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The California High Speed Rail Proposal: A Due Diligence Report

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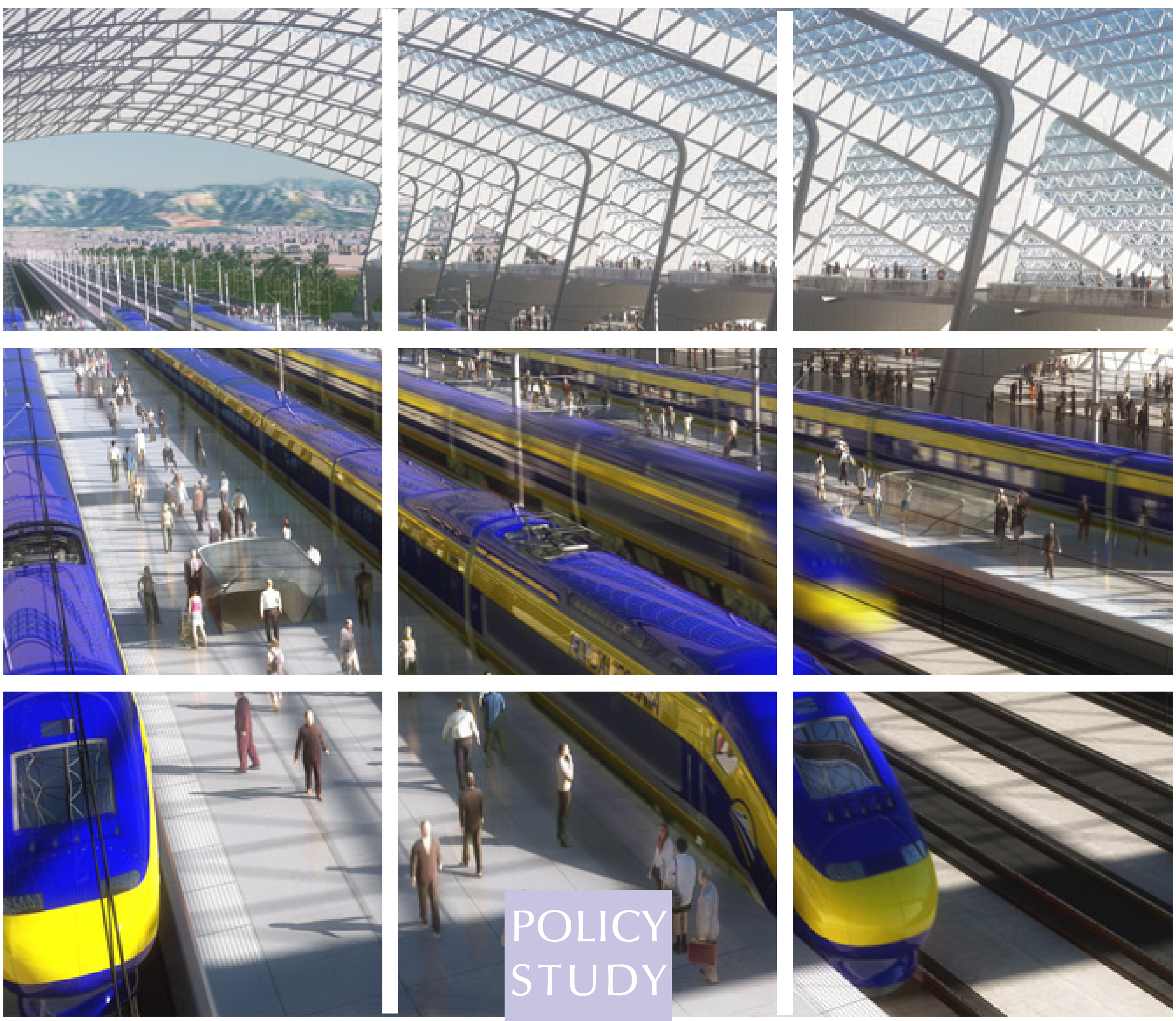

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Executive Summary

The purpose of this Due Diligence Report is to examine the proposal to build a California high-speed rail system (HSR) between the San Francisco Bay Area and Sacramento to Los Angeles and San Diego via the San Joaquin Valley. The general plan is to build a system of from 700 to 800 miles with an initial state general obligation bond of $9 billion and a similar amount in grant funding from the federal government. The balance of what has now become at least a $54.3 billion system would be provided by private equity investors and commercial bond purchasers. As is noted below, the system has already encountered substantial capital cost increases and this Due Diligence report projects that the final cost of the system is likely to be between $65.2 billion and $81.4 billion (2008$).

The California High-Speed Rail Authority (CHSRA or Authority), which is responsible for the project, anticipates that operating profits will pay for operating expenses, profits to private investors, debt service to commercial bond holders and sufficient revenues to build segments beyond Phase I (downtown San Francisco to Los Angeles and Anaheim). This would include a line from Los Angeles through the Inland Empire to San Diego, a line connecting Sacramento to the system in the San Joaquin Valley, a line through Altamont Pass and an East Bay line from San Jose to Oakland. The CHSRA has expended $58 million in state funding during the last 10 years planning such a system of "bullet trains."

It is possible that HSR can serve legitimate public and environmental purposes and be a financial success in California. However, the current CHSRA proposal cannot achieve such objectives. The principal message of this Due Diligence report is that CHSRA's plans have little or no potential to

be implemented in their current form and that the project is highly risky for state taxpayers and private investors.

The CHSRA plans as currently proposed are likely to have very little relationship to what would eventually be built due to questionable ridership projections and cost assumptions, overly optimistic projections of ridership diversion from other modes of transport, insufficient attention to potential speed restrictions and safety issues and discounting of potential community or political opposition. Further, the system's environmental benefits have been grossly exaggerated, especially with respect to reduction of greenhouse gas emissions that have been associated with climate change.

The CHSRA documentation provides virtually no objective analysis about risks and uncertainties, nor has CHSRA documentation been scrutinized in an independent review. This report is such an effort—which is why it is a Due Diligence Report—one that examines the CHSRA's documentation based on empirical data, historical trends and domestic and international experience.

This report specifically examines the following topics: HSR ridership and revenue, demographics, construction costs, operating costs, financing costs, airport and highway alternatives, train speeds, train designs, safety regulations and standards, greenhouse gas reductions, potential community opposition and historical experience in the United States. Regarding ridership and costs, this report evaluates projections from CHSRA and also develops independent projections.

Financial Prospects

The HSR system can be categorized as a "mega-project," one taking many years to decades and many billions of dollars to construct and put in operation. Such mega-projects run high risks of failing to meet their ridership projections, financial forecasts and other objectives. This analysis compares the CHSRA's proposed system with major HSR systems operating overseas. It is noteworthy that California is proceeding with HSR plans based on assumptions that may be appropriate to European and Asian environments but hold little applicability in the state. Moreover, it is not clear that the world's HSR systems have typically covered their operating and capital costs without subsidies—a determination that would be appropriate in a due diligence process for any commercial HSR proposal.

The CHSRA and state officials are proposing or in the past have proposed sources of public funds to pay for HSR's construction and operation, which include bond issues, sales taxes and matching funds from the federal and local governments. Such an array of public funding is expected to induce private investment. The state Senate Transportation and Housing Committee observed that Californians are being asked to be "investors" in a project based on promises of commercial return. However, most commentary and analysis by the Authority relies on unrealistically optimistic forecasts, is promotional in nature, and falls far short of conveying the project risks to taxpayers and potential investors.

The CHSRA lacks a comprehensive financing plan. The proposed state bonds would be insufficient to build Phase I, much less the rest of the system. Little appears firm about potential matching funds from federal and local governments and from potential investors. The state Senate Transportation and Housing committee has issued cautionary statements about the availability of matching federal funds. Also, CHSRA advisor Lehman Brothers has outlined risks that can be a barrier to private investment, including cost overruns, failure to reach ridership and revenue projections and political meddling. Meanwhile, the cost of the project continues to grow.

It should give pause that previous HSR projects have been halted in three states—California (for Los Angeles–San Diego), Texas and Florida. The federally sponsored HSR program for Boston–New York–Washington serves only a fraction of its projected ridership and carries a fraction of the passengers that European and Japanese lines carry. Despite such data going back decades, it does not appear that the CHSRA has taken into sufficient account market, costs, financing or community concerns.

In the final analysis, it will be most difficult for CHSRA to obtain sufficient financing to complete the Phase I San Francisco–Los Angeles–Anaheim route. This Due Diligence report concludes that commercial revenues from that route are unlikely to be sufficient to pay operating costs and debt service, much less finance Phase II and other extensions. As a result, it seems highly unlikely that the Inland Empire–San Diego, Sacramento, East Bay San Jose–Oakland and Altamont Pass routes will be built. Further, in the worst case, funding shortfalls could require greater use of improved conventional rail infrastructure in Phase I, which could add hours to the promised travel times.

All of this could lead to negative financial consequences, such as substantial additional taxpayer subsidies, private investment losses, and commercial bond defaults.

Costs and Revenues

To determine a more realistic construction cost estimate, it should first be noted that capital costs have risen 50% to $49.0 billion in 2008$ (or $45.4 billion in 2006$) at the same time the Oakland–East Bay–San Jose line (referred to as the “Missing Phase” in this report) has been dropped from the plan. It is estimated that including the Missing Phase would raise the cost to $54.3 billion (2008$), based upon CHSRA projections. The system, including Phase I, Phase II and the Missing Phase is likely to escalate in costs to between $65.2 billion and $81.4 billion (2008$). Additional segments, referred to as the “Implied Phase” (Altamont Pass, Anaheim–Irvine and the Dumbarton Bridge over lower San Francisco Bay) would raise costs even further.

During severe funding shortages, more expensive urban route sections would be particularly at risk and new HSR infrastructure could be relinquished in place of improvements to existing tracks. The

HSR trains could gain access by sharing upgraded tracks with slower commuter rail and freight trains on the Peninsula line in the San Francisco area and Metrolink in Los Angeles and Orange County. Trains on such a “skeletal” HSR system would offer slower schedules, which could seriously reduce ridership and revenues.

This report offers a Case Study about what can go wrong should funding be insufficient to complete the Inland Empire line between Los Angeles and San Diego. The Authority may view service to San Diego as part of its continuing mission and revive plans to operate high-speed trains over an upgraded in-place rail alternative—the Coastal Route via Fullerton, Anaheim, Tustin, Irvine, San Juan Capistrano, San Clemente, Oceanside, Encinitas and Del Mar. The route change would likely stir strong opposition in communities that helped stop a former high-speed rail plan.

It is likely that HSR will require substantial additional taxpayer funding to complete Phase I, Phase II, and the Missing Phase or more of the state will go without high-speed rail service than is immediately apparent. Also, it is likely that the system will not generate sufficient revenues to cover either its operating costs or debt service. As result, continuing subsidies from California taxpayers are likely to be necessary and made a permanent part of Sacramento’s annual appropriations process.

Travel Time, Speed and Train Design

Based upon international HSR experience, it appears that the CHSRA speed and travel time objectives cannot be met. As a result, HSR will be less attractive as an alternative to airline travel and is likely to attract fewer passengers than projected. Notably, the CHSRA’s anticipated average speeds are not being achieved *anywhere in the world*, including on the most advanced systems. Additionally, incomplete consideration has been given to California’s urban and terrain profiles where HSR trains must operate more slowly than circumstances allow in, for example, France. This study, by assuming realistic speeds, estimates that a non-stop San Francisco–Los Angeles trip would take 3 hours and 41 minutes—59 minutes longer than the statutory requirement of 2 hours, 42 minutes. In the future, the CHSRA’s travel times may be further lengthened by train weight and safety issues and also by political demands to add stops to the system.

The proposed HSR system appears unlikely to provide travel time advantages for long-distance airline passengers. It is likely that HSR door-to-door travel times would be greater and there would be considerably less non-stop service than air service. Moreover, HSR would be unattractive to drivers in middle-distance automobile markets because little or no door-to-door time savings would be achieved and costly local connections would often be required (rental cars or taxicabs). Another convenience factor is that California urban areas lack the extensive local transit infrastructure that connects with HSR systems found in dense Asian and European urban areas. The HSR system will experience disadvantages and commercial challenges in competing with air and auto travel that have been understated in CHSRA documentation.

No existing European or Asian HSR train capable of meeting the speed and capacity goals of the CHSRA system can legally be used in the United States. The CHSRA's intention to share tracks with commuter and freight trains complicates designing a train to meet Federal Railroad Administration (FRA) safety and crashworthiness standards that are considered the toughest in the world. The necessary regulatory approvals of an overseas train are unlikely to be achieved without substantial changes in design and weight.

The CHSRA has yet to decide on basic design specifications for a train and has based studies on inconsistent seating capacities of 450-500, 650, 1,175, 1,200 and 1,600 per train. Also, a train redesigned for the U.S. will become much heavier and is thus unlikely to reach promised speeds. In short, the Authority does not have a usable train design and the eventually required modifications could substantially impair operating performance.

Because of the above circumstances it is fair to state that the CHSRA's train may become the world's longest and heaviest HSR train—yet be expected to operate at the highest speed current technology permits. It is likely that a series of designs, tests, prototypes and safety reviews never before achieved anywhere in the world must succeed for the CHSRA's train to become a reality. Any degradation in performance would negate the CHSRA's assumptions on which it has based travel times, ridership and revenues, energy requirements, GHG emissions, noise generation, capital and operating costs, and overall system financial performance.

Ridership Projections

It appears that the CHSRA 2030 ridership projections are absurdly high—so much so that they could well rank among the most unrealistic projections produced for a major transport project anywhere in the world. Under a passenger-mile per route-mile standard, the CHSRA is projecting *higher* passenger use of the California system than is found on the Japanese and French HSR networks despite the fact that these countries have conditions that are far more favorable to the use of HSR.

The CHSRA's ridership projections reflect assumptions contrary to actual experience, forecasts inconsistent with independent projections, load factors and other calculations that are highly questionable, and reliance on extraordinarily low fares that are not found on similar systems.

The CHSRA has been increasing forecasted ridership over time and has issued a Base Projection of 65.5 million intercity riders and a High Projection of 96.5 million intercity riders for 2030. The CHSRA ridership projections are considerably higher than independent figures developed for comparable California systems in Federal Railroad Administration and University of California Transportation Center at Berkeley studies.

Using generous assumptions this Due Diligence Report projects a 2030 base of 23.4 million intercity riders, 64% below the CHSRA's base of 65.5 million intercity riders, and a 2030 high of

31.1 million intercity riders, nearly 60% below the CHSRA's high of 96.5 million. It is likely that the HSR will fall far short of its revenue projections, leading to a need for substantial additional infusions of taxpayer subsidies.

Greenhouse Gas Reduction

Claims about HSR's environmental benefits have been greatly overstated. California HSR will do little to reduce CO_2 emissions (greenhouse gas emissions). Based upon California Air Resources Board projections, HSR would ultimately remove CO_2 emissions equal to only 1.5% of the current state objective. This is a small fraction of the CHSRA's exaggerated claims of "almost 50%" of the state objective. The Intergovernmental Panel on Climate Change (IPCC) has indicated that for between $20 and $50 per ton of reduced greenhouse gases emissions, deep reversal of CO_2 concentrations can be achieved between 2030 and 2050. A McKinsey report indicates that substantial CO_2 emission reductions can be achieved in the United States for less than $50 per ton. Yet the cost per ton of CO_2 emission removal by HSR is far higher—between 39 and 201 times the international IPCC ceiling of $50. The reality is that HSR's impact on CO_2 would be inconsequential while being exorbitantly costly.

Hence, HSR's CO_2 emission reduction strategy cannot be legitimately included as an element of a rational strategy for reducing GHG emissions. In view of the untenable traffic impact projections and other factors, CHSRA's claims are considered specious. There is a need for an objective, independent assessment of HSR's CO_2 impacts, including both operations and construction. Until such an analysis is completed, CHSRA should cease making any statements about CO_2 or other air quality impacts.

Safety

Terrorism against rail targets is a concern considering the extent of attacks that continue to occur on rail systems around the world. The Authority appears to be have given insufficient attention to this issue notwithstanding the RAND recommendation to industry and government regarding improvements to domestic rail security. The CHSRA documentation provides virtually no evidence that a proper security assessment of the proposed HSR system has been undertaken, nor does it appear that security applications and methodologies elsewhere have been reviewed. The Authority assumes minimal security at HSR train stations and concludes passengers will be spared airport-like security screening and delays. However, should more stringent security measures become necessary, the CHSRA's ridership demand forecasts would be even further undermined. The CHSRA has not issued a low-end ridership forecast based on such a circumstance.

Opposition

Emerging public opposition will likely spread as site-specific urban, suburban and rural impacts become better understood. It is unlikely that the California HSR program will find smooth sailing among impacted communities. This finding is based in part on nascent opposition to the project. Opposition to prior HSR projects has been based on underestimated costs, overestimated ridership, eminent domain and environmental impacts. Also, the credibility of HSR promoters has waned as pledges of "no subsidy" or "only low subsidies" turned into calls for high subsidies. This Due Diligence Report identifies such factors as weaknesses in the CHSRA planning process.

In prior cases opponents have shown great resourcefulness in sustaining campaigns to oppose HSR construction. Opposition could spread, particularly in communities where train speeds and noise would be considered excessive, where massive elevated railways would create a "Berlin Wall" effect that divides communities—a prospect that has caused Menlo Park and Atherton to join in a lawsuit against the CHSRA's environmental review process—or where a history of staunch opposition exists, such as in Tustin or San Diego County.

Diversion from Other Modes of Transport

The assertion that the Highway and Aviation Alternatives to HSR will cost $82 billion is highly inflated and based on dubious assumptions and fundamental flaws. Examples include the CHSRA proposing far more highway construction than is necessary to accommodate the demand that would exist if HSR were not built. This Due Diligence Report estimates that with realistic estimates regarding highway construction costs and diversion of drivers, HSR could reduce highway construction needs by approximately $0.9 billion. This immense cost difference illustrates how modest a future role HSR will play in reducing highway congestion. In short, meeting the highway demand that would occur if HSR were not built would require much less investment compared to the cost of HSR.

Also, diversion of air travelers is over-estimated. The CHSRA assumes that airlines will cancel a large share of the flights within California because passengers will have switched to HSR—and the diversion will free up airport capacity and make it possible to avoid costly airport expansions. This is not the experience even on the premier Japanese and French systems, which show that strong air markets remain after HSR corridors are in operation. Moreover, the CHSRA treats the commercial aviation system as if it is static—as if efficiencies to enhance capacity are impossible.

The CHSRA alternatives appear to be of little value in genuine cost analysis and cannot be taken seriously. They are, in fact, little more than "straw men," which have the effect of misrepresenting the choices that are available to policy makers in California, in such a way that HSR, which is exceedingly expensive, is made to appear affordable.

Conclusion

Considering the factors enumerated above, it appears unlikely that sufficient private funding and public subsidies will be found to finance the complete HSR plan. There are no genuine financial projections that indicate there will be sufficient funds to complete Phase I, much less Phase II or any other phases. It is possible that the system will either be built only in part or not at all.

Claims of profitability could not conceivably be credible under even the most optimistic assumptions, unless some or all capital and debt costs are ignored. This due diligence analysis indicates that the San Francisco–Los Angeles line alone by 2030 would suffer annual financial losses of up to $4.17 billion, with a small profit possible under only the most optimistic and improbable conditions.

Finally, the HSR system as envisaged in state statute appears highly unlikely to be delivered under the present plan. The taxpayers and potential investors can be appropriately served only by objective analysis, not by the kind of exaggerations and projections that would be expected in brochures promoting speculative real estate investment. That nearly $58 million in public funds has been spent on such a flawed planning process makes it all the more troubling.

There is little likelihood that the passenger or revenue projections will be met, that the aggressive travel times will be achieved, that the service levels promised will be achieved, that the capital and operating costs will be contained consistent with present estimates, that sufficient funding will be found, or that the system will be profitable.

It is likely that these circumstances will represent an expensive and continuing drain on the state's tax resources. Under three of the four scenarios outlined in this report, an early bond default, taxpayer bailout, and investment losses by private funding participants could occur.

To address a fiscal shortfall, past and present proposals to finance HSR's construction and operation through various federal, state and local taxpayer subsidies could be futile. Hence, the HSR system is unlikely to be completed in any form consistent with the current plan and that even the delivery of a recognizable Phase I could be most difficult. The outcome could mean investors in the project will see no financial returns and the HSR system as proposed could require significant subsidies from California taxpayers in perpetuity.

A summary of the CHSRA and Due Diligence projections is found in Table 1.

Table 1: Summary of CHSRA and Due Diligence Report Projections		
	CHSRA	Due Diligence Report
Annual Ridership: 2030: Base, Intercity Only	65,500,000	23,400,000
Annual Ridership: 2030: Base, Intercity + Commuter	88,000,000	No Projection
Annual Ridership: 2030: High, Intercity Only	96,500,000	31,100,000
Annual Ridership: 2030: High, Intercity + Commuter	117,000,000	No Projection
Capital Cost: Entire System (2008$): Low*	$54,300,000,000	$65,200,000,000
Capital Cost: Entire System (2008$): High*		$81,400,000,000
Capital Cost: Phase I (2008$): Low	$33,100,000,000	$39,700,000,000
Capital Cost: Phase I (2008$): High		$49,600,000,000
Operating Cost: Phase I (2008$): Low	$1,100,000,000	$1,430,000,000
Operating Cost: Phase I (2008$): High		$1,760,000,000
Fastest Non-Stop Express Travel Time: LA-SF	02:38	03:41
Greenhouse Gas Reduction (Tons of CO_2): 2030**	1,770,000	630,000
Share of California 2020 Goal	1.0%	0.4%
Cost per CO_2 Ton Reduced: Low	$1,949	$7,409
Cost per CO_2 Ton Reduced: High	$2,409	$10,032
Times CO_2 IPCC $50-per-Ton Ceiling: Low	39	148
Times CO_2 IPCC $50-per-Ton Ceiling: High	48	201
Net Profit: 2030: Phase I: Optimistic Midpoint	No Projection	($350,000,000)
Net Profit: 2030: Phase I: Pessimistic Midpoint	No Projection	($3,590,000,000)
Unmet Capital Need: Phase I	No Projection	$7,600,000,000 to $33,100,000,000
Unmet Capital Need: Entire System	No Projection	$28,800,000,000 to $64,900,000,000
Note: *Entire system cost. Includes Missing Phase. Does not include Implied Phase **CHSRA greenhouse gas reduction adjusted to account for improved automobile and airline fuel efficiency.		

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Part 1

Introduction

The Authority has an ambitious plan to link major metropolitan areas with a high-speed rail system to reduce congestion at airports and on highways. There is a need for a due diligence examination of these plans.

High-speed rail systems have been operating in Japan since 1964, in France since 1981, and on some lines elsewhere in Europe and Asia. (See Part 3, International Experience.) Such service has generated interest in the United States and has been proposed as a strategy to relieve highway and airport congestion in markets of under 500 miles. This, proponents claim, would reduce the necessity for highway and air system expansion. Advocates also claim that significant reductions in greenhouse gas emissions would result as high-speed rail captures a substantial portion of the intercity travel market from automobiles and airlines. The California High-Speed Rail Authority (CHSRA or Authority) has been planning such a system to link major population centers, a system that it states can operate at a profit.

Description of California High-Speed Rail Plan

For travelers, the idea of taking quick train trips between California urban areas can be attractive. It is time to examine the significant differences between the *idea* of and the *multiple realities* of financing the capital costs for construction, paying for its continued operation, and operating the HSR system in a commercial and geographical environment that is quite unlike circumstances found overseas.

The CHSRA described its planned system as follows in March of this year:

> *The HST [high-speed train] will provide for state-of-the-art, statewide, high performance passenger rail service comprising over 800 route miles for the full system. The Authority has proposed high-speed train service between the major metropolitan centers of the San Francisco Bay Area, Sacramento in the north, through the Central Valley, to Los Angeles, Orange County, the Inland Empire and San Diego in the south. The proposed HRS system is projected to carry between 93 million and 117 million passengers annually by the year 2030.*[1]

Legislative Requirements

State legislation maintains "that a high-speed passenger train network as described in the High-Speed Rail Authority's Business Plan is essential for the transportation needs of the growing population and economic activity of this state."[2]

Senate Bill 1856, enacted in the 2002 session of the legislature places significant routing and performance requirements on the HSR system, including "maximum nonstop service travel times" for the following corridors:[3]

- San Francisco–Los Angeles Union Station: 2 hours, 42 minutes.
- Oakland–Los Angeles Union Station: 2 hours, 42 minutes.
- San Francisco–San Jose: 31 minutes.
- San Jose–Los Angeles: 2 hours, 14 minutes.
- San Diego–Los Angeles: 1 hour.
- Sacramento–Los Angeles: 2 hours, 22 minutes.
- Sacramento–San Jose: 1 hour, 12 minutes.
- Inland Empire–Los Angeles: 29 minutes.

SB 1856 requires that the trains be capable of operating at sustained speeds of at least 200 miles-per-hour (mph), or 322 kilometers-per-hour (kph). In fact, the CHSRA's plans are for the "bullet trains" to operate at up to 220 mph (354 kph). Non-express or "local" trains are required to serve all intermediate stations, and the system is required to have a maximum of 24 stations.[4]

Table 2 provides a summary of the planned HSR system, using CHSRA terminology (Phase I and Phase II) and terminology developed in this Due Diligence report—Missing Phase, Implied Phase, and a Skeletal System that might represent the final system due to funding shortages.

Table 2: Phases and Systems		
Phase/System	Source	Routes
Phase I	CHSRA Current Plan	San Francisco-San Jose-Pacheco Pass-Fresno-Palmdale-Los Angeles-Anaheim
Phase II	CHSRA Current Plan	Sacramento connection (Merced area) to SF Bay Area and Los Angeles; San Diego-Riverside-Los Angeles
Missing Phase	In Earlier CHSRA Plans	Oakland-East Bay-San Jose
Implied Phase	Intermittently referred to by CHSRA and its supporters	Altamont Pass Dumbarton Bridge Anaheim-Irvine
Skeletal System	Minimum system required to allow HSR trains to operate between San Francisco and Los Angeles, though at well above presently anticipated travel times	Gilroy to Palmdale (Entry to downtown Los Angeles, San Jose and downtown San Francisco at conventional commuter rail speeds once existing routes are double-tracked and upgraded.)

Assembly Bill 3034 was still under consideration when this report went to press. If approved by the governor, AB 3034 would allow bond funding to be expended on the Altamont Corridor connecting the Central Valley to the East Bay and from Anaheim to Irvine, in addition to Phase I, Phase II and the Missing Phase.

State Financial Estimates

The 1999 *Business Plan* estimated that the entire system would be built for $30.3 billion ($25 billion in 1999$). The 2005 Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) raised the estimate to $40.5 billion. By 2008, documents prepared for a meeting for potential investors indicated that the costs had risen to $45.4 billion. This figure included $30.7 billion for Phase I (Anaheim–San Francisco) and $14.7 billion for Phase II (Sacramento and San Diego extensions).[5]

The Authority adds that “the service provided by the system is expected to yield annual operating surpluses in excess of $300 million” (in 1999$).[6] The most recent declaration was in March 2008 when the CHSRA represented to Governor Arnold Schwarzenegger that “California’s proposed system will bring a $1 billion annual profit or surplus, once built.”[7]

The CHSRA planners indicate that construction of Phase I would be financed primarily with public funding. Phase I assumes a $9.95 billion general obligation bond that will be put before the voters in the November, 2008 election. Of that amount, $9 billion would be directed to the high-speed system while the other $950 million would be available elsewhere in the state for “feeder systems” such as Amtrak, commuter rail, and local transit agencies with which the HSR system would eventually connect. Proponents have expressed the hope to obtain another $9 billion in federal funds to match the money from the bonds; additional financing would be obtained from private investors for completion of the system.

Virtually none of this funding is in place. This broad outline of a financing program has been rendered irrelevant as a result of the huge increases in project costs. At the moment, the CHSRA has no detailed funding plan for the entire system. The CHSRA is also interested in obtaining additional funding from local units of government, such as counties, municipalities and regional transit agencies. Again, none of this funding is in place and in the difficult funding environment that has characterized local governments in California, any material local funding level could be challenging to obtain.

The CHSRA has projected opening the San Francisco–Los Angeles–Anaheim line via San Jose and Fresno in about 2020. A second phase designed to link Los Angeles–San Diego via Riverside, and to connect Sacramento to the system in or near Merced is expected by the CHSRA to begin five to ten years after the initial phase.[8] In some instances, the planned HSR routes would be longer than highway distances and, of course, are longer than air distances.

Conclusion

The Authority has an ambitious plan to link major metropolitan areas with a high-speed rail system to reduce congestion at airports and on highways. Funding sources for HSR are expected to include riders, state taxpayers, the federal government, private investors and local governments. Some public officials and policy leaders recognize the significant challenges in financing and building the system.

Part 2

The Necessity for Due Diligence

A California Senate Committee observed that the public deserves a full accounting of the project's risks and benefits because the project has been portrayed as a future commercial success. This study relies on empirical data, historical trends and other data to apply a due diligence process to the proposal.

The Authority has spent $58 million in public funding to promote and plan for high-speed rail links among the state's major population centers. Due to the magnitude of the project and because the project has been portrayed as a future commercial success, there is a need for a due diligence examination of this plan.

To this end, this work is based on a methodical analysis of the rail proposal—the type that would be conducted by potential investors prior to advancing capital in support of a business proposal, project, venture or transaction. In the business world, due diligence means undertaking sufficient independent analysis to ensure that an acquisition is worth the proposed price.

Addressing Investment Risk

The state Senate Transportation and Housing Committee recently set the precedent for addressing taxpayers as investors and helps set the stage for everything that follows in this Due Diligence Report. Hence, the logic as it appeared in a June 2008 report from the Senate Committee deserves to appear at the onset of this study and is summarized as follows:

> *The California High-Speed Rail Authority has embarked upon a $33 billion program to provide high-speed rail service between Anaheim, Los Angeles, and San Francisco. An additional $7 billion will be required to extend service to San Diego and Sacramento. The project is not being developed as a conventional public works project to be built with pay-as-you-go funding, or by relying on public debt financing. Instead, the Authority is offering California's voters a business proposition. Should the voters approve the $9.95 billion measure on November's ballot, the Authority is anticipating using the bond revenues and future federal funds to attract a substantial amount of private capital. The Authority's underlying assumption is that the demand for high-speed rail is so strong that it will attract a private consortium to design, construct, finance, and operate the high-speed system, one that*

> *will generate sufficient revenue to repay the consortium's investment, cover the annual cost of operations, and provide a profit. The Authority assumes that the rail service will not require any future operating subsidy from the State of California. This will be a large and complex task given the uncertainty regarding federal funding and the limited state funding allocated to the project. Voters are being asked to make a major commitment. It is, therefore, imperative that voters and policy makers have a full accounting of the project's risks and benefits.*[9]

While the Senate Committee review is groundbreaking in presenting a serious discussion of investment risk associated with the project, it does not provide a level of detailed analysis. This report will perform that task. Moreover, the emphasis on risk in this document is justified because the CHSRA business plan is advocacy in nature and perils appear to be understated.[10]

In preparation for this study, thousands of pages of CHSRA's documentation spanning approximately a ten-year period have been reviewed. Also, reports from other state and federal agencies and documents from overseas high-speed rail systems have been examined. This report attempts to clarify material facts and outline foreseeable risks that have received insufficient public attention. Hence, it is a Due Diligence Report designed to help policy makers make informed decisions with respect to public funding. The Senate Committee report insists on the value of a prospectus in stating:

> *The Authority must update its business plan in a format consistent with a standard financial prospectus of the type that is required to be prepared for investors in new stock or bonding offerings. A prospectus discusses the investment opportunity, its financial strategy, its benefits to the investors, as well as the types and level of risk the investors are assuming. It is essential that voters be provided with adequate financial information concerning the project.*[11]

Californians are being asked to be investors in a project being portrayed as a future commercial success, but the CHSRA's documentation often relies on theoretical capabilities or reflects advocacy positions. This study relies on empirical data, historical trends and other data to evaluate key issues related to the program, namely:

- Ridership and marketability
- Demographics
- Costs and overall financing
- Operational issues including safety
- Train Speeds
- Technological developments and limitations
- Greenhouse gas emissions

- Community factors
- Possible line truncations or route substitutions
- High-speed rail experience elsewhere
- Highway and airport alternative scenarios
- Adequacy of planning

Moreover, this Due Diligence Report follows the admonition of the U.S. Securities and Exchange Commission (SEC) that disclosure documents should "speak to investors in words they can understand. Tell them plainly what they need to know to make intelligent investment decisions." [12] Indeed, policy makers and private parties *will* be making investment decisions regarding the high-speed system when they make decisions about public funds or commit their own private investments.

Limitations to Review

The following challenges were encountered in this due diligence analysis, as a result of difficulties and inconsistencies in the CHSRA documentation.

- **Reference Years.** At the time of this analysis, the horizon years of the CHSRA source documents are inconsistent. As one example, in some cases the latest available projections are for 2020 while in other cases 2030 projections are available.

- **Data.** Important data have varied widely. For example, various documents differ in the proposed route structures and estimated seating capacity of the high-speed trains. These variables could negatively affect the ridership that can be expected and thus cause a concomitant decline in projected revenues.

- **Costs.** Construction cost estimates are inconsistent. The Senate Committee report cites $33 billion to build the first phase (San Francisco–Los Angeles–Anaheim) and an overall project cost of $40 billion. Presumably, this information was obtained from CHSRA. Yet, CHSRA documentation prepared for an investors meeting during virtually the same time frame puts the figure at $45.4 billion.[13]

- **Ridership.** Variations in CHSRA's ridership projections claims are extensive and in many cases the data presented appear to be inadequate to support the conclusions reached. The Authority has acknowledged that it has commissioned a new ridership and revenue forecast. However, considering the exceptionally high demand that has been projected, it will be prudent for future forecasts to be subject to independent verification if they are to be considered plausible.[14]

Another function of a Due Diligence Report is to bring to attention costs that have been downplayed or overlooked.

- **Risk Minimization.** Environmental impact documents are replete with references to using the Union Pacific Railroad (UPRR) right-of-way. In 2008 when the UPRR declared its unwillingness to sell its land, the Authority's chairman said he was unconcerned.[15] However, land-purchase costs could increase and re-alignments could affects speeds, marketability and construction costs. A related issue is that landowners facing possible eminent domain proceedings may file legal challenges. Municipalities have already filed suits to require environmental impact statements to be redone.[16] Consequences could include construction delays and cost increases.

- **Employee Injury Risks.** A franchise operator will find exceptional risks regarding worker injuries and payouts. An anachronistic law, the Federal Employers' Liability Act (FELA) passed in 1908, subjects rail operators to costly, arcane and time-consuming tort-based provisions (all other industries are covered by less onerous no-fault workers' compensation laws).[17] An attempt to exempt a franchisee from FELA is certain to be met by opposition from the rail labor unions and the trial lawyers' lobby. It cannot be determined from the CHSRA documentation if such high-cost provisions have been included in operating cost projections.

- **Labor Demands.** A risk exists that labor organizations will demand unique provisions in contracts with high-speed rail operators identical to what they have with Amtrak, particularly a labor protection clause that provides generous severance compensation for up to five years if a job is abolished or moved more than 30 miles. Amtrak's protection obligations remain significantly higher than those of non-railroad corporations.[18] Because of the strength of railway labor unions, and because it is typical for the federal government to impose labor protection regulations on assistance, it is likely that such provisions would be applied to a California HSR system.

- **Subsidies.** Statements about taxpayer obligations are contradictory. For example, on January 11, 2008, the CHSRA chairman, Quentin Kopp, said at a state Senate Transportation and Housing Committee hearing that another bond measure after the November vote may be necessary if costs continue to rise.[19] Ten days later, on January 21, another CHSRA board member, Rod Diridon, insisted: "Having the people of California pay one-third the price of this project and then never again having to put money into a program that will expand and expand and expand is an awfully good deal for California."[20] After ten more days, on January 31, Chairman Kopp wrote to legislators: "We believe that if additional state funds appear needed for the remaining segments, it is the prerogative of the legislature to determine the amount, source and timing of such funds, similar to its action on Phase One."[21] By June 22, the chairman stated unequivocally that the HSR system would operate at a profit "without taxpayer subsidy."[22] It is unimaginable that such inconsistent statements would be made by corporate executives seeking investor financing without running afoul of securities regulators.

The Authority has stated that the proposed high-speed rail system "is one of the world's largest public works projects."[23] Thus it is even more imperative that all involved be cautious because "mega-project" financing has begun to breed mistrust. The leading worldwide infrastructure study on such projects concluded:

> *The cost estimates used in public debates, media coverage and decision making for transport infrastructure development are highly, systematically and significantly deceptive. So are the cost-benefit analyses into which cost estimates are routinely fed to calculate the viability and ranking of projects. . . . An important policy implication for this highly expensive and highly consequential field of public policy is for the public, politicians, administrators, bankers and media not to trust the cost estimates presented by infrastructure promoters and forecasters.*[24]

This report finds that the CHSRA's documentation and public statements are indeterminate as to the project's commercial viability and indeed suggest that the project is not feasible. This report finds that the CHSRA's documentation and public statements fail to confirm the project's commercial viability and the analysis in this report suggests that the project is not feasible.

Conclusion

The California Senate Transportation and Housing Committee observed that CHSRA ought to provide a financial prospectus on the HSR project because the project has been portrayed as a future commercial success. This study relies on empirical data, historical trends and other data to serve in part as a Due Diligence Report. It finds that conclusions in the CHSRA documentation are inconsistent, cost estimates have not been updated, projections appear to be based on data inadequate to justify the conclusions reached, risks in several areas (e.g., rights-of-way, liabilities for exceptional employee costs) are understated or completely ignored, and statements about future taxpayer subsidies are contradictory. The Authority has yet to balance issuance of its many advocacy documents with cautionary documents that are typically issued in an investment environment.

Part 3

Overview of High-Speed Rail

A. International Experience

High-speed rail systems operate in a number of countries overseas. The state of California is proceeding with its HSR plan based on assumptions that are appropriate to European and Asian environments but generally hold little applicability in the state.

High-speed rail systems have been developed in the United States, Japan, France (with a British line connecting through the Channel Tunnel), Germany, Spain, Italy, South Korea and Taiwan.

Generally, high-speed rail is defined as trains that reach 150 mph (241 kph) or more. The top commercial speed on one line in the world is now 217 mph (350 kph), which came about with China's launch in 2008 of Beijing–Tianjin service.[25] China expects to run at 236 mph (380 kph) on the planned Beijing–Shanghai line.[26] Within the TGV (*Train à Grande Vitesse*) system is the TGV-Est—operated between Paris and Strasbourg by the French National Railway (SNCF)—which reaches a top speed of 200 mph (322 kph). Japan's Bullet Trains were the first high-speed rail trains and today operate up to 186 mph (300 kph), as do trains in Spain, South Korea and Taiwan. Amtrak's Acela service reaches a top speed of 150 mph (241 kph) on a portion of its Washington–Boston route. While the infrastructure on the TGV-Est, Korea and Spanish HSR routes are designed to permit operations at 220 mph (354 kph), no trains currently operate at that speed. Even faster magnetic levitation (maglev) trains have been proposed for a few lines around the world, although the only commercial application is an airport line within the Shanghai urban area—one that reaches speeds near 270 mph (435 kph).[27]

The proposed California HSR is intended to provide service at a top speed of 220 mph (354 kph) from Sacramento and the San Francisco Bay Area to the Los Angeles and San Diego areas and points in between. The system has been variously described in planning documents as having a route length of from 700 miles to 800 miles.

Comparison With Routes Overseas

The Los Angeles–San Francisco "backbone" route is between 432 and 520 miles, depending upon the CHSRA source cited.[28] Plans are for the non-stop service to operate at under 2 hours and 40 minutes. Generally, the HSR routes most analogous to the Los Angeles–San Francisco route are the following:

- **Tokyo–Osaka Bullet Train.** The rail distance between these terminals is approximately 335 miles, shorter than the Los Angeles–San Francisco route–and the fastest travel time is approximately 2 hours and 30 minutes. Door-to-door rail and air travel times are similar to the California HSR, as proposed. Service began on this route in 1964.

- **Paris–Marseille TGV.** The rail distance is approximately 480 miles and the non-stop services take slightly more than 3 hours. Door-to-door rail and air travel times are similar to the California HSR as proposed. Service began on this route in 2001.

The new Madrid–Barcelona AVE service is similar in distance, rail travel time and air travel time to the Los Angeles–San Francisco route. However, this service has only recently begun to operate and so is referenced less frequently. The Taiwan and South Korea routes are also relatively new, far shorter than proposed for California, and are referenced less frequently.

Comparison of Markets

The market of the proposed California HSR is compared to markets for the Japanese Bullet Train and European HSR systems. (Comparisons with the Amtrak Acela will be found in Part 3, United States Experience.) There are considerable differences between these markets with the conditions in California being far less favorable to the development of HSR. Consider comparisons with Japan, as indicated below.

The Japanese were prudent to adapt their transport system by using rail to serve their dense populations stretched into linear corridors. Today the HSR market in Japan is the strongest in the world, and it is difficult to imagine a more favorable operating environment. The following factors combine to make HSR far more attractive in Japan than in California.

- The current population of the Japanese Bullet Train market is more than double that of the California market as projected for 2030. The counties and metropolitan areas that will have stations in the California system are projected to have less than 44 million people in 2030.[29] By comparison, the prefectures of Japan served by the Bullet Trains already have a population of more than 97 million.[30]

- The Japanese urban areas are considerably more dense than the California urban areas. This means that HSR stations are closer to more of the urban population than they would be in California.[31] In addition, the large Japanese urban areas have large central business districts (CBD's or downtowns). The Tokyo CBD has more than twice as many jobs as Manhattan has south of 59th Street. and the Osaka central business district is larger than any for which data is available, except for Tokyo and New York. Nagoya's CBD has more than twice as many jobs as the San Francisco CBD.[32] The CBD employment is a strong generator of ridership because HSR stations are located in the CBD and they are easily accessed by rapid transit,[33] by short cab rides or by walking. This gives the Bullet Trains a substantial market advantage.

- Japan has the developed world's most comprehensive transit systems. In the Tokyo and Osaka–Kobe–Kyoto urban areas, 63 and 56% respectively of urban travel is by transit.[34] In the third largest urban area, Nagoya, transit's share is approximately 25%. Approximately 80% of that transit travel is by rapid transit modes in each area, which tend to be competitive in travel time with cars (subways and commuter rail).[35] Finally, in each of these large urban areas, commercial revenues (including fares) account for more than 95% of operating *and* capital costs.[36] By contrast, the San Francisco urban (urbanized) area's transit market share is 3.8%, Los Angeles is 1.6%, San Diego 1.2%, San Jose 0.8% and Sacramento 0.7%.[37] The existence of Japan's comprehensive rapid transit systems, which were built as the urban areas spread out, makes near "seamless" travel possible throughout the Japanese urban areas. In California, the overwhelming majority of HSR trips are likely to require a car at one or both ends to complete the trip in a reasonable time and with reasonable comfort.

- The automobile ownership rate is considerably lower in Japan. The auto and SUV ownership rate per household is approximately 70% higher in the United States than in Japan.[38]

- Driving is considerably more expensive in Japan. Gasoline costs more and the intercity freeways have very steep tolls.

- Finally, each of the Bullet Train routes were preceded by a strong conventional rail service—a "ready market" from which a large portion of the high-speed rail ridership was attracted. Before the high-speed system opened in the 1960s, there was little air service and there were relatively few automobiles. Thus, much of the HSR ridership simply transferred from slower trains to faster trains. By comparison, California has a small market potential in diverting traffic from traditional rail services.

Europe's inherent HSR market advantages are not as great as those of Japan, but they are still superior to California's:

- Large urban areas are generally closer together than in California. Moreover, a number of these urban areas are clustered in relatively close proximity to the hub of Europe's HSR system, Paris. Western Europe's two largest metropolitan areas, London and Paris have a combined population of more than 24 million—approximately the same population as the Los Angeles and San Francisco combined statistical areas.[39] They are less than 200 miles apart compared to the 380 highway miles that separate San Francisco and Los Angeles. Also, Brussels, Antwerp, Rotterdam, the Hague, Amsterdam, Lyon, Lille, Aachen and Cologne, all metropolitan areas with more than 1 million people, are less than 300 miles away, and all are served by HSR from Paris.

- In addition to proximity, another important factor is that France is a very centralized nation. Much commercial travel in France requires connecting through Paris, either through its airports or its train stations (both in the city and at Charles de Gaulle Airport). In contrast, no metropolitan area of California is such a travel hub because most travel in California is point to point.

- HSR in Europe has a particularly robust market as a result of the strong government employment that exists in national capitals, such as London, Paris, Brussels and the Hague. Brussels is also the principal governance center of the European Union, as home of the European Commission. The TGV-Est line is also likely to have higher ridership because its terminus is Strasbourg, home of the European parliament.

- While less dense than Japanese urban areas, European urban areas are generally more dense than in California. Again, this means that HSR stations are closer to more of the urban population than they would be in California.

- Europe's transit systems are less comprehensive than those of the largest Japanese urban areas, but are far more so than any transit systems in California. Large European urban areas typically have transit market shares of from 10 to 25%, which compares to the 0.7 percent to 3.6% in California markets. A number of the European HSR urban areas have extensive subway and commuter rail systems that can often compete with the auto in travel time.

- The European HSR ridership is not all new ridership. On many lines there was considerable traffic before the coming of HSR. In France, Germany, Italy and Spain, which accounted for the overwhelming majority of HSR ridership in Europe, conventional (non-HSR) ridership dropped 27 million between 1990 and 2006.[40] This represents 40% of the HSR increase of 69 million.[41] Many HSR riders are former train riders who switched to the faster services.

Profitability

As in the case of CHSRA, HSR proponents claim that systems overseas are profitable. However, it is not clear that the world's HSR systems have typically covered their operating and capital costs without subsidies.

France. The TGV system is a sensible adaptation to a nation where Paris is a major transport hub as a destination and for connecting passengers. The most recent financial reports show that overall the French national rail operator, SNCF earned a profit.[42] However, this is a far more complex issue.

- SNCF financial reports classify subsidies from national, regional and local governments as commercial revenues, rather than subsidies, as they would be classified in the United States.
- Separate financial data is not provided for the high-speed rail operations. Thus, any statements to the effect that TGV is profitable (which it may or may not be) have not been subjected to the normal accounting standards that apply to annual financial reporting.
- SNCF runs on the national rail system owned by the Réseau Ferré de France (RFF) and pays fees for its usage.[43] According to a report by the French parliament, RFF and SNCF together have a debt of more than 40 billion Euros, or approximately $55 billion.[44] This is a significant amount for a nation with a population one-fifth that of the United States. The SNCF access fees paid to the RFF cover little more than infrastructure maintenance and provide virtually no contribution to debt service, capital costs or depreciation.[45] Moreover, RFF receives annual subsidies from the French government of more than 10 billion Euros. It is possible that some of the annual subsidy is attributable to TGV.
- Construction of the newest line, the TGV-Est line, from Paris toward Strausbourg was subsidized to at least the extent of 75%.[46]
- Reports are that RFF will be substantially increasing track access charges to pay for expansion and maintenance of the French rail network. Any such increase could cause a deterioration in SNCF financial performance.[47]

Given the lack of transparency regarding railway debt, continuing subsidies to RFF and the apparent lack of any comprehensive analysis[48] using generally accepted accounting principles, no definitive statement can be made about the profitability of high-speed rail in France.

Japan. The story is similar in Japan. The Japan National Railway was privatized in the late 1980s and the new private companies assumed some of the heavy debt that had been accumulated. However, the public shouldered most of the debt, which amounted to 250 trillion yen at privatization and grew to 280 trillion after that. At current exchange rates, this is more than $250 billion.[49] This is a substantial amount for a nation with a population 60 percent less than the United States.

As in the case of France, in view of the huge debt and the apparent lack of any comprehensive analysis using generally accepted accounting principles, no definitive statement can be made about the profitability of high-speed rail in Japan.[50]

Summary of Differences

The CHSRA in promotional literature frequently cites developments in Europe and Asia to justify building such a system in California.[51] Absent from such material is recognition of critically different circumstances and environments. Overall, the dissimilarities are great. *Congressional Digest* summarized Europe's train-friendly circumstances well:

> *Conditions in those countries are, in many ways, more favorable to passenger rail transportation than in the United States. Their population densities are higher (which makes train travel more efficient), their fuel prices, including taxes, are higher (which makes driving more expensive relative to other travel options), and their land area is relatively smaller (which makes travel time by train more competitive with air travel).*[52]

While factors exist that allow high-speed rail systems to be well-used overseas, they nonetheless appear insufficient to allow those very same HSR systems to attain profitability under generally accepted accounting practices. Moreover, while the conditions were favorable for the development of HSR in Europe and Japan, they are less clearly so in the United States.[53]

Conclusion

High-speed rail systems operate in a number of countries overseas. The state of California is proceeding with its HSR plan based on assumptions that are appropriate to European and Asian environments but generally hold little applicability in the state.

Considerable market differences exist with conditions in California being far less favorable to the potential success of such a system. Dissimilarities include population densities in urban areas, size of central business districts, extent of connecting transit systems, distances between urban areas, and the degree to which a train-riding market existed prior to HSR service. Financially, it is not clear that the world's HSR systems have typically covered their operating and capital costs without subsidies—a determination that would be appropriate in a due diligence process for commercial HSR proposals in any nation.

B. United States Experience

A Federal Railroad Administration study found that subsidies are likely to be required on all HSR systems proposed in the U.S. Such projects have been halted in three states—California (Los Angeles–San Diego), Texas and Florida. The federally sponsored HSR program for Boston–New York–Washington serves only a fraction of the passengers that European and Asian lines carry.

The multi-state high-speed rail improvement project that links Boston, New York and Washington has been funded principally by the federal government through subsidies to Amtrak. Other systems have been proposed using the term “high-speed rail,” but which would not reach HSR speeds, such as programs in the Midwest and Southeast.

High-speed rail systems have been proposed for the United States and have failed to move ahead in Florida, Texas, Pennsylvania, Ohio and in California between Los Angeles and San Diego. All of these projects have been canceled for a variety of reasons, one of which has been the failure to attract commercial investment.

Following are summaries of prior studies regarding subsidies, details regarding HSR projects for Texas, Florida and the Los Angeles–San Diego line, and a review of the Northeast Corridor. All have “lessons learned” that are relevant to the California project.

The United States in Context

The most comprehensive study of the potential for high-speed rail around the United States was prepared for the Federal Railroad Administration (FRA) of the U.S. Department of Transportation (DOT). This study found that commercial revenues would fall far short of operating and capital costs in all studied corridors (Table 3).[54] On average, capital and operating subsidy levels of more than 70 percent would be required.

Table 3: High Speed Rail Corridors FRA Feasibility Study: 2020

Corridor	Commercial Revenues	Subsidies
San Francisco–Los Angeles-San Diego	31.8%	68.2%
Los Angeles–San Diego	15.6%	84.4%
Chicago–Milwaukee-Detroit-St. Louis	22.8%	77.2%
Chicago–Detroit	21.6%	78.4%
Chicago–St. Louis	13.6%	86.4%
Miami–Orlando-Tampa	37.7%	62.3%
Washington–New York-Boston	55.3%	44.7%
Eugene–Portland-Seattle-Vancouver	17.0%	83.0%
Houston–Dallas-Austin-San Antonio	42.7%	57.3%
Average: High-Speed Rail	28.7%	71.3%

Source: Overview Report: *High Speed Ground Transportation for America* (Washington, D.C.: Federal Railroad Administration, United States Department of Transportation), August 1996.

Moreover, in an independent review, Professors William L. Garrison and David M. Levinson say it is doubtful whether without considerable subsidy high-speed rail could be constructed, much less be profitable, in the United States.[55]

Projects Halted in Three States

Florida: 1984–2004. Florida was the first state to embark on a program to build HSR with the 1984 passage of the High Speed Rail Act. In addition to creating an Authority to plan and oversee the project, the state established a franchise certification process designed to interest the private sector in helping to underwrite a Miami–Orlando–Tampa HSR project.

In 1986, state planners and potential system developers stated that the new HSR line would attract significant numbers of travelers from automobiles and airplanes. Predictions were that the line could be built at a cost ranging from $2 billion to $4.5 billion, depending on the number of stations, and be in service within nine years.[56]

Projected construction costs continued to increase, and by 1990 the state required the franchise holder, the Florida High Speed Rail Corporation (FHSRC), to submit a new financing proposal. One trade publication described it as follows:

> *FHSRC's new financing plan included a request for state bonding authority of $5.35 billion ($214 million annually for 25 years), together with imposition of a 10 percent tax on high speed rail tickets; a $2 surcharge on automobile license tags, and a 2.5 cents per gallon increase in the motor fuel tax. FHSRC also asked that the Florida legislature authorize "available monies" to eliminate existing at-grade crossings on the proposed system. . . . FHSRC's proposal did not find an enthusiastic audience.*[57]

Public displeasure intensified in 1996 when five consortia submitted proposals in a new franchise process that was designed around the state's new—and very controversial— commitment to a $70-million-a-year subsidy.[58]

The state selected the Florida Overland Express consortium (FOX) to build the system, based in part on their plan to begin operating the entire line by 2006. At the same time, state officials balked at FOX's bid request for subsidies of $95 million annually from the state—$25 million more than planned.[59] Meanwhile, dissatisfaction by environmentalists grew over FOX's plan to use alignments near water conservation areas, which were inconsistent with plans to prohibit development and protect coastal water supplies.[60]

Promoters pushed a 2000 state constitutional amendment requiring the state to build HSR, which the voters approved. However, the project ran into significant opposition as issues arose regarding the project's cost, optimistic ridership estimates, adverse environmental impacts and the degree of highway and airport congestion relief that could reasonably be expected.

Three years later, the state legislature was compelled to address growing concerns about costs and debated prohibiting the use of sales-taxes or tax exemptions for developers to help fund the system.[61] Public concerns mounted that the state was to be exposed to inordinate financial risk and another measure was placed on the ballot in 2004 to repeal the state HSR constitutional amendment. The voters approved the measure by a 2-to-1 margin, effectively terminating the Florida HSR project.[62]

Texas: 1989–1994. The legislature in 1989 created the Texas High-Speed Rail Authority (THSRA) to award a franchise to build and operate a system with three lines to link the “Texas Triangle” urban areas of Dallas/Fort Worth, Houston and San Antonio. The law prohibited expenditures of public monies on the project, except for some limited planning efforts. The private sector could not count on government subsidies for capital or operating purposes.

The action was taken based on a study that concluded 185-mph trains could move passengers between Dallas and Houston in less than two hours; it also forecast that the system could be economically viable as highways and airports became more congested. The three-phased project called for the Dallas/Fort Worth area–Houston line to be built by 1998; the Houston–San Antonio–Austin route to be in operation by 2003, and Austin–Dallas could be ready by 2008.

A French-American group, the Texas TGV Corporation, won the contract for the franchise against a German-American ICE Train consortium.[63] Public opposition grew in rural areas because of a belief that the use of eminent domain for the HSR routes would cause considerable harm to farmers and ranchers. Eventually, thousands of residents gathered in meetings to oppose the HSR system. Their biggest concern was “landlocking,” when the high-speed track splits a ranch or farm in two and the owner cannot get from one section to the other without an easement across a neighbor’s property or traveling some distance.[64] (The California Authority calls “landlocking” by a different name—“severance.”)

Another issue was the continual escalation in the estimated project cost. In 1991, the first estimate was $4.4 billion.[65] Cost refinements were issued depending upon which routings were to be selected, and the new figures became a range of $5.7 billion to $6.7 billion.[66] As planning continued, the cost rose to $7 billion.[67] Finally, when it appeared that the project would be abandoned in late 1993, the estimate totaled $8.4 billion.[68]

Skepticism deepened when the Texas TGV consortium admitted a need for grants from local and federal governments, $3 billion in tax-free bonds and possible government guarantees. Texas Railroad Commissioner Bob Krueger said the project was doomed: “I believe this project will ultimately fail, because the economics are faulty, the ridership numbers are fantasy and the very credibility of the managing consortium is suspect. I don’t think the economics are here for this project, and I don’t think this group can pull it off without monumental government support.”[69]

With consortium officials seeking more public funding, Southwest Airlines filed a suit challenging the manner in which the THSRA awarded the franchise to the Texas TGV consortium. The airline’s position was that it did not want to compete with an entity that will be subsidized by the government; they were willing to compete head-on, but not with the government.[70]

In early January 2004, it was clear that the Texas TGV Corporation had defaulted on its agreement with the state.[71] With controversies underway regarding the need for public subsidies and the system's possible intrusion on farmlands and other property, the project was cancelled. According to many news accounts, this terminated a state administrative proceeding against Texas TGV for its failure to raise $170 million in equity financing for the $8.4 billion project by the December 31, 1993 deadline. The state also required Texas TGV to repay a $1 million appropriation made by the legislature to the THSRA.[72]

The consortium cited an inability to secure financing because of delays beyond its control, such as waiting for federal safety approval of Texas TGV's proposed technology and unrealistic equity funding deadlines. State officials declined to pursue a default judgment against Texas TGV because to do so would keep the project nominally alive. The state wanted an unquestioned rescission to permit landowners whose property lay in the path of the proposed train to be free of possible eminent domain proceedings, a relief that hundreds of rural property owners had repeatedly demanded of the state.[73] Also, the legislature abolished the Authority and designated no successor for HSR functions.[74]

It is notable that the Texas project expired even though the state has topographical conditions more favorable than what are found on the California routes—namely, the lack of mountain ranges that provide significant construction and operating challenges.

Southern California: 1981-1984. The state has experienced strong public opposition to the construction of a high-speed rail line, as was evidenced in the past when the American High Speed Rail Corporation (AHSRC) proposed building a Los Angeles–San Diego bullet train. Although a private company, the AHSRC was headed by executives from the federally subsidized Amtrak organization and in 1981 Amtrak provided an unsecured $750,000 loan to partially finance startup costs.

The following year, the California legislature approved $1.25 billion in tax-exempt revenue bonds for the project, whose feasibility depended on the marketability of the bonds.[75] The company intended to repay bond holders from passenger revenues.

The AHSRC proposed to build a $3.1 billion bullet train line 130 miles long. The privately funded and operated system would be completed by 1988, after which trains were projected to carry 100,000 passengers daily on about 100 trains daily. The system would use Japan's Bullet Train technology and be capable of 160 mph operation over exclusive use of new HSR lines. Stations would be located at Los Angeles International Airport, Union Station in downtown Los Angeles, Norwalk, Anaheim, Santa Ana, Irvine, Oceanside, La Jolla and in downtown San Diego.[76]

The AHSRC would receive about $5 million from Japanese interests for initial planning. Next, an investment syndicate would seek a minimum of $2 billion needed to acquire right-of-way and build the line.[77] About a quarter of the funding was expected to come from Japanese sources and the remainder from the United States and elsewhere.[78] The company routinely indicated that HSR operating in Southern California could make a profit, based in part on non-stop Los Angeles-San Diego express train schedules of 59 minutes and air-competitive fares. Wall Street expressed skepticism, and one Shearson-American Express analyst called the proposal "far fetched."[79]

Eventually, Japanese investors provided much of the $14.75 million raised and agreed to take responsibility for 25 percent of the financing required to complete the project. First Boston, an investment bank, was putting together a package to raise additional money to complete design work and start building.[80] However, resistance to the project was mounting and potential investors became unsettled when a chain of events occurred:

- Five communities—San Diego, Del Mar, Carlsbad, Oceanside and Tustin—filed a lawsuit that argued the process being followed violated environmental regulations and was inadequate to fully assess the project's impacts. Joining the lawsuit was the United Citizens Coastal Protective League (UCCPL), an organization with more than 1,000 members.[81] The UCCPL likened the plan to using a supersonic Concorde jet for commuter flights between San Diego and Los Angeles.[82]

- A rail passenger consultant who had accurately forecast San Diego Trolley ridership found that the AHSRC had used "terrible logic" in justifying high passenger-volume projections. He determined that inadequate population density exists to support the line, that promoters had vastly overestimated the market, and that such a system could not operate at a profit anywhere in the United States.[83]

- The city of Tustin contracted for an analysis of projected ridership, capital and operating costs, and financial planning. The study discredited overly optimistic estimates, and one conclusion was that the AHSRC had projected "vastly greater numbers of passengers" for the HSR line than justified.[84]

- At about the same time, a report from the Office of Technology Assessment, a congressional agency, found that the Southern California bullet train and similar U.S. high-speed rail projects will probably require government subsidies to survive. Researchers questioned the ridership projections because the insufficient population density would mean that every person in the region would have to ride the train at least 3.7 times a year to total the 36.5 million annual passengers first predicted by project promoters. Reviewers also concluded that commuter and short-trip travel—the greatest cause of traffic problems—would continue despite the HSR system and that ultimate energy savings might be insignificant.[85]

- Public officials became uncompromising in their opposition. For example, a California Transportation Commission member and former State Assembly Transportation Committee chairman, Walter Ingalls, warned that he would not vote to approve state money for the bullet train if—as he was predicting—private investors could not pay for the project. "There will never, ever, ever be any public monies expended for this project," Ingalls declared.[86]

In an attempt to calm public officials and reassure potential investors, the AHSRC released new projections that the bullet train would earn $380 million in its first year of operation (1989$) and escalate in following years based on an inflation rate of 7 percent annually. The new forecasts were drawn up by Arthur D. Little Inc., which had devised the first ridership and revenue estimates that had become controversial.[87]

The AHSRC forecast brought skepticism from independent analysts. Even a planning organization normally receptive to rail proposals, the San Diego Association of Governments, declined to endorse the new projections because the planners did not know what methods were used or what factors were considered by the consultants. Far more blunt was an Oceanside Councilman, Walter Gilbert, who said, “I don’t believe it. First they had a survey that forecast ridership of 60,000. When we proved that the project wouldn’t pay for itself with that number, they come up with a new, refined survey that claims there will be 100,000 riders. That’s not realistic.”[88]

By mid-1984, the public learned that Japanese investors had put up only about $9 million of the $14.75 million originally promised. The AHSRC needed $50 million to continue planning and officials admitted that a forecast of an early 1985 start of construction had been too optimistic.[89] Next, the AHSRC missed filing deadlines with Caltrans and the California Public Utility Commission.[90]

A major figure entered the fray when Paul Gann announced disapproval of the project. Gann, known as the co-author of the Proposition 13 “tax revolt referendum,” said he opposed HSR because the $1.25 billion in revenue bonds the state legislature had authorized represented potential risks to taxpayers.[91]

On November 13, 1984, the Los Angeles–San Diego bullet train plan collapsed when AHSRC officials announced they had run out of funds. A campaign to raise money from investors had met with widespread skepticism.[92] Moreover the company never fully convinced state officials that it could proceed without the need for public subsidies. Planning documents were sold to Amtrak for $200,000.[93]

Researchers concluded that public and political opposition caused investment community interest to evaporate. “The project proved to be very controversial, with the proponents eventually unable to obtain financing to continue.”[94] Indeed, this appears to have portended the type of potential “political meddling” that CHSRA consultant Lehman Brothers cited as a current risk in investor documents.[95]

U.S. Northeast Corridor. The strongest rail passenger line in the United States runs through the heavily populated Northeast Corridor (NEC) linking Washington D.C., New York and Boston. The route is historically the nation’s busiest route and has characteristics more favorable to HSR than California.

- The New York–Washington distance of 225 miles and the New York–Boston distance of 231 miles are shorter than the anticipated Los Angeles–San Francisco "backbone" line projected by the CHSRA to be between 432 and 490 miles.

- The metropolitan areas from Washington through New York to Boston have a population of 44 million,[96] a population not projected for the California HSR corridor until 2030.

- Four of the six largest downtowns (central business districts) in the United States are on the Acela HSR line (New York, Washington, Boston and Philadelphia).[97] The combined employment of the major downtown areas along the route, including Baltimore, is approximately 2.6 million, which includes Manhattan (below 59th Street), the world's second largest central business district.[98] In contrast, the California HSR system has only one of the six largest central business districts in the nation (San Francisco) and the combined employment of the large central business districts is less than 600,000.[99] Central business district (CBD) employment is a strong generator of ridership, because there are HSR stations in the CBD that are easily accessed by short cab rides, transit rides or walking. In this regard, the NEC is more favorable to HSR than the California corridor.

- Despite not being as comprehensive as European transit systems, the transit systems of the NEC metropolitan areas are generally stronger than in California. New York's transit network is by far the largest in the nation and has the largest rapid transit system with an urban-area transit market share of approximately 10 percent.[100] Boston, Washington and Philadelphia have some of the most extensive rapid transit systems in the nation, as is evidenced by their strong ridership. San Francisco also has a strong system in BART and some commuter rail service. Los Angeles, Sacramento, San Jose and San Diego have far less intense transit systems than San Francisco. The better transit connections in the NEC make it a more promising market for HSR than California.

Federal subsidies to Amtrak were used to develop the Acela service in the NEC, and the trains began operating on this route in 2000. Door-to-door rail and air travel times are similar to the California HSR as proposed. In the New York–Washington portion of the NEC, where the rail distance is 225 miles, the fastest trains take as little as 2 hours and 45 minutes. Early in 2001 Amtrak announced that it would add a "non-stop super-express connecting New York and Washington in 2 hours, 28 minutes."[101] However, by mid-year the nonstop failed to lure as many airline passengers as forecast and was replaced by a train that stops along the way.[102] As of 2008, no non-stop Acelas operate on the route. The Amtrak Reform Council stated that, "The fact that Acela isn't doing what Amtrak expected is an enormous problem. Amtrak has definitely hitched its star to the Acela Express."[103]

The NEC has been a historically strong intercity rail market. As a result, Acela has had a ready pool of train riders that have transferred from the slower, conventional services to the high-speed services. Again, California does not have this advantage.

Even so, the Boston–New York–Washington HSR service has ridership that is only a fraction of the intensity of the Japanese and European systems. (See Part 4, Forecasting Ridership.)

Commonalities

Similarities can be found in the failures of the Florida, Texas and California projects. Sustained public opposition is just one of a number of factors contributing to their demise.

Understated cost estimates also caused controversies. In California, to appease critics along the Los Angeles–San Diego line, promoters pledged costly changes to plans such as tunneling or taking tracks into submerged trenches with landscaped sides, yet the overall price for the system never seemed to reflect such alterations.[104]

Concern is growing about the current CHSRA project. The California Chamber of Commerce announced its opposition based on costs, with President and CEO Allan Zaremberg stating, "There are other projects that mitigate congestion that should be a higher priority."[105] Jon Coupal, president of the Howard Jarvis Taxpayers Association, pointed out that the HSR bonds are not "free money," and with the state carrying significant debt the HSR bonds could further lower the state's bond rating.[106]

Conclusion

The Federal Railroad Administration has found that subsidies are likely to be required on all HSR systems proposed in the United States.

Such projects have been halted in three states—California (Los Angeles–San Diego), Texas and Florida. The cancellations occurred because the public, community organizations and elected officials objected to underestimated costs, overestimated ridership and revenue, threatened use of eminent domain, and environmental impacts. Also, the credibility of HSR promoters waned as pledges of "no subsidy" or "only low subsidies" needed turned into requests for higher subsidies. In each case opponents showed great resourcefulness in conducting sustained campaigns to oppose HSR construction.

Support for HSR has evaporated among potential investors and in state legislatures that have felt the brunt of citizen displeasure. With history as a guide, and as HSR environmental impacts become better understood, similar opposition could develop within California's urban, suburban and rural communities located along the CHSRA's proposed system.

Part 4

Analysis of California High-Speed Rail Plan

A. Forecasting Ridership

Based upon an examination of the market and the international experience with ridership projections, it appears that the CHSRA 2030 ridership projections are absurdly high. It is likely that the HSR will fall far short of its revenue projections, leading to a need for substantial additional infusions of taxpayer subsidies.

The Crucial Role of Ridership

Sufficiently accurate ridership projections are essential because they serve as the basis for revenue projections, and passenger fares represent the principal operating revenue for the proposed HSR system. Specifically, the ridership and fares need to be high enough to pay for the infrastructure costs, debt interest and return on investment for costs not covered by taxpayer subsidies.[107]

If HSR ridership falls short of the projections, revenue is likely to be similarly short, which can lead to financial difficulties. Lower than anticipated revenue levels could lead to the need for taxpayer bailouts or even bond defaults.

In the process of due diligence that will necessarily precede any private equity or debt investment, the ridership and revenue projections must be demonstrated to be both plausible and sufficient or the investment will not be forthcoming for the project. The analysis in this chapter is limited to evaluating the HSR ridership projections. The context of these projections relating to the overall market and modes (highways and aviation) is examined in Part 5, "Alternatives to Building the HSR System."

Overview of International and Domestic Ridership Projections

The most comprehensive study on large transportation project projections was by European academics Bent Flyvbjerg, Nils Bruzelius and Werner Rothengatter.[108] Their study examined 258 transportation infrastructure “megaprojects” covering seven decades (1927-1998) on five continents. This “world infrastructure research” found a number of difficulties in project financing plans, such as overestimation of customer demand, overestimation of commercial revenues and understatement of capital and operating costs (the latter two points are discussed elsewhere).[109] While the principal focus of the research was capital cost overruns, the authors noted:

> *…the problem with cost overrun is exacerbated by the fact that often this problem comes hand in hand with lower-than-estimated revenues. The consequence is projects that are risky to the second degree.*[110]

The world infrastructure research found that overly optimistic ridership projections have been the rule rather than the exception, concluding that “Traffic estimates used in decision making for rail infrastructure development are highly, systematically and significantly misleading. Rail passenger traffic forecasts are consistently and significantly inflated.”[111] Such faulty forecasts influenced the construction of systems that produced lower than anticipated financial returns, which in turn have resulted in higher than planned public subsidies. The world infrastructure research also found that costs are routinely underestimated. (See Part 4, Forecasting Costs.)

For example, the Eurostar, the Paris to London and Brussels HSR service, began operating through the new cross-channel tunnel in 1994. It was projected that 15.9 million passengers would use the service in its first year with an eventual increase to 18 million.[112] Actual traffic was 2.9 million passengers in the first full year of operation, which fell short by 82 percent of the forecast.[113] Only in the last year (2007), a full 12 years after opening, has ridership exceeded one-half of the first-year projection, at 8.3 million.[114] And if it is assumed that recent ridership increases from the St. Pancras Station extension in London is carried through a full year, Eurostar’s ridership will still be more than one-third below the first-year prediction (1995).[115] Eurostar abandoned services to its London Waterloo Station upon opening the new St. Pancras Station in 2007. It had planned to continue offering services to both stations, but the Waterloo service was cancelled because ridership had fallen so far short of the 18 million projection.[116]

Overestimation of intercity rail ridership has been true for decades in the United States. One example: On numerous occasions the Government Accountability Office (GAO) has questioned the traffic forecasts upon which Amtrak bases its revenue projections as being too optimistic. A 1976 GAO report noted Amtrak’s projection that the “number of passengers will increase from 17.3 million in fiscal year 1975 to 32.9 million in fiscal year 1980—a 90 percent increase.”[117] The actual passenger count in 1980 was 21.2 million—35.6 percent off the estimate. Even in 2007 when Amtrak set an “all-time record,” the rail system carried 25.8 million passengers—nearly 10 million passengers lower than it was projected to reach nearly three decades ago.[118] Unachieved projections have remained a hallmark at Amtrak from its inception in 1971 through today.

The problem of over-estimating demand has also been noted by the California Senate Transportation and Housing Committee in a report on the HSR project. The report notes the demand projection inaccuracies in toll roads and further notes with respect to mega-projects that

… there is a pattern of economic analyses and demand forecasts that are often overly optimistic … [119]

California: Numerous Ridership Studies

Many studies of California HSR have resulted in issuance of a plethora of forecasts based on wide variations in assumptions. Below in Table 4 is a listing of studies that will be referred to in the ensuing analysis:

Table 4: Ridership Studies & Projections

Title	Explanation
1997 Base Ridership	The existing market used as a base by CHSRA for 2020 ridership projection. Produced by Charles River Associates (2000)
2005 Base Ridership	The existing market used as a base by CHSRA for 2030 ridership projection. Produced by Cambridge Systematics (2007)
2010 University of California Projection	SF-Sacramento- LA-San Diego only route study by the University of California Transportation Center Berkeley (1994)
2020 FRA Projection	SF-LA-San Diego only route study by the Federal Railroad Administration (1997)
2020 Investment Grade Projection (2020 Base Projection)	Ridership projection by CHSRA indicated as base for 2020. Also called "investment grade." Produced by Charles River Associates (2000)
2020 High Projection	Ridership projection by CHSRA indicated as "sensitivity analysis" or "high" for 2020. Produced by Charles River Associates (2000)
CHSRA 2030 Base Projection	Ridership projection by CHSRA indicated as base for 2030. Produced by Cambridge Systematics (2007)
CHSRA 2030 High Projection	Ridership projection by CHSRA indicated as "sensitivity analysis" or "high" for 2020. Produced by Cambridge Systematics (2007)
2030 Due Diligence Base Projection	Ridership projection considered most likely by this report. (2008)
2030 Due Diligence High Projection	Ridership projection considered highest likely by this report. (2008)

Analysis of CHSRA Projections

The CHSRA has produced two principal sets of ridership projections.

- The first set of ridership projections for a horizon year of 2020 was the basis of the 2005 EIS/EIR that CHSRA produced. Two principal projections were produced, which are referred to in this Due Diligence Report as the "2020 Investment Grade Projection" and the "2020 High Projection."

- The second set of ridership projections for a horizon year of 2030 was used in the 2008 Northern California EIS. Two principal projections were produced, which are referred to in this report as the "CHSRA 2030 Base Projection" and the "CHSRA 2030 High Projection."

The University of California Transportation Center at Berkeley and the Federal Railroad Administration (FRA) previously produced independent projections for similar systems. The University of California Projection used a horizon year of 2010, while the FRA Projection used a horizon year of 2020. Independent projections are particularly important, because those involved in their preparation can hope for no potential financial gain from a project's approval.[120]

This review attempts to achieve a consistency between these projections of differing years, by adjusting all to a horizon year of 2030 (Table 5). This report uses the ridership projections from the "trip tables" containing the 2020 CHSRA projections and the 2030 CHSRA projections. These data are sometimes at odds with data in other portions of the same reports.

Table 5: Ridership Data & Projections

		Annual HSR Projection Ridership in Millions		
Title	Explanation	Annual Intercity Ridership Projection (Original Projection Year) 2030	Commuter	Total Including Commuter Ridership
1997 Base Ridership	The existing market used as a base by CHSRA for 2020 ridership projection. Produced by Charles River Associates (2000)	Note: These are base year market assumptions. There are no projections		
2005 Base Ridership	The existing market used as a base by CHSRA for 2030 ridership projection. Produced by Cambridge Systematics (2007)	Note: These are base year market assumptions. There are no projections		
2010 University of California Projection	SF-Sacramento- LA-San Diego only route study by the University of California Transportation Center Berkeley (1994)	(12.5) 22.1	No Commuter Projection	22.1
2020 FRA Projection	SF-LA-San Diego only route study by the Federal Railroad Administration (1997)	(15.6) 25.8	No Commuter Projection	25.8
2020 Investment Grade Projection (2020 Base Projection)	Ridership projection by CHSRA indicated as base for 2020. Also called "investment grade." Produced by Charles River Associates (2000)	(32.0) 37.9	10.0	47.9
2020 High Projection	Ridership projection by CHSRA indicated as "sensitivity analysis" or "high" for 2020. Produced by Charles River Associates (2000)	(58.4) 69.1	10.0	79.1
CHSRA 2030 Base Projection[121]	Ridership projection by CHSRA indicated as base for 2030. Produced by Cambridge Systematics (2007)	65.5	22.5	88.0
CHSRA 2030 High Projection	Ridership projection by CHSRA indicated as "sensitivity analysis" or "high" for 2020. Produced by Cambridge Systematics (2007)	96.5	20.5	117.0
Projection figures in parentheses are year of report. Figures without parentheses are 2030 or adjusted to 2030.				

The year 2030 projections are the most recent and were prepared by Cambridge Systematics, using 2005 as a base year,[122] and are used in the Northern California EIS.[123] The projections are based on intercity riders (those traveling between metropolitan areas rather than within them) and commuters (riders within the metropolitan areas of the Bay Area, Los Angeles and San Diego).

- The CHSRA 2030 Base Projection indicates that the system would carry 65.5 million annual intercity riders in 2030. An additional projection of 22.5 million commuter riders bring the total to 88.0 million.

- The CHSRA 2030 High Projection indicates that the system would have 96.5 million annual intercity riders in 2030. When commuter ridership of 20.5 million is included, this figure rises to 117 million riders.

Significant Variation in Ridership Projections

The new 2030 ridership projections cited above are considerably higher than earlier findings. This raises questions of credibility, especially since independent projections prepared for similar systems in the past have been below the earlier CHSRA projections. The previous projections prepared for the Authority by Charles Rivers Associates in 2000, using a base year of 1997,[124] are as follows:

- The 2020 Investment Grade Projection forecast 32 million annual riders plus 10 million commute[125] riders for 2020.

- A "sensitivity" analysis was performed by the CHSRA to estimate the impact of different assumptions on ridership. These included slower automobile travel times, slower air travel times, higher automobile and air market growth rates and higher air fares. CHSRA then selected the *most favorable possible combination* of these assumptions and produced the CHSRA 2030 High Projection of 58.4 million annual riders,[126] plus the 10 million commute or intraregional riders for a total of 68.4 million riders. This higher Sensitivity Projection, rather than the Investment Grade Projection, was used in much of the analysis in the 2005 EIR/EIS.

"Investment Grade" Ridership Projections

The CHSRA uses the term "investment grade" as the title of its 2020 base ridership projections. This is significant, because investment grade projections are considered to be of the highest quality and of sufficient accuracy upon which to rely for private investment purposes.

However, even investment grade projections can be fatally flawed. This is illustrated by the case of the Las Vegas Monorail, where an "investment-grade" projection over-estimated ridership by more than 100 percent and where a strong probability of bond default may occur by 2010.[127]

As is noted below, the CHSRA 2020 Investment Grade Ridership Projection has been superseded by a far more aggressive 2030 Base Ridership Projection, which is not labeled as "investment grade" by CHSRA. Given the international experience with ridership and revenue projections, this much higher, apparently less authoritative projection is cause for serious concern.

Evaluation of CHSRA Ridership Projections and Assumptions

There are a number of factors that call into question the reasonableness of the CHSRA 2030 Ridership Projections. This is illustrated by various reasonableness tests below:

- The 2030 CHSRA ridership projections are much higher than the previous CHSRA projections (2020), even after adjusting to account for anticipated growth from 2020 to 2030. There is no reasonable justification for the large increases between the two years (below). This could indicate the type of ridership and revenue projection "inflation" documented in the world infrastructure research.

- The CHSRA 2030 Base Ridership Projection (65.5 million annual passengers) is an inexplicable 73 percent higher than the CHSRA 2020 Investment Grade Ridership Projection, which it replaces. This is after adjusting the 2020 Investment Grade Ridership Projection to account for CHSRA projected growth in the market between 2020 and 2030 to 37.9 million annual passengers).[128]

- Similarly, the CHSRA 2030 High Ridership Projection is also significantly higher than the CHSRA 2020 High Ridership Projection (adjusted to 2030), which it replaces. The 2030 High Ridership projection of 96.6 million annual intercity riders is 40 percent above the 69.1 million annual intercity riders that result from adjusting the 2020 High Ridership Projection to 2030.[129] As in the case of the 2020 projections, CHRSA has often used this more optimistic scenario in both its formal analysis and promotion.

The enormous increase in ridership projections between 2020 and 2030 cannot be justified by any reasonable factor in the market. The difference appears to be at least in part due to changes in the assumptions used by CHSRA in its ridership projection methodology ("modeling").

Unrealistic Base Year Travel Market Increase

Ridership modeling begins with scoping the size of the existing market. In that regard, ridership projection models use a platform of a "base year." In the case of the 2020 CHSRA projections, the base year is 1997. In the case of the 2030 CHSRA projections, the base year is 2005.

Changes in base year data have the generalized impact of driving up the ultimate ridership projections. A simple example can be used to illustrate the point. If a base year's total travel estimate is 50 percent higher than another estimate for the same base year, it can be expected that the resulting travel projection in the horizon year (for example 2030) will be much higher than if the projection is based upon data from the lower base year estimate.

There is an enormous increase in the 2005 base year total travel estimate used by CHSRA compared to the 1997 base year estimate used for the 2020 ridership projections. The increases from 1997 to 2005 are the basis of the much higher 2030 CHSRA projection. Overall, CHSRA's estimate of the travel market in 2005 was more than 275 percent higher than in 1997. This enormous increase, reported by CHSRA, is not consistent with market trends over the same period.

- Airline volume decreased 12 percent between the major airports in the HSR corridors between 1997 and 2005, according to U.S. Department of Transportation data.[130] This decline is far different from CHSRA's 2005 base estimate of the airline market, which is more than 25 percent higher than its 1997 base estimate.

- Travel on state highways increased 19 percent from 1997 to 2005.[131] This modest increase is far below CHSRA's 2005 base estimate of automobile usage, which is 325 percent higher than its 1997 base estimate.[132]

Explanation of the Higher 2030 Ridership Projections

The principal cause of the sizable market increase between the 1997 and 2005 bases is in the much higher automobile (principally shorter distance) demand. Based upon the unaccountably large intercity automobile market in its 2005 base (below), CHSRA projects that 74 percent of HSR passengers will come from automobiles.[133] This is an implausibly high figure for capture of auto drivers. The projected 74 percent from automobiles is nearly double the 42 percent in the 2020 Investment Grade Projection. It is also *four times* the 19 percent diversion share from autos projected in the 2020 FRA Projection.

Further, the international experience demonstrates that HSR's principal source of ridership is airline passengers, rather than automobile users, especially in longer distance markets, such as California. The FRA projected that the California corridor would receive 51% of its ridership from airlines and only 19% from autos. A new FRA report indicates that significant improvements to travel times in the Washington–New York–Boston market would attract only one-half as many car drivers as air passengers.[134]

Another major difference between the 1997 and 2005 base projections is the number of "out of corridor" trips (trips that include the service area of HSR but begin or end outside of it)[135] that are included in the analysis. CHSRA's 2005 "out of corridor" trips are nearly seven times the 1997 level.

A comparison of the 2020 and 2030 intercity projections illustrates the primary drivers of the much higher CHSRA 2030 projections (Figure 1[136] and Figure 2).[137]

- **Automobile Markets (Shorter Distance Markets.** The CHSRA 2030 Base Projection assumes 25.5 million more HSR riders in the stronger automobile markets (namely San Francisco–Sacramento, Los Angeles–San Diego, and the San Joaquin Valley to both Los Angeles and San Francisco) than the 2020 Investment Grade Projection.

- **Airline Markets.** The CHSRA 2030 Base Projection assumes a small reduction in HSR ridership in California's strongest air markets (which are Los Angeles–San Francisco, Los Angeles–Sacramento, San Francisco–San Diego and Sacramento–San Diego) from the 2020 Investment Grade Projection.

- **Outside the Corridor Markets.** The CHSRA 2030 Base Projection assumes an increase of 9.2 million HSR passengers who would travel to or from outside the corridor compared to the 2020 Investment Grade Projection. These are passengers who would use the HSR system, but whose trips would begin or end in the central coast area (between Los Angeles and San Jose coastal counties), northern California (north of Sacramento) and the western Sierra Mountains area. In fact, the total CHSRA 2030 "out of corridor" projected trip volume is greater in number than CHSRA projects to carry between the two largest markets, the Los Angeles area and the San Francisco Bay Area. This is simply not reasonable.

In fact, more than all (107 percent) of the 2030 projected ridership increase from 2020 is in shorter distance, auto-dominated markets or trips starting or ending outside HSR markets. The automobile and out-of-corridor market increases are greater than the overall increase because of the CHSRA projected *decline* in HSR ridership in the air markets (longer distance markets) between 2020 and 2030.

As is indicated above, HSR competes much better for airline passengers than for automobile drivers and passengers. The inconceivable incongruities between the 2020 and 2030 projections is cause for the most serious concern and severely undermines the credibility of the 2030 projections.

Figure 1: HSR Projection Change: 2020-2030

2030 BASE COMPARED TO 2020 INVESTMENT GRADE

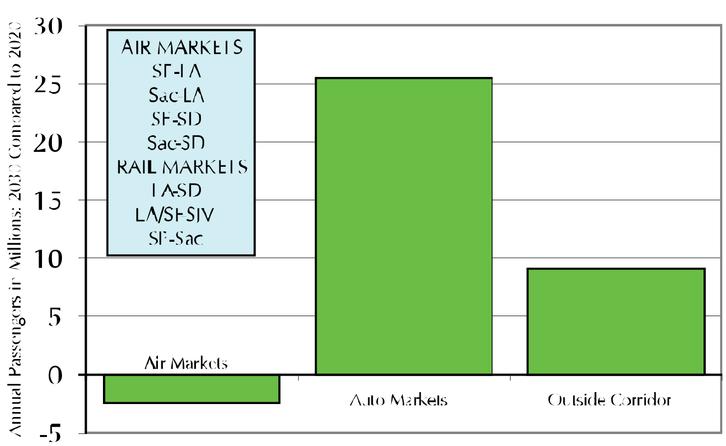
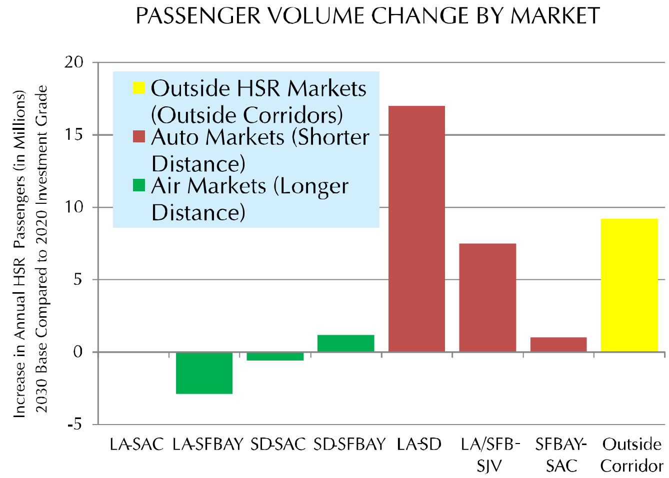


Figure 2: Explanation of Higher 2030 Projections



Inconsistencies: CHSRA and Independent Projections

The CHSRA projections are exceedingly optimistic. Earlier independent projections for similar routings estimated considerably lower ridership levels than any that have been produced by the CHSRA.

A University of California Berkeley report analyzed a projected system with a route structure similar to the CHSRA proposal except that it did not link Los Angeles–San Diego.[138] Like the current proposal, this plan anticipated trains running at up to 220 miles per hour (350 kilometers per hour). The University of California ridership projection, adjusted to 2030 and accounting for the somewhat longer currently planned system, would be 22.1 million intercity riders.[139] The CHSRA 2030 Base Projection (65.5 million) is nearly 3 times the 2010 University of California Projection , while the CHSRA 2030 High Projection (96.5 million) is more than four times the University of California projection.

Another independent HSR projection was prepared in a Federal Railway Administration report[140] for a San Francisco–Los Angeles–San Diego route. A 2030 projection of 25.8 million annual intercity riders is obtained by adjusting this projection for market growth to 2030 and route and speed differences.[141] The CHSRA 2030 Base Projection (65.5 million) is 2.5 times FRA Projection as adjusted to 2030. Moreover, the CHSRA 2030 High Projection (96.5 million) is nearly 4 times the FRA projection as adjusted to 2030.

The immense differences in ridership between these independent projections and the CHSRA projections also suggest a significant exaggeration in the CHSRA 2030 ridership projections. It is meaningful that the independent projections are far closer to the 2020 Investment Grade Projection (all adjusted to 2030) than the 2030 Base Projection and CHSRA 2030 High Projection. This is further indication that the current projections may be highly inflated.

Unachievable Load Factors

Load factor is the measure of the average number of passengers on trains compared to the capacity. Thus, if the average train can carry 1,000 passengers and the average number of passengers on trains is 700, then the load factor will be 70%.[142] CHSRA anticipates an average load factor of nearly 85 percent.[143] This is a very high figure and is contrary to experience on high-speed lines elsewhere. The FRA California high-speed rail study placed the average load factor at 51 percent. The CHSRA's projected load factor is so high that it represents additional evidence that the forecasts for California are exceptionally optimistic. Load factors are materially smaller on other, well-established systems (Figure 3).[144]

- The TGV (*Train à Grande Vitesse*) high-speed rail system in France claims a load factor of 71 percent. The French system prides itself on effective "yield management" techniques[145] for filling seats and may have reached a practical load factor limit.[146] The CHSRA's projected load factor is nearly 20 percent higher than the impressive French figure.

- Amtrak's Acela has an estimated load factor of approximately 55 percent.[147]

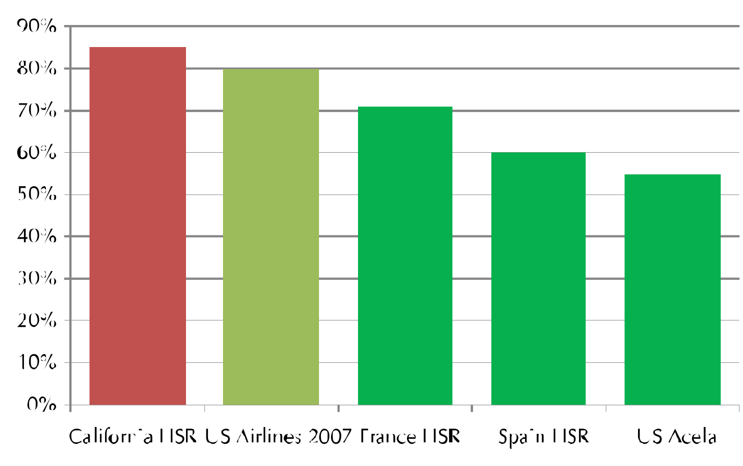
- The Spanish high-speed rail system achieved a load factor of 60 percent in 2004.[148]

In addition, a National Research Council study of the prospects for high-speed rail in the United States assumed a 50 percent load factor in modeling a prototypical system.[149]

In 2007, domestic airlines achieved a load factor of 80 percent.[150] This is an unprecedented figure for the airlines, which had historically achieved between 60 and 70 percent load factors. Such a high figure is not likely with respect to a high-speed railway because of important operational differences.

Figure 3: California HSR Load Factors in Context

COMPARED TO AIRLINES AND OTHER HSR SYSTEMS



Trains stop at multiple stations and are likely to have lower load factors than airliners, which generally do not make intermediate stops. A Los Angeles–San Francisco train stopping at Palmdale might also stop at a number of stations such as Bakersfield, Fresno, Merced, Gilroy, San Jose, Redwood City or San Francisco Airport. Between each of these locations, other passengers can ride, leaving seats empty for other parts of the trip. In short, it is rare that all the seats on trains are filled from the train's origin station to its ultimate destination station, except of course when it is a non-stop train operating at a peak period, such as a San Francisco to Los Angeles express.

Thus, it is more difficult for a rail line to achieve airline-style high load factors. The CHSRA's forecast of an 85 percent load factor appears to be far greater than is likely to be achieved and therefore lacks credibility.

Comparison to Acela Projections

During the 1990s, Amtrak announced plans to improve the speed of and expand its high-speed rail operations in the Northeast Corridor (NEC), between Washington, New York and Boston.[151] In the Boston–New York sector alone, Amtrak projected an increase of two million annual riders on its Acela service.[152]

Yet in 2007, ridership was only 1.1 million passengers higher over the *entire* Washington–New York–Boston corridor than in 1997.[153] In 1997, the Metroliner service, later replaced by the Acela, carried 2.1 million passengers. In 2007, the Acela service carried 3.2 million passengers. Thus, the actual ridership increase was at least 45 percent below the projection.[154]

The NEC's high-speed ridership is starkly different than the CHSRA's projected ridership. Amtrak's current ridership of 3.2 million annually is 95 percent below the CHSRA intercity projection of approximately 65.5 million riders. Even if the regional Amtrak trains operating over the NEC are added, the total annual ridership is only 10 million—less than 20 percent of the CHSRA 2030 Base Projection for the California HSR system. Moreover, the Acela's modest ridership increases have occurred at the same time that gasoline prices have risen by an unprecedented magnitude. Finally, the NEC metropolitan areas in 2006 had a population of 44.3 million, slightly more than the CHSRA's current 2030 projection for the California corridor at 43.8 million.

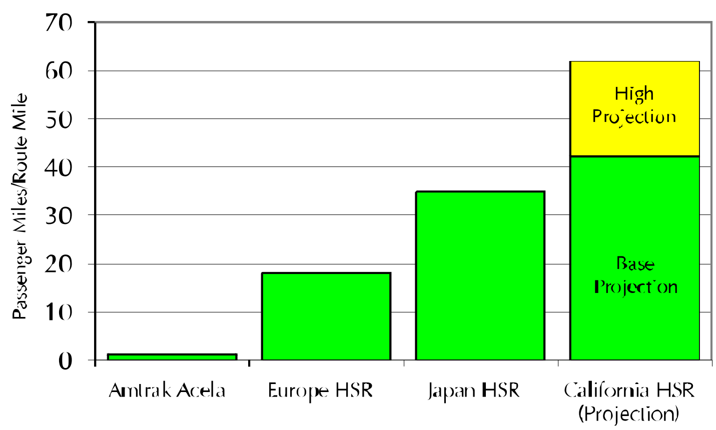
As in the case of Japan and Europe below, the Northeast Corridor is a historically strong route. Current ridership does not principally consist of travelers diverted from automobile and air trips, but rather from retaining passengers who were already traveling by rail. The rail trips that might be retained in California are a small fraction of the proposed ridership.

Unrealistic Ridership Intensity Projection

Ridership intensity—passenger miles per route mile—is a measure of the demand that exists for HSR service on a particular system (See Figure 4).

Figure 4: Ridership Intensity Comparisons

PASSENGER MILES PER ROUTE MILE



CHSRA projects ridership intensities that are far above those achieved in Japan, France and the Northeast Corridor, each of which is at least comparable or superior to the California market in its underlying HSR market dynamics. (See Part 3, International Experience.)

- **Amtrak Acela.** It is estimated that Amtrak's Acela service achieves approximately 1.2 million passenger miles per route mile.[155] The CHSRA ridership intensity of 42 million to 62 million passenger miles per route mile is more than 30 times the Acela ridership intensity.

- **Japan's Bullet Train.** In 2005, the Bullet Train system registered a ridership intensity of 33 million passenger miles[156] of travel per route mile.[157] The CHSRA is projected to attain a far higher 42 million to 62 million intercity passenger miles[158] of travel in 2030.[159]

- **France's TGV.** The CHSRA's ridership projections are also higher than the TGV system in France, which carried 29 million passenger miles per route mile in 2006.[160] The California HSR system is projected to carry 42 million to 62 million intercity passenger miles per route mile—a substantially higher ridership intensity than is found on the French TGV.

- **The FRA Projection:** The FRA projected ridership intensity of 10.7 million passenger miles per route mile on the California HSR system, adjusted for market growth to 2030. The CHSRA ridership intensity of 42 million to 62 million passenger miles per route mile is four to six times the FRA projection.[161]

The California HSR ridership intensity projections are far above the actual experience of mature high speed rail systems in Japan, France and the Northeast Corridor. Moreover, they are far above the independent projection for a similar California corridor. This is further indication that the CHSRA ridership projections are unrealistically high.

Unattainable Speeds Reduce Potential

CHSRA claims that HSR would enable travel between downtown Los Angeles and downtown San Francisco in 2 hours and 38 minutes. However, this Due Diligence Report estimates that the fastest non-stop expresses would take much longer—3 hours and 41 minutes. (See Part 4, Forecasting Speed, Federal Safety Standards and Security in Age of Terrorism for additional reasons for potentially slower trip times.) Slower travel speeds would reduce the attractiveness of HSR relative to airlines and result in lower levels of ridership.

Moreover, there will be few non-stop expresses, perhaps from four to six trains between the two downtown stations daily (See Part 4, Passenger Convenience). This means that most if not all trains will fail to achieve the aggressive travel time that CHSRA projects. Each stop added to a train schedule lengthens its travel time. Less frequent express trains will make HSR less competitive with airlines and reduce its potential to achieve the CHSRA ridership projections.

Fare Revenues: Extremely Low

Fare levels are an important factor in demand modeling. If lower fares are assumed, the resulting ridership projection will generally be higher. A review of commercial revenues indicates the likelihood that projected fares are far below levels on other high-speed rail systems. This is another factor that suggests that the ridership projections are high.

For example, the projected San Francisco–Los Angeles unrestricted business class fare is proposed to be $70 in 2030.[162] The California HSR will thus have fares below that of other major HSR systems. The highest fares (business class) are Tokyo–Osaka $135, Paris–Marseille $140 and New York–Washington $172.[163] Each of these is a major market in which the travel times of HSR and airlines are comparable.

Moreover, CHSRA data indicates 2030 commercial revenues to be the equivalent to $0.10 per passenger mile.[164] It is always risky to make international cost comparisons, however these differences, on the order of three to one, suggest that CHSRA is relying on unrealistic fare assumptions. Compare that estimate with the following:

- **Japan.** The Bullet Trains on each of the three main Japanese HSR lines received the equivalent of between $0.31 and $0.33 in revenue per passenger mile in 2007.[165]

- **France**: While commercial revenue for the world's second largest high-speed rail system is unavailable, business class fares are higher in France than in Japan, indicating an even higher cost structure. Further, TGV fares could rise substantially above their current levels. It has been reported that the French national railway (SNCF) may be required to increase fares as much as 80 percent by 2015 to pay for track improvements maintenance and debt service.[166]

- Neither the Japanese nor the French system is saddled with the huge debt service payments that will be required of the California HSR system, making the low-fare revenue assumptions look even less achievable.

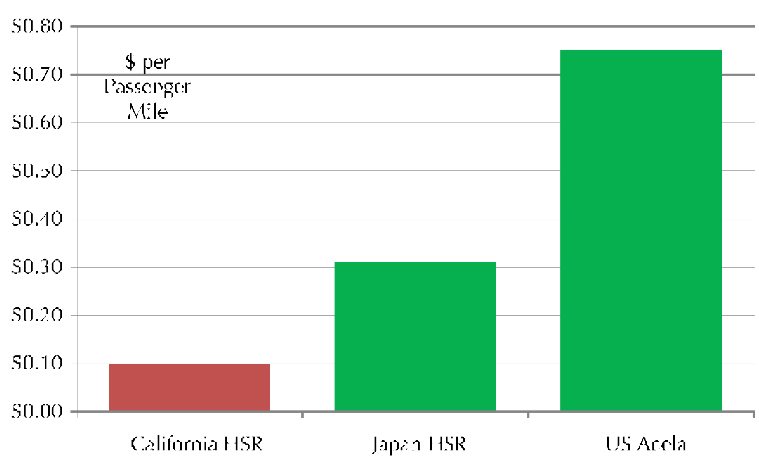
- The discrepancy between proposed CHSRA fare levels and those of Amtrak's Acela are even more stark. It is estimated that in 2007, the fare revenue per passenger mile on Acela was approximately $0.75, excluding ancillary revenues.[167] This is more than seven times the CHSRA's projected revenue per passenger.

The experience of such HSR operators leads to the conclusion that the proposed fares are unrealistically low (see Figure 5). It seems likely that the CHSRA will have to charge higher fares in its efforts to achieve profitability—or simply to cover higher-than-anticipated costs—which would result in lower ridership.

The effect of the higher fares likely to be necessary would be that HSR in California will be a less potent price competitor in the marketplace than the CHSRA planners assert. This is another factor that makes it unlikely that the CHSRA's ridership projections are realistic.

Figure 5: California HSR Revenue/Passenger Mile in Context

COMPARED TO OTHER HSR SYSTEMS



Commuter Projections Appear Overstated

Unlike some HSR systems, CHSRA plans to provide a substantial amount of "commuter service," within regions, principally in Southern California and the Bay Area. For example, CHSRA would be targeting people traveling to work between Orange County and downtown Los Angeles and between San Jose and downtown San Francisco.

CHSRA indicates that its commuter fares would be set 50 percent above those of conventional commuter rail. This usage is not projected to provide the greatest part of the commercial revenue, nonetheless the projections appear to be high.[168]

- In Southern California, annual HSR commuter ridership is projected to exceed 18 million in 2030. The HSR commuter rail service would radiate on three lines from Los Angeles Union Station (toward Palmdale on the line to San Francisco; to the Inland Empire on the line to San Diego; and a "stub" line to Orange County). In 2006, the commuter rail systems in Los Angeles (Metrolink) and San Diego (The Coaster) combined carried 13 million annual riders[169] on eight lines.

- In the Bay Area, 4.5 million annual HSR commuter riders are projected in 2030. The present Peninsula commuter rail line (Caltrain), and the Altamont Commuter Express (ACE) that uses the Altamont Pass on its Stockton–San Jose routing, carried 9.6 million riders in 2006.[170] Another 1.5 million passengers are being carried on the Capital Corridor trains (Sacramento-Oakland-San Jose). Thus, HSR is projected to add approximately 40 percent to current commuter rail volumes.[171]

The HSR commuter ridership projections appear to be enormously high for two reasons. The first is that the far higher fares seem likely to deter ridership, even at greater speeds. The second is that there is little potential for increasing commuter rail ridership overall. Commuter rail, as a transit mode, is most effective in serving downtown destinations, which have the highest concentration of employment locations. Other stations tend to have far fewer jobs that can be easily accessed by walking from the station or by quick, frequent and convenient local transit services. It does not appear that the market exists for such a large increase in commuter rail ridership. Thus, as in the case of intercity ridership, HSR commuter ridership appears to be greatly overestimated.

CHSRA 2030 Ridership Projections: Absurd

The CHSRA 2030 Ridership Projections are indicated as very optimistic by the reasonableness tests above. The CHSRA explains the higher 2030 ridership projections as follows:

> *These new ridership forecasts are higher than those analyzed in the previous program EIR/EIS for the HSR system; however, this analysis is consistent with that provided in the previous document because the infrastructure and facilities footprints analyzed in that document would accommodate the new ridership forecasts.*[172]

The explanation is unsatisfactory because infrastructure and facilities do not increase the size of the market nor do they materially increase ridership. This is akin to arguing that building a larger stadium will materially increase attendance at football games in and of itself. In fact, demand is independent of capacity. Providing additional HSR service is unlikely to materially increase demand. Moreover, the fact that this unsubstantiated increase occurred relative to an investment-grade projection could justify considerable skepticism.

Both the CHSRA 2030 Base and 2030 High ridership projections are far above the 2020 Investment Grade projection and the independent projections (all adjusted to 2030). Moreover, this Due Diligence report notes that CHSRA has often cited the higher, more optimistic projections, without reference to its own more conservative projections in its analysis and promotion.

Overall, both the 2030 CHSRA Base Ridership Projection and the 2030 CHSRA High Ridership Projection are so optimistic as to be characterized as “absurd.”

Due Diligence Ridership Projections

Based upon a review of available data and projections, this report provides a range of realistic intercity ridership projections for 2030.[173] Commuter ridership is assumed to vary from CHSRA projections by the same percentage as intercity ridership, since insufficient ridership and revenue data is available in CHSRA documents. Further, commuter ridership is not integral to the financial success of the project. The projections of this Due Diligence Report are as follows:

- **2030 Due Diligence Base Projection.** A realistic base forecast is that annual intercity HSR ridership would reach 23.4 million passengers. This is 64 percent below the CHSRA 2030 Base Projection of 65.5 million passengers. Even more striking, it is 76 percent below the CHSRA 2030 High Projection of 96.5 million passengers.[174]

- **2030 Due Diligence High Projection.** A realistic high forecast is that the annual intercity ridership would be 31.1 million. This higher ridership forecast would be more likely if airline fares, or to a lesser degree, automobile operating costs should rise materially relative to HSR fares. This is 53 percent below the CHSRA Base Ridership Projection of 65.5 million passengers and 68 percent below the CHSRA High Ridership Projection of 96.5 million passengers.

This report’s due diligence projections are compared to other projections in Table 6 and Figure 6, adjusted to 2030 and adjusted for route segments not in the original projections. None of the projections, by the University of California Berkeley, by the Federal Railway Administration or by this report reaches the adjusted 2030 level of the CHSRA’s 2020 Investment Grade Projection.

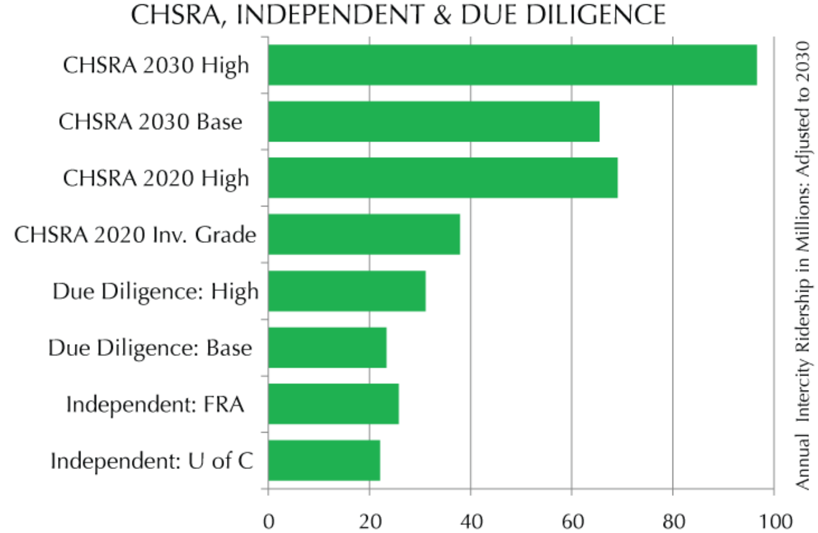
Table 6: Comparison: Intercity Ridership Projections & Adjustment to 2030

Title	Explanation	2030 Projection* (Millions of Annual Riders)	Projection Compared to CHSRA 2030 Base Projection
2010 University of California Projection	SF-Sacramento- LA-San Diego only route study by the University of California Transportation Center Berkeley (1994)	22.1	-66%
2020 FRA Projection	SF-LA-San Diego only route study by the Federal Railroad Administration (1997)	25.8	-61%
2020 Investment Grade Projection	Ridership projection by CHSRA indicated as base for 2020. Also called “investment grade.” Produced by Charles River Associates (2000)	37.9	-42%
2020 High Projection	Ridership projection by CHSRA indicated as “sensitivity analysis” or “high” for 2020. Produced by Charles River Associates (2000)	69.1	+5%
CHSRA 2030 Base Projection	Ridership projection by CHSRA indicated as base for 2030. Produced by Cambridge Systematics (2007)	65.5	0
CHSRA 2030 High Projection	Ridership projection by CHSRA indicated as “sensitivity analysis” or “high” for 2020. Produced by Cambridge Systematics (2007)	96.5	+47%
2030 Due Diligence Base Projection	Ridership projection considered most likely by this report. (2008)	23.4	-64%
2030 Due Diligence High Projection	Ridership projection considered highest likely by this report. (2008)	31.1	-53%

* Note: Where the projection year is before 2030, projections are estimated upward to account for market growth to 2030, using CHSRA assumptions. Adjustments are also made to make route lengths comparable. Original projection figures are in Table 5.

Figure 6: Intercity Ridership Projections: 2030

CHSRA, INDEPENDENT & DUE DILIGENCE



Summary of Ridership Differences

Extensive differences exist between the various CHSRA projections. That, combined with the substantial disparities between the current CHSRA projections with high-speed rail systems elsewhere in the world indicates a pattern consistent with ridership over-projections for projects documented in the international experience.[175] Excessive ridership and revenue projections are a serious concern because any financial plan will require sufficient ridership to cover operating expenses, principal and interest on bonds, and the return on investment for private participants.

It is highly likely that the ridership projections will pose substantial problems for the project, the state taxpayers, and private investors as the revenue projections fall far short of providing the required project funding.

This study is not the first instance where concerns about the California HSR ridership projections have been raised. Even before the much higher 2030 ridership projections were released, the CHSRA's forecasts had come under unusually provocative criticism. University of California professor and transportation textbook author William Garrison characterized claims of massive ridership and low fares as "outrageous statements and lies,"[176] which echoed the evaluation of the world infrastructure research previously cited.

Former State Senate President James Mills—considered the "father" of the San Diego Trolley—served on the CHSRA board. It is reported that Mills resigned from CHSRA at least partially because he "couldn't get the truth" out of staff. In 2004, he is reported to have "described the entire project as 'based on a fallacy' of wildly exaggerated ridership projections. It stems, he said, 'from hiring a consulting firm (and) letting them know what you want them to say.'"[177]

In 2008, Mills said he is skeptical it will attract the level of private funding that the CHSRA envisions, adding: "I think it's a scam. It commits the state to $10 billion and we don't even know if we will get a high-speed rail system for it."[178] These are extraordinary statements from a long-time and continuing rail supporter, who nonetheless, points to a significantly flawed planning process.

There are multiple indications that the CHSRA ridership projections appear to be absurdly high. Ridership inflation is consistent with the experience of demand exaggeration that has been identified in the world infrastructure research. As a result, it can be expected that CHSRA fare revenue will be far less than anticipated, leading to financial difficulties. (See Part 9, Due Diligence Financial Projections.)

Conclusion

Based upon an examination of the market and the international experience with ridership projections, it appears that the CHSRA 2030 ridership projections are absurdly high. It is likely that the HSR will fall far short of its revenue projections, leading to a need for substantial additional infusions of taxpayer subsidies.

The CHSRA's ridership forecasts could well rank among the most unrealistic projections produced for a major transport project anywhere. That is because the projections reflect assumptions that are contrary to actual experience, forecasts are inconsistent with independent projections, load factors and passenger miles-per-route mile calculations ("ridership intensity") are questionable, and studies rely on extraordinarily low fares that are not found on similar HSR systems.

This study—which relies on assumptions that are generous to HSR —projects 2030 intercity ridership at from 23.4 million to 31.1 million, which are 64 percent and 53 percent lower, respectively, than the CHSRA's same-year base projections.

B. Forecasting Costs

Capital costs have risen from the CHSRA's 1999 business plan estimate of $30.3 billion for the entire system to a $45.4 billion estimate in 2008 for Phases I and II alone. Depending upon future plans, costs could increase to between $51.4 billion and $82.3 billion (all in 2006$.) It is likely that HSR will require substantial additional taxpayer funding to complete Phase I, Phase II, the "Missing Phase" and the "Implied Phase."

Evolution of Capital Costs

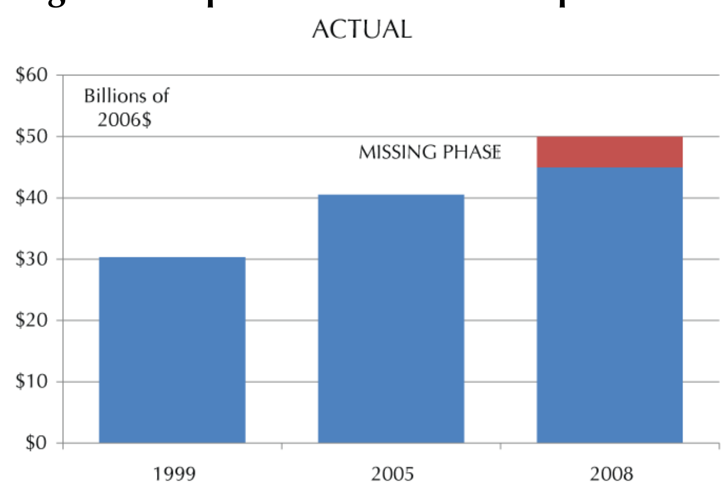
The projected capital costs of HSR have risen strongly during the planning process, even after adjustment for inflation. (All data is adjusted to 2006$.)[179]

The 1999 CHSRA *Business Plan* estimated that the entire system would be built for $30.3 billion ($25 billion in 1999$). The 2005 EIS/EIR raised the estimate to $40.5 billion. By 2008, documents prepared for a meeting for potential investors indicated that the costs had risen to $45.4 billion. This figure included $30.7 billion for Phase I (Anaheim to San Francisco) and $14.7 billion for Phase II (Sacramento and San Diego extensions).[180]

However, the investor documents with the $45.4 billion figure do not appear to include the Oakland-East Bay to San Jose section that was in the original proposal (Senate Bill 1856).[181] Should the $45.4 billion figure include only Phases I and II, however, then the "Missing Phase" of Oakland–East Bay–San Jose would increase the cost to approximately $50.2 billion.[182] Thus, the cost of the HSR system rose a minimum of 50 percent from 1999 to 2006 (from $30.3 billion to $45.4 billion and to $50.2 billion when including the "Missing Phase"), as shown in Table 7 and Figure 7.

Table 7: Capital Costs: Evolution (in Billions of Dollars)			
Planning Document	Inflated to 2006$	Original Estimate	Year$ of Original Estimate
Business Plan: 2000	$30.3	$25.0	1999$
FEIS: 2005	$40.5	$37.0	2003$
Investor Package 2008	$45.4	$45.4	2006$
Phase 1 San Francisco-Los Angeles-Anaheim	$30.7	$30.7	2006$
Phase 2 Sacramento-Merced, Los Angeles-San Diego	$14.7	$14.7	2006$
Investor Package 2008: with Missing Phase	$50.2	$50.2	2006$
Phase 1 San Francisco-Los Angeles-Anaheim	$30.7	$30.7	2006$
Phase 2 Sacramento-Merced, Los Angeles-San Diego	$14.7	$14.7	2006$
Missing Phase: Oakland-East Bay-San Jose[183]	$4.8	$4.8	2006$

Figure 7: Capital Cost Escalation Experience



It is typical for costs to rise further as more detailed planning and engineering proceeds. There is much more of such work to be done and thus, potential for further capital cost increases.

World Infrastructure Research Findings

The already experienced cost increase may be just the beginning. Comprehensive international research has identified such cost increase trends as the rule rather than the exception for large transportation projects.

European researchers reviewed the capital cost experience of 258 transportation projects in Europe and North America from 1927 to 1998.[184] They found that cost escalation from the point of project approval to completion can be as much as from 50 percent to 100 percent above projection and cost overruns occurred in 9 out of 10 projects.[185] The average cost escalation for rail projects was 45%. Further, this world infrastructure research concluded that initial project estimates have *not* become more accurate over time.[186]

Boston's "Big Dig" highway project is particularly noteworthy. Flyvbjerg et al., note that the project cost increased by nearly 200 percent, escalating to a final bill of nearly $15 billion.[187] Overseas, the Channel Tunnel's actual construction and financing costs turned out to be 140 percent higher than forecast.[188]

The world infrastructure research found that projections typically lacked realism and failed to take into consideration risks such as unanticipated project delays, changes in specifications and unanticipated geologic risks.[189] In an article published by the Transportation Research Board of the National Research Council (United States), Skamris and Flyvbjerg conclude:

> *All of this combines to create an environment in which cost forecasts are often optimistic, raising taxpayer costs well above the projections used when projects are approved. This is an international problem, as a National Research Council study reported: ". . . the main lessons are that cost overruns of 50 to 100 percent are common; overruns of more than 100 percent are not uncommon."*[190]

The world infrastructure research concluded that "Megaproject development is currently a field where little can be trusted, not even—some would say especially not—numbers produced by analysts."[191] Moreover, after considering numerous explanations for the pervasiveness of unrealistically low estimates, the researchers attribute underestimated costs to "strategic misrepresentation, namely lying, with a view to getting projects started."[192] The use of the term "lying" in academic research is highly unusual, which given the strong reputations of the authors represents a strong indictment of megaproject planning.

The report of the California Senate Transportation and Housing Committee raises these concerns:

> *California's high-speed rail project is a "mega" project. The cost, schedule, project scope and risks associated with such a project are unusually large. This has been demonstrated in mega projects throughout the world. For example, Boston's Big Dig, the Eurotunnel (or "Chunnel") linking Great Britain with France, and the Denver Airport experienced substantial difficulties controlling project cost, schedule and budget. Each of these large infrastructure projects deployed technologies that were known and understood, but each was delayed and came in significantly over budget.*[193]

Finally, according to the president of the Korean national railway (Korail), the new South Korea high-speed rail system experienced capital costs that were three to four times the original projection.[194]

The experience thus far with the California project cost projections is consistent with the experience described in the world infrastructure research. Additionally, as noted above, it seems highly likely that the project will become even more expensive as planning and engineering moves from CHSRA and consultant offices to "the field" and actual construction.

Appropriately Designing Megaprojects

The cost escalation (and customer usage, see Section IV, Forecasting Ridership) identified with respect to these large transportation projects does not mean that they should not be built. It does suggest, however, the importance of skillful and effective project management design. Avoiding the mistakes so prevalent in the research requires appropriately structuring the incentives and project delivery mechanisms. One of the most important concerns is the conflict of interest that arises with projects that are developed and promoted by governments. As Flyvbjerg et al., note:

> *…can a government act effectively both as promoter of megaprojects and as the guardian of public interest issues … shielding the taxpayer against unnecessary financial risks? We answer the question in the negative.*[195]

Another problem is that major project management firms, consulting companies and construction contractors bear virtually none of the financial risk and thus, as experience has shown, have insufficient incentives to ensure that project estimates are accurate and that costs are kept under control.

The problem for California is that the CHSRA project combines the worst of megaproject incentives—a government agency serving the role of promoter (rather than objective evaluator) and virtually no cost control risk being assumed by project management, consulting and construction companies.

The California Cost Challenge

At the same time, the California HSR project could be at particular risk of additional cost escalation because of the unique circumstances of its environment. In particular, it will be necessary to build the system in one of the world's most active geologic zones. This requires compensating for geologic risk in designing the high-speed rail system to withstand major earthquakes. For example, the second most intense earthquake in the lower 48 states since 1900 was the Tehachapi or Kern County earthquake of 1952, which had its epicenter near Arvin, not far from the currently planned alignment of the high- speed rail route between Bakersfield and Palmdale.[196] Long tunnels are anticipated. Building enduring tunnels in potentially unstable conditions could result in substantial capital cost increases as the project is developed further. The difficulties are acknowledged by CHSRA:

> *The Tehachapi mountain range crossing for the proposed HSR system would present difficult terrain and require extensive tunneling to accomplish the necessary traversing alignments. In the screening evaluation, alignment options were considered that could require a total of more than 80 miles (129 km) of twin-tube tunneling, including the potential for continuous tunnel segments of more than 30 mi (48 km). Crossing the Tehachapi Mountains between Los Angeles and Bakersfield could require 30 to 45 total miles (48 to 72 km) of tunneling in extremely challenging seismic and geologic conditions. These mountain crossings and the required tunneling would represent serious challenges for the construction of a proposed HSR system.*[197]

In short, the cost to build the tunnels will be directly related to the length of tunnels, the complexity of their design and construction, and their ultimate routing, and none of these issues is settled at this time.

What CHSRA consultant Lehman Brothers has called "political meddling" could add further costs required by changes in plans or phasing. This is illustrated by a position expressed to the CHSRA's board of directors by former Oakland Mayor and now State Attorney General Jerry Brown:

> *I think you are going to want take Oakland into account in a serious way and not in an afterthought. And who knows, even by that time Oakland will have a lot of political power…. if you want to build two lines up on the East Shore as well as the Bay Shore, what's a few extra billion dollars among friends?* [198]

As noted above, the Oakland-East Bay-San Jose line appears to have become an afterthought, being excluded from Phases I and II and representing the "Missing Phase."

Political pressures could lead to adding stations even when ridership, cost and environmental considerations indicate they are unjustified—as is the case with Visalia/Tulare/Hanford. In 2005, the CHSRA issued documentation stating, "The BNSF alignment is the preferred option for the HSR services between Fresno and Bakersfield with <u>no</u> potential station between Fresno and Bakersfield (emphasis by CHSRA)."[199] Documentation also states that the stop has "low ridership potential compared to other potential station locations investigated by the Authority"[200] and "not having the Hanford HST station would eliminate the alignment through Hanford, resulting in cost savings of about $420 million plus less potential environmental impact since the HST alignment would avoid the Hanford urban area."[201] Despite such ridership, environmental and cost liabilities, the CHSRA in 2008 authorized a feasibility study to provide for a station serving the Hanford-Visalia area—an announcement included at the bottom of a press release on a completely different subject (greenhouse gas emissions).[202] As of September 2008, CHSRA shows Visalia/Tulare/Hanford as a station on its interactive website map.[203]

Finally, community pressures could lead to the necessity of additional improvements that are not included in present cost projections. This could include, for example, placing HSR tracks either in tunnel or covered trench through some areas or adding sound walls on elevated structures to mitigate noise levels in urban neighborhoods.

Financial Uncertainty

Cost increases could pose substantial problems for the project, the citizens of the state, state government, private investors and even local governments.[204] The current plans fall far short of providing the funding that would be required for the project, even Phase I. (See Part 4, Financial Uncertainty.)

Currently, the plan is to undertake construction of a “Phase I.” This would provide service from Anaheim, through Los Angeles and the San Joaquin Valley to San Jose and San Francisco. This section, as noted above, is projected to cost nearly $30.7 billion (2006$). Yet, the financing plan is by no means set.

This factor creates substantial risks. Failure to secure complete and timely funding for Phase I could cause construction activities to be extended much longer than intended. As a result, many more years could be required for service commencement, or only limited service might be operated. This would have significant negative impacts on overall financial performance, especially because of CHSRA’s operating ridership revenue projections that are considered to be highly optimistic. (See Part 4, Forecasting Ridership.)

More expensive route sections would be particularly at risk, should insufficient funding be available to finance the likely increasing costs of construction. For example, the sections in the San Francisco Bay area and the Los Angeles area might be forgone altogether. Instead, trains on a “skeletal” HSR system would gain access by sharing tracks with slower commuter rail and freight trains on the Peninsula line in the San Francisco area and Metrolink in Los Angeles and Orange County.[205] This would considerably slow operations and make service less reliable. Given the crucial nature of minimal travel time, any such cost cutting measure could seriously reduce ridership and revenues, while putting investors at serous risk.

There is currently no financing plan for Phase II of the project, which would extend service to Sacramento and San Diego from both San Francisco and Los Angeles. Should cost or financing difficulties arise with respect to Phase I (a likely event), construction of the Sacramento and San Diego extensions could be indefinitely delayed, if not cancelled altogether, or alternate routings via existing rail lines could be proposed. (See Part 8, If the CHSRA Runs Out of Money.)

The potential cost problems extend to comparisons made by the CHSRA with highly exaggerated alternatives for highway and airport expansion that are used to suggest that “high-speed trains would cost less than half as much to build over 30 years than other transportation options.” (See Part 5, Alternatives to Building the HSR System.)

All such factors indicate that further capital cost escalation is likely, which would lead to misallocation of scarce resources, which, in turn, will produce losers among those financing and using infrastructure, be they taxpayers or private investors.[206]

Due Diligence Cost Projections

If, as is already apparent, the international capital cost escalation experience applies in California, it is reasonable to expect capital cost overruns. This report offers a Due Diligence Base Capital Cost Projection of 20 percent above current plans and a Due Diligence High Capital Cost Projection of 50 percent above the current figure (Table 8 and Figure 8). These projections are considered conservative in light of the international research documenting even greater cost escalation and the recent overall escalation in construction costs that has occurred in the economy.

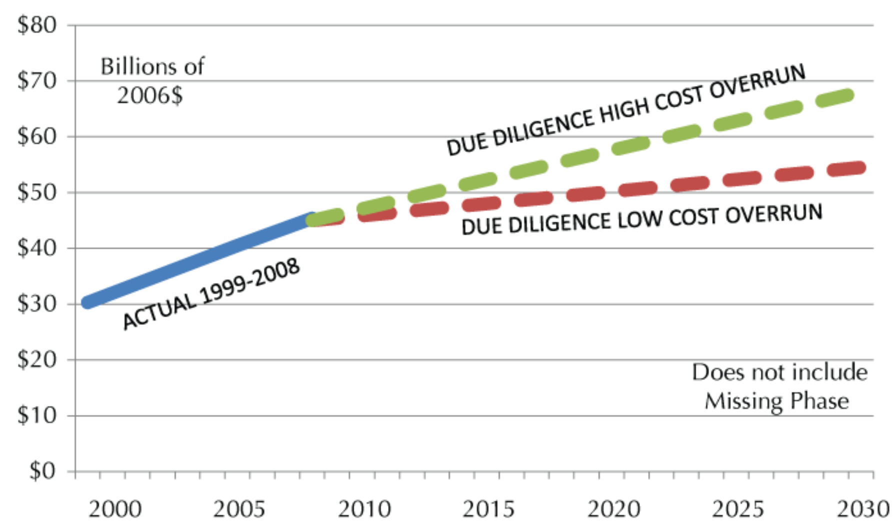
- If it is assumed that the investor documentation represents the entire system that will be built, then the final estimated capital cost would rise from $45.4 billion to between $54.5 billion and $68.1 billion (2006$).[207]

- If it is assumed that the entire system is built, including the Missing Phase, then the final estimated capital cost would rise from $50.2 billion to between $60.2 billion and $75.3 billion (2006$).[208]

Table 8: Capital Costs – CHSRA, Due Diligence Low and High Projections

	CHSRA Projection	Due Diligence Low Projection	Due Diligence High Projection
Phases I & II	$45.4	$54.5	$68.1
With Missing Phase (Oakland-East Bay-San Jose)	$50.2	$60.2	$75.3
In billions of 2006$ Does not include Implied Phase			

Figure 8: Capital Cost Projection
Due Diligence High and Low Cost Overrun



Operating Costs

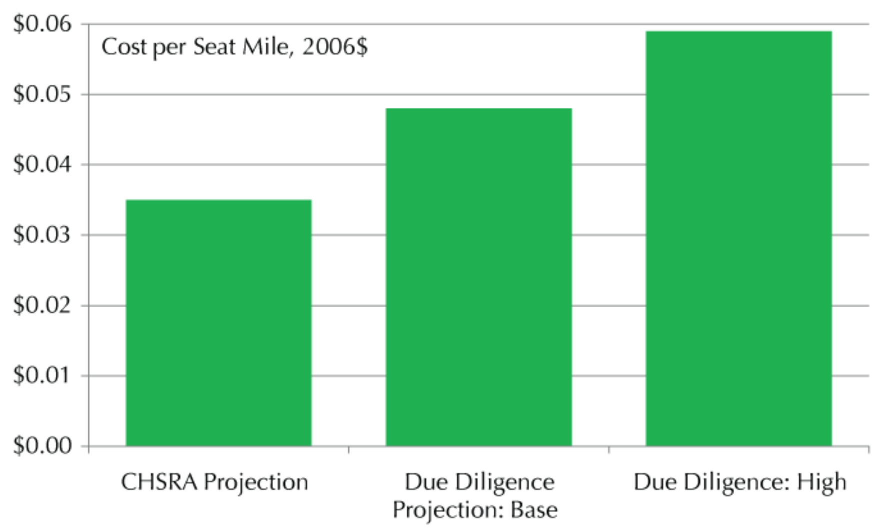
Further, the projected operating cost for the HSR system appears to be low. This is illustrated by analysis of data of comparable projects.

The operating cost per seat mile from the FRA study for the California corridor (2006$) is approximately 40 percent higher than that of the CHSRA projections. A Transportation Research Board report estimated the operating costs of the now defunct Texas TGV at more nearly 70 percent higher than the CHSRA operating cost projections.[209]

Based upon these costs, the Due Diligence Base Operating Cost Projection is 30 percent above CHSRA figures and the Due Diligence High Operating Cost Projection is 60 percent above CHSRA forecasts (Figure 9).[210] The potential for additional operating costs could arise depending upon the performance of trains that have yet to be designed to U.S. standards and the level of security that might ultimately have to be built into the system, but such costs cannot be determined at this time. (See Part 4, Federal Safety Standards and Security in Age of Terrorism.)

Figure 9: HSR Operating Costs

CHSRA & Due Diligence Projections



Conclusion

Capital costs have risen from the CHSRA's 1999 business plan estimate of $30.3 billion for the entire system to a $45.4 billion estimate in 2008 for Phases I and II alone. Depending upon the final extent of the system that is built, capital costs could increase to between $51.4 billion and $82.3 billion (all in 2006$.) It is likely that HSR will require substantial additional taxpayer funding to complete Phase I, Phase II, the Missing Phase and the Implied Phase.

There is overwhelming international evidence that the capital costs of mega projects, including HSR projects like the California HSR, tend to increase substantially. Moreover, the experience with HSR operating costs indicates the potential for much higher costs than are being assumed by the CHSRA.

C. Forecasting Speed

Based upon an examination of operating conditions and the international HSR experience, it appears that the CHSRA speed and travel time objectives cannot be met. As a result, HSR will be less attractive as an alternative to airline travel and is likely to have fewer passengers.

Travel time is a critical factor for HSR in competing against airlines. If the actual travel times are slower than projected, ridership is likely to be lower than projected.

HSR already faces a challenge to its ability to minimize travel times by its circuitous routing. The airline distance between Los Angeles and San Francisco is approximately 345 miles. The road distance is approximately 380 miles. CHSRA documentation uses various rail route lengths between San Francisco and Los Angeles, ranging from 432 miles to 490 miles.[211] The longer HSR routings would make non-stop travel times longer.

Senate Bill 1856 establishes maximum travel times for non-stop services between various terminals. For example, HSR is required to achieve a 2 hour and 42 minute travel time between downtown Los Angeles and downtown San Francisco. The CHSRA's projections indicate that this requirement would be met (2 hours and 38 minutes via the preferred Pacheco Pass alignment and 2 hours and 36 minutes via Altamont Pass).

However, in some corridors, current plans *do not* anticipate achievement of the statutorily required travel times. These corridors are illustrated in Table 9. Perhaps most notably, anticipated Los Angeles–San Diego travel times are nearly one-third longer than the statutory requirement (1 hour and 18 minutes versus 1 hour).[212]

Table 9: Comparison of Statutory and Planned Travel Times

Route	Statutory Requirement*	Plan: Pacheco	Plan: Altamont
San Francisco-Los Angeles Union Station	02:42	02:38	02:36
Oakland-Los Angeles Union Station	02:42	02:30	02:23
San Francisco-San Jose	00:31	00:30	NA
San Jose-Los Angeles	02:14	02:09	02:19
San Diego-Los Angeles	01:00	01:18	01:18
Inland Empire-Los Angeles	00:29	00:33	00:33
Sacramento-Los Angeles	02:22	02:11	02:17
Sacramento-San Jose	01:12	01:18	00:49

Indicates statutorily required time not achieved

Travel Times from NCEIS Table 2.3-1 and Figure 4E-1.

* Statutory times are from Senate Bill 1856. Assembly Bill 3034 slightly changes non-stop operating times, with the exception of Sacramento–San Jose, which would no longer have a maximum non-stop operating time specified in law, and Los Angeles–San Diego, which increases to 01:20.

The Sacramento to San Francisco HSR travel time (not mentioned in the statute) would not be generally materially superior to cars, at approximately 1 hour and 50 minutes (Sacramento to San Jose at 1 hour and 18 minutes plus 30 minutes to San Francisco).

More fundamentally, while state legislation outlines travel time requirements for non-stop trains it does not require non-stop services. As a result, it appears that the CHSRA can skirt the statutory travel time requirements by simply not providing non-stop service over these particular routes. The latest CHSRA principal document (the NCEIS)[213] is internally inconsistent on this matter, in one place stating that there will be non-stop service and in another indicating that the longer routes (such as downtown San Francisco to downtown Los Angeles) will have one intermediate stop. (See Part 4, Passenger Convenience.)

Unprecedented Average Speeds

More importantly, it appears that it will be challenging for HSR to achieve the statutorily required travel times. This is indicated by comparing the proposed speeds to the fastest operating segments in other countries operating HSR (Table 10). The CHSRA documentation provides express operating times between stations. The longest segment of route not in one of the five largest urban areas is from Palmdale to Gilroy. The Authority indicates an express operating time of 1 hour and 35 minutes for this 312-mile segment. At that speed, HSR would average 197 mph, which is unprecedented anywhere in the world. This is a full 25 mph faster than France's fastest TGV service (on the TGV-Est, the world's fastest HSR line), which is on a much shorter segment. It is also 38 mph faster than the world's fastest operating segment that is longer than Palmdale to Gilroy (TGV, Paris to Avignon).

Table 10: Fastest Station-to-Station Travel Times: International High Speed Rail

Segment	Mileage	Travel Time	Average Speed (mph)
CA-HSR Trunk (Gilroy-Palmdale)	312	01:35	197
France: TGV-Est (200 mph)	104	00:36	174
France: TGV Paris-Avignon (186 mph)	408	02:34	159
Japan: Bullet Train	90	00:34	159
Taiwan	111	00:44	152
Germany: ICE Train	83	00:34	146
China: Beijing–Tianjin (217 mph)	70	00:30	140
Spain: AVE	191	01:21	126
South Korea	100	00:50	120
Italy	162	01:31	106
Data from CHSRA and Railway Gazette International and www.china-briefing.com/news/2008/08/01/beijing-tianjin-high-speed-train-service-launched.html			

Moreover, the California HSR speed challenges are generally greater than those faced by other HSR systems. This conclusion results from an analysis of route length, share of length in built-up (urban) areas and projected speed estimates as contained in project documents.

On the California route, approximately *one-third* of the operation will be in urban areas (built-up areas), while in France, less than *one-tenth* of the operation is in urban areas. In contrast to the California HSR proposal, French high-speed rail trains generally have only their terminal stations in urban cores (such as Paris and Marseille on the Paris–Marseille line), with intermediate stations located outside urban areas or in very low density suburban areas. This allows higher speeds for longer distances.

Topography

Higher mountain passes and greater elevation changes can slow high-speed rail. The Paris–Marseille route is far more "HSR friendly" than the San Francisco–Los Angeles route. Paris–Marseille is largely at low elevations, facilitating higher speeds, and has a single significant pass of approximately 1,500 feet. The California line would encounter more challenging topography. The line would begin at near sea level in Los Angeles, reach approximately 4,000 feet between Sylmar and Bakersfield, drop back to near sea level in the San Joaquin Valley, return to more than 1,000 feet in the Pacheco Pass, and then drop again to near sea level in the San Francisco Bay Area. These operating conditions would tend to reduce speeds relative to the Paris–Marseille line.

Yet, HSR projections call for a higher average speed on the California line than on the Marseille line. A Los Angeles–San Jose non-stop train is slated for an average speed of nearly 180 mph, according to CHSRA.[214] The fastest average travel time for non-stop Paris–Marseille trains is approximately 155 mph.[215]

Political Impacts on Speed

Political considerations could slow train travel times even more, as local citizens seek to slow train speeds to reduce noise levels and as communities seek to obtain stations that are not in the current plan. Additional stations would require additional slower operations through built-up areas.[216]

For example, the current HSR Phase I map[217] does not include Merced on the Los Angeles to San Francisco route. However, much HSR documentation indicates a Merced station on that routing, including the NCEIS. A political expectation may have been created that Merced would be included as a stop between Los Angeles and San Francisco. As noted above, this routing would add mileage and additional travel time to Los Angeles–San Francisco non-stop trains.[218]

As previously described, the Authority found that it would have no stop between Fresno and Bakersfield. Yet the Authority has a study underway to serve a potential Visalia/Tulare/Hanford station. (See Part 4 for a more complete discussion of the inclusion of this stop.)

There could be political pressure to require more Los Angeles–San Francisco trains to stop at locations such as Fresno, Bakersfield and elsewhere. An obvious example would be Santa Clarita, which is the 12th largest urban area along the route, the 4th fastest growing and the 21st largest in California.[219] With nearly 200,000 residents, Santa Clarita is larger than other urban locations for which stations are planned, such as Merced, Livermore, Gilroy-Morgan Hill and Tracy.

Moreover, planned operating speeds through urban areas could be reduced further because of public displeasure about noise—again slowing the train schedules.[220]

The extent, if any, of these potential impacts cannot be foreseen. Even after the system is operating, community impacts could be the basis of costly enhancements or service constraints. In the final analysis, a project of this proportion is necessarily political.

Rural Area Speeds

A National Academy of Sciences report on the potential for HSR in the United States indicates that a system with top speeds of 200 miles per hour would average a maximum of 150 mph in rural areas.[221] Based upon the international experience and the National Academy of Sciences report, this Due Diligence Report estimates that the average speed outside built-up areas would not exceed 170 mph.[222]

Urban Area Speeds

At least 150 miles of the route would be in built-up areas and the train could be forced to slow down as it travels through at least five urban areas (Santa Clarita, Palmdale-Lancaster, Bakersfield, Fresno and Merced, in addition to the terminal urban areas of the San Francisco Bay Area and Los Angeles). This is a considerably higher figure than in the similar length Paris to Marseille HSR route, where the alignment passes through less than 30 miles of built-up land. Between the fringes of Paris and Marseille, high-speed rail traverses little or no built-up area.

There are additional challenges to meeting the aggressive travel times required by state statute and proposed by the CHSRA. The use of shared rights-of-way between San Francisco and Gilroy and Los Angeles and Anaheim could make schedule adherence less reliable. (See Part 4.) High-speed trains would encounter interference from the existing commuter trains along such routes, and freight trains may cross the HSR/commuter tracks or even share them. Freight service operates much slower than commuter rail and could slow HSR trains.

The CHSRA plans very high train travel speeds through California communities (Figure 10 and Table 11).

Average speeds of 100 to 150 mph are planned:

- From Gilroy through San Jose, San Mateo County and to San Francisco.
- In the northern San Fernando Valley of Los Angeles.
- On a segment between Norwalk and Anaheim (Los Angeles and Orange County)
- On a segment between Anaheim and Irvine (Orange County)
- From Los Angeles, through the San Gabriel Valley, into the Inland Empire and Riverside.

Higher average speeds of 150 to 200 mph are planned:

- From Riverside through Murrieta and Temecula to Escondido.
- From Escondido to the University City neighborhood of San Diego.

State legislation seems to require top operating speeds through communities in other areas, going so far as to specify that infrastructure be built so that non-stop trains "shall have the capability to transition intermediate stations, or to bypass those stations, at mainline operating speed."[223] This could mean that non-stop trains could operate at 220 miles per hour through such urban areas as Fresno, Merced, Modesto and Hanford (if the station is built).

The National Research Council on U.S. HSR potential indicated that HSR would have slower average speeds—maximum average speeds in urban areas would be from 60 mph to 100 mph.[224] The safety implications of using the proposed, light HSR trains on the same tracks as heavy commuter trains and even freight trains are discussed elsewhere (See Part 4, Federal Safety Standards.) With these constraints, likely community concerns about noise, and operating procedures in overseas high-speed rail urban environments, this Due Diligence Report projects average urban speeds will not exceed 90 mph, much less reach 150 mph in urban segments.

Forecasted Speeds Declining

Already, HSR travel times are being lengthened. In the 2005 EIS/EIR, the downtown San Francisco–downtown Los Angeles nonstop travel time was 2:25. In the 2008 NCEIS, the nonstop travel time is 2:38. This is likely to be just the beginning in the inflation of travel times.

Figure 10: Average Operating Speeds on High-Speed Train System

Average Operating Speed on High-Speed Train System

The CHSRA map is part of the May 2007 Board Meeting Minutes; map located at www.cahighspeedrail.ca.gov/images/chsr/20080121165751_052307_SpeedMap.pdf.

Table 11: Examples of Communities Through Which HSR Speeds Would Exceed 100 Miles per Hour In San Francisco Bay Area, Los Angeles Area & San Diego Area			
150-200 MPH			
Arleta	Perris	Santa Clarita	Temecula
Murrieta	San Fernando	Sun Valley	
100-150 MPH			
Atherton	Kearny Mesa	Morgan Hill	San Diego
Belmont	La Puente	Mountain View	San Fernando
Bloomington	Lincoln Heights	Newark	San Francisco
Brisbane	Linda Vista	Ontario	San Gabriel
Burbank	Livermore	Orange County**	San Jose
Burlingame	Los Angeles	Palo Alto	San Leandro
Carmel Mountain	Los Angeles County*	Pleasanton	San Lorenzo
City of Industry	Menlo Park	Pomona	San Mateo
Colton	Millbrae	Redwood City	Santa Clara
El Sereno	MIra Mesa	Rialto	South San Francisco
Escondido	Miramar	Riverside	Sun Valley
Fontana	Milpitas	Riverside	Sunnyvale
Fremont	Mission Valley	San Bruno	University Heights
Gilroy	Montclair	San Carlos	Walnut
Hayward			
* Los Angeles County south of Norwalk (indeterminable from map): Could include Norwalk, La Mirada, Santa Fe Springs			
** Orange County north of Anaheim (indeterminable from map): Could include Buena Park, Fullerton, Anaheim. Also Orange County between Anaheim and Irvine. Could include Santa Ana, Tustin			

Due Diligence Travel Times

Assuming these Due Diligence average operating speeds (170 mph rural and 90 mph urban), it is estimated that a non-stop train from downtown San Francisco to downtown Los Angeles would take 3 hours and 41 minutes.[225] This is 1:13 more than the CHSRA projection and nearly one hour (59 minutes) more than the statutory requirement. The more numerous trains stopping at intermediate stations would have longer travel times. For example, a train between San Francisco and Los Angeles that stops at four stations (such as San Jose, Fresno, Bakersfield and Palmdale) would have a travel time of approximately 4:17.[226]

It can be expected that the statutorily required travel times will not be met on the long-distance routes such as Oakland–Los Angeles and San Jose–Los Angeles.

It would appear that the statutorily required travel time can be achieved only on the relatively short San Francisco–San Jose corridor (Table 12). As noted above, it is estimated that non-stop express trains between downtown San Francisco and downtown Los Angeles would take 3:41, which is 53 minutes more than the legal requirement. The statutes, however, provide virtually no protection to the riders and taxpayers. This is because the legally required travel times can be easily altered or repealed by a majority vote of the legislature. Finally, slower speeds would result in higher operating costs, because additional labor hours would be required. Slower speeds could also increase capital costs, because additional train sets would be required to fulfill the train timetable.

Table 12: Potential for Achieving Statutorily Required Travel Times		
Route	Statutory Requirement[227]	Potential to be Achieved
San Francisco-Los Angeles Union Station	02:42	NONE
Oakland-Los Angeles Union Station	02:42	NONE
San Francisco-San Jose	00:31	SOME
San Jose-Los Angeles	02:14	NONE
San Diego-Los Angeles	01:00	NONE
Inland Empire-Los Angeles	00:29	NONE
Sacramento-Los Angeles	02:22	NONE
Sacramento-San Jose	01:12	NONE

Finally, in the worst case, it is possible that funding will only be possible for a skeletal system, which would involve a dedicated HSR system from Palmdale to Gilroy, with entry to Los Angeles and San Francisco over existing tracks (although upgraded) that handle commuter rail and freight trains. Minimum non-stop travel times would be hours longer. (See Part 8, If the CHSRA Runs Out of Money.)

The scenarios described above could make HSR less competitive with airlines by slowing the train schedules. Certainly, given the time-sensitivity of travel prediction models, it is likely that such slower travel times would materially reduce ridership projections. All of this leads to the conclusion that the projected high-speed rail travel times are overly aggressive and not likely to be achieved. Slower operating speeds are likely to contribute to lower passenger volumes and less revenue.

Conclusion

Based upon an examination of operating conditions and the international HSR experience, it appears that the CHSRA average speed and travel time objectives cannot be met. As a result, HSR will be less attractive as an alternative to airline travel and is likely to have fewer passengers.

The planned HSR routes are generally longer than highway mileage between the urban areas, which impacts the trains' competitive advantage despite their speeds. The CHSRA's anticipated average speeds are not being achieved anywhere in the world, including on the most advanced systems. HSR trains must operate more slowly through urban areas, and the CHSRA system's urban profile is quite challenging. For example, in comparing San Francisco–Los Angeles with Paris–Marseille, the California line would run through five times as much urban mileage as does the French TGV line that was designed to skirt many urban areas. This study, by assuming realistic speeds, estimates that a non-stop San Francisco–Los Angeles trip would take 3 hours and 41 minutes, longer than the CHSRA projection and the statutory requirement. In the future, the

CHSRA's travel times may be further lengthened by train weight and safety issues and also by political demands to add stops to the system.

D. Federal Safety Standards

No existing HSR trains capable of meeting the goals of the CHSRA system can legally be used in the United States. It is by no means certain that the necessary regulatory approvals of a train from overseas can be achieved without substantial changes in train design and weight. The Authority does not have a usable train design.

The Good News About HSR Safety

A review of railroad safety issues results in a positive conclusion about high-speed rail. The HSR trains that operate on dedicated tracks on which no slower passenger trains and no freight trains are permitted to operate have a virtually perfect safety record. In fact, the CHSRA is accurate in stating that high-speed trains are the safest mode of travel, with no passenger fatalities ever registered on new infrastructure designed for high speeds.[228] However, the CHSRA plans to intermingle high-speed passenger trains with commuter trains, Amtrak trains and freight trains along certain portions of its system. Such intermixing can pose safety problems and require specifications for the California high-speed trains to meet U.S. safety standards that are far more rigorous than overseas standards.

HSR Accidents and Safety Concerns

While safety records on new infrastructure specifically designed for HSR trains is remarkably positive, some serious HSR accidents have occurred that have captured the attention of government officials who set rail safety standards.

The world's most tragic high-speed rail disaster occurred on the Deutsche Bahn AG (German National Railway) on June 3, 1998 when the Inter City Express (ICE Train) derailed because of a wheel malfunction, which resulted in 101 fatalities and many injuries. Contributing to the severity of the accident was that the train derailed into supports for a highway overpass, which in turn collapsed onto the train and completely demolished several railroad coaches. The event occurred on mixed-use tracks which limited the train speed at that point to 124 mph (200 kph).[229] However, the non-dedicated nature of the tracks was irrelevant to the accident. Such a wheel malfunction could have occurred on dedicated high-speed lines that constitute a portion of the train's Munich–Hamburg route. The ICE Train is capable of a cruising speed 186 mph (300 kph), and had the wheel malfunction occurred at such a speed on a dedicated line the consequences could have been just as severe if not worse.

In July 2008, the German railway pulled from service all ICE-3 trains, the newest model of the ICE Train, for precautionary safety checks. Inspectors carried out ultrasound tests after a defective axle caused one of the trains to derail in a station after possibly being damaged earlier on its high-speed run to Cologne.[230]

In short, component failures on high-speed trains can lead to accidents on dedicated high-speed lines or joint-use lines.

A Eurostar (Paris–London) train derailed in France on June 5, 2000 because of a mechanical failure and 14 injuries resulted. While minor, the train was about one-half hour from the Channel Tunnel. Because of how much more catastrophic the accident could have been had it occurred in the tunnel, a transport spokesman in the European Parliament called for a European body to be set up to investigate rail accidents instead of each country conducting investigations in its own territory.[231]

High-speed trains can and do intermingle with slower-moving commuter trains, intercity passenger trains, and freight trains—operations that raise safety concerns.[232] In the case of the CHSRA proposal, the extent of such inter-mingling will be considerably more significant than in Japan or France. (This issue is discussed in more detail below; also, the effect on travel times is addressed in Part 4.")

Track Sharing Approved

The CHSRA indicates that the HSR trains will share tracks with other types of trains over certain urban links. Joint track usage is usually arranged where land-use factors prohibit the construction of all-new HSR-dedicated tracks alongside the existing tracks. The CHSRA stated:

> *While the majority of the high-speed train system is being planned with dedicated separate tracks, there are two sections of the system that are proposed to be shared with existing commuter and intercity trains at reduced speeds. Under current regulations, either the selected European or Asian equipment would have to be modified structurally to meet the FRA requirements or the proposed system would have to be modified in other ways to avoid compatibility conflicts with freight trains and conventional passenger trains.*[233]

Locations where the CHSRA planners anticipate such track sharing include the Caltrain commuter line that links San Francisco with San Jose and Gilroy and over the Metrolink commuter system between Los Angeles and Anaheim (and possibly continuing to Irvine should the Implied Phase be built).[234]

Additionally, long-run budgetary difficulties could require track sharing with Metrolink trains on routes out of Los Angeles to Riverside County or San Diego. (See Part 8, If the CHSRA Runs Out of Money.) The Authority reinforces track-sharing arrangements according to the following EIR/EIS statements:

- In some locations the HSR system would share tracks at lower speeds with other passenger rail services. Shared track operations would use existing rail infrastructure in areas where construction of new separate HSR facilities would not be feasible. While shared service would reduce the speed, flexibility and capacity of HSR service because of the need to coordinate schedules and slower speed limits, it would also result in fewer environmental impacts and a lower construction cost.[235]

- In Northern California, "The Caltrain Corridor (Shared Use) is the preferred alignment option for direct service to San Francisco and San Francisco International Airport (SFO). The alignment between San Francisco and San Jose is assumed to have four tracks, with the two middle tracks being shared by Caltrain and HSR."[236]

- In Southern California the existing Los Angeles–San Diego rail line is the "preferred option to link for HSR service between Los Angeles and Orange County." This assumes shared operations with other passenger services and separation from freight with four total tracks (two for passenger services and two for freight) between Los Angeles and Fullerton. From there to Anaheim and Irvine, the high-speed trains would share two tracks and some passing tracks with Metrolink commuter trains, Amtrak trains and Burlington Northern Santa Fe (BNSF) freight trains.[237] The CHSRA provided a visual portrayal of such track sharing (Figure 11).

- In the San Fernando Valley, "The segment between Los Angeles and Palmdale could yield significant early commuter benefits if a cooperative operating plan can be developed with Metrolink. Under this scenario Metrolink could utilize the new tracks, alignment and grade separations constructed for HST to operate its trains more frequently, efficiently, and safely."[238]

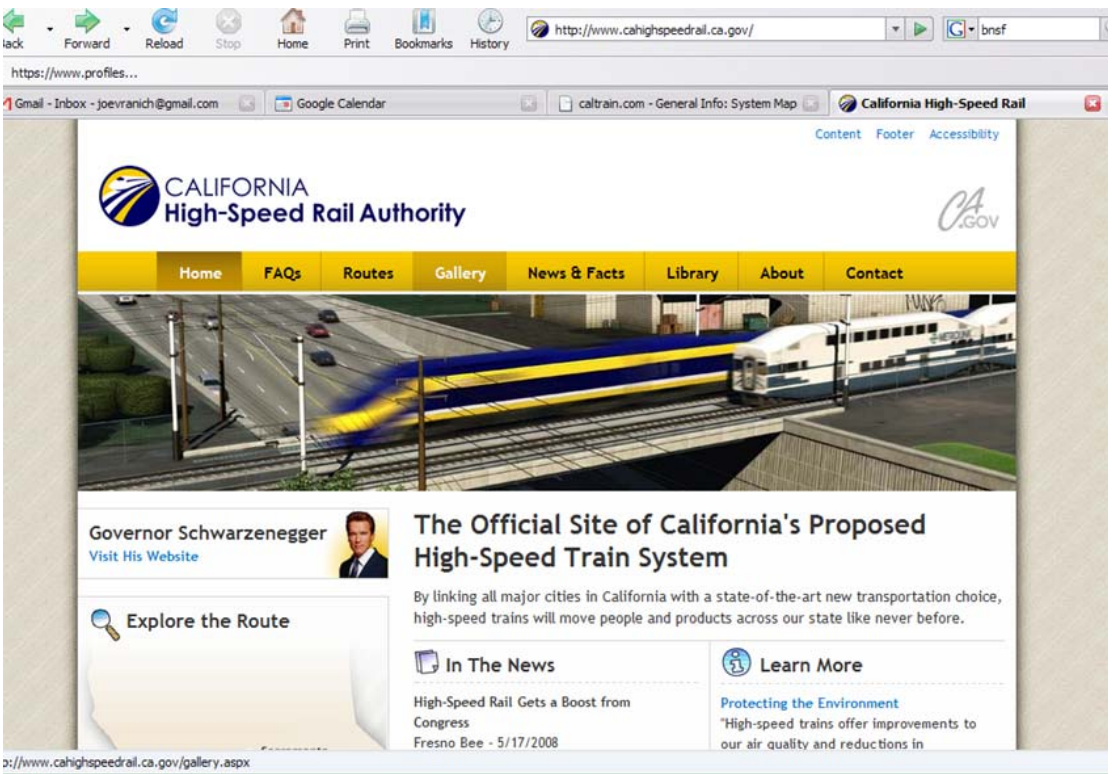
- Among the criteria that all shared-use corridors would be required to meet is "physical or temporal separation from conventional freight traffic."[239]

Views supporting joint operations have been echoed by the CHSRA's industry and political supporters, as follows:

- The Association for California High-Speed Trains is a trade organization whose membership appears to consist of consulting firms that stand to gain from the project. It is the professional judgment of the organization's members that track-sharing arrangements are appropriate, at least temporarily, stating, "HSR trains can share tracks with existing services, and branch off on high-speed segments as they are completed."[240]

- A further track-sharing scenario is suggested by Assemblywoman Cathleen Galgiani, who supports using a portion of the HSR bond money to upgrade the Altamont Commuter Express (ACE) train route taken by some San Joaquin Valley workers to the East Bay and San Jose. "Essentially, we're preparing the ACE system so that it could share tracks with high-speed trains," she said.[241] The ACE trains utilize tracks owned by the UPRR, a railroad that has given no indication that it would permit such shared use of its tracks and indeed has expressed an unwillingness to sell its land for the HSR system.[242]

Figure 11: CHSRA Visual Portrayal of Track Sharing



Screen shot of a film clip displayed on the CHSRA's home page showing a high-speed train sharing tracks with a slower Southern California Metrolink commuter train. Not shown are track configurations where the trains switch from one track to another—for example when a high-speed train has to pass slower-speed commuter trains or freight trains. Film and photos at www.cahighspeedrail.ca.gov/ do not adequately show the intermingling or mixed use of tracks as they would actually occur.

Track Sharing Safety Challenges

Despite the positive comments cited above regarding mixed-used operations, the CHSRA itself has discouraged that very scenario for the proposed rebuilding of a commuter rail bridge across lower San Francisco Bay, stating that conventional trains to be used for the Dumbarton rail service would "not be compatible" with HSR trains in service around the world, nor with the similar electric multiple unit (EMU) trains that Caltrain proposes to begin using in the future.[243]

Moreover, in a June 2008 report, the California Senate Transportation and Housing Committee raised concerns about modified HSR train designs operating on the line south of Los Angeles, stating:

> *Under European safety methodology, equipment is designed foremost to avoid accidents. The US standard requires equipment whose primary safety objective is to survive accidents. This incompatibility in standards introduces substantial risk, especially in a segment such as Fullerton to Commerce where American standard freight and passenger trains are continuously operating. A change in standards would require that the freight and commuter railroads operating in the same corridors as the high-speed trains change their train control technology. Ultimately, the change in standards may become a major challenge for the railroad industry operating in the state.*[244]

A change in standards would indeed be a major challenge because of the record amount of capital the freight railroad industry is investing to expand capacity to handle freight movements.

For example, the Commerce–Fullerton right-of-way, owned by the BNSF, links the Ports of Long Beach and Los Angeles to the BNSF's national network. Approximately 75 freight trains and 52 Amtrak and Metrolink passenger trains traverse this segment per day and additional freight and Metrolink trains will be added in the future. When construction is complete on a third track between Fullerton and Commerce, no space will remain for an additional track and overlaying high-speed passenger service will have risks. Other constraints exist in the San Fernando Valley, especially in the Burbank–Los Angeles segment where the existing two tracks are adjacent to the Los Angeles River, major streets and other impediments. Moreover, the line's remaining capacity is increasingly consumed by UPRR freight operations.[245]

Federal Railroad Administration

Federal authority over railroad safety is extensive, with the Secretary of Transportation authorized to "prescribe regulations and issue orders for every area of railroad safety."[246] The lead Department of Transportation (DOT) agency is the Federal Railroad Administration (FRA), which issues rail safety regulations and standards for rail equipment that have the force of law.[247]

The FRA states that it "has established an ultimate goal of 'Zero Tolerance' for rail-related accidents, injuries and fatalities."[248] Hence, the FRA's standards are considered among the toughest in the world. The agency requires U.S. passenger trains to be stronger and heavier than European trains because rail freight equipment on domestic railroads is much larger and heavier than that encountered in most other parts of the world. Under equivalent speeds, a collision of a U.S. boxcar with its larger mass and heavier weight presents a much more serious hazard than does a lighter

European boxcar. Therefore, the risk to passenger safety is higher in the United States than in Europe.

A recent accident in Massachusetts illustrates why passenger-freight shared track usage poses a danger. On March 25, 2008, a "runaway" freight car loaded with building materials rolled about two miles from where it had been parked on an industrial sidetrack. Once the car reached the main line, a signal alerted the engineer of a Massachusetts Bay Transportation Authority commuter train who was able to stop his train. The freight car collided with the stationary train and left 150 passengers and crew with injuries.[249] The alert engineer's action along with stringent U.S. passenger car-strength standards helped prevent more serious injuries or fatalities. The incident occurred near Canton Junction on a route also used by Amtrak's high-speed Acela trains.

The Caltrain or Metrolink segments are shared with freight trains and have sidings for parked freight cars. The above scenario would have far more serious consequences if it involved a lighter-weight, European-style high-speed train moving at a fast rate. Moreover, Caltrain and Metrolink commuter trains are heavier and stronger than most European commuter trains and a collision involving a European-style train with a commuter train would, comparatively speaking, have a more serious outcome. In either scenario a far greater number of passenger injuries and possibly fatalities would occur in California as compared with Europe.

Moreover, mixed-track usage is more challenging in the United States than overseas because domestic railroads carry far more freight than do foreign railroads. Domestic rail volume is 10 times higher than on European railroads and 97 times greater than on Japan's railways.[250]

The FRA's work includes establishing crashworthiness requirements for passenger trains operated below 125 mph (200 kph) and for trains used above 125 mph. Some safety requirements are based on longstanding practices that originated in specifications for U.S. Railway Post Office cars in the 1940's; others are updated to take into account newer train designs. An extensive paper on train crashworthiness standards summarizes the concerns of rail safety experts:

> *Increased traffic, which can increase the likelihood of the occurrence of train collisions, increased equipment speed, which can increase the severity of train collisions, and the application of [European] equipment developed for operating environments, which include smaller and lighter freight equipment than the equipment used in the U.S., have raised concerns about the crashworthiness of rail equipment. Fatalities and injuries occur as a result of train collisions and derailments. The crashworthiness features of the train are intended to provide protection to the passengers and crew in the event of a collision or derailment… Crashworthiness standards can be described as either design standards or performance standards.*[251]

Converting Overseas Trains to U.S. Safety Standards

In developing high-speed trains to conform to U.S. safety regulations, the CHSRA states that "The California high-speed train has been developed with criteria and standards that allow use of any of the existing European and Asian technologies." The Authority adds that it intends on having suppliers "adapt off-the-shelf equipment" to minimize the risks of unproven technology and lower design costs. The Authority recognizes that:

> *The FRA currently requires all existing U.S. passenger trains to be* ***at least twice as strong*** *in certain aspects than the lightweight equipment used in European and Asian high-speed trains. In order to meet this strength requirement, manufacturers would have to structurally redesign their trains, at significant additional development cost and time . . . . Such a redesign would make high-speed rolling stock heavier, jeopardizing the low axle loadings that have efficiently enabled the high speeds, low operating and maintenance costs, and positive cash flows like those enjoyed by high-speed train operations in Europe and Asia. In addition to being more costly to purchase and operate, heavier equipment may cause changes in other system components such as track or bridges and result in higher maintenance costs (emphasis added).*[252]

The engineering details behind design standards are complex and therefore are beyond the scope of this report.[253] A particular concern, however, is the "buff" strength of a train, which is the anti-crush standard as determined by the strength of a passenger car body.[254] No current European or Asian train that meets the CHSRA's speed and performance requirements also meets U.S. car buff regulations, nor do such trains meet other crashworthiness standards that are required for equipment used in this country.

The CHSRA Has No HSR Train Design

Client-imposed specifications are typically imposed when corporations or state agencies order locomotives, passenger cars or complete trainsets. To illustrate just how far away the CHSRA is from having specifications or even an overall design, the Authority has issued conflicting statements about the expected capacity of the HSR trains, as follows:

- 450-500 passengers[255]
- 650 passengers[256]
- 1,175 passengers[257]
- 1,200 passengers[258]
- 1,600 passengers[259]

Compared with other trains in the world, the CHSRA train would be very large—it could be the longest high-speed train in the world. For example:

- 1,323 seats is the capacity of one jumbo-capacity HSR train, the Japanese Series 700, which is a 16-car, single-level train.[260] The train offers seating with three passengers on one side of the aisle and two on the other side (3-2 seating)—and still does not reach 1,600 in capacity. Moreover, a 3-2 seating arrangement is likely to be unacceptable to American intercity travelers and it is likely that California will offer standard 2-2 seating. If so, the train with the 1,200 passengers would be longer than the Japanese train.

- 770 passengers can ride a Eurostar, which offers American-style seating in a train 18 cars long (however, the cars are much shorter than American, Japanese and other European railroad cars).[261]

- 600 seats outfit the high-speed train recently launched in China between Beijing and Tianjin.[262] The trains are known variously as the CRH 3, Hexie and Harmony.

- 516 to 1,032 seats is the capacity of a TGV Duplex double-deck train depending upon whether it is operating as an 8-car single unit or two such trains hooked together operating as a 16-car unit.

- 245 to 446 seats in the French AGV (*Automotrice Grande Vitesse*) depending on whether it is operating as a 7-car train or an 11-car train. Note: 892 seats are possible by combining two 11-car trains, however the builder states that few operators would actually operate a 22-car train.[263]

Length of Trains

The Authority is also inconsistent on the length of trains. In the reference to 1,200 passengers, the length was specified as "a 16-car trainset (engines and cars)." An earlier CHSRA study of travel times between Los Angeles and San Diego assumed a train length "based on an eight-car train set (two power cars and six passenger cars)."[264] The Authority's literature and video clips portray HSR trains as being single-level, a perspective that is unmistakable when the trains are pictured next to double-decked commuter trains. The plan for single-level trains is confirmed by the CHSRA's statement that the system could carry "many more passengers than indicated in the high ridership forecast" by using double-decker cars.[265]

The CHSRA is opposed to physically separating and linking trainsets ("splitting and joining trains") along the route, pointing out that the percentage of HSR trains using this practice worldwide is "<u>very</u> small." In France, about 10% of the TGV trainsets are split, whereas in Japan the percentage is even smaller. The practice generally is avoided during peak hours or at peak traffic points because combining two trains into one or vice versa wastes time. Despite such cautionary comments, it cannot be determined from the documentation whether the Authority favors operating two trains joined together provided they operate in that configuration end-point to end-point.[266]

While builder specifications for the CHSRA's train do not exist, it is fair to state that the CHSRA's design may become the world's longest HSR train if it remains a single-level design.

The Authority has no high-speed train design that meets U.S. safety regulations and also matches its required performance standards. Indeed, the locomotives and coaches of any European or Asian train must undergo *major* re-designs to reach stringent U.S. structural integrity standards.

Moreover, the performance of "Americanized" TGVs from France, Bullet Trains from Japan or ICE Trains from Germany would be diluted in comparison to the forerunners operating in their home countries. Because of U.S. safety regulations, a California HSR train will bear little structural, weight or acceleration resemblance to its predecessor (although external appearances may be strikingly similar). The train that is selected must be substantially redesigned, proceed through a prototype stage, and pass exhaustive testing and evaluation while under federal government scrutiny.

Initiating the Federal Regulatory Process

The safety regulatory process will be a major undertaking for the following reasons:

- The FRA began its safety rule-making process in relation to operation of modified French TGV trains in Texas. But the cancellation of the Texas HSR project in the mid-1990s meant that the FRA's work was never completed.[267] To FRA it will not be as simple as taking up where the agency left off because the CHSRA wants to run trains faster than were proposed for Texas (220 mph versus 200 mph), and would co-mingle HSR trains with freight trains and conventional passenger trains, which was excluded in the Texas plan. Moreover, the Texas-style TGV would not have met the CHSRA's high-capacity requirements.

- Technology proposed for a high-speed rail plan in Florida—which the public voted to terminate in a 2004 ballot measure—will help California even less.[268] The Florida plan involved using the Swedish X-2000 train on tracks separated from freight trains. The design had started to go through the FRA regulatory review process, but the halting of the Florida project meant that FRA rule-making was never completed.[269] Even if it had proceeded, the X-2000 is incapable of meeting the CHSRA's speed and capacity requirements.

- The only high-speed train that meets U.S. safety standards is Amtrak's Boston–Washington Acela, the genesis of which was the French TGV. Performance is far below the CHSRA's requirements in several respects: (1) With 304 seats, it has 46.8 percent of the Authority's lowest stated capacity of 650 seats and only 19 percent of the CHSRA's highest stated capacity of 1,600 seats.[270] (2) Compared with European HSR trains, the Acela is about twice the weight at 624 tons each[271]; and (3) The Acela is unable to match European speeds. One of many reasons for added weight is that the Acela is made of stainless steel to better survive major impact and the TGV is made of aluminum. The Acela arrived with so many design and mechanical problems that more than 200 modifications were required for each train, which involved lengthy periods in shops for each of the 20 trains. Troubles with the train were so extensive that a former Amtrak president said Amtrak will never order another Acela.[272] Hence, the only FRA-approved HSR train offers nowhere near the capabilities to meet the CHSRA's capacity, speed and travel time requirements.

Hence, California will be required to initiate the regulatory process that will lead to a FRA "Rule of Particular Applicability," a time-consuming process that the Authority estimates would take "two to three years." The Authority and the selected train supplier would confer on issues to be addressed by the rule with the FRA and would consult with other affected rail operators. If the rule can be concluded more rapidly, train system testing, construction and delivery could be accelerated.[273]

No guarantee exists that the final result would be a federal acceptance of a re-designed HSR train without further changes and adjustments. Any FRA action that dilutes performance (such as requiring additional weight) could raise the CHSRA's capital and operating costs, reduce speeds, increase travel times, and reduce passenger volumes and revenue-generating capacity. Also, from an environmental standpoint, heavier trains would be louder, consume more energy and have higher levels of greenhouse gas emissions.

In the Acela case, when asked about its stringent policies, FRA officials acknowledged that its crash energy system increased the weight of the train but said such a system resulted in safer trains.[274] The FRA rule-making process is public and numerous interest groups, including other operators like Caltrain, Metrolink, UPRR and BNSF, and others interested in safety are likely to offer views and recommendations. As a result, it is by no means a certainty that the FRA rules will be changed sufficiently to satisfy the CHSRA's many requirements; it is more likely that the CHSRA's specifications must change to satisfy the FRA.

Admittedly, under certain circumstances in which a train is unable to fully meet U.S. safety regulations, the FRA can issue waivers to permit operation. The willingness of the agency to be generous with waivers is open to question. The FRA is concerned about the risks inherent in passenger trains that operate at 220 mph and that share tracks with slower commuter and intercity passenger trains (top speed 79 mph) and freight trains (top speed usually around 60 mph but in congested areas can be 40 mph or even 20 mph). Hence, it could be difficult to obtain the necessary waivers from the FRA, an agency that takes pride that "Rail passenger accidents—while always to be avoided—have a very high passenger survival rate."[275] Every indication is that the FRA will continue to proceed in a cautious manner.

Due in part to heavier weight and a flawed tilting design that restricts speeds on curves, the Acela trains between Boston and New York fail to meet the federal statutory requirement to connect the cities in less than three hours.[276] The fastest current schedule is 3 hours and 30 minutes and the slowest is 3 hours and 42 minutes.[277] Similar circumstances could cause a redesigned train to fail to meet California's statutorily required travel times between stations.

In short, no train yet exists that can meet the CHSRA's extraordinary performance standards and capacity while adhering to U.S. safety standards. The CHSRA told the California Senate Transportation and Housing Committee that it has "worked with the Federal Railroad Administration to allow light weight foreign high-speed rail equipment to operate in California."[278] What this means is unclear. However, any such "work" prior to a serious and formal process that is open to public review and comment is likely to have little or no impact.

A series of steps never before achieved anywhere in the world must be taken for the CHSRA-style train to move beyond the conceptual stage—namely, a train must be designed and built with the capacity to:

- Operate at a peak speed of 220 mph.
- Meet U.S. crashworthiness standards and safety standards for mixed-track usage.
- Carry up to 1,200 or even 1,600 passengers, certainly making it the heaviest and possibly longest high-speed train in the world.
- Incorporate a more powerful propulsion system to enable moving a longer, heavier train through the challenging physical environments found in the state's mountain passes.
- Meet the schedules mandated in California law.

Designing such a train will involve unprecedented engineering challenges, so much so that the train design could make the system less competitive commercially.

Top Speed in the U.S. Railroad Environment

It is possible that 220-mph train speeds can eventually be achieved in California. The top commercial speed on one line in the world now achieves 217-mph (350 kph), which is on China's Beijing–Tianjin service. (See Part 3 for a summary of the world's fastest currently operated and planned trains.)

In a number of cases, planned higher speeds have not been implemented. Some countries have infrastructure designed to permit trains to operate at 220 mph (350 kph)—namely France, Spain, Korea and Taiwan—but no trains in commercial service currently reach that speed. For example, the Korean High Speed Rail system "is designed to run 350 kph and operated at 300 kph maximum for safety."[279] At 300 kph (186 mph) the Korea HSR system would not meet the minimum 200 mph requirement of Senate Bill 1856. Nor would the new Madrid–Barcelona line, which is also being limited to 186 mph. The new TGV-Est is designed to allow 220 mph speeds, yet trains operate at a top speed of 200 mph (320 kph).[280]

The two trains capable of reaching the CHSRA's desired top speed of 220 mph (354 kph) are China's CRH 3 and France's AGV. However, the trains have no locomotive at each end—they are powered by traction motors under the cars.[281] Meanwhile, the sturdiness of locomotives is highly desirable to help comply with FRA's Crash Energy Management requirements suitable for shared-use tracks. The lack of locomotives to absorb energy during an accident presents safety concerns in the U.S. railroad environment.

Earthquake Considerations

Because of California's seismic conditions, the safety of HSR during an earthquake is a consideration. The CHSRA states that a "failsafe" technology would be in place to stop the trains when an earthquake is detected.[282] The Japanese have long used a system whereby sensors cut electricity to the trains when first tremor is detected, which is designed to ensure that the trains come to a halt.

The system's limitation came to light on October 24, 2004, during a 6.8 magnitude earthquake when a Bullet Train derailed in Nagoaka while traveling at 130 mph (210 kph). The train stopped after the driver applied emergency brakes. Experts said the sensors work best when the epicenter of an earthquake is some distance away. When the quake is right beneath the train, as it was in this case, the sensors cannot slow the train in time to stop potential damage. Remarkably, in this unprecedented accident, there were no injuries aboard the train.[283] In light of the limitations of the automatic system, the Transport Ministry established a panel to study whether other measures were needed to safeguard Bullet Trains during earthquakes.[284]

Conclusion

No existing HSR trains capable of meeting the goals of the CHSRA system can legally be used in the United States. It is by no means certain that the necessary regulatory approvals of a train from overseas can be achieved without substantial changes in train design and weight. The Authority does not have a usable train design.

High-speed rail has an excellent safety record although risks are somewhat greater than stated in the CHSRA documentation, especially with plans for the HSR trains to share certain tracks with commuter trains and freight trains. Track sharing complicates designing a train to meet FRA safety standards that are considered the toughest in the world. Currently, no European or Asian HSR train meets U.S. crashworthiness standards.

The CHSRA has yet to decide on basic design specifications for a train. For example, documentation shows a capacity range of 650 to 1,600 seats per train. It is likely that a series of designs, tests, prototypes and safety reviews never before achieved anywhere in the world must succeed for the CHSRA's train to become a reality.

A train redesigned for the U.S. will become much heavier and thus unlikely to reach promised speeds, especially when coping with the state's challenging physical environments. A lower-performing train would negate the CHSRA's assumptions on which it has based travel times, ridership projections, revenue forecasts and profits. The outcome could mean investors in the project will see no financial returns and HSR could require subsidies from California taxpayers in perpetuity.

E. Security in Age of Terrorism

Terrorism against rail targets is a concern considering the extent of attacks that continue to occur on rail systems around the world. The Authority appears to have given insufficient attention to this issue notwithstanding the RAND recommendation to industry and government for more analysis of and improvements to domestic rail security.

The Authority has repeatedly declared that overall trip time can be reduced if passengers shift from planes to trains because they can proceed more quickly through train stations that do not have the security checkpoints found at airports.[285] The CHSRA assumption may be overly optimistic considering the security risks that officials say prevail today.[286]

The Authority's revenue and ridership forecast of July 2006 established airport wait times at 55 minutes and HSR station wait times at 15 minutes. The CHSRA stated:

> *The hassle and time variance of getting a boarding pass, checking luggage, and getting through security requires arrival at the airport earlier than at a train station without security checkpoints. It is explicitly assumed that high-speed rail will not have the elaborate security check-in procedures, boarding passes will not be required to wait for a train, seats are not assigned, and that luggage is typically self-carried on the train.*[287]

A subsequent report was more explicit in stating that "There are currently no plans for airport security measures at high-speed rail stations."[288] The time differential was one of many assumptions used to determine competitiveness and create ridership projections.

Risks to High-Speed Trains

The RAND Corporation, in a 2007 study of transportation security, stated, "Recent attacks on passenger-rail systems around the world highlight the vulnerability of this form of transportation. The high use of passenger rail and the frequency with which terrorists target rail systems elsewhere call for a commitment to analyzing and improving rail security in the United States."[289] A review of threats and actual attacks against HSR systems is illustrative:

- In June 2008, French anti-terrorism police investigated a series of bomb threats targeting at least one TGV. Calls warned of bombs placed either near tracks or aboard trains traveling between the towns of Chambery and Aix-les-Bains, an area that draws tourists to mountain resorts.[290] Two months later, rail traffic was interrupted when a bomb was found on TGV tracks in the French Basque region.[291]
- In May 2008, the West Japan Railway Co. received telephone calls in a money extortion plot related to timed incendiary devices at main stations in Kyoto, Osaka, and Kobe. Police found one improvised fire bomb at the Kyoto Station.[292]
- In 2004, terrorists took aim at high-speed systems by threatening to place bombs under tracks in France and Spain, which cause both railways to be searched in a costly and time-consuming process. In France, ten thousand railway employees walked the tracks to look for bombs while trains were patrolled by the police and armed forces.[293] French authorities put train stations on a red alert, the second-highest of its four levels of emergency preparedness, after the discovery of explosives on tracks near the town of Troyes, 120 miles (193 kilometers) east of Paris, and another device under rails in central France.[294] After finding a bomb under the tracks of Spain's Madrid–Seville high-speed line, police "combed all high-speed tracks 'kilometer by kilometer' while 45 helicopters [kept] watch from above and police dogs [sniffed] for explosives below."[295]
- Also in 2004, an ICE Train avoided derailment after six metal plates were discovered bolted to the tracks, believed placed there as part of a terror campaign. The incident occurred near Dortmund on the high-speed Cologne–Berlin ICE Train line. The engineer of an approaching train spotted the plates, which were covered by garbage bags, and was able to brake sharply, slowing and stopping the train, which stayed on the rails. No one was injured.[296]

Some criticism has been directed to French officials for leaving the TGV system open to terrorist infiltration for a long time.[297] The TGVs have been targeted since the 1980s. On March 17, 1986, an explosion occurred in the luggage compartment of a Paris–Lyon TGV while the train was on top a viaduct crossing a river. The emergency brakes brought the train to a stop at the Brunoy train station. On December 31, 1983, a bomb had been placed in the luggage compartment of a TGV on the Paris–Marseille line. It exploded near Lyon resulting in 5 deaths and 50 injured.[298]

Recent Rail Attacks Worldwide

Protecting rail passenger facilities is hardly an academic exercise. In a report to Congress The RAND Corporation summarized the history of worldwide attacks on passenger rail systems:

> *Between 1998 and 2003, there were approximately 181 attacks on trains and related rail targets such as depots, ticket stations and rail bridges worldwide. Attacks on light rail systems and subway systems are included in these estimates. Attacks have occurred in all corners of the globe, including Venezuela, Colombia, India, Pakistan, Spain and the United Kingdom. These attacks resulted in an estimated 431 deaths and several thousand injuries. Bombs were the most frequently used weapon in these attacks, although firearms and arson have also been used.*[299]

Since that testimony, other attacks have occurred resulting in an additional 536 fatalities, for a total of 967 between 1998 and 2007.[300] The most infamous attack occurred on March 11, 2004, when ten bombs were detonated aboard four crowded commuter trains in Madrid, Spain, causing 191 fatalities and more than 1,800 injuries.[301]

Attacks on trains and rail facilities are incessant. In 2007, a bomb set along railroad tracks exploded and derailed the Moscow–St. Petersburg "Nevsky Express," injuring scores of passengers and shutting down one of Russia's busiest rail lines. The authorities said that counter-terrorist measures would be strengthened.[302] In the same year, in Delhi, India, explosives on a train killed at least 66 people and injured 13 others.[303] On July 11, 2006, a total of 187 commuters died and more than 700 were wounded in coordinated blasts in India on Mumbai's train network during rush hour.[304] Also in that year, German officials discovered a "mega-murder plot" on trains out of Cologne where two suitcases were discovered that contained firebombs wired to explode at the same time that could have killed hundreds of travelers.[305] In London in July 2005, suicide bombers detonated bombs on the Underground subway system, killing 52 people and injuring several hundred.[306] In February 2004, an explosion in a Moscow subway train killed 40 riders.[307]

Europeans and Rail Security

In the aftermath of the Madrid train bombings, France deployed nearly 500 soldiers to transportation hubs to beef up local security, especially on the high-speed rail lines from Paris to Lyon and Marseille. A senior French counter-terrorism official said: ‘‘The trains worry me more than the planes."[308]

Airport-style security screening is in place and is required for all high-speed Eurostar passengers at St. Pancras station in London, Gare du Nord in Paris and Midi/Zuid in Busssels. Travelers submit to a security process before boarding, much like the check-in procedures at any airport. Eurostar screens all passengers and hand luggage and x-rays all checked luggage at all stations.[309] Occasionally an alarm is raised, as for example in April 2008 when a bomb scare caused St. Pancras station to be evacuated for nearly two hours and delayed some trains.[310]

The time required for the Eurostar check-in depends mainly on what class the passenger is ticketed. Eurostar requests that passengers checking in allow a minimum of 10 minutes for Business Premier travelers, 30 minutes for most passenger categories, and between 60 and 90 minutes for certain passengers heading to Avignon or ski areas (see Table 13).

Table 13: Eurostar Security Check-In Times

Required Time Before Departure in Minutes	Applicable Travelers
At least 10	Holders of Business Premier tickets and Eurostar carte blanche
At least 20	Eurostar Frequent Traveler members
At least 30	Standard, Leisure Select and all other ticket types
At least 45	Passengers with special needs (e.g., wheelchair user), need help getting to the train or need a staff member for assistance
At least 60	All travelers for Avignon or Ski services
Source: http://www.eurostar.com/UK/us/leisure/travel_information/at_the_station/check_in.jsp	

Some may consider Eurostar's security procedures to be irrelevant because they were designed in part to defend against an attack occurring within the 31-mile long (50-km) Channel Tunnel between England and France.[311] Note, however, that the CHSRA also plans extensive tunneling—about 95 miles (153 km) of potential alignments are proposed to be placed in tunnels through the Pacheco Pass and Diablo Range; for the Bakersfield–Los Angeles region, about 38 miles (62 km) of the potential route is proposed to be in tunnels in the mountainous area.[312]

Any event in a rail tunnel isn't to be dismissed lightly. The DOT Inspector General has in stark terms advised Congress about the serious consequences that could result from a fire aboard a train while it is in a tunnel:

> *On November 11, 2000 one of the worst Alpine disasters ever claimed the lives of more than 150 people as a funicular train in Kaprun, Austria caught fire less than one-half mile into a 2-mile long tunnel. Many of the victims died from smoke inhalation as they tried to escape the blazing train through billowing smoke being forced up the tunnel by a chimney-like wind effect.*[313]

Indications are that British rail security screening may extend to conventional intercity and commuter trains. In November 2007, plans were unveiled to increase armed police patrols at high-profile targets such at Eurostar's St. Pancras station in London.[314] Further, passengers using trains at other British stations may be subjected to airport-style checks on a random basis, including having to take off their shoes to prevent dangerous devices from being smuggled aboard trains.[315]

The Inherent Vulnerability

The United States is fortunate that its rail system has escaped major attacks. Every mode of transportation has unique features that make it inherently vulnerable. Security has improved at airports—"closed and controlled locations with few entry points," as the GAO calls them.[316] The busiest train stations, in contrast, rely on the unencumbered movement of people through many unguarded doorways and trains. The RAND Corporation explains the concerns:

> *Passenger rail facilities present potentially inviting targets for terrorists for a variety of reasons. They are easily penetrated and may have high concentrations of people. The logistics of a passenger rail attack are comparatively simple. For example, given the typical passenger density in a passenger rail station, substantial casualties can be inflicted with a backpack-sized bomb. This is a substantially lower logistical burden than the one faced by the terrorists who committed the September 11 attacks. In addition, terrorists likely perceive psychological benefits to attacking passenger transportation networks. Rail transportation, like air travel, necessitates the passengers' willingness to put personal safety in the hands of others. An attack is likely to leave passengers reluctant, however temporarily, to travel on the passenger rail system.*[317]

Precautionary Steps in the United States

Security measures have been strengthened on domestic rail systems. In June 2008, random searches began of passengers and their baggage on Metrolink commuter trains in Southern California as officers looked for "explosives" or other "dangerous items." Passengers have been informed that they must pass through checkpoints to gain access to the station platform; anyone refusing to be searched will not be allowed to board a train. The program was described as something that is becoming standard procedure at other rail agencies across the nation.[318]

Earlier in 2008, the New York police commissioner urged construction of security barriers around Penn Station. The permanent security perimeter would include bollards (a series of posts preventing vehicles from entering an area) and barriers able to stop truck bombs. The commissioner warned, "there simply is no evidence that the terror threat is in any way diminishing," a view shared by the New York State Homeland Security Director.[319]

There is some history to train station security that is not well known. Station security took on greater importance after officials discovered plots against U.S. rail systems. Following the arrest of the September 11 architect, Khalid Sheikh Mohammed, officials learned that terrorists had begun considering ways to derail a passenger train on a curve on a mountainside because it would be spectacular. The plot sought to achieve "Hollywood-like" effect to fit in with other major attacks.[320]

Amtrak has not been spared threats and sabotage. The most recent event occurred in July 2008 when a man left a suspicious backpack with wires sticking out on an Amtrak train, halting Amtrak and BART service for about four hours at the Richmond, California station. The suspect escaped by jumping out of a top window of double-decker train car and running away. No bomb was found. Meanwhile, the police blocked off the parking lot and nearby streets during the incident.[321] In May 2008, an explosive device was discovered on tracks in Connecticut used by commuter and Amtrak trains. Rail service was disrupted as bomb technicians investigated the device and secured the area.[322] Two months earlier, an Amtrak passenger said he had a bomb in his bag. The train stopped in Emporia, Virginia, all passengers were evacuated, and police shut down streets in the middle of town. Passengers were delayed for five hours while the State Police Bomb Squad searched the train and determined that the threat was a hoax.[323]

The most famous instance of Amtrak sabotage was the October 1995 derailment of the Sunset Limited in the Arizona desert. The wreck resulted in one fatality and 78 injuries. The act was attributed to one or more saboteurs because of notes left at the scene.[324] No one has yet been arrested in that case. Another known occurrence of sabotage came in August 1992 when the "Colonial" from New York heading toward Newport News, Virginia, derailed at a switch that had been aligned to send the train careening onto a side track.[325] Two men who had a keen interest in railroads were convicted of the crime.

As of February 2008, Amtrak has deployed a specialized Mobile Security Team to patrol stations and trains and randomly inspect passenger baggage to detect and prevent a terrorist incident. The squads consist of armed Amtrak police, explosives-detecting K-9 units and uniformed counter-terrorism special agents. The new measures are coordinated with the Department of Homeland Security and other domestic and international counter-terrorism agencies.[326] China put more stringent security checks in place at Beijing stations as the Olympic Games approached, including asking passengers to taste any liquids they carry or put a sealed one under a special detector to identify its contents. Baggage was being X-rayed and banned items were being confiscated.[327]

Should greater security be required at California's HSR stations, travel times will be less competitive relative to airlines and the likelihood is high that existing ridership and revenue projections will prove to be inflated. The CHSRA should issue a realistic low-end forecast regarding lessened demand should station security and screening procedures be put in place. (See Part 4, Forecasting Ridership for other reasons why ridership could be below the CHSRA's projections.) Because of the potential for more intensive security procedures, it would be prudent for the CHSRA to plan passenger wait times in stations accordingly.

Conclusion

Terrorism against rail targets is a concern considering the extent of attacks that continue to occur on rail systems around the world. The Authority appears to be have given insufficient attention to this issue notwithstanding the RAND recommendation to industry and government for more analysis of and improvements to domestic rail security. The CHSRA documentation provides virtually no evidence that a proper security assessment of the proposed HSR system has been undertaken, nor does it appear that security applications and methodologies elsewhere have been reviewed. The Authority assumes minimal security at HSR train stations and concludes passengers will be spared airport-like security screening and delays. However, should more stringent security measures become necessary, the CHSRA's demand forecast would be even further undermined. The CHSRA has not issued such a low-end ridership forecast based on such a circumstance.

F. Passenger Convenience

HSR would provide virtually no advantage as an alternative for long-distance (airline) markets, because door-to-door travel times would be greater and there would be less frequent non-stop service. Similarly, HSR would be unattractive to car drivers in middle-distance (automobile-oriented) markets because little or no door-to-door time savings would be achieved and costly local connections would often be required (rental cars or taxicabs).

Potential passengers are promised that HSR will whisk them between the Los Angeles and San Francisco Bay areas with travel times of little more than two and one-half hours.

All trips by passengers are from one point to another point. High-capacity (non-personal) modes of transport such as trains and airplanes do not provide point-to-point mobility. All trips start with walking, transit or driving from the origin to the train station or airport and then end with driving, transit or walking to the final destination from the train station or airport. As a result, door-to-door travel times are longer than the time spent in a plane or train.

Generally, the international standard for maximum walking trip distance to and from local transit stops is approximately one-quarter mile (400 meters).[328] A very small percentage of the population lives within walking distance of an intercity rail station or an airport terminal. As a result, the overwhelming majority of access trips at the beginning and end of the high-capacity mode trip will be by auto, taxi or transit.

As indicated earlier, it seems likely that HSR travel times will not achieve the advertised 2 hours and 38 minutes between downtown San Francisco and downtown Los Angeles. (See Part 4, Forecasting Speed.) An increase in travel times is already evident in HSR travel times between these two stations, which increased 13 minutes between 2005 and 2008,[329] even before ground has been broken.[330]

The reality, however, is that actual door-to-door travel times for the typical HSR passenger will be considerably more than that, as is shown below. Moreover, even in the unlikely event that the

CHSRA travel times are attained, the many Los Angeles to San Francisco Bay area travelers will find HSR to take longer than a trip by air.

HSR: Its Attractiveness to Airline Passengers

In longer HSR markets, the principal source of passengers is from airlines despite the fact that CHSRA projects most of its passengers to be captured from automobiles. The speed of operation makes high-speed rail competitive with airlines for door-to-door trips of approximately three hours or less. Of course, HSR operates much slower than airplanes—a maximum of 220 mph, compared to a jet airliner, which cruises at speeds above 500 mph.

Door-to-Door Travel Times: Air

High-speed rail requires less "overhead" time, such as shorter check in and boarding times; and HSR tends to operate on a more reliable schedule, not being subject to weather and congestion delays that can affect airline schedules. The CHRSA projects that that door-to-door trips from downtown Los Angeles to downtown San Francisco will be 14 minutes faster than by air in 2030 (3 hours and 24 minutes versus 3 hours and 38 minutes).[331] This advantage, however, is questionable, because even as train travel times were increasing from 2005 to 2008, CHSRA claims that door-to-door travel times would be reduced for HSR.[332] Without this unexplained improvement in door-to-door travel times, airline travel between the two downtown areas would be slightly faster than by HSR.

Moreover, the present 14-minute time advantage is overly favorable to HSR and not reflective of typical travel between the San Francisco and Los Angeles areas. Downtown-to-downtown HSR door-to-door travel times are faster than trips between other origins and destinations, simply because the two non-stop HSR stations are located *downtown*. Airports, which are located some distance away from downtowns, are at an inherent disadvantage in the CHSRA presentation of downtown-to-downtown travel. For some travelers, downtown stations will be closer to trip origins and destinations and for others, airports will be closer.

While this downtown bias is conceded by CHSRA,[333] the prominent use of data that inordinately favors HSR has the potential to mislead with respect to the typical travel time impacts on HSR non-stop services. On the other hand, trips beginning and ending near airports would advantage airlines in comparison with HSR. In fact, however, most trips do not begin and end near downtowns, nor do they begin and end near airports. This is because downtowns (or airports) contain only a small share of metropolitan employment.[334] Moreover, the great majority of residents do not live in downtown areas. Thus, the *typical* trip between San Francisco and Los Angeles will involve origins and destinations that are relatively distant from both downtown HSR stations and the airports. Moreover, because both areas are served by multiple airports, it is likely that many origins and destinations will be closer to airports than to the downtown HSR stations where the non-stop services can be accessed.

More accurate travel time comparisons would result from a series of examples to and from various non-downtown origins and destinations in both urban areas, or, for that matter, to have provided travel times for typical trips using regional transportation demand models. Without such a detailed analysis, it is impossible to predict the "typical" (or average) door-to-door travel times of either airline or HSR trips.

Finally, as noted in "Forecasting Speed," this Due Diligence Report estimates that HSR will operate more slowly over the entire route than projected, which will increase travel times and reduce the ridership potential.

Alternative door-to-door travel times are presented in Figure 12 and Table 14, along with CHSRA downtown-to-downtown travel times. These figures show travel times between typical locations in each urban area that would require 30 minutes travel time from both downtown and the airport.[335] Both CHSRA train travel time and Due Diligence train travel time assumptions are used.[336]

- For downtown-to-downtown trips, the CHSRA train travel-time assumptions give HSR a 14-minute door-to-door advantage. However, the Due Diligence train travel-time assumptions indicate that air travel would be 49 minutes faster, door-to-door than the fastest express trains (semi-express travel times would be at least 1:08 longer).[337]

- For a hypothetical trip that is equidistant from airports and HSR stations at both trip ends, the CHSRA train travel-time assumptions would give air travel a 26-minute door-to-door advantage. The Due Diligence train travel-time assumptions indicate that air travel would be 1 hour and 29 minutes faster, door to door.

Thus, it is possible that HSR would provide no travel time advantage relative to air travel for the majority of passengers between the San Francisco and Los Angeles areas even if HSR's travel time requirements were met. No definitive finding can be offered, however, because CHSRA limited its analysis to the unrepresentative downtown-to-downtown market.

Finally, actual HSR travel times could be longer if adapting European-style trains to the U.S. environment, which makes them heavier and less able to operate at intended speeds (See Part 4, Federal Safety Standards), or if Eurostar-type security procedures similar to airport screenings are applied at some point in the future. (See Part 4.)

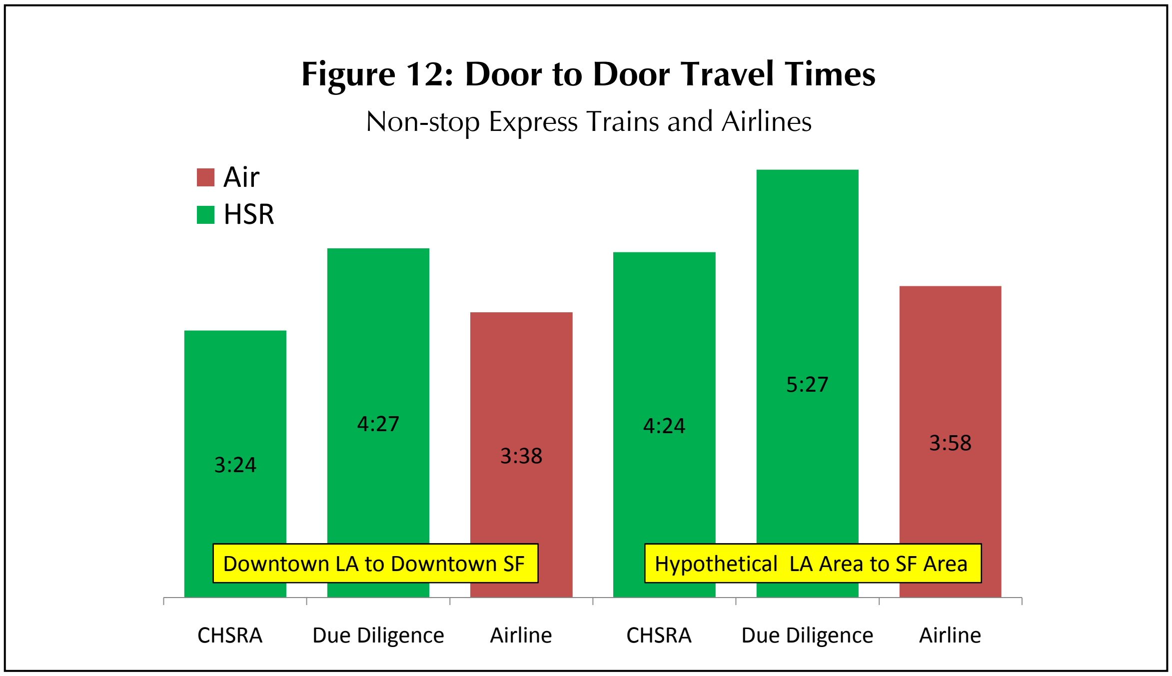


Table 14: Door-to-Door Travel Times

	San Francisco–Los Angeles Downtown to Downtown			San Francisco–Los Angeles Hypothetical Equidistant from HSR Station and Airport		
	CHSRA Assumption: HSR	Due Diligence Assumption: HSR	CHSRA Assumption: Air	CHSRA Assumption: HSR	Due Diligence Assumption: HSR	Due Diligence Assumptions: Air
Travel Time	02:38	03:41	01:20	02:38	03:41	01:20
To & From Train/Plane	00:46	00:46	02:18	01:46	01:46	02:38
Door to Door Time	03:24	04:27	03:38	04:24	05:27	03:58
HSR Compared to Airline	-00:14	00:49		00:26	01:29	

Types of Trains: Express, Semi-Express and Local

Non-Stop Service. Non-stop express service between northern California (San Francisco, San Jose and Sacramento) and southern California (Los Angeles and San Diego) has been a major thrust of CHSRA publicity. Longer distance non-stop express service such as this is the exception rather than the rule in international high-speed rail markets. For example:

- Bullet Train schedules in Japan currently indicate no non-stop service between the central Tokyo and central Osaka stations. There are a minimum of four station stops between Tokyo and Osaka.[338]

- There are only five non-stop expresses between Paris and Marseille daily.

- There are no non-stop Acelas between Washington and New York. Non-stop Acela service was briefly provided and withdrawn.

The extent of non-stop express services is not clear from CHSRA documentation. The NCEIS indicates that 16 daily non-stop trains will operate in each direction from San Francisco, San Jose and Sacramento to Los Angeles and San Diego (non-stop interpretation #1).[339] Elsewhere, the NCEIS indicates that the 16 express trains between these terminals would have one intermediate stop (non-stop interpretation #2).[340] Moreover, these two references in the same report show apparently irreconcilable differences between numbers of trains and types of services.[341] Moreover, while state legislation mandates non-stop travel times in a number of markets, it does not mandate non-stop service. The legislatively mandated travel times would not be met by trains that make a stop. Thus, under non-stop interpretation #2, none of the long-distance non-stop travel times would be achieved because of an intermediate station stop. HSR's paucity of non-stop service under either non-stop interpretation faces two daunting challenges in competing with airlines.

Modest HSR Non-Stop Service Frequencies. The first difficulty is that the service frequency will be miniscule compared to airline frequencies. This is illustrated by an example service design based upon the 16 non-stop trains in each direction (interpretation #1, no intermediate stops), which allocates the 16 trains based upon the size of the demand (Table 15). As CHSRA acknowledges, providing service between multiple markets can "greatly" reduce service frequencies along particular routes.[342] In the example, there would be four or at most six daily non-stop San Francisco–Los Angeles trains in each direction. This compares to 108 non-stop flights from the San Francisco area (SFO and OAK) to the Los Angeles area (LAX, BUR, ONT, LGB and SNA). Indeed, there are more non-stop flights from each of the seven airports to the other urban area than the four non-stop HSR trains projected here.[343]

Granted, more of the 16 non-stop trains could be operated between San Francisco and Los Angeles. However, if a minimal two-train non-stop schedule is assumed for the other markets (San Jose and Sacramento to Los Angeles and San Diego and San Francisco to San Diego), the highest number of San Francisco to Los Angeles non-stop trains possible would be six. This would still be modest relative to the airline frequencies.

HSR's competitive disadvantage would be heightened by the multiple points from which airline non-stop service is available in Los Angeles and San Francisco. Non-stop airline service is available between five airports in the Los Angeles area and three in the San Francisco-San Jose area. By comparison, nearly all flights from Tokyo to Osaka operate out of a single airport (Haneda), despite the fact that the Tokyo urban area (developed area) covers more than 1.5 times the urban land area of Los Angeles.[344] Even Long Beach Airport, with by far the fewest San Francisco area flights, has five non-stop flights—a number that is, all by itself, competitive with the likely number of non-stop trains between San Francisco and Los Angeles. Thus, not only would air service remain far more frequent, it would be more geographically accessible to the large majority of residents in San Francisco–San Jose and Los Angeles.

Business travelers who would pay the highest HSR fares want the flexibility of having many departure times available to allow ease of travel throughout the day. Daily non-stop train frequencies of from four (to as many as six) trains between San Francisco and Los Angeles are unlikely to be attractive to those unable to adjust their schedules to work within such a constrained service pattern. The far higher level of airline service would continue to be more attractive. Some passengers would be better served by HSR because of other stations in the two large urban areas that permit connections or through travel between downtown San Francisco and downtown Los Angeles.

Table 15: Estimate of Daily One Way Non-Stop Service Compared to Airline Service

Flights & Trains	Non-Stop Trains (Market Share Allocation)	Non-Stop Trains (Max. Los Angeles-San Francisco)	Airline Flights
San Francisco–Los Angeles	4	6	108
San Francisco–San Diego	2	2	39
San Jose–Los Angeles	2	2	62
San Jose–San Diego	3	2	15
Sacramento–Los Angeles	3	2	48
Sacramento–San Diego	2	2	13
Total Non-Stop Trains/Flights	16	16	285
Assumes Interpretation #1 (no intermediate stops between major terminals)			

Intermediate Stops. In the San Francisco–Los Angeles market and the other non-stop markets, the non-stop HSR service between the downtown areas would be the most competitive with airline service, since intermediate stops would add additional travel time.

Should interpretation #2 of the CHSRA express service plan be correct, then, for example, there would be one intermediate stop between downtown San Francisco and downtown Los Angeles. This could be expected to add approximately nine minutes to the travel time. This would mean a 2:47 travel time under the CHSRA schedule and 3:50 under the Due Diligence Report estimates.

The slower trains would be less attractive to airline passengers. Semi-express services would have at least two intermediate stops, which would add approximately 18 minutes to travel times. The CHSRA's local trains are expected to serve "all intermediate stops, with potential for skipping stops to improve service depending on demand."[345] Such trains between San Francisco and Los Angeles could take as much as an additional 1 hour and 12 minutes, if all stations are served.

Thus, HSR would be considerably less attractive to passengers than is implied in the CHSRA documentation. There would be, at best, only token levels of non-stop service between northern and southern California. Air schedules would be far more frequent and in the San Francisco and Los Angeles areas, non-stop service would be more accessible to a larger number of residents. Finally, the experience with other HSR systems raises the likelihood that the much advertised non-stop service may not materialize.

Passenger Fares. Above it is suggested that the proposed HSR fares are far below what is likely to be necessary (See Part 4, Forecasting Ridership). As proposed, the HSR fares would be considerably lower than air fares (as is the case in Tokyo–Osaka, Paris–Marseille and New York–Washington). However, the California air market has been typified by more competitive air fares and should HSR fares be materially higher than proposed (a highly likely possibility, above), there could be little or no cost advantage to HSR.

Moreover, airlines remain strong in each of these HSR markets:

- The air shuttle between Tokyo and Osaka is provided with large, wide-bodied aircraft (principally Boeing 777s), which is unusual for a shuttle service. By contrast, the air shuttle flights between the Los Angeles and San Francisco Bay areas are generally smaller planes, such as 737's and MD-80's.
- Air France continues to offer high-frequency shuttle service between Paris and Marseille, despite the HSR service in the same corridor. (See Part 5, Alternatives to Building the HSR System.)
- Frequent air shuttle service is offered in the New York to Boston and the New York to Washington markets, where Acela service operates. Moreover, a FRA report indicates that significant improvements in travel times would reduce airline use in the corridor by only 20 percent.[346]

The other HSR systems also have an advantage with respect to local connections. Like air travel, HSR travel most often requires connecting transport at one end (the non-home end) of the trip. Thus, passengers often rent cars to complete their trips, since most destinations in an urban area are not within walking distance of an HSR station or an airport. In some cases, transit service can provide this trip completion function, however this is a far less feasible alternative in California than in Japan, Europe or even the Northeast Corridor. The overwhelming majority of local connections in California are likely to be by personal auto, taxi or rental car.

HSR: Attracting Auto Drivers

HSR is less successful in competing against autos in the longer distance markets where HSR competes well against airlines. HSR has three principal disadvantages in attracting ridership from autos.

Flexibility. Automobile travel offers greater flexibility in time of departure, route selection, and ability to stop at multiple locations more easily than when traveling on a scheduled train or airplane.

Costs. The first HSR disadvantage is cost—generally the operating costs of an auto will be less than the HSR (or air) fare.[347] This is an even more important factor when more than one person is traveling in an auto, since HSR would require payment of a fare for each person, while the auto operating cost would be the same with two or more people as with a single occupant. Moreover, unlike travel by auto, it is generally necessary to hire taxis or rental cars at the non-home destination, which adds significantly to costs. There is also the possibility of parking fees at the HSR station. All of these costs are likely to deter drivers from using HSR.

However, because of high tolls and high gasoline taxation levels, traveling by auto is far more expensive than traveling by HSR in the comparable international markets. Driving between Tokyo and Osaka is 50 percent more costly than HSR travel in economy class (gasoline and tolls). Yet, a new parallel expressway is under construction from Tokyo, to Nagoya and Osaka area (New Tomei Expressway). Similarly, driving is at least 50 percent more costly than HSR between Paris and Marseille (gasoline and tolls). On the other hand, in the New York–Washington market, travel by high-speed rail is more expensive than traveling by auto, even at $4.00 per gallon for gasoline.

Door-to-Door Travel Times: Autos

A disadvantage of HSR is connecting between the non-home station and the final destination. This will often require, as noted in the air section above, renting a car or taking a taxi, which adds considerable expense. There is also the limited potential to use transit to reach the final destination. Each of these alternatives can significantly lengthen travel times, because of the time necessary to transfer from the train to the ultimate mode of transport to the destination. High-speed rail travelers to stations such as Gare du Nord in Paris and Union Station in Washington, D.C., often face long waits in taxi queues (as they often do at airports).

Even in short and medium distance markets, where airlines are less important or service may be non-existent, HSR has little travel time advantage compared to autos. This would include markets such as the Los Angeles area to the San Joaquin Valley, the San Francisco Bay Area to the San Joaquin Valley, Sacramento to the San Francisco Bay Area and the Los Angeles area to the San Diego area. This is illustrated by HSR estimates of door-to-door travel times in 2030:[348]

- From downtown Los Angeles to downtown Fresno, HSR would save only three minutes, at 3 hours and 38 minutes, instead of 3 hours and 41 minutes by auto, according to CHSRA. Under the speed assumptions of this Due Diligence Report, train travel time would increase 36 minutes, making HSR slower than auto travel door-to-door by 33 minutes. Of course, few destinations in either the Los Angeles or Fresno area are within walking distance of the downtown stations. This means that most travelers would need to use a rental car or taxi to reach their final destination. As in the case of San Francisco to Los Angeles, many trips would take longer than downtown-to-downtown trips.
- From downtown Los Angeles to downtown San Diego, HSR would save two minutes (2 hours and 39 minutes compared to 2 hours and 41 minutes for autos). Under the speed

assumptions of this report, train travel time would increase 33 minutes, making HSR slower than auto travel door-to-door by 31 minutes. The less direct routing through the Inland Empire instead of along the more direct coastal route materially compromises the ability of HSR to provide faster travel. Little of either the Los Angeles or San Diego area is within walking distance of the downtown stations. This means that most travelers would need to use a rental car or taxi to reach their final destination. As in the case of San Francisco to Los Angeles, many trips would take longer than downtown-to-downtown trips.

HSR would have substantial door-to-door travel time advantages compared to the auto in longer-distance markets, such as the Los Angeles or San Diego areas to the Sacramento, San Francisco or San Jose areas. However, because long-distance drivers tend to be more price-sensitive, and especially because of the expensive local connections (rental cars or taxicabs) that would be necessary, HSR is not likely to strongly compete for longer distance auto drivers.

Conclusion

HSR would provide only minimal advantages as an alternative for long-distance (airline) markets, because door-to-door travel times would be greater and there would be less frequent non-stop service. Similarly, HSR would be unattractive to car drivers in middle-distance (automobile-oriented) markets because little or no door-to-door time savings would be achieved and costly local connections would often be required (rental cars or taxicabs).

As was indicated earlier, it is quite likely that HSR trip times will be longer than has been published. Adding to trip length is that HSR door-to-door travel times in some cases are only slightly advantageous over air or auto travel and in other cases HSR is disadvantaged. Air travelers who want schedule flexibility will find HSR's frequencies to be exceedingly modest relative to airline frequencies. Auto travelers are principally concerned about costs (especially when more than one person is traveling in a car), which are likely to deter auto travelers from using HSR. The HSR system will experience disadvantages and commercial challenges in competing with air and auto travel, difficulties that have been understated in CHSRA documentation.

G. Financial Uncertainty

It appears unlikely that sufficient private and public subsidy funding will be found to finance the HSR plan. Funding is not even set for Phase I. As a result, it is more likely that the system will either be built only in part or not at all. Moreover, claims of profitability could not conceivably be true under even the most optimistic assumptions, unless payment of debt is ignored.

There is currently no comprehensive financing plan for HSR in California. So far, the only funding has been the $58 million spent by CHSRA on planning.[349]

There is a proposal on the November 2008 ballot for $9 billion in bonds that would be used for the system.[350] This bond issue referendum was originally to be on a 2002 ballot, but was postponed to 2004 and again postponed from the 2006 ballot.

Evolution of Financing

When the bond issue was originally proposed, it was assumed that it would pay approximately one-third of the cost of the HSR system, which had been announced at $25 billion. It was further assumed that there would be federal "matching" funds of $9 billion (despite the fact that there was and is no federal matching program for HSR), with the balance to be supplied by private investors.

No guarantee exists that the necessary federal program would be enacted and if it were, there could be many potential claimants. With a myriad of HSR proposals around the nation (See Part 3, United States Experience) it could be expected that government sponsors, vendors and advocacy groups would seek funding. In short, any substantial federal HSR funding program would be very expensive to federal taxpayers. CHSRA advisor Lehman Brothers has indicated that federal "grants in the amount of $10 billion may be difficult to attain."[351]

The report of the state Senate Transportation and Housing Committee expressed broader concerns about funding:

> *Although the early draft of the Authority's financial plan anticipates $2 to $4 billion in contributions from local governments and others for the development of the high-speed system, there is no guarantee that these funds will materialize. Similarly, there is an expected federal commitment of $10 to $12.5 billion. This would represent a substantial new federal program, and is a funding option that will require further analysis by the Authority, as it potentially affects the strength of the entire financial plan.*[352]

In the intervening years, the cost of the HSR system has escalated at least 50 percent, to $45.4 billion. At this rate, the $9 billion bond issue would provide only 20 percent of the necessary funding, well below the one-third previously planned. Moreover, it appears that the $45.4 billion does not include the Missing Phase of the Oakland–East Bay–San Jose segment.

Phase I

As the HSR system has escalated in cost, CHSRA has focused on building less than the entire system. The Phase I system would be built from Anaheim though Los Angeles to San Francisco. Phase I is projected to cost $30.7 billion (2006$). Virtually all of the current CHSRA financing documentation relates only to Phase I, despite earlier financial plan references that pertained to the entire system. In April 2008, CHSRA Chairman Quentin Kopp indicated that Phase I would be funded one-third by the state bonds, one-third by the federal government and one-third by the private sector.[353]

However, the Kopp funding outline is inconsistent with the materials that have been provided to the investment community. According to a report for the Commission by Lehman Brothers,[354] the funding program for Phase I would include these elements:

- A state subsidy of from $9 billion to $12.5 billion.
- Federal capital subsidies of from $9 billion to $12.5 billion.[355]
- Local government funding and cost sharing of from $3 billion to $8 billion
- Carbon market credits of $0.5 billion or more.
- Private investment of $5 billion to $7.5 billion

This hodgepodge of funding is highly speculative. There are no local government funding programs in place, nor any cost sharing programs. However, federal funding for HSR is very limited.

Even the anticipated private funding appears to be short of previous expectations. CHSRA advisor Lehman Brothers places the likely amount below Chairman Kopp's anticipated one-third funding level. Private investment would be limited to between one-fourth and one-sixth of the total Phase I cost.[356]

There are even potential difficulties with the proposed, modest private investment. Indeed, Lehman Brothers, a CHSRA advisor, notes that "political meddling" is a risk of concern to potential private investors.[357] Lehman cites the Route 125 toll road in the San Diego area, where community opposition made it impossible to complete the entire route. (See Part 7.)

Moreover, as Lehman Brothers implies in its CHSRA memorandum, the private investment is likely to materialize only after the federal, state and local taxpayer funding of from 75 to 85 percent is secured. This could be most difficult and without securing these government funds, financing for HSR could well be limited to the $9 billion state bond issue, assuming that it is approved by the voters. Of course, in that eventuality, HSR could not be built in any configuration that resembles current plans.

Lehman Brothers mentions additional funding sources, such as revenues from a statewide sales tax, additional general obligation state bonds, additional local government contributions ("local partnerships") and others. In particular, funding from local governments appears unlikely, given the difficult financial situation faced by counties and municipalities. Lehman Brothers also indicates the potential for funding from “safe-harbor” leasing, which would require a change in federal legislation.

Phase II

But if the funding for Phase I is a speculative hodgepodge, the $14.7 billion currently estimated funding for Phase II is even more problematic (Sacramento to Merced, for a Sacramento to Southern California connection, Los Angeles to San Diego). There has been some suggestion Phase II might be built with profits from Phase I.[358] This Due Diligence Report concludes that there is virtually no likelihood that such profits will materialize, either for private investors or for the CHSRA.

Even CHSRA Chairman Kopp stressed the need for additional taxpayer financing, while not mentioning revenues from Phase I as a funding source in a letter to Senate Transportation and Housing Committee Chairman Alan Lowenthal.

> *As to construction of the remaining part, we have not prepared a specific plan. We believe that if additional state funds appear needed for the remaining segments, it is the prerogative of the Legislature to determine the amount, source and timing of such funds, similar to its action on Phase one.*[359]

Phase II appears to be unlikely to be built, unless it is virtually fully funded by additional taxpayer subsidies. There would seem to be a significant possibility that these sections would not be built at all, leaving taxpayers in Sacramento area, Stockton-Modesto, the San Gabriel Valley, the Inland Empire and San Diego financing a system serving only Anaheim through Los Angeles to San Francisco; taxpayers in other unserved areas of the state would also be paying for the system.

Missing Phase

The Missing Phase (Oakland–East Bay–San Jose) would face an even more uncertain funding future than Phase II. This would mean that travel times between Sacramento and the Bay Area would be extended, because of routing through Merced.

The Implied Phase

This report has created a category named the “Implied Phase” to include certain routes (Anaheim–Irvine, the Altamont Corridor connecting the Central Valley to the East Bay, and the Dumbarton Bridge across lower San Francisco Bay), which have been much discussed but have not been generally included in the preferred alignment planning for HSR.

Some public expectation may have developed that these HSR segments will be built because the CHSRA has referenced them in project and promotional materials.[360] To take Irvine as an example, the CHSRA declared in 2005 that "For the Irvine alignment scenario, service from [Los Angeles Union Station] and Irvine would begin on January 1, 2019."[361] One ridership report estimated Irvine fares and station parking fees while another included Irvine in a multitude of forecasts.[362] A presentation in March 2008 identified the planning contractor for Los Angeles–Irvine.[363] Finally, one map shows Irvine on a "preferred alignment" while another indicates that a train speed range of between 100 mph and 150 mph is slated for the Irvine–Anaheim segment.[364] The public has received many signals about service to Irvine, yet it is not included in present plans.

The Implied Phase faces a most uncertain future and funding would be even more speculative than for Phases I and II and the Missing Phase. It is incomprehensible that the Implied Phase would be built without significant taxpayer subsidies.

Public Private Partnerships

Public Private Partnerships (PPP) have been used successfully in many projects throughout the world. The private investment in CHSRA would be a PPP. However, not all PPPs are successful. To be a success, a PPP must be based upon a robust funding plan and business model. Moreover, for investors, risks must be more than offset by the realistic potential of sufficient profits.

CHRSA advisor Lehman Brothers noted that there are significant political risks with HSR in the United States. Political risks can be a more significant barrier to private investment than market risks. Lehman Brothers specifically indicated a number of risks that could complicate the potential for private investment in HSR. These include:

- The potential for cost overruns. Lehman Brothers indicates that some potential investment funds do not participate in "green field" (new) projects due to cost overruns.
- The potential for delays, which can materially increase costs and erode anticipated profits. As with cost overruns, the threat of delays precludes some potential investment funds from "green field" projects according to Lehman Brothers.
- Failure to reach ridership projections. Lehman Brothers notes the "poor past transit" experience as a concern with respect to ridership projections.
- Failure to reach revenue projections (and thus profit uncertainty).
- Political meddling: Lehman Brothers notes that political meddling has been a problem already in a California public private partnership (State Route 125 toll road in San Diego).

These risks could discourage a sufficient level of private investment or make the cost of that investment higher. Further, the report of the state Senate Transportation and Housing Committee noted that “forecasts are viewed skeptically in the investment community and may require additional independent verification.”[365]

As a result of these risks, obtaining sufficient private sector funding will be challenging.

The Question of Profits

As has been noted, there are serious questions about whether any HSR system in the world is profitable when all factors are considered. (See Part 3, International Experience.) However, CHSRA Executive Director Mehdi Morshed has indicated that the California HSR system would be profitable and has even predicted an annual profit of $1 billion.[366] While Morshed provides no detailed data, such a result is doubtful under the most optimistic assumptions.[367] CHSRA Chairman Quentin Kopp wrote that the HSR system would “operate at a profit (just like the European and Asian systems) without taxpayer subsidy.”[368]

Statements such as these are countered by transportation experts William L. Garrison and David M. Levinson who indicate that the claim of profitability for HSR systems “conveniently ignores the very high capital costs” and that “HSR has in all cases required government subsidy.”[369] Indeed, to claim that HSR systems are not subsidized when much of their capital costs (and perhaps even operating costs) are paid for by government is akin to claiming a household budget produces a surplus without including the mortgage on the house.

At the same time, this is in contrast to other forms of intercity passenger transportation. The airline system is virtually all supported by user revenues, rather than general subsidies.[370] (See Part 5.) Intercity highways and freeways are virtually all paid for by user revenues as well, rather than general subsidies.[371] Similarly, intercity buses are largely unsubsidized.

Finally, there is virtually no likelihood that HSR system surpluses will be available to finance system completion or expansion, simply because HSR profits are likely to be miniscule or non-existent. (See Part 9.)[372]

Thus, in addition to the likelihood that ridership and revenues will fall short, that capital costs will be higher, that operating costs will be higher, that anticipated operating speeds are not likely to be achieved, CHSRA lacks a viable financial plan. Moreover, there appears to be no short-term prospect that such funding will materialize, beyond the possible voter approval of the $9 billion bond issue.

Conclusion

It appears unlikely that sufficient private and public subsidy funding will be found to finance the complete HSR plan. As a result, it is more likely that the system will either be built only in part or not at all. Moreover, claims of profitability could not conceivably be true under even the most optimistic assumptions.[373]

While current focus is on HSR's initial capital costs, the future costs for on-going capital renewal and replacement can be very large in their own right. Examples include vehicle replacement and major right-of-way renewal. Such costs have typically been insufficiently accounted for on large rail projects. The extent to which CHSRA has accounted for such future costs is not clear.

At this time the state of California lacks a comprehensive HSR financing plan. The proposed state bonds would be insufficient to build Phase I, much less the rest of the system. Little is firm about potential matching funds from federal and local governments and from potential investors. The state Senate Transportation and Housing Committee has issued cautionary statements about the availability of matching funds.

Also, CHSRA advisor Lehman Brothers has outlined risks that can be a barrier to private investment, including cost overruns, failure to reach ridership and revenue projections and political meddling. Meanwhile, the cost of the project continues to grow.

Part 5

Alternatives to Building the HSR System

The costs of the CHSRA highway and aviation "alternatives" are highly exaggerated. If the system were built, diversion of traffic from the highway and aviation systems would be imperceptible. In fact, meeting the demand that would otherwise be switched to HSR would require much less investment compared to the cost of HSR.

CHSRA has produced cost estimates for the Highway and Aviation Alternatives (referred to as "modal" alternatives in the EIS/EIR) that it claims would be necessary to meet the demand that would otherwise be met by HSR, if built. Overall, CHSRA indicates that the cost of such alternatives would be $82 billion[374]—$66 billion for highways and $16 for airports.[375]

At $82 billion, the Highway and Aviation Alternatives were expected to cost between 2.2 and 2.5 times that of the HSR system, which was estimated at $33 billion to $37 billion (2003$) when the alternatives analysis was announced.[376]

Public officials and the media have largely accepted the CHSRA analysis without question. For example, a *San Francisco Chronicle* editorial summarizes what has become the prevailing view among HSR proponents:

> *If we don't build a high-speed rail train, California would need to build 3,000 additional miles of highway and five airport runways to meet future intercity travel demands. The cost of building a high-speed train is less than half the cost of expanding freeways and airports.*[377]

Even as HSR cost escalation has continued, the proponents' claims have become more strident. Assembly Bill 3034, introduced in 2008, declared that the "alternatives" had expanded to three times the cost of HSR.

> *The high-speed train system proposed by the authority will cost about one-third of what it would cost to provide the same level of mobility and service with highway and airport improvements…*[378]

CHSRA projects road demand to increase 52.5% from 2000 to 2030 and airline demand to increase 75% from 2000 to 2030.[379] Such large increases would require additional airport and highway capacity *regardless* of whether or not the HSR system is built. These increases would overwhelm the modest impacts of HSR (below). Little if any reduced capacity requirement in either highways or aviation would be attributable to demand reduced by HSR. CHSRA attributes *all* of the costs of its major highway and airport expansion proposals to HSR, when, in fact, HSR would be a small factor in such expansions. Moreover, CHSRA uses highly inflated costs in its highway construction estimates.

This chapter finds the CHSRA Highway and Aviation Alternatives estimates to be faulty, composed of transportation improvements that are not needed or which have little to do with HSR and cost estimates that are highly exaggerated. As a result, the CHSRA's highway and airport expansion estimates are not genuinely reflective of the costs of alternatives to HSR.

This Due Diligence Report estimates the attributable avoidable cost for the Highway and Aviation Alternatives to be *$0.9 billion with HSR in place* rather than the $66 billion claimed by CHSRA. The maximum impact of HSR would be to delay required highway expansions by little more than 18 months. This cost difference of *more than 98%* illustrates how modest a future role HSR will play in reducing highway congestion. Further, much more modest aviation volume increases and operational improvements are likely to virtually accommodate far more new passenger volumes than would be reduced by HSR.

As a result, the CHSRA alternatives cannot be taken seriously. They are, in fact, little more than "straw men," which have the effect of misrepresenting the choices that are available to policy makers in California, in such a way that HSR, which is exceedingly expensive, is made to appear affordable. The CHSRA alternatives are discussed further below.

Subsidies and User Fees

However, before discussing the CHSRA alternatives in detail, it is appropriate to consider the subjects of "subsidies" and "user fees." Expenditures on highways and airports are often referred to as "subsidies." In fact, they are overwhelmingly not. Intercity highways are paid for virtually exclusively by user taxes and fees, which are principally assessed on drivers, intercity buses and trucks, based upon their use of fuel. Airports and commercial air travel are nearly all financed by user taxes on airline tickets, landing fees and other user charges.[380] These charges are not levied on other goods or services. Subsidies are amounts collected from all taxpayers, regardless of whether they use the particular government service on which they are spent. Simply put, those who do not drive do not pay for highways and those who do not fly do not pay for airports (or airline operations).

The difference is illustrated by an example from outside transportation. Virtually all taxpayers pay for public schools, regardless of whether they use them. The expenditures on public schools are thus the result of subsidies. However, residents who obtain their electricity from the city of Los Angeles Department of Water and Power (DWP), a government organization, pay user fees for the power that they use. DWP expenditures are made from user fees, not subsidies. It would be no more reasonable to characterize a DWP customer as being subsidized than it would to characterize a customer of Southern California Edison, a privately owned electricity supplier, as being subsidized.

In intercity transportation, nearly all government expenditures are derived from user taxes and user fees. Highways, airports and intercity buses are therefore provided with little or no subsidy. The one exception is intercity rail (Amtrak), which receives substantial general taxpayer subsidies and has benefited from government-guaranteed loans that it was not required to repay; Amtrak also receives user fees in the form of passenger fares. If intercity rail were funded in the same manner as highways and airports, its public funding would be obtained from a dedicated tax on tickets.

There is a simple test to differentiate between user fees and subsidies:

- If only those who use a service pay for it, it is a user fee. In the case of roads, only those who use the roads are charged. In the case of airports, only those who use them pay. People who do not use roads or airports do not pay for them.

- If taxpayers pay for a service whether or not they use it, it is a subsidy.

This is an important distinction to keep in mind in considering HSR and its purported alternatives. In California, highways and airports are paid for by user charges. Thus, whatever are the legitimate costs of meeting HSR demand by expanding highways and airports will be paid for by their users. However, substantial amounts of taxpayer funding will be required for HSR, in addition to the user fees (fares) that passengers will pay.

A. The CHSRA Highway Alternative

The CHSRA Highway Alternative would add a single lane in each direction along virtually the entire HSR corridor (Table 16) and two lanes in each direction lanes on I-5 between downtown Los Angeles and the I-5/SR-14 junction at the northern edge of the San Fernando Valley.[381] CHSRA included roadway expansions on corridor routes, whether or not they were needed (in a number of cases, no serious traffic congestion was projected by CHSRA in the horizon year). In some corridors, lanes are added on more than one roadway, such as parallel I-5 and SR-99 between Sacramento and the Bakersfield area and the parallel I-15 and I-5 between the Los Angeles area and San Diego. Overall, approximately 2,900 lane-miles would be added.[382] According to CHSRA, the cost of the Highway Alternative would be $66 billion. This report finds the cost to be highly exaggerated as the result of:

- Projections that attribute far more of the cost of highway expansion to HSR than is reasonable, because HSR would reduce traffic volumes so little.

- Unit costs (cost per highway lane mile) that are far above realistic estimates.

- Inclusion of highway segments that would not require expansion under any scenario by the horizon year (2020 or 2030, depending on the CHSRA projection set).

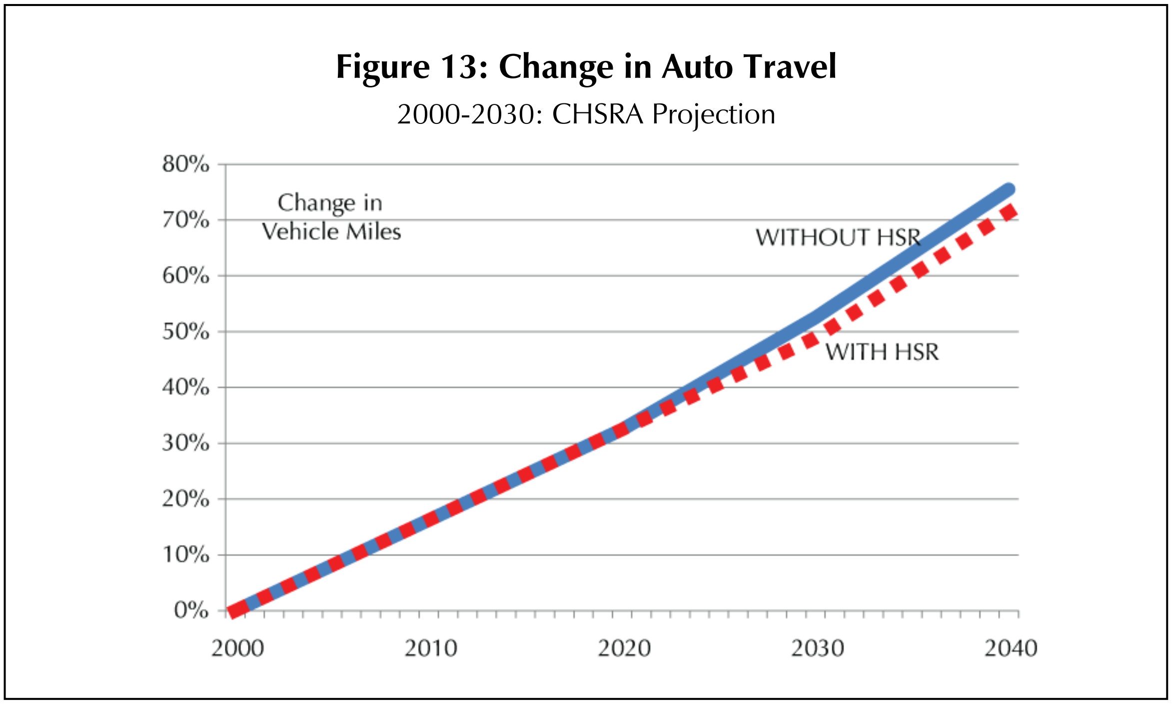
Table 16: Roadway Expansions

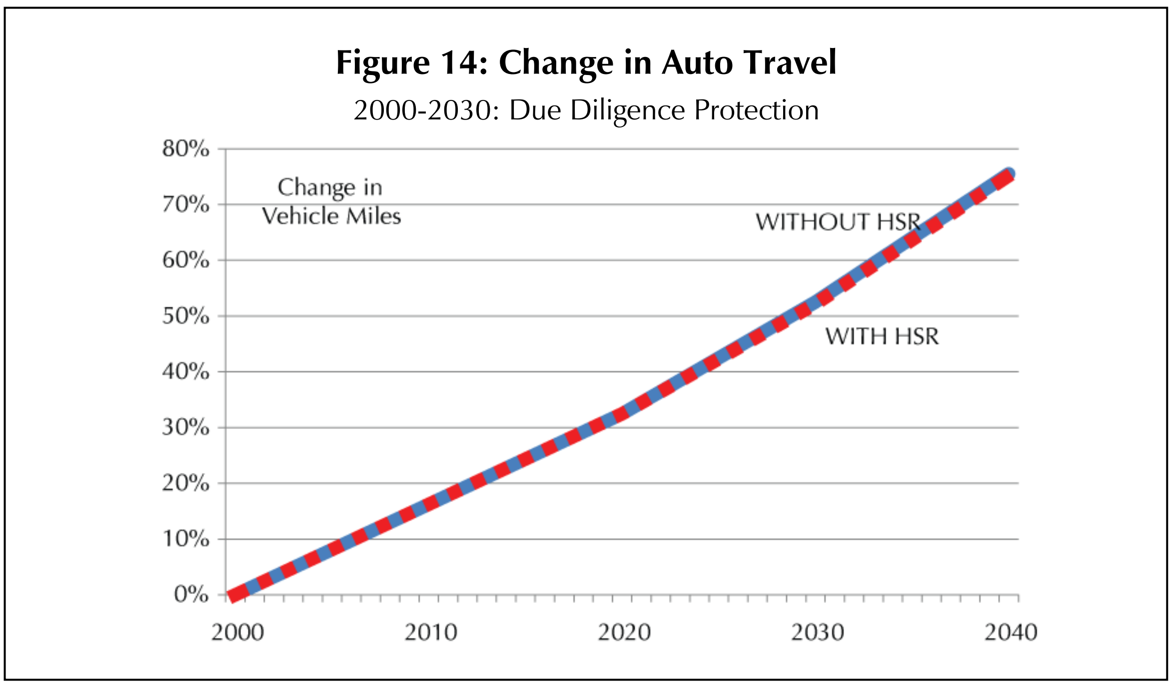
Roadway	From	To
I-5	Sacramento	San Diego
I-8	I-5 Jct. (San Diego)	SR-163 Jct. (San Diego)
I-10	Los Angeles	Riverside
SR-14	Palmdale	I-5 Jct. (south of Santa Clarita)
I-15	Ontario	SR-163 Jct. (San Diego)
I-80	San Francisco	Sacramento
SR-99	Sacramento	I-5 Jct. (south of Bakersfield)
US-101	San Francisco	Gilroy
SR-152	Gilroy	Jct. SR-99 (south of Merced)
SR-163	I-15 (San Diego)	I-8 (San Diego)
I-215	Riverside	Murrieta, Temecula
I-580/I-238	I-880 Jct. (East Bay)	I-5 Jct. (east of Tracy)
I-880	Oakland	San Jose

Exaggerating the HSR Attributable Share

Further, CHSRA attributed the full cost of these roadway expansions—$66 billion—to HSR. In other words, CHSRA's assumption is that in the absence of HSR it would be necessary to spend $66 billion to accommodate the demand that would otherwise be accommodated by HSR. This is not a plausible proposition, because the traffic that CHSRA projects would be attracted from roads to HSR is so small.

HSR Impact on Traffic Volumes. The latest CHSRA traffic projections indicate that HSR would reduce future volumes (2030) on corridor roadways by 2.5% (Figure 13).[383] Under the Due Diligence Report projections, the impact would be two-thirds less (Figure 14), at approximately 0.8 percent. By comparison, CHSRA projects overall roadway traffic growth of 52.5% (2000-2030), which would overwhelm the HSR traffic impact (2.5%) by many times. Of course, this strong roadway traffic growth would require substantial additional roadway construction, especially where roads are near or above capacity today. However, the modest demand that would otherwise be diverted to HSR is not the principal or proximate cause of this highway expansion. A reasonable estimation of the Highway Alternative cost cannot exceed the share of any expansion that is attributable to HSR.





HSR Traffic Impact in Context. On a typical 4-lane freeway, an additional lane in each direction will add approximately 50 percent to capacity. On an urban 8-lane freeway, an additional lane in each direction would add 25 percent to capacity. HSR's traffic impact would be small by comparison—ranging from 1/10th to 1/20th or less of the additional highway capacity that would be added under the CHSRA Highway Alternative. The CHSRA projected 2.5 percent reduction in traffic due to HSR would represent 1.7 years growth in roadway traffic based upon the 2000-2030 rate (additional analysis of HSR's traffic impact is below).[384]

HSR Impact on Traffic Congestion: Elaboration. CHSRA projections indicate little HSR impact on reducing traffic congestion by 2020:

- If HSR is not built and the Highway Alternative is not built, traffic demand would average 31 percent above roadway capacity.
- If HSR is built and the Highway Alternative is not built, traffic demand would average 26 percent above roadway capacity.
- If the Highway Alternative is built and HSR is not built, traffic demand would average 4 percent above roadway capacity.

Thus, traffic congestion would be considerably *worse* with HSR than with the CHSRA Highway Alternative. This is illustrated by Table 17, which is reproduced from the EIS/EIR.[385] On average the Highway Alternative would reduce traffic congestion five times as much as HSR, according to CHSRA. The Highway Alternative would reduce traffic congestion[386] 21%, while HSR would reduce traffic congestion 5%. The Highway Alternative would thus reduce traffic volumes by *five times* the traffic reduction that is projected if HSR is built (Figure 15). Even at the exaggerated CHSRA costs, the Highway Alternative would be three times as cost-effective in traffic congestion reduction as HSR.[387]

Further, CHSRA's estimate of statewide traffic reduction (2.3 percent) is untenably high in view of its 2.5 percent peak period estimate for northern California roadways. The traffic on all of the state highways CHSRA studied as impacted by HSR in its EIS/EIR account for less than one-quarter (23 percent) of the state's annual driving.[388] Thus, the CHSRA traffic diversion estimate as indicated on northern California roadways is more likely to represent approximately a 0.6 percent statewide traffic reduction, rather than 2.3 percent.[389]

Further, the CHSRA projected impact of HSR on traffic congestion would be so slight that there would be *no* perceivable change in traffic congestion along corridor routes as measured by the level of service along the routes evaluated in the NCEIS.[390]

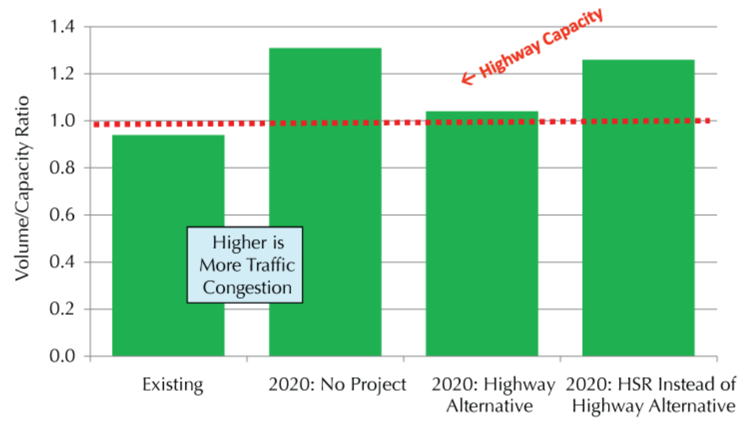
Table 17: Traffic Impacts: Highway Alternative and HSR: 2020

Region	Intercity Highway Segment Averages				
	NP	Modal Alternative		HSR Alternative	
	V/C	V/C	% Change from NP	V/C	% Change from NP
Bay Area to Merced	1.22	0.96	21%	1.14	7%
Sacramento to Bakersfield	0.92	0.62	33%	0.89	4%
Bakersfield to Los Angeles	1.67	1.38	14%	1.67	1%
Los Angeles to San Diego via Inland Empire	1.40	1.15	19%	1.29	9%
Los Angeles to San Diego via Orange Co.	1.35	1.11	16%	1.31	3%
Average	1.31	1.04	21%	1.26	5%
NP = No Project Alternative. Source: Parsons Brinkerhoff, 2003.					

Source: Reproduction of CHSRA's EIS/EIR Table 3.1-4. V/C = ratio of volume to capacity

Figure 15: Average HSR Corridor Traffic Congestion

Volume/Capacity Ratio



Unneeded Highway Expansions and Expansions Indicating no HSR Impact

The CHSRA Highway Alternative includes roadway segment expansions that are not needed, and over-capacity roadway segments on which HSR would have virtually no impact in reducing traffic congestion.

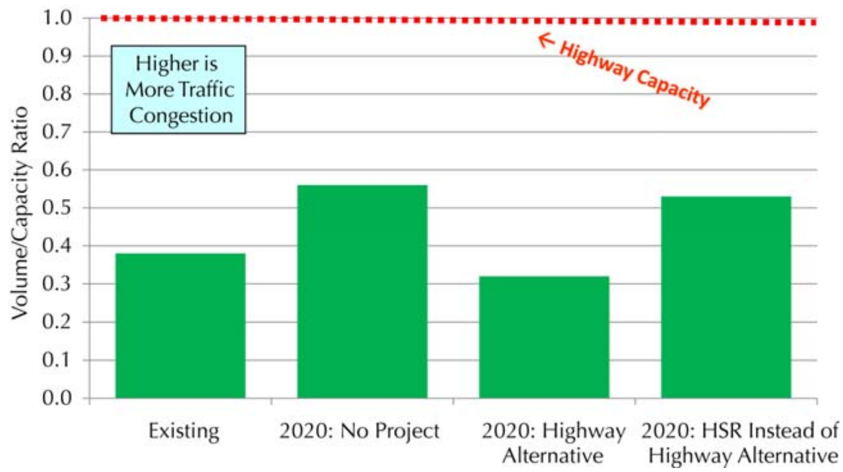
Segments Not Needing Expansion. According to the CHSRA traffic analysis, traffic on a number of roadway segments would remain at least 20 percent below capacity in 2020. Where there is at least 20 percent capacity remaining, roadway expansion would not be necessary.[391] Nevertheless, CHSRA's Highway Alternative anticipates expanding these roadway segments. The most significant examples are as follows:

The CHSRA Highway Alternative would expand I-5 by one lane in each direction between I-205 (near Stockton) and near Santa Clarita. This approximately 200-mile stretch of roadway expansion would require, based upon CHSRA estimates, an expenditure of more than $4 billion. However, CHSRA data shows the roadway to be at least 20% *below* capacity in 2020 at every reported point, with HSR and without highway expansion.

The CHSRA Highway Alternative would expand State Route 99 by one lane in each direction between Merced and its junction with I-5 south of Bakersfield. This nearly 200-mile stretch of roadway expansion would require, according to CHSRA, an expenditure of more than $6 billion. However, CHSRA data shows the roadway to exceed 80% of capacity at only one point (south of Fresno, between Fresno and Selma). It is estimated that approximately one-sixth of roadway expansion proposed by CHSRA under its Highway Alternative is unnecessary because sufficient capacity would remain with or without HSR.

Figure 16: Additional Capacity Not Justified

Example: Merced County: SR-99 Segment



Segments Where HSR Makes No Difference. CHSRA proposes highway expansions in cases where its own projections show that HSR would have virtually no impact on traffic congestion. The CHSRA proposed expansions would leave highway segments at *above* capacity, with or without HSR. For example:

- CHSRA proposes adding two lanes in each direction to Interstate 5 between Burbank and Los Angeles. Yet, 2020 traffic volumes are projected by CHSRA to be 226 percent above capacity with HSR (and no roadway expansion) and 224 percent above capacity with no roadway expansion and *no* HSR. Thus, according to CHSRA, the traffic conditions are worse *with* HSR than without it (Figure 17).[392]

Figure 17: Example: Over-Capacity Segment

Los Angeles County: I-5 Burbank

- CHSRA proposes adding one lane in each direction between Fremont and San Jose. Yet, both with and without HSR, 2030 traffic volumes are projected by CHSRA to be 58 percent above capacity. Thus, according to CHSRA, the traffic conditions are the same, *with* HSR and without it.[393]

Urban Highway Expansion Would Be Needed Anyway

Further, the CHSRA anticipates a number of highway expansions in urban areas. Because of the higher traffic demand in these areas, freeways are more frequently expanded. This expansion is principally the result of traffic *within* the urban area, not *between* urban areas. Thus, as California's urban areas continue to grow, these expansions will be necessary, regardless of whether HSR is built. HSR would not be a material factor in reducing the demand for expanding freeways in urban areas or elsewhere, because of the small amount of traffic that it would divert. Moreover, even with the proposed commuter services, CHSRA projections indicate that HSR would make virtually no difference in local traffic congestion conditions where operated in the San Francisco Bay Area, the Los Angeles area or the San Diego area.

Exaggerating Unit Costs

CHSRA uses exceedingly high unit cost (cost per mile) estimates for its highway "alternative." Based upon Federal Highway Administration cost factors, a plausible estimate of costs of the highway expansions proposed by CHSRA would be approximately $18.7 billion (Table 18).[394] This is less than one-third of the $66 billion estimated by CHSRA.

Station Congestion Impacts

While HSR would have virtually no perceivable impact on roadway congestion along the corridor, it seems likely that the most significant traffic impact will be increased traffic congestion around stations, according to CHSRA data. At a majority of station locations being considered on the preferred Pacheco alignment, CHSRA projects that there will be an increase in traffic congestion as measured by the "level of service."[395]

It does not appear that CHSRA projections include the capital costs that will be imposed upon municipalities for roadway expansions that might be necessary as more traffic is added to small, often already congested areas.

CHRSA Highway Expansions: Due Diligence Cost Estimate

The reality is that the program of highway expansions proposed by CHSRA is not an alternative to HSR at all, but would largely be required regardless of whether HSR is built. The capture of highway demand by HSR would simply be a minor factor in reducing the need for highway expansion, since overall traffic growth trends are so much greater.

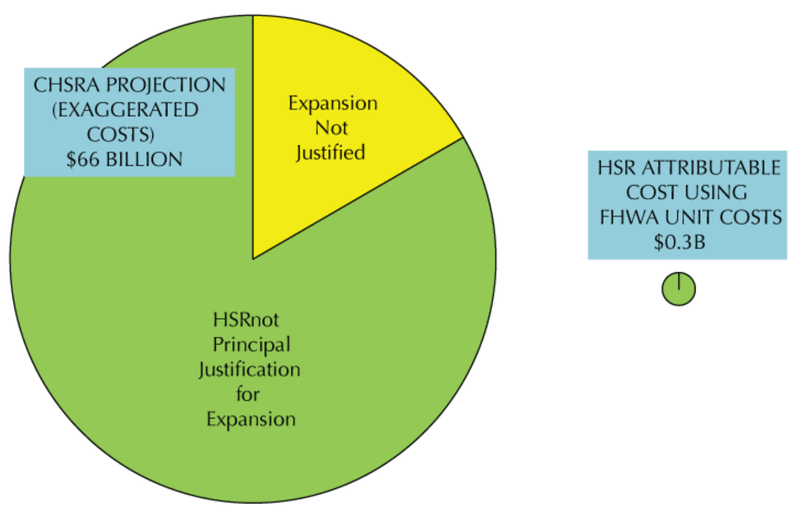
Above it was estimated that a more realistic cost estimate for the program of highway expansions proposed by CHSRA would be $18.7 billion. This figure can be reduced to $15.6 billion, to account for the estimated costs of unnecessary roadway expansions in the CHSRA Highway Alternative. HSR's attributable share of the $15.6 billion would be approximately 6 percent,[396] or approximately $0.9 billion (Table 18).[397] Thus, the more realistic HSR-related cost of the Highway Alternative is 98 percent below the CHSRA $66 billion claim (Figure 18). Under the Due Diligence Report traffic projections, the HSR-related cost of the Highway Alternative would be approximately $300 million.

Table 18: Adjusted Cost of Highway Alternative

Type of Expansion	Lane Miles	Per Lane Mile (Millions)	Total Cost (Billions)
Rural Flat	1,352	$1.6	$2.1
Urban Under 50,000	161	$2.6	$0.4
Urban 50,000-500,000	200	$2.9	$0.6
Urban 500,000-1,000,000	258	$4.8	$1.2
Urban Over 1,000,000: Normal	725	$9.5	$6.9
Urban Over 1,000,000: Heavy	151	$39.7	$6.0
Rural Freeway Mountainous	182	$5.1	$0.9
SF Bay Crossing	18		$0.6
	3,046		$18.7
Expansion not Justified			$3.1
Expansion Justified by Normal Traffic Growth			$15.6
HSR Share			5.8%
Attributable to HSR: CHSRA Basis			$0.9
Attributable to HSR: Due Diligence Basis			$0.3
2003$, inflated from 2002 FHWA lane mile cost factors; San Francisco Bay Crossing cost from CHSRA			

Figure 18: Highway Alternative Costs

Size of Pies Indicate Relative Costs



B. The CHSRA Aviation Alternative

CHSRA asserts that California would need "Over 90 new gates and five new runways statewide—equivalent to more than two new Ontario International Airports" without HSR.[398] According to CHSRA, this would require $16 billion additional in expenditures. As in the case of the CHSRA Highway Alternative, the CHSRA Aviation Alternative is based upon challengeable assumptions.

- That there would be significant growth in the underlying demand for airline service in California. In fact, airline passenger volumes are running far behind CHSRA assumptions—a situation that was developing when the EIS/EIR and NCEIS were prepared and has since continued.

- That a large share of airline passengers would switch to HSR and that airlines would cancel a large share of the flights within California. This purportedly would make it possible to avoid the costly airport expansions. International experience shows that the number of airline flights remain high in the longer HSR markets, even after HSR is built.

- A failure to recognize the potential for expanding airport capacity through operational improvements.

The combination of these factors makes it unlikely that the capture of airline passengers by HSR would have any material impact on airport volumes.

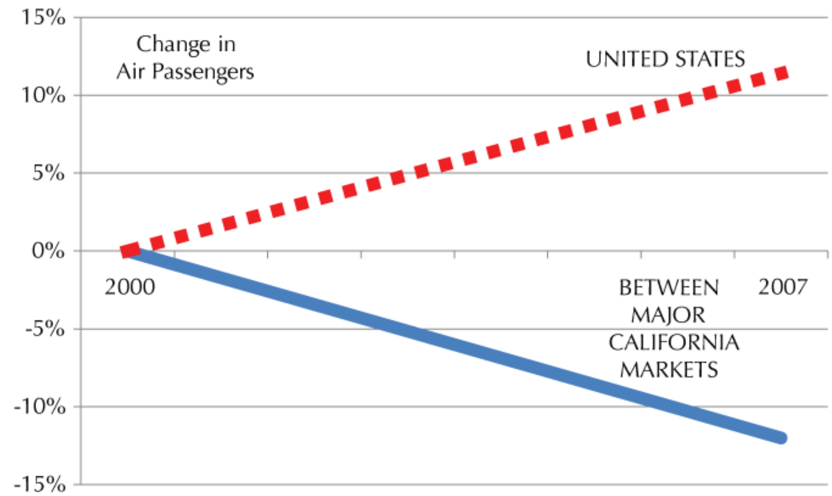
Airline Market Growth. CHSRA projects an airline passenger volume increase in the HSR corridors of approximately 75 percent from 2000 to 2030. This projection seems remarkably high. Since 2000, average daily passenger volumes between the major airports in the Los Angeles, San Francisco Bay, San Diego and Sacramento areas have fallen 11.9 percent.[399] A principal factor was the impact of the 911 terrorist attacks, which led to reduced airline passenger volumes.

However, the ridership declining effects of 9-11 have lingered much longer in California, which is nearly the opposite of the trend in the rest of the nation that has seen overall airline volumes *increase* 11.4 percent between 2000 and 2007 (Figure 19).[400] In 2007, airline passenger volumes were nearly 30 percent below what would have been expected under the CHSRA projections.[401]

The decline in California airline travel also extends to interstate flights. Overall, take-offs and landings declined 10.0 percent at the five major Los Angeles area airports between 2000 and 2007. Airline take-offs and landings there declined 8.7 percent.[402] At San Francisco International Airport, total take-offs and landings declined 12.4 percent, while airline takeoffs and landings declined 20.0 percent from 2000 to 2007.[403] Total take-offs and landings at Oakland International Airport declined 27.8 percent from 2000 to 2008.[404]

Figure 19: Airline Passenger Trends

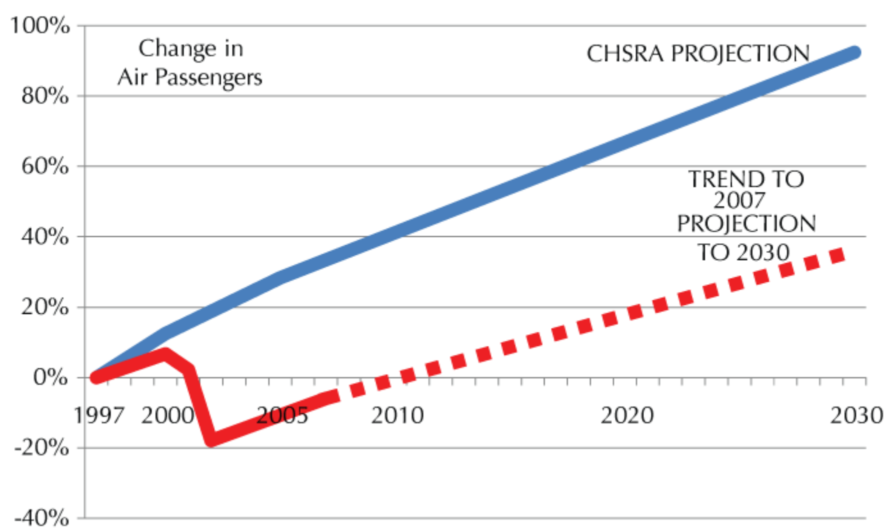
Major California Markets: 2000-2007



It seems highly unlikely that the CHSRA projected increase in airline ridership will occur. If airline volumes were to increase at the projected 2005 to 2030 rate from their 2007 level, the 2030 volume would be only 36 percent above 2000, less than one-half of the CHSRA projected 75 percent increase (Figure 20[405]). Finally, the recent increases in fuel costs have led to a reduction in air service in a number of markets. As a result, the CHSRA airline volume projections appear to be very high.

Figure 20: Airline Passenger Projections

California to 2030



Sources: Calculated from USDOT data, CHSRA projections.

Projected HSR Capture of Airline Passengers

CHSRA projections indicate that HSR would attract from approximately 60 percent to 95 percent of the combined Los Angeles–San Francisco Bay area HSR-air market in 2030, which represented nearly one-half of air travel within the HSR markets in 2005.[406]

The air-diversion estimates are all exceedingly optimistic. No high-speed rail system achieves such market dominance in any strong market of similar distance or travel time. Even in the Tokyo–Osaka market served by the Bullet Trains, the HSR share of the air and HSR market is a considerable 80 percent, but that is with far higher driving costs (including high tolls), higher air fares and a pre-existing strong conventional rail market. It is also considerably higher than the Paris–Marseille market (similar in distance to San Francisco–Los Angeles) at 65 percent.

Strong Air Markets Would Remain in HSR Corridors

High HSR market shares do not necessarily lead to air-service reductions of nearly the same magnitude. The large HSR market shares in the Paris–Marseille and Tokyo–Osaka markets might lead to the impression that there is little air service, or that most of the air service has been cancelled. The facts are otherwise.

- The Tokyo–Osaka air market is one of the largest air markets in the world despite the availability of Bullet Trains. On a daily basis, this market serves more than 23,000 daily passengers, which is nearly 2.5 times the volume of the busiest air route in the United States (New York–Chicago, at 9,900).[407] Frequent service is provided by wide-bodied jets (principally Boeing 777s). At least 40 non-stop flights are provided on weekdays.[408]

- The Paris–Marseille air market was strong before the Marseille high-speed TGV train service began and remains strong today. The Air France Paris Orly Airport–Marseille shuttle continues to operate between 17 non-stop services in each direction on weekdays and six more non-stop flights are operated from Charles de Gaulle Airport in Paris.[409] Although its frequency has been reduced by one-third since before the Marseille HSR service opened (2001),[410] the airline's service reduction was well short of the two-thirds that might be expected as a consequence of the 65 percent HSR market share.

- Despite the *Eurostar* HSR service, 30 non-stop flights are operated in the Paris–London market each weekday.[411]

- Despite Amtrak's Acela service, more than 30 non-stop flights are operated in the New York–Washington market each weekday.[412]

Airport expansion is not required by the number of passengers so much as it is by the number of daily takeoffs and landings. As noted for Paris–Marseille TGV and Tokyo–Osaka Bullet Trains, strong airline frequencies remain despite what are arguably the world's most effective HSR systems. This is likely to be the case in California as well.

The CHSRA also presumes that airlines will not strongly respond to the competition from HSR. Most of the California air routes are long enough that airlines can continue to operate strong schedules, as they do in the above-mentioned markets. It seems likely that the reduction in airline flights between the markets, and takeoffs and landings, will be insignificant. (See Part 4, Passenger Convenience for travel-time reasons why airline travelers will opt for flights over HSR.)

The airlines could simply reduce the size of aircraft and maintain similar service frequencies. The result would be no reduction in airport expansion requirements. At the most, it is likely that airlines would only modestly reduce their frequencies, as indicated by the case of Air France in the Paris–Marseille market or the continuing strong service frequencies in the Tokyo–Osaka market. Thus, it is optimistic to assume that any reduction in the number of flights would be proportional to the share of passengers that might be diverted to HSR.

Moreover, in California, the small number of non-stop express trains between major markets (San Francisco, San Jose, Sacramento, Los Angeles and San Diego) would present a major competitive disadvantage for HSR.

CHSRA Ignores Future Airline/Aviation Efficiencies

The CHSRA treats the commercial aviation system as if it is static—as if efficiencies to enhance capacity are impossible. Specifically, the CHSRA fails to consider potential improvements in air traffic control (ATC), which could materially increase airport capacities. For example, use of Required Navigation Performance (RNP) technology could boost the operational capacity of San Francisco International Airport by as much as 54 percent over current bad weather capacity without constructing another runway—a significant feat.[413] Moreover, capacity increases will come about during good weather through increased runway capability as the Next Generation ATC system uses RNP and other new technologies.[414] The impact of these improvements is not recognized in the CHSRA airline projections.

The CHSRA does not consider the possibility that Palmdale Airport could become the principal international airport for the Los Angeles area, as is preferred by the metropolitan planning organization.[415] From 2010 to 2020, the Regional Aviation Plan calls for Los Angeles World Airports to provide financial support to Palmdale and Ontario airports to construct new facilities and establish long-haul and international service through attractive pricing arrangements and other inducements.[416]

Such developments could allow transfer of flights from Los Angeles International Airport (LAX) to Palmdale, which has two runways capable of servicing the largest commercial aircraft. This would create significant new capacity at LAX. A higher volume Palmdale airport could be served by advanced transportation alternatives, such as highway tunnels or maglev.[417]

The metropolitan planning organizations in San Diego and Los Angeles areas are considering development of maglev to serve new or expanded airports that are somewhat distant from present population centers (e.g., Imperial Valley for San Diego and Palmdale for Los Angeles).[418] Thus, airport plans generally anticipate meeting the new demand for airline service, with or without HSR. It is thus unreasonable to presume that HSR would have any serious impact on the necessity for expanding airport facilities.

Airport expansion is more difficult in the San Francisco Bay Area, where regional plans anticipate the need to expand the number of runways. However, these plans do not consider HSR to be a material factor, noting that HSR "would not divert enough passengers to make up for the shortfall in runway capacity."

> *High Speed Rail has been evaluated based on the alignment and results of work conducted by the California High Speed Rail Authority. The primary benefit would be the diversion of travelers flying to major Southern California airports, and a secondary benefit would be for passengers flying on commuter flights to the Central Valley cities. Even with the large diversion of air passengers predicted by the Rail Authority (35% to 56%), we found that the projected runway demand at SFO would only be reduced 4-7%, due to the large number of SFO flights not associated with the California market. Additionally the diversion of passengers from flights to the Central Valley would be limited because the only city on the alignment with significant flight activity would be Fresno. Finally, it is possible that the airlines would compete more effectively with fares than assumed in the HSR report.*[419]

Based upon the international experience and the conditions in the California markets, it seems unlikely airline operations directly related to the HSR market would be materially reduced. Moreover, any such diversion would transfer generally more affluent passengers from a largely unsubsidized mode of transport to subsidized HSR.

The relatively small overall impact, combined with the determination of local authorities to meet airline demand, and new capacity created by operational improvements would make it unnecessary to materially expand airports any more if HSR is not built than if it is. Finally, as indicated above, the fraction of runway use affected by HSR would not change while growth in other air markets will continue, meaning that California will still need more airport capacity.

Conclusion

The costs of the CHSRA highway and aviation "alternatives" are highly exaggerated. If the system were built, diversion of traffic from the highways and airports would be imperceptible. In fact, meeting the demand that would otherwise be switched to HSR would require much less investment compared to the cost of HSR. The assertion that the Highway and Aviation Alternatives to HSR will cost $82 billion is highly inflated and based on documentation that contains dubious assumptions and fundamental flaws. Examples include the CHSRA proposing far more highway construction than is necessary to accommodate the demand. Moreover, the CHSRA treats the commercial aviation system as if it is static—as if efficiencies to enhance capacity are impossible.

The diversion factor from air is overestimated. The CHSRA assumes that airlines will cancel a large share of the flights within California because passengers will have switched to HSR—and the diversion will free up airport capacity and make it possible to avoid costly airport expansions. This is not the experience even on the premier Japanese and French systems, which shows that strong air markets remain after HSR corridors are in operation. The CHSRA's analysis of the Highway and Aviation Alternatives appear to be of little value in genuine cost analysis or in evaluating future roadway and airport expansion needs.

Part 6

High Speed Rail and Greenhouse Gas Reduction

One of the most important selling points of HSR has been its claimed potential to reduce CO_2 emissions. The data indicates otherwise. The cost per ton of CO_2 removed by HSR is projected to be between 39 and 201 times the international IPCC ceiling of \$50. HSR has been greatly oversold for its CO_2 emission reduction potential. The reality is that HSR's impact on CO_2 would be inconsequential while being exorbitantly costly.

California state law requires significant greenhouse gas (GHG) emission reductions. Highway and air transportation produce greenhouse gases, especially carbon dioxide (CO_2), which is the principal greenhouse gas.[420] HSR is routinely cited, both in California and internationally as a very effective way of reducing CO_2 emissions. In one document, CHSRA refers to HSR as "earth friendly" and claims that it will reduce CO_2 emissions from highways and air transportation by 12.4 billion *pounds* (this is 5.7 million metric tons).[421] A CHSRA presentation to a California Senate committee predicted that HSR would reduce CO_2 emissions 8.7 million tons in 2030 and that this amount "meets almost 50 percent of AB 32 greenhouse gas reduction goal."[422] In fact, the recently emerging data from CHSRA shows the HSR CO_2 emission impact to be slight (3.1 million tons) at best, and this analysis shows the cost of such reduction to be anything but a bargain.[423]

In short, CHSRA's own data indicates that the CO_2 emission reduction benefits of HSR have been exaggerated. Even the CHSRA's corrected CO_2 emission reduction projection of 3.1 million annual tons are above those derived from the California Air Resources Board of 2.5 million tons and those estimated in this report, at between 0.6 and 1.8 million tons (described below under "Analysis of Emissions Reduction Scenarios").

International (IPCC) Ceiling

While there is wide agreement that CO_2 emissions must be reduced, there is also concern that efforts to reduce CO_2 emissions must be cost effective. Overly expensive CO_2 reduction strategies have the potential to reduce economic growth, increase unemployment and increase poverty levels.

Thus, to merely quantify a reduction of CO_2 from a particular strategy is not the end of the analysis, it is only the beginning. The fundamental questions relate to how much *in the context of overall emissions* would HSR reduce emissions and, even more importantly, *at what cost*. Any strategy for reducing CO_2 emissions needs to be subjected to a cost test. As is indicated below, no such test was applied by the CHSRA, which in light of California's world policy leadership in CO_2 emission reduction seems unusual.

The generally accepted maximum ceiling for assessing greenhouse gas emissions is $50 cost per metric ton[424] of CO_2 removed, as noted in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment report.[425] According to IPCC, between $20 and $50 per ton is the maximum amount necessary to accomplish deep reversal of CO_2 concentrations between 2030 and 2050. It is reasonable to suggest that any strategy that would cost more than $50 per ton is questionable, even extravagant and likely to contribute to unnecessary economic and social disruption.[426] Moreover, a recent report by McKinsey & Company and The Conference Board indicates that strategies are available for substantially reducing CO_2 emissions at less than $50 per ton[427] and an average of $17 per ton.[428]

> *The United States could reduce greenhouse gas emissions in 2030 by 3.0 to 4.5 gigatons of CO_2e … at marginal costs of less than $50 per ton, with the average net cost to the economy being far lower if the nation can capture sizeable gains from energy efficiency.*[429]

A 3.0 to 4.5 gigaton reduction (3,000,000,000 to 4,500,000,000 tons) would amount to from 42 percent to 63 percent of 2006 national emissions levels.[430] Thus, any strategy that costs more than $50 per ton of CO_2 removed can be generally considered too costly, likely to impose undue burdens on the economy (including the expansion of unemployment and poverty because they are associated with slower economic growth). Indeed, strategies that substantially exceed the $50 per ton standard can be classified as excessively expensive.[431] With regard to GHG reduction, HSR would be considered a rational strategy if its cost per ton of GHG reduction is below $50 *and* there are not sufficiently less expensive strategies to achieve GHG reduction goals.

Evaluating the CHSRA Claims

Autos and SUVs and airplanes emit CO_2 in direct proportion to their fuel consumption. At the same time, HSR is responsible for an increase in CO_2 emissions to the extent that power production for HSR produces CO_2 emissions.[432] Different methods of power production are responsible for CO_2 emissions in highly variable amounts. Nuclear power and hydro-electric power emit virtually no CO_2, while coal and fossil-fuel power production produce large amounts of CO_2 emissions. HSR will reduce CO_2 emissions to the extent that the increases in CO_2 emissions for which it is responsible are less than the decline in CO_2 emissions HSR induced in auto, SUV and airplane operations.

There are serious difficulties with the CHSRA CO_2 reduction claims. As has been noted with other project data, considerable variation exists in the numbers used by CHSRA for CO_2 reduction.[433]

The CHSRA CO_2 reduction claims are considered high in the following ways.

- The data in the CHSRA CO_2 analysis fails to take any account of the significant and widely anticipated improvements in personal vehicle (cars and sport utility vehicles) fuel economy. This is important, because there is a direct relationship between fuel use and CO_2 emissions.

- The CO_2 analysis is based upon a statewide traffic reduction analysis that is much higher than would be indicated by CHSRA's own roadway segment analysis.

Future Fuel Economy

The CHSRA analysis assumes no improvement in personal vehicle fuel economy between 2005 and 2030. In fact, however, substantial improvements in personal vehicle fuel economy have been foreseeable for some time. The effect of the CHSRA under-estimation of fuel economy is to produce a significantly higher CO_2 beneficial impact for HSR, which exaggerates HSR's purported environmental benefits.

By the time of the NCEIS, California had adopted strong, improved fuel economy standards for highway vehicles for 2020. However, because the California Air Resources Board (CARB) had not prepared new projections for 2030, CHSRA assumed no improvement in vehicle fuel efficiency. This seems to be an insufficient justification for virtually ignoring the widely anticipated improvements in the carbon intensity of autos and SUVs. The CHSRA concedes that fuel efficiency improvements *could* lessen the energy purported energy advantage of HSR:

> *The magnitude of the expected annual operational energy savings resulting from the HST system could also be lower … given the possibility of automobile fuel efficiency improvements.*[434]

If CHSRA felt that it must wait for the lead of CARB, it certainly could have provided a scenario with alternative projections that attempted to quantify the fuel economy improvement, something this Due Diligence Report does. The CHSRA's failure to include a reasonable estimate of future vehicle fuel economy renders its estimates of CO_2 reduction highly exaggerated and inappropriate for genuine analysis.

More recently the implementation of the California fuel economy standards has been suspended by the failure of the U.S. Environmental Protection Agency (EPA) to grant a required waiver. Litigation is now pending.[435] However, even the new national GHG emission reductions standards would have significantly improved fuel economy and reduced GHG emissions from a specified level of driving. Recently published projections by the U.S. Department of Energy (DOE), which are less strong than the California requirements,[436] indicate that substantial improvements are in the offing principally as a result of the newly enacted federal energy bill.[437] According to the DOE, average "on the road" fuel economy for cars and SUVs in 2030 will be 21 percent improved from 2005.[438]

Similarly, CHSRA fails to assume any improvement in airline fuel efficiency, despite the fact that there is a general view that improvements will occur.[439]

Over-Estimation of Traffic Impacts

The CHSRA CO_2 analysis[440] assumes a reduction in driving that is greater than would be indicated in its own projections of driving reductions on segments of roadway impacted by HSR.[441] As was noted above (see Part 5, Alternatives to Building the System), the CHSRA roadway segment analysis converts to a 0.6 percent statewide reduction under the CHSRA 2030 Base Ridership Projection, though it could be slightly higher if off-peak automobile diversion is greater than peak. This is well below the 2.3 percent statewide traffic reduction projection offered by CHSRA.[442]

If the roadway segment traffic projections are reasonably accurate, the CO_2 analysis significantly overstates emissions reduction and, again, exaggerates HSR's purported environmental benefits.

Analysis of Emission Reduction Scenarios

This Due Diligence Report presents four CO_2 emission reduction scenarios (Table 19).[443] The first two scenarios are based upon the CHSRA 2030 projection of a 3,060,000-ton reduction in CO_2 emissions.[444] This figure is reduced in this Due Diligence Report to account for the widely anticipated fuel economy improvements that are predicted for 2030 by the DOE. The third and fourth projections assume the Due Diligence base ridership projection. The cost analysis includes the 2030 consumer cost (fares) of HSR and the annual capital costs not covered by fares. The net cost is obtained by reducing these gross HSR costs by the annual cost of attributable roadway expansions (that would largely be delayed for less than two years) and the consumer cost savings for air fares and auto use.[445]

Each of the scenarios uses the CHSRA assumption in HSR attributable CO_2 increases. According to CHSRA, 2,400,000 additional tons of CO_2 would be emitted for electricity generation with HSR than without HSR.[446] This may seem surprising, given the sometimes repeated claims that HSR does not emit CO_2. HSR can be largely carbon neutral if all of the electric power used in its service area is generated by hydro-electric or nuclear facilities. That, however, is not the case in California, and the CHSRA estimates appear to account for that, noting that 58 percent of in-state electrical generation in 2005 came from natural gas and coal.[447] The results are as follows (Table 19):

Table 19: CO_2 Projection Scenarios				
	CO_2 Projection Scenario I: Optimistic	CO_2 Projection Scenario 2: Optimistic–Middle	CO_2 Projection Scenario 3: Pessimistic-Middle	CO_2Projection Scenario 4 Pessimistic
Ridership Assumption	CHSRA Base	CHSRA Base	Due Diligence Base	Due Diligence Base
Capital Costs	CHSRA	Due Diligence Low	Due Diligence Low	Due Diligence High
Operating Cost	CHSRA	Due Diligence Low	Due Diligence Low	Due Diligence High

CO_2 Projection Scenario 1: Optimistic. Scenario 1 assumes that CHSRA's capital and operating cost projections will not inflate further and that ridership will equal the CHSRA base projection. Based upon CHSRA CO_2 reduction data, adjusted to account for anticipated improvements in highway and airline fuel economy, it is projected that HSR would reduce CO_2 emissions 1.77 million tons annually in 2030. This converts to an annual cost per ton of CO_2 removed of $1,949 in 2030 (2008$).[448] This is 39 times the IPCC ceiling and 115 times the McKinsey average cost per ton removed.

CO_2 Projection Scenario 2: Optimistic-Middle. Scenario 2 assumes that CHSRA's capital and operating cost projections will rise at the Due Diligence low overrun projections (30 percent and 20 percent) and that ridership will equal the CHSRA base projection. Based upon CHSRA CO_2 reduction data, adjusted to account for anticipated improvements in highway and airline fuel economy, it is projected that HSR would reduce CO_2 emissions 1.77 million tons annually in 2030. This converts to an annual cost per ton of CO_2 removed of $2,409 in 2030. This is 48 times the IPCC ceiling and 142 times the McKinsey average cost per ton removed.

Summary of CO_2 Optimistic Projection Scenarios. The mid-point between the two optimistic projection scenarios would be a $2,179 per ton. This results in a mid-point 44 times the IPCC ceiling and 128 times the McKinsey average cost per ton removed.

CO_2 Projection Scenario 3: Pessimistic-Middle. Scenario 3 assumes that CHSRA's capital and operating cost projections will rise at the Due Diligence low overrun projections (30 percent and 20 percent) and that ridership will equal the Due Diligence base projection. Based upon CHSRA CO_2 reduction data, adjusted to account for anticipated improvements in highway and airline fuel economy, it is projected that HSR would reduce CO_2 emissions 0.63 million tons annually in 2030. This converts to an annual cost per ton of CO_2 removed of $7,409 in 2030. This is 148 times the IPCC ceiling and 436 times the McKinsey average cost per ton removed.

CO_2 Projection Scenario 4: Pessimistic. Scenario 4 assumes that CHSRA's capital and operating cost projections will rise at the Due Diligence high overrun projections (70 percent and 50 percent) and that ridership will equal the Due Diligence base projection. Based upon CHSRA CO_2 reduction data, adjusted to account for anticipated improvements in highway and airline fuel economy, it is projected that HSR would reduce CO_2 emissions 0.63 million tons annually in 2030. This converts to an annual cost per ton of CO_2 removed of $10,032 in 2030. This is 201 times the IPCC ceiling and 590 times the McKinsey average cost per ton removed.

Summary of CO_2 Pessimistic Projection Scenarios. The mid-point between the two pessimistic projection scenarios would be a cost of $8,721 per ton. This results in a mid-point 174 times the IPCC ceiling and 513 times the McKinsey average cost per ton removed.

Carbon Neutral Electricity? Even if the electricity consumed in California were 100 percent efficient—that is if there were no transmission or generation losses with their attributable GHG emissions—HSR would still be a very costly strategy for reducing GHG emissions. If, as a result, there were no GHG emissions from HSR and HSR's GHG impact was only to reduce highway and aviation GHG emissions, the cost per ton removed would be $827 to $2,086. This is between 17 and 42 times the international IPCC ceiling of $50 per ton.

Table 20: HSR CO_2 Emission Reduction & Costs of Reduction: 2030 Analysis Based Upon CHSRA Data

	Projection Scenario I: Optimistic	Projection Scenario 2: Optimistic–Middle	Projection Scenario 3: Pessimistic–Middle	Projection Scenario 4 Pessimistic
ANNUAL COST ELEMENT (Billions)				
Gross HSR Costs	$6.69	$7.51	$6.27	$7.92
Highway Construction Savings	($0.11)	($0.11)	($0.04)	($0.04)
Highway & Air Savings (Fares)	($3.13)	($3.13)	($1.56)	($1.56)
Total	$3.45	$4.26	$4.67	$6.32
Total CO_2 Annual Tons Removed: 2030	1,770,000	1,770,000	630,000	630,000
Cost per Ton Removed	$1,949	$2,409	$7,409	$10,032
Midpoint		$2,179		$8,721
Times $50 IPCC Ceiling	39	48	148	201
Midpoint		44		174
Times $17 McKinsey Average	115	142	436	590
Midpoint		128		513

Costs in billions of 2008$
Gross HSR costs include consumer expenditures plus any annual capital cost not covered by fares.
Highway Construction costs are from "Alternatives to Building the HSR System."
Highway and air savings are consumer expenditures on highway and air travel.
Note: CHSRA data adjusted to account for improved roadway vehicle fuel economy by 2030.

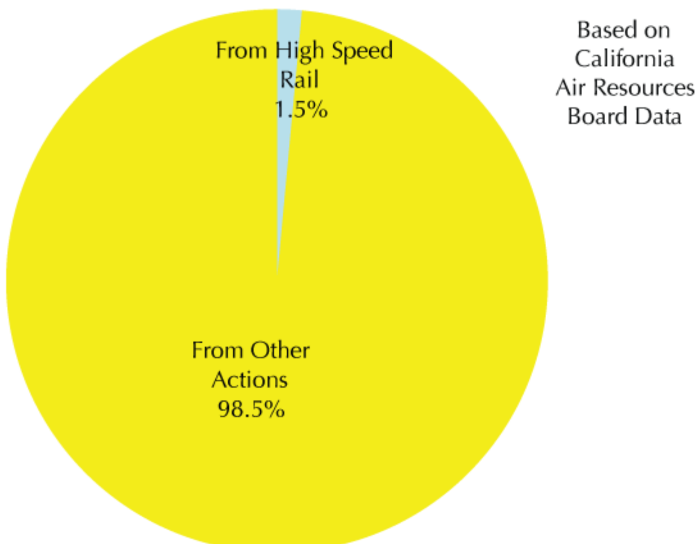
The California Air Resources Board Analysis: In its recently released "Scoping Report," CARB estimated the GHG emission reduction potential of HSR at 1,000,000 tons in 2020.[449] Insufficient details were provided to determine whether the CARB estimate was based upon the CHSRA 2030 Base Ridership Projection or the High Ridership Projection.

CARB estimates that by 2020, HSR will have achieved 40 percent of its projected 2030 ridership. On that basis, the CARB projection would rise to 2,500,000 tons[450] in 2030, a figure similar to this Due Diligence Report's estimate for the CHSRA 2030 High Ridership projection reduction.

Moreover, a reduction of 2,500,000 tons of CO_2 is inconsequential, especially in view of the costs. CARB estimates indicates that it will be necessary to reduce GHG emissions 169,000,000 annual tons in California by 2020. HSR would represent barely 0.5 percent of that reduction in 2020. If the 2030 figure is used, HSR's contribution would rise to 1.5 percent (Figure 21). Indeed, the annual net increase in expenditures on HSR in the most optimistic scenario above ($3.45 billion) is greater than the amount that would be required to accomplish the 169,000,000 ton GHG reduction at the $17 average cost per ton in the McKinsey report (above).

Figure 21: Impact of HSR on GHG Reduction Goal

2020: Using 2030 HSR Impacts



Costs of CO_2 **Emissions Reductions in Context.** The inconsequential contribution of HSR to the California GHG reduction goal would be achieved at great cost.

- Assuming the most optimistic figures (Scenario 1), the HSR cost per ton of CO_2 removal is nearly 40 times the IPCC ceiling of $50 per ton and nearly 200 times the price of carbon offsets now for sale and being purchased by leading California political officials.

- Assuming the least optimistic figures (Scenario 4), if the HSR cost per ton of CO_2 removal were used for the entire 169,000,000 metric ton California objective, the total cost would be more than the current California gross state product ($1.8 trillion). If the nation were to reduce CO_2 emissions by 3,000,000 tons (consistent with the McKinsey report)[451] at the same cost per ton as HSR, the total annual cost would be 2.5 times the present gross domestic product of the United States ($33 trillion). Obviously, reducing CO_2 emissions at this cost would decimate the economy and increase both unemployment and poverty.

- HSR's impact on CO_2 emissions is so inconsequential that a similar reduction would be achieved by a statewide 0.5 mile per gallon improvement in car and SUV fuel economy in

2030. This is less than the apparent improvement in national new auto and SUV fuel efficiency between the first six months of 2008 and 2007, based upon an analysis of the 20 leading vehicle models (10 autos and 10 SUVs).[452]

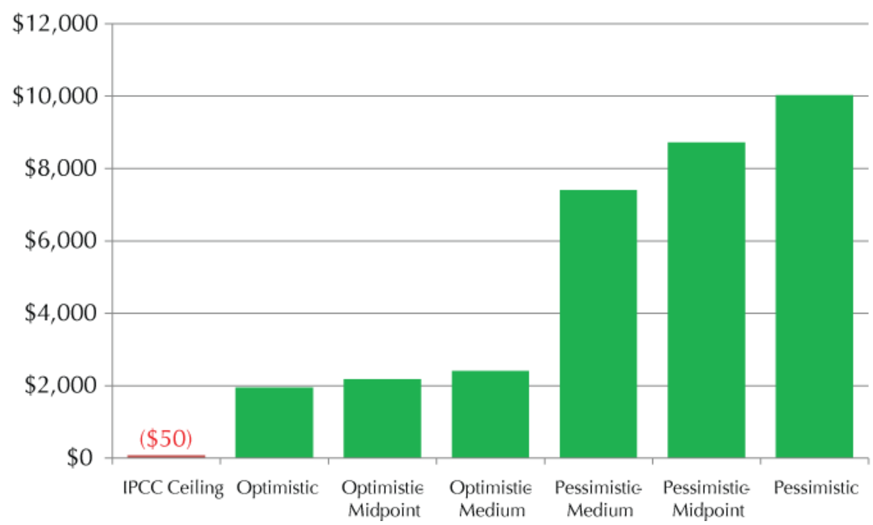
HSR Construction-Related GHG Impacts

Construction of the HSR system will also produce GHG emissions. Planning documents indicate that the energy required to build the system would be "paid back" by 3.8 years of energy savings.[453] However, the documents do not convert that analysis to GHG emissions, which again seems unusual given California's policy leadership in GHG policy.

While there is no analysis of construction-related GHG emissions, if the "payback" period on GHG emissions were equal to the energy payback period, then from 3.8 years (under the CHSRA 2030 Base Ridership Projection) to more than 11 years (under the Due Diligence 2030 Base Ridership Projection) could be required. This would materially reduce the already modest GHG reduction impacts of HSR and increase the cost per GHG ton removed to substantially above its already enormously expensive level.

Figure 22: Cost per Ton of CO_2 Removed

2030 Projections and IPCC Ceiling



Insufficient Disclosure

The CHSRA claim, made to the state Senate Transportation and Housing Committee, that HSR would achieve nearly 50 percent of the state GHG reduction goal was thus exaggerated by at least 30 times.[454] The newly published CHSRA annual CO_2 emissions reduction figure of 3,060,000 metric tons is 65 percent below the 8.7 million tons claimed in the CHSRA materials provided to the Senate committee. Moreover, the recently released CARB GHG estimate of 2.5 million tons is 70 percent below the figure provided to the Senate committee. CHSRA has characterized the errors that required this revision as "technical corrections." In fact, the errors were far more serious than could be rationally characterized as technical corrections.[455] It would seem that full and open disclosure would require CHSRA to notify the Senate committee of these material differences.

In view of the extent to which the CHSRA has been promoting HSR as an effective means of GHG emission reduction, the interest of the state in GHG reduction, and the interest of the Senate committee in objective information, it would seem that the Authority had an obligation to notify the public much more directly of this massive change in impact and not merely to characterize the change in terms of "technical corrections." As of the publication deadline for this report, there was no indication that CHSRA had provided such notification to the Senate committee.

Other Emissions

The underestimation of fuel economy also renders the CHSRA criteria pollution projections of no value. These factors would inflate CO, NOx, TOG and PM pollution projections far beyond any reasonably achievable level.[456]

Conclusion

The impact of HSR on GHG reduction is both inconsequential and costly. The cost per ton of reducing CO_2 by HSR is exorbitant—projected by this Due Diligence Report to be between 39 and 201 times the IPCC ceiling of $50. Based upon CARB projections, HSR appears to be an inordinately costly CO_2 emission reduction strategy and cannot be legitimately included as an element of a rational strategy for reducing GHG emissions.

In view of the under-estimation of automobile fuel economy and the untenable traffic impact projections in the statewide traffic analysis, CHSRA's claims are considered specious. There is a need for an objective, independent assessment of HSR's CO_2 impacts, including both operations and construction. Until such an analysis is completed, CHSRA should cease making any statements about CO_2 or other air quality impacts.

Part 7

Community Considerations

Public opposition that is beginning to emerge is likely to spread as site-specific urban, suburban and rural impacts become better understood by citizens, community organizations and public officials. It is unlikely that the California high-speed rail program will find smooth sailing among impacted communities.

Potential Opposition

Planning has been cancelled for several high-speed rail projects in the United States and public opposition has been a major contributing factor. The impact of the proposed California system cannot be fully understood at this stage of the planning process. The Authority's documentation recognizes that planners will more thoroughly understand impacts later in the process:

> *Most of the potential impacts associated with the implementation of the proposed [HSR] system are highly site-specific in nature. These site-specific issues would be addressed during subsequent project level environmental review, based on more precise information regarding location and design of the facilities proposed. . . . Only after the alignment is refined and the facilities are fully defined through project level analysis, and site-specific avoidance and minimization efforts have been exhausted, would specific impacts and mitigation measures be addressed.*[457]

Once such site-specific impacts have been identified, opposition is likely to build among affected citizens, community organizations and public officials. The greater the impact, the greater the opposition. Objections typically are raised when the HSR system runs the risk of:

- Increasing noise and disrupting the quality of life, particularly in residential areas and near schools.
- Creating new physical barriers such as sound walls, overpasses and trenches that result in a physical disruption to community cohesion.
- Provoking a decline in property values because of noise or the above physical barriers, which can limit visibility or be unsightly.

- Using eminent domain proceedings to take homes, businesses and agricultural lands from unwilling owners.
- Constructing rail lines that split farm lands and ranches in the Central Valley, a practice sometimes called "landlocking" or "severance."
- Altering the environment of parks and wilderness areas by the noise and infrastructure associated with the project.

It is highly likely that project opponents will emerge as public understanding builds regarding local and neighborhood impacts.[458]

Californians may be faced with a concern that did not arise in former HSR proposals in the United States—the construction of stations that may be the longest in the world. Station designs are tied to train lengths, and this report earlier addressed the various CHSRA's specifications for HSR train capacities, noting that the eventual design may become the world's longest HSR train. (See Part 4, Federal Safety Standards.) Documentation is unclear whether the CHSRA has established any standard regarding the length of platforms in train stations where such trains would stop.[459]

The CHSRA's planned high-capacity trains would require exceptionally elongated station platforms—nearly 1,300-feet long if designed to TGV dual-train operating standards, or more than four football fields in length.[460] Moreover, the types of platforms that are outdoors would seem likely to be elevated above street level and have roofs to protect passengers from the elements. Communities may find such massive structures to be visually intrusive and objectionable along with trenches and "Berlin Wall' structures such as sound walls and overpasses.

What follows below are accounts of initial resistance to the current HSR project in the San Francisco Bay Area, reasons why opposition may build in the Central Valley, and an example of concerns in Southern California, particularly in Orange County.

The Emerging Bay Area Opposition

Concerns over how land is used in urban and suburban areas generates citizen interest, which can turn into opposition if plans are unsatisfactory. The Authority is aware of this, as noted in its EIR/EIS:

> *Assessment of potential property impacts is based on the types of land uses adjacent to the particular proposed alignment alternative, the amount of right-of-way potentially needed due to the construction type, and the land use sensitivity to potential impacts. Impacts include potential acquisition, displacement and relocation of existing uses, or demolition of properties.*[461]

The issue of "land use sensitivity" has already generated community resistance. For example, the city of Pleasanton has express concerns about HSR because of right-of-way constraints, incompatibility with single-family residential neighborhoods, the aesthetic effects of elevated structures, and noise and vibration.[462] Livermore and Fremont have similar concerns. In the debate over routing, the Sierra Club recently reiterated its support for the Altamont option, which includes these communities.

On the Caltrain Peninsula commuter line, HSR construction would mean building overpasses or underpasses to separate the existing tracks from the local roads.[463] Public officials have criticized the plan, with an Atherton councilman saying that it is difficult to see the benefits of high-speed rail to his town.[464] A Menlo Park official went so far as to declare high-speed rail a "disaster."[465] In August 2008, a lawsuit was filed to challenge the CHSRA's environmental reviews that failed to disclose the UPRR's objections to the use of its right-of-way—the consequences of which may be to relocate the HSR line in ways that divide existing communities—and understated the impacts of building a line through Pacheco Pass.[466] The CHSRA's responses included a comment by Board Member Rod Diridon that if the bond measure passes, the high-speed train system will override local objections.[467]

Southern California

Tustin was a hotbed of opposition to the first bullet train proposed in the 1980s[468] and skepticism toward HSR remains today. Beginning in 1999, the city of Tustin opposed designs by the CHSRA to convert the existing railroad line into a high-speed route.[469] In a 2004 letter, Tustin officials reminded the CHSRA:

> *Tustin remains concerned that the proposed [HSR] system will have significant and unavoidable adverse noise, vibration, safety, aesthetic and traffic impacts on adjacent properties. . . . The burden of these impacts on existing residential areas of our community outweighs any potential benefits to our community."*[470]

The letter noted that in studies the CHSRA applied "standard growth rates" to the local traffic analysis, but that adjacent roads serve new developments and the estimates were probably inaccurate. Indeed, Tustin's biggest growth is occurring on property immediately adjacent to the right-of-way that would be included in the HSR system. The former Tustin Marine Corps Air Station is being converted to a mixed-use development named Tustin Legacy, and construction is moving ahead on 4,600 homes located near the tracks.[471] The master development plan for the area calls for two new elementary schools and one new high school.[472] Also in progress on the former base is a 1.1 million square-foot center featuring retail, entertainment and resort hotel properties, which is named The District at Tustin Legacy.

The CHSRA is aware of the skepticism, acknowledging that "The City of Orange raised concerns regarding potential property, community, and land use impacts adjacent to rail corridor and the City of Tustin submitted comments opposing [high-speed rail] service through Tustin (between Anaheim and Irvine)."[473] The Authority said that more detailed environmental analysis and engineering would be required to determine whether Orange County cities would support service south of Anaheim. (For a review of a failed 1980s proposal to build a Los Angeles–San Diego high-speed line, see Part 3, United States Experience.)

Central Valley Agricultural Lands

The Authority admits that "farmland severance," the division of one farmland parcel into two or more areas by the placement of the rail line, are potential outcomes of HSR construction through the Central Valley.[474] The Authority preliminary identified these agricultural land locations on routes out of San Francisco that could be affected:[475]

- Along the route from the East Bay to the Central Valley via alternative routings that include Tracy, Lathrop and Manteca.
- The San Jose to Central Valley alternatives, which include significant areas where "the potential for severance impacts is greatest."
- Generally in the San Joaquin Valley, "the addition of an alignment alternative in or adjacent to existing rail or roadway corridors still could lead to limited severance of farmland as a result of greater restrictions on crossing of the corridor."

In areas on the route from Sacramento to Bakersfield, the system when not adjacent to existing rail corridors would require new alignments traversing farmland areas with the potential to sever the vast majority of parcels traversed due to the curving nature of the alignments.[476] The reluctance of the UPRR to sell rights-of-way to the Authority, as mentioned previously, could expand the number of severances beyond what was identified in earlier studies.

It is difficult for agricultural communities to evaluate potential impacts because HSR plans are not firm. The CHSRA states, "Parcel-specific information was not considered in this program-level analysis. Project-level farmland severance impacts would be addressed in subsequent project-level documents."[477] At that point, agricultural communities will be in a better position to evaluate the HSR systems' potential impacts.

Another factor not generally recognized in rural areas is the noise produced by high-speed trains. Segments from Stockton and Tracy and most of the line through Pacheco Pass are planned for operation at between 200 mph and 220 mph, with trains continuing at those speeds all the way to Bakersfield. Other sectors such as Sacramento-Stockton, Bakersfield–Sylmar and Riverside–Escondido are slated for trains to run at between 150 mph and 200 mph. Since speeds will vary for non-stop trains rolling through stations, it is difficult to estimate what level of noise would occur. However, when the mainline speeds approaching and leaving the station are high—more likely in rural areas—when a train passes through without stopping the noise level will be high. That is because Senate Bill 1856 requires infrastructure to be built so that non-stop trains "shall have the capability to transition intermediate stations, or to bypass those stations, at mainline operating speed."[478]

Conclusion

Public opposition that is beginning to emerge is likely to spread as site-specific urban, suburban and rural impacts become better understood. It is unlikely that the California high-speed rail program will find smooth sailing among impacted communities. This finding is based in part on nascent opposition to the project. Opposition to prior HSR projects has been based on underestimated costs, overestimated ridership, eminent domain and environmental impacts. Also, the credibility of HSR promoters waned as pledges of “no subsidy” or “only low subsidies” turned into requests for high subsidies. These factors also are weaknesses that this Due Diligence Report identifies in the CHSRA planning process. In prior cases opponents have shown great resourcefulness in conducting sustained campaigns to oppose HSR construction. Opposition could spread, particularly in communities where train speeds and noise would be considered excessive or where a history of staunch opposition exists, such as in Tustin or San Diego County.

Part 8

If the CHSRA Runs Out of Money

There is no serious indication of sufficient funding for much of the proposed system. Indeed, even by the most optimistic funding assumptions, there is an unfunded deficit even for Phase I. This could lead to cancellation of routes, truncated HSR service, or unpopular but more expedient re-routings. The alternative would be substantially larger and continuing taxpayer subsidies.

Public understanding is increasing that costs for the California high-speed rail project continue to escalate and gaps are widening between anticipated funding and costs. The CHSRA could be in a situation where it is unable to raise the necessary funds to cover construction even at current costs. Also, if funds are raised, they may be insufficient to cover cost escalation.

It is typical for projects such as these to cut back on routes and services in response to budgetary challenges. This has already begun, ass is evidenced by the abandonment of the Missing Phase in current project cost projections.

A state Senate committee report issued in June 2008 noted that purchasing power of the proposed HSR rail bond has eroded. The report said if the upcoming bond proposal on the 2008 ballot were to be adjusted for inflation, the $9 billion for HSR would need to be increased to $13.3 billion.[479]

However, there is another component of cost escalation that cannot be overlooked: the probability is that costs will increase greater than the Senate Committee's prediction by a wide margin. Such a conclusion can be reached based on an extensive worldwide study of cost overruns occurring after projects got underway:

> *Contractors, who are an interest group in its (sic) own right, are eager to have their proposals accepted during tendering. Contractual penalties for producing over-optimistic tenders are often low compared to the potential profits involved. Therefore, costs and risks, are also underestimated in tenders. The result is that real costs and real risks do not surface until construction is well under way."*[480]

Just how seriously costs can escalate was reflected earlier in this report. Calculations indicate that HSR capital costs already have grown from a 1999 figure of $30.3 billion to a 2005 figure of $40.5 billion to the most recent 2008 figure of $45.4 billion (all data adjusted to 2006$). Moreover, segments costing as much as $11 billion may not be included in the most recent ($45.4 billion) figure.[481]

Despite worldwide evidence regarding the financial risks of such a project, the CHSRA's documentation is silent on the topic. The state Senate committee report noted:

> *Neither the Authority's 2000 business plan nor any of the agency's subsequent documents discuss the risks that might be associated with the project. Among the possible risks that need to be considered are construction cost increases, ridership and revenue estimates, financial capacity (including third party financing), state general fund exposure, right-of-way costs, unforeseen technological complications, and regulatory barriers (both state and federal).*[482]

It will likely be impossible under current assumptions for the state to deliver the complete statutorily required system. The Authority itself admits it has no plan to fund segments other than in the first phase, stating that, "We believe that if additional state funds appear needed for the remaining segments, it is the prerogative of the Legislature to determine the amount, source and timing of such funds, similar to its action on Phase one."[483]

Of course, statutes can be repealed by simple legislative majorities and a gubernatorial signature, and funding increases can be withheld, so the requirement for completing the entire system could be more transitory and theoretical than binding and real. Hence, this chapter will respond to concerns about inadequate financing that have arisen in failed attempts to build HSR systems between Los Angeles and San Diego and in Florida and Texas.

For example, in the case of the AHSRC's plan for a Los Angeles–San Diego line, a common question was what would happen if the line were only "half built" before funds were depleted. In Texas, where three lines were proposed, the public wanted to know if cost overruns affected the project then which section would be pulled from the plans. In Florida, environmentalists wanted to know if under-capitalization would cause re-routings and more intrusion into sensitive wetlands areas. (See Part 3, United States Experience for details on the three projects.)

A. The Phased Construction Plan

Construction is to occur in three phases, the first of which is detailed in current CHSRA documentation:[484]

- **Phase I.** Phase I would operate from Anaheim, through Los Angeles and across Pacheco Pass to San Jose and San Francisco. This phase would not serve Sacramento, the northern San Joaquin Valley, Oakland–East Bay and Los Angeles–San Diego.

- **Phase II:** Phase II would add segments from Merced (or south of Merced) to Sacramento and from Los Angeles to San Diego through the San Gabriel Valley and the Inland Empire.
- **The Missing Phase:** The Oakland–East Bay to San Jose line would apparently be built after the completion of Phase II, if at all.

It is presumed that other HSR segments—the Implied Phase—would be built after the three phases above. Given the anticipated shortage of funding, there would appear to be no likelihood that this Phase would ever be built.

In the worst case, financial challenges could make completion of an operable Phase I San Francisco—Los Angeles line impossible, particularly based upon the present broad financial plan outline.[485] It seems likely that any circumstance in which a substantial portion of Phase I has been completed, but with funding insufficient to complete an operable San Francisco–Los Angeles line, would lead to a campaign to complete and operate the line with additional state taxpayer funding, regardless of the amount of subsidies that would be required. At such a time, HSR might be thought of as a project "too large to be allowed to fail."

Such a risk has been identified by a San Diego taxpayer advocate, causing him to present this hypothesis:

> *The strategy by rail proponents is what I call the "hole in the ground" ploy. First get the taxpayers to approve a paltry $10 billion bond, leaving open the ultimate cost and the remaining financing. Then, with the project started, proponents figure that the voters will reluctantly approve massive additional expenditures, on the shaky premise that "we can't stop now."*[486]

B. Skeletal System: Truncating San Francisco–Los Angeles

Should insufficient funding be available, the Phase I San Francisco-Los Angeles line could be scaled back to new HSR infrastructure limited to the section between Gilroy and Palmdale (a skeletal system). This would make it possible for high-speed trains to complete the downtown San Francisco to downtown Los Angeles route by operating at lower speeds over the existing-but-upgraded commuter rail and freight tracks between San Francisco and Gilroy and between Palmdale and Los Angeles (and perhaps to Anaheim). (See Part 4, Federal Safety Standards for concerns about HSR sharing tracks with freight trains and commuter trains.)

Given the difficult financing situation, and considering how HSR construction costs vary for different segments, such a skeletal system could well emerge. For example, it appears that approximately one-half of Phase I construction costs are attributable to the San Francisco–Gilroy and Anaheim–Los Angeles–Palmdale segments. Hence, it is possible that the Gilroy–Palmdale section of the line could be built for between \$15 billion and \$22 billion, depending on the extent of capital cost overruns.[487] It would be possible to fund such a truncated line from the currently hoped-for financing sources (state bond, matching federal funding and private investment). However, as indicated in Due Diligence Financial Projections (Part 9) obtaining this even this amount of funding is likely to be difficult.

Further, the Authority has indicated that the earliest segments to be built will be in the San Joaquin Valley. The first segment includes "development of a test track from Bakersfield to Merced, regardless of whether the Altamont or Pacheco Alignment is selected. Thus, the Central Valley is served between Bakersfield and Merced for either alternative."[488]

Consequently, events could develop in such a way that genuine HSR service would operate only between the peripheries of the Los Angeles and Bay Areas, namely Gilroy and Palmdale, meaning that California would have the form but not the substance of high-speed rail. The speeds on such a skeletal system would be faster than current rail services, but would fall far short of HSR standards and would provide little or no competition to airlines between the two major markets.

Because the existing Bay Area and Los Angeles rail lines are heavily utilized, the CHSRA would need to add track capacity, electrify the lines, and enhance grade-crossing protections. Even with such upgrading the HSR trains would need to mesh with the operating schedules and travel times of the commuter trains.

The skeletal system would be able to provide service between San Francisco and Los Angeles on a non-stop schedule of up to 5 hours and 30 minutes and between San Francisco and Anaheim with a stop in Los Angeles on a schedule of up to 6 hours and 15 minutes.[489]

Another factor relevant to the Palmdale–Los Angeles segment is that the Southern California Association of Governments (SCAG) envisages construction of a maglev train system.[490] Plans include maglev lines from the Los Angeles International Airport to the Palmdale airport.[491] Such a development could exacerbate financial challenges for the HSR line, resulting in truncating even the Phase I operation into Los Angeles. This could result in Palmdale being the southern terminus for the HSR system with passengers transferring between it and the maglev system.

C. Potential Line Cancellations

If the funding for Phase I appears to be speculative, funding the $14.7 billion currently estimated cost for Phase II is even more problematic. There has been some suggestion that Phase II might be built with profits from Phase I.[492] However, it is likely that no such profits will materialize. (See Part 10, Due Diligence Projections.) Hence, Phase II construction appears unlikely unless it is virtually fully funded from tax subsidies. Phase II consists of these segments:

- **Sacramento–Merced.** This segment would meet the San Francisco–Los Angeles Phase I line at Merced and would make service possible between Sacramento and San Francisco, San Jose, Central Valley points, Los Angeles and San Diego.
- **Los Angeles–San Diego.** This segment would link San Diego with the rest of the system. Completion here could also be jeopardized for another reason—plans by SCAG to build a maglev train system between Los Angeles International Airport and the Ontario Airport. HSR documentation indicates that if this maglev line and a proposed San Diego maglev line is built, the Los Angeles–San Diego high speed rail line could be cancelled.[493] (See Part 8, for the Case Study: Shifting the Los Angeles–San Diego Route, which is immediately below this section.)

Another potential consequence of a funding shortfall is that the CHSRA may abandon plans to serve the state's third and fourth largest metropolitan areas, San Diego and Sacramento, respectively.

Current plans by the Authority would abandon the Oakland-East Bay-San Jose route. If the latter route were not built, it would make it particularly difficult for HSR to be time-competitive with flights from Oakland to the Los Angeles area. Currently, the Oakland International Airport handles more Los Angeles-area flights than any other San Francisco Bay Area airport.

D. Case Study: Shifting the Los Angeles–San Diego Route

This section will examine the Los Angeles–San Diego route as a "case study" in what can go wrong should funding be insufficient to complete the system. Essentially two route options exist to link the two urban areas: the Inland Empire route officially proposed by the CHSRA and the Coastal Route over which existing passenger trains operate.

The CHSRA's preferred Los Angeles–San Diego high-speed route is via the Inland Empire with stops at East San Gabriel Valley (City of Industry), Ontario Airport, Riverside (UC Riverside), Temecula Valley (Murrieta), Escondido, University City and Downtown San Diego. In 2005, the cost to complete this 160-mile section was estimated to be $8.1 billion.[494]

It is conceivable that plans to build the Inland Empire line will be shelved for any of a number of reasons:

- The Authority could exhaust its capital budget while state taxpayers oppose grants from the general fund, additional bonds, or efforts to pass new funding authority through sales taxes or other mechanisms.
- The Inland Empire route presents many challenges, as noted by the Authority: "The San Diego to Los Angeles corridor is a heavily developed area that has many environmental issues that constitute concerns for the high-speed rail system."[495] Hence, cost escalations here could be greater than on rural portions in the San Joaquin Valley.
- The CHSRA had intended to build tracks along the I-15 right-of-way. In September 2008 it was revealed that planners "are going back to the drawing board to map out a new route for 20 miles of high-speed railroad tracks in North [San Diego] County." That is because I-15 express lane construction between Escondido and Miramar will leave insufficient room for the HSR line.[496]
- In many cases, the CHSRA documentation indicates a preference for utilizing existing alignments owned by the UPRR where the HSR system "would be either in or immediately adjacent to the freight railroad right-of-way."[497] However, such rights-of-way will be exceedingly difficult or impossible to assemble because the UPRR stated it will not sell such property for use by the HSR system. The railroad company wants to retain its ability to meet growing demand for rail cargo transportation.[498]
- In August 2008, a bill passed the legislature that would increase the "maximum nonstop service travel time" on the San Diego–Los Angeles route from 1 hour to 1 hour, 20 minutes.[499] This means the time advantage of the Inland Empire route has become somewhat less significant as compared with the potential of an improved Coastal Route.
- The CHSRA notes uncertainty stemming from conflicting regional plans: "The Southern California Association of Governments (SCAG) is continuing its studies aimed at [maglev] service between Los Angeles, Ontario, and Riverside. . . . Similarly, the San Diego Association of Governments (SANDAG) will be studying the potential use of Maglev technology between San Diego and Riverside. . . . Once the technology is defined in more detail, if the need remains for the California HST network to serve this area, then the Authority should consider a staging strategy that addresses the defined system and service needs" (emphasis added).[500] Moreover, the FRA determined that "The similar and extensive level of investment necessary to implement either the [HSR] system or maglev network makes construction of both unlikely in common corridors serving the same travel markets."[501]

Even if it is assumed that the maglev lines are not built, it is conceivable that the Inland Empire line will not be constructed due to lack of funding. However, the Authority may view service to San Diego as part of its continuing mission. Also, public officials in Orange and San Diego counties who experience tax dollars flowing from their areas to build HSR elsewhere may demand some type of HSR service.

It is at this point that the CHSRA may revive plans to operate high-speed trains over an in-place rail alternative—the Coastal Route. This is the line that was proposed by the AHSRC in the 1980s via Fullerton, Anaheim, Tustin, San Juan Capistrano, San Clemente, Oceanside, Encinitas and Del Mar.[502] The CHSRA has studied and has much data regarding the Coastal Route.

The CHSRA has recognized that a dedicated Los Angeles–San Diego system using the Coastal Route with completely separate tracks would present challenges because of severe constraints, construction issues, high costs and previous opposition. The Authority also is aware of the considerable environmental impacts inherent along the Coastal Route: "Although the corridor provides the most direct rail route between Los Angeles and San Diego, it passes through some of the state's most populated regions and environmentally sensitive areas (wetlands, coastal lagoons, fragile coastal bluffs, and coastal communities)."

The Authority has acknowledged that Caltrans has the responsibility for conventional (not high speed) rail improvements for the Irvine–San Diego segment.[503] However, the CHSRA could re-open the door to high-speed trains on the Coastal Route inasmuch as it already has an inventory of environmental conditions along the line.

While the CHSRA would probably not recommend speeds up to 220 mph as it does for the San Joaquin Valley, it may well decide to operate in the 100-to-150 mph range (already proposed for segments between Los Angeles and Irvine). The required improvements are likely to be less expensive than building the all-new Inland Empire line with planned speeds of between 150 mph and 200 mph. Moreover, operating electrically powered HSR trains on the Coastal Route would permit passengers on the segment to proceed to other HSR system points without the need to change trains in Los Angeles. This is in line with the viewpoint that HSR trains can share tracks with existing services, yet branch off on high-speed segments.[504]

Upgrading and adding tracks will be necessary to expand capacity to handle HSR trains in addition to the Metrolink, Coaster, Amtrak, and freight trains already operating on the Coastal Route. Also, the following environmental conditions will provide challenges, as noted in the CHSRA documentation:[505]

- The coastal bluffs are narrow in some areas and susceptible to failure, in particular the Del Mar Bluffs. Noise and vibration from steel-wheel-on-steel-rail traffic could result in harm to the fragile bluffs above the beach.

- The existing right-of-way divides Encinitas. Additional service in the corridor could restrict access and enjoyment of the beach area for visitors and residents.

- To prevent dangerous pedestrian crossings of the tracks, the railroad rights-of-way would need to be fenced. This would restrict or block beach access and concentrate the crossing of pedestrian and vehicle traffic at fewer locations.

- Noise and vibration from trains would be disruptive to ecologically sensitive coastal areas and lagoons (e.g., San Elijo Lagoon). The saltwater marshes and lagoons are a winter habitat to residential avian species protected under state and federal laws.

- The trains would be electrified, and the structures and overhead catenaries could block ocean and community views, creating a negative aesthetic impact on tourism-related businesses and potentially reducing property values adjacent to the corridor.

The CHSRA documentation noted: "The high level of existing passenger rail, extensive existing rail infrastructure, and mixed rail traffic operations on this corridor, along with the limited existing right-of-way and sensitive coastal resources, make a dedicated electrified [HSR] service infeasible for this corridor *at this time* (emphasis added). Incremental improvement phasing, however, would be feasible. For this option, improvements would be made to the existing [coastal service]. These improvements could be applied with or without the implementation of an inland (I-15) corridor."[506]

Shifting from the Inland Empire route to the Coastal Route would entail political risks. Yet that precise change has happened before. In the 1980s, the AHSRC's original Los Angeles–San Diego plan called for using the Interstate Highway right-of-way to construct new grade-separated tracks for use by Japanese bullet trains. Nonstop travel time from Los Angeles to San Diego was estimated at 59 minutes. However, the AHSRC changed direction and began the planning necessary to build new track along the existing railroad rights-of-way on the Coastal Route.[507] Admittedly, that shift away from the I-5 corridor and toward the coast contributed to public opposition and the demise of the AHSRC as a corporation.[508]

Environmental organizations might assume that such a change could not happen because of the difficult approval process. Yet Sacramento eased up on regulations to help the AHSRC's Los Angeles–San Diego proposal. In 1982, state legislation passed that exempted the bullet train from having to be approved by the California Coastal Commission and with having to comply with the California Environmental Quality Act.[509] A question arises whether such a measure could be considered again.

The CHSRA may find itself in the position of evaluating which route opposition is more severe—the Coastal Route or the San Gabriel Valley–Inland Empire route. Residents along the latter may find the Authority's plan to operate trains in 100 and 200 mph range to be intolerable and may also generate concerns about noise, reduction in property values and eminent domain. Should a shift occur to the Coastal Route, the Authority could face public opposition similar to what the AHSRC experienced.

It is difficult to foresee at this time the level of public opposition on either route. However, cost factors may favor the Coastal Route because its 128-mile alignment is shorter than the 160-mile

Inland Empire route, a virtue that even looks more favorable if the Phase I work is competed on the 31-mile segment on the coastal line between Los Angeles and Anaheim.

Current funding proposals require taxpayers statewide to subsidize HSR even though much of the state would receive no service even upon completion of the entire system. Should the CHSRA exhaust its funds, more of the state may go without high-speed rail service than is immediately apparent.

Conclusion

There is no serious indication of sufficient funding for much of the proposed system. Indeed, even by the most optimistic funding assumptions, there is an unfunded deficit even for Phase I. This could lead to cancellation of routes, truncated HSR service, or unpopular but more expedient re-routings. The alternative would be substantially larger and continuing taxpayer subsidies.

The CHSRA fails to adequately address risks in its business plan, nor does it have a financial plan to insure completion of each phase and the alternative routes. Therefore options that may appear to be extreme, such as San Francisco–Los Angeles becoming a skeletal line, canceling routes outright, or even unpopular but more expedient re-routings are not without possibility. A high risk exists that the riders, taxpayers and investors will not see a final system that resembles what has been promised and that genuine HSR service will be severely limited.

Part 9

Due Diligence Financial Projections

The Phase I HSR system would be far short of its necessary funding even if the state bonds of $9 billion are provided and federal funding is obtained. If sufficient funding is found, Phase I is likely to incur financial losses and may not be completed in recognizable form. This could lead to negative financial consequences, such as substantial additional taxpayer subsidies, private capital investment losses, and bond defaults. In this environment, it seems highly unlikely that Phase II and the Missing Phase will be built. Indeed, completion of Phase I could be problematic.

As has been noted above, CHSRA has provided only the most sketchy financial projections in its extensive planning process. CHSRA planning documents do not appear to have "profit and loss" or "income" statement estimates that include revenues, expenses, debt service and profits or losses as would be expected in any complete and serious business proposition. Even the CHSRA Lehman Brothers report[510] (noted in Part 4, Analysis of California High-Speed Rail Plan, Forecasting Costs) provides only the broadest outline of potential funding sources and that only for Phase I. This Due Diligence Report contains financial projections for the HSR project based upon what appears to be the best current information.

The Financial Projections

The financial projections below are based on assumptions from the CHSRA planning process and the analysis in this report. These projections should be considered highly tentative, since the underlying information from CHSRA has been sketchy and inconsistent. Nonetheless, the projections are sufficient to conclude that there is a serious likelihood that the financing to build the HSR may simply be unobtainable, even for Phase I.

This analysis develops four scenarios, which are summarized in Table 21. The scenarios assume the following tentative funding for HSR: [511]

- The proposed state bond of $9 billion, which will be approved or rejected by the voters of California in November 2008.
- Private funding amounting to $7.5 billion. This is the high-range of the Lehman Brothers estimate. It is assumed that 20 percent of the private investment would be equity ($1.5 billion) and the other 80 percent would be bonded indebtedness, placed in the private

market. The risk associated with the resulting $6 billion in privately placed debt could make bond insurance[512] or even a full faith and credit guarantee of the state of California necessary.

- Combined, this financing totals $16.5 billion.

In addition, two of the four funding scenarios assume the availability of $9 billion in federal subsidies to match the California general obligation bonds. This is despite the fact that CHSRA advisor Lehman Brothers has characterized a similar amount as "unlikely" and that there is no material federal capital program (see Part 4, Financial Uncertainty).

Various additional funding sources have been suggested by the CHSRA, such as additional taxes and local government grants. However each of these is speculative at this point.

Table 21: Financial Projection Scenarios

	Financial Projection Scenario I: Optimistic	Financial Projection Scenario 2: Optimistic–Middle	Financial Projection Scenario 3: Pessimistic—Middle	Financial Projection Scenario 4 Pessimistic
Ridership Assumption	CHSRA Base	CHSRA Base	Due Diligence Base	Due Diligence Base
California General Obligation Bond ($9 Billion)	Yes	Yes	Yes	Yes
Federal Subsidy ($9 Billion)	Yes	Yes	No	No
Private Equity ($1.5 Billion)	Yes	Yes	Yes	Yes
Private Debt ($6 Billion)	Yes	Yes	Yes	Yes
Capital Costs	CHSRA	Due Diligence Low	Due Diligence Low	Due Diligence High
Operating Cost	CHSRA	Due Diligence Low	Due Diligence Low	Due Diligence High

Summary of Tentative Phase I Financial Results

Generally, Phase I results in annual financial losses (Table 21a, Figure 23 and Figure 24):

Phase I Financial Projection Scenario 1 (Optimistic). This is the most optimistic scenario. It assumes CHSRA ridership projections, assumes there will be no further cost escalation and the highest possible funding levels as currently understood (above). In 2030, there would be a small profit of $0.09 billion (with the assumption of the subsidies from the state bonds and the federal government, which CHSRA would not be required to pay back).[513] It is not known how this profit would be distributed between the private equity investors and the CHSRA. However, the 6% rate of return would be less than one-half the 13% threshold[514] necessary to attract private investors.[515]

This scenario falls $7.6 billion short of the capital cost figure that would be required to build the system. Funding in excess of the anticipated state, federal and private sources would be required. However, if the state, federal and private funding anticipated under this scenario is obtained, it is possible that the “skeletal” system could be funded (between Gilroy and Palmdale, with entry to Los Angeles and San Francisco on upgraded commuter rail and freight rights of way, see “If the CHSRA Runs Out of Money”).

Phase I Financial Projection Scenario 2 (Optimistic: Middle). This scenario assumes CHSRA ridership projections, assumes the low Due Diligence capital (20 percent) and operating cost (30 percent) overrun projections and the highest possible funding levels as currently understood (above).[516] In 2030 there would be a loss of $0.79 billion (with the assumption of the subsidies from the state bonds and the federal government, which CHSRA would not be required to pay back). In this scenario, it is likely that there would be a default on commercial bonds, unless they are guaranteed by the state government or privately insured. Equity investors would face losses.

This scenario, however, falls $14.2 billion short of the capital cost figure that would be required to build Phase I. Funding in excess of the anticipated state, federal and private sources would be required.

Summary of Phase I Optimistic Financial Projection Scenarios. The mid-point between the two optimistic financial projection scenarios would be a 2030 annual loss of $0.35 billion. The mid-point of the capital shortfall would be $10.9 billion. This could represent an insurmountable challenge.

Phase I Financial Projection Scenario 3 (Pessimistic: Middle). This scenario assumes Due Diligence ridership projections, assumes the low Due Diligence capital (20 percent) and operating cost (30 percent) overrun projections and includes the funding sources outlined above with the exception of federal funding.[517] In 2030 there would be an annual loss of $3.02 billion (with the assumption of the subsidies from the state bonds, which CHSRA would not be required to pay back). In this scenario, it is likely that there would be a default on commercial bonds, unless they are guaranteed by the state government or privately insured. Equity investors would face losses.

This scenario, however, falls $23.2 billion short of the capital cost figure that would be required to build the system. Funding in excess of the anticipated state, federal and private sources would be required. As is described below, this could represent an insurmountable challenge.

Phase I Financial Projection Scenario 4 (Pessimistic). This scenario assumes Due Diligence ridership projections, assumes the high Due Diligence capital (50 percent) and operating cost overrun (60 percent) projections and includes the funding sources outlined above except for federal funding. (See Part 4, Forecasting Costs.) In 2030 there would be loss of $4.17 billion (with the assumption of the subsidies from the state bonds, which CHSRA would not be required to pay back). In this scenario, it is likely that there would be a default on commercial bonds, unless they are guaranteed by state government or privately insured. Equity investors would face losses.

This scenario, however, falls $33.1 billion short of the capital cost figure that would be required to build the system. Funding in excess of the anticipated state, federal and private sources would be required.

Summary of Phase I Pessimistic Financial Projection Scenarios: The mid-point between the two pessimistic financial projection scenarios would be a 2030 annual loss of $3.59 billion. The mid-point of the capital shortfall would be $28.2 billion. Obtaining this additional capital could represent an insurmountable challenge.

Figure 23: HSR Phase 1 Financial Results: 2030

High, Low, and Midpoint Projections by Case

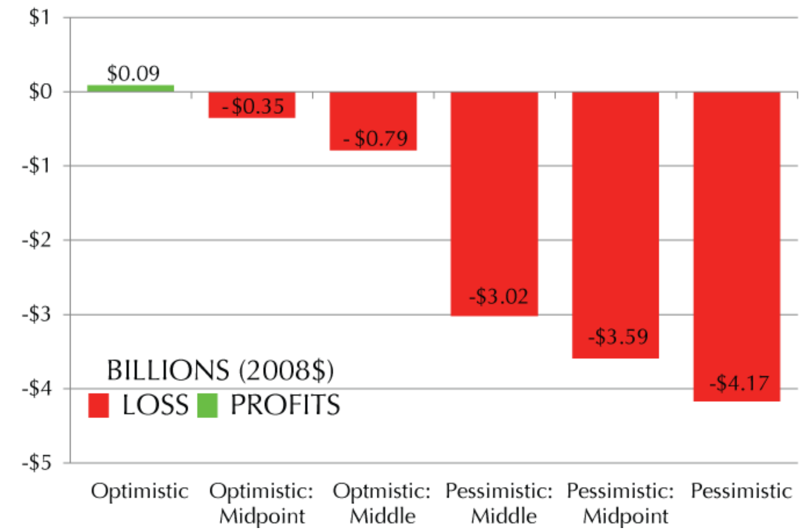


Figure 24: HSR Phase 1 Capital Shortfall

By Financial Projection Scenario

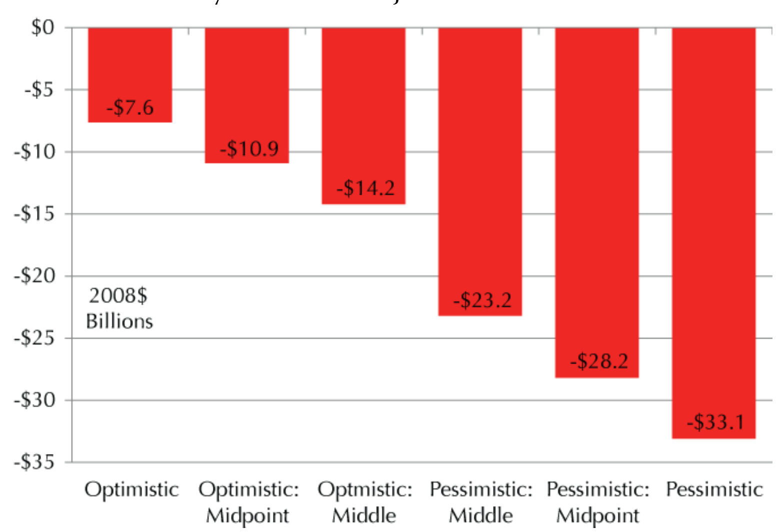


Table 21a: Phase I Financial Projections: 2030 (Annual)				
	Financial Projection Scenario I: Optimistic	Financial Projection Scenario 2: Optimistic–Middle	Financial Projection Scenario 3: Pessimistic–Middle	Financial Projection Scenario 4: Pessimistic
OPERATING STATEMENT				
Operating Revenue	$2.31	$2.31	$0.83	$0.83
Operating Cost	$1.10	$1.43	$1.43	$1.76
Net Before Debt Service	$1.21	$0.88	($0.60)	($0.93)
Debt Service (Including Capital Shortage, Below)	$1.12	$1.67	$2.41	$3.23
Profit (Loss)	$0.09	($0.79)	($3.02)	($4.17)
Midpoint	($0.35)		($3.59)	
ASSUMPTIONS				
Total Capital Cost	$33.1	$39.7	$39.7	$49.6
State Bond	$9.0	$9.0	$9.0	$9.0
Federal Grant	$9.0	$9.0	$0.0	$0.0
Private Equity	$1.5	$1.5	$1.5	$1.5
Private Debt	$6.0	$6.0	$6.0	$6.0
Capital Shortage (Additional Debt or Subsidies Required)	$7.6	$14.2	$23.2	$33.1
Midpoint	$10.9		$28.2	
In billions of 2008$ Note: Scenario 1 and 2 operating revenue from RFEI documents, Appendix C. All CHSRA debt included but California state general obligation bonds of $9,000,000,000 excluded.				

Capital Projections for the Complete Project

With the uncertainty about arranging funding for the Phase I project, it would be premature to provide a pro-forma income statement of revenues, expenditures and profits or losses for the complete project (including Phase I, Phase II and the Missing Phase, which is Oakland–East Bay–San Jose). However, general capital cost projections are offered for the same four financial scenarios as above. Separate estimates are provided for combined Phases I and II and for Phases I, II and the Missing Phase (Table 22 and Figure 25).

System Financial Projection Scenario 1 (Optimistic). This scenario assumes that there would be no further cost escalation. As regards capital costs, this scenario is based upon current CHSRA cost projections. It also assumes the highest possible funding levels as currently understood (above) would be obtained. Total capital costs would be $49.0 billion for Phases I and II and $54.3 billion including the Missing Phase. The capital shortfall would be from $23.5 billion to $28.8 billion.

System Financial Projection Scenario 2 (Optimistic: Middle). This scenario assumes the Due Diligence low capital cost escalation projection (20 percent) and the highest possible funding levels as currently understood (above) would be obtained. Total capital costs would be $58.8 billion for Phases I and II and $65.2 billion including the Missing Phase. The capital shortfall would be from $33.3 billion to $39.7 billion.

Table 22: Complete Project Capital Costs: Phases I, II and Missing Phase

	Financial Projection Scenario I: Optimistic (Based on CHSRA Present Cost Projections)	Financial Projection Scenario 2: Optimistic–Middle	Financial Projection Scenario 3: Pessimistic–Middle	Financial Projection Scenario 4: Pessimistic
Phase I and Phase II				
Capital Costs	$49.0	$58.8	$58.8	$73.5
State Bond	$9.0	$9.0	$9.0	$9.0
Federal Grant	$9.0	$9.0	$0.0	$0.0
Private Equity	$1.5	$1.5	$1.5	$1.5
Private Debt	$6.0	$6.0	$6.0	$6.0
Current Capital Shortfall	$23.5	$33.3	$42.3	$57.0
Midpoint Capital Shortfall	$28.4		$49.6	
Potential Government Capital Subsidy	$41.5	$51.3	$51.3	$66.0
Potential Government Capital Subsidy Share	85%	87%	87%	90%
With Missing Phase				
Capital Costs	$54.3	$65.2	$65.2	$81.4
State Bond	$9.0	$9.0	$9.0	$9.0
Federal Grant	$9.0	$9.0	$0.0	$0.0
Private Equity	$1.5	$1.5	$1.5	$1.5
Private Debt	$6.0	$6.0	$6.0	$6.0
Current Capital Shortfall	$28.8	$39.7	$48.7	$64.9
Midpoint Capital Shortfall	$34.2		$56.8	
Potential Government Capital Subsidy	$46.8	$57.7	$57.7	$73.9
Potential Government Capital Subsidy Share	86%	88%	88%	91%
Amounts in billions of 2008$ Note: Potential government (taxpayer) capital subsidy assumes all debt is government except for private debt and includes both state bonds and federal subsidies.				

Summary of Optimistic System Financial Projection Scenarios: The mid-point capital shortfall between the two optimistic system financial projection scenarios would be $28.4 billion for Phases I and II and $34.2 billion including the Missing Phase. It is likely that this funding would need to be raised from taxpayers, since the projected losses (above) would deter further private investment.

System Financial Projection Scenario 3 (Pessimistic: Middle) This scenario assumes the Due Diligence low cost escalation projection (20 percent) and assumes no federal funding. Total capital costs would be $58.8 billion for Phases I and II and $65.2 billion including the Missing Phase. The capital shortfall would be from $42.3 billion to $48.7 billion.

System Financial Projection Scenario 4 (Pessimistic). This scenario assumes the Due Diligence high cost escalation (50 percent) and assumes no federal funding. Total capital costs would be $73.5 billion for Phases I and II and $81.4 billion including the Missing Phase. The capital shortfall would be from $57.0 billion to $64.9 billion.

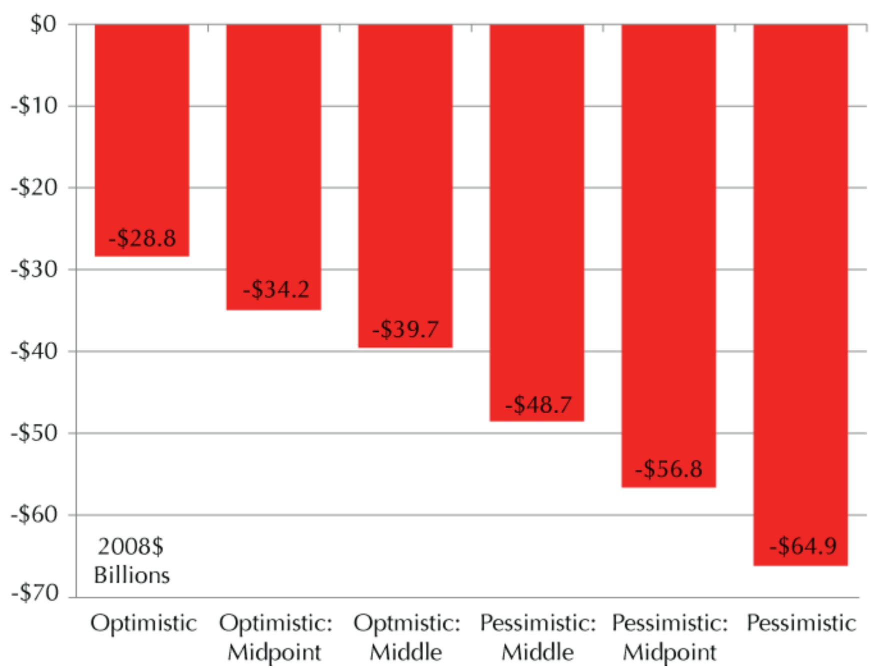
Summary of Pessimistic System Financial Projection Scenarios. The mid-point capital shortage between the two optimistic system financial projection scenarios would be a $49.6 billion for Phases I and II and $56.8 billion including the Missing Phase. It is likely that this funding would need to be raised from taxpayers, since the projected financial losses (above) would deter further private investment.

As conceived earlier in the decade, the system would have required government subsidies of approximately one-third of capital costs. As capital costs have escalated, the maximum government capital subsidies required may have increased to between 85 percent under the most optimistic CHSRA based projections to 91 percent under the most pessimistic Due Diligence Report projections.

Despite assertions to the contrary by the CHSRA, there would be no profits from Phase I to build the balance of the system (Phase II, the Missing Phase or the Implied Phase).

Figure 25: Overall Project Capital Shortfall

Phase 1 and 2 (Excludes Missing Phase)



The Bleak Funding Situation

As noted above, both the Phase I project and the complete project (including Phase I, Phase II and the Missing Phase) are far short of their financial requirements. The potential for private funding is limited and would become even more elusive as capital costs rise further and as financial losses become apparent. This leaves the taxpayers of California to pay for the large unfunded HSR capital deficit.

The state Legislative Analyst's Office determined the fiscal cost regarding the $9.95 billion HSR bond proposal:[518]

> *The costs of these bonds would depend on interest rates in effect at the time they are sold and the time period over which they are repaid. The state would make principal and interest payments from the state's General Fund over a period of about 30 years. If the bonds are sold at an average interest rate of 5 percent, the cost would be about $19.4 billion to pay off both principal ($9.95 billion) and interest ($9.5 billion). The average repayment for principal and interest would be about $647 million per year.*

The state treasurer, in noting that budget deficits will continue to hamstring California, indicated that:[519]

> *So, while we might get to the point where we have issued more debt than we can "afford," we will always pay our debt—on time every year. The ones who suffer will be the people of California, all of us who benefit from the myriad State programs—health, environmental, recreational, public safety and others— that our General Fund supports.*

The situation is so serious that the treasurer indicated it might be necessary to invoke strategies such as retiring some bonds with a new statewide property tax, taxes on the internet, higher state income taxes, sales tax on services, limiting the home mortgage deduction on state income tax returns, or eliminating state support for the University of California system.[520] A further sobering factor is the strong out-migration that has occurred from California in recent years. Between 2000 and 2007, net domestic migration was a minus 1.2 million—equivalent to the population of the city of San Diego.[521]

It seems unlikely that the HSR will be built in any form materially similar to what has been promised the people of California. Even Phase I appears to be far short of the necessary funding, regardless of whether the state provides the proposed $9 billion in bonds (Part 8, If the CHSRA Runs Out of Money). The complete system appears virtually impossible to complete, simply because the funding is so far short and the state subsidy levels that would be required seem unattainable.

Economic Impacts

Because HSR ridership is likely to be only a fraction of CHSRA projections, the long-term economic impact of the system (beyond the construction jobs) is expected to be slight, at best. This is consistent with the world infrastructure research, which finds that:

> *It is common for proponents of major infrastructure projects to claim that such projects will result in substantial regional and/or national development effects. Empirical evidence shows that these claims are not well founded.*[522]

Project Risks

The HSR program faces a number of risks, which are summarized and rated in Table 23. The risks rated "high" are (1) ridership and revenue would fall short of projections (Risks #1 and #2), capital and operating costs would be higher than projected (Risks #3 and #4) slower travel times than projected (#5) and insufficient grant funding (#6). Risks rated "medium" include community opposition (#7) and political meddling (#8). Unforeseen environmental and geologic risks are rated "low" (Risks #9 and #10). In its analysis of risks, CHSRA consultant Lehman Brothers echoed risk concerns with respect to ridership less than projected (Risk #1), revenue less than projected (Risk #2), higher capital costs than projected (Risk #3) and political meddling (Risk #8).[523]

All of these risks combine to indicate that the combined HSR system is unlikely to be completed in any form consistent with the current plan and that even the delivery of a recognizable Phase I could be most difficult.

Conclusion

The CHSRA has provided only the most sketchy financial projections that fall far short of what would be expected in any complete business proposition. This Due Diligence Report attempts to provide such financial projections based on more realistic and consistent assumptions and data.

The Phase I HSR system is likely to incur serious losses and may not be completed in recognizable form. This could lead to negative financial consequences, such as substantial additional taxpayer subsidies, private capital investment losses and bond defaults. In this environment, it seems highly unlikely that Phase II, the Missing Phase or the Implied Phase will be built.

All of the HSR phases would require significantly greater financing than the initial $16.5 billion proposed (funding from the state bond of $9 billion that could be approved by the voters and the private investment of $7.5 assumed). While CHSRA officials and consultants have repeated a litany of other potential funding sources, none is in place and each would represent serious challenges.

Table 23: Summary of Risks

#	Risk	Potential Consequences	Degree of Risk
1	Ridership Falls Short of Projection	Insufficient Revenue Higher Subsidies Investor Losses Bond Default	HIGH
2	Revenue Falls Short of Projection	Investor Losses Bond Default Higher Subsidies (federal, state, local).	HIGH
3	Construction Cost Overruns	System not Completed. Higher Capital Subsidies (federal, state, local) Discouragement of Private Capital Participation	HIGH
4	Operating Costs Above Projections	Less Favorable Financial Performance Higher Subsidies	HIGH
5	Slower Travel Times than Projected	Lower Ridership Higher Subsidies (See Risk #2)	HIGH
6	Insufficient Government Grant Funding	System not Completed (Especially Sacramento-San Joaquin Valley Los Angeles-San Diego Oakland-East Bay-San Jose) Higher State or Local Subsidies	HIGH
7	Community Opposition	Slower Operating Speeds (See Risk #2) Higher Capital Costs for Mitigation (See Risk #3) Delay (See Risk #8)	MEDIUM
8	Delays Occur from Various Other Risk Factors	Higher Costs, Especially for Interest Higher Capital Subsidies	HIGH
9	Higher Borrowing Costs	Higher Costs for Debt and as a Result Construction Higher Capital Subsidies	HIGH
10	Political "Meddling"	Additional Stations Additional Stops on Express Trains Route Changes Additional Capital Expense Additional Operating Expense Higher Subsidies Slower Travel Times Lower Ridership Levels Lower Revenue Levels (See Risks 1, 2, 3, 4, 5)	MEDIUM
11	Unforeseen Environmental Impacts	Higher Capital Costs Higher subsidies (See Risk #3)	MEDIUM
12	Unforeseen Geologic Impacts	Higher Capital Costs Higher subsidies (See Risk #3)	LOW

Summary of CHSRA and Due Diligence Projections

The CHSRA and Due Diligence Report projections are summarized in Table 24.

Table 24: Summary of CHSRA and Due Diligence Report Projections

	CHSRA	Due Diligence Report
Annual Ridership: 2030: Base, Intercity Only	65,500,000	23,400,000
Annual Ridership: 2030: Base, Intercity + Commuter	88,000,000	No Projection
Annual Ridership: 2030: High, Intercity Only	96,500,000	31,100,000
Annual Ridership: 2030: High, Intercity + Commuter	117,000,000	No Projection
Capital Cost: Entire System (2008$): Low*	$54,300,000,000	$65,200,000,000
Capital Cost: Entire System (2008$): High*		$81,400,000,000
Capital Cost: Phase I (2008$): Low	$33,100,000,000	$39,700,000,000
Capital Cost: Phase I (2008$): High		$49,600,000,000
Operating Cost: Phase I (2008$): Low	$1,100,000,000	$1,430,000,000
Operating Cost: Phase I (2008$): High		$1,760,000,000
Fastest Non-Stop Express Travel Time: LA-SF	02:38	03:41
Greenhouse Gas Reduction (Tons of CO_2): 2030**	1,770,000	630,000
Share of California 2020 Goal	1.0%	0.4%
Cost per CO_2 Ton Reduced: Low	$1,949	$7,409
Cost per CO_2 Ton Reduced: High	$2,409	$10,032
Times CO_2 IPCC $50-per-Ton Ceiling: Low	39	148
Times CO_2 IPCC $50-per-Ton Ceiling: High	48	201
Net Profit: 2030: Phase I: Optimistic Midpoint	No Projection	($350,000,0000
Net Profit: 2030: Phase I: Pessimistic Midpoint	No Projection	($3,590,000,000)
Unmet Capital Need: Phase I	No Projection	$7,600,000,000 to $33,100,000,000
Unmet Capital Need: Entire System	No Projection	$28,800,000,000 to $64,900,000,000

Note:
*Entire system cost. Includes Missing Phase. Does not include Implied Phase
**CHSRA greenhouse gas reduction adjusted to account for improved automobile and airline fuel efficiency.

If the Implied Phase is included, at least another $7.5 billion would be required to fund HSR segments in the Altamont Pass, the Dumbarton Bridge and between Anaheim and Irvine. This would make the gross project cost a minimum of $61.8 billion and an estimated maximum of $92.7 billion. The capital funding shortfall would be from $7.5 billion to more than $11 billion larger than indicated in Table 22.

Conclusion

The Phase I HSR system would be far short of its necessary funding even if the state bonds of $9 billion are provided and federal funding is obtained. If sufficient funding is found, Phase I is likely to incur financial losses and may not be completed in recognizable form. This could lead to negative financial consequences, such as substantial additional taxpayer subsidies, private capital investment losses, and bond defaults. In this environment, it seems highly unlikely that Phase II, the Missing Phase and the Implied Phase will be built. Indeed, completion of Phase I alone could be problematic.

Part 10

Due Diligence Conclusions

The Authority's Advocacy

Senate Transportation and Housing Committee Chairman Alan Lowenthal has expressed the necessity for the CHSRA to avoid advocacy, noting that "the business plan should be modeled on an investment prospectus and not an advocacy document" in his letter to CHSRA Chairman Quentin Kopp.[524]

Yet, the Authority has acted as an advocate rather than demonstrating objectivity in planning California's high-speed rail system. This can be illustrated by a visit to the Authority's Website "Featured Items" page, which on August 9, 2008 listed the following items:[525]

- Let's Make Tracks for High Speed Rail
- Let's Put the State on Fast Track to the Future
- Believe in the Bullet Train
- Creating Jobs and Boosting Our Economy
- Improving Transportation and Reducing Traffic
- Protecting the Environment

The titles of these publications convey more of a bias than objective analysis, and their content at times present unrealistic claims.

Advocacy goes beyond the CHSRA website. Rod Diridon, a CHSRA board member, in a January 2008 radio interview, declared that "117 to 120 million riders per year will use this system . . . . So that's pretty attractive, and these are conservative estimates." In fact, it is incorrect to refer to the 117 million figure as "conservative" when it is found in the CHSRA's unrealistic 2030 High Ridership Projection and the 120 million figure is an embellishment not justified even by the documentation.[526]

Advocacy also involves altering the meaning of words. The Authority's chairman stated in June 2008 that "the high-speed rail system will operate at a profit . . . without taxpayer subsidy."[527]

However, the state bonds, if approved would represent a taxpayer subsidy. Moreover, this report indicates that a profit is not likely.

Board member Rod Diridon also led a radio audience to believe that there are no costs to taxpayers beyond the initial bonds for the system. He stated, “once we approve the bonds for California, the general obligation bonds, no-tax-increase bonds in the November election in California, we won’t have to go back to the voters in California for more money.”[528]

This report finds the opposite—that it is highly likely additional funding will be required from California taxpayers because of the highly optimistic ridership and revenue projections and the fact that this highly risky HSR financial environment is likely to deter sufficient private investment. As a result, it is difficult to imagine a set of circumstances in which the taxpayers of the state will not be required to finance much more than the currently proposed $9 billion. Even the claim of “no tax increase” bonds is debatable, since the state treasurer has said fiscal demands on the General Fund are such that it might be necessary to retire some bonds with a new statewide property tax.[529]

At the same time, the CHSRA has been less vigilant about notifying the people of California about factors that fail to portray the HSR in the best light. For example, it has been noted that the CHSRA appears to have not notified the Senate Transportation and Housing Committee of material reductions in estimates of GHG emission impacts that can be characterized as only 1/30th as significant as was claimed in materials provided to the committee earlier in the year. The previous data had been in error, though the CHSRA referred to the dramatic reduction in terms of a “technical correction.”

The Authority has yet to balance issuance of its many advocacy documents with cautionary documents regarding risks. Skepticism of the CHSRA is justified considering its “demand exaggeration,” a planners’ trait that has been identified in other major transportation projects in world infrastructure research.

Consequences for California

The fundamental conclusion is that HSR in California as proposed is likely to fail to achieve virtually all of the projections that are crucial to its success. This report concludes that the Authority’s analysis of the proposed HSR system is insufficient, inconsistent and inaccurate. The CHSRA’s cost estimates have not been updated, ridership projections are inconsistent with both international experience and California market characteristics, risks are understated or ignored, and statements about future taxpayer subsidies are contradictory. Specific findings are condensed in the Executive Summary and in a separate document, the Policy Summary.

The proposed California HSR system has already experienced a series of cost estimate increases, and the need for capital subsidies is likely to escalate. Once in operation, the system as presently constituted is unlikely to provide the advertised quick journeys to passengers and meet its ridership and revenue projections.

The likelihood of higher capital costs and need for continued operating subsidies is likely to represent an expensive and continuing drain on the state's tax resources. Under three of the four scenarios outlined in this report, an early bond default, taxpayer bailout, and investment losses by private funding participants could occur.

During a fiscal shortfall, past and present proposals to finance HSR's construction and operation through bond issues and sales taxes—along with matching funds from the federal and local governments—could take on added urgency.

A high risk exists that the state will not see a final system that resembles what has been promised unless taxpayers are prepared to shoulder large new tax obligations in perpetuity. Senator Alan Lowenthal, Chairman of the Senate Housing and Transportation Committee posed the question: "What assurance can the authority provide that California taxpayers will not be stuck with a massive bill in the future?"[530] The answer is "none."

About the Authors

Wendell Cox is principal of Demographia, a St. Louis region-based public policy firm. He was appointed to three terms on the Los Angeles County Transportation Commission by Mayor Tom Bradley, where he introduced the amendment to Proposition A (1980) that established the local funding set-aside for the Los Angeles light rail and metro lines. He was also appointed to the Amtrak Reform Council by Speaker of the House Newt Gingrich to complete the unexpired term of New Jersey Governor Christine Todd Whitman. There, he was instrumental in forging the final financial self-sufficiency plan that was required by the U.S. Congress.

He has worked on numerous projects in the United States and internationally. Mr. Cox's professional endeavors on urban and intercity transport have been characterized by the objective of ensuring that riders and taxpayers receive fair value in return for their funding and that scarce public resources are directed to the most beneficial projects and programs.

He was author of the 1997 James Madison Institute evaluation report on the proposed Florida Overland Express high-speed rail system, and authored reports on subsequent Florida high-speed rail proposals. His analysis of the proposed Las Vegas Monorail contained accurate ridership projections, in contrast to the project-sponsored "investment grade" projections that were more than double the eventual ridership. Further, his prediction that the Las Vegas system would ultimately be unable to service its bonded indebtedness has now been repeated by Wall Street analysts. His 2000 commentary in the *Apple Daily*, Hong Kong's largest newspaper, argued for vigorous expansion of that urban area's rail system.

Demographia's "Public Purpose" website (www.publicpurpose.com) was designated twice by the *National Journal* as a "Top Transport Internet Site."

Joseph Vranich has been involved in rail passenger issues for more than thirty-five years. He has advocated building high-speed train systems through public-private partnerships and served as President/CEO of the High Speed Rail Association in the early 1990s, where he won the Distinguished Service Award. He has testified numerous times before the U.S. Congress on high-speed rail and Amtrak—including support for Amtrak's high-speed Acela program. Early in his career he served as an Amtrak public affairs spokesman.

He has spoken internationally at the invitation of Japan's Ministry of Transport, Japan's Railway Technical Research Institute, European railway suppliers, and addressed a visiting Chinese government delegation in comments that were published in *Vital Speeches*. Also, he has met with the U.S. Department of Transportation, the Office of Management and Budget, and the U.S. General Accountability Office on rail passenger issues and was a U.S. Senate appointee to the Amtrak Reform Council.

He is the author of *Supertrains* (St. Martin's Press, 1991), a significant public policy book advocating construction of HSR systems in the U.S. His second work, *Derailed: What Went Wrong and What to do About America's Passenger Trains* (St. Martin's, 1997), recommended creation of public-private partnerships and competitive franchising. His most recent book, *End of the Line: The Failure of Amtrak Reform and the Future of America's Passenger Trains* (AEI Press, 2004), outlined how Amtrak failed to comply with reform laws; it also detailed Amtrak's development of the Acela trains and examined railway reforms in 55 nations.

He has addressed rail issues on many TV and radio programs, including the CBS Evening News, CNN News, CSPAN and National Public Radio. His work has been featured in *The New York Times*, *Newsweek* and *Railway Gazette International* and his commentaries have appeared in *The Wall Street Journal*, *Washington Post*, *Chicago Tribune* and many other publications.

Definition of Terms

ACE	Altamont Commuter Express
Acela	Amtrak high-speed train
AHSRC	American High Speed Rail Corporation
AGV	*Automotrice Grande Vitesse* train
ATC	Air Traffic Control
Authority	California High Speed Rail Authority
BART	Bay Area Rapid Transit
BNSF	Burlington Northern Santa Fe Railway Company
Bullet Train	High-speed train in Japan
Caltrain	Commuter rail service linking Gilroy, San Jose and San Francisco
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CBD	Central Business District
CHSRA	California High Speed Rail Authority
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DERAIL	Demanding Ethics Responsibility Accountability in Legislation (Texas)
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DWP	Los Angeles Department of Water and Power
EMU	Electric Multiple Unit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
Eurostar	High-speed train operating London–Brussels/Paris
FAA	Federal Aviation Administration
FHSRC	Florida High Speed Rail Corporation
FOX	Florida Overland Express
FRA	Federal Railroad Administration
GAO	U.S. Government Accountability Office
GHG	Greenhouse Gas
Gigaton	One billion metric tons
HSR	High Speed Rail
I-#	Interstate highway number

IPCC	Intergovernmental Panel on Climate Change
ICE Train	Inter City Express, German train
Korail	Korean national railway
Kph	Kilometers per hour
LAX	Los Angeles International Airport
LOSSAN	Los Angeles to San Diego
Maglev	Magnetic levitation train
Metrolink	Commuter rail service in the greater Los Angeles region
Mph	Miles per hour
NCEIS	Northern California Environmental Impact Statement
NEC	Northeast Corridor (Boston–New York–Washington)
PPP	Public Private Partnerships
RFEI	Request for Expression of Interest
RFF	French rail infrastructure owner (*Réseau Ferré de France*)
RNP	Required Navigation Performance
ROW	Right-of-Way
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
Shinkansen	Bullet Train in Japan
SNCF	The French national railway
SR-#	State highway number
THSRA	Texas High-Speed Rail Authority
TGV	*Train à Grande Vitesse*
UCCPL	United Citizens Coastal Protective League
UPRR	Union Pacific Railroad Company
US-#	United States highway number

Endnotes

1 California High-Speed Rail Authority, “Request for Expressions of Interest for Private Participation in the Development of a High-Speed Train System in California,” March 6, 2008, p. 4.

2 Senate Bill No. 1169, Chapter 71, the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century, approved by Governor June 24, 2004. Filed with Secretary of State June 24, 2004, pp. 1–2.

3 AB 3034 would slightly reduce maximum non-stop operating times, with the exception of Los Angeles–San Diego, which would increase from 1 hour to 1 hour and 20 minutes, and the Sacramento–San Jose route, which would no longer have a maximum non-stop operating time specified in law.

4 California High-Speed Rail Authority, “Request for Expressions of Interest,” March 6, 2008, p. 4.

5 Request for Expression of Financial Interest documents, Appendix C. These cost figures are used throughout this report because they are the latest published and were provided to the investment community. Public officials are under a legal obligation to provide the investment community with the best possible information (indicative of this duty are securities fraud charges relating to municipal bonds that have been filed by the Securities and Exchange Commission against five former city of San Diego officials. See www.sec.gov/news/press/2008/2008-57.htm).

6 California High Speed Rail Authority, *Implementation Plan*, 2005, www.cahighspeedrail.ca.gov/images/chsr/20080123171537_ImplementationPlan.pdf.

7 “High-Speed Rail Executive Director Promotes Public-Private Partnerships in Discussion With Governor Schwarzenegger,” press release, California High-Speed Rail Authority, March 12, 2008, www.cahighspeedrail.ca.gov/news/Press-Release--P3-31208.pdf, p. 1.

8 “Oversight Hearings of the California High-Speed Rail Authority,” Committee Report, Senate Transportation and Housing Committee, June 2008, p. 1–2.

9 Alan Lowenthal, “To the Reader,” Oversight Hearings of the California High-Speed Rail Authority, Committee Report, Senate Transportation and Housing Committee, June 2008, link appears on this page

www.senate.ca.gov/ftp/SEN/COMMITTEE/STANDING/TRANSPORTATION/_home/REPORTS.HTP, no page number.

10 Senate Transportation and Housing Committee Chairman Alan Lowenthal noted that “the business plan should be modeled on an investment prospectus and not an advocacy document” in his letter to CHSRA Chairman Quentin Kopp (Senate High Speed Rail Report, p. 31).

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11 Ibid., p. 5.

12 "A Plain English Handbook: How to create clear SEC disclosure documents" (Washington, D.C.: U.S. Securities and Exchange Commission, 1998), www.sec.gov/pdf/handbook.pdf, p. 4.

13 Senate committee report, p. 2. The higher cost figures are in Request for Expression of Interest for Participation in the Development of a High-Speed Train System in California, Exhibit B, pp. 13-14 (CHSRA, March 6, 2008). The cited pages indicate an estimate date of February 2008, one month after the Senate Transportation and Housing Committee meeting (January 11, 2008) and four months before issuance of the Senate committee report.

14 Senate committee report, p. 26.

15 See quote from Quentin Kopp, a former legislator who serves as chairman of the California High Speed Rail Authority, in Michael Cabanatuan, "Union Pacific won't share with high-speed rail," *San Francisco Chronicle*, Friday, June 6, 2008, www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/06/05/BAL8113I9K.DTL. Also see Eric Bailey, "Proposed L.A.-to-S.F. bullet train hits a snag," *Los Angeles Times*, June 4, 2008, www.latimes.com/news/local/la-me-bullet5-2008jun05,0,7414713.story.

16 *Town of Atherton v. California High Speed Rail Authority*, Case No. 2008-80000022, Superior Court of California, Sacramento County, August 7, 2008.

17 When a rail employee is hurt on the job, he or she becomes the plaintiff in a potentially limitless lawsuit against a rail carrier, with each side having a strong financial incentive to blame the other for the injury. In 2004, the most recent year for which data are available, total FELA payouts by railroads totaled more than $750 million. See Edward R. Hamberger, Association of American Railroads, "Hearing on the Impact of Railroad Injury, Accident, and Discipline Policies on the Safety of America's Railroads," Testimony before the U.S. House of Representatives, Committee on Transportation and Infrastructure, October, 25, 2007, www.aar.org/PubCommon/Documents/Testimony/ERH_Final_AAR_Test_102507.pdf. Also, although dated, see comparative FELA costs versus state workers' compensation costs in Neal P. Curtin, *Comparison of Amtrak Employee Injury Settlement Costs Under the Federal Employers' Liability Act and State Workers' Compensation Programs*, (Washington, D.C.: U.S. General Accounting Office, June 22, 1988), Report No. T-RCED-88-49, archive.gao.gov/d39t12/136135.pdf. Disparities continue between FELA and state worker's compensation costs, with FELA costs running much higher than workers' compensation costs.

18 Amtrak Reform Council, *A Preliminary Assessment of Amtrak: The First Annual Report of the Amtrak Reform Council* (Washington, D.C.: Government Printing Office, January 24, 2000), govinfo.library.unt.edu/arc/materials/final14.pdf, p. 22.

19 Christopher Heredia, "Lawmakers want to give voters firm data on high-speed rail," *San Francisco Chronicle*, January 12, 2008, p. B3.

20 Patti Reising and Ed Cavagnaro, "Interview with Rod Diridon," *In Depth: High-Speed Rail*, KCBS, January 21, 2008, www.kcbs.com/topic/play_window.php?audioType=Episode&audioId=1317495.

21 Quentin L. Kopp, Authority chairman in January 31, 2008, letter to Alan Lowenthal, chairman, Senate Transportation and Housing Committee, appearing in "Oversight Hearings," pp. 32–33.

22 Quentin L. Kopp, "Let's put state on fast track to the future," op-ed, *The Sacramento Bee*, June 22, 2008, www.sacbee.com/110/story/1029467.html, p. E3.

23 *Implementation Plan*, p. 24.

[24] Bent Flyvbjerg, Nils Bruzelius and Werner Rottengatter, *Megaprojects and Risk: An Anatomy of Ambition*, (Cambridge, UK: Cambridge University Press, 2003) p. 20.

[25] In the interest of accuracy, it is acknowledged that general press and trade press reports for the train's speed vary. As of the publication deadline for this report, it is believed that the 217-mph figure is correct. Schedules (in Chinese) found at economy.enorth.com.cn/system/2008/07/30/003610838.shtml.

[26] Xin Dingding, "China sets sights on rail record," *China Daily*, September 1, 2008, www.chinadaily.com.cn/china/2008-09/01/content_6984688.htm.

[27] Maglev trains operate much faster than HSR using technologies that allow a wheelless train to glide above a "guideway" suspended by magnetic fields. Extension of the Shanghai route across the city has doubled in price and sparked some of the most highly publicized citizens protests in the history of modern China. The extension appears to have been postponed. See www.forbes.com/markets/feeds/afx/2008/01/04/afx4493945.html and

www.forbes.com/afxnewslimited/feeds/afx/2008/03/06/afx4743679.html. Principally because of cost increases, plans to build new maglev lines from Berlin to Hamburg and Munich to the Munich Airport have been abandoned. A maglev project remains in the early planning process for Los Angeles–Las Vegas and also within the Los Angeles and San Diego areas. The local plans could significantly impact HSR system plans, even resulting in the abandonment of some Los Angeles and San Diego HSR segments.

[28] The CHSRA interactive train website indicates a distance of 432 miles, while the March 27, 2008 RFEI Information Session indicates a 520-mile distance (Parsons Brinkerhoff, Quade and Douglas, *Overview of California High Speed Rail Project–Technical Information*, p. 17). The Los Angeles– San Francisco road distance is approximately 380 miles and the air distance (LAX to SFO) is approximately 340 miles.

[29] Calculated from State Department of Finance data.

[30] Calculated from California State Department of Finance and Census of Japan data.

[31] For urban area population densities, see www.demographia.com/db-worldua.pdf.

[32] Demographia, "Employment in International Central Business Districts," www.demographia.com/db-intlcbd.htm.

[33] Rapid transit is transit that is sufficiently separated from road traffic to permit speeds that are competitive with the automobile (this is in contrast to conventional bus service and many light rail lines). Examples of rapid transit in California are BART in the Bay Area, the Los Angeles Red Line, and long-haul commute buses on dedicated or semi-dedicated lanes, such as the El Monte Busway/High-Occupancy Vehicle lanes.

[34] This high transit market is not reflective of growth, rather decline. *Japan Statistical Yearbook* data indicates that *all* travel growth in the Tokyo, Osaka–Kobe–Kyoto and Nagoya areas has been automobile since 1990. See www.publicpurpose.com/ut-japan3met19902003.htm. Transit market share has also been in long-term decline in the U.S., and California, for many years.

[35] Demographia, "Tokyo-Yokohama: Transport Market Share," Urban Transport Fact Book, www.publicpurpose.com/ut-tokmkt.htm. See data for "Osaka–Kobe–Kyoto: Transport Market Share" at www.publicpurpose.com/ut-osamkt.htm.

[36] Demographia, “Urban Rail Ridership & Subsidies: Japan Urban Areas,” Urban Transport Fact Book, www.publicpurpose.com/ut-japanurbanrail.htm.

[37] Demographia, “Public Transport Market Share Trend: 1983-2003 Largest Urban Areas Estimated,” Urban Transport Fact Book,” www.publicpurpose.com/ut-pt20trend.pdf.

[38] Calculated from data at www.fhwa.dot.gov/policy/ohim/hs06/index.htm, www.stat.go.jp/english/data/nenkan/

[39] This includes the San Francisco, San Jose, Santa Cruz, Santa Rosa, Vallejo, Los Angeles, Riverside–San Bernardino, and Oxnard metropolitan areas (MSAs).

[40] European Union, *Energy and Transport in Figures: 2007.*

[41] Some of this ridership transferred to HSR, though it is unknown how much.

[42] SNCF 2007 Accounts (in French) at medias.sncf.com/resources/en_EN/medias/MD0305_20070803/template/RF/2007/Rapport_de_gestion_comptes_consolides_comptes_sociaux_EPIC2007.pdf

[43] Réseau Ferré de France is the company that owns and maintains the French national railway network.

[44] www.assemblee-nationale.fr/12/rap-info/i1725.asp.

[45] Assumes €1.00 equals $1.40 (approximate exchange rate at September 10, 2008).

[46] Rémy Prud’homme (Professor Emeritus, University of Paris XII), Les Péages Ferroviaires en France: Note préparée pour une audition de la commission présidée par M. Hervé Mariton, Assemblée Nationale (Memorandum prepared for a hearing of the commission chaired by Mr. Herve Mariton, National Assembly), April 14, 2008.

[47] “France train fares on track for increase; railway tolls in France could go up 80%,” *Web in France Magazine*, March 24, 2008, www.webinfrance.com/france-train-fares-on-track-for-increase-rail-tolls-france-could-go-up-80-percent-325.html.

[48] Such a report would allocate to high-speed rail its share of any RFF subsidy, debt and interest.

[49] At the September 10, 2008 exchange rate of 108 yen to the dollar.

[50] Such a report would allocate to high-speed rail its share of any subsidies, debt and interest.

[51] Examples of CHSRA promotional literature include the newsletter “High Speed Train News,” winter 2007 issue, that offers content on seven existing or proposed HSR systems around the world at www.cahighspeedrail.ca.gov/news/chsr-newsletter.pdf. Also “Seminar Offers Vital Information as State Moves Forward With Plan for High-Speed Train,” press release, California High-Speed Rail Authority, February 1, 2008, at www.cahighspeedrail.ca.gov/news/PressReleaseShinkasenBayArea.pdf. Even the CHSRA *Implementation Plan* contains promotional commentary on overseas systems at www.cahighspeedrail.ca.gov/images/chsr/20080123171537_ImplementationPlan.pdf, pp. 9–10.

[52] “Amtrak Overview,” *Congressional Digest* 80, no. 12 (December 2001), p. 291.

[53] William L. Garrison, David M, Levinson, *The Transportation Experience: Policy, Planning and Deployment* (New York: Oxford University Press USA, 2005) p. 122.

[54] *Overview Report: High Speed Ground Transportation for America* (Washington, D.C.: Federal Railroad Administration, United States Department of Transportation, August 1996).

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[55] William L. Garrison and David M Levinson, *The Transportation Experience: Policy, Planning and Deployment*, Oxford University Press, 2006, p. 122.

[56] Peter Adams, “High-Speed Train Could Roll by 1995, Supporters Assert,” *Orlando Sentinel*, May 28, 1986, 9A.

[57] Donald M. Itzkoff, “Florida’s Problems Hold Lessons for Other High Speed Planners,” *Railway Age*, February 1, 1991, p. 14.

[58] A summary of the five proposals can be found at Mary Ellen Klas, “Time to Shift from Neutral and Gear Up for High-Speed Rail,” *The Palm Beach Post*, February 27, 1996, p. 1A.

[59] Roger Roy, “Orlando Company Gets Million-Dollar Rail Deal - FOX Gets a Green Signal - And $70 Million Yearly in State Funds During the Next 25 years,” *Orlando Sentinel*, February 28, 1996, p. A1.

[60] “High-Speed Proposals Would Railroad Florida,” *The Palm Beach Post*, February 25, 1996, 2F.

[61] House of Representatives Staff Analysis, Bill HB 855 Florida High-Speed Rail Authority, March 24, 2003, www.flsenate.gov/data/session/2003/House/bills/analysis/pdf/h0855.tr.pdf, p. 1.

[62] Commentary regarding the 2-to-1 vote by the public in favor of terminating the Florida high-speed rail system can be found at “Face reality,” *Florida Times-Union*, January 4, 2005, B-6.

[63] Roy Bragg, Clay Robison, Bennett Roth, “Bullet train plans to be unveiled,” *Houston Chronicle*, September 26, 1989, p. 1.

[64] Bob Burns, “Rural movement against high-speed rail is growing,” *Austin American-Statesman*, November 29, 1991, p. A1, and Joe Fohn, “Bullet train vs. ag interests addressed, *San Antonio Express-News*, December 5, 1991, p. 7E.

[65] Bennett Roth, “Report says mag-lev rail future wave - Texas train plan not as high- tech,” *Houston Chronicle*, July 20, 1990, p. 1.

[66] Bob Burns, “Texas TGV has proposed a 590-mile, $5.7 billion dollar system and $6.7 depending upon the routes selected, Plans for high-speed train meet resistance,” *Austin American-Statesman*, January 17, 1991, p. B1.

[67] Chris Kelley, “Consultants say bidding for `bullet’ train too low Experts doubt project can be built without tax funds,” *Dallas Morning News*, March 22, 1991, p. 29A

[68] John Williams, “Bullet train fund plan in disarray - Stockholders fighting about a salvage plan,” *Houston Chronicle*, December 14, 1993, p. 23. See also Curtis Howell, “Bullet train firm says it can’t meet financing deadline Money won’t be raised by Dec. 31 deadline,” *The Dallas Morning News*, December 18, 1993, p. 27A.

[69] David Bennett, “Rail plan doomed, Krueger says at rally in Geronimo,” *San Antonio Express-News*, August 29, 1992, p. 1B.

[70] Linda Latham Welch, “County joins in railroad quarrel,” *Austin American-Statesman*, December 19, 1991, p. 1.

[71] Curtis Howell, “Texas TGV defaults on pact with state,” *The Dallas Morning News*, January 4, 1994, p. 12A.

[72] Sylvia Moreno, State board terminates bullet train franchise - Consortium to refund taxpayers' money it used, " *The Dallas Morning News*, August 20, 1994, p. 42A. Also, a summary of the cessation of planning for the Texas system can be found at Stuart Eskenazi, "Settlement on rail plan gets approved," *Austin American-Statesman*, August 20, 1994, p. B1.

[73] Sylvia Moreno.

[74] "Agency History," Texas High Speed Rail Authority: An Inventory of Records at the Texas State Archives, 1970-1995 (bulk 1990-1994), Texas State Library and Archives Commission, 'www.lib.utexas.edu/taro/tslac/20071/tsl-20071.html#a0..

[75] Jay Mathews, "San Diego 'Bullet Train' Put on Track With $1.25 Billion Sendoff," *The Washington Post*, September 4, 1982, p.A3.

[76] "Bullet train firm issues timetable," *The San Diego Union*, August 22, 1984, p. B–3.

[77] Christopher Lindsay, "Private Group Plans High-Speed Railroad," Associated Press as it appeared in *The Boston Globe*, April 1, 1982, p. unknown.

[78] Carole Shifrin, "Bullet Train' Is Planned On West Coast," *The Washington Post*, April 1, 1982, p. D11.

[79] Christopher Lindsay.

[80] Douglas B. Feaver, "Hush-Loving Californians Try to Pull Plug on Electric Bullet Train," *The Washington Post*, February 19, 1984, p. A3

[81] George Flynn, "Oceanside warns it may ask bullet train environment review," *The San Diego Union*, January 30, 1984, p. B-1.

[82] George Flynn, "Bullet train struggles to stay on track," *The San Diego Union*, February 5, 1984, p. B-1.

[83] The consultant was New Hampshire-based Carl R. Englund Jr., who had conducted studies on railroad passenger services for more than three decades. More detail about his findings are at George Flynn, "Bullet train forecast called far off target," *The San Diego Union*, February 4, 1984, p. B–1.

[84] George Flynn, "Bullet train forecasts mistaken," *The San Diego Union*, December 6, 1984, p. B-4.

[85] George Flynn, "Agency questions bullet trains They usually need subsidies, U.S. office says," *The San Diego Union*, January 13, 1984, A-1.

[86] Anne Krueger, "Official vows to block state aid for bullet rail," *Evening Tribune* (San Diego), February 11, 1984, p. A-5.

[87] Anne Krueger, "New bullet train figures released," *Evening Tribune* (San Diego), March 28, 1984, p. B-9.

[88] Virginia Spiller, "Revised bullet train revenue, ridership forecasts fail to sway local officials," *The San Diego Union*, April 8, 1984, B-3.

[89] Ed Jahn, "Bullet train runs up against the need for money Project hurdles political, ecological obstacles but faces $50 million climb," *The San Diego Union*, August 19, 1984, p. B-3.

[90] Before the AHSRC could begin operations, the California Public Utility Commission would have had to issue a Certificate of Public Convenience and Necessity; a sample of an

application is here: ftp://ftp.cpuc.ca.gov/puc/energy/environment/cpcnprocess.doc. Also the commission has authority over rail safety. See www.cpuc.ca.gov/PUC/hottopics/4railsafety/.

91 P.J. Garcia, "Gann, area figures join in media blitz against bullet train Tax crusader cites state-backed bond in affirming opposition to rail project," *The San Diego Union*, October 16, 1984, B-1. Also, Paul Gann joined Howard Jarvis in promoting Proposition 13 to reduce California's property taxes. On June 6th, 1978, nearly two-thirds of the state's voters passed Proposition 13. For more information, see Howard Jarvis Taxpayers Association at www.hjta.org/index.php.

92 Anne Krueger, "Bullet train's death gives life to other ideas," *Evening Tribune* (San Diego), November 14, 1984, p. A-1.

93 Dan Weikel, "Bullet train is canceled no funding, Failure to raise $50 million dooms high-speed rail plan," *The San Diego Union*, November 14, 1984, p. A-1.

94 G. C. Smith and E. Shirley, "High-Speed Rail in California: The Dream, the Process, and the Reality," *Transportation Research Record*, No. 1143, Environmental Issues: Noise, Rail Noise, and High-Speed Rail, 1987, out of print, from abstract at pubsindex.trb.org/document/view/default.asp?lbid=282890.

95 www.cahighspeedrail.ca.gov/images/chsr/20080319105301_RFEI.pdf (Investor Documents), Appendix C, March 6, 2008.

96 Calculated from US Bureau of the Census data.

97 www.demographia.com/db-cbd2000.pdf.

98 www.demographia.com/db-intlcbd.htm.

99 Downtown Los Angeles, while containing some of the nation's tallest buildings, ranks 49th out of the 50 U.S. urban areas in its share of employment. See www.demographia.com/db-cbd2000.pdf.

100 www.publicpurpose.com/ut-usa2005r.htm.

101 Amtrak, "Acela Express Gets Off To Strong Start," press release ATK-01-03, January 11, 2001.

102 Laurence Arnold, "Acela Express Off to Slow Start," Associated Press, August 21, 2002.

103 Penelope Overton, "Bullet Trains Missing Targets," *Hartford Courant*, August 21, 2001.

104 George Flynn, "Wrong system, wrong reasons," *The San Diego Union*, November 14, 1984, A-13.

105 "CalChamber Announces Positions on November Ballot Measures," California Chamber of Commerce press release, September 8, 2008, www.calchamber.com/News/Pages/CalChamberAnnouncesPositionsonNovBallotMeasures.aspx.

106 Jon Coupal, "This bond should be derailed," *Orange County Register*, August 5, 2008, www.ocregister.com/articles/billion-prop-california-2115464-state-money.

107 Accurate ridership projections are also important to ensure that projected reductions in traffic congestion or aviation volumes can be achieved. These issues are discussed in "Alternatives to Building the HSR System."

[108] Flyvbjerg is a professor at the University of Aarlborg in Denmark. Bruzelius is an associate professor at the University of Stockholm. Rothengatter is head of the Institute of Economic Policy and Research at the University of Karlsruhe in Germany and has served as president of the World Conference on Transport Research Society (WCTRS).

[109] Bent Flyvbjerg, Nils Bruzelius and Werner Rottengatter, *Megaprojects and Risk: An Anatomy of Ambition,* (Cambridge, UK: Cambridge University Press).

[110] Flyvbjerg et al., p. 14.

[111] Flyvbjerg et al., p. 31.

[112] "Eurostar to quit Waterloo in 2007," *Railway Gazette International,* December 1, 2004.

[113] Flyvbjerg et al., p. 22.

[114] 2007 ridership was 8.26 million.

[115] Based upon 2008 first quarter ridership as reported in *International Railway Journal,* May 2008.

[116] "Eurostar to quit Waterloo in 2007," *Railway Gazette International,* December 1, 2004.

[117] U.S. General Accounting Office, *How Much Federal Subsidy Will Amtrak Need?* GAO/RED-76-97 (Washington, D.C.: Government Printing Office, April 21, 1976), p. 5.

[118] "Annual Amtrak Ridership Sets All-Time Record; Fifth Straight Year of Increases," Amtrak press release, ATK-07-117, October 23, 2007, p. 1.

[119] Senate Transportation and Housing Committee, Final High Speed Rail Report, p. 24.

[120] It is typical for firms involved in the planning process for mega projects to continue their participation as the project continues through construction.

[121] Ridership projections vary significantly even within CHSRA documents. The intercity ridership projections are taken from NCEIS Tables 3.2-12 and 3.2-13, which are the only detailed ridership figures in the NCEIS (65.5 million for the 2030 Base Ridership Projection and 96.5 million for the CHSRA 2030 High Ridership Projection). Table 2.3-3 lists total trips under 2030 Base Ridership Projection at 88 million, including 25 million commuter trips and 117 million for the CHSRA 2030 High Ridership Projection, including 36 million commuter trips. This would leave 63 million trips (rather than the 65.5 million in Table 3.2-12) for the 2030 Base Ridership Projection and 81 million (rather than the 96.5 million in Table 3.2-13) for the CHSRA 2030 High Ridership Projection. Because the project is principally a high-speed rail system, and because the data in Tables 3.2-12 and 3.2-13 are the only comprehensive data, this report principally relies on these data. Because of these discrepancies, the commuter ridership is estimated by subtracting the intercity ridership from the total ridership.

[122] This base year of 1997 is used as a "platform" from which various factors are applied to project ridership in 2020.

[123] NCEIS, p. 3.2-25.

[124] This base year of 2005 is used as a "platform" from which various factors are applied to project ridership in 2030.

[125] Commuter trains would operate within rather than between the larger urban areas, such as the Los Angeles area, the San Francisco Bay area and the San Diego area.

[126] Charles River Associates, "Independent Ridership and Passenger Revenue Projections for High Speed Rail Alternatives in California," January 2000 p, 16.

[127] The Las Vegas Monorail represents an instructive case because of its reliance on an Investment Grade ridership projection. The monorail was developed as a private venture and supported by tax-exempt industrial development bonds issued by the state of Nevada. Project promoters produced an "investment grade" projection of 53,500 daily riders for 2004. In 2007, the average daily ridership was 21,600—60 percent below projection. One of the present authors, (Wendell Cox) had produced a report during the planning process projecting between 16,900 and 25,400 daily riders for 2004, the mid-point of which, at 21,200, was two percent below the actual 2007 ridership (www.publicpurpose.com/ut-lvmono-0006.pdf). The eventual results in Las Vegas may be unfortunate for investors. Moody's Investors Services has downgraded the bonds to "junk" status and has indicated that "At current ridership and revenue levels, a payment default is anticipated by 2010 once reserves are exhausted." (www.kvbc.com/Global/story.asp?S=7797066 and www.reuters.com/article/companyNews/idUSN2959008320080129). Finally, the bond insurer, AMBAC Financial Services, has run into financial difficulties and has had its credit rating dropped two levels (www.bloomberg.com/apps/news?pid=20601087&sid=asLtTQyLRQQs&refer=home). Holders of insured Las Vegas Monorail bonds could lose their investments, along with holders of uninsured bonds. This circumstance is an example of why reliable ridership and revenue estimates are vital to project success and to avoid taxpayer bailouts.

[128] Based upon the CHSRA assumed annual growth rate between 2005 to 2030.

[129] Based upon the CHSRA assumed annual growth rate between 2005 and 2030.

[130] Based on 2nd quarter 2005 U.S. DOT data.

[131] "Historical Monthly Vehicle Miles of Travel 1972–2006," traffic-counts.dot.ca.gov/monthly/VMTHIST1.pdf.

[132] Comparison of data in EIS/EIR Table 3.2-12 and NCEIS Table 3.2-11.

[133] Cambridge Systematics, Inc, *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study Ridership and Revenue Forecasts*, August 2007. Report for the CHSRA and the Metropolitan Transportation Commission.

[134] Federal Railroad Administration, "Analysis of the Benefits of High-Speed Rail on the Northeast Corridor" (Washington, D.C.: June 2008), www.oig.dot.gov/StreamFile?file=/data/pdfdocs/HSR_Final_7-1-08.pdf.

[135] Out-of-corridor examples might include Eureka to Fresno, Monterey to San Diego or Redding to Bakersfield.

[136] Sources: CHSRA EIR/EIS and NCEIS.

[137] Calculated from CHSRA trip tables (EIS/EIR Table 3.2-13 and NCEIS Table 3.2-12). In this comparison, the 2020 ridership projections are not adjusted to 2030.

[138] Daniel Leavitt, Erin Vaca, Peter Hall, "Revenue and Ridership Potential for a High-Speed Rail Service in the San Francisco/Sacramento-Los Angeles Corridor," Working Paper UCTC No 185, University of California Transportation Center, Berkeley, February, 1994, www.uctc.net/scripts/countdown.pl?185.pdf.

[139] Mid-point projection. Adjustments were as follows. The 2010 University of California Projection was increased to account for market growth in the corridor from using the 2005 to 2030 annual market growth assumed in the NCEIS. The projection was adjusted upward to account for route sections included in the current proposal, but not the FRA plan.

[140] www.fra.dot.gov/Downloads/RRDev/cfs0997all2.pdf.

[141] These adjustments were as follows. The 2020 FRA projection was increased to account for market growth in the corridor from using the 2005 to 2030 annual market growth assumed in the NCEIS. The projection was further increased to account for the higher maximum speed, using a ratio between the FRA high-speed rail alternative and the FRA "maglev" alternative. Finally, the FRA figure was adjusted upward to account for route sections included in the current proposal, but not the FRA plan, using the market ratios in the 2020 Investment Grade Projection (considered the most reliable projection produced by CHSRA and the only projection labeled "investment grade").

[142] Calculation: 700 divided by 1,000 = 70 percent.

[143] An average load of 994 passengers are assumed on trains that have a seating capacity of 1,175 (Average load factor calculated from NCEIS 4-20 and NCEIS Table 3,5-5). Other CHSRA documents project train capacities of 450-500, 650, 1,175, 1,200 and 1,600. Obviously the projected loads could not be accommodated in the smaller trains, which further erodes the credibility of CHRSA ridership projections (more fully discussed in Section IV, Analysis of California High-Speed Rail Plan, Federal Safety Standards).

[144] Sources: www.bts.gov/press_releases/2008/bts013_08/html/bts013_08.html, republicans.transportation.house.gov/Media/File/Testimony/Rail/4-19-07-Metzler.pdf. Estimated from Amtrak monthly performance reports, September 2007 and September 2005, Calculated from data in the RENFE 2004 annual report, and National Academy of Sciences.

[145] The commercial aviation industry pioneered yield management, also known as revenue management, to maximize revenue by selling as many as seats as possible on every flight. Experts working with software have developed models that use historical data regarding traffic flow and consumer behavior to anticipate the likelihood of future ticket sales. Next, fares in varying amounts are matched to available seats. The model has maximized revenue from what is a "perishable resource"—an airline seat. (Unsold seats are "perishable" because unless sold revenue from that seat on that trip is lost forever.) Yield management has succeeded in generating higher revenue yields for airlines. Some intercity railroads have contracted with airlines to modify software and practices for their particular needs.

[146] republicans.transportation.house.gov/Media/File/Testimony/Rail/4-19-07-Metzler.pdf,

[147] Estimated from Amtrak monthly performance reports, September 2007 and September 2005.

[148] Calculated from data in the RENFE 2004 annual report.

[149] Transportation Research Board, National Research Council, *In Pursuit of Speed: New Options for Intercity Passenger Transport*, Special Report 233, 1991, p. 154.

[150] www.bts.gov/press_releases/2008/bts013_08/html/bts013_08.html.

[151] The proposed and now operating Acela high-speed rail service operates more slowly than the European and Japanese systems.

[152] FRA, *Northeast Corridor Transportation Plan: New York City to Boston:* July 1994.

[153] Calculated from Amtrak Monthly Report data.

[154] The actual shortfall in ridership relative to projections may have been more. Overall projections for the entire corridor were not found.

[155] Estimated from data in Amtrak monthly reports.

[156] Calculated from data from West Japan Railway, East Japan Railway and Central Japan Railway 2007 annual reports. This passenger intensity is somewhat overstated because some high-speed rail trains start or end their trips on conventional sections of route, especially on the East Japan Railway.

[157] Passenger miles per route mile (PM/RM) is a key indicator of demand relative to the extent of infrastructure constructed. It would be expected that when comparing overseas HSR systems to the proposed California HSR network that those of Japan and Europe would perform better (the reasons for this are described in Part 3, International Experience, and Part 4, Forecasting Ridership) which are described elsewhere). Despite such differences, the CHSRA's PM/RM demand projections show California's system as being superior to HSR systems in Japan and Europe. This untenable estimate is further evidence that the HSR system projected ridership lacks credibility.

[158] The actual passenger miles do not appear to be stated in recent project documents. The CHSRA 2030 Base Ridership Projection passenger miles estimated using data in NCEIS Table 4.3-2 (Cost of station services divided by cost per passenger mile of station services). The CHSRA 2030 High Ridership Projection is estimated assuming the average trip length from the base 2030 projection.

[159] Estimated from NCEIS data for the base and high end projections.

[160] ec.europa.eu/dgs/energy_transport/figures/pocketbook/doc/2006/2006_transport_en.pdf. The French ridership intensity is somewhat overstated because some high-speed rail trains start or end their trips on non-high-speed conventional routes, which means the CHSRA's projections are overly optimistic.

[161] No passenger mile data was provided in the University of California study.

[162] Based on 1999 CHSRA plan, inflated to 2006$. The NCEIS does not include later estimates for business class fares.

[163] Internet inquiries: May 2008 (Japan and France), July 2008 (Washington-New York).

[164] Calculated from gross intercity passenger miles as estimated from NCEIS data gross commercial revenues relating to Alternative P1 (Pacheco) in Cambridge Systematics, 2007.

[165] Calculated from data in annual reports.

[166] "France train fares on track for increase; railway tolls in France could go up 80%," *Web in France Magazine*, www.webinfrance.com/france-train-fares-on-track-for-increase-rail-tolls-france-could-go-up-80-percent-325.html.

[167] Calculated from Amtrak *Monthly Performance Report: for September 2007* using average Acela passenger trip length from September 2005 in the Amtrak *Monthly Performance Report for September 2005*. Ancillary revenue data is not provided. If ancillary revenue data were available, the difference between Acela per passenger mile yields and the proposed CHSRA passenger mile yield would be greater.

[168] This analysis is based upon the Pacheco Pass alignment.

[169] Data from National Transit Database.

[170] Data from National Transit Database.

[171] www.capitolcorridor.org/about_ccjpa/press_room/2008/03/capitol_corridor_ridership_soa.php.

[172] NCEIS, p. 2-11.

[173] Projection Assumptions:

LOW PROJECTION

Based upon FRA 1997 for SD-LA-SF Corridor 2020 projections

Adjusted upward for additional mileage using market data ratios from 2020 Investment Grade Projection.

Adjusted upward for 2020 to 2030 travel market size using CHSRA assumptions.

HIGH PROJECTION

Airline diversion 1/3 of the market, HSR automobile diversion projection from 2020 Investment Grade Projection adjusted for market growth to 2030.

[174] The 2030 Due Diligence Base Projection is based upon the 1997 FRA report projection for 2020, adjusted for the additional route length and updated to 2030. The 2030 Due Diligence Base Projection does not include the adjustment for slower speeds (See Forecasting Speed and Federal Safety Standards). However, this projection is considered generous because of the likelihood that the HSR system will not be able to achieve its aggressive operating speed objectives, which is likely to result in even lower ridership than the Due Diligence projections.

[175] As documented by Flyvbjerg et al.

[176] Erik N. Nelson, "Dodging the Bullet Train," *Oakland Tribune*, November 19, 2006, findarticles.com/p/articles/mi_qn4176/is_20061119/ai_n16857538/pg_1

[177] Sean Holstege, "Truth may have come off the tracks," *Oakland Tribune*, Aug 22, 2004, findarticles.com/p/articles/mi_qn4176/is_20040822/ai_n14582033.

[178] Steve Schmidt, "2008 Vote: State Propositions, $10 billion bond for high-speed rail sought," *The San Diego Union-Tribune,* September 9, 2008, www.signonsandiego.com/news/state/20080909-9999-1n9rail.html.

[179] 2006$ are used because most current CHSRA documentation uses 2006$.

[180] Request for Expression of Interest (RFEI) documents, Appendix C. These cost figures are used throughout this report because they are the latest published and since they were provided to the investment community. Public officials are under a legal obligation to provide the investment community with the best possible information (indicative of this duty are securities fraud charges that have been filed by the Securities and Exchange Commission against five former city of San Diego officials. See www.sec.gov/news/press/2008/2008-57.htm).

[181] Request for Expression of Interest documents (RFEI), Appendix C.

[182] Estimated based upon an analysis of Missing Phase segments in previous CHSRA reports.

[183] This Due Diligence Report relies on the lowest cost alternative used in estimating cost of the Missing Phase.

[184] Flyvbjerg et al.

[185] Flyvbjerg et al., p. 44

186 Flyvbjerg et al., p. 14–16

187 Flyvbjerg et al., p. 14

188 Flyvbjerg et al., p. 12.

189 Flyvbjerg et al., p .12.

190 Mette K. Skamris and Bent Flyvbjerg, “Accuracy of Traffic Forecasts and Cost Estimates on Large Transportation Projects,” *Transportation Research Record* (Washington, D.C.: Transportation Research Board, National Research Council), 1996.

191 Flyvbjerg et al., p. 5.

192 Flyvbjerg et al., p. 16.

193 Senate committee High Speed Rail Report, p. 24

194 David Briginshaw, “KTX Takes The Lead in Korea,” *International Railway Journal,* January 2007, p. 21.

195 Flyvbjerg et al., p. 138.

196 Only the San Francisco earthquake of 1906 was stronger. Three other earthquakes were of the same intensity as the Tehachapi earthquake, Montana, Landers, California and Eureka (1947). See earthquake.usgs.gov/regional/states/historical.php and www.cahighspeedrail.ca.gov/regional/pdf/baker/Geology_Plates_3-4.pdf.

197 EIR/EIS, Volume I: Report, August 2005, www.cahighspeedrail.ca.gov/images/chsr/20080129162048_ch-2.pdf, p. 2-9.

198 Jerry Brown, Mayor of Oakland, speaking to the Board of Directors, CHSRA, July 20, 1999, as reflected in the meeting minutes, www.cahighspeedrail.ca.gov/images/chsr/20080123145357_Minutes_0799.pdf, p. 4.

199 EIR/EIS, p. 6A-16.

200 Ibid., p. 6A-9.

201 Ibid., p. 6A-17.

202 “California High-Speed Rail Authority to Study Zero Greenhouse Gas Emission,” press release, February 7, 2008,

www.cahighspeedrail.ca.gov/news/Press-Release--Zero-Greenhouse-Gas-Emissions.pdf.

203 Though, unlike other stations, travel time information is not provided to and from this station. See http://www.cahighspeedrail.ca.gov/map.htm.

204 The limited funding documentation available indicates funding from local partnerships, which could include counties, cities and special districts (such as transit districts).

205 While it is true that such operations occur in the French and Japanese systems, the distances where HSR shares tracks with commuter and freight trains in the urban areas of California would be longer; freight train volumes (which operate much more slowly than commuter rail trains) are much more intense than found on lines overseas. In the U.S. context, any such operations are likely to add more to travel times than overseas experience suggests.

206 Flyvbjerg et al., p. 20.

207 $49.0 billion to $73.5 billion in 2008$ (see Due Diligence Projections).

[208] $54.3 billion to $81.4 billion in 2008$ (see Due Diligence Projections).

[209] The Texas TGV operating costs per seat mile are estimated at 70 percent higher than the CHSRA projection (adjusted to 2006$). Transportation Research Board, National Research Council, *In Pursuit of Speed: New Options for Intercity Passenger Transport,* Special Report 233, 1991, Table A-14 (operating cost items only).

[210] This high estimate could be overly conservative, given the enormous differences between CHSRA revenue per passenger mile assumptions and those actually experienced by Japanese HSR trains and Acela.

[211] The 432-mile Los Angeles–San Francisco distance appears to be a mistake. The CHSRA interactive map indicates a distance of 432 miles from Los Angeles–San Francisco. However, the same map indicates a Los Angeles–Gilroy distance of 370 miles and a Gilroy–San Francisco distance of 79, for a total of 449 Los Angeles–San Francisco miles. The same route with a Merced stop, as indicated in the NCEIS, would be approximately 460 miles. A 490-mile route was calculated from the Request for Expression of Financial Interest documents.

[212] The Los Angeles–San Diego time was lengthened to 1 hour and 20 minutes upon enactment of AB 3034.

[213] On page 2-13, the NCEIS indicates that express trains would operate non-stop between Sacramento, San Francisco or San Jose and Los Angeles or San Diego. On page 4-20, the NCEIS indicates that express trains would have one intermediate stop.

[214] Calculated from interactive system map (384 miles in 2:09), www.cahighspeedrail.ca.gov/map.htm.

[215] Calculated from information in Colin J. Taylor, "TGV Est Lifts the Record," *Railway Gazette International*, September 2007.

[216] This occurred on the Cologne to Frankfurt HSR line in Germany, where political considerations resulted in the addition of five stations. See Flyvbjerg et al., p. 40.

[217] CHSRA map at www.cahighspeedrail.ca.gov/map.htm.

[218] EIR/EIS, www.cahighspeedrail.ca.gov/images/chsr/20080129182904_ch-6a.pdf, p 6A-17.

[219] Based on the 2006 population in the US Bureau of the Census, American Community Survey estimates for urbanized area boundaries as delineated in 2000. See www.demographia.com/db-caua.pdf.

[220] A coefficient exists indicating that the faster a HSR train travels the greater its exterior noise output; such technical details are beyond the scope of this report.

[221] Transportation Research Board, *In Pursuit of Speed: New Options for Intercity Passenger Transport,* National Research Council, 1991, Table A-15.

[222] Assumes operating speed of the world's fastest operating HSR segment of greater length (Paris to Avignon), with an adjustment to account for a peak operating speed of 200 mph (320 kph).

[223] SB 1856, p. 4.

[224] Transportation Research Board, *In Pursuit of Speed: New Options for Intercity Passenger Transport,* National Research Council, 1991, Table A-15.

[225] Alternative route lengths noted above could reduce this time by 6 minutes or increase it by 9 minutes. Consistent with CHSRA documentation in the EIS/EIR, 10 minutes is added for the Tehachapi-Palmdale routing (as opposed to the I-5 Tejon Pass routing).

[226] Variations occur per station stop. This study assumes that each station stop adds an average of 9 minutes to the travel time This is the result of slowing from top speed to a stop, "dwell" time in the station for passengers to disembark and board, and the time required to resume top speed (this estimate is based upon an examination of TGV and Bullet Train schedules).

[227] Assembly Bill 3034 was approved by the Assembly and at publication it was unclear whether the bill would be signed by the Governor. AB 3034 would slightly reduce maximum non-stop operating times, with the exception of Sacramento–San Jose, which would no longer have a maximum non-stop operating time specified in law.

[228] "What Is a High-Speed Train System?" California High Speed Rail Authority, undated, www.cahighspeedrail.ca.gov/plan/pdf/Plan_1.pdf.

[229] Photos of the complete destruction of ICE Train passenger cars can be found at Gunnar J. Kuepper, "Colossal impact of German train crash," EMD Reports (Emergency and Disaster Management Inc.), www.emergency-management.net/fire1.htm. Of all the reports on this accident, perhaps the most cogent is by Masayuki Nakao, Institute of Engineering Innovation, University of Tokyo, "InterCity Express Accident," Failure Knowledge Database at the Japan Science and Technology Agency, undated, shippai.jst.go.jp/en/Detail?fn=2&id=CA1000637.

[230] "German railway inspects high-speed trains, cancels dozens of services," *International Herald Tribune*, July 11, 2008, www.iht.com/articles/ap/2008/07/11/europe/EU-Germany-Deutsche-Bahn.php.

[231] "Eurostar train derails in France," BBC News, June 5, 2000, news.bbc.co.uk/2/hi/europe/779027.stm.

[232] This report will not attempt to provide an inventory of rail accidents on tracks jointly used by different types of trains because of the exhaustive nature of such a list. The FRA maintains such records. See safetydata.fra.dot.gov/officeofsafety/.

[233] Implementation Plan, California High-Speed Rail Authority, 2005, www.cahighspeedrail.ca.gov/images/chsr/20080123171537_ImplementationPlan.pdf, pp. 21–22.

[234] For a map of the Caltrain system see www.caltrain.com/caltrain_map.html; for the Metrolink system see www.metrolinktrains.com/documents/Stations/MetrolinkMap.pdf; for the CHSRA system see www.cahighspeedrail.ca.gov/map.htm.

[235] California High Speed Rail Authority and Federal Railroad Administration, *Final Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the* Proposed *California High-Speed Train System*, Volume I: Report, August 2005, www.cahighspeedrail.ca.gov/images/chsr/20080129162048_ch-2.pdf, p. 2-2, hereinafter referred to as EIR/EIS.

[236] Ibid., p. 6A-4. Also, see several drawings of HSR with commuter train and/or freight train shared track segments in California High Speed Rail Authority and Federal Railroad Administration, *Final Bay Area to Central Valley High-Speed Train (HST) Program Environmental Impact Report/Environmental Impact Statement* . . . Volume 2: Appendices, May 2008, hereinafter referred to as NCEIS. www.cahighspeedrail.ca.gov/images/chsr/20080602142821_Complete%20Volume%202%20

wCover.pdf. Shared tracks with Caltrain and freight trains is Figure CC-2, “San Francisco to San Jose Caltrain Corridor Typical Four Tracks at Grade,” p. 2-E-2 and p. 2-E-8; a shared HSR/commuter rail station at Tracy can be seen at “Bay Area to Central Valley Altamont Pass,” 2-E-99; HSR and commuter trains only (no freight) at Figure PP-9, “San Jose to Los Banos Pacheco Pass Typical Retained Fill,” p. 2-E-56.

237 EIR/EIS, Volume I, p. 6A–26.

238 “The California High-Speed Train Network - The Next Steps to Construction,” undated, phasing recommendations approved by the CHSRA board as reflected in the meeting minutes of May 23, 2007, p. 6. The link to the minutes is www.cahighspeedrail.ca.gov/images/chsr/20080121164421_052307_min.pdf and the Phasing Plan is at www.cahighspeedrail.ca.gov/images/chsr/20080121165954_052307_plan.pdf.

239 NCEIS, Volume 1, p. 2–9.

240 Association for California High-Speed Trains, untitled and undated article on Home page at www.highspeedtrainsforca.com/default.asp.

241 Garth Stapley, “Bill to update ACE trains needs votes from valley,” *Modesto Bee*, May 07, 2008, www.modbee.com/local/story/291160.html.

242 Michael Cabanatuan, “Union Pacific won’t share with high-speed rail,” *San Francisco Chronicle*, Friday, June 6, 2008, www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/06/05/BAL8113I9K.DTL and Eric Bailey, “Proposed L.A.-to-S.F. bullet train hits a snag,” *Los Angeles Times*, June 4, 2008, www.latimes.com/news/local/la-me-bullet5-2008jun05,0,7414713.story.

243 NCEIS, p. 127.

244 “Oversight Hearings of the California High-Speed Rail Authority,” Committee Report, Senate Transportation and Housing Committee, June 2008, p. 25.

245 Ibid., p. 25.

246 Authorized under 49 U.S.C. § 20103.

247 Legal challenges to preempt FRA’s authority have failed. The most recent example is the California Court of Appeal ruling on June 3, 2008 that FRA regulations governing the “push” mode of “push-pull” commuter trains preempt the practice from being used against Metrolink in a class-action lawsuit that stems from a January 2005 train crash. The accident in Glendale resulted in 11 fatalities and nearly 200 injuries. The appellate court ruled that because the type of operation is lawful under FRA regulations, the plaintiffs cannot argue in state court that the practice was negligent. See Angela Hokanson, “Metrolink wins push-pull case,” *Burbank Leader*, June 4, 2008, www.burbankleader.com/articles/2008/06/04/publicsafety/blr-metrolink07.txt. See the ruling in Southern California Regional Rail Authority et al., v. Superior Court of Los Angeles County, Respondent: James Tutino et al., in the Court of Appeal of the State of California, Second Appellate District, June 3, 2008 at www.courtinfo.ca.gov/opinions/documents/B200777.pdf. In June 2008, the individual accused of parking his vehicle on the tracks and causing the accident was found guilty of multiple charges; see Tony Castro, “Alvarez convicted of 11 counts of murder in Glendale train crash incident,” *Los Angeles Daily News*, June 27, 2008, www.dailynews.com/news/ci_9714112.

248 Railroad Safety Statistics 2005 Annual Report (Washington, D.C.: Federal Railroad Administration, December 2006), safetydata.fra.dot.gov/Objects/bull2005-book.pdf, p. 1.

[249] Milton Valencia and James Vaznis, "Freight car rams commuter train, injuring 150," *The Boston Globe*, March 26, 2008, www.boston.com/news/local/articles/2008/03/26/freight_car_rams_commuter_train_injuring_150/. Also, "Freight car hits Boston commuter train," Associated Press, March 25, 2008, www.forbes.com/afxnewslimited/feeds/afx/2008/03/26/afx4815428.html

[250] According to the latest published data, the U.S. rail industry moved 1.5 billion ton-miles compared with 1.1 billion ton-miles on roads (2001), approximately a 58 percent share of the combined rail/truck market. In the European Union, railroads carried 158.1 million ton-miles compared with 923.1 million ton-miles on roads (2002), a 14.6 percent rail share. In Japan, railroads transported 15.4 million ton-miles compared with 224.7 million on roads (2005), a rail share of only 6.4 percent.

[251] Tyrell, D., "Rail Passenger Equipment Accidents and the Evaluation of Crashworthiness Strategies", Volpe National Transportation Systems Center, U.S. Department of Transportation, paper presented to the Institute of Mechanical Engineers, London, May 2001, www.fra.dot.gov/downloads/Research/uscr_std.pdf, pp. 1–2.

[252] *Implementation Plan*, pp. 21–22.

[253] Suffice to say that FRA regulations control the amount of weight required to be built into the front of a passenger train in order to clear the track of obstacles and to help withstand collisions. Car crashworthiness includes crash energy management features, longitudinal structural strength and rollover strength requirements, the frequency and manner in which trains are inspected, interior features that may affect passenger safety and other factors.

[254] Car body strength is discussed in Ronald Mayville, Richard Stringfellow, Robert Rancatore, and Kent Johnson, "Development of a Passenger Rail Vehicle Crush Zone," Proceedings of the 1999 IEEE/ASME Joint Railroad Conference, April 13-15, 1999, IEEE Catalog Number 99CH36340, ASME RTD Vol. 16.

[255] Parsons Brinkerhoff, Quade and Douglas, *Overview of California High Speed Rail Project–Technical Information*, p. 6.

[256] EIR/EIS, Volume I, p. 4-6.

[257] Ibid., and also NCEIS, p. 4-20.

[258] NCEIS, p. 3.5-3.

[259] *Implementation Plan*, p. 4.

[260] Brian Hollingsworth and Arthur Cook, *The Illustrated Directory of Trains of the World* (Minneapolis: MBI Books, 2000) p. 471.

[261] "Eurostar Train," Railway Technology, www.railway-technology.com/contractors/suburban/eurostar-train.html.

[262] "Beijing-Tianjin High-Speed Commuter Link, China," Railway Technology, undated, www.railway-technology.com/projects/beijing-tianjin/specs.html.

[263] David Briginshaw, "AGV: the next generation," *International Railway Journal*, March 2008, pp. 23–26.

[264] "Los Angeles to San Diego via Orange County High-Speed Train Alignments/Stations Screening Evaluation," California High-Speed Train Program EIR/EIS, Revised Draft,

Prepared by IBI Group Team, Task 2.3.1R, July 25, 2001, www.cahighspeedrail.ca.gov/images/chsr/20080131152437_LAX_Report.pdf, p. 32.

[265] NCEIS, p. 2-11.

[266] EIR/EIS, p. 4-20.

[267] The cessation of planning for the Texas HSR system that was to use redesigned TGV trains is summarized at Stuart Eskenazi, "Settlement on rail plan gets approved," *Austin American-Statesman*, August 20, 1994. p. B1.

[268] Commentary regarding a 2-to-1 vote by the public in favor of terminating the Florida high-speed rail system can be found at "Face reality," *Florida Times-Union*, January 4, 2005, p. B-6.

[269] *Implementation Plan*, p. 21.

[270] The reference to 1,175 seats is found in EIR/EIS, Volume 1, p.4–20 and the reference to 1,600 seats is in *Implementation Plan*, p. 4.

[271] The Acela's 2 power cars and 6 coaches at 614 tons is the heaviest high-speed train. An Italian Pendolino built for Virgin Trains in Britain weighs approximately 471 tons; the TGV Duplex (double-decked) weighs about 424 tons; and the German ICE Train ICE3 version weighs in the order of 409 tons. Data available at www.railway-technology.com. All weights are in metric tons.

[272] Don Phillips, "Acela Rapidly Disappoints - New Amtrak Trains Fast but Unreliable," *The Washington Post*, August 6, 2002, p. E1.

[273] Implementation Plan, p. 27.

[274] JayEtta Hecker, "Acela's Continued Problems Underscore the Importance of Meeting Broader Challenges in Managing Large-Scale Projects," U.S. Government Accountability Office, Testimony Before the Subcommittee on Railroads, Committee on Transportation and Infrastructure, House of Representatives, May 11, 2005, www.gao.gov/new.items/d05698t.pdf, p. 6.

[275] Joseph H. Boardman, Administrator, Federal Railroad Administration, "2007 FRA Rail Safety Program," testimony before the Senate Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security; Committee on Commerce, Science, and Transportation, July 25, 2007, www.fra.dot.gov/us/content/1849.

[276] The failure of Acela to achieve the travel time required by federal law indicates that investors, taxpayers and riders should not consider such legislative provisions as guarantees. Despite the law, Acela operates slower than required. It is likely that the CHSRA system will also fail to meet its statutory travel time requirements and probably face no legal sanctions. (This issue also discussed in "Forecasting Speed.")

[277] Amtrak Northeast Corridor Timetable, May 12, 2008, see link "Northeast Corridor 2" at www.amtrak.com/servlet/ContentServer?pagename=Amtrak/Page/Schedules_Index_Page&c=Page&cid=1080072922206&ssid=3, pp. 2–3.

[278] "Oversight Hearings of the California High-Speed Rail Authority," Committee Report, Senate Transportation and Housing Committee, June 2008, p. 15.

[279] "Railroad Information," Korail, 2007, info.korail.com/2007/eng/ein/ein01000/w_ein01100.jsp.

[280] Colin J. Taylor, "TGV Est Lifts the Record," *Railway Gazette International*, September 2007.

[281] For example, the CHR 3 train is a version of the Velaro, which in turn is a redesign of the ICE Train without locomotives. In railroad parlance it is referred to as an EMU (electrical multiple unit), meaning that motors under each car power the train. The more technical designation is that it is a "distributed power" train. See *Jane's World Railways 2004-2005* (Surrey, United Kingdom: Jane's Information Group), p. 568.

[282] NCEIS, p. 3.2-22.

[283] Jathon Sapsford, "Quake Shakes Japan's Bullet Train–Derailment Shatters A Myth of Invincibility Despite Lack of Injuries," *The Wall Street Journal*, October 26, 2004, p. A7A. Also, "Shinkansen track destroyed by earthquake," *The Daily Yomiuri*, October 26, 2004, p. 4.

[284] "Bullet Train Manufacturers To Bolster Earthquake Measures," Nikkei Report, October 26, 2004.

[285] The first mention of the train station advantage over airports found in documents currently on line is in EIR/EIS Volume 1: Report, p. 3.2-1.

[286] Airline prospectuses typically include cautionary language regarding the material risks of security threats. As one example, a recent Continental Airlines prospectus contains sections entitled, "Additional security requirements may increase our costs and decrease our traffic" and "Additional terrorist attacks or international hostilities may further adversely affect our financial condition, results of operations and liquidity." See: "Final Prospectus Supplement, Registration No. 333-133187 of June 19, 2008 to Prospectus dated April 10, 2006, prepared by UBS Investment Bank for Continental Airlines regarding the pricing of a public offering of 11 million shares of Class B Common Stock, Risk Factors as filed with the SEC," www.sec.gov/Archives/edgar/data/319687/000095012908003613/h57701b2e424b2.htm#103, pp. S-5----S11.

[287] *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Findings from Second Peer Review Panel Meeting*, draft report, prepared for Metropolitan Transportation Commission by Cambridge Systematics, July 2006, www.cahighspeedrail.ca.gov/images/chsr/20080128160100_Findings.pdf, p. 4-14. Verbatim language appeared in *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Final Report* prepared for Metropolitan Transportation Commission and California High-Speed Rail Authority, by Cambridge Systematics, et al,., July 2007, www.cahighspeedrail.ca.gov/ridership/pdf/R9a_Report.pdf pp. 6-5, 6-6.

[288] "Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Levels-of-Service Assumptions and Forecast Alternatives," final report, prepared for Metropolitan Transportation Commission and California High-Speed Rail Authority, prepared by Cambridge Systematics, August 2006, www.cahighspeedrail.ca.gov/images/chsr/20080128144927_R6b_LOS_Assumptions.pdf, p. 2-34.

[289] Jeremy M. Wilson, et al., *Securing America's Passenger-Rail Systems* (Santa Monica: Rand Corporation, 2007), www.rand.org/pubs/monographs/2007/RAND_MG705.pdf, p. III.

[290] "France probes bomb alerts linked to Red Brigades," AFP, June 16, 2008, www.france24.com/en/20080616-france-probes-bomb-alerts-linked-red-brigades.

[291] "Makeshift bombs defused in French tourist hotspot," AFP, August 8, 2008, afp.google.com/article/ALeqM5g3-6AF3ip8axDLr2fw_UiU7Vcvqw.

[292] "JR West target of bomb threat extortion bid," *The Yomiuri Shimbun*, May. 6, 2008, www.yomiuri.co.jp/dy/national/20080506TDY03301.htm.

[293] "Operators Respond to Bomb Attacks," *Railway Gazette International*, April 2004, p. 181.

[294] "Attempted Derailment Raises Train Security Fear," Deutsche Welle Broadcasting, April 5, 2004, www.dw-world.de/dw/article/0,,1162163,00.html.

[295] Dale Fuchs, "Partly Made Bomb Is Found Under a Rail Line in Spain," *New York Times*, April 3, 2004, page unknown, and "Bomb found on Spanish rail track," April 2, 2004, news.bbc.co.uk/2/hi/europe/3593927.stm.

[296] "Attempted Derailment Raises Train Security Fear," Deutsche Welle Broadcasting, April 5, 2004, www.dw-world.de/dw/article/0,,1162163,00.html.

[297] For a more complete view regarding TGV network passenger security systems, see Dylan Kissane, "Terror on the TGV? The Terrorist Threat to France's High Speed Train Network," American Graduate School of International Relations and Diplomacy. Paris, France, June 2007. works.bepress.com/dylankissane/13.

[298] Photos of the damage to both train sets are available at Didier Leveque, Yannick Chauveau, and Louis Dangas, "Numerical assessment of the impact on structure during an explosion," Centre D'Ingenierie du Materiel, paper given at the 1st European HyperWorks Technology Conference, Berlin, Germany, October 24, 2007, www.altairhyperworks.co.uk/html/en-GB/session5/Leveque_SNCF.pdf, pp. 3–4. This incident did not occur on a dedicated HSR right of way.

[299] Senate Committee on Commerce, Science, and Transportation, *Passenger and Freight Rail Security*, 108th Cong., 2nd sess., March 23, 2004, p. 2.

[300] The additional 536 fatalities represent a calculation by the authors based on news accounts and should be considered a minimum figure. A thorough compilation of official government tallies from around the world would result in a higher number.

[301] "Madrid Train Attacks," BBC News, last updated February 14, 2007, news.bbc.co.uk/2/hi/in_depth/europe/2004/madrid_train_attacks/default.stm.

[302] C.J. Chivers, "Bomb derails a passenger train in Russia," *International Herald Tribune*, August 14, 2007, www.iht.com/articles/2007/08/14/europe/russia.php.

[303] Jeremy M. Wilson, et al., *Securing America's Passenger-Rail Systems* (Santa Monica: Rand Corporation, 2007), www.rand.org/pubs/monographs/2007/RAND_MG705.pdf, p. 1.

[304] "Scores dead in Mumbai train bombs," BBC News, July 11, 2006, news.bbc.co.uk/2/hi/south_asia/5169332.stm. Also, Kalpana Sharma, "Mumbai back on track," *The Hindu*, July 13, 2006, www.hindu.com/2006/07/13/stories/2006071308100100.htm

[305] David Frum, "Terrorism's Enablers," column in *National Post* (Canada), August 19, 2006, as published by the American Enterprise Institute, www.aei.org/publications/filter.all,pubID.24798/pub_detail.asp

[306] To better understand the impact of the attack see "Bombers target London," Special Reports from CNN News, undated, www.cnn.com/SPECIALS/2005/london.bombing/ and also Intelligence and Security Committee, "Report into the London Terrorist Attacks on 7 July 2005," May 2006, www.official-documents.gov.uk/document/cm67/6785/6785.pdf.

[307] "Many dead in Moscow metro blast," BBC News, February 6, 2004, news.bbc.co.uk/2/hi/europe/3464545.stm.

[308] Patrick E. Tyler and Don Van Natta Jr., "Bombing in Madrid: The Aftermath; Europe Adds New Security Measures to Its Well-Traveled Rail System, *The New York Times*, March 13, 2004, query.nytimes.com/gst/fullpage.html?res=9D07E2D9113EF930A25750C0A9629C8B63.

[309] "Eurostar Safety and Security," Travel Pro Network, undated, www.london-paris-chunnel.com/eurostar-safety-and-security.html.

[310] Brian Lysaght, "Eurostar Trains Delayed Because of Tunnel, Station Problems," Bloomberg News, April 7, 2008, www.bloomberg.com/apps/news?pid=20601102&sid=aNbeYzGosylA&refer=uk.

[311] According to owner Eurotunnel, "The Channel Tunnel is the longest undersea tunnel in the world. The section under the sea is 38km long. The three tunnels, each 50km long, were bored at an average 40m below the sea bed, and link Folkestone in Kent to Coquelles in Pas-de-Calais." www.eurotunnel.com/ukcP3Main/ukcCorporate/ukcTunnelInfrastructure/ukcInfrastructure/ukpChannelTunnelInfrastructure

[312] EIR/EIS, www.cahighspeedrail.ca.gov/images/chsr/20080129172033_ch-3_part_2.pdf, p. 3.9-15.

[313] Kenneth M. Mead, inspector general, Department of Transportation, letter to Representative Frank Wolf, December 18, 2000, pp. 3–4.

[314] Philip Johnston, "Fortress Britain: Brown unveils tough new laws," November 16, 2007, www.smh.com.au/news/world/fortress-britain-brown-unveils-tough-new-laws/2007/11/15/1194766868451.html.

[315] Graeme Wilson, "Body searches for trains," November 15, 2007, *The Sun* (London), www.thesun.co.uk/sol/homepage/news/article467080.ece.

[316] Peter F. Guerrero and Norman J. Rabkin General Accounting Office, testimony before the Senate Committee on Commerce, Science, and Transportation, *Passenger and Freight Rail Security*, 108th Cong., 2nd sess., March 23, 2004, p. 8.

[317] Ibid., p. 4.

[318] Steve Hymon, "'Random' searches of passengers on Metrolink," Bottleneck Blog, *Los Angeles Times*, June 13, 2008, latimesblogs.latimes.com/bottleneck/2008/06/random-searches.html.

[319] Jonathan Dienst, "NYPD Letter Blasts Security Lapses At Penn Station," News 4, April 8, 2008, www.wnbc.com/investigations/15829781/detail.html.

[320] Bob Simon, "Are America's Trains Safe?" *CBS News*, March 31, 2004.

[321] Robert Salonga, "Suspicious man, package closes Richmond BART, halts Amtrak service for hours," *Contra Costa Times*, July 22, 2008, www.contracostatimes.com/search/ci_9949681?IADID=Search-www.contracostatimes.com-www.contracostatimes.com.

[322] Bharat Ayyar, "YPD officers help investigate bomb found on train tracks," *Yale Daily News*, May 21, 2008, www.yaledailynews.com/articles/view/24488.

[323] "Yemeni Man Yells He Has A Bomb - Passengers Evacuated From Amtrak Train In Virginia," *Homeland Security National Terror Alert - Homeland Security News*, March 16, 2008, www.nationalterroralert.com/updates/2008/03/16/yemeni-man-yells-he-has-a-bomb-passengers-evacuated-from-amtrak-train-in-virginia/.

[324] The sabotage is covered in William Claiborne, "Amtrak Train Derailed by Sabotage In Arizona, Killing 1, Injuring 78," *Washington Post*, October 10, 1995, A1; also, Don Phillips, "110,425 Miles Cannot Be Secured; Until Monday, Railroaders Worried About Trespassers and Petty Vandals," *Washington Post*, October 12, 1995, A14.

[325] Bill Geroux and Rex Springston, "FBI Joins Probe in Wreck of Train, Sabotage Possible in Switch Tampering," *Richmond Times-Dispatch*, August 14, 1992, A1.

[326] "Amtrak Launches New Security Procedures," Amtrak press release, February 19, 2008, www.amtrak.com/servlet/ContentServer?pagename=Amtrak/am2Copy/News_Release_Page&c=am2Copy&cid=1178294112060&ssid=180. Also: Mimi Hall, "Amtrak expands random security sweeps," *USA Today*, July 10, 2008, www.usatoday.com/travel/news/2008-07-10-amtrak_N.htm.

[327] "Beijing transport services on high alert ahead of Olympics," Xinhua News, July22, 2008, www.thaindian.com/newsportal/sports/beijing-transport-services-on-high-alert-ahead-of-olympics_10074581.html.

[328] Some U.S. sources place the walking distance maximum at 0.5 miles, double the international standard. This is a questionable figure and would seem to be particularly questionable for intercity travelers, who generally carry more in the way of luggage and personal effects than local transit passengers.

[329] Comparison of travel times between in the 2005 EIS/EIR (2:25, Appendix 3.2-A) and the 2008 NCEIS (2:38, Table 2.3-1).

[330] Moreover, some of the travel time comparisons can be characterized as misleading. In the EIS/EIR, CHSRA indicates that door-to-door HSR travel between Los Angeles and San Diego would take 2 hours and 16 minutes compared to 3:00 hours air travel time. This would represent a net savings of 44 minutes. This induced a California Senate committee to note that: "Travelers enjoying the greatest travel time savings would be those journeying between San Diego and Los Angeles" (Senate High Speed Rail Report, pp. 21–22). In fact, few people fly San Diego–Los Angeles, because, as the source EIS/EIR table indicates, car travel is generally faster. Federal data indicates that approximately 125 people fly between Los Angeles and San Diego on a daily basis (U.S. Department of Transportation *Domestic Air Passenger Consumer Report*, 2007, 4th quarter), ostpxweb.dot.gov/aviation/domfares/table6074.csv)—not enough passengers to fill a single Boeing 737. Similarly, CHSRA reports show travel time savings for non-stop air travelers between San Jose and Sacramento. In 2005, the NCEIS base year, there were fewer than 10 passengers daily flying between Sacramento and San Jose. As of 2008, there is one daily flight on a propeller-driven aircraft. The inclusion of travel time savings for air passengers in markets that have little or no air ridership can mislead. The members and staff of the California Senate cannot be expected to have the expertise to have identified the irrelevance of this finding. CHSRA, however, has exactly the expertise that should have either not shown the virtually theoretical travel time differences or should have noted the minimal significance of the figure.

[331] The air trip is also assumed to be downtown to downtown, with the necessary ground transportation links. NCEIS Tables 3.2-6 and 3.2-7.

[332] The 3 hour and 24 minute door-to-door HSR travel time indicated from downtown San Francisco to downtown Los Angeles in the NCEIS is 6 minutes less than the 3 hour, 30 minute travel time reported in the EIS/EIR (Table 3.2-7, with Antelope Valley routing, per footnote 3 on page 3.2-12). At the same time, the NCEIS projects a train travel time of 2 hours and 38 minutes on the route, while the EIS/EIR projected a train travel time of 2 hours and 25 minutes.. Thus, CHSRA changed the access time to and from the train from 1 hour, 5 minutes under the EIS/EIR to 46 minutes under the NCEIS. If CHSRA had used a consistent access time (non-train travel time portion of the door-to-door time), the door-to-door travel time would have been 3 hours and 43 minutes, instead of 3 hours and 24 minutes. This is a substantial door-to-door travel time improvement and is likely to have had a material impact in inflating the ridership in the NCEIS ridership projections.

[333] NCEIS, p. 3.2-11.

[334] Downtown San Francisco, represents 12 percent of the employment in the San Francisco Bay area. Downtown Los Angeles represents 3 percent of the employment in the Los Angeles area. Downtown San Diego represents 5 percent of the employment in the San Diego area. Downtown Sacramento represents only 11 percent of the employment in the Sacramento area; see: www.demographia.com/db-cbd2000.pdf.

[335] It is assumed that the CHSRA airport travel time is 20 minutes longer to and from the downtown destinations than HSR.

[336] The newer, shorter non-train travel times in the NCEIS are assumed. The longer door-to-door travel times for the train in the EIS/EIR would disadvantage train travel another 19 minutes relative to air travel.

[337] It is assumed that semi-express trains, the second fastest type of train, would stop twice along the route (such as in Fresno and Bakersfield). See NCEIS p. 2-13.

[338] Shinagawa, Yokohama, Nagoya and Kyoto. Based upon timetable at March 2008. www.japanrail.com/pdf/timetable_fare/timetable_fare1_west.pdf.

[339] NCEIS p. 2-13.

[340] NCEIS p. 4-20.

[341] For example, 17 to 26 semi-express trains are forecast on page 2-13 and 34 are forecast on page 4-20.

[342] NCEIS, p. 2-12.

[343] Data from air schedules available online for November 12, 2008.

[344] www.demographia.com/db-worldua.pdf.

[345] NCEIS, p. 4-20.

[346] www.oig.dot.gov/StreamFile?file=/data/pdfdocs/HSR_Final_7-1-08.pdf.

[347] Analysis uses improved fuel economy as projected by the Energy Information Administration. Auto operating costs are marginal only, including gasoline, tires and maintenance, but excluding insurance and ownership expenses.

[348] NCEIS Table 3.2-5

[349] Senate High Speed Rail Report, p. 1.

[350] The bond authorization would be for $9.95 billion, of which $950 million would be made available to the state and regional or local units of government.

[351] REFI, Appendix C, p. 98.

[352] Senate High Speed Rail Report, p. 26.

[353] Quentin L. Kopp, "No boondoggle," *San Francisco Chronicle*, April 26, 2008, www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/04/26/ED7J10BHUI.DTL

[354] www.cahighspeedrail.ca.gov/rfei/pdf/Exhibit_C.pdf.

[355] This is despite the fact that no federal program exists capable of funding an amount remotely similar to such amounts.

[356] www.cahighspeedrail.ca.gov/rfei/pdf/Exhibit_C.pdf.

[357] REFI, Appendix C.

[358] Senate High Speed Rail Report pp. 32-33.

[359] Ibid., pp. 32–33. In this letter, Chairman Kopp indicates that surplus revenues from Phase I would be used to complete Phase II. As this report indicates, there is little likelihood that any such a surplus will materialize. (See Due Diligence Projections.)

[360] One example is CHSRA, *A Comprehensive Approach to Intercity Rail*, January 31, 2001, p. 1.

[361] EIR/EIS, p. 5-5.

[362] Cambridge Systematics, Inc., *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Levels-of-Service Assumptions and Forecast Alternatives*, August 2006 and Cambridge Systematics, Inc., *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Ridership and Revenue Forecasts*, draft report, August 2007.

[363] Parsons Brinkerhoff, Quade and Douglas, *Overview of California High Speed Rail Project–Technical Information*, March 27, 2008, p. 4.

[364] CHSRA, *Preferred Alignments and Stations – South*, August 4, 2005 and *Average Operating Speed on High-Speed Train System*, May 22, 2007.

[365] Senate High Speed Rail Report, p. 26.

[366] businesswire.com/portal/site/google/?ndmViewId=news_view&newsId=20080312006330 &newsLang=en

[367] Proponents sometimes claim that HSR is profitable with respect to operating costs, and exclude the cost of construction and capital. A profitable enterprise must return greater revenues than all costs, both capital and operating.

[368] Quentin L. Kopp, "Another View: Let's put state on fast track to the future," *The Sacramento Bee*, June 22, 2008, www.sacbee.com/110/story/1029467.html.

[369] Garrison and Levinson, p. 122.

[370] Examples of such user revenues are landing fees and user taxes on airline tickets (whose proceeds are dedicated to aviation). There is a small annual subsidy to the aviation system for FAA's safety and regulatory functions and also the Essential Airline Service program, which subsidizes airline service to a small number of smaller urban areas.

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371 Such user revenues include special (rather than general purpose) taxes on fuel and tolls (subsidies from www.bts.gov/programs/federal_subsidies_to_passenger_transportation/, airline revenues from *National Transportation Statistics*).

372 As used in this context, profits are the net of commercial revenues over operating and capital costs, excluding the taxpayer costs of bonds or grants.

373 This assumes payment of operating costs and CHSRA debt service.

374 EIR/EIS, p. 2-1.

375 Financial information in this chapter is in 2003$, since that was the basis of CHSRA's cost estimates for the highway and Aviation Alternatives.

376 Use of 2003$ here is an exception to this report's adjustment of data to 2006$ because of the CHSRA's exclusive use of 2003$ in its analysis of alternatives.

377 www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/04/26/ED7J10BHUI.DTL.

378 Assembly Bill 3034 (2008), Section 1(a), as introduced.

379 Automobile increase calculated from NCEIS Table 3.5-4. Airline increase estimated from CHSRA 1997-2005 and 2005-2030 annual rates.

380 Advocates of intercity passenger rail often note that airlines have historically lost large amounts of money. However, these losses have been sustained by private investors, not governments. There is a small federal subsidy (principally for the Federal Aviation Administration's safety regulation and to subsidize airline service to smaller urban areas, which was estimated at less than $3 billion in 2002 (latest estimate available). This represented $0.006 per passenger mile, a small fraction of the total airline revenues of $0.12 per passenger mile. In contrast, the federal subsidy to Amtrak was $0.159 per passenger mile in 2002, more than the total airline revenue per passenger mile (subsidies from www.bts.gov/programs/federal_subsidies_to_passenger_transportation/, airline revenues from *National Transportation Statistics*). A $5 billion program of one-time assistance to airlines was established to compensate for the losses arising from the 9-11 terrorist attack, which is more properly considered compensation for a virtual act of war than a subsidy (assistance to New York City transportation authorities for 9-11 related damages should be similarly considered).

381 EIS/EIR Table 2.5-1. The Highway Alternative was developed by CHSRA based upon 2020 traffic projections using 2003 costs. This was the full system operation planning horizon year at the time of the "alternatives" analysis and has not been fully updated. Thus, the assumption was that the entire HSR system would be in operation in 2020. The HSR planning horizon year has since been changed to 2030 from 2020. The traffic projections have been updated only in Northern California and the "alternatives" analysis has not been updated. As a result, this analysis uses the 2020 data, except where later representative data is available. As in the case of the CHSRA analysis, this analysis assumes that the *entire* HSR system would be in operation under either the 2020 or 2030 traffic projections.

382 "Lane-miles" is standard terminology in denoting a single, one-way lane for a mile. Thus, if a freeway were expanded by a single lane in each direction, over each mile two lane-miles would be added.

383 Figures extended to 2040 to show longer term impact of HSR (beyond 2030, when the full system is in operation).

384 Calculation: 2.5%/1.4% = 1.7 years (HSR impact divided by annual traffic growth rate).

[385] This can be a confusing table and is shown to demonstrate that not even CHSRA claims that the HSR alternative would reduce traffic congestion more than the Highway Alternative.

[386] As measured by the volume-capacity ratio. The volume-capacity ratio measures the traffic on a roadway relative to its capacity. A value of 1.00 means that a roadway is operating at capacity. A value above 1.00 means that the traffic is above capacity and that there is significant traffic congestion. A value below 1.00 means that the roadway has less traffic than its capacity.

[387] Using the 2003 CHSRA costs, the Highway Alternative costs $2.4 billion for each percentage point reduction in congestion ($66 billion divided by a 27 point reduction in the volume/capacity ratio), while HSR costs $7.4 billion ($37 billion divided by a 5 point reduction in the volume/capacity ratio).

[388] Estimated from Caltrans traffic count data for 2005, comparing vehicle miles in segments impacted by HSR (as identified in the EIS/EIR) to the total vehicle miles on the state highway system (from FHWA).

[389] Calculation: 2.3% x 23% = 0.6%. Little traffic diversion would occur on local roadways, which means even the 0.6% figure is generous. On the other hand, it is possible that off-peak diversion by HSR would be greater than peak. It seems highly unlikely that the difference, however would be enough to raise the traffic reduction to a figure approaching 2.3 percent.

[390] The “level of service” is a categorization of the volume-capacity ratio. Level of service “A” occurs when traffic volumes are 60% or less of roadway capacity. Level of service “B” is from over 60% to 70% of capacity. Level of service “C” is from over 70% to 80% of capacity. Level of service “D” is from over 80% to 90% of capacity. Level of service “E” is from over 90% to 100% of capacity. Level of service “F” is from over 100% of roadway capacity. A total of 18 segments were evaluated in the NCEIS. In one case there was an improvement in the level of service, however CHSRA attributes that change to roadway expansion, not HSR (NCEIS Table 3.1-2).

[391] In fact, many California roadways operate above 80% capacity and even at 100% capacity today, yet are not being expanded.

[392] EIS/EIR Table 3.1-A-6.

[393] NCEIS Table 3.1-2.

[394] Estimated applying FHWA lane mile cost estimates (2000 inflated to 2003, using the Caltrans Construction Cost Index) to the roadway segments proposed for expansion by CHSRA. Like the CHSRA estimate, the Due Diligence estimate is expressed in 2003$. The 2002 cost base is used and inflated to 2003, using the Caltrans “Price Index for Selected Highway Construction Items,” www.dot.ca.gov/hq/esc/oe/contract_progress/exhibitA.pdf.

[395] NCEIS, Table 3.1-3.

[396] This is a generous estimate. Calculation: 1.7 years divided by 30 year discount period = 5.8%.

[397] At the exaggerated CHSRA costs, the attributable cost of the HSR Highway Alternative would be $3.2 billion.

[398] California High-Speed Rail Authority, *Fly California . . . without ever leaving the ground,* undated, www.cahighspeedrail.ca.gov/eir_final/pdf/EIR-EIS_brochure_8-2005.pdf, p. 2.

[399] USDOT, Domestic Airfares, Second quarter data, all years.

[400] Calculated from National Transportation Statistics, Table 1-34 (2008).

[401] At the CHSRA projection rate, airline volumes within California should have been at least 20% higher than in 2000. Volumes were nearly 12 percent lower.

[402] Los Angeles, Glendale-Burbank, Santa Ana, Long Beach and Ontario airports. Calculated from airport statistics at www.scag.ca.gov/aviation/.

[403] Calculated from San Francisco International Airport data.

[404] Calculated from Oakland International Airport data.

[405] Sources: Calculated from USDOT data, CHSRA projections.

[406] Calculated from NCEIS page 3.2-24

[407] July 2007 Tokyo-Osaka air passengers calculated from data in Central Japan Railway, *Data Book 2007*, page 14 (english.jr-central.co.jp/company/data_book.html). U.S. airline market data for 2007, 3d quarter from ostpxweb.dot.gov/aviation/domfares/table1073.csv).

[408] Schedule consulted for September 18, 2008. www.eskyguide.com.

[409] Schedule consulted for September 18, 2008. www.eskyguide.com.

[410] Author's examination of Air France timetables in the Air France Library, Paris.

[411] Schedule consulted for September 18, 2008. www.eskyguide.com.

[412] Schedule consulted for September 18, 2008. www.eskyguide.com.

[413] Viggo Butler and Robert W. Poole, Jr., *Increasing Airport Capacity Without Increasing Airport Size*, Policy Study No. 368, (Los Angeles: Reason Foundation, March 2008), www.reason.org/ps368.pdf, pp. 25–26. These technologies collectively are generally called the NextGen system.

[414] Ibid. Other new technologies include Automatic Dependent Surveillance-Broadcast, Wide Area Augmentation System, Continuous Descent Approach and Surface Area Movement Management and managing flight through wake turbulence.

[415] "Regional Aviation Plan for the 2004 Regional Transportation Plan," Southern California Association of Governments, April 2004.

[416] Los Angeles World Airports is the airport agency of the city of Los Angeles, which administers LAX, Ontario and Palmdale airports, as well as other airports not engaged in certificated airline service.

[417] A Glendale to Palmdale tunnel would cost $2.3 billion and would be self-supporting from tolls; see www.reason.org/ps324.pdf. Maglev would cost from $8.2 billion to $11.9 billion; see www.scag.ca.gov/Maglev/pdf/lax_palmdale.pdf.

[418] See for example, www.sandag.org/index.asp?projectid=291&fuseaction=projects.detail and www.scag.ca.gov/rtptac/pdf/2007/tac082707_4_1.pdf. Also see www.reason.org/ps324.pdf, pp-13–16.

[419] www.mtc.ca.gov/planning/air_plan/RASP_FinalReport.pdf, p.32

[420] More than 80 percent of greenhouse gas emissions in California are CO_2, www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF, p5.

[421] CHSRA, *The High Speed Train is Earth Friendly*, www.highspeedtrainsforca.com/PDFFiles/EIR%20intro3.pdf. CHSRA documents and officials

have variously used "pounds" and "tons" to characterize anticipated CO_2 reductions. The international parlance is "tons" and the use of "pounds" tends make the impact look larger.

422 CHSRA, *California High Speed Train*, package presented to the Senate Transportation and Housing Committee, January 11, 2008, page 13.

423 CHSRA claims on greenhouse gas emissions have been inconsistent. Upon the signing of AB 3034, CHSRA Chairman Quentin Kopp issued a statement to the effect that HSR would reduce CO_2 emissions by 12 billion pounds, which is the equivalent of 5.4 million tons, a figure that is nearly 80 percent higher than the 3.1 million ton figure indicated in the correction to the NCEIS more than two months earlier (Addendum/Errata to NCEIS, Table 3.3-7).

424 All references to tons are metric tons. A metric ton is 1.10 U.S. tons.

425 Terry Barker, Igor Bashmakov, et al., "Mitigation from a cross-sectoral perspective," Intergovernmental Panel on Climate Change, 2008, www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter11.pdf, p. 621.

426 By comparison, carbon offsets can be purchased for $10 to $12 per ton of carbon dioxide (www.carbonfund.org/site/pages/carbon_calculators/), a fraction the IPCC ceiling. Governor Schwarzenegger, Speaker of the House of Representatives and San Francisco Congresswoman Nancy Pelosi and former Vice-President Al Gore have purchased such offsets to compensate for their use of air travel; see for example: www.nativeenergy.com/pages/individuals/3.php, www.pacificforest.org/news/pdf/Gov-ERs-Purchase-PR-12-3-07.pdf, www.pacificforest.org/news/pdf/PelosiPRfinal.pdf.

427 McKinsey notes that this can be accomplished while "maintaining comparable levels of consumer utility," which means, "no change in thermostat settings or appliance use, no downsizing of vehicles, home or commercial space and traveling the same mileage" (though McKinsey envisions car mileage improvements more substantial than called for in the recent federal energy bill). *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* McKinsey & Company, The Conference Board, Executive Report, December 2007, www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf, p. ix. This report was co-sponsored by Environmental Defense Fund, the Natural Resources Defense Council (NRDC), Shell, National Grid, DTE Energy and Honeywell.

428 Calculated from McKinsey.

429 CO_2e means 'carbon dioxide equivalent.' This is the international standard for measuring GHGs. GHGs other than CO2 are converted into CO_2e based upon their "global warming potential."

430 U.S. Department of Energy, Energy Information Administration, www.eia.doe.gov/oiaf/1605/ggrpt/.

431 Throughout the international literature on GHG emission reduction, there is considerable concern about the most cost-effective achievement.

432 Including transmission losses.

433 The CO_2 reduction of 8.7 tons cited in the CHSRA testimony to the state Senate Transportation and Housing Committee was above the 8.0 million ton reduction reported in the Draft NCEIS (calculated from daily figure in Table 3.3-11), which was current at the time (January 2008).

434 NCEIS, p. 3.5-15.

435 www.arb.ca.gov/cc/ccms/ccms.htm.

[436] www.arb.ca.gov/newsrel/nr050808b.htm.

[437] www.eia.doe.gov/oiaf/aeo/index.html.

[438] Calculated from data in the U.S. Department of Energy, Energy Information Administration, *2008 Annual Energy Outlook*, Reference Case. This figure may be overly conservative. The McKinsey & Company report (www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf) indicates that average fuel economy could approach 45 miles per gallon by 2030. General Motors data indicates that new hybrid electric automobile technology, to be on sale early in the next decade, could average more than 50 miles per gallon; gm-volt.com/chevy-volt-faqs/.

[439] For example, the International Air Transport Association notes that the industry intends to improve fuel efficiency by 25 percent (which would also mean a 25 percent reduction in GHG emissions). See: www.iata.org/whatwedo/environment/climate_change.htm.

[440] NCEIS Table 3.2-9.

[441] NCEIS Table 3.1-2.

[442] See cahighspeedrail.ca.gov/images/chsr/20080630134004_HSR_Addendum_Revisions %20to%20FEIR_Jun08.pdf, p. 3.1.-2.

[443] No analysis is provided of the CHSRA 2030 High Ridership Scenario. CHSRA provides insufficient information for such an analysis to be performed. Moreover, the CHSRA 2030 High Ridership Scenario is considered so absurdly optimistic as to be highly improbable.

[444] Calculated from Addendum/Errata to NCEIS, Table 3.3-7, www.cahighspeedrail.ca.gov/images/chsr/20080630134004_HSR_Addendum_Revisions%20to%20FEIR_Jun08.pdf.

[445] The airfares are based upon the 2005 average fare using U.S. DOT data for California markets at approximately $100. The expected incremental automobile operating expense per mile of $0.17 is assumed for automobiles. (Incremental costs include gasoline, repairs, tires, but exclude ownership and insurance expenses, which would not be reduced by using HSR.) The basis of this cost estimate is the average cost per vehicle mile from the U.S. Department of Labor Bureau of Labor Statistics (BLS) Consumer Expenditure report for 2005. Other higher figures might be obtained from widely publicized sources such as the American Automobile Association (AAA) and Hertz Car Rental. The AAA and Hertz figures, however, ASSUME much earlier retirement of autos than the actual experience, which is better reflected in the BLS data, and is adjusted for the anticipated improvement in fuel economy as projected by the U.S. Department of Energy. Capital costs are discounted at 7 percent over 30 years. Cost annualization methodology and discount factor from U.S. Office of Management and Budget Circular A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,” October 29, 1992; www.whitehouse.gov/omb/circulars/a094/a094.pdf.

[446] www.cahighspeedrail.ca.gov/images/chsr/20080630134004_HSR_Addendum_Revisions. %20to%20FEIR_Jun08.pdf, Calculated from data in Tables 3.3-4, 3.3-5, 3.3-7

[447] In-state electricity generation, which accounted for 78 percent of the 2005 total electrical supply, is fueled by natural gas (38 percent); nuclear sources (14 percent); coal (20 percent); large hydroelectric resources (20 percent); and renewable resources (11 percent), including wind, solar, and geothermal. Electricity imports in 2005 accounted for 22% of total production. See NCEIS, p. 3.5-7.

[448] 2008$ are used in the CO_2 analysis and the Due Diligence Projections (financial) that follow.

[449] www.arb.ca.gov/cc/scopingplan/document/draftscopingplan.pdf

[450] CARB estimates will be higher to the extent that CHSRA ridership estimates are erroneously optimistic.

[451] See www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.

[452] Calculated from wardsauto.com/keydata/.

[453] Until release of the errata document (June 2008), CHSRA had maintained that the energy consumption in construction would be paid back in one year (NCEIS 3.5-6). This is not atypical of what could be characterized as "wild fluctuations" in CHSRA data. As in the case of the revised, much lower CO_2 emission estimates, it would seem that this significant change would have justified notification to the public from CHSRA. www.cahighspeedrail.ca.gov/images/chsr/20080630134004_HSR_Addendum_Revisions%20to%20FEIR_Jun08.pdf, Page 3.17-16.

[454] Calculation: 50 percent divided by 1.5 percent equals 33.3.

[455] The previous CHSRA figure was based on a traffic projection error according to the June 2008 NCIES errata publication. The previous traffic volume projections had anticipated a 6.4 percent reduction in statewide traffic by 2030 due to HSR. A 35 percent combined reduction in traffic volumes was projected for San Francisco, San Mateo, Alameda and Contra Costa Counties—an amount equal to increasing BART, AC Transit, San Francisco Municipal Railway and SamTrans ridership five times with every new rider being a former auto driver. An 11 percent reduction in traffic volumes was projected for areas of the state outside the HSR corridors; of course, traffic reductions to this extent are absurd. This detail is provided because CHSRA's errata publication characterized these as "technical corrections" that were "more substantial than simple typographical errors."

[456] The definitions of pollutants based upon the abbreviations generally used in GHG reports are as follows: NOx–Oxides of nitrogen, CO–Carbon monoxide, TOG–Total organic gases, PM–Particulate matter.

[457] EIR/EIS, p. 3.0-1.

[458] The news media, often a bellwether for public opinion, has expressed doubts about the HSR program. For examples, see "Boondoggle express," editorial, *Contra Costa Times*, June 12, 2008, www.contracostatimes.com/search/ci_9571277?IADID. Also "Nowhere, fast," editorial, *San Diego Union-Tribune*, May 6, 2007, www.signonsandiego.com/uniontrib/20070506/news_lz1ed6top.html.

[459] Railroads and regulatory agencies often establish platform standards. U.S. standards are based in great part upon the statutory provisions of the Americans with Disabilities Act and FRA guidelines. In Britain, new stations must include a "standard" platform defined as the length "long enough to accommodate the longest train formation regularly booked to stop at a platform." See HM Railway Inspectorate & Safety Policy Directorate, "HMRI's Approach to Non-Standard Station Platform Lengths and Selective Door Operation," RGD-2003-02, www.rail-reg.gov.uk/upload/pdf/rgd-2003-02.pdf, November 13, 2007.

[460] Based on TGV platform at Avignon, France, a stop for TGV trains that operate in tandem. Measured using Google Earth imagery, earth.google.com/.

[461] NCEIS, p. 3.7-3.

[462] NCEIS, pp. S-20 and 3.7-25; NCEIS, *Volume 3: Response to Comments*, letter from Pleasanton Mayor Jennifer Hosterman, p. S.25-26.

[463] *The Almanac*, a newspaper covering Menlo Park, Atherton, Portola Valley, and Woodside on the San Francisco Peninsula has covered the HSR issue comprehensively in 2007 and 2008. Articles outline objections from city councils, local residents, and organizers of a group named Derail. The content is far to extensive to list here; see the newspaper's search function at www.almanacnews.com/index.php.

[464] Rory Brown, "On the Right Track?" *The Almanac*, February 27, 2008, www.almanacnews.com/morguepdf/2008/2008_02_27.alm.section1.pdf.

[465] Rory Brown, "Atherton, Menlo Park councils slam plans for high-speed rail," *The Almanac*, February 6, 2008, www.almanacnews.com/story.php?story_id=5638.

[466] Legal action based on the California Environmental Quality Act. See *Town of Atherton v. California High Speed Rail Authority*, Case No. 2008-80000022, Superior Court of California, Sacramento County, filed August 7, 2008. Also: Rory Brown, "MP, Atherton join suit against high-speed rail," *The Almanac*, August 5, 2008, www.almanacnews.com/news/show_story.php?id=2407; Will Oremus, "Peninsula cities planning suit to block bullet trains in South Bay," *The Mercury News*, August 8, 2008, www.mercurynews.com/peninsula/ci_10139005?nclick_check=1; and Michael Cabanatuan, "Suit filed over state high-speed rail project," *San Francisco Chronicle*, August 9, 2008, www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/08/09/BALT127ODF.DTL

[467] Diana Diamond, "Bullet trains loom for cities, But there's good news, too," *Palo Alto Daily Post*, June 26, 2008, derailhsr.com/page/daily1.htm.

[468] Jonathan Richmond for City of Tustin, *Slicing The Cake: The Case for a Los Angeles–San Diego Bullet Train Service*, August 1983 and *Bullet Train Results Depend Upon An Error of Computation*, November 1984.

[469] California High-Speed Rail Authority, "Environmental Impact Report / Environmental Impact Statement Regional Studies—LAX, LA, to Orange County, San Diego," Revised Draft, July 25, 2001, pp 43 and 50.

[470] Comment Letter AL076, Scott Reekstin, Senior planner, City of Tustin, Community Development Department, August 31, 2004, in EIR/EIS, Volume II: Response to Comments, August 2005, www.cahighspeedrail.ca.gov/images/chsr/20080130110538_ch-4_pg318-331.pdf, p. 4-326.

[471] See Tustin Legacy details at www.tustinlegacy.com/.

[472] See more about Tustin's school construction plans at www.tustinlegacy.com/article.cfm?id=60.

[473] EIR/EIS, Volume I: Report, August 2005, www.cahighspeedrail.ca.gov/images/chsr/20080129182904_ch-6a.pdf, p. 6A-27.

[474] In Texas, HSR opponents had another name for farmland "severance"—they called it "landlocking."

[475] NCEIS, www.cahighspeedrail.ca.gov/images/chsr/20080529170928_Sec_3.8_AgLands.pdf, p. 3.8-1.

[476] Ibid., www.cahighspeedrail.ca.gov/images/chsr/20080129172033_ch-3_part_2.pdf, p. 3.8-14.

[477] Ibid., www.cahighspeedrail.ca.gov/images/chsr/20080529170928_Sec_3.8_AgLands.pdf, p. 3.8-1.

[478] AB3034, p. 6.

[479] “Oversight Hearings of the California High-Speed Rail Authority,” p. 2.

[480] Flyvbjerg et al., p. 45.

[481] In describing what appears to be the most recent capital cost estimate, the Request for Expressions of Interest documents appear to exclude the Oakland–East Bay–San Jose, Altamont Pass, Dumbarton Bridge and Irvine extensions.

[482] “Oversight Hearings of the California High-Speed Rail Authority,” p. 3.

[483] Quentin L. Kopp, Chairman, CHSRA, letter to Alan Lowenthal, Chairman of the Senate Transportation and Housing Committee, January 31, 2008, in “Oversight Hearings of the California High-Speed Rail Authority,” p. 32.

[484] REFI, p. 5.

[485] As is noted in Financial Uncertainty, there is currently no detailed financial plan. The general plan appears to be that state bonds, private investment and federal funding would contribute one-third each to the capital costs. This approach may not be viable and other funding sources have also been mentioned, such as a sales tax, additional bond issues, and local government contributions.

[486] Richard Rider, “California High-Speed Rail Project Dead? Not Dead Enough,” *North County Times*, January 8, 2008, www.nctimes.com/articles/2008/01/09/opinion/rider/20_46_081_8_08.txt. Mr. Rider is chairman of the San Diego Tax Fighters.

[487] Estimated using CHSRA data and the maximum projected Due Diligence Report capital cost escalation of 50 percent.

[488] NCEIS, Volume 3: Responses to Comments, www.cahighspeedrail.ca.gov/images/chsr/20080602143948_Complete%20Volume%203%20wCover.pdf, p. 22–4.

[489] Estimated from proposed HSR travel times, Metrolink travel times in the Los Angeles area, Caltrain Peninsula service in the Bay Area, and recognition that HSR schedules will be faster than commuter schedules even though such work will not permit HSR trains to reach their highest speeds.

[490] Maglev trains operate considerably faster than high speed rail (up to 300 mph, or 483 kph). They are more expensive to build and there is only one in commercial operation (Shanghai Pudong Airport to the outskirts of the Shanghai central business district). Maglev lines from Hamburg to Berlin and from Munich to the airport have been cancelled, both largely due to cost overruns.

[491] NCEIS, Volume 1: Report, p. 2-19.

[492] Quentin Kopp, CHSRA Chairman, letter, Senate High Speed Rail Report pp. 32-33.

[493] Record of Decision California High-Speed Train System,” Federal Railroad Administration, November 18, 2005, www.fra.dot.gov/downloads/RRDev/hst_rod.pdf, p. 33.

[494] Calculated as Los Angeles–Riverside at $2.9 billion, Riverside–Mira Mesa at $4.0 billion, and Mira Mesa–San Diego at $1.2 billion. From EIR/EIS, Volume I: Report, p. 6A-31.

[495] Comments of the CHSRA Executive Director as reported in the Minutes of the meeting of the Authority's Board of Directors, Sacramento, Calif., May 23, 2007, www.cahighspeedrail.ca.gov/images/chsr/20080121164421_052307_min.pdf, p. 5.

[496] Dave Downey, "I-15 work triggers search for new rail route," *North County Times*, September 3, 2008, http://www.nctimes.com/articles/2008/09/03/news/sandiego/z63081b88d1ba8d43882574b900758499.txt

[497] EIR/EIS, Volume I: Report, p. 6A-22.

[498] Eric Bailey, "Proposed L.A.-to-S.F. bullet train hits a snag," *Los Angeles Times*, June 4, 2008, www.latimes.com/news/local/la-me-bullet5-2008jun05,0,7414713.story. Also, Michael Cabanatuan, "Union Pacific won't share with high-speed rail," *San Francisco Chronicle*, Friday, June 6, 2008, www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/06/05/BAL8113I9K.DTL.

[499] The Los Angeles–San Diego 1 hour time is required in SB 1856, which would be lengthened to 1 hour, 20 minutes under AB 3034. As of the publication date, it is unknown if the governor will enact AB 3034 into law.

[500] "The California High-Speed Train Network - The Next Steps to Construction," undated, phasing recommendations approved by the CHSRA board as reflected in the meeting minutes of May 23, 2007, p. 3. Phasing Plan is at www.cahighspeedrail.ca.gov/images/chsr/20080121165954_052307_plan.pdf, p. 3.

[501] "Record of Decision California High-Speed Train System," Federal Railroad Administration, November 18, 2005, www.fra.dot.gov/downloads/RRDev/hst_rod.pdf, p. 33.

[502] To be more specific, the coastal routing is via Norwalk, Fullerton, Anaheim, Orange, Santa Ana, Tustin, Irvine, Laguna Niguel/Mission Viejo, San Juan Capistrano, Capistrano Beach, San Clemente, Oceanside, Carlsbad, Leucadia, Encinitas, Cardiff-by-the-Sea, Solana Beach, and Del Mar.

[503] EIR/EIS, Volume I: Report, p. 6A-26.

[504] Association for California High-Speed Trains, untitled article on Home page at www.highspeedtrainsforca.com/default.asp. As the composition of the association's board of directors shows, it is made up primarily of consulting firms that stand to gain from system construction.

[505] The bullet points are summarized from EIR/EIS, Volume I: Report, www.cahighspeedrail.ca.gov/images/chsr/20080129162048_ch-2.pdf, pp. 2-37, 2-38.

[506] Ibid., p. 2-38.

[507] U.S. Passenger Rail Technologies (Washington, D. C.: Office of Technology Assessment, OTA-STI-222, December 1983) govinfo.library.unt.edu/ota/Ota_4/DATA/1983/8327.pdf, p. 62.

[508] George Flynn, "Wrong system, wrong reasons," *The San Diego Union*, November 14, 1984, p. A–13.

[509] The legislation was AB 3647 and the story is told in detail by Richard Trainor, who was the author of one of the reports critical of the AHSRC; see "Process and Profits," CounterPunch, December 9, 2003, www.counterpunch.org/trainor12092003.html. For later environmental developments, see George Flynn, "Bullet train review outlined by state," *The San Diego Union*, March 21, 1984, p. B-1.

[510] REFI documents, Appendix C.

[511] No analysis is provided of the CHSRA 2030 High Ridership Scenario. CHSRA provides insufficient information for such an analysis to be performed. Moreover, the CHSRA 2030 High Ridership Scenario is considered so absurdly optimistic as to be highly improbable.

[512] Private bond insurance, if it could be obtained in sufficient amounts, would increase the cost of borrowing.

[513] State or federal general obligation bonds would have to be paid back, but not by the HSR system.

[514] In the investor documents (Appendix C), Lehman Brothers indicates that private partners could require profit margins of 13% to 20%.

[515] Calculation: Profit $0.90 billion divided by investment $1.5 billion = 6%.

[516] See Section IV, Forecasting Costs.

[517] See Section IV, Forecasting Costs.

[518] Legislative Analyst's Office, July 1, 2008, "Proposition 1," pp. 2–3, www.lao.ca.gov/ballot/2008/1_11_2008.pdf.

[519] *California Debt Affordability Report*, p. 3.

[520] Ibid., pp. 3–4 and p. 34.

[521] Calculated from US Bureau of the Census data. Excludes net international migration and the natural increase in population (births minus deaths).

[522] Flyvbjerg et al., p. 72.

[523] RFEI documents, Appendix C.

[524] Senate Transportation and Housing Committee Chairman Alan Lowenthal letter to CHSRA Chairman Quentin Kopp (Senate High Speed Rail Report, p. 31)

[525] www.cahighspeedrail.ca.gov/news.aspx?type=Featured%20Items.

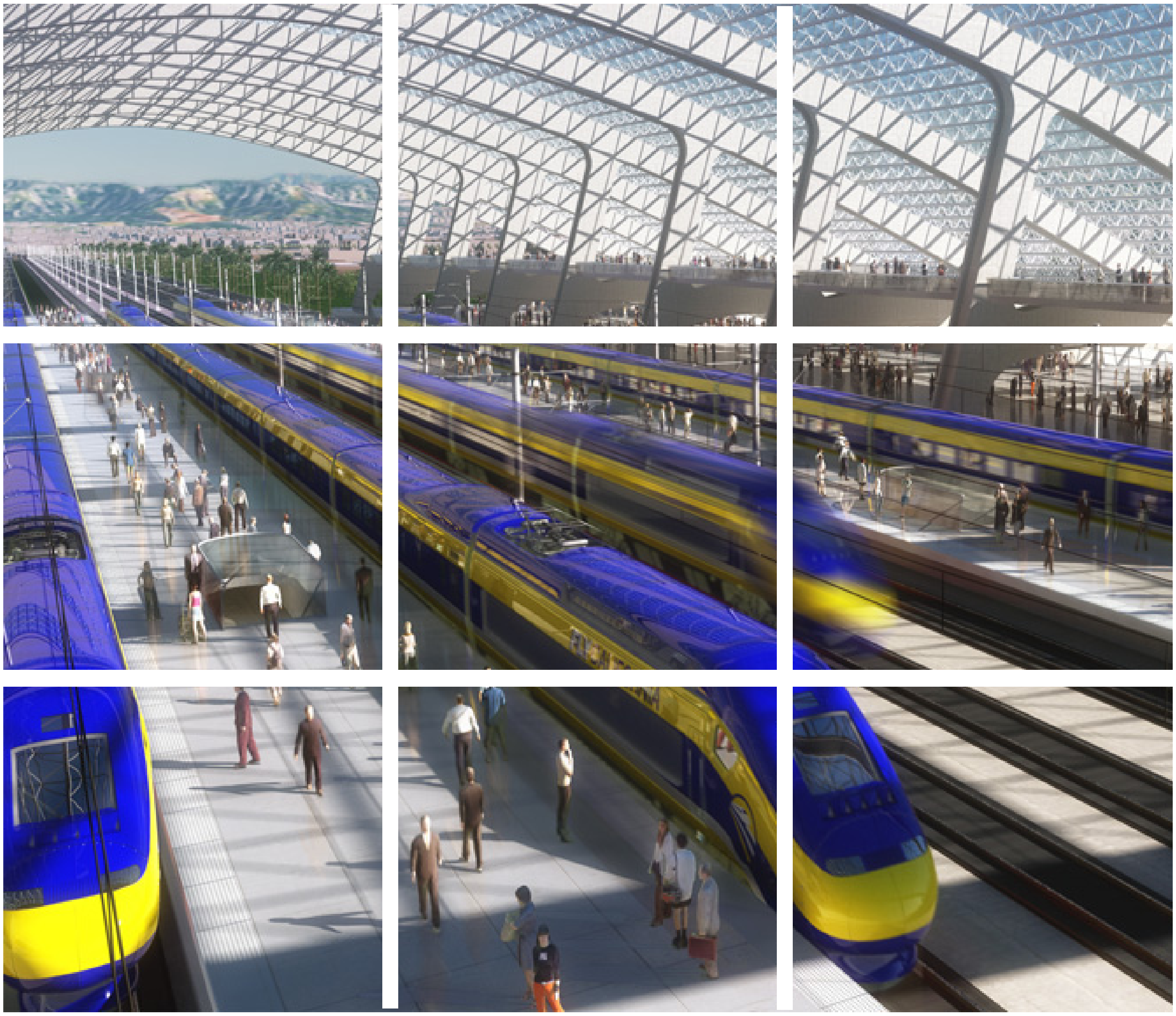
[526] Patti Reising and Ed Cavagnaro, "Interview with Rod Diridon," In Depth: High-Speed Rail," KCBS, January 21, 2008, www.kcbs.com/topic/play_window.php?audioType=Episode&audioId=1317495.

[527] Quentin L. Kopp, "Another View: Let's put state on fast track to the future," *The Sacramento Bee*, June 22, 2008, www.cahighspeedrail.ca.gov/news/SacBeeKopp..pdf.

[528] Patti Reising and Ed Cavagnaro.

[529] California State Treasurer, *California Debt Affordability Report*, p. 3.

[530] "Editorial: High-speed rail bill is back, but answers are needed before November," *The Sacramento Bee*, June 11, 2008, www.sacbee.com/110/v-print/story/1003976.html.



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