, six years after the completion of Phase 1.

EXHIBIT 4.5 FAREBOX REVENUE, IOS THROUGH PHASE 1 (YOE \$ IN MILLIONS)

SCENARIO	2025	2030	2035	2040	2045	2050	2055	2060
High Ridership	\$1,071	\$2,522	\$3,615	\$4,552	\$5,546	\$6,757	\$8,233	\$10,031
Medium Ridership	\$801	\$1,966	\$2,831	\$3,564	\$4,342	\$5,291	\$6,446	\$7,854
Low Ridership	\$577	\$1,469	\$2,139	\$2,692	\$3,280	\$3,997	\$4,870	\$5,934

ANCILLARY REVENUE FORECASTS

Ancillary revenue sources are an important revenue component of most international high-speed rail systems. They often include various combinations of commercial development and real estate, parking, on-board services, communications and third party use of right-of-way, advertising and sponsorship. The composition of these sources varies from system to system and is contingent upon the specific business environment and structures for government and private involvement for each system. For example, in Japan, the East Japan Railway Company operates a portion of the high-speed system and also developed and operates related shopping centers, hotels and other real estate ventures.

The Authority is continuing to refine its analysis of potential future ancillary revenues. In order to provide a planning assumption for the 2014 Business Plan, we reviewed public information on ancillary revenue contributions. Based on public information from the U.S., Japan, Taiwan and several European countries, ancillary revenue ranged from 3 percent to 30 percent of net revenues. The Authority has used a planning assumption of 4 percent of net revenues for all ancillary activities. During the first five years of ramp-up, a six percent factor was used to adjust for activities such as commercial uses of fiber and cell towers that will start early as ridership is growing.

COMPARISON WITH 2012 BUSINESS PLAN FORECASTS

The ridership forecasts presented in this 2014 Business Plan are driven by the updated model input data as discussed above. The updated forecasts show higher ridership than previously projected, on average, approximately 25 percent higher in the Medium scenario. The forecasts also showed lower farebox revenues than previously projected ranging from 5 percent lower in 2025 to 10 percent lower in 2040 (adjusted for inflation and excluding ancillary revenues, which have been updated and offset, to some degree, by the decline in farebox revenues). The enhanced model was developed using the most recent observed trip data from 2010 that suggest an increase in the total numbers of trips people will take, but also a reduction in average length of their trips compared to the previous data set used for the 2012 Business Plan. As a result, the total high-speed rail ridership forecasts have increased, but, reflecting the increase in the number of shorter trips, with lower fares, farebox revenues are somewhat lower. In many ways, the results demonstrate that a private operator would implement ways to optimize the farebox revenues and O&M costs by adapting service levels and fare structures. Such an optimization is work the Authority is planning to undertake, with continued review and input by the external academic experts on the RTAP, as an on-going refinement process.

Section 5: Operations and Maintenance

INTRODUCTION

This section describes the O&M cost forecasts for the 2014 Business Plan. Over the last two years, the O&M cost estimates have undergone significant external review from the independent California High-Speed Rail Peer Review Group (PRG), the GAO, and the UIC. Each of these reviews involved in-depth explanations and assessments of the workings, assumptions and inputs to the O&M cost model. All of the reviews found the model adequate for the purposes for which it was being used. However, each of the reviewers offered specific recommendations for ways to continue to improve the O&M cost estimates as the system advances through stages of design and as more information becomes available. This feedback was valuable input to helping the Authority meet the following requirement of SB 1029:

“The High-Speed Rail Authority shall, as part of its [May] 1, 2014, Business Plan, include: a proposed approach for improving ... (b) operations and maintenance cost models”

The Authority incorporated these recommendations in developing a new O&M model that provides a more detailed forecast of the costs that will be incurred during operations and allows the Authority to conduct the analyses that will need to be undertaken over the next two years (including evaluating procurement options and conducting more detailed risk analysis).

This section describes how the new 2014 O&M cost model was created, the overall model structure and the resulting updated cost estimates. For more information on the 2012 model, please refer to Chapter 6 of the 2012 Business Plan, and for more information on the 2014 model, please refer to 2014 Business Plan *Operations and Maintenance Cost Model Documentation* posted on the Authority’s website at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html.

2014 O&M COST MODEL AND FORECAST APPROACH

The 2014 O&M model was designed based on guidance from the USDOT Inspector General (DOT IG). The DOT IG guidance describes best practices for O&M cost forecasts at various stages of program/project development. Forecasts are classified as either “Preliminary,” “Intermediate,” “Final,” or “Commercial Close Out” stage with more advanced forecasts being created as more information becomes available about the system being built, the planned service, the operations and the risks involved. The DOT IG anticipates that forecasts will continue to be upgraded to move from one stage to the next. The 2014 cost model can be classified as largely an Intermediate stage forecast with some elements still in Preliminary stages and some in Final stages.

REVIEW OF THE O&M MODEL BY THE PEER REVIEW GROUP

When the interim progress on the 2014 O&M model (and other analyses) was shared with the independent PRG during the summer of 2013, the PRG stated that:

“We believe that the Authority has made manifest progress in all areas of planning and management since the Revised 2012 Business Plan. This assessment applies to risk management, demand forecasting, operating and maintenance (O&M) cost modeling and the analysis of the impact of HSR on California’s greenhouse gas emissions.”

In regard to O&M in particular, the PRG stated that:

“The O&M cost modeling effort is much improved from the Revised 2012 Business Plan, both in terms of the structure of the model and the incorporation of probabilistic analysis of the results.”²⁸

²⁸ Source: California High-Speed Rail Peer Review Group. August 14, 2013 Letter. <http://www.cahsrprg.com/final-docs-7-9-13-meeting/final-14-aug-letter-signed-and-scanned.pdf>

Following the guidance, the model includes detailed cost categories based on the most granular and up-to-date system information available, plus well-analyzed and defined unit costs for each category. The O&M cost model is built in a modular fashion that can continue to be refined and updated as further information becomes available. The main model modules are as follows:

- Operations Costs
- Maintenance of Equipment Costs
- Maintenance of Infrastructure Costs
- Dispatching Costs
- Station Costs
- Commercial Expenses
- General and Administrative Costs
- Unallocated Contingency

Additionally, each cost category in the base model includes various levels of allocated contingency based on the DOT IG guidance and on the risks and uncertainty associated with that particular cost category. These contingencies were then used as part of the input to the Monte Carlo analysis that evaluated the risk associated with the forecasts and the range of outcomes that were possible as described below.

In moving toward a risk-based approach to O&M cost estimating, the Authority performed both a top-down, or reference class analysis, and a bottom-up analysis evaluating specific risk/uncertainty factors. In reference-class analysis, the risk exposure curve is based on a set of outcomes from similar projects. As with the lifecycle cost risk analysis discussed earlier, the resulting shape of the risk exposure curve was applied to the base model O&M estimates and served as the input to the Monte Carlo simulation. From this resulting analysis, the Authority is able to determine how likely a particular O&M cost result is based on objective evidence from similar projects.

In a bottom-up analysis, by contrast, individual risks and uncertainties serve as the inputs to the analysis. The simulation results “build-up” the risk-exposure curve with different combinations and values for the identified risks. Unlike the reference-class analysis, the resulting analysis provides information on the likelihood and importance of individual risk drivers in addition to a full range of possible outcomes and their associated probabilities. With either method, the objective is to better inform planning, construction, and operations by identifying, quantifying and incorporating the uncertainties and challenges a particular project faces in a transparent, systematic manner.

The UIC stated that,

“The experts [who reviewed the O&M model] did not find any fatal flaws on the O&M cost process” and that, “It is the experts’ view that the O&M costs’ preparation was thorough.”²⁹

²⁹ Source: International Union of Railways. March 2013. *UIC Peer Review of Operating and Maintenance Costs of the California High-Speed Rail Project*. http://www.hsr.ca.gov/docs/about/legislative_affairs/LR_UIC_Peer_Review_Operating_Maintenance_Costs_May_17_2013.pdf

O&M FORECASTS

O&M costs begin with the start of IOS system operations in 2022. In the early years (when levels of service are relatively low), the majority of the costs are fixed costs related to regulatory requirements for inspections and maintenance, while operating costs become a larger share of total costs as the system expands and grows. This is consistent with international experience and with feedback received from the UIC.

As with both the farebox revenue forecasts and the lifecycle cost estimates, the O&M cost forecasts are presented as High, Medium and Low scenarios. The variance between the scenarios is drawn from the Monte Carlo analysis. Exhibit 5.1 shows five year increments of O&M costs through 2060 in 2013 dollars, and Exhibit 5.2 shows how the O&M costs are projected to change over time. The major increases in costs represent the expansion of the system as Bay to Basin and Phase 1 come online.

EXHIBIT 5.1 O&M COSTS FOR SELECTED YEARS, IOS THROUGH PHASE 1 (2013 \$ IN MILLIONS)

TOTAL	2025	2030	2035	2040	2045	2050	2055	2060
High	\$403	\$920	\$946	\$982	\$1,007	\$1,027	\$1,049	\$1,066
Medium	\$358	\$817	\$841	\$872	\$894	\$912	\$932	\$947
Low	\$317	\$730	\$752	\$788	\$807	\$821	\$838	\$850

EXHIBIT 5.2 O&M COSTS FOR IOS THROUGH PHASE 1 (2013 \$ IN MILLIONS)

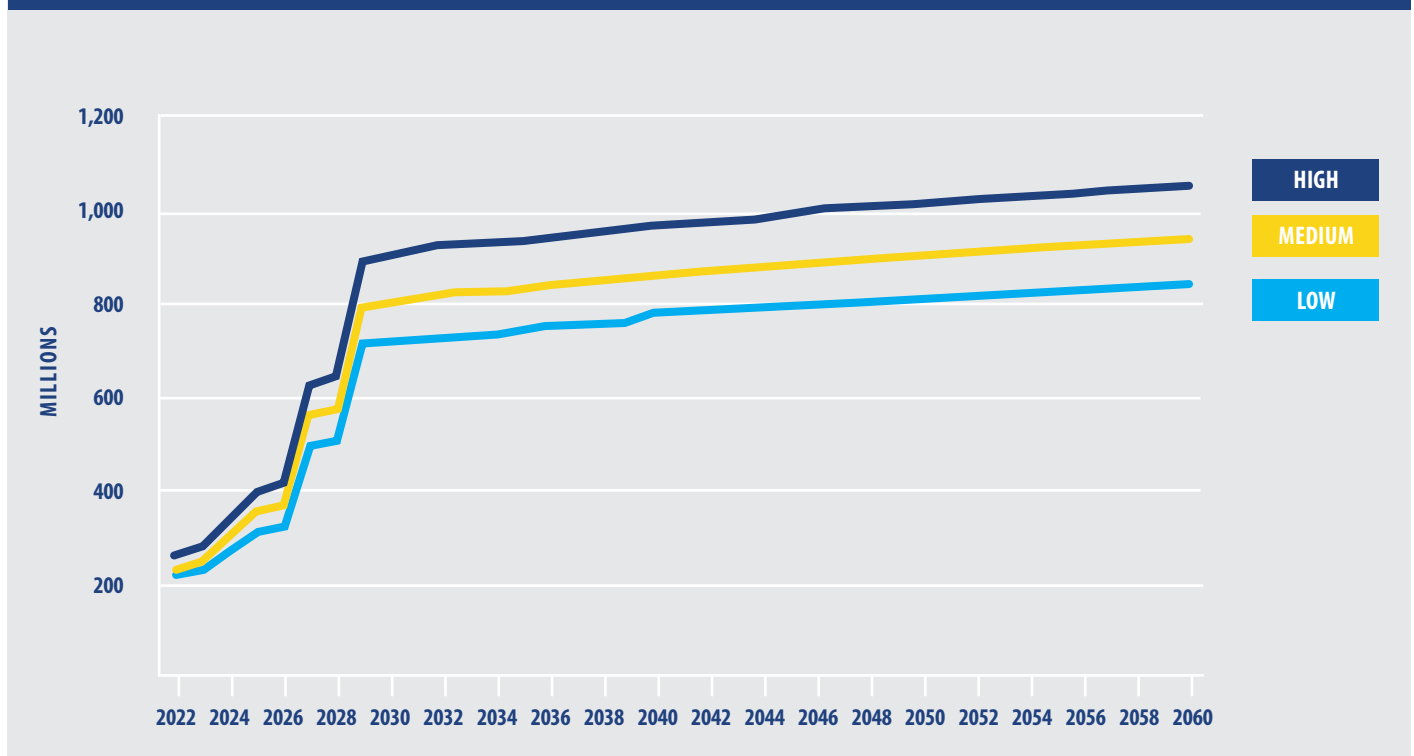


EXHIBIT 5.3 O&M COSTS FOR SELECTED YEARS, IOS THROUGH PHASE 1 (YOE \$ IN MILLIONS)

SCENARIO	2025	2030	2035	2040	2045	2050	2055	2060
High	\$558	\$1,476	\$1,761	\$2,119	\$2,519	\$2,977	\$3,525	\$4,153
Medium	\$496	\$1,312	\$1,565	\$1,882	\$2,237	\$2,644	\$3,131	\$3,689
Low	\$438	\$1,173	\$1,399	\$1,700	\$2,017	\$2,379	\$2,817	\$3,313

Exhibit 5.3 shows the O&M forecasts in YOE dollars.

For the validation process, the results from the 2014 O&M cost model were compared against the O&M results from the 2012 Business Plan using identical inputs, such as levels of service and operating plans. The differences between the two models were as expected (and as recommended by the UIC) in that the early year forecasts were higher than projected in 2012, while the out year forecasts were lower. This change can be attributed to the more detailed bottom-up methodology allowing for a better differentiation between fixed and variable costs leading to a larger share of fixed costs in early years.

Due to the increase in the number of riders discussed in Section 4: Ridership and Revenue Forecasts, more train trips are needed and the updated O&M costs for the 2022 through 2060 analysis period show an approximately 14 percent increase from the overall cost estimates in the 2012 Business Plan. This is largely attributed to changes in the service plans that serve as input to the O&M cost model. For the 2014 Business Plan, the service plans underwent a thorough evaluation by the Authority, with input from the UIC, and were adjusted to reflect the results of the ridership forecasts. This resulted in higher levels of service and thus more operating costs.

Section 6: Financial Analysis and Funding

This section presents the financial analysis and funding strategy for the California high-speed rail program using the updated cost and farebox revenue data described in the preceding chapters. The key topics addressed in this section are as follows:

- Operational viability
- Funding of capital costs
- Private sector financing

OPERATIONAL VIABILITY

This section discusses the operational viability of the system based on a range of alternative financial scenarios – High, Medium, and Low farebox revenue and O&M cost estimates. The revenue projections include both the forecasts of ticket revenue from ridership and revenues from ancillary activities (station activities, advertising etc.) as described in Section 4 “Ridership and Revenue Forecasts.”

Net cash flow from operations is calculated as projected revenues minus O&M expenses. This measure evaluates the projected cash flow surplus from operations (no operating subsidy). This is the same cash flow analysis approach used in the 2012 Business Plan.

As described in Sections 4 and 5, the revenue and operating cost projections have been significantly remodeled and reanalyzed for the 2014 Business Plan; based on input from and review by industry and outside experts, and have undergone a risk analysis to provide greater confidence in their reliability. The resulting updated projections continue to show that the system will be self sustaining and not require an operating subsidy as defined in Proposition 1A, consistent with other high-speed rail systems around the world. The statistical risk analysis performed shows that the probability of these outcomes is extremely high.

Exhibits 6.1, 6.2 and 6.3 below show net cash flow from operations for the first five years of system operation during which time the IOS ramps up to full operations. Revenues and operating costs are based on those described in Sections 4 and 5.

The High, Medium and Low scenarios illustrate that the system can be operationally self-sustaining and not require an operating subsidy during either the five-year ramp-up period, or as it reaches maturity. Both the High and Medium scenarios are projected to have positive cash flow in the first year of operations. The Low scenario, which is the most conservative, is projected to reach a positive cash flow during year two.

Consistent with almost any new operation or business in any industry, there will be a period of ramp-up during which fixed and other startup costs have been incurred and during which revenues are growing. Similar to nearly all other businesses, the high-speed rail project will need to hire and train employees and initiate operations before revenues start to be generated. To

The Peer Review Group stated that,

“Our experience with high-speed rail elsewhere and our review of the demand and cost sensitivity analyses performed by the Authority indicate that the HSR operator should be able to cover operating costs from revenues and thus not need a subsidy as defined in Prop 1A.”³⁰

³⁰ Source: California High-Speed Rail Peer Review Group.
May 18, 2012 Letter.

http://www.cahsrprg.com/files/bus_plan.pdf

EXHIBIT 6.1 SUMMARY OF NET CASH FLOW FROM OPERATIONS FOR IOS DURING RAMP-UP PERIOD*High Scenario*

YOE \$ IN MILLIONS	2022	2023	2024	2025	2026
Revenue	\$437	\$640	\$860	\$1,102	\$1,370
Less: O&M	(\$340)	(\$378)	(\$471)	(\$558)	(\$605)
Net Cash Flow from Operations	\$97	\$262	\$389	\$544	\$765

EXHIBIT 6.2 SUMMARY OF NET CASH FLOW FROM OPERATIONS FOR IOS DURING RAMP-UP PERIOD*Medium Scenario*

YOE \$ IN MILLIONS	2022	2023	2024	2025	2026
Revenue	\$324	\$475	\$639	\$819	\$1,019
Less: O&M	(\$300)	(\$334)	(\$418)	(\$496)	(\$538)
Net Cash Flow from Operations	\$24	\$141	\$221	\$323	\$481

EXHIBIT 6.3 SUMMARY OF NET CASH FLOW FROM OPERATIONS FOR IOS DURING RAMP-UP PERIOD*Low Scenario*

YOE \$ IN MILLIONS	2022	2023	2024	2025	2026
Revenue	\$234	\$338	\$456	\$585	\$729
Less: O&M	(\$284)	(\$312)	(\$377)	(\$438)	(\$473)
Net Cash Flow from Operations	(\$50)	\$27	\$79	\$147	\$256

address the initial cash flow needs of the system in its early months, the Authority anticipates utilizing two cash flow management tools. First, it could enter into a multi-year operating contract that would span beyond the ramp-up period and would be structured to incentivize the operator to match revenues and expenses and cash flow such that surplus net cash flow generated during the early years could be used to cover any potential cash needs in early months. Second, the Authority could put in place a short-term working capital reserve loan as a backup, if needed. These working capital approaches can be revolving short-term loans to support cash flow management and are not cost subsidies. Positive cash flow from the system can be used to repay short term borrowings for cash management purposes.

BREAKEVEN ANALYSIS

As described earlier, the revenue and cost projections for the 2014 Business Plan have been significantly remodeled and re-analyzed, based on input from industry and outside experts, and have undergone a risk analysis to provide greater confidence in their reliability. The resulting updated projections continue to show that the system will not require an operating subsidy consistent with other systems around the world.

The Monte Carlo risk analysis of system breakeven provides further statistical support for the projections that the system will perform at or above its breakeven point and not require an operating subsidy. The detailed risk analysis shows that the probability of these outcomes is extremely high, reaching a 97 percent probability by the end of the IOS ramp-up period in 2026. This is consistent with the findings of the range of projections for High, Medium and Low scenario above, and the results of other systems around the world. The Monte Carlo analysis is further discussed in Sections 3, 4 and 5 and in the supporting documents referenced in those specific sections.

As described, the IOS will undergo an initial ramp-up period that is consistent with the experience of all international high-speed rail systems at the initiation of service. As discussed in Section 2, Business Model, the Authority is exploring entering

into a multi-year operating contract with an operator with skill and experience in this area which would extend beyond the ramp-up period.

The activities of the operator are expected to include managing operating schedules to accommodate growth in demand, providing input on fares and pricing, developing ancillary revenues, managing the addition of new services as the system expands and introducing new trains into service. A key objective of the operator will be to manage operating performance, i.e., matching revenues against operating costs, in order to enhance profitability while building the service. Consistent with

RISK ANALYSIS - MONTE CARLO SIMULATION

A Monte Carlo analysis (or simulation) is a tool to understand the probability or potential for an event to occur, in this case the probability that the system will breakeven. The analysis works as though there are two large bags full of marbles, one with 5,000 marbles each containing potential O&M costs, with more of the marbles having values around the median cost estimate than around the extreme (high or low) values. The second bag of 5,000 marbles contains potential revenue outcomes, again with more marbles with values around the median than the high or low outliers.

- A Monte Carlo analysis simply “picks” one marble at random from the revenue bag and one marble at random from the cost bag, subtracts the number written on the cost marble from the one written on the revenue marble and records the value.
- The analysis then puts the marbles back into their respective bags and repeats the process approximately 5,000 more times which builds up a distribution of potential results and generates a degree of confidence (or confidence interval, expressed as a percentage) as to the likelihood of project breakeven.

proven international experience, this early expertise will help the Authority build an initial operating service plan that balances profitability, growth in ridership, brand recognition and revenue for long-term success. The operator will help build the California high-speed rail brand through a strategic marketing effort including brand awareness, interface with stakeholders such as regional transportation providers, and various types of promotion.

FUNDING OF CAPITAL COSTS

This section discusses the total funding needed to build the system, funding that has been committed, capital that can be borrowed based on the net cash flow of the system, and funding that is not yet committed.

The first construction segment of the IOS will be funded with a mix of Proposition 1A funds and federal funds. A total of \$6 billion has been appropriated for the first construction segment.

After completion of the first construction segment of the IOS and funding of book-end investments, \$4.2 billion of Proposition 1A bond proceeds remains available to partially fund the remainder of the IOS.

Exhibit 6.5 illustrates the costs and funding needed to complete the IOS.

The Authority has Proposition 1A bond proceeds and federal grant funds available to fund the IOS. Revenues from the state's Cap and Trade program have also been identified as a potential funding source.

EXHIBIT 6.5 SOURCES AND USES FOR COMPLETING THE IOS (YOE DOLLARS IN MILLIONS)	
IOS SOURCES AND USES OF FUNDS	
YOE \$ IN MILLIONS	
SOURCES OF FUNDS	
Appropriated Funds	
State Bonds (Proposition 1A)	\$2,684
Federal Grants (ARRA/Other)	\$3,316
Committed Funds	
State Bonds (Proposition 1A)	\$4,240
Uncommitted Funds	\$20,934
TOTAL	\$31,174
USES OF FUNDS	
Capital Expenditure	\$31,174
TOTAL USES	\$31,174
<i>Numbers are subject to rounding</i>	

Project revenues will also be available to support future capital costs or financing. These sources of funds are detailed more fully below:

→ **Federal Sources**

A number of strategies are available for securing federal funding over the long term. These strategies include the development of a dedicated trustfund for intercity and high-speed rail that is funded with an annual appropriation. Funds could then be allocated to those states with high-speed rail programs.

→ **State Sources**

The Authority anticipates \$7 billion in Proposition 1A bond proceeds will be used to fund the IOS, of which \$2.6 billion is currently appropriated.

High-speed rail has been a priority investment for state Cap and Trade funding since the inception of the program, as noted in the ARB 2008 Scoping Plan and recent investment plan. The 2012 Business Plan identified state Cap and Trade revenue as a potential backstop for the project. The Governor’s 2014-15 Budget – submitted to the Legislature – proposes to use Cap and Trade proceeds as an investment in statewide rail modernization in order to reduce greenhouse gases and modernize the state’s inter-regional transportation system (with \$250 million for high-speed rail and \$50 million for urban, commuter and intercity rail projects). In addition to the 2014-15 proposed expenditure of \$250 million for high-speed rail, the Budget also proposes legislation to provide an ongoing state commitment of Cap and Trade proceeds to high-speed rail.

The ongoing commitment of Cap and Trade funds for rail modernization is important in several key respects, both for enhanced transportation and the reduction of greenhouse gas emissions through electrified train service.

First, combined with the remaining Proposition 1A bond funds, it will allow the Authority to proceed without delay and continue construction past the initial Madera to Bakersfield segment – to tunnel through the Tehachapis to create the first dedicated passenger rail connection between Northern and Southern California. Connecting to the multi-modal transit center in Palmdale and connecting rail service will be available throughout Southern California initially via the Metrolink commuter rail system.

Second, a committed, long-term source of funding will reduce the Uncommitted Funds (funding gap) amount (Exhibit 6.5). The amount of the funding gap reduction is dependent on the amount and duration of the Cap and Trade commitment, financing options including federal loans, other public financing tools and private equity investment, potentially financing completion of the IOS. Such a program could allow for multiple sections of the program to be

The American Public Transportation Association (APTA) recently submitted a proposal to Congress calling for legislation which should authorize no less than \$50 billion over the next six years to facilitate the development of a High Speed and Intercity Passenger Rail System (HSIPR). APTA seeks this funding either through reauthorization of the Passenger Rail Investment and Improvement Act of 2008 or as a separate rail title to surface transportation authorization legislation. APTA also advocates for a dedicated funding stream for HSIPR investments, expanding Congestion Management and Air Quality funding, streamlining the Railroad Rehabilitation and Improvement Financing loan program; and a full breadth of finance, tax, and revenue approaches to attract private capital and promote public private partnerships.

**Excerpts from Testimony to the Authority
Board of Directors, January 14, 2014:**

“A multi-year commitment of funding would allow private firms to begin looking at building these projects now. They would also be able to consider financing the construction of one or more corridors and thus be able to start construction much sooner. In addition, depending on the corridor, they may consider adding their own equity into the financing and agree to be repaid over the long term.

In short, this new source of funding for high-speed rail could, if it is a multi-year commitment, significantly change the private sector views of the project, their willingness to finance and invest in it, and do that much sooner than thought. To me that would present a real opportunity for the Authority to take a new look at how and when they move forward on the next phases of the project and the role you expect from the private sector to play.”

Michael Liikala,
President of Solutions International

accelerated and therefore reduce overall costs and the funding gap.

Third, establishment of a committed revenue stream will allow the Authority to immediately engage the private sector in the delivery of the system, earlier than planned private investment which would yield significant cost savings. International high-speed rail projects have proven that significant cost savings can come from having long term strategic partners, with investments in the project that are responsible for designing the most cost effective solutions and responsible to build, install and operate major portions of the system.

→ **Local and Project Sources**

The Authority is studying how to develop the system to take advantage of a number of non-ticket revenue opportunities. These opportunities include parking revenue, commercial development, advertising and sponsorship rights, communication right-of-way sharing and onboard revenues.

Once the IOS is in operation, cash flows will be available from the project that can be used to support capital from government, private-sector debt programs and private-sector equity investments. As discussed in the next section, \$6.2 billion to \$12.4 billion is anticipated to be available from project-supported capital sources for use in developing the Bay to Basin phase. For planning purposes, the Authority has assumed the midpoint of this range – \$8.5 billion – will be available from project-supported capital sources. The remainder of the funding for the Bay to Basin phase is expected to come from a combination of federal, local and other funds as described above.

Exhibit 6.6 illustrates the costs and funding needed to complete the Bay to Basin phase. Phase 1 construction costs are estimated to be \$16.9 billion, and the Authority anticipates funding and financing Phase 1 in a manner similar to the Bay to Basin phase.

PRIVATE-SECTOR FINANCING

As the system develops over time, it will generate financial value through positive net operating cash flow. Once the IOS begins operation, allowing high-speed passenger service revenue forecasts to be demonstrated, the IOS is projected to have material value to a potential private-sector investor as a stand-alone service.

When the IOS is demonstrating strong ridership and revenues, as forecasted, along with overall strong asset operational performance, the private sector is also expected to have interest in investing in the Bay to Basin phase of the system, which will help fund the completion of the Bay to Basin phase. The amount of additional financing to be supported by future IOS and Bay to Basin revenues would be determined based on the private sector’s valuation of the future cash flows from the expansion of the system.

The financing transactions for each phase of system expansion are likely to be structured as a combination of private debt financing, federally subsidized loans or other financing tools and private equity. The structures for both public and private investment have yet to be fully determined, but may include a combination of revenue risk-based transactions and the availability of payment-based transactions, depending on the specific system component being procured.

EXHIBIT 6.6 SOURCES AND USES FOR COMPLETING BAY TO BASIN (YOE DOLLARS IN MILLIONS)

BAY TO BASIN SOURCES AND USES OF FUNDS	
	\$'MM YOE
SOURCES OF FUNDS	
Net Operating Cash Flow	\$165
Private Sector Financing	\$8,542
Uncommitted Funds	\$10,830
TOTAL	\$19,537
USES OF FUNDS	
Capital Expenditure	\$19,537
TOTAL USES	\$19,537

Numbers are subject to rounding

EXHIBIT 6.7 DISCOUNTED CASH FLOWS FOR PLANNING CASE IOS THROUGH BAY TO BASIN (YOE DOLLARS IN MILLIONS)

\$ MMS	DISCOUNT RATE		
	8%	11%	14%
INVESTMENT PROCEEDS	\$12,400	\$8,500	\$6,200

Numbers are subject to rounding

FILLING THE FUNDING GAP BEYOND THE BOND FUNDS APPROVED IN PROPOSITION 1A

When the Legislature approved AB 3034 and the voters approved Proposition 1A (the Bond Act) in 2008, they authorized \$9.95 billion of which \$950 million was dedicated to connectivity projects and 10 percent of the remaining amount was dedicated to system development costs. This left approximately \$8 billion to initiate the construction of a high-speed rail system. A core requirement of the Bond Act is that state bond proceeds used for construction must be matched on at least a one-to-one basis. Fully matching the bonds would provide approximately \$16 billion for constructing the system, or less than half of the estimated cost of the system identified in 2008. So even with the passage of Proposition 1A in 2008, the state faced a funding gap that would need to be filled. At that time there was no existing source of match for the bonds either at the federal or the state level. The first source became available in 2009 with the enactment of the federal American Recovery and Reinvestment Act of 2009 (ARRA), where California was successful in securing \$3.3 billion in federal funds to begin construction.

The financial analysis performed resulted in a range of estimates for the amount of potential investment that could be secured based on a number of discount rates – from \$6.2 billion to \$12.4 billion.

The analysis has been based on the discounting of the net operating cash flow after capital replacement at three illustrative discount rates: 8 percent, 11 percent and 14 percent. The discount rate applied by the private sector in valuing future net operating cash flow is based, in large part, on the level of risk transferred to a private sector partner. For example, it is more likely that the private sector would apply a higher discount rate to any net revenue from future sections yet to be completed. Conversely, a lower discount rate (and therefore higher valuation) would be used for proven cash flows from existing operational sections.

For the purpose of planning the sources of funds for the Bay to Basin phase, an 11 percent discount rate was selected to discount future net operating cash flows from operations after capital replacement costs. This resulted in an estimated \$8.5 billion of private sector capital that could be used to augment government funding contributions for completion of the Bay to Basin phase.

This plan recognizes that the amount to be financed is very large in current private-sector investment terms, and the transaction would likely need to encompass low-cost federal debt programs and be staged to allow for market capacity and competition. Additionally,

given the size of the project, it is likely that the entire system delivery will be procured using multiple concession agreements for individual components that break the project into more financeable parts.

To assist the Authority in ensuring that private-sector ideas and innovation are integrated into the system, the Authority's Board of Directors has approved the development of an unsolicited proposal process. This process has been successfully used in a number of states, and will allow interested private-sector companies to propose solutions for construction, equipment or other systems development that include both financial and technical components. These proposals will be a key source of ideas for innovation and efficiency. The Authority is also working with other state agencies and the private sector to identify strategies for developing the financial potential of the system. This could include, for example, allowing access to the Authority's right-of-way for technology and telecommunications.

Annual cash flow projections underlying the 2014 Business Plan can be found in 2014 Business Plan *High, Medium, Low Cash Flows*, which can be accessed at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html. These projections are based on the farebox revenues described in Section 4, the O&M costs described in Section 5, capital costs and development schedule described in Section 3, and funding and financing sources described in this section.

Section 7: Economic Impact

INTRODUCTION

This section summarizes the economic impact and benefit-cost analyses (BCA) that have been performed for the high-speed rail system for the 2014 Business Plan. This includes the work that has been undertaken over the last two years and updated results based on new and updated input information.

The 2012 Business Plan included the first comprehensive economic analysis of the high-speed rail system. The 2012 Business Plan analyzed the following:

- The benefit-cost ratio of the system to evaluate the overall impact to the state's economy.
- The jobs that will be created during construction and operations.
- The state of the California economy at that point in time.
- The fiscal impacts of the expenditure on construction.
- The long-term wider economic impacts from changes to the economic geography of the state created by high-speed rail.
- The potential local development impacts around the high-speed rail stations.

These analyses can be found in Chapter 9 of the 2012 Business Plan. Subsequently, the Authority's economic analysis underwent a rigorous and thorough year-long review by the GAO. After completing its review, the GAO found that:

“The Authority did a comprehensive job in identifying the potential economic impacts of the high-speed rail project. This includes identification of user impacts, such as effects on travel time reliability, and non-user impacts, such as effects on highway congestion.”³¹

In addition, the GAO offered two recommendations for specific improvements to the BCA. Specifically, the GAO suggested that the analysis incorporate more of the potential negative impacts associated with the project, and include more information regarding the risks associated with the inputs to the analysis. Both of these have been incorporated into the updates to the BCA for the 2014 Business Plan.

PROGRESS SINCE THE 2012 BUSINESS PLAN

Since the 2012 Business Plan, the Authority has continued to update its analyses with relevant data as it has become available. In particular, in response to the GAO recommendations, the Authority has expanded its BCA to include more data on potential negative impacts of the system, such as the taking of agricultural land, emissions during construction, etc. These negative impacts, while important to understand and evaluate, did not have a major impact on the overall results of the updated BCA. Most of the changes to the BCA stem from updated guidance from USDOT, updated inputs for ridership, demand, costs, and changes to outside inputs and forecasts.

Additionally, the Authority has updated its analysis on the state's economy to include data from the last two years, produced more detailed O&M job estimates and updated the construction job forecasts based on the updated capital costs (as shown in Section 3).

RESULTS

The updates to the economic analysis since the 2012 Business Plan include an updated and expanded BCA, updated jobs estimates during construction and operation of the system, and updated fiscal impacts of the construction of the FCS. Additional information on the BCA for this 2014 Business Plan is available in 2014 Business Plan *California High-Speed Rail Benefit-Cost Analysis*, which can be accessed at http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html.

BENEFIT COST ANALYSIS

The BCA incorporates the latest guidance from USDOT, and updated inputs from the Authority’s forecasts and from outside sources. Additionally, the analysis incorporates disbenefits, such as impacts on agricultural production from the taking of land for the system, GHG emissions during construction, and noise impacts from train operations.³² Consistent with guidance on conducting BCAs, and the methodology used in the 2012 Business Plan, the results of the BCA are presented in discounted constant (2013) dollars to account for the difference in economic value of present and future benefits and costs.

The results of a BCA are often analyzed and compared in three forms: the benefit-cost ratio, the net present value, and the economic rate of return. The benefit-cost ratio is the ratio of lifecycle societal economic benefits from building this system compared to a no-build scenario. The net present value is the total dollar value of discounted benefits minus discounted costs. The economic rate of return represents the project’s (real) rate of return and provides a means to compare the returns of this project against other competing public investments.

The BCA was conducted on a 50-year timeframe from the start of operations. The results of the updated BCA show that each phase of the system produces significant economic benefits over the analysis period. Exhibit 7.1 shows the results in discounted 2013 dollars. Results show that estimates for some phases have increased, some have decreased, all within approximately ten percent of the 2012 results.

As with the 2012 analysis, the benefits that accrue from the system accrue both to users of the system through travel time savings and improved reliability, among others and to non-users through reduced auto and air congestion, fewer emissions, and fewer car crashes, among others. The benefits and costs can be summarized into their main components, as demonstrated in Exhibit 7.2.

EXHIBIT 7.1 BENEFIT-COST ANALYSIS RESULTS IN MILLIONS OF DISCOUNTED 2013 DOLLARS

SYSTEM	DISCOUNTED TOTAL BENEFITS (2013 \$ IN MILLIONS)	DISCOUNTED TOTAL COSTS (2013 \$ IN MILLIONS)	NET PRESENT VALUE (2013 \$ IN MILLIONS)	ECONOMIC RATE OF RETURN	BENEFIT-COST RATIO
IOS	\$46,548	\$20,832	\$25,716	12.17%	2.23
Bay to Basin	\$66,595	\$28,371	\$38,224	12.60%	2.35
Phase 1	\$80,542	\$34,639	\$45,903	12.54%	2.33

EXHIBIT 7.2 DETAILED BENEFIT-COST ANALYSIS RESULTS IN MILLIONS OF DISCOUNTED 2013 \$

CATEGORY	IOS	BAY TO BASIN	PHASE 1
BENEFITS			
Benefits for high-speed rail users	\$29,989	\$43,132	\$52,523
Benefits from reduced driving	\$16,498	\$23,304	\$27,810
Benefits from reduced flying	\$207	\$363	\$448
Disbenefits and mitigations	(\$145)	(\$205)	(\$239)
Total benefits	\$46,548	\$66,595	\$80,542
COSTS			
Construction costs	\$17,833	\$24,250	\$29,437
O&M costs	\$2,713	\$3,723	\$4,725
Periodic rehabilitation costs	\$317	\$438	\$546
Salvage value	(\$31)	(\$39)	(\$70)
Total costs, net of salvage value	\$20,832	\$28,371	\$34,639
NET PRESENT VALUE	\$25,716	\$38,224	\$45,903
BENEFIT-COST RATIO	2.23	2.35	2.33
ECONOMIC RATE OF RETURN	12.17%	12.60%	12.54%

JOBS DURING CONSTRUCTION

The estimates of jobs during construction follow established practices from USDOT and others, and include people who will be directly employed building the system, people who will be employed indirectly by the suppliers, people who will be providing services to construct the system, and induced employment in the greater economy by the infusion of income and expenditure in the local economy. Indirect and induced job impacts are often referred to as multiplier effects. The jobs figures, just as those in the 2012 Business Plan, are presented in job-years or the equivalent of one full-time job for one person for one year. So, for example, 50,000 job-years over two years would be the equivalent of 25,000 full-time jobs each year.

Exhibit 7.3 shows the estimated employment from construction of the system (including the direct, indirect and induced jobs). For a full description of the methodology for these estimates, please refer to the *2012 Business Plan Economic Impact Analysis Report* available at http://hsr.ca.gov/docs/about/business_plans/BPlan_2012EIR.pdf.

EXHIBIT 7.3 TOTAL PROJECTED EMPLOYMENT FROM CONSTRUCTION OF THE SYSTEM (INCLUDING DIRECT, INDIRECT AND INDUCED JOBS) BY PHASE IN JOB-YEARS

STEP	TOTAL EMPLOYMENT (JOB-YEARS)
FCS	100,000
IOS	510,000
BAY TO BASIN	810,000
PHASE 1	1,010,000

DIRECT JOBS DURING OPERATIONS

In addition to the jobs created during construction, operating and maintaining the system will create permanent jobs in both the public and private sector. This will include train operators and maintenance yard workers, station managers, operations planners, and others. Operating jobs are estimated based on the positions and labor needs as calculated in the O&M cost model. The direct employment to run the system changes and grows over time as new segments are added and as high-speed rail operations expand. The biggest changes in employment will be with the start and growth in operations of the IOS, followed by significant jumps in employment as Bay to Basin and Phase 1 Blended come online. Exhibit 7.4 shows the total projected employment associated with system operations for select phases and years.

DIRECT OPERATING JOBS	TOTAL
IOS IN 2022 (OPENING YEAR)	1,000
IOS IN 2026 (AFTER SERVICE RAMP-UP)	1,450
BAY TO BASIN IN 2027 (OPENING YEAR)	2,400
PHASE 1 IN 2034 (AFTER SERVICE RAMP-UP)	3,400

FISCAL IMPACTS

In the 2012 Business Plan, the Authority looked at the results of studies by Moody's Analytics and the American Public Transportation Association (APTA) to estimate the potential fiscal impacts of the construction of the first construction section in the Central Valley. Since the FCS is a budget-constrained set of construction projects, and if the Moody's and APTA study results are applied to the FCS, the expected impacts will be as follows:

- An increase of \$8.3 to \$8.8 billion in net GDP.
- \$629 million in tax revenues generated by state and local governments.
- More than a 3-to-1 return in GDP on the state's share of the funds to construct the FCS.
- Nearly 25 percent of the state's investment that will be recouped by the increase in tax revenue that the system's construction will generate.

OTHER BENEFITS- BROADER ECONOMIC IMPACTS

The high-speed rail system will provide greatly improved connectivity and reduced congestion, and as a result, California's economy will become more efficient, productive, and competitive, and businesses will have much greater access to labor and other markets. Key economic sectors and clusters, such as technology, will expand output and hire more workers as businesses gain better access to legal, financial, and other services, and can work more effectively with research institutions, vendors, suppliers, and others. Job impacts will increase over the long term as highway and aviation congestion worsen and the travel benefits of high-speed rail service increase. The research is generally, but not uniformly, positive with respect to major long-term economic impacts, but methods and results can vary widely.

While results and methods vary greatly and cannot be considered precise, some consistency can be identified. For example, an oft-cited study conducted by the U.S. Conference of Mayors estimated creation of about 55,000 jobs in the greater Los Angeles metropolitan area from the full California high-speed rail investment.³³ That study did not provide a complete estimation of job creation for the entire California high-speed rail corridor, but if it is extrapolated based on the Los Angeles Basin's share of the corridor's economy, that study finding would imply a full corridor economic impact of about 100,000 to 150,000 jobs.

A majority of studies that attempt to estimate these impacts numerically lead to similar conclusions, while also indicating the variability in estimates and results. For example, a report by APTA, "The Case for Business Investment in High-Speed and Intercity Passenger Rail", cites the U.S. Conference of Mayors Report, as well as academic studies³⁴ to try to estimate impacts. One report noted prominently in APTA's business case is a case study of high-speed rail impacts in the Frankfurt-Cologne corridor in Germany. Ahlfeldt and Feddersen of the London School of Economics in "From Periphery to Core: Economic Adjustments to High-Speed Rail", 2010, the present following two findings as reported by APTA:

- Counties that are adjacent to intermediate rail stations in the Frankfurt-Cologne corridor were found to have a 2.7 percent premium in GDP compared to areas not having rail access.
- For the much larger economic area served by the Frankfurt-Cologne high-speed rail, the researchers found 0.25 percent growth in GDP for every 1 percent increase in access.

The initial finding, if assumed applicable in California and then extended to the entire California high-speed rail economic impact area, would yield estimates of around 400,000 long-term/permanent jobs created. The second finding – with the 0.25 elasticity – closely mirrors the estimate of about 100,000 jobs, as extrapolated from APTA's results.

For a full description of the methodology for these estimates, please refer to the *2012 Business Plan Economic Impact Analysis Report* available at http://hsr.ca.gov/docs/about/business_plans/BPlan_2012EIR.pdf.

WORK UNDERWAY

We are undertaking a more in-depth look at the potential economic impacts of the high-speed rail system in the Central Valley during construction, once the IOS is open, and after the Central Valley communities are fully connected to San Francisco and Los Angeles. This involves working closely with the Central Valley public sector economic development agencies and business leaders to make this assessment, and to understand what the economic impacts are on the ground. The study will be completed and released after the 2014 Business Plan is submitted to the Legislature.

Section 8: Systems Assurance/ Risk Management

INTRODUCTION

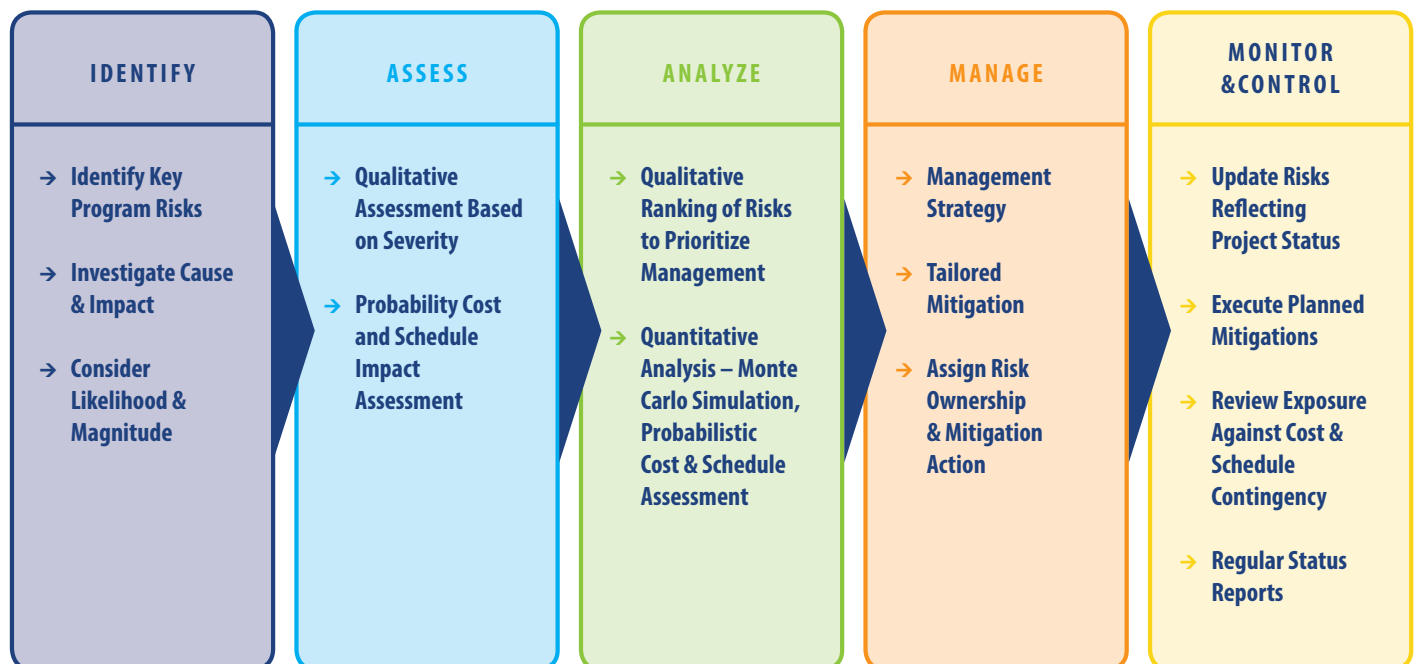
The Authority’s systems assurance program facilitates a comprehensive, consistent and system-wide approach to the overall management of the high-speed rail program. Systems assurance is developing robust quality, risk, reliability, availability, maintainability, and safety management processes, policies, and procedures. It will then be used to assist in the implementation of those policies and procedures as the high-speed rail infrastructure and system-wide elements are constructed and readied for operation.

RISK MANAGEMENT

Identifying and managing project risks are essential elements of successfully delivering the high-speed rail program. The Authority is using a state-of-the-art approach to risk management, including extensively detailed calculation of variables to quantify risk and the incorporation of lessons learned by global experts from other programs.

Since 2012, the Authority has made a number of modifications and improvements to its risk management program and processes to better meet its own objectives and external program requirements. The changes are both organizational and process related, and improvements have been realized in a number of key undertakings since 2012. Organizationally, the Authority appointed a Program Risk Manager, who oversees and directs risk management efforts at both the program and regional team level, ensuring a uniform, proactive process with support at all levels of the program. The process itself, as described in the revised Authority's Project Risk Management Plan issued in 2013, has been significantly improved to better define and sys-

EXHIBIT 8.1 RISK MANAGEMENT PROCESS SUMMARY



tematize risk management efforts and objectives, better address SB 1029 requirements, and quantify the program's financial risk exposure.

The products of this effort include quantitative determinations of risk exposure and risk-adjusted estimates for O&M costs, lifecycle costs, ridership and revenue and breakeven analysis, all employing state-of-the practice Monte Carlo analysis in both traditional "bottom-up" and reference class analysis. The Authority has also deployed these tools to develop risk-informed contingency recommendations for CP 1, as well as schedule analysis for CP 1 and CP 2-3. Future construction packages will undergo the same rigorous risk analysis, identifying, quantifying and managing risk exposure through appropriate mitigations and risk-informed contingency planning. Finally, the Authority has developed a web-based Risk Management System and integrated it within the larger Program Management Information System to monitor and control all of this information and ensure that risks are considered with a holistic understanding of the program and its objectives. The Authority is also working with the PRG to gain the benefit of its perspective and guidance to continually improve the program.

The risk management program provides the Authority with a formal, systematic approach to identifying, assessing, evaluating, documenting and managing risks that could jeopardize the success of the program. These include specific engineering, environmental, planning, right-of-way, procurement, construction, organizational, stakeholder, budget and schedule risk, or any other potential inabilities to deliver the required results. The risk management program's objectives are to:

- Systematize the process by which the Authority responds to circumstances that could increase the cost or significantly delay or halt the program.
- Increase transparency regarding challenges to project plans and objectives.
- Capture project opportunities.
- Satisfy legal and regulatory requirements and meet the needs and expectations of other stakeholders.
- Rationalize allocation of resources including cost and schedule contingencies.

The Risk Management section of the 2012 Business Plan discussed the risk management plan being administered by the Authority and identified a number of high-level risks together with a description of the specific risk mitigation and management approach that the Authority is applying to each. The former was summarized by the process shown in Exhibit 8.1. This section describes changes and updates since the 2012 Business Plan.

RISK MANAGEMENT ORGANIZATION

The most significant change to the risk management program has been in the area of staffing. Effective September 1, 2012, the Authority appointed a Director of Risk Management and Project Controls who reports directly to the Chief Executive Officer and the Authority Board of Directors. The Risk Manager's responsibilities include the following:

- Ensures proactive response to all risks and opportunities that will impact the successful delivery of the program.
- Approves and regularly reviews the Program Risk Management Plan in conjunction with Program Director to ensure compliance with applicable regulatory requirements and successful implementation.
- Approves risk management reports recommended by the Project Risk Manager.
- Promotes and directs risk management for the program, maintaining its independence from Project and Program management.
- Participates in risk meetings as needed.
- Ensures implementation of risk response actions.
- Monitors the effectiveness of risk response actions.
- Consolidates project risk data into program level results.
- Reports to the CEO and Authority Board of Directors on risk management results, major issues and concerns.
- Accumulates the lessons learned in the area of risk management.

RISK MANAGEMENT PLAN

With the appointment of the Risk Manager, the Authority instituted a number of changes to its risk management organization and process. These were realized in an updated Risk Management Plan (RMP) issued in November 2012, and in an expanded use of quantitative methods – such as Monte Carlo simulations – to assess and analyze capital expenditure and construction schedule risk, lifecycle and O&M costs and ridership and revenue.

In July 2013, the Governor signed SB 1029 which established a number of requirements on risk management for the Authority, including the following:

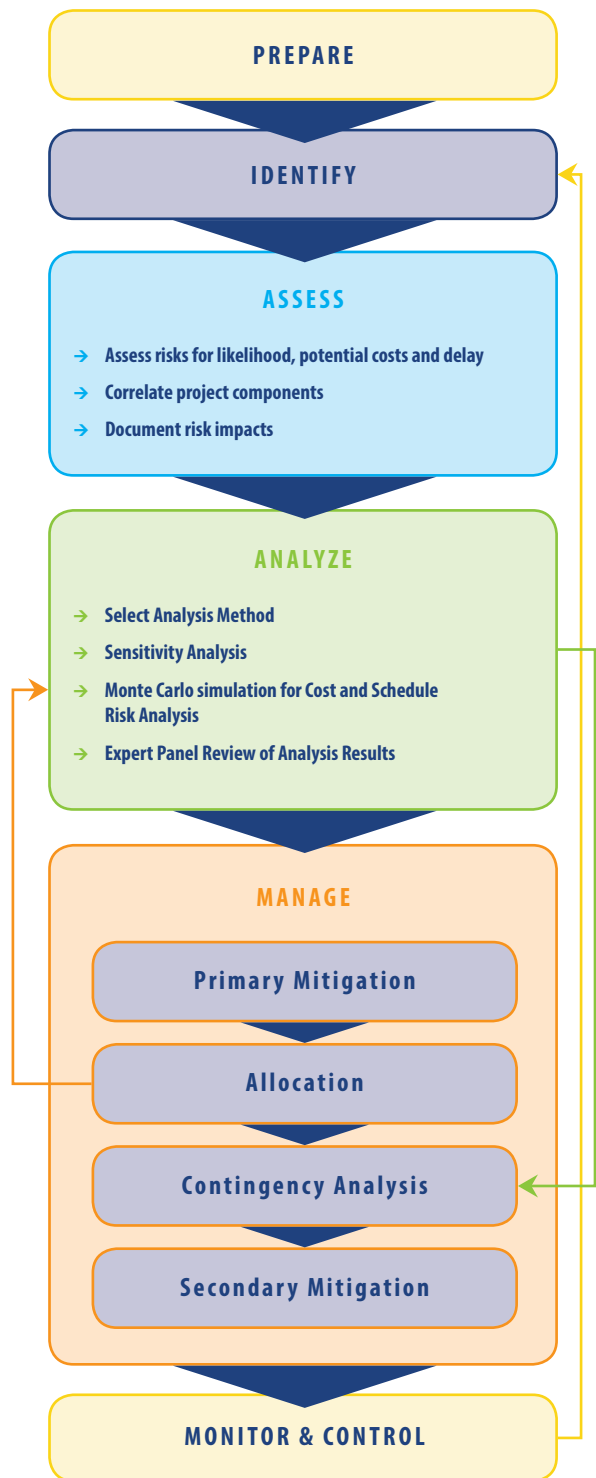
- A comprehensive risk management plan that defines roles and responsibilities for risk management and addresses the process by which the Authority will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the duration of each project.
- A process by which identified risks will be quantified in financial terms.
- Development of documents that will be used to track identified risks and related mitigation steps.
- Plans for regularly updating its estimates of capital and support costs.
- Plans for regularly reassessing its reserves for potential claims and unknown risks, incorporating information related to risks identified and quantified through its risk assessment processes.
- Plans for regularly integrating estimates for capital, support costs, and contingency reserves in required reports.

In furtherance of the above objectives, and in accordance with SB 1029, the Authority’s RMP was revised and submitted to the Legislature again in July 2013.

The July 2013 update to the RMP further refined the Authority’s implementation and enhanced the Authority’s risk management “tool set.” While the overall process of identifying, assessing, analyzing and managing risks is the same, the plan was significantly augmented to more directly tie the risk management process to the underlying scope, cost and schedule basis, as well as follow-on program management efforts. The most significant additions are to the Authority’s process for quantitatively assessing, analyzing and managing its financial risk exposure. The revised RMP now delineates a specific process and workflow, summarized in Exhibit 8.2, by which risk will be quantified in financial terms – related to the underlying scope – cost and schedule, analyzed and then managed through primary mitigations, contractual allocation, contingency and, if necessary, secondary mitigations. The overarching purpose of these and other revisions is to further systematize and motivate the identification and management of risks and ensure that the Authority meets the requirements as set forth in SB 1029. Other significant changes to the Authority’s process and RMP from 2012 include the following:

- Terminology and process steps have been brought more in-line with a transportation/infrastructure focus (e.g. FTA, FHWA) as opposed to general project delivery of the previous version.
- The qualitative assessment and criteria have been expanded to include Scope and Quality (including Safety) in line with Caltrans guidance, which better reflects the Authority’s expanded risk management effort.
- Prescribed time/milestone for beginning of quantitative risk management process.

EXHIBIT 8.2 REVISED AND EXPANDED RISK MANAGEMENT PROCESS SUMMARY



OVERVIEW OF KEY RISK AREAS

Below is an overview of the key risk areas that the Authority has identified and manages on an ongoing basis.

CAPITAL REHABILITATION AND REPLACEMENT COSTS

Without a directly comparable system operating in the U.S., there is a risk that current estimates for lifecycle costs are different than eventual actual costs. For the 2014 Business Plan, the Authority has developed a comprehensive lifecycle cost model to capture the 50-year capital rehabilitation and replacement costs for the infrastructure and assets of California's high-speed rail system. The 2014 model presents the methodology used to develop lifecycle requirements for each asset, allows changes to rehabilitation and replacement costs, timing, and spread for each asset, and generates outputs to summarize 50-year lifecycle costs in real and inflated dollars.

MANAGEMENT AND MITIGATIONS

The model includes detailed estimates for each cost category based on the design life and experience around the world for asset lifespans and rehabilitation requirements. Contingency was applied to the model to account for inherent risks and uncertainties with forecasting lifecycle costs. Similar to the O&M and revenue estimates, a Monte Carlo analysis was developed to evaluate a potential range of lifecycle forecasts. The analysis helped form the basis for Low, Medium and High lifecycle cost estimates.

ENVIRONMENTAL APPROVALS

The risk associated with environmental approvals may be broadly separated into risk of obtaining approvals in the requisite time necessary to avoid delays to construction, and risk associated with conditions of the approval (e.g., work windows). While the working relationship between the Authority and various resource agencies (e.g., the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the State Water Resources Control Board and the California Department of Fish and Wildlife) is positive and constructive, delays can and do occur (at least partially and perhaps largely due to review periods extending longer than anticipated). Given the interdependencies between various approvals and permits granted by different agencies, a delay in one or two permits could delay the entire process. The conditions and restrictions associated with these permits or approvals are another area of uncertainty, as is the relationship between property acquisition and the ability to implement pre-construction permitting requirements. Per terms of the contract with the design-build contractor, meeting these conditions will be the responsibility of the design-build contractor, but they will not be fully known until the permit has been issued and will not be achievable until the property(ies) in question are acquired.

MANAGEMENT AND MITIGATIONS

The Authority continues to manage this risk by increasing staff levels and maintaining intergovernmental collaboration, while complying with all approval processes in addition to the risk transfer described above. Mitigation includes, but is not limited to, obtaining written commitments for accelerated review periods from appropriate agencies, developing right-of-entry agreements with private landowners, integrating environmental considerations earlier into the Alternatives Analysis process and pursuing early access to parcels and funding of survey work whenever feasible.

FINANCING AND FUNDING RISK

A number of risks exist for the program related to funding and financing. Failure to receive the anticipated amount of public funding at the requisite time could threaten the pace of development of the full program. Additionally, failure to manage the timing of committed funds against the cash flow requirements of the construction program presents a risk. While state and federal funding have been committed for the first construction segment of the IOS, administrative requirements still need to be met for full and timely receipt of funds.

MANAGEMENT AND MITIGATIONS

The near-term funding risk is mitigated by the identification of all necessary sources for the \$6 billion cost. The ultimate scope of the first construction section will be managed to ensure that the first construction segment of the IOS is completed within the current \$6 billion appropriation. Steps to address uncertainties in future federal funding include continuing to work with members of Congress and state legislators, the USDOT, the private sector and other stakeholders to maintain support for funding and financing programs that the California high-speed rail program is eligible for, such as reauthorization of the Passenger Rail Investment and Improvement Act of 2008 and the Moving Ahead for Progress in the 21st Century Act. The Authority will also engage private sector entities to discuss the ability of private finance to complement or supplement public-sector funding.

LITIGATION RISK

In the normal course of business associated with implementing a complex transportation infrastructure project, public agencies typically address a range of litigation challenges and adjudicatory administrative processes related to project funding, environmental clearances, property acquisition and contract disputes. These litigation challenges have the potential to affect project schedules, costs and financing. In very general terms, the legal challenges raised against the program to date have fallen into two broad categories: those related to location-specific impacts and mitigations and those related to programmatic and process issues.

MANAGEMENT AND MITIGATIONS

The Authority works closely with affected stakeholders and consultants to address issues before they become formal lawsuits or, for legal issues raised through lawsuits, the Authority typically seeks to resolve them. In addition to court resolution processes, the Authority seeks to use alternative dispute resolution such as mediation or arbitration. Most disputes are very specific to stakeholders' interests as a result of the project and are resolved through negotiations, alternative dispute resolution or litigation. In fact, each of the site-specific lawsuits filed related to impacts and mitigation has been resolved through settlement. However there are a limited number of lawsuits filed by project opponents which can only be resolved through protracted litigation. The Attorney General represents the Authority in all litigation except in those cases where additional expertise may be required.

OPERATIONS AND MAINTENANCE COSTS

Without a directly comparable system operating in the U.S., there is a risk that current estimates for O&M costs will be different than eventual actual costs. Currently, development of pre-revenue O&M costs are captured as part of the testing and start-up costs in the capital cost estimate, and are estimated as percentages of the system elements that are subject to the testing and startup operations.

MANAGEMENT AND MITIGATIONS

To further refine its understanding of the system's O&M costs, the Authority undertook a comprehensive effort to develop a bottom-up O&M cost model for the 2014 Business Plan. The upgrades to the O&M model are described in Section 5, Operations and Maintenance.

As an Intermediate stage forecast, the estimate for the 2014 Business Plan accounts for all known cost categories and includes appropriate contingencies (based on the DOT IG guidance) for each cost category in the baseline forecast. Additionally, the Authority has undertaken an effort to understand the risks associated with the O&M cost forecasts more thoroughly. To do that, the Authority conducted Monte Carlo simulations that analyzed the risk to the total cost estimate based on the accuracy of relevant other O&M forecasts (reference cases). Other mitigation strategies have included extensive consultations with the UIC and other outside reviewers to evaluate international best practices. These efforts are also documented in Section 5, Operations and Maintenance, and the Authority's semi-annual Project Update Reports.

RAILROAD AGREEMENTS

Given the interface with existing railroad right-of-way, there is a need for agreement with the railroad companies. At this time, there is not a master agreement in place between the Authority and Burlington Northern Santa Fe (BNSF) or between the Authority and Union Pacific Railroad (UPRR) to inform design and construction of modifications to UPRR or BNSF facilities and each railroad's right-of-way and operational requirements. There is also risk related to fulfilling the obligations of the agreements once they are in place. In addition, there may be significant additional costs to the program associated with any disruptions to service experienced by BNSF and UPRR during construction. If agreements cannot be reached with the railroad companies, then design work in progress or already completed may be affected, leading to cost increases or schedule delays that could become significant if the delay in reaching agreements persists. In addition, the terms of these agreements and constraints imposed by the railroad's normal operations may negatively impact (implicit) productivity assumptions made during the development of the program's schedule and cost estimate, as well as the eventual contractor's possible means and methods.

At the same time, these railroad agreements would have to account for the risk of possible grade crossings in the Caltrain corridor.

MANAGEMENT AND MITIGATIONS

While the Authority is responsible for securing the agreements with railroad companies, the Authority intends to transfer much of the risk related to performance under the agreements to the design-build contractors. The design-build contract will mandate that the contractor is responsible for fulfilling the Authority's obligations under the agreements with continued participation by the Authority.

The Authority has executed reimbursement agreements with the following railroads and operating agencies: Orange County Transportation Authority, Southern California Regional Rail Authority, Capitol Corridor Joint Power Authority, San Joaquin Regional Rail Commission and UPRR. In addition, the Authority has executed MOUs with both BNSF and UPRR. Currently, the Authority is negotiating a reimbursement agreement and an overpass agreement with BNSF. The Authority has also signed an indemnification/insurance agreement with UPRR. Additionally, the Authority has made substantial progress in negotiating a master engineering, construction and maintenance agreement with the UPRR. Finally, the Authority has begun negotiations with UPRR on a purchase and sale agreement, which will include all the parcels required from the UPRR for CP 1.

Risks in the Caltrain corridor areas would be mitigated in one of four ways, in accordance with the Federal Railroad Administration's "High-Speed Passenger Rail Safety Strategy", specifically:

1. Eliminate all redundant or unnecessary crossings together with any crossings that cannot be made safe due to crossing geometry or proximity of complex highway intersections.
2. Install the most sophisticated traffic control/warning devices compatible with the location (e.g., median barriers, special signage, possible active advanced warning, four-quadrant gates) where train-operating speeds are between 80 and 110 mph.
3. Protect rail movement with full width barriers capable of absorbing the impact of highway vehicles where train-operating speeds are between 111 and 125 mph.
4. Eliminate or grade-separate all crossings where trains travel at speeds above 125 mph.

RIDERSHIP AND REVENUE

The financial viability of the program is dependent on public funding for early construction, and then on ridership revenues to support access to private capital as the program matures. Given that the program is entirely new, and no high-speed rail currently operates in the U.S., a risk exists that the actual ridership demand and revenue will differ from the projections currently being used. The impact to the program could be wide ranging and include the following:

- Decreased commercial and financial viability
- Lower-than-expected project revenue
- Increase in the public funding required
- Loss of stakeholder support

MANAGEMENT AND MITIGATIONS

Demand and ridership estimates have been refined and peer reviewed, and a range of revenue scenarios have been evaluated for sensitivity. The model developed for the 2014 Business Plan has been enhanced with additional features and the latest available input data. Four main sources of data were updated, complementing previous datasets and widening the range of perspectives. The most recent dataset was developed in conjunction with Caltrans to ensure better consistency with other California model data. Additional features include a more detailed access/egress mode choice model, variable forecast horizon years, a streamlined model structure and faster run times.

As part of the 2014 Business Plan forecasting effort, the Authority has developed a Risk Analysis Model to estimate a ridership and revenue forecast range and associated probabilities for each of the Business Plan scenarios. The risk model is used to develop Monte Carlo simulations for each of the Business Plan scenarios and associated forecast years. The risk analysis model includes a range of assumptions relating to various risk factors having the greatest combination of uncertainty and impact on the results. Together, these risk factors help create a range of potential ridership and revenue results and the probability of occurrence for each of these results. For more information see Section 4, Ridership and Revenue Forecasts.

RIGHT-OF-WAY

Before construction can begin on a parcel of land, the parcel must be acquired by the Authority. Thus, the acquisition of right-of-way is directly linked to the ability to meet project deadlines. This ability may be affected by timing of achievement of environmental milestones, receipt of funding, and completion of multiple levels of governmental review and approval processes. Delays in the acquisition process could affect the contractor's ability to meet deadlines or costs.

MANAGEMENT AND MITIGATIONS

The Authority is mitigating and managing the risk associated with right-of-way in a variety of ways, including development of a highly detailed right-of-way acquisition plan, vetting the right-of-way acquisition plan with contractors, and prioritizing right-of-way acquisition to meet initial contractor work-zone requirements and securing technical expertise and additional capacity.

Steps being taken include consultation with the Department of Finance and the State Public Works Board to allow earlier site selection, accelerating survey and appraisal of all parcels, ensuring adequate resources to avoid staffing constraints and keeping review agencies (e.g., Department of Finance, Department of General Services, and Caltrans) involved and informed regarding the program, status and expected workload.

STAFFING AND ORGANIZATIONAL STRUCTURE

During the peak construction years, the annual construction outlay will be as much as several billion dollars. The Authority faces the risk that it will not have the number of experienced staff necessary to meet the demands of the program from an internal management perspective. If this risk is not mitigated by enhancing in-house capabilities, engaging supplemental resources, and considering appropriate business and commercial structures to transfer or share risk, then staffing and organizational structure may prove to be inadequate to the demands of the high-speed rail program, and the first construction section in particular. Without adequate staffing and expertise necessary to make timely, informed decisions necessary to advance the program, delays and increased costs are likely.

MANAGEMENT AND MITIGATIONS

The risks associated with staffing and organizational structure have been addressed with key hires at all levels of the Authority. The Authority has made significant progress in filling the positions authorized by the Legislature. As of April 28, 2014, there were 118.5 staff. At the same time, the CP 1 Project and Construction Management Team is addressing this risk with key hires in the quality and in the Central Valley risk management areas.

STAKEHOLDER SUPPORT

The program could face potential adverse effects due to a possible decline of local public support. Local interest groups could attempt to prevent or delay the local authorization process and local permitting or cooperation necessary for work to advance. Maintaining public support at the local level poses its own risks to the project if expectations are not clearly managed and mitigated. If the Authority does not clearly present both the program's cost and benefits or agrees to mitigations (and their associated costs) in an incremental manner without first determining the cost implications for the overall program, there is a risk that public support will erode and/or that the program's overall costs could exceed current cost estimates.

MANAGEMENT AND MITIGATIONS

Mitigation of this risk overlaps to some extent with staffing risk, as described above. Regional Directors in Northern California, the Central Valley and Southern California were appointed in 2012, and the Authority's Central Valley, Northern California, and Southern California offices all opened in 2013. These Regional Directors and their staff have a program-level understanding of the cost implications of potential program decisions, and they use this information to act as a point of contact for local and regional stakeholders when addressing their needs and concerns related to potential project effects in their region. Regular outreach meetings are held by all Regional Directors and their staff to provide outreach and facilitate communication opportunities between the program and stakeholders. A Small Business Advocate was also appointed in 2012 to serve as the main point of contact between the Authority and small businesses.

THIRD-PARTY AGREEMENTS

The program faces a number of challenges, both general and location specific, associated with third-party agreements. A significant number of project dependencies are introduced in a longitudinal project. Simply put, key activities necessary to construct the project are not under the direct control of the project team (Authority, Project Management Team, or contractor). The relocation of fiber-optic cable or major utilities in many locations will be done by third-party(ies) operating under their own business constraints and according to their own schedule.

UTILITIES

Prior to selecting a preferred alternative on any project section, the program faces information limitations regarding the physical location of many utilities (both major and minor), ownership of utilities, and, generally, a limited understanding of how this and other third-party work is best integrated with construction of high-speed rail infrastructure and systems to provide a schedule and cost estimates with a high degree of confidence. While the Authority is currently in negotiations with the utility owners who will be affected by the system's construction and anticipates securing all cooperative utility agreements prior to receiving proposals for construction, there may be some utilities for which the Authority does not have enough information in order for design-build contractors to price the cost of the relocation or removal. There is also a risk that such relocation or removal may require additional right-of-way. Minor to significant delays and additional costs to the overall program may also arise from lengthy regulatory processes for signing utility agreements and requisite assumptions that must be made to advance the work at the regional level.

MANAGEMENT AND MITIGATIONS

The Authority is working to mitigate and manage the risk associated with utilities in a variety of ways, including working closely with the affected utility companies in managing utility design and construction requirements, and in finalizing all cooperative utility agreements prior to the receipt of proposals to construct. In June 2013, Governor Brown signed SB 85 (Committee on Budget and Fiscal Review, Chapter 35, Statutes of 2013) that established a framework for the reimbursement or payment, and apportionment, of utility relocation costs, clarifying the Authority's utility relocation process on land acquired for the high-speed rail project. SB 85 will help the Authority avoid delays in project delivery from a failure to reach agreements with utility companies regarding the relocation of utility facilities. These provisions were modeled after existing statutes used by Caltrans for the relocation of utilities within right-of-way acquired for highway purposes in order to establish a familiar framework for utility companies.

QUALITY MANAGEMENT

To aid in the implementation of control and operational procedures, the Authority has developed a system to establish and document the organizational structure, responsibilities, procedures, processes and resources needed to keep the project within scope, on schedule and under budget. The Master Quality Plan serves as the main document used in developing and implementing this system. The Master Quality Plan is applicable throughout the project lifecycle, including the conceptual planning phase, environmental approvals, detailed design, procurement, construction, testing and commissioning into revenue service.

As of January 2013, the Authority developed Part 1 of the Master Quality Plan and began implementing the system throughout the program. In 2014, the Authority will integrate all elements of the program into the Quality Management System, which consists of the Quality Policy, the Master Quality Plan (Parts 1 and 2), and the associated program and project quality plans, procedures, work instructions and quality records. All of these documents and processes collectively, comprise the Authority's Quality Management System as illustrated in Exhibit 8.3. To verify compliance with management, administrative and technical procedures for the program, the Authority conducts periodic quality surveillance audits of its various in-

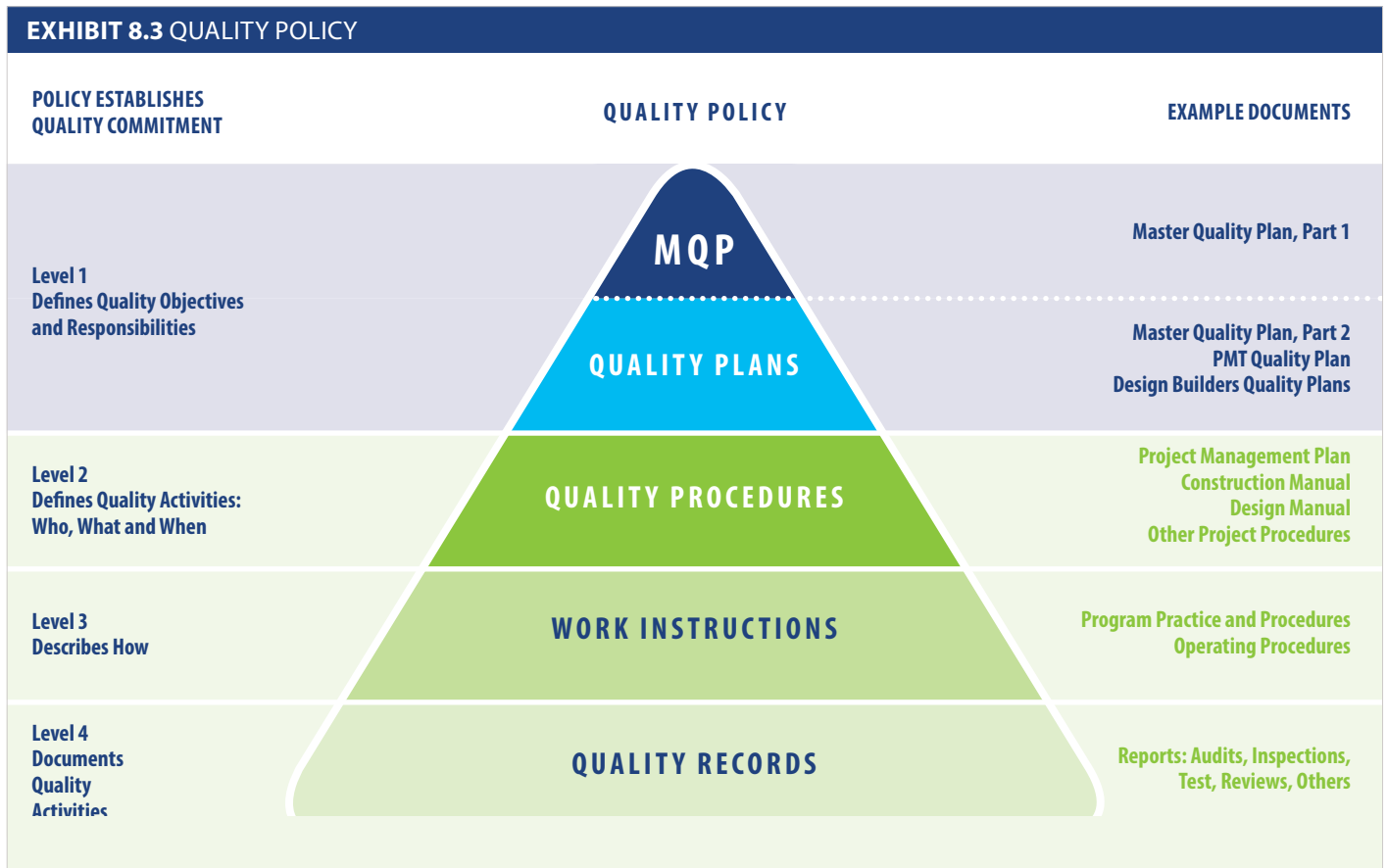
ternal elements, including the Program Management Team, Regional Consultants and Project and Construction Management Team. As construction packages are procured, the Authority will also perform quality oversight of the design-build teams to deliver a program with quality that meets or exceeds acceptable industry and government standards, on schedule, and at the lowest possible cost.

SAFETY/SECURITY MANAGEMENT

The Authority is implementing a Safety and Security Management Plan that includes the following elements:

1. The safety assurance portion of the RAMS (Reliability-Availability-Maintainability-Safety) program.
2. A hazard management program that includes hazard identification and hazard assessment in the form of preliminary hazard analyses and threat and vulnerability assessments.
3. Coordination with fire and life safety agencies having jurisdiction such as the Office of the State Fire Marshal, Federal Railroad Administration, the Department of Homeland Security and local emergency response agencies.

The hazard assessment effort includes collaboration with the system disciplines (engineering, core systems, rolling stock, and operations) to develop safety and security design requirements that mitigate the risk to an acceptable level. The Safety and Security Management Plan also describes process requirements that demonstrate the achievement of Safety and Security Certification, and communication processes administered by the Safety and Security Team, including internal and external committee meetings and stakeholder outreach.



Acronyms & Abbreviations

AB	Assembly Bill
APTA	American Public Transportation Association
ARRA	America Recovery and Reinvestment Act
Authority	California High-Speed Rail Authority
BART	Bay Area Rapid Transit
BCA	Benefit-Cost Analysis
BNSF	Burlington Northern-Santa Fe Railway
CalSTA	California State Transportation Agency
Caltrans	California Department of Transportation
CEO	Chief Executive Officer
CP	Construction Package
DBE	Disadvantaged Business Enterprise
DOT IG	Department of Transportation Inspector General
DVBE	Disabled Veterans Business Enterprise
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
FCS	First Construction Segment
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GAO	Government Accountability Office
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IOS	Initial Operating Section
LAX	Los Angeles International Airport

MB	Micro-Business
MOU	Memorandum of Understanding
O&M	Operating and Maintenance
PCM	Project and Construction Management
PRG	Peer Review Group
RAMS	Reliability-Availability-Maintainability-Safety
RFP	Request for Proposals
RFQ	Request for Qualifications
RMP	Risk Management Plan
ROD	Record of Decision
RTAP	Ridership Technical Advisory Panel
SB	Senate Bill
SBA	Small Business Administration
SFO	San Francisco International Airport
STB	Surface Transportation Board
TOD	Transit-Oriented Development
UIC	International Union of Railways
UPRR	Union Pacific Railroad
USDOT	U.S. Department of Transportation
YOE	Year of Expenditure

Footnotes

¹ Source: Public Utilities Code Section 185033

http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=19.5.&title=&part=&chapter=3.&article

² Source: UIC Peer Review of Operating & Maintenance Costs of the California High-Speed Rail Project – May 17, 2013

http://www.hsr.ca.gov/docs/about/legislative_affairs/LR_UIC_Peer_Review_Operating_Maintenance_Costs_May_17_2013.pdf

³ Source: SB 1029 (Budget Act of 2012-13)

http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_1001-1050/sb_1029_bill_20120718_chaptered.pdf

⁴ Source: http://www.hsr.ca.gov/About/Business_Plans/2014_Business_Plan.html

⁵ AB 3034 (Galgiani, Chapter 267, Statutes of 2008) established a Peer Review Group (PRG) whose duty is to evaluate the California High-Speed Rail Authority's funding plans and prepare its independent judgment as to the feasibility and the reasonableness of the Authority's plans, appropriateness of assumptions, analyses and estimates, and any observations or evaluations the PRG deems necessary. Membership of the PRG has evolved since the 2012 Business Plan was issued.

Its current members include: Walter C. Bell, P.E. The UBS Global Asset Management Corporation and Member, Board of Trustees, The Polytechnic Institute of New York University; Diane Eidem, Strategic Policy Advisor to San Diego Association of Governments (SANDAG); Stacey Mortensen, Executive Director, San Joaquin Regional Rail Commission; Louis S. Thompson, Principal, Thompson, Galenson and Associates, LLC.

⁶ In 2006, the California State Legislature passed and Governor Schwarzenegger signed into law AB 32 (Nunez, Chapter 488, Statutes of 2006), the California Global Warming Solutions Act of 2006, to reduce greenhouse gas emissions (GHG) in California to 1990 levels by 2020, while delivering co-benefits to protect the state's human and natural resources.

According to the California Air Resources Board (ARB), a total reduction of 80 million metric tons (MMT) of greenhouse gas is necessary to achieve the 2020 GHG reduction goals established by AB 32. Of these reductions, approximately 78% are to be achieved through direct regulation; the balance (approximately 18 MMT) will be achieved through the implementation of a cap-and-trade program, the ARB's preferred market-based mechanism for GHG reductions, and the subsequent investment of cap-and-trade auction revenues.

Governor Brown's 2014-15 Budget Proposal <http://www.ebudget.ca.gov/>

⁷ The Ridership Technical Advisory Panel (RTAP) was established to provide verification and validation of the California High-Speed Rail ridership and revenue models and forecasts developed by the Authority's consultants. The RTAP is a group of International experts and academics, who have backgrounds in transportation demand forecasting with unique experience in model estimation.

The panelists include: Frank S. Koppelman, PhD, Professor Emeritus, Department of Civil Engineering, Northwestern University (chair); Kay W. Axhausen, Dr.Ing., Professor, Institute for Transport Planning and Systems, ETH Zurich (Swiss Federal Institute of Technology Zurich); Eric Miller, PhD, Professor, Department of Civil Engineering, University of Toronto; David Ory, PhD, Principal Planner/Analyst, Metropolitan Transportation Commission; Kenneth A. Small, PhD, Professor Emeritus, Department of Economics, University of California-Irvine

- ⁸ The International Union of Railways (UIC) is an international organization of the railway sector comprised of 197 members across 5 continents. They are responsible for developing centers of competence and best practices such as high-speed rail. The UIC support member organizations in their efforts to develop new businesses and areas of activity, propose and develop new and improved technical and environmental performance and measures and create new world standards for railways, including the development of international high-speed rail standards. <http://www.uic.org/>
- ⁹ Source: California High-Speed Rail Authority. April 2012. *California High-Speed Rail Program Revised 2012 Business Plan*. http://www.hsr.ca.gov/About/Business_Plans/2012_Business_Plan.html
- ¹⁰ Source: California High-Speed Rail Authority. May 2013. *High-Speed Rail Connectivity and Bookends Fact Sheet*. <http://www.hsr.ca.gov/docs/newsroom/fact%20sheets/High-Speed%20Rail%20Connectivity%20and%20Bookends.pdf>
- ¹¹ Source: American Lung Association (ALA). 2013. *Most Polluted Cities*. <http://www.stateoftheair.org/2013/city-rankings/most-polluted-cities.html>
- ¹² The Bay to Basin phase of the system is envisioned to create a connection between the high-speed rail system and the Caltrain corridor that would allow for a seamless one seat-ride to the Transbay Transit Center in downtown San Francisco. The Authority is currently working with its partners on how to develop and design this connection with a number of decisions still to be made. Because of that, in order to be conservative in preparing the ridership and revenue forecasts, a transfer to Caltrain has been assumed instead. The planned one-seat ride connection between the two systems will generate higher ridership and revenue than is shown in the current forecasts.
- ¹³ One-seat ride means that passengers do not need to switch trains, even if the train operates over two systems (e.g., moving north on dedicated high-speed rail infrastructure and then moving onto Caltrain tracks at San Jose, assuming electrification of Caltrain corridor by 2019 as proposed by Caltrain)
- ¹⁴ Source: California Department of Finance. January 2013. *Report P-1 (County): State and County Total Population Projections, 2010-2060 (5-year increments)*. http://www.dof.ca.gov/research/demographic/reports/projections/p-1/documents/P-1_County_CAProj_2010-2060_5-Year.xls
- ¹⁵ Source: Texas A&M Transportation Institute (TTI). December 2012. *Urban Mobility Report*. <http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/mobility-report-2012.pdf>
- ¹⁶ Source: Puentes, R., A. Tomer, J. Kane. March 2013. *A New Alignment: Strengthening America's Commitment to Passenger Rail*. Metropolitan Policy Program at Brookings.
- ¹⁷ Source: U.S. Department of Transportation. 2013. Research and Innovative Technology Administration Bureau of Transportation Statistics. <http://www.rita.dot.gov/bts/>
- ¹⁸ Source: Eno Center for Transportation. November 2013. *Addressing Future Capacity Needs in the U.S. Aviation System*. http://www.ustravel.org/sites/default/files/page/2013/08/USTravel_Eno.pdf
- ¹⁹ Source: American Lung Association. 2013. *State of the Air 2013*. <http://www.stateoftheair.org>
- ²⁰ Source: Dutzik, T., & Baxandall, P. (2013). *A New Direction Our Changing Relationship with Driving and the Implications for America's Future*. U.S. PIRG Education Fund, Frontier Group.
- ²¹ Source: Baxandall, P. (August 2013). *Moving off the Road: A State-by-State Analysis of the National Decline in Driving*. U.S. PIRG Education Fund.
- ²² Source: American Public Transportation Association. (May 2012). *APTA High-Speed Train Survey*.
- ²³ Important Farmland includes prime farmland, unique farmland, and farmland of statewide or local importance, as defined by Section 1540(c)(1) of the Farmland Protection Policy Act of 1981. The California Department of Conservation monitors Important Farmland in California. <http://www.conservation.ca.gov/dlrp/FMMP/Pages/Index.aspx>

²⁴ Source: http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0501-0550/sb_535_bill_20120930_chaptered.pdf

²⁵ Economically distressed areas are defined by the Public Works and Economic Development Act of 1965 (PWEDA), as amended. In particular, areas are deemed economically distressed if their per capita income is 80 percent or less of the national average or if they have an unemployment rate that has been at least 1 percent higher than the national average unemployment rate for the past 24 months. Additionally, areas that don't qualify based on these two criteria may still be deemed an economically distressed area under several special criteria including the closure of large business(es) resulting in sudden job losses, the threat of business closure that would result in imminent job losses, military base closure or realignment or other defense industry reductions in force, or natural disasters. These special criteria have to meet specific provisions laid out in the PWEDA.

Source: 42 USC 3121 et seq. December 2000. *Public Works and Economic Development Act of 1965*.

<http://www.epw.senate.gov/pweda65.pdf>

²⁶ Source: California High-Speed Rail Authority. June 5, 2013. *Project Risk Management Plan*.

http://www.hsr.ca.gov/docs/about/legislative_affairs/Final_June_5_Risk_Management_Report.pdf

²⁷ Source: Maintenance, Renewal and Improvement of Rail Transport Infrastructure to Reduce Economic and Environmental Impacts (MAINLINE). *Deliverable 5.4: Proposed Methodology for a Life Cycle Assessment Tool (LCAT)*. November 2013.

http://www.mainline-project.eu/IMG/pdf/ml-d5.4-f-proposed_lcat_methodology.pdf

²⁸ Source: California High-Speed Rail Peer Review Group. *August 14, 2013 Letter*.

<http://www.cahsrprg.com/final-docs-7-9-13-meeting/final-14-aug-letter-signed-and-scanned.pdf>

²⁹ Source: International Union of Railways. March 2013. *UIC Peer Review of Operating and Maintenance Costs of the California High-Speed Rail Project*.

http://www.hsr.ca.gov/docs/about/legislative_affairs/LR_UIC_Peer_Review_Operating_Maintenance_Costs_May_17_2013.pdf

³⁰ Source: California High-Speed Rail Peer Review Group. *May 18, 2012 Letter*. http://www.cahsrprg.com/files/bus_plan.pdf

³¹ Source: U.S. Government Accountability Office (GAO). March 2013. GAO-13-304. *California High-Speed Passenger Rail: Project Estimates Could Be Improved to Better Inform Future Decisions*. <http://www.gao.gov/assets/660/653401.pdf>

³² Disbenefits is a term used in benefit-cost analysis to describe negative impacts of a project, which count against the economic value that the benefits of the project generate. Disbenefits are included as negative values in the numerator of the benefit-cost ratio. This is an important distinction from costs, which is the amount of investment necessary to build, operate, and maintain the project and makes up the denominator in the benefit-cost ratio.

³³ Source: U.S. Conference of Mayors. 2010. *The Economic Impacts of High-Speed Rail on Cities and Their Metropolitan Areas*.

³⁴ Source: American Public Transportation Association (APTA). February 2011. *The Case for Business Investment in High-Speed and Intercity Passenger Rail*.

Appendix

California High-Speed Rail Peer Review Group

Lou Thompson
Chairman

Walter Bell

Diane Eidam

Stacey Mortensen

April 6, 2014

The Honorable Darrell Steinberg
Senate President Pro Tem
State Capitol Building
Room 205
Sacramento, CA 95814

The Honorable John Perez
Speaker of the Assembly
State Capitol Building
Room 219
Sacramento, CA 95814

The Honorable Bob Huff
Senate Republican Leader
State Capitol Building
Room 305
Sacramento, CA 95814

The Honorable Connie Conway
Assembly Republican Leader
State Capitol Building
Room 3104
Sacramento, CA 95813

Dear Honorable Members:

The California High-Speed Rail Authority issued its Draft 2014 Business Plan, "Connecting California," on February 7, 2014. The Authority also issued its "Project Update Report to the California Legislature" on March 1, 2014. In accord with our responsibility to review and comment on reports and funding plans published by the Authority, the Peer Review Group has reviewed these documents as well as the background documents supporting the 2014 Business Plan. We met with the Authority's management team on March 14, 2014 to discuss these documents. We would like to express our appreciation for the time and effort the Authority has spent in responding to our questions and requests for information.

In overall summary, we believe that the Authority has continued to make progress in the structure and evaluation in its Business Plans. The important topics are now covered and the method for presenting risk and potential variation in outcomes (Monte Carlo simulation) is much better developed. A partial solution to the financing challenge that would stabilize the

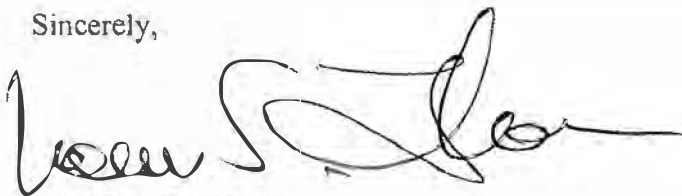
Authority's planning base is now on the table. Demand forecasting has been improved through updated data and additional model refinements. The operations and maintenance cost (O&M) model is more detailed and offers a better approach to relating costs to the volume of operations. Thus far the Authority has been able to meet the staffing challenge.

This generally favorable assessment of the 2014 Business Plan is qualified by the fact that actual experience so far is limited. One bid has been advertised and awarded below the initial budget, but the final design for that project is not complete and no construction has actually commenced. Demand forecasts are based on an improved demand model using better data, but only actual operation will show how Californians will respond to high-speed trains. Litigation beyond the control of the Authority could delay the project and cause costs to rise significantly. For all these reasons, the improved estimates and forecasts still have a significant range of uncertainty and it is not yet clear how confident we can be that the outcome will fall within the boundaries indicated by the Monte Carlo analyses. This will only be resolved with experience.

The 2014 Draft Business Plan does raise a series of issues that we will discuss in more detail below. The Authority does not yet have a source of available, committed funding that will fully close the roughly \$20 billion financing gap to complete the IOS as it is currently defined, though the Governor has proposed a number of possible sources, such as use of cap-and-trade funds, which would close a part of the gap. The blended system from San Francisco to San Jose raises a number of complex issues involving the interactions among Caltrain, High-Speed Rail and freight operations that deserve continuing attention. There are plans to develop the demand modeling further for the 2016 Business Plan and the results should be appropriate for planning purposes, but more participation in model development from potential operators and investors should be invited in order to reflect commercial pricing and costing issues. The Authority's business model continues to evolve, but more detail on the roles and responsibilities of the Authority, the State and the private sector will be needed if private capital is to be attracted. The Authority believes it can meet the September 30, 2017 deadline to spend American Recovery and Reinvestment Act of 2009 (ARRA) money if it is not further impeded by litigation or funding delays. The decision in the 2014 Business Plan to defer single seat service through Los Angeles Union Station to Anaheim should be revisited in the 2016 Business Plan. Attention to these issues in the near-term will be important to resolving potential future problems.

Our more detailed comments are below. Please let us know if you have any questions or need clarification on any of the discussion in this letter.

Sincerely,



Louis S. Thompson
Chairman
California High-Speed Rail Peer Review Group

cc: Hon. Mark DeSaulnier, Chair, Senate Transportation and Housing Committee
Hon. Ted Gaines, Vice Chair, Senate Transportation and Housing Committee
Hon. Bonnie Lowenthal, Chair, Assembly Transportation Committee
Hon. Eric Linder, Vice Chair, Assembly Transportation Committee
Brian Kelly, Secretary, Department of Business, Transportation and Housing
Mac Taylor, State Legislative Analyst
Ken Alex, Director, Governor's Office of Planning and Research
Dan Richard, Chair, California High-Speed Rail Authority
Jeff Morales, Chief Executive Officer, California High-Speed Rail Authority
Members, California High-Speed Rail Peer Review Group

Finance. The table below summarizes the Authority’s projections for the completion and cost of the various system segments.

Segment	Location	Miles	Year of Completion	Cost (Billion 2013\$)	Cost (Billion YOES)
IOS	Merced-San Fernando	300	2022	27.8	31
Bay to Basin	San Jose to San Fernando	410	2026	42.5	51
Phase I Blended	LA Union Station to San Francisco Transbay Terminal	5250	2028	55.9	68

Source: "Connecting California," 16, 34 and 35.

Against these amounts, the Authority potentially has access to \$9.95 billion from Proposition 1A and \$3.479 billion in Federal grant funding (\$2.55\$ billion from ARRA expiring if unspent by Sept 30, 2017 and \$928.6 million in FY 2010 appropriations that does not expire).¹ Of the Proposition 1A money, \$0.95 billion is allocated for local rail purposes and is not available for high-speed rail construction. Another \$1 billion in Proposition 1A funding has been allocated for projects on the “bookends” (San Jose to San Francisco and the Los Angeles area) where advance improvements such as electrification of Caltrain or a straight-through routing at the Los Angeles Union Station will be built. Local authorities are matching the Proposition 1A money. Thus, the Authority has about \$12.5 billion (of which the release of about \$5 billion will depend on finding new matching sources). This leaves, according to the Authority, “uncommitted funds” of \$20.934 billion needed to complete the IOS.²

In the Revised 2012 Business Plan, the Authority argued that the gap could partly be filled by use of funds from the Greenhouse Gas Reduction Fund (GGRF) generated from the state’s Carbon emissions cap-and-trade program. This proposal has since been developed in the Governor’s 2014-2015 budget proposals to include \$250 million from 2014-2015 funding, plus \$400 million that will be paid back from the 2013-2014 budget, plus one-third of all GGRF amounts beginning in the 2015-2016 budget year.³

It is difficult to estimate the amounts that the GGRF will actually yield. The Legislative Analyst’s Office (LAO) stated that “[s]everal economists who have evaluated ... [the] cap-and-trade program have estimated that, over the life of the program ... total revenue for the program through 2020 could be roughly \$15 billion.”⁴ This could vary significantly depending on the percentage of allowances that are given away rather than auctioned and on the market price of each permit. It is also not clear whether this is measured in YOES or constant\$: if it is constant 2013\$, the Authority would recover somewhat more of the YOES cost of the IOS. In addition, the LAO cites a possible range of \$12 billion to \$45 billion depending on a large number of

¹ An additional \$16 million has been spent on PTC design and analysis in the Caltrain corridor.

² See “Connecting California,” page 53.

³ See <http://www.lao.ca.gov/Publications/Detail/2953>, accessed March 17, 2014, for a description of the Cap-and-Trade program.

⁴ Legislative Analyst, “The 2014-2015 Budget: Cap-and-Trade Auction Revenue and Expenditure Plan,” page 4, February 2014

assumptions. If the actual number ended up at the higher end of the range, this could also close the gap accordingly.

Authorization for the current system beyond 2020 is unclear, so projections after that date are not fully established. Based on the \$15 billion estimate cited by the LAO, the total funding proposed by the Governor would reduce the IOS funding gap by \$5.65 billion, leaving roughly another \$15 billion that will have to come from another source of near-term funding, such as other existing or new Federal programs or added State sources. The Authority has also noted that the design and scope of the IOS is a matter of the Authority's definition and not a matter of law. If the Authority could reduce the cost or scope of the IOS, the immediate gap would also fall.

There are three established Federal programs for which the HSR program might qualify: the Railroad Rehabilitation and Improvement Financing (RRIF) program administered by the Federal Railroad Administration; the Transportation Infrastructure Finance and Innovation Act (TIFIA) administered by the Federal Highway Administration; and, the Transportation Investment Generating Economic Recovery (TIGER) grants administered by the Office of the Secretary of the U.S. DOT.

The RRIF program makes only loans, mostly to freight railroads, though loans have been made to Amtrak or other rail passenger station projects. The total authorization of the RRIF program is \$35 billion, of which \$7 billion is restricted to smaller freight railroads and a total of \$15 billion has been committed. Because the program consists of a large number of individual loan transactions, there is no stable annual level of funding.

The TIFIA program makes loans or guarantees loans for a part of the cost of a project, mostly for highway or intermodal programs, though the program could extend to projects that include rail components (for example, the Transbay Terminal project in San Francisco received a \$171 million loan). TIFIA loans generally are less than \$1 billion, though the largest was \$1.6 billion for the replacement for the Tappan Zee Bridge in New York State. The President's Budget calls for an annual funding level for TIFIA of \$1 billion annually through FY 2018.

The TIGER grant program has averaged around \$700 million annually since its inception in 2009. One of the criteria for TIGER grants is matching funding by other agencies. TIGER grants ranged between \$1 million to slightly over \$20 million per project in 2013, and are widely distributed across all states. The President's budget requests TIGER funding of \$1.25 billion annually through FY 2018.⁵

Finally, the President's budget requests authorization for a new grant program to support "high-performance passenger rail networks,"⁶ for which the California HSR program would presumably qualify. If approved, the funding would be \$1.3 billion annually through FY 2018. This funding would have to be distributed over an unknown number of applicants.

The three loan programs need annual Congressional appropriations for which the outcome is difficult to foresee with any confidence. The outcome of the high-performance passenger rail

⁵ For TIFIA and TIGER, see U.S. DOT Budget Highlights for FY 2015 at page 4.

⁶ U.S. DOT Budget Highlights for FY 2015 at page 29.

networks program is also unpredictable as it requires both a new authorization and appropriation. The share that the HSRA program might receive in all four programs is also unclear.

The Authority has proposed the use of private investment as a significant way of filling the longer term gap (\$37 billion in YOES or \$28 billion in 2013\$) that must be filled between 2022 and 2028 in order to complete the system. The Authority's cash flow forecasts support a role for private investment in one form or another after completion of Phase I. Even assuming successful experience in proving out the Authority's forecasts, this is not likely to occur until 5 years or so after commissioning the system, or about 2027. This will also be influenced by the Authority's business model that we discuss below.

This issue has unclear prospects. **The Legislature may want to request a specific study of the funding prospects of the GGRF program and the variables that may affect it in order to have a clearer idea of the amounts that may be raised and the potential amounts that could contribute to the HSRA funding gap.**

Blended System issues. Access to San Francisco's Transbay Terminal has posed a challenge to the program from the beginning. The ideal engineering outcome – a new, four track system separating HSR from Caltrain and freight service – was problematic because of its high cost and environmental impact. An alternative approach was adopted that blends the services of Caltrain and HSR on the same two track system, mostly within the existing right-of-way but with specific additions of passing tracks where needed and with the possibility of incremental increases in capacity when justified by demand. When combined with electrification of the Caltrain lines, paid half-and-half by Caltrain and HSRA, this approach should work to serve the needs of both systems at least through the first decades of the Phase I Blended system. In a number of our previous letters, the Group has supported the blended system approach; our comments below are aimed at improving its implementation.

The blended approach will require a true joint effort by Caltrain and HSRA with full participation of other parties including the Transbay Joint Powers Authority (that has the responsibility for the connection from the current Caltrain terminus at 4th and King Streets to the Transbay Terminal) and the Union Pacific Railroad (that has freight operating rights on the same lines). There are a number of issues on which the interests of the parties must be explicitly balanced if the blending is to work:

- Currently, Caltrain uses a platform height of 8" above rail. This means that boarding/deboarding requires stepping up/down from the floor of the train (25" above rail), which can impose delays and risks of tripping and falling, especially when the needs of disabled passengers must be accommodated. The result is longer and less reliable schedules. The low platform height is dictated by the regulations of the California Public Utilities Commission (PUC) that require platforms to be no higher than 8" on tracks that may also carry freight trains. Unless a waiver from this regulation is granted, or expensive track work is installed, Caltrain will be limited to low platforms. At its current frequency of services, the lack of level boarding is manageable (if undesirable), but it will become much less tenable when Caltrain frequencies are increased and HSR trains are added.

- Under current plans, the floor of HSR trains will be about 50” above the rails, which is typical practice for most of the world’s HSR systems and consistent with Amtrak’s plans in the Northeast Corridor. Caltrain is experiencing rapid demand growth, a process that will accelerate when service to the Transbay Terminal is inaugurated. Caltrain’s plans call for acquiring new bi-level, electric multiple-unit rolling stock. Since the existing Caltrain coaches have a 25” floor level, consistency would suggest a 25” floor level for the new equipment. This would mean that platforms for the two systems would be at different levels, making transfers within station more difficult to arrange. This might be manageable at many common stations where Caltrain and HSR could have separate platforms, but the platform disparity would be more serious at the Transbay Terminal because the number of platforms is limited. As a result, routing of traffic into and out of the station will be more complex, and dispatchers will not have the flexibility to send either system to all platforms when delays or operating problems would otherwise dictate. One approach, turning a number of Caltrain services at 4th and King and limiting the number of Caltrain services to the Transbay Terminal, has been suggested, but would pose restrictions for Caltrain’s access to the Transbay Terminal.
- The basic standards of the PUC for electric catenary wire call for a clearance of 22 feet 6 inches above the rail. On the one hand, both Caltrain and HSR may want a lower catenary height in order to reduce construction cost for which the PUC will have to grant permission: on the other hand, the Union Pacific and port interests may want to protect the hypothetical possibility of future freight cars requiring even more clearance. HSR’s current electrification designs are appropriate for HSR-only operations and may not be acceptable for use in the Caltrain area. There are a number of specific locations where Caltrain’s clearance is already below 22 feet 6 inches, but there is no generally agreed height limitation.
- Positive Train Control (PTC) is a requirement of Federal law. Facing this mandate, Caltrain developed its own system – CBOSS – that is now being implemented. CBOSS may not be appropriate for use by HSR trains. If so, HSR trains may have to deal with two signal systems. In addition, the Union Pacific Railroad will have to operate in the same territory so will have to have conforming signal systems in its locomotives.

None of these problems is impossible to resolve, albeit at added investment and operating cost by one or more of the parties. There is nothing unique about having multiple freight and passenger operators on a single line and there is experience in the U.S. and Europe with resolving the normal issues. All parties in the blended area are aware of the issues and there has been full cooperation among them.

We are concerned, however, that near-term decisions could be made by the parties acting separately that would ultimately compromise the performance of the system. For example, a decision by Caltrain not to plan for at least 25” platforms, which would provide an essential approach to level boarding, would lead to increased delays and uncertainty that could become

unmanageable when Caltrain frequencies increase to meet the rapidly growing demand, especially that caused by the opening of the Transbay Terminal. This problem would get worse when four HSR trains per hour are added to the blended system in 2026. Caltrain will definitely need an expanded fleet, and bi-level cars are an efficient way to meet the need. That said, a decision to buy 25" floor level, bi-level coaches would mean that Caltrain and HSR would be committed to operating on incompatible platforms, which would add rigidity to a system that will be challenged for capacity. This problem could be alleviated if Caltrain ordered coaches that can serve both platform levels or if it adopted a uniform 50" platform, but either solution would clearly add investment costs above those planned. In all cases, the design of the electrification for Caltrain will need PUC approval and will need to consider the interests of all of the operators on the line.

This is a complex issue involving technology, investment, system performance and sequencing including the interests of a number of parties. Clearly there is no perfect answer and it is actually a problem resulting from success in attracting more passengers. **We recommend that the Legislature request periodic joint reports from Caltrain, HSR and the Union Pacific Railroad that will use the tools available, including line capacity simulators, to assess the impact of alternative approaches to coach floor and platform height on capital and operating cost, capacity and reliability of both systems. This would include the impact on Caltrain if it has to construct 25" or 50" platforms. This study should also include the investment and operating cost impact of the alternative approaches to catenary height and platform clearance and should outline the decisions that the PUC will be asked to make.**

Blended operations also pose the issue of accidents at grade crossings. Even at its existing speeds and frequencies, Caltrain experiences about 20 grade crossing and intruder deaths per year and generates delays on the local streets as autos and trucks wait for passing trains. This will get worse as train frequency and road traffic both increase over time. It would be difficult to overstate the risks of more frequent, faster and quieter Caltrain service combined with 110 mph HSR trains interacting with growing road traffic in the middle of California's increasingly busy cities. **We recommend that the Legislature ask Caltrain, HSR and the communities involved to develop a joint report assessing the likely future risks of increasing train traffic and speeds on the grade crossings in the areas impacted and identifying possible approaches to resolving the issue over time.**

Demand Models. The Authority has continued to develop its demand modeling over the past few Business Plans. The latest model, "Version 2," is based on updated economic data, better transport data and surveys, and a number of revisions in the structure of the model. Version 2 also employed Monte Carlo simulations to produce a clearer view of the range and probability of outcomes. Although comparisons between the demand forecasts of 2012 and 2014 are difficult to make, the overall result has been a lower percentage of business travel and a shorter average trip. Taken together, these changes have meant that, while the number of projected riders has gone up by about 25 percent, the expected revenue has actually decreased by 10 percent.⁷ In addition, the Authority has not yet attempted to include significant non-passenger revenues, such

⁷ "Connecting California," page 45. The percentages shown are based on similar scenarios in the 2012 and 2014 Business Plans, but would change somewhat if other scenarios are used.

as station area rentals and leases. The net result is that the financial forecasts in 2014 are somewhat more conservative than in 2012.

The table below shows the passenger demand and revenue forecasting results:

		HSR Scenarios for Phase I in 2040				
		Low	Medium	High		
		15%	25%	50%	75%	85%
Riders (million)		21.9	25.4	33.1	44.0	49.9
Revenue (million 2013\$)		1,030.6	1,195.0	1,559.4	2,050.1	2,349.8

See Ridership and Revenue Forecasting Technical Memo, pg 7-3

The Authority has defined the low scenario to be the demand and revenue levels for which there is only a 25% probability that the actual demand will fall below the forecast of 25.4 million passengers and a 75% probability that the actual demand will be above forecast. The medium forecast is one where the probability is 50% that the actual demand will be below (or above) 33.1 million riders while the high forecast has a 75% probability that the actual demand will be below the forecast of 44 million riders and a 25% probability that actual demand will exceed forecast levels. We have added the 15% and 85% levels to give an indication of greater caution on the low side and greater optimism on the high side. The critical point is that the program must be assessed not just on the medium forecast but on the range of outcomes in order to get a better picture of demand risk at this point in the program.

The Authority is now discussing plans for an improved modeling effort (“Version 3”) in its 2016 Business Plan. Among other issues, a better modelling effort could: use different fares for business versus recreational travelers; reflect time of day, day of week and seasonal variations (the current model uses averages); and, adjust for the actual trip duration to allow for overnight or longer travel. There are also proposals to adopt an entirely new form of modeling more in accord with model structures that have been developed since the HSRA modeling was initiated. We support these ideas and believe that it will be appropriate to use the improved model for overall planning purposes and for assessing the Authority’s goals in designing alternative management contracts or franchise proposals. An improved demand model will also permit inclusion of factors, such as demand peaking, which will have an effect on fleet size and operating costs. At the same time, there is a concern that the modeling effort will more and more put the Authority into the position of proposing operating strategies and commercial policies that it is less qualified to formulate and that would be better made by the operators. As discussed below, to the extent possible the Authority should begin to bring market and operating expertise, and potential risk capital, into the picture.

Business Model evolution. The HSRA discussion of its proposed business model has developed over time. The current view is that the HSRA will plan and build the system itself through

completion of the IOS.⁸ At that point, the Authority may award a management contract for operation of the system in order to prove the potential demand in the opening five years. In this case, the Authority will need to take the lead role in determining initial service frequency, quality, fare policies, equipment design, safety controls, and all other aspects of the system other than providing management and operating skills and labor. The Authority could alternatively consider a form of gross cost franchising in which the potential operator could be brought into the planning process earlier and assist in establishing the commercial policy for the system.

The Authority is considering a longer-term concessioned operator when demand has been proven. This could include significant investment and pricing flexibility on the part of the operator. In this case, the State will need policies and an agency to regulate the operator. The Authority and its operator will also need to interact with the local operators of the blended systems in order to share scheduling, dispatching and maintenance responsibilities and costs.

We have discussed this issue in most of our letters. We believe that the Authority is making progress in defining its business model options and initial memoranda of understanding (MOU) have been developed for the blended operations. With this acknowledged, we believe that the Authority should be more and more specific about the business model options it is considering because its ability to generate interest from potential private investors and operators will clearly be improved when the private parties have a clearer view of their role. Private investors are not likely to put up significant risk capital until the demand forecasts are proven and the role and authority of the private operator has been clearly established.

As discussed above, the demand projections in the 2016 Business Plan are likely to lead the Authority into issues, such as pricing of business versus recreational travel or peak versus off-peak travel, which should have a significant input from commercial operators. In addition, the Authority has apparently had to leave significant issues undecided such as the sharing of operating costs in the Caltrain area (see "Operations and Maintenance Cost Model Documentation, page 5), which make the estimated O&M costs borne by the Authority higher than they might actually be. **We recommend that these issues be discussed in more detail in the 2014 Business Plan or in later presentations to the Legislature.**

Status of the ability to use the ARRA money that expires on September 30, 2017. The money being provided by the U.S. DOT contains a \$2.5 billion component financed from ARRA funds that will expire unless the money is expended and billed to the U.S. DOT by September 30, 2017. Under the terms of the agreement, the State must match the Federal funding, but the Authority's ability to do so is currently threatened by litigation over the use of Proposition 1A bond funds.

This poses two issues; the source of the State's matching funds, and the actual ability to spend money on construction rapidly enough assuming sources of the State's match can be found. If the pending litigation is resolved in the Authority's favor, Proposition 1A bonding can provide the State's match. If the Governor's proposal to provide cap-and-trade funding to HSRA is enacted, the State match will also be available. We are assured by the Authority that, assuming

⁸ It is possible that Amtrak or another operator will operate re-routed San Joaquin trains from Sacramento to Bakersfield when that section in the Central Valley is completed and before the link to San Fernando is finished.

construction can begin this summer as planned, they expect to be able to expend all of the ARRA money that would otherwise expire.

Service to Anaheim. For a number of reasons, including the high cost of constructing a new, separated high-speed line from Los Angeles to Anaheim, the Authority removed the link to Anaheim from their demand projections and program plans in the 2014 Business Plan, leaving the connection to be provided by Metrolink. While this may be appropriate for the 2014 Business Plan, we believe it should be reconsidered in the 2016 Business Plan since the demand generated by Anaheim and Norwalk in earlier demand modeling was actually greater than Los Angeles Union Station. While we understand that the issue is under discussion with Metrolink, we believe that, as with the blended service between San Jose and San Francisco, the Authority should evaluate conventional speed electrification from Los Angeles Union Station to Norwalk and Anaheim. There appears to be a reasonable possibility that single seat conventional service through to Anaheim would generate enough additional demand and revenue to justify the added investment and operating cost.

California High-Speed Rail Peer Review Group

Walter Bell

John Chalker
Vice Chairman

Diane Eidam

Stacey Mortensen

Lou Thompson
Chairman

August 14, 2013

The Honorable Darrell Steinberg
Senate President Pro Tem
State Capitol Building
Room 205
Sacramento, CA 95814

The Honorable John Perez
Speaker of the Assembly
State Capitol Building
Room 219
Sacramento, CA 95814

The Honorable Bob Huff
Senate Republican Leader
State Capitol Building
Room 305
Sacramento, CA 95814

The Honorable Connie Conway
Assembly Republican Leader
State Capitol Building
Room 3104
Sacramento, CA 95813

Dear Honorable Members:

SB1029 passed by the Legislature in July of 2012 required the California High-Speed Rail Authority (Authority) to make a number of changes or additions to its existing analytical work for incorporation in the 2014 Business Plan and later plans. Specifically:

- Section 8, para. 8 required the Authority to develop a comprehensive risk management plan.
- Section 8, para. 9 required the authority to develop a proposed approach to improving demand projections, the operations and maintenance (O&M) cost model and benefit-cost analysis as applied to future project decisions. It also required that the Authority make available a study conducted by the Union Internationale des Chemins de Fer (UIC) that assessed the applicability of European Union HSR techniques and methods to potential operations and maintenance practices in California. These were to be "...based on

recommendations of the authority's peer review panel, advice from the international rail community and academic review." The Peer Review Group (Group), in our review of the Revised 2012 Business Plan, strongly urged these improvements as well.

- Section 8, para. 10 required the Authority to prepare and submit an analysis of the "net impact of the high-speed rail program on the state's greenhouse gas emissions."

The Peer Review Group met with the Authority on July 9, 2013 to discuss the Authority's progress against these requirements as outlined in a series of presentations that are listed below and available on the PRG's website at www.cahsrprg.com. We would like to thank the Authority for the effort involved in preparing these presentations and we recommend that the Legislature review them with care. Each of the topics will be discussed separately below, but we do have some summary observations.

We believe that the Authority has made manifest progress in all areas of planning and management since the Revised 2012 Business Plan. This assessment applies to risk management, demand forecasting, operating and maintenance (O&M) cost modeling and the analysis of the impact of HSR on California's greenhouse gas emissions.

We particularly compliment the inclusion in all of the upcoming financial and economic analyses of probabilistic assessments based on Monte Carlo simulation techniques so that future reports will more accurately report the range and likelihood of potential outcomes. The Authority also expects to incorporate their cost experience in real time at every stage so that future plans will more and more be based on results rather than expectations. As noted by the U.S. GAO, the Authority's steps to take uncertainty into account are appropriate for this stage in the project. With this said, we also emphasize that essentially all of the Authority's plans and budgets so far necessarily remain based on estimates rather than experience, causing all of the plans to have a wider range of uncertainty than might be the case 5 to 10 years from now.

We would also like to stress the need to evaluate the Authority's near-term plans against the actual decisions that will be made based on them. Most of the relevant policy and budgeting decisions through completion of the Central Valley work and the two "bookends" have now been made. The 2014 Business Plan will have little relevance to these decisions unless it should contradict the Revised 2012 Business Plan in some major way, which seems unlikely. The next major decision to be made – whether and when to proceed with the link from Bakersfield to the San Fernando Valley (IOS South) starting with closing the gap between Bakersfield and Palmdale – will happen after the 2014 Business Plan. From this perspective, the 2014 Business Plan is an interim document that should focus on improving analytical methods and input information, especially demand surveys and construction experience gained, with the objective of leading to later Business Plans that would provide much better support for the next real decisions.

To make this point a different way, the new management of the Authority, upon taking over the development of the 2012 Business Plan, simply did not have the time to deal adequately with a number of well-known criticisms (especially the lack of good demand survey data, but also the

comments of its own Peer Review Panel) that were on the table. Our positive assessment above is based on the expectation that the Authority's plans will be implemented as discussed in the July 9th meeting. Though some improvements will be incorporated in the 2014 Business Plan, the time and resources are available in the 2016 and subsequent Business Plans to fix the problems discussed. We are encouraged by their progress so far but want to highlight the importance of continued development.

Our comments on the presentations are below. Please let us know if you have any questions or need clarification on any of the discussion in this letter.

Sincerely,

A handwritten signature in black ink, appearing to read "Louis S. Thompson". The signature is fluid and cursive, with a long horizontal stroke at the end.

Louis S. Thompson
Chairman
California High-Speed Rail Peer Review Group

cc: Hon. Mark DeSaulnier, Chair, Senate Transportation and Housing Committee
Hon. Ted Gaines, Vice Chair, Senate Transportation and Housing Committee
Hon. Bonnie Lowenthal, Chair, Assembly Transportation Committee
Hon. Eric Linder, Vice Chair, Assembly Transportation Committee
Brian Kelly, Acting Secretary, Department of Business, Transportation and Housing
Mac Taylor, State Legislative Analyst
Ken Alex, Director, Governor's Office of Planning and Research
Dan Richard, Chair, California High-Speed Rail Authority
Jeff Morales, Chief Executive Officer, California High-Speed Rail Authority
Members, California High-Speed Rail Peer Review Group

Comments on the presentations

Risk Management. Documents: “Program Risk Management Plan, June 5, 2013” prepared under the Authority’s direction by Parsons Brinckerhoff in June 2013 and the “Update to Peer Review Group of work in progress on Risk Management” presentation.

The Program Risk Management Plan appears to be a thorough and well developed summary of the current state of the art in identifying risk issues and methods for dealing with them. The Risk Management presentation, given by Jon Tapping, the Authority’s new risk manager, is a professional summary of the principles of the risk management planning, including use of probabilistic methods to assess degrees of risk and calculation of the most cost effective methods of managing risk.

The Authority’s risk management plan is being implemented, building upon and refining work that has been ongoing for a number of years. The Group’s primary comments were that it will be a major continuing task to **implement** the approach described in the manual and presentation, especially because the organization will be under increasing day-to-day stress as work gets underway and long-term plans are confronted with immediate problems. In addition, risk management requires a disciplined effort to update the information in the system so that future plans benefit from actual experience: this will again require attention from management. Risk management also requires focused leadership within the organization to ensure proper attention and a common approach. Finally, risk management is an issue of corporate culture more than simply data collection and reporting. The entire organization will need to be encouraged to identify risks and develop solutions; senior management cannot do this by itself.

Ridership and Revenue Modeling and Forecasts. Document: “Update to Peer Review Group of work in progress on Ridership and Revenue Modeling and Forecasts,” presented by Thierry Prate of Parsons Brinckerhoff.

Ridership and revenue forecasting has undergone significant development in preparation for the 2014 Business Plan. In accord with a range of comments received, with particular emphasis on comments received from the Authority’s demand forecasting Peer Review Panel, The Authority now plans to approach demand forecasting in three “Versions.” Version 1 was used to develop the forecasts used up through the Revised 2012 Business Plan. Version 2 will be used for the 2014 Business Plan, and Version 3 will be the basis for Business Plans beyond 2014 and specifically for use in making the IOS South decision.

Version 2 will incorporate as many of the changes recommended by the Peer Review Panel as can be included within the time available. It will also make the transition to presenting the outcome in probabilistic terms rather than the “Low, Medium, High” approach in previous plans. We note that Version 1 produced lower forecasts than prior work. With the changes planned, Version 2’s probabilistic approach will give a clearer picture of the range of potential outcomes. Given that the 2014 Business Plan will not be used to support major new investment decisions, the changes planned for Version 2 appear adequate for current needs.

Good demand and revenue forecasts are the central issue of planning and justifying any project. This means that getting Version 3 right by continuing to refine the forecasts will be critical. Version 3 may incorporate some additional changes in analytical approach, but the major change will be the collection and use of much better survey data defining the California travel market. The need for better input data has long been recognized as a weakness in the demand forecasting. The Group understands that the Authority has initiated a large data gathering effort to support Version 2 and Version 3 modeling, an effort that we support. This effort includes incorporation of the new California Household Survey, which is a large new set of data and survey results from Caltrans. We urge the Authority to ensure that the data gathering effort receives the highest priority.

Train Performance Calculation and Trip Time Analysis. Documents: “Phase I Blended Travel Time,” a memo from Frank Vacca to Jeff Morales dated February 2, 2013, and presentation entitled “Update to Peer Review Group of work in progress on Train Performance Calculation (TPC) Trip Time Analysis,” presented by Frank Vacca.

Section 2704.09 of AB 3034 (Prop. 1A) requires, in pertinent part, that “The high-speed train system ... shall be designed to achieve ... [m]aximum nonstop service travel times for each corridor that... shall not exceed ... (1) San Francisco-Los Angeles Union Station: two hours, 40 minutes ... (3) San Francisco-San Jose: 30 minutes. The authority has employed the Berkeley Simulation train performance calculator (TPC) model to establish the ability of the system to meet these mandatory goals.

The Group agrees that the “pure run time” for non-stop trains from San Francisco Trans Bay Terminal to LA Union Station has thus far been designed to be 2 hours, 32 minutes, and from San Francisco Trans Bay to San Jose has been designed to be 30 minutes. Subject to the accuracy of the input data on speeds, distances, grades, curvature, signaling and equipment characteristics, the model does produce usable results. The Authority believes that this “pure run time” is the metric that most accurately reflects the Proposition 1A requirement of the trip times that the system “shall be designed to achieve.” With this said, however, the results are based on a number of assumptions that could be different from actual operating service travel times and that should be fully understood:

- The alignment of the system is still at the 15 percent design level, so the input assumptions about speed constraints may not fully reflect actual conditions. In addition, the rolling stock performance characteristics are still based on a generalized design, so actual performance may deviate (upward or downward) from the initial data. Moreover, the calculations assume that 220 mph operation through urban areas in the Central Valley and between Palmdale and Los Angeles will be acceptable to the local communities.
- “Pure run time” assumes perfect driver behavior whereas, in practice, drivers rarely accelerate or brake exactly as the model assumes. In addition, adverse weather, problems with passenger loading, minor mechanical failures, interference from other traffic and many other incidents cause systems to depart from perfection. Modern practice is to add six or seven percent to the designed, pure run time to recover from these typical deviations. The

Authority's proposed schedules on which the demand forecasts are based include such "pad" time allowances.

- Capacity simulations completed jointly by Caltrain and the Authority show that interactions between Caltrain and potential HSR schedules will produce an actual non-stop HSR run time from San Francisco to San Jose of 37 to 39 minutes during hours of normal operation (see "Caltrain/California HSR Blended Operations Analysis," March 2012, page 50). Again, we note that this is a different question than the TPC analysis of the minimum travel time that could be achieved based on the system's design parameters.

For all these reasons, it is unlikely that trains would actually be **scheduled** to run during normal hours of operation within the 30 minute or 2 hours 40 minute limits at the completion of the Phase I Blended system. The Authority's service plans, ridership forecasts and O&O cost estimates include allowance for these factors and assume longer operating travel times than the times that the system is being designed to achieve. The Authority believes this is consistent with the Proposition 1A requirements and the anticipation of various levels of services (e.g. express service, local service and other options). Of course, these system design targets could eventually be met if demand justifies the added investment in the San Francisco to San Jose area when the system is fully built out, although the Authority currently has no plans to complete dedicated tracks in the area. In the meantime, the primary requirement is that actual expected scheduled trip times be consistently employed in the demand forecasting models, which we understand to be the case. It will also be important to ensure that the TPC is kept up to date with alignment or other speed-related changes as the status of design evolves.

O&M Cost Modeling. Documents: "UIC Peer Review of Operating & Maintenance Costs of the California High-Speed Rail Project," Final Report, January 2013, untitled response of Authority to the UIC report, presentations "Update to Peer Review Group of work in progress on O&M cost modeling and projections," and "Update to Peer Review Group of work in progress on O&M Cost Risk and Monte Carlo Analysis," both presented by Frank Vacca.

The O&M cost modeling effort is much improved from the Revised 2012 Business Plan both in terms of the structure of the model and the incorporation of probabilistic analysis of the results. Since the O&M costs are as important as the demand and revenue forecasts in determining the financial and economic justification of the project, this work will greatly improve the confidence in the cost and financial projections. The PRG recommends that this effort be pursued. While the UIC analysis is quite useful, it is not fully based on methods, practices and cost levels typical of railways in the U.S. We believe the Authority should consider hiring an expert who can review the O&M cost modeling from the point of view of likely U.S. results.

HSR's Impact on Greenhouse Gas Emissions. Document: "Contribution of the High-Speed Rail Program to Reducing California's Greenhouse Gas Emission Levels," June 2013.

Though this subject was not discussed in detail at the meeting, we do want to highlight one aspect of the report. Overall, the projections of greenhouse gas emission reductions due to the planned operations of HSR are credible and within the limits projected by a number of studies.

From this starting point, however, the Authority has made two further commitments; first, the system will be operated with 100% renewable energy; and, second, the Authority assumes that the renewable energy will be generated from a mix of 20% solar, 40% wind, 35% geothermal and 5% biogas (see report, page 10).

We believe these should be understood as laudable goals, not fixed requirements. The current project does not include an allowance for the investment needed to construct and operate the necessary additions to generating and transmission capacity and there is no clear way that the Authority can ensure that the planned mix actually happens. We understand that the Authority's preliminary review of the responses to their Call to Industry showed that there is capacity available today from several renewable energy providers with properties in the state to meet the needs of the future system operator. Though this would not guarantee the exact mix described above, the Authority believes that the overall capacity required will be available. With this in mind, we recommend that the Authority consider sources and costs of electricity carefully in their public planning and devote specific attention to the possible variations in the cost of energy in the O&M cost calculations.

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

May 18, 2012

The Honorable Darrell Steinberg
Senate President Pro Tem
State Capitol Building
Room 205
Sacramento, California 95814

The Honorable John Perez
Speaker of the Assembly
State Capitol Building
Room 219
Sacramento, California 95814

The Honorable Bob Huff
Senate Republican - Leader
State Capitol Building
Room 305
Sacramento, California 95814

The Honorable Connie Conway
Assembly Republican Leader
State Capitol Building
Room 3104
Sacramento, California 95814

COMMENTS ON REVISED BUSINESS PLAN

Dear Honorable Members:

Comments of the Peer Review Group on the Revised 2012 Business Plan

The Peer Review Group (Group) has now reviewed the Revised 2012 Business Plan (Revised Plan) approved on April 13, 2012 by the California High-Speed Rail Authority (Authority). Our comments on the Revised Plan follow comments on the Funding Plan dated Jan 3, 2012 and on the Draft 2012 Business Plan dated March 21, 2012.¹ These reports follow a number of earlier reports by the Group dealing with issues that have developed in the course of our analysis of the plans and programs of the Authority. All of the reports may be found on the Group's website at www.cahsrprg.com.

We are pleased to announce the addition to the Group of Stacey Mortensen, Executive Director of the Altamont Commuter Express. She completes the requirement for the Group to include

¹ Comments were delayed at the request of the Authority

² Revised Business Plan, Page 7 -15

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

two expert representatives from agencies providing intercity or commuter passenger train services in California. The Group now has seven members, with one appointment remaining open.

In making our comments, we would like to begin by acknowledging the positive efforts by the Authority to improve communications with the Group. Subsequent to our comments on the Funding Plan on January 3rd, the Group and Authority have held a number of meetings to discuss the Group's comments and the Authority's responses. We believe there is now a much better understanding of issues on both sides and this is reflected in our comments on the Revised Plan.

Summary

As a result of public input, the Revised Plan has been modified from the original Draft 2012 Business Plan. In a number of significant ways the Revised Plan has been measurably improved, including: a clearer vision of HSR within California's overall transportation system; a better approach to the phasing of the project; early attention to the "Bookends" of the system (Sylmar - Los Angeles/Anaheim, and San Jose - San Francisco) so that benefits will be generated much earlier and stranded investment risk will be reduced; a more realistic business model; and, clarification of employment and equivalent capacity issues, both of which had led to potential misunderstanding of the actual benefits of the system.

Some concerns from earlier reports by this Group remain. There is still no source of federal or private funding to finance construction beyond the work in the Central Valley, although the Brown Administration has offered the potential of state-level options such as cap-and-trade revenues in amounts sufficient to finance the gap if other sources do not materialize. The Group also strongly believes that management resources are inadequate to the immense task ahead and that the Authority will have difficulty in meeting that challenge within current State bureaucratic limitations. Capital costs in the Central Valley appear to be reasonably estimated, but costs outside the Valley are still in earlier stages of development and are based on assumptions of availability of funding that are not settled. The Authority has included contingencies in its estimates, but potential schedule slippages could put pressure on the contingency allowances. Demand forecasts have again been lowered and are supported by professional peer review; however, we believe that the forecasts continue to be subject to a broad range of potential outcomes. Operating and Maintenance (O&M) Costs are based on a relatively simple model that should be improved in order to yield better forecasts of cash flow generation and thus a better picture of the prospects for private investment beyond the Initial Operating Section (IOS) stage. We also recommend that the Benefit-Cost analysis be further strengthened.

Improvements in the Plan

Clearer Vision. There are a number of themes in the Revised Plan that enhance the overall vision for the program. The concept of HSR as an integrated part of California's broader transportation network has been much more clearly articulated and gives a better picture not only of HSR but also of its linkages to conventional intercity rail and to commuter rail, mass transit and bus services. This in turn has led the Authority to emphasize the phasing of the building of

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

the HSR system in conjunction with a plan for improving the linked conventional services so that Sacramento and San Diego, for example, will see better service sooner than previously planned. Equally important, the concept of early investment in the Bookends, long advocated by the Group and others, has now been adopted. As a result, services currently carrying the most passengers will be improved at the outset, maximizing the overall benefits of the project. The Authority has also elected to build the IOS on the southern part of the network (formerly called IOS South) first, reflecting the fact that no workable connection at all now exists to complete the link between Bakersfield and Palmdale. The broad vision of the project is much improved and, if implemented, this approach goes a long way toward addressing concerns over the stranded investment issue and of the need to produce immediate benefits from the project.

Better Business Model. The business model for the project has been the subject of considerable attention by the Group in earlier reports. The business model described in the Revised Plan is clearer and, as we have suggested in earlier reports, is probably the only choice available at this point. The implications of the business model need to be clearly stated because they highlight a theme that will run throughout this report: **the need for a clear understanding and acceptance of the risks that remain even though the Authority has taken reasonable measures to contain them.**

In brief, the business model has the Authority in charge of planning and initial design of the project, which means that the entire capital cost risk against budget lies with the Authority. When the construction is awarded to Design-Build contractors, some cost and schedule risk will be transferred, but the exposure for later changes and cost overruns cannot now be known and some risk will remain with the Authority. In an indirect way, the Authority has acknowledged this risk by clearly stating that the initial (Madera to Bakersfield) set of projects in the IOS is defined by budget rather than scope; they will complete whatever they can for the money available.

The utility of the work in the Central Valley from Madera to Bakersfield, without adequate connections either to the south or to the north, is essentially limited to improvements in San Joaquin service between Sacramento and Bakersfield. The first real, higher-speed improvement in the system would come with completion of the high-speed connection beyond Bakersfield to the San Fernando Valley, which would have to be fully funded through construction by the Authority's funds – as the Revised Plan foresees. This means that the financial risk of completing the construction of at least the IOS is entirely dependent on the ability of the Authority to obtain federal funding (or added State funding) in the amounts and times required. The private sector will not be prepared to participate in financing any portion of the IOS or beyond until results of completion of the IOS are known.

The Authority's business model looks to a management contract for the first few years of operation on the IOS until actual demand and operations and maintenance costs have been demonstrated. Thus, the Authority will retain the risk for demand and at least some risk of operating costs through the period of the management contract. Moreover, a contract operator with a short-term management contract is unlikely to assume any of the design or investment risk for the rolling stock (the cost of which is included in the Authority's plans), so capital risk for at least the initial order of rolling stock will remain with the Authority. At the end of the

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

management contract, the Authority plans to offer a more comprehensive longer-term concession for which some ensuing demand and investment risk may be taken by the concessionaire if demand and cost have been proven at the levels foreseen by the Authority. If demand and cost levels do not meet forecasts, the contribution of the private sector will be less than expected, and the contribution from public funding will rise accordingly.

The Authority tentatively plans to award and manage a contract for track maintenance and charge the operator(s) a fee to cover costs. Finally, the active role of the Authority in system design and procurement, rolling stock design and procurement, and system maintenance and management will necessarily expose the Authority to various types of liability in the event of accidents. This liability is acknowledged in the estimate of \$25 million annually for liability insurance.

None of the above is meant to be critical. Rather, it underlines the inevitable consequence of the business model available to the Authority. In our July 1, 2011 letter, we said “There are no risk free „mega-projects.“None.” Our concern was, and is, that “...when risks are not fully understood and discussed at the outset, some (or all) of the parties involved will feel deceived when the inevitable problems emerge, eroding the trust and commitment that is always needed to finish a project of this size when problems are encountered.” We concluded that “[w]**hatever else is accomplished before construction commitments begin, it is essential that major risks be defined, clarified, understood, allocated and accepted to the degree possible.**” [emphasis in original] We believe that the revised business model will be a good framework for defining the remaining risks: it will be for the Legislature to decide whether the remaining risks as defined are acceptable or need further clarification or reduction.

The Group’s Continuing Concerns

Financing the Project. In our report on the Funding Plan issued by the Authority, we noted that there were no existing, significant sources of funding at the federal level beyond the ARRA program and related federal appropriations. Since federal grant funding is expected to be \$20.3 billion (80 percent of the total \$25.3 billion cost) to complete the IOS beyond the Madera to Bakersfield section in the Central Valley,² this would require the creation of a new federal program to support a national HSR program along with a reliable funding source for that program of which California’s share would have to be around \$2.9 billion annually beginning in 2015. Enactment of such a program will clearly be a challenge in today’s constrained budget climate.

In the absence of actual new federal programs, 80 percent of the funding of the IOS and, depending on the role of the private sector, 50 to 75 percent of the remainder of the funding for the program, is in question. It has been proposed that the revenues from the California carbon emission cap-and-trade program could be allocated to fund HSR, but the prospects for implementation of the program, for funds generation and for allocation of a high percentage of revenues to HSR are not for us to judge. The price of carbon emission permits will have to be high to generate resources on the scale required even if wholly dedicated to HSR.³ Nonetheless,

² Revised Business Plan, Page 7 -15

³ See LAO, “The 2012-2013 Budget: Cap-and-Trade Auction Revenues,” February 16, 2012

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

the Group has discussed the availability of these funds with Director of Finance Ana Matosantos, and she maintains that funds will be available if needed. In any event, if the program is to proceed beyond the Madera to Bakersfield section, the Governor and Legislature are inherently assuming that a workable financing solution will be found

Project Management. The Group has repeatedly and forcefully argued that the management capability of the Authority is not up to the immense challenge of managing a construction program of the proposed size and complexity of the HSR project. The Authority has long had a shortage of staff to supervise its contractors and this has, at times, forced contractors to take on roles or make decisions that are more appropriate for Authority employees. The Authority has had continuing problems obtaining skilled people, and uncertainty about the future of the program has compounded the problem. The Authority highlights this issue as one of the major risks of the program, and we agree. The Revised Plan discusses the progress the Authority has made in increasing the number of slots available (not all are currently filled, including the CEO) and in working with Caltrans and other agencies to obtain people on a transfer or reimbursable basis.

These are all positive developments, but we continue to believe that management resources at the Authority are inadequate to supervise the enormous contracting effort now in prospect, that bureaucratic restrictions on slots and salaries will continue to hinder the Authority's ability to manage, and that attempts to launch a massive construction program in response to federal completion deadlines will only make the problem worse. To put this in perspective, the current Caltrans annual capital budget is approximately \$4 billion⁴ whereas the Authority's spending plans look to annual construction commitments of over \$4 billion by 2015 and over \$5 billion by 2021⁵. Thus, as we have stated earlier, the Authority proposes to ramp-up almost immediately to a construction supervision burden that equals or exceeds that of Caltrans. This will be a real challenge.

We strongly urge the Legislature and the Governor to work with the Authority to ensure that management skills and resource requirements will be met and that the flexibility to employ and terminate personnel as needed is in place. We believe the project should not proceed until a plan for resolving this challenge is prepared, and until support by the Authority's Board and the Administration is secured.

Capital Cost Estimates. Our review of the capital cost estimates for the Central Valley part of the project suggests that the estimating work is in accord with professional standards and that the estimates and contingencies used for the individual construction packages are within expected limits. Further changes will not emerge until competitive contracts are awarded and until the design-build contractors take the designs from today's 25 percent level to final design and are well along in construction. The Authority believes that significant construction cost risk will be mitigated through the use of design-build contracting. Design-build, whereby significant design responsibility is shifted to the constructor, can be an important tool for controlling cost and

⁴ Excel spreadsheet of Caltrans capital spending provided on Caltrans website at <http://www.dot.ca.gov/>

⁵ Revised Business Plan, Page 7-7

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

schedule risk. However, design-build contracts must be managed effectively. Simply attempting to shift all risk to the contractor will result in dramatic increases in the bid prices for the project.

Managing design-build contracts will require individuals with specific experience and expertise in the area. We suggest that the contractor be awarded a specific contract that allows mobilization of the management and key elements of the engineering team three to six months prior to the planned start of construction. This will permit working jointly with the client's team, so the contractor can review and possibly improve the designs from the standpoint of experience in construction methodologies. In addition the contractor and the Authority can sort out any contractual and administrative issues prior to start of work and develop a close sense of partnering, all in the hope of achieving the best possible outcome for the project with a minimum of friction during the execution of the work.

Cost estimating outside the Valley remains less certain because the scope and alignment are still in flux. As the project confronts the detailed problems of selecting alignments in urban areas and in mountainous topography, experience thus far has shown that cost estimates tend to grow. There is certainly a possibility that this trend will continue.

A significant concern emerging from our review is that project scheduling is currently based on the assumption that ROW availability and financing will not be constraints: that is, construction is being planned on the most efficient and intensive basis without regard to the timing of funding and of ROW availability. Basing the overall project costs and expected construction times on these optimal assumptions entails risk. If these assumptions turn out to be false, capital costs and construction times will increase due to schedule changes alone.

A related concern is our impression that a lack of appropriate decision-making by the Authority, due to a shortage of supervisory staff, is forcing contractors to make decisions that should be made by the Authority. As we have discussed in the management section above, this is not a criticism of the contractors or, indeed, of the Authority staff; it is simply an observation of the supervisory challenge faced by the Authority – one that we believe will get worse without effective action to increase resources.

Finally, we believe that the service implications of the low and high cost options should be clearly identified. We recommend that the Legislature request the Authority to issue a better and more detailed description of the two options including a clear statement of the proposed schedules and trip times from San Francisco to Los Angeles under the blended service plan so that the Authority's plans can be shown to be consistent with the legal requirements in Prop 1A.

Demand Forecasts. We have had a number of discussions with the Authority and their demand forecasting peer review panel about the demand forecasts. The Revised Plan has again modified the demand forecasts somewhat downward, along with the associated revenue.

As we have acknowledged in earlier reports, the demand forecasts have been prepared by professionals in the field and appear to be within the state of the art. The analyses of the models, including various sensitivity tests and comparisons with the Northeast Corridor, show that the models function as expected: HSR demand goes up if prices go down, HSR demand falls as auto

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

costs or air fares fall, etc. The Authority's peer review panel has stated that their analysis of the demand modeling work and related sensitivity checks indicate that the demand models produce reasonable, even conservative results. With due respect to the experts, given the international experience with demand forecasting experience for HSR, we remain cautious.

HSR in California will be a "greenfield" system: that is, neither HSR nor adequate intercity rail service on any significant scale exists in California today. Most HSR systems in other countries were based on improvements (often significant) on existing services so that the forecasting challenge was closer to extrapolation than sophisticated forecasting. Even so, virtually all initial rail passenger forecasts, including HSR, have turned out to be optimistic, with actual demand averaging about 60 percent of forecast and an unusually wide range of errors from projections.⁶

This is relevant as there has been no experience in California with HSR and only limited experience with existing intercity rail passenger services between the state's major markets. As a result, the HSR demand models are necessarily based on "stated preference" studies in which various segments of the potential market are asked what they would do if offered a completely new and different service at various qualities and prices. This yields estimates with a larger range of potential error than estimates based on actual experience with existing services where quality and price have been changed and reactions observed ("revealed preference"). Given the enormous investment involved, the private sector is rightly unwilling to take any significant demand risk based on demand forecasts at this stage, but will wait until demand has actually been demonstrated on the IOS before considering significant investment based on its own forecasts.

The Authority notes that it attempted to take into account the key factors identified in the Flyvbjerg book (footnoted below) and argues that this provides a buffer against optimism bias. To mitigate the demand forecast risks described in the book, particularly regarding the market estimating issues, the Authority has made use of more conservative input data in its more recent forecasts, including: 1) post-recession socioeconomic forecasts (population and employment) significantly lower than that used by the California Department of Finance; 2) more recent and conservative trip survey data for use in trip generation; 3) up-to-date Energy Information Agency forecasts for the price of gasoline in 2030 including a very low forecast of \$2.24/gallon (2009\$) in the low scenario; 4) Corporate Average Fuel Economy standards for fuel efficiency in calculating automobile operating costs; and 5) ticket prices of competing modes (air and conventional rail) maintained at their lowest level to make their competitive response as strong as possible. As a result, the Authority notes that the forecasts used for the Revised Plan are only 63% of the August 2011 forecasts (72% for the medium case). In addition, the low/high range increased from a 40 percent interval to a 60 percent interval, which may give a better measure of the potential variability in the results.

Operations and Maintenance (O&M) Cost Model. We are concerned about the current stage of development of the O&M cost model, because the results of the O&M model are a critical determinant of the ability of the system to generate positive cash flow for use in financing future parts of the system beyond the IOS. Our experience with HSR elsewhere and our review of the demand and cost sensitivity analyses performed by the Authority indicate that the HSR operator

⁶ Flyvbjerg, et al, "Megaprojects and Risk: An Anatomy of Ambition," pg. 26

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

should be able to cover operating costs from revenues and thus not need a subsidy as defined in Prop 1A. Performance beyond the break-even point is less clear.

The existing model is relatively simple and does not reflect the relationship between costs and the level of operations as well as it could. The checks we have been able to perform on the elements of the O&M model do not reveal major errors in the individual components, but the overall results of the model appear optimistic by comparison with readily available data on the closest comparable U.S. HSR operations (Amtrak's operations in the Northeast Corridor). The Authority's comparisons with international operators tend to support the Authority's position, but the data are not fully subject to detailed verification and, in any event, there is no experience anywhere with the extremely high speeds that the Authority plans to operate. If the Authority's model is optimistic, the private sector will be less able to augment public investment in the Bay-to-Bay and Phase I Blended stages of the project. The Authority did perform a series of sensitivity tests at the request of the Group. These tests suggest that the financial performance of the project is robust over a reasonable range of assumptions; but, again, there is no fully comparable and documented experience available to resolve the issue.

Benefit-Cost Analysis. The Revised Business Plan includes significant improvements from the Draft Plan, but does not fully document the basis for the changes through more detailed, supplementary reports. We are told that the Benefit-Cost studies have been subjected to thorough review, but there is no single and authoritative evaluation of the results. We therefore believe that the results should still be viewed as needing further confirmation and refinement.

A Summary Observation. Aside from being critical to the eventual project, the time and effort in completion of the Madera to Bakersfield segment and the Bookends will offer some important learning opportunities. While the Revised Plan is a good initial step in integrating the HSR system into the state's overall transportation network, including local transit and conventional rail services, it is critical that much better analysis of the state's transportation needs be undertaken by the State in parallel with the initial set of projects in the Valley and on the Bookends so that any decision to proceed beyond this investment can be based on a firmer understanding than exists today of overall and long-range needs. Among other things, this should lead to a strengthening of public transportation systems providing access to HSR stations (e.g. extension of BART's planned East Bay line through to the HSR San Jose station and rail improvements scheduled for the Los Angeles metropolitan area). We also stress, though, that the Authority must take advantage of the time available during initial construction to improve the validity of the Authority's demand modeling, its O&M Cost modeling and its Benefit-Cost evaluations. Before proceeding beyond the Central Valley and the Bookends to build the IOS, the Authority should conduct a thorough and detailed evaluation of its demand modeling and its O&M Cost models to ensure that planning for the IOS and beyond is sound and based on the latest and best available information. It has been frustrating to try to analyze these issues against the compressed time-frame required by the ARRA money; it would be highly unfortunate to have the same issues arise at the end of the initial projects if the improved evaluation work is not done in the meantime. We note that the Authority's own peer review panel has recommended a series of improvements in the demand models and we urge the Authority to take these recommendations into account in future demand modeling work.

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

Worst-Case Scenario

It may be useful to the Legislature to discuss the implications of a decision to allow use of Prop 1A funding for the more immediate appropriation decisions to be made – initiating construction in the Central Valley and on the Bookends. What would be the worst case outcome?

As a “worst case scenario,” the Group assumes that up to 130 miles of the Central Valley segment is completed, that the majority of projects listed in the Bay Area and Southern California Memorandums of Understanding (the Bookends) are funded and completed, and that no further federal, state or private sector funding is available to expand the initial HSR segment in the Central Valley or the rail improvements made in the Bay Area and Southern California regions. This scenario, which assumes that any legal and environmental challenges are successfully overcome, nonetheless provides a major and substantial upgrade to intercity passenger rail service with substantial independent utility realized in some of the most heavily populated and congested regions in the state. Completion of the initial segment, in spite of limited independent utility, would provide valuable design and construction experience, including real construction cost data that would form the basis for future capital cost estimates. Additionally, completion of the Central Valley segment and the Bookend improvements would also serve as an appropriate decision point, a “go” or “no go” decision point for continuation of the HSR program. This same “go” or “no go” decision point could be revisited upon completion of the IOS should a decision be made to complete the Bakersfield to Palmdale rail gap.

Beyond the worst case scenario, what is an unacceptable risk in the Central Valley projects and the Bookends? At worst, the work could become so snarled in litigation or cost overruns that it would never be completed. As we have stated in other reports, we are not qualified to assess litigation risks, but we do believe that the current state of construction planning gives some confidence that a significant part (if not all) of the 130 mile section can be completed and used for the San Joaquin services. If so, and if the project ends at this point, the state would be responsible for repaying \$2.7 billion in Prop 1A bonds on a segment that may not serve as a test segment for 220 mph service and that could clearly carry fewer passengers than originally planned. It would be a poor use of resources and an embarrassment, but not a financial disaster for the state.

Major Risks in the Central Valley Segment and the Bookends

The Central Valley section from Madera to Bakersfield does pose a number of risks that can be clearly delineated. Three of these are common to many projects, while the fourth is unique to the HSR project: 1) the bids may come in above estimates; 2) projects, once awarded, may face substantial cost increases due to change claims or delays not caused by the contractor (environmental or other litigation, availability of ROW, changes in alignment after award); 3) contractors may prove incapable of doing the work, or may go bankrupt; or 4) the Authority, due to lack of management resources, may be incapable of overseeing the work and lose control over the project.

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

For the Bookends, which we believe are an essential part of the overall project, the actual risks are of less concern. The work planned is clearly needed to support eventual HSR services and full funding is either currently available or has high likelihood of availability within existing funding sources. The planning and construction will be managed by local authorities with full experience in improving their own facilities (which will relieve the managerial burden and reduce some of the cost risk on the Authority), and the work can be fully integrated with local operational requirements, both during construction and in later operations. Cost sharing with the local authorities will ensure their commitment to project completion on time and within budget. The Authority will also be able to learn from the experience on these projects. Perhaps most important, the vast majority of existing rail passenger traffic is on the Bookends, so the benefit will be immediate and permanent even if, for whatever reason, the remainder of the project is not successful. Overall, we believe the Bookend risks are minimal and the benefits substantial.

The net result of these factors is that there will be a number of go/no go checkpoints, both in the Central Valley and in the Bookends, against which performance can be measured and at which the project could be stopped if it appears to be seriously off track. The Legislature can and should require full and timely reporting against these checkpoints. In the process, the Authority will have the opportunity to show that it is (or is not) up to the job, while experience and better engineering will yield a clearer understanding of the costs of the IOS and of the feasibility of new sources of funding such as cap-and-trade at the state level, or new sources at the federal level can be identified or validated.

Conclusions

The Revised 2012 Business Plan represents a substantial improvement in the implementation strategy for high speed rail in California. The Peer Review Group finds that the Revised Business Plan, while still involving some significant risks, is considerably more reasonable and realistic than earlier proposals. Our previously identified concerns regarding the independent utility of the initial proposed investment have been substantially addressed by the Authority's early focus on the IOS, to include completion of a connection between Bakersfield and the San Fernando Valley, as well as the proposed initial service concept for Northern California. This emphasis on connectivity reduces the concerns about a stranded initial investment and responds to our questions about the system benefits of the Madera to Bakersfield segment. Any investment in the Bookends will also not be lost, and the public will benefit from these improvements regardless of the future of the high speed rail program. While we remain apprehensive regarding the availability of long-term financing, the potential application of AB 32 funding through a cap-and-trade program offers some possible relief for capital funding if other state or federal money is not forthcoming.

Because the utility of the system will be enormously enhanced by going beyond the Central Valley to completion of the IOS, we believe that the ability of the cap-and-trade program, or some other source of reliable financing, to support the IOS completion is critically important. We urge that the Legislature, working with the Administration, assure itself that the fledgling cap-and-trade program is a viable source of funding for high speed rail capital improvements in the event that no other state or federal money is identified for the program in the near-term. This assurance should also include a determination that these funds will be available in the

CALIFORNIA HIGH-SPEED RAIL PEER REVIEW GROUP

appropriate amount and as needed to complete at least the initial connected system (and Bookends) proposed in the Revised Business Plan.

Based on this new approach to providing an initial connected system of improvements and the focus on early investments that will provide long-term benefits to the public with or without a fully complete system, the Peer Review Group recommends that any legislative appropriation of Proposition 1A bond funds be subject to the following conditions:

- 1) That the Authority present an approved action plan to the Legislature for obtaining adequate management resources to effectively conduct a program of this magnitude. This plan should fully describe the program management concept proposed by the Authority and include a discussion of staff position priorities and a timeline for bringing these resources on board. The Legislature will need to be comfortable with this management approach prior to the appropriation of funds.
- 2) That the Legislature be fully informed of the risks associated with the development of a high speed rail system for California as outlined in this report and input from other sources, including those risks that accompany the development of the initial connected system, and that any legislative action with respect to high speed rail be based on a full knowledge of those risks. In addition, the Legislature should require appropriate progress reports from the Authority so that interim results and go/no go points can be assessed in a timely way.
- 3) That the Authority be required in its 2014 Business Plan to: a) substantially upgrade its demand modeling through better input data on sources of demand, updated socioeconomic data, and wider sensitivity analysis with particular attention to the issues associated with extension to the San Fernando Valley; b) develop a more capable and credible O&M Cost model based on extensive interviews with existing HSR operators and network agencies and apply this model to the issues of extension to the full IOS; and, c) based on better demand and operating cost information, revise the Benefit-Cost analysis and subject it to full, external academic peer review.

There are two issues the Group has not addressed in our comments on the Revised Plan. First, we recognize that there are broader policy determinations to be made regarding statewide budgetary priorities, and responsibility for those decisions lies appropriately with the Legislature and the Administration. Further, the Group does not possess the legal capabilities to assess whether the proposed program meets the requirements of Proposition 1A. We can say, however, that mega-projects by their nature are typically constructed incrementally over an extended period of time. The important challenge for program managers is to continue to focus on the ultimate vision of a completed system and to build toward that vision as financing becomes available.

Meeting Business Plan Statutory Requirements

The requirements for the 2014 Business Plan are included in the beginning of the document and the table below shows which sections of the document address each of the requirements:

PUBLIC UTILITIES CODE SECTION 185033 REQUIREMENTS

The authority shall prepare, publish, adopt, and submit to the Legislature, not later than May 1, 2014, and every two years thereafter, a business plan

The Final Plan is being submitted by May 1, 2014.



At least 60 days prior to the publication of the plan, the authority shall publish a draft business plan for public review and comment.

The Draft 2014 Business Plan was released on February 7, 2014.



The draft plan shall also be submitted to the Senate Committee on Transportation and Housing, the Assembly Committee on Transportation, the Senate Committee on Budget and Fiscal Review, and the Assembly Committee on Budget.

This Draft 2014 Business Plan was submitted on February 7, 2014.



THE BUSINESS PLAN SHALL INCLUDE, BUT NEED NOT BE LIMITED TO, ALL OF THE FOLLOWING ELEMENTS:

- A description of the type of service the authority is developing
- The proposed chronology for the construction of the statewide high-speed rail system
- The estimated capital costs for each segment or combination of segments
- A forecast of the expected patronage, service levels, and operating and maintenance costs for the Phase 1 corridor as identified in paragraph (2) of subdivision (b) of Section 2704.04 of the Streets and Highways Code and by each segment or combination of segments for which a project level environmental analysis is being prepared for Phase 1. The forecast shall assume a high, medium, and low level of patronage and a realistic operating planning scenario for each level of service.
- Alternative financial scenarios for different levels of service, based on the patronage forecast in subparagraph (above), and the operating break-even points for each alternative. Each scenario shall assume the terms of subparagraph (J) of paragraph (2) of subdivision (c) of Section 2704.08 of the Streets and Highways Code.
- The expected schedule for completing environmental review, and initiating and completing construction for each segment or combination of segments of Phase 1.
- An estimate and description of the total anticipated federal, state, local, and other funds the authority intends to access to fund the construction and operation of the system, and the level of confidence for obtaining each type of funding.

Section 1



Section 1



Section 3



Section 4



Section 6



Section 1



Section 6



→ Any written agreements with public or private entities to fund components of the high-speed rail system, including stations and terminals, and any impediments to the completion of the system.	Section 8	
→ Alternative public-private development strategies for the implementation of Phase 1.	Sections 2 and 6	
→ A discussion of all reasonably foreseeable risks the project may encounter, including, but not limited to, risks associated with the project's finances, patronage, right-of-way acquisition, environmental clearances, construction, equipment, and technology, and other risks associated with the project's development. The plan shall describe the authority's strategies, processes, or other actions it intends to utilize to manage those risks.	Section 8	
→ To the extent feasible, the business plan should draw upon information and material developed according to other requirements, including, but not limited to, the preappropriation review process and the preexpenditure review process in the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century pursuant to Section 2704.08 of the Streets and Highways Code	Full document	
→ The authority shall hold at least one public hearing on the business plan and shall adopt the plan at a regularly scheduled meeting.	Public comment was taken at the regularly scheduled Board of Directors meetings on February 11, March 11, and April 10. The 2014 Business Plan was adopted at the April meeting.	
→ When adopting the plan, the authority shall take into consideration comments from the public hearing and written comments that it receives in that regard, and any hearings that the Legislature may hold prior to adoption of the plan.	Were considered by the Authority in preparing final plan.	

BUDGET ACT OF 2012 REQUIREMENTS

THE HIGH-SPEED RAIL AUTHORITY SHALL, AS PART OF ITS [MAY] 1, 2014, BUSINESS PLAN, INCLUDE A PROPOSED APPROACH FOR IMPROVING:

→ Demand projections	Section 4	
→ Operations and maintenance cost models	Section 5	
→ Benefit- cost analysis as applied to future project decisions	Section 7	

These business plan components approved, as consistent with the criteria in this provision, by the Secretary of Business, Transportation and Housing shall be based on recommendations of the authority's peer review panel, advice from the domestic and international rail community, and external academic review.

Sections 1, 3, 4, 5, and 7

