

Chapter 8

Risk Identification and Mitigation

Introduction

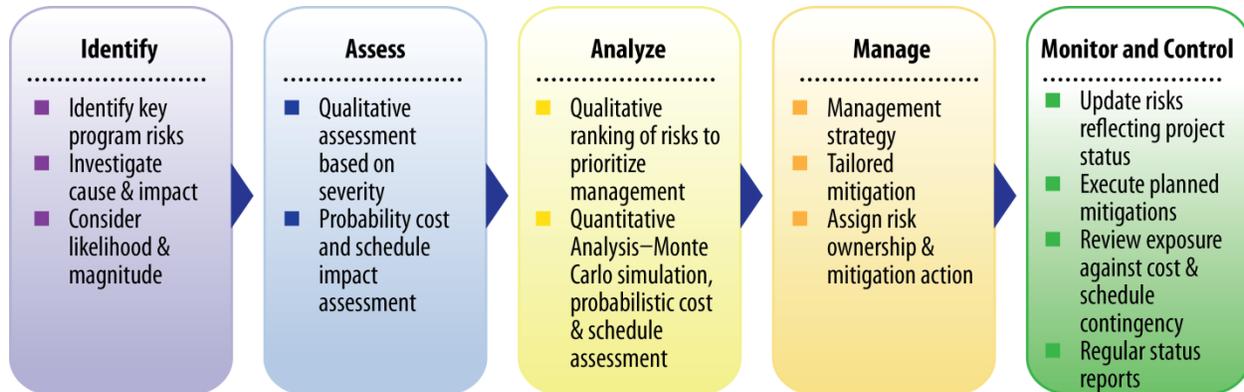
Undertaking a program as large as the California high-speed rail (HSR) system involves risk from both the program and project-level perspectives. It is critical to identify, manage, and mitigate risks at each stage of the HSR system's life cycle.

This chapter identifies high-level risks associated with the system's successful execution and a description of the specific risk mitigation and management approach that the Authority is applying to each of those risks. In addition, this chapter discusses general risk mitigation and allocation strategies, as well as the risk management plan being administered by the Authority. In summary, this chapter provides the following:

- **Identification of key risks**—This section discusses key system risks identified to date. Individual risks have been consolidated into risk categories for presentation purposes. It is likely that additional risks will arise and may become critical path items as the program moves forward to implementation and operation. The purpose of identifying risks is to assess and understand them so that mitigation plans, risk allocation strategies, and risk management processes can be applied in an appropriate manner.
- **Risk mitigation and allocation strategies**—This section discusses initial risk mitigation strategies for the key risks. Each risk is unique and is often linked to other risks; a tailored risk mitigation strategy is required to address them proactively. In determining and implementing the most appropriate risk mitigation strategies, the Authority has drawn heavily on international precedent and lessons learned. These general approaches include procurement contracting and delivery strategies with associated risk transfer.
- **Risk management plan and processes**—This section discusses processes to manage and monitor risk throughout the HSR system's life cycle. A key step in tailoring risk management processes is occurring as part of the risk management plan process for delivery of the first construction segment of the Initial Operating Section (ICS).

The Authority’s risk management process involves five key steps, as illustrated in Exhibit 8-1. This chapter discusses outputs from the “Identify” and “Manage” activities described in Exhibit 8-1.

Exhibit 8-1. Authority’s risk management process



Key risks

The Authority has taken a number of steps to reduce and mitigate risk to the program. An overall risk management plan and organization have been established, as described in the Risk Management Plan section later in this chapter. Foreseeable risks have been identified that may threaten the program’s viability; and the causes of each risk have been investigated to determine the underlying driver and cause. This process is integral in guiding the risk assessment and analysis described in the Risk Mitigation and Allocation Strategies section of this chapter. This process also helped in the identification of the relevant and effective mitigation and management strategies described below. Discussed below are key high-level program risks that have currently been identified. In addition, the Authority has developed numerous tools to identify and manage all foreseeable project risks in considerably more detail. It is not the purpose of this chapter to detail all of the potential risks the program will face but rather to highlight key categories of risks.

Cost and schedule

Description

The current cost estimating system is based on static inputs, such as unit prices and inflation. Thus a risk exists that projected costs and schedule could fluctuate as these underlying inputs are refined or change in world markets.

Design on the first construction segment of the IOS has progressed in excess of 15 percent in certain segments, and many cost and schedule updates and changes have been incorporated to reflect more detailed design, environmental mitigation measures, and refined contingencies; however, the design and environmental process for the project is not complete. The federal Record of Decision (ROD) for the Merced-to-Fresno section of the first construction segment of the IOS is expected to be received in June 2012; however, the Fresno-to-Bakersfield section has been delayed following the public comment process and a supplementary alignment has been added. Although considered unlikely, the design for

the first IOS construction segment (and the project as a whole) could change and, therefore, capital costs could further change.

The schedule is tied directly to the availability of funding. While this has been discussed with a range of stakeholders, the actual schedule will be different, as discussed in Chapter 3, Capital Costs. In the event that funds are provided over longer periods of time, capital costs likely will rise as a result of inflation.

In relation to the four design-build construction projects that comprise the IOS first construction segment, certain federal funds require that this portion of the project be completed in 2017, which requires a specific plan and risk mitigation strategy for the project.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay or inability to complete the program
- Increase in construction and operations costs
- Loss of stakeholder support
- Delay or inability to receive or keep funding

Mitigation and management approach

Realizing that increases to costs and schedule are a risk to the program, the Authority has been heavily focused on managing these risks and has implemented a variety of mitigation measures, including the following:

- **Adopting the Phase 1 Blended systems strategy as the preferred implementation strategy.** This strategy allows the system to use existing assets in urban areas, thereby significantly reducing costs, development risk, and time frames.
- **Developing and implementing the HSR using a phased approach, beginning with the IOS.** Developing the system in phases allows individual, stand-alone projects to be implemented and decisions to be made incrementally on when and how to proceed. This phased approach reduces both delivery and cost overrun risk by reducing the size and scope of individual projects to be delivered. For more detailed information, see Chapter 2, The Implementation Strategy: Blending, Phasing, Investing in Early Benefits.
- **Including significant contingencies, inflation estimates, and schedule extension in the financial plan.** The Phase 1 Blended construction cost in 2011 dollars includes a contingency of between 15 and 25 percent to protect against material cost increases, use of different components or parts, and minor changes in quantities, depending on the cost category. A six-year schedule extension is factored into the plan to account for funding delays. These assumptions individually and collectively are mitigations for the risk that the financial plan costs are materially understated.
- **Procuring the IOS under design-build contracts that transfer significant cost and schedule risk to the design-build contractor.** The Authority has included a number of terms and conditions in the first construction package of the IOS (and would include similar provisions in future contracts) that are designed to help ensure schedule and cost certainty. These proposed contract provisions include

limiting the situations in which change orders, increase to costs, and time extensions are allowed. In addition, the design-build contract stipulates that liquidated damages are payable to the Authority in the event the design-build contractor cannot deliver the first construction package by a certain date.

- **Advancing the procurement for the initial construction segments of the IOS to take advantage of favorable construction pricing, maintaining project schedule, and resolving issues before implementing system-wide operations.** Additionally, once construction is completed and systems and electrification installed for the IOS, it will be the initial segment for resolving regulatory and technical issues, extensive systems and train set commissioning, and operational development common to any initial construction segment of HSR. This will allow subsequent extensions to be implemented in a simpler and more cost-efficient manner.
- **Adopting an aggressive cost-management strategy for the entire system that leverages private-sector delivery models that transfer risk of cost increases and schedule delay where appropriate.** These models include design-build, concession structures for train operations; an infrastructure operating and maintenance (O&M) concession for infrastructure operations and maintenance; or broader public-private partnership arrangements. These contracting methodologies have the ability to provide greater price certainty and transfer the risk of cost and schedule overruns, contract interface, and performance of the HSR system or its components to the private sector. For a discussion of public-private partnership delivery models, see Chapter 4, Business Model.
- **Continuing to review and validate construction cost estimates, including the underlying cost (e.g., unit prices).** Two peer reviews—a selected cost item peer review by regional consultants and a contract bid peer review of the Fresno-to-Bakersfield section—were conducted to assess the accuracy and validity of the cost-estimating methodology applied to current cost estimates. The selected cost item peer review investigated the unit prices being used to build up the cost estimates and found that the unit prices were consistent with appropriate standards. The contract bid peer review for the Fresno-to-Bakersfield section found that the cost estimating methodology was producing reasonable results. For a more detailed discussion of capital cost estimating methods, see Chapter 3, Capital Costs.
- **Developing construction cost estimates based on a range of alternative alignments, underlying cost assumptions, escalation factors, and implementation timing to understand impacts to the program’s commercial and financial viability.** As noted above, the construction costs and associated contingencies have been refined to reflect additional design work and the steps required for environmental mitigation.
- **Continuing to review and validate O&M cost projections, including the underlying unit prices, international precedent comparables (e.g., European and Japanese HSR systems), and local California context (e.g., local labor and cost levels).** High, Medium, and Low O&M cost projections were developed to analyze the impact to O&M cost projections based on fluctuations in ridership levels. In addition, the O&M cost projections contain a 10 percent contingency to account for unknowns and future changes to the underlying O&M cost assumptions. Chapter 6, Operating and

Maintenance Costs, discusses this in more detail. The O&M cost projections are undergoing review by the International Union of Railways, an international organization representing high-speed rail operators around the world, to further validate the assumptions underlying the O&M cost projections.

- **Continuing to incorporate value engineering to reduce overall program cost without compromising quality or safety as engineering proceeds to the 30 percent design level.** For example, the first design-build contract for the IOS has incorporated Alternative Technical Concept and Value Engineering processes that incentivize the design-build contractor to find innovative solutions that will help lower the overall cost of construction without compromising quality.
- **Developing a schedule for the entire program based—and highly dependent—on funding availability.** If all of the funding required to complete the program were available, the blended system could be built as early as 2023. The Authority has structured the construction packages relating to the first construction segment of the IOS so that construction may be completed with available funds. In particular, the scope of the two final construction packages (#4 and #5) of the segment will be adjusted up or down to accommodate the remaining funds and/or procurement savings in the project budget. For the purposes of financial planning, a schedule was developed to illustrate program completion that results in a completion date of 2028. This additional time in the financial plan schedule would mitigate most schedule-oriented risks.

Staffing and organizational structure

Description

Implementation of a high-speed rail program is a complex undertaking. The scale, size, and technical complexities necessitate a robust internal program management team, complemented by external resources, with the specific skills and expertise necessary to manage this unique program. For example, during the peak construction years, the annual construction outlay will be several billion dollars. This volume of effort alone warrants attention on the size and capabilities of the Authority's staffing and organizational structure. The Authority will be negotiating daily with the heads of organizations that have been part of the world's most successful high-speed rail programs. In-depth high-speed rail industry expertise and experience is critical within state service.

The Authority has increased staffing and capacity, and expanded its organizational structure. The Authority is working with the California Department of Transportation (Caltrans) and other state agencies to identify both permanent transfers and temporary secondments to fill needed positions. This focus on increased staffing will continue to be required to meet the future demands of the program. The Authority supplements its internal staff with full-time and part-time consultants with particular areas of expertise, including a Program Management Team (PMT). As with many large-scale public works programs and projects within California, the U.S., and internationally, the PMT augments Authority staff in specific project-related functions, such as planning, engineering and construction management, project administration, risk management, and procurement/contract administration. Coordinated Authority staff augmentation using consultants will continue to be critical for a program of this magnitude since it will be difficult for the state to have ready access to the breadth and depth of expertise required and

address the significant peaks and valleys in workforce requirements inherent in the development, design, construction, and initial operation of the project components.

Staff augmentation does not relieve the need to build the Authority's management and support team as consultants are not in a position to establish strategy and make management decisions on behalf of the state. Authority management and staff, the PMT, other key Authority consultants and supporting state agencies must coalesce into a seamless, integrated structure for successful implementation of this program.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay in critical management decision making
- Loss of stakeholder support
- Delay or inability to receive funding
- Delay or inability to complete the program
- Increase in construction and operations costs

Mitigation and management approach

The Authority's Board of Directors has made this a priority and is working with staff to address key issues. The Authority has implemented and will continue to implement measures aimed at mitigating and managing risk related to staffing and organizational structure. Some of these mitigation measures include the following:

- **Soliciting candidates to fill open positions to lead major work streams**, including a new chief executive officer and chief deputy director, as well as a designated Authority risk manager, chief financial officer, and chief program manager. Additional positions also have been created and filled in communications and outreach at both the headquarters and regional levels, such as general counsel, as well as a variety of planning, right-of-way, contracts, and financial control positions, including a funds manager who will interface with the Federal Railroad Administration (FRA) for American Recovery and Reinvestment Act (ARRA) funds, and a Caltrans master agreement coordinator. Areas targeted for additional expansion include grants management and procurement, reflecting the growing demands and opportunities in these areas. The Authority continues to obtain the requisite approvals to fill open positions and meet the salary requirements of appropriately qualified individuals.
- **Engaging the PMT and other consultants to provide supplemental expertise** in areas necessary to develop and implement the IOS. An integrated organizational structure has been developed to support that effort.

In addition to the measures described above, the Authority is pursuing the use of business and commercial structures to transfer risks associated with certain administrative and management functions during the construction and operation phases. For a more detailed discussion of these structures see Chapter 4, Business Model.

Approvals

Description

Delay in or inability to receive environmental approvals is a program risk. The approvals process for a project of this size and nature are complex and involve a large number of agencies at the federal, state, and local levels. Coordination both within and outside the Authority must be managed daily and is inextricably linked to staffing and organizational structure risk.

The environmental approvals process also has implications for public support of the program as the public's reaction is largely dependent on the transparency and quality of information disseminated during the environmental approval process.

Currently the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Merced-to-Fresno section of the IOS is progressing and a ROD is expected to be received in June 2012. The EIR/EIS for the Fresno-to-Bakersfield section of the IOS has been delayed following the public comment process and a supplementary alignment has been added. As a result, a revised EIR/supplementary EIS will be certified in November 2012 and a ROD is expected in December 2012.

In addition, there are many other permits and governmental approvals that must be secured before beginning construction.

Potential impact

The impact to the program could be wide ranging and include the following:

- Loss of public funding (ARRA) and an increase to the amount of state funding required for the program
- Increase in costs associated with schedule delay
- Inability to secure necessary environmental clearances and approvals

Mitigation and management approach

The Authority understands the risk related to the approvals process and is taking the requisite steps to mitigate this risk, including the following:

- **Increasing the Authority's internal staffing and soliciting individuals** given the complicated nature and magnitude of agencies involved in the approval processes. The risk of delay in or inability to obtain approvals is linked to the internal management of these processes.
- **Developing a planning schedule to evaluate funding needs that extends Phase 1 Blended completion five years from 2023 to 2028.** This extension of time in the financial plan will address and mitigate most schedule-oriented risks. The option for phasing and early implementation of an IOS also would provide additional time to address development issues in urban areas.
- **Continuing to coordinate with federal agencies to further the Authority's interagency collaboration efforts.** For example, in July 2011 the Authority was joined by the FRA, the U.S. Department of Housing and Urban Development, the U.S. Department of Transportation, and the U.S. Environmental Protection Agency to establish a partnership for sustainable planning. The Authority will continue to coordinate with FRA staff on regulatory requirements, particularly the environmental

requirements for the first construction segment of the IOS, including implementing a schedule with deadlines and an accountability matrix that assigns ownership of each approval process. In addition, the Authority will continue to coordinate with FRA regarding technical and operational safety standards. The Authority has funded positions with a number of resource agencies to ensure timely review of submissions to meet program deadlines.

- **Focusing on ensuring that the right-of-way acquisition and environmental approval processes are legally compliant and aligned to project delivery schedules.** Currently, the Attorney General's office monitors the environmental approval process and assists in the submission of environmental documents and reports in order to mitigate potential legal issues. Legal and regulatory compliance and due process will be a key responsibility of the newly appointed legal counsel to ensure, in so far as possible, the Authority is not subject to legal claims and litigation. In addition, the Authority continues to coordinate with the Public Works Board to refine the ROW acquisition process with the objective of shortening the duration of time necessary to acquire ROW.
- **Pursuing a variety of methods in which to transfer risk related to approvals.** Apart from securing the ROD for both the Merced-to-Fresno and Fresno-to-Bakersfield sections of the IOS, the Authority is transferring the responsibility (and risk) associated with securing other permits and governmental approvals to the design-build contractors for the first design-build construction package of the IOS. For example, under the design-build contract, the design-build contractor is not entitled to receive any increase in costs or time extensions for the delay or inability to receive any permits or governmental approvals (apart from the RODs).

Demand/ridership and revenues

Description

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 HSR currently operates in the U.S., a risk exists that the actual ridership demand and revenue will differ from the projections currently being used. In other international jurisdictions, the private sector has been unwilling to accept the full demand and ridership risk from the outset of a new system, although the private sector has been willing to accept this risk as ridership becomes proven based on actual results.

Potential impact

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

Mitigation and management approach

The Authority has acknowledged the risk related to demand and ridership and has taken a number of steps toward mitigating this risk. A number of these activities were undertaken at the direction of the Authority's Board in the past six months. These steps include the following:

- **Developing a range of revenue and ridership projections, including Low, Medium, and High Scenarios to understand the impact on the operational and financial viability of the program under a variety of scenarios.** The updated projections are based on post-recession economic conditions and population growth. A range of inputs for gas prices and fuel efficiency was modeled based on independent industry guidance. The range of possible outcomes was compared to operating costs and to the system's breakeven point. All projections analyzed, which encompass a wide range of inputs, result in a positive cash flow. The testing of possible ridership scenarios illustrates that the system can be expected to generate positive operating results and not require operating subsidies even if ridership comes in well below initial estimates. This is consistent with other high-speed rail operations internationally.
- **Commissioning an independent, international Ridership Peer Review Panel comprised of experts on travel forecasting to review the forecast approach, assumptions, documentation, data, and model that generated the revenue and ridership projections.** The Panel focused specifically on the ridership model's suitability for the business planning and performed three basic functions: (1) evaluated forecast work performed to date; (2) focused on guiding further work being performed; and (3) advised on further improvements as the Authority moves to a "best-in-class" modeling tool. See Chapter 5, Ridership and Revenue, for more information.
- **Analyzing the project's operating performance from a breakeven standpoint.** As illustrated in Chapter 7, Financial Analysis and Funding, the system's breakeven point is well below the lowest projection of ridership. This includes a Low Scenario projection that incorporates gasoline prices at \$2.60 per gallon, which is much lower than current and any recent historical prices.
- **Testing the operation of the model overall using an actual system and comparing with known results.** The HSR model was tested using the attributes of the Acela system running in the North-eastern United States. As discussed in Chapter 5, Ridership and Revenue, the attributes for the functioning system were input into the California model and the model results generated a projection that was within 79 percent of the actual results of the functioning system.
- **Actively assessing innovative ways to transfer risk related to demand and revenue to the private sector.** The Authority has undertaken initial market sounding exercises with potential private-sector participants to gauge the level of interest in accepting some or all of this risk at appropriate stages of program development. For more information, see Chapter 4, Business Model.

Funding

Description

A number of risks exist related to funding. Failure to receive the anticipated amount of public funding at the requisite time could threaten the pace of development and ultimately the viability of the full program. In addition, the amount and timing of public funding impacts many other aspects of the program, including the chosen business model, project schedule, phased implementation, staffing and management approach, and technical aspects, such as operating speed and travel time.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay or inability to complete the program
- Significant increase to program costs
- Loss of stakeholder support

Mitigation and management approach

The Authority acknowledges the risk associated with the receipt of public funding and has taken a number of steps to mitigate and manage this risk. The Authority's risk mitigation and management approach includes the following:

- **Securing backup funding for the full IOS.** The Authority has been working with state stakeholders, including the California Department of Finance, to develop backup funding support for the full IOS should federal funding support fall short of the amount needed to complete the IOS. Cap-and-Trade funds are available, as needed, upon appropriation, as a backstop against federal and local support to complete the IOS. This is a major milestone in the mitigation efforts to decrease the risk related to funding the IOS.
- **Developing the system in functional phases and placing completed sections into immediate service.** The phased implementation of the system mitigates the risk of funding delays by providing decision points for state policy makers to determine how and when the next steps should proceed while leaving a fully operational phase that generates economic benefits. For example, the completion of the first IOS construction segment will be used by Amtrak San Joaquin service and potentially other operators. Similarly, when the gap between Bakersfield and Palmdale is closed, it will be available for immediate use by others. Once the full IOS is commissioned there will be fully operational high-speed rail service that is forecast to generate a strong level of net operational cash flow from the start of operations. This would allow the timing of the schedule to deliver Bay to Basin to be flexible to match the availability of funding. For more information, see Chapter 2, The Implementation Strategy: Blending, Phasing, Investing in Early Benefits.
- **Focusing on maintaining stakeholder support for the program.** This involves, among other things, completing the environmental documentation for the statewide program, achieving 15 percent design for selected ARRA program sections, and environmental processing leading to issuance of the environmental clearance for two program sections.

- **Performing a full economic analysis report, as well as technical reports, to demonstrate the need for public funding for such an important program.** The benefit-cost analysis calculated a benefit-cost ratio of 1.57 to 1.78, reinforcing the value of investing in the high-speed rail system in California and in the resulting job creation and economic growth. See Chapter 9, Economic Analysis, for an in-depth discussion of the economic benefits of the program.
- **Maintaining effective communication.** The Authority is actively communicating with state agencies and policy leaders for the appropriations requests as part of the fiscal year 2012-13 budget process. The Authority will submit an Expenditure Funding Plan as required under Proposition 1A following issuance of this Revised 2012 Business Plan (Revised Plan) in April 2012.

The Authority continues to work closely with legislators, the FRA, the Federal Transit Administration, the private sector, and other stakeholders to maintain funding support for the program. For example, the Authority provides quarterly updates to the FRA on the administration of all grant funding committed to the project. The Authority will continue to evaluate future sources of federal funding, as identified in Chapter 7, Financial Analysis and Funding, in conjunction with federal project partners and funders.

The Authority also is continuing to meet with private-sector entities to discuss the ability of private financing mechanisms to complement or supplement public-sector funding. For more information, see Chapter 4, Business Model.

- **Establishing a cash management strategy.** The Authority is meeting with the California Department of Finance, the State Treasurer's Office, and the State Controller's Office, as needed, to refine the cash management process associated with the timely receipt of bond proceeds for project expenditures and the appropriate handling of federal reimbursement payments.

Financing

Description

While the program will require significant public funding, third-party financing is anticipated to be available once revenue service is stabilized. The ability to finance the program, or a specific portion of the program, is largely dependent upon the risks associated with the revenue source used for repayment and the availability of significant amounts of capital in the market.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay or inability to complete the program
- Increase in the public funding required
- Re-scoping of project segments or contract approaches
- Loss of political support
- Increase in program costs

Mitigation and management approach

The Authority understands the potential need for supplementary private financing to deliver the HSR system and has begun mitigating and managing risk related to potential financing. The Authority's risk mitigation and management approach includes the following:

- **Understanding the risks associated with the ridership and associated revenues in High, Medium, and Low Scenarios and the effect on the operational viability of the system.** A key risk measurement for private investors is the accuracy of projections, and missed projections are a significant concern. The Authority has carefully evaluated ridership ranges and operating scenarios and has had the projection model evaluated by an expert peer review panel. Prior to initiating a private-sector financing transaction, additional ridership projection work will be undertaken to develop investment-grade projections. See mitigation approaches to demand and ridership and cost and scheduling for more information.
- **Considering the use of delivery models that leverage private finance to help deliver elements of the program.** The Authority has had extensive discussions with potential private financiers who may be interested in investing in the HSR system through the Requests for Expressions of Interest process. The feedback has been incorporated into the business model. For detailed information, see Chapter 4, Business Model.
- **Monitoring private-sector investor interest.** The analysis presented in Chapter 7, Financial Analysis and Funding, was based on an assumption that private-sector capital will be sought prior to the completion of the Bay-to-Basin section. The ability of the private sector to procure the level of capital associated with the future value of the revenue is a risk that will be managed by considering how this value could be separated into a number of different transactions. The valuation of the revenue also will depend on the perceived view of the project and market risk at the time of the investment. It should be noted that the transaction is estimated to occur in 2023 and hence the status of the markets, inflation, and fiscal policy is likely to be very different from that of today. The financial market environment will continue to be monitored throughout the program.
- **Considering the use of innovative commercial mechanisms and ancillary revenue sources that may help reduce any perceived risk of repayment associated with the underlying revenue source.** Examples of ancillary sources of revenue are retail and commercial property rents, parking charges and fees, signage, and advertising revenue. In some situations, these ancillary revenues may be used to offset specific costs that may otherwise be borne by the Authority or other public-sector organizations. For more information, see Chapter 7, Financial Analysis and Funding.
- **Developing a statewide strategy for passenger station development and operations requirements to secure local funding commitments.** The Authority is investigating implementation of a variety of transit-oriented development initiatives that would incentivize private-sector participation.
- **Working to align state stakeholders.** This will help reduce the perceived risk associated with financing as lenders carefully review the public sector's commitment to a program. Key to this confidence is continuity of support to advance the HSR system. This also will help reduce the

perceived risk associated with private financing as lenders and financiers carefully evaluate public-sector partners prior to making investments.

- **Continuing outreach and communication with potential private partners.** The Authority undertakes ongoing outreach to the private sector to keep them updated as to the HSR program progress and to seek input to ensure the program reflects and protects the future interest of private-sector participants. This will provide long-term value to the state and other stakeholders. For more detailed discussion, see Chapter 4, Business Model.

Right-of-way

Description

Acquiring right-of-way (ROW) for a program of this nature is normally the responsibility of the procuring authority. A risk exists with regard to the estimated cost and schedule of acquiring ROW. This is partly because of opposition to certain alignments of the program and the schedule required to meet conditions of federal funding sources.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay or inability to complete the program
- Increase in program costs
- Schedule delays
- Loss of political support
- Increase in the public funding required

Mitigation and management approach

The Authority is working toward mitigating and managing the risk associated with ROW in a variety of ways, including the following:

- **Engaging qualified ROW firms with significant experience.** These firms are well versed in the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (Uniform Act), along with other federal and state requirements established for uniform and equitable land acquisition policies for public projects and have a demonstrated success in delivering property rights for large-scale, design-build transportation projects.
- **Developing a ROW acquisition plan for the first design-build contract for the IOS that sets forth the parcels that must be acquired and the timeline for acquisition.** Sharing this ROW acquisition plan with other appropriate state agencies also will facilitate timely receipt of funding and completion of the relevant government review and approval processes. The ROW acquisition plan will be released for review by all design-build contractors who have been prequalified to submit a proposal to enter into the first design-build contract. The design-build contractors must design and construct the work within the right-of-way limits set forth in the ROW acquisition plan. In addition, each design-build contractor must agree to the ROW acquisition plan before submitting its proposal and certify that it is able to construct within the ROW acquisition plan.

- **Structuring the first design-build contract for the IOS such that multiple notices to proceed can be issued as the ROW is acquired.** This will mitigate delay to one portion of the work as a result of delay in ROW acquisition for a distinctly separate portion of the work.
- **Continuing communications with the Union Pacific Railroad (UPRR), the Burlington Northern Santa Fe Railway (BNSF), and other stakeholders** that may hold shared ROW required for the HSR alignment.
- **Commissioning a peer review of ROW estimates** and the use of a formal approval process after the review to improve accuracy and accountability.
- **Identifying ROW risk and uncertainty early in the process** to focus design efforts that mitigate ROW cost and setting a contingency amount that reflects these risks and uncertainties to allow for the appropriate understanding and communication of estimate accuracy.
- **Implementing ROW cost-control mechanisms** founded on the baseline ROW cost estimate and documentation supporting estimate updates to provide the Authority with information to make timely decisions.
- **Continuing cost control throughout the appraisal and acquisition process** to monitor actual ROW expenditures for comparing forecast ROW costs with the updated baseline budget.

Stakeholder agreements, interface, and integration

Description

Given the complex, multi-jurisdictional nature of this program, many interface agreements and integration risks exist associated with both construction and operation activities. For example, a system integration and interface risk exists related to the UPRR and BNSF. Other entities also will have an interface with the program, including Caltrain, Amtrak, Caltrans, and other local transportation and transit agencies. This includes the joint use of ROW and the joint use of stations and ancillary facilities with other rail operators and local transit agencies.

Important to the success of the program is its integration within a larger statewide rail and transportation strategy. The program must integrate with and support local transportation systems to allow travelers to move long distances and then within metropolitan areas to their destinations. The program must be part of a larger statewide strategy for transportation that includes airports and highways to allow efficient investment of transportation funds. The Authority must be an active participant within the larger statewide transportation planning structure.

Interface management is an Authority risk. In addition to integration and interface risks with other agencies and entities, an integration risk related to the rail infrastructure, vehicles, and operating companies also exists. Given the experiences of other high-speed rail projects with system integration risk, the Authority is focused on mitigating and managing this risk from both a technical (e.g., system) and stakeholder (e.g., Caltrain, UPRR) perspective.

Potential impact

The impact to the program could be wide ranging and include the following:

- Delay or inability to complete the program
- Increase in program costs
- Decrease to demand and ridership
- Loss of political support

Mitigation and management approach

The Authority is mitigating and managing integration and interface risk in a variety of ways, including the following:

- **Increasing Authority staff dedicated to third-party agreements/interface and developing detailed cooperation agreements/memorandums of understanding with UPRR, Caltrans, relevant cities, Caltrain, and other local transit agencies.**
- **Drafting technically detailed utility agreements and finalizing them with utility owners, as well as seeking exemption from the state utility process.** While the Authority is responsible for securing agreements with the utilities, the Authority intends to transfer much of the risk related to maintaining the agreements to the design-build contractors responsible for constructing the IOS. For example, the first design-build contract for the IOS mandates that the contractor will be responsible for fulfilling the Authority's obligations under the agreements with continued participation by the Authority.
- **Implementing a verification and validation approach that employs independent verification and validation based on proven international practice in HSR and internationally accepted standards.** This approach provides full transparency and ensures that all requirements in the procurement documents provided to the contractor can be traced back through the requirements development process to state and federal codes, industry standards, and international guidelines. In addition, fewer hold-points are created, resulting in a positive impact on delivery schedule and cost while placing liability with the contractor to demonstrate compliance.
- **Implementing a phased approach to the HSR system** allows commissioning and testing of high-speed trainsets and control technologies, staff development, and operational development to mitigate technical integration and interface issues before the full system becomes operational.
- **Using innovative delivery models that transfer system integration risk** (vehicle, signaling, communications system, and track infrastructure) to the private sector, where appropriate.
- **Developing Memoranda of Understanding and future operating agreements with transit agencies, Caltrain, and Amtrak about optimizing future operations, including coordination on schedules, ticketing, station operations, and parking.** Memoranda of Understanding for both Southern California and the San Francisco Bay Area have been drafted and are in the process of approval.

- **Enhancing stakeholder outreach and communication.** To maintain stakeholder support, the Authority has employed a multi-pronged initiative of outreach and communication to all stakeholder groups throughout California, and specifically in the Central Valley. This strategy involves regular communication with local elected officials and local government staff to keep them apprised of new information relating to the Project, building trust and confidence in the Authority. Business organizations, such as chambers of commerce and economic development groups, have been contacted to establish relationships. Additionally, through the environmental processes (workshops, open houses, meetings, etc.) the Authority has attempted to reach out to the broader community to communicate the goals and benefits of the project.

Risk mitigation and allocation strategies

The previous section identified key risks, as well as the specific mitigation and management approach. This section describes those strategies that the Authority has implemented to mitigate many types of risks.

Principles

The Authority's risk mitigation and allocation approach is based on four key principles:

- **All project personnel are part of the risk management process**—Risk management is integrated with other program management processes and aligned with the Authority's goals and values. As such, everyone is involved, and risk management is every team member's responsibility.
- **Key risks must be documented and monitored**—All key programmatic risks are documented in a risk register that contains relevant information about the risk, including underlying causes, probability of occurrence, potential impact, mitigation strategy, and status. The risk register is discussed in more detail below.
- **Risks are "owned"**—All key risks are assigned a named owner within the team responsible for monitoring and control of the risk. Additionally, specific mitigation actions are assigned to named team members who are in the best position to execute these actions, with due dates for their completion. Specific responsibilities are discussed in the Organizational Structure section below.
- **Communication and reviews are regular**—The risk register is reviewed weekly and updated to reflect the current status of the program and its risk management efforts. Progress on mitigation actions, status of key program risks, and mitigation actions along with any new risks that have arisen is reported monthly.

The Authority has developed and will continue to develop tailored mitigation strategies based on the nuances of a particular risk. Some general, overarching themes exist, such as balanced risk transfer and contracting strategies.

Balanced risk transfer

The Authority is aligning technical and operational risk transfer with commercial and financial risk transfer to realize the benefits of a balanced risk transfer approach. For example, transferring the responsibility of construction and operation to a private-sector partner insulates the procuring authority only to the extent that the private-sector partner also bears the appropriate level of financial risk. See Chapter 4, Business Model, for more detail on business models being considered.

Contracting strategies

The Authority is also planning to capture the benefits of innovative contracting strategies to transfer risk to a private-sector partner. Other jurisdictions implementing a HSR system have used innovative contracting strategies that place the responsibility for risks on a private-sector contractor to reduce the risk borne by the procuring authority. Such contracting methods include the design-build model, and the design-build-finance-operate-maintain model. See Chapter 4, Business Model, for more detail on contracting strategies being considered.

For example, the Authority is using a design-build contracting method for the first construction segments of the IOS. The first design-build contract for the IOS has been developed and the procurement is underway. This contract transfers a significant amount of risk to the design-build contractor. This approach to risk transfer via a design-build contract also will be used by the Authority for the remaining construction packages for the IOS to achieve cost and schedule certainty.

Risk management plan

The Authority has implemented an ongoing risk management program with the objective of reducing the risk through formal processes and procedures. These processes allow the Authority to understand and manage the key risks and their impact on the program's objectives. The Authority manages risk using industry standard risk management tools, as discussed below. The risk management plan is continually reviewed and refined to take account of current information, program development, and stakeholder feedback. The primary objectives of the process are as follows:

- Minimizing differences between project plans and objectives
- Determining risks and costs of proposed project changes
- Increasing transparency regarding challenges to project plans and objectives
- Exploring project opportunities
- Using priorities to identify project alternatives
- Minimizing unknown risk
- Rationalizing allocation of resources
- Informing key stakeholders

Organizational structure

The Authority has implemented an organizational structure to manage risk internally, on both a programmatic and project level. The program risk manager is responsible for establishing and overseeing risk analysis methodologies and procedures; coordinating risk management activities among the Authority, program management, and regional consultant teams; and reporting on status of overall program risk management activities.

The engineering risk manager is responsible for overall coordination of technical risks, including informing the program risk manager of any gaps in the current risk register relating to risks identified by the engineering management team and ensuring implementation of appropriate mitigations to technical risks.

Regional managers are responsible for ensuring that risks identified in the program risk register provide a current and comprehensive representation of the risks within their region. Regional managers are also responsible for motivating response planning, supporting quantitative risk assessment, preparing for quantitative risk analysis, and incorporating into their work plans the resources and time required to execute specified mitigations.

Regional risk managers work with regional teams to identify and assess risks to the program's scope, cost, and schedule objectives and develop appropriate mitigation strategies and actions; facilitate quarterly risk workshops; coordinate with risk owners and regional consultant risk managers to monitor risks and implement risk response strategies; and report on progress monthly to the program risk manager.

Regional consultant risk managers coordinate with the risk owners to monitor risks and implement risk response strategies and mitigations, report on progress updates for regional consultant-owned risks and response actions as part of the regional consultant's monthly progress report, and coordinate with the regional risk manager on risk management activities.

The risk owner (regional consultant, PMT, or Authority team members) develops and updates the assigned risk response strategy, as necessary; monitors the assigned risk; informs the regional manager, regional risk manager, and regional consultant risk manager of any changes to its status; and executes the agreed upon response strategy and associated action items for assigned risk.

In addition to the above dedicated risk management staff, the Authority intends to augment the program's risk management organization with an Authority risk manager, as discussed in the Staffing and Organizational Structure section, above.

At the regional level, risk management process and protocols are documented in a technical memorandum, *Risk Register Development Protocol for Regional and Core Systems Teams TM 0.6*.

To complement its internal risk management procedures, the Authority has the benefit of external project reviews that help provide additional perspective and guidance on appropriate risk management processes. The Authority also has extensive interaction with funding agencies and, as such, is subject to those agencies' rigorous risk programs and oversight.

Risk assessment workshops

Risk assessment workshops are conducted regularly by the Authority and its consultant team to assess identified risks, mitigation strategies, and management plans. The risk manager facilitates the identification of risks and appropriate management strategies and mitigations through workshops and ongoing risk reviews with key personnel with Authority staff and consultant teams. Risk workshops take place at project milestones (i.e., 15 percent design, 30 percent design, start of final design and construction, or start of a critical contract package procurement) with the frequency of formal reviews increasing as the program advances. Formal program-level reviews, by the Authority, its staff, and consultants, are held quarterly. For regions within the first construction segments of the IOS, workshops are held monthly. For other regions, formal reviews are held quarterly.

In addition to formal risk management workshops and risk review sessions with key personnel, monthly meetings are held with senior project management to discuss key programmatic risks, management strategies, and progress on continuing mitigation actions. As indicated above, at the regional level, each section also has a dedicated two-person team who continually reviews individual risks with team members, monitors progress on mitigation actions, and updates the register to reflect the current status and risk environment.

Risk register

The risk register is the tool that integrates risk identification, assessment, management, and mitigation status with the data and information on risks. It is an iterative and dynamic document, continually changing as the program and project advances and new information about risks is developed and refined. In addition, a risk register is an input into and aids in the estimate of contingency levels and quantitative risk adjustments, as discussed below. The program risk register contains a description of the risk, including primary cause and potential impact on cost and/or schedule elements, risk owner, management strategy, and planned mitigations. Both ownership/responsibility and specific mitigation actions are assigned to named individuals based on which regional consultant, PMT, or Authority member is in the best position to manage the identified risk. If applicable, identified risk can trigger development of contingency plans for specified risks. The risk register serves as a communications tool, identifying and prioritizing the program challenges, and as an action plan, specifying actions to be taken by the identified team members to limit the project's risk exposure.

Monte Carlo simulation (risk analysis)

Using the information developed in the risk register as a key input, quantitative risk analysis is employed at a program level. Such a quantitative risk analysis aggregates risks numerically that are assessed for probability of occurrence and potential cost or schedule impact. Based on this information and the underlying cost and schedule estimates, it simulates possible project cost and schedule outcomes. The Authority will employ Monte Carlo simulation for quantitative cost and schedule risk analyses to model the likelihood of particular cost and schedule outcomes given the identified risks and other uncertainties. Monte Carlo simulation quantifies the probability that the project and its phases will finish within objectives, identifies key risks and uncertainties driving cost and schedule estimates, and motivates monitoring and control of available cost and schedule contingency against risk exposure. This tool is

particularly helpful in quantifying the likely financial impact of multiple program/project risks and associated risk contingencies that are input into the total project costs.

Summary

The Authority has implemented a detailed risk management process with the objective of reducing risk through formal processes and procedures. These processes allow the Authority to understand and manage key risks and their impact on the program's objectives. An overall risk management plan and organization has been established, and foreseeable risks have been identified that may threaten the program's viability. In addition, the causes of each risk have been investigated to determine the underlying driver and cause.

This process is integral to the development of the program and will continue to be refined as the program progresses. This will allow further detailed analysis of the high-level program risks identified in this chapter. Furthermore, detailed risk analysis will be carried out for each segment, and this process already has commenced with the detailed technical risk register for the first construction of the IOS.

The risk analysis will be used as a key foundation in the development of commercial agreements with the private sector for design and construction of the first IOS segment as well as future sections of the IOS.

The program's development plan has been structured to help mitigate the following key risks:

- **Enhancing the value of early investments**—The Authority has adopted the blended operations strategy to allow other operators to use the first IOS segment and portions of the IOS before commencement of HSR service. This approach increases the value of early investments, provides earlier benefits to California, and allows the system to be built up over time and “walk before it begins to run.”
- **Schedule and approval**—The program has been analyzed assuming a schedule delay due to funding availability. A five-year delay is included in the Business Plan that should mitigate many of the schedule and approval risks.
- **Project cost**— The Phase 1 Blended system strategy has been adopted, which allows HSR to reduce the amount of dedicated track to be built, reduces costs, and accelerates benefits. Significant on-the-ground engineering assessment has been completed in the last two years to reduce the risk in planning estimates. The risk of construction overruns is significant in government projects, and it is critical that portions of this risk be transferred to the private sector through design-build, design-build -finance-operate-maintain, and other structures described in the business model.
- **Demand and ridership**—Estimates have been reduced and peer reviewed and a range of revenue scenarios have been evaluated for sensitivity. High, Medium, and Low revenue estimates all illustrate that the project will generate a positive operating cash flow.
- **Financing**—Financing strategies align with successful high-speed rail projects in other parts of the world, including HS1 in the U.K. Financing is timed to align with project cash flows to enhance project value.

While all of the risks identified in this chapter are significant, two require the special focus of the Authority and other state agencies and officials:

- **State staffing**—The Business Plan is predicated on having an organization with experienced staff who can execute it. Funding and filling the needed positions with professionals with high-speed rail experience are perhaps the single best investment that the state can make toward reducing costs and accelerating development of the program. Any delay in filling positions increases the risks in all other categories.
- **Funding**—The amount and timing of funding for the program remains a risk. Major accomplishments have been made to mitigate this risk for the IOS. Notably, the Authority has secured a backup funding commitment from the state for funding the full IOS should the estimated amount of federal funding not materialize. In addition, the blended approach provides for fully functioning segments after each phase of the program. The ability to develop the program through a set of self-sufficient, stand-alone projects allows funding risk to be addressed incrementally rather than on a full program basis. This allows individual decisions to be made on the merits and benefits of each incremental phase.

