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What Holds High-Speed Rail Back: Lessons from Global Systems and California's Experience

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16. Abstract This report examines benefits and challenges of integrating California High-Speed Rail (CHSR) with other rail systems and reviews California legislation impacting HSR's contracting and financing alternatives. The research compares CHSR with high-speed rail systems around the world to identify similarities and differences in costs, speeds, ridership, and operating conditions. It also reviews Japan's Land Readjustment Act as a model for value capture and land assembly and explores international experiences on rail integration, along with U.S. cases from the East Coast and Los Angeles. A review of California's transportation legislation highlights how laws for highways and bridges differ from those for HSR. The study uses a database of oversight reports and legislative documents to identify recurring challenges such as funding shortfalls, permitting, cost escalation, and right-of-way acquisition. Semi-structured interviews with subject matter experts further highlight legal, financial, and project delivery issues. The study concludes that stable funding, early resolution of land and environmental issues, streamlined permitting, and better coordination across agencies are necessary for future HSR projects. Recommendations include creating stronger partnerships with third parties, adopting value capture, crowdsource financing, and reforms to eminent domain and permitting processes. This research demonstrates that effective rail integration is a governance and policy imperative critical to building a connected, sustainable, and economically competitive California.			
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Purpose

To assess how California High-Speed Rail (CHSR) can better integrate operations with other rail services, to review relevant California legislation that affects contracting and financing options for High Speed Rail (HSR), and to identify the principal barriers and possible policy, finance, and delivery responses.

Objectives

- Compare CHSR with international HSR systems (costs, speeds, station spacing, track strategies) to surface transferable lessons.

- Review Japan's land-readjustment / value-capture experience to identify funding and land-assembly approaches that could inform California practice.

- Analyze rail-network integration case studies (international and U.S.) and LA Metro's Rail Network Integration Study (RNIS) to identify benefits, barriers, and implementation requirements for multimodal integration.

- Gather and analyze expert perspectives on project delivery, legal authority, funding certainty, and stakeholder negotiation to produce evidence-based recommendations.

Task / Methodology

- Literature and comparative analysis of international HSR projects (cost / mile, speeds, station spacing, track strategies).

- Legal and policy review of California statutes, HSR-specific laws (e.g., Proposition 1A; Public Utilities Code sections creating CHSRA), and federal rail rules.

- Case synthesis of rail integration studies, including LA Metro's Rail Network Integration Study (RNIS), and East-Coast examples.

- Expert interviews with senior stakeholders (CHSRA officials, peer reviewers, inspector general, and other experts) analyzed via reflexive thematic analysis (Braun & Clarke) using NVivo.

- Collation of oversight / agency reports to produce a frequency-based summary of the project's recurring challenges.

Key findings

- **CHSR's principal problems are structural and institutional, not primarily technical.** Experts repeatedly described funding uncertainty, limited legal authority, fragmented responsibilities, and protracted acquisition and permitting as the main causes of delay and cost escalation.

- **High unit cost and ambitious speed / station tradeoff.** In inflation-adjusted 2025 dollars CHSR's cost per mile (~$196M / mi) places it among the highest in the sampled international projects; simultaneously, CHSR targets very high operating speeds (design up to 220 mph), while planning relatively close station spacing (~38 miles average), producing operational trade-offs and risk.

- **Blended infrastructure complicates delivery but supports integration.** CHSR's mix of new dedicated track and upgraded / shared segments (the "blended" approach) is pragmatic for cost control and network ties (e.g., Caltrain sharing) but introduces scheduling, signaling, and rights conflicts that raise complexity relative to fully dedicated corridors.

- **Top recurring challenges:** Funding shortfalls & financing uncertainty; utility relocation & third-party permits / agreements; CEQA / NEPA and litigation complexity; cost escalation & estimating error; Right-of-way (ROW) acquisition & property impacts. These five show up repeatedly across oversight and agency documents.

- **Rail integration yields clear rider, environmental, equity, and economic benefits, but requires heavy upfront coordination and capital.** LA Metro's RNIS and international case studies show that unified wayfinding, coordinated timetables, integrated ticketing, and first / last-mile strategies increase ridership and reduce GHGs. However, capital needs can be large (RNIS aggregate $2.0–$3.3B in 2022$ for LA recommendations).

- **Japan's land-readjustment / value-capture offers useful tools but is not directly transplantable.** Japan's reserve-land and pooling mechanisms demonstrate how to align landowner incentives to finance transit-oriented development (TOD) and rail; California has partial analogs (special assessment districts, urban renewal), but lacks a comprehensive, largely consensual legal instrument comparable in scope. Implementation would require statutory changes, strong outreach, and institutional capacity.

- **Project Delivery Methods (PDMs) matter less than contract clarity and governance.** Experts argued that labels (design-build, P3, etc.) are less important than clear scope, contractual risk allocation, and enforceable authority; PDMs only work when embedded in predictable funding and statutory clarity.

Recommendations

The report's recommendations aim to address the structural constraints first, then the operational / technical elements.

A. Strengthen funding certainty and diversify financing toolbox

- Pursue long-term, committed funding streams. Advocate for multi-year state / federal commitments (legislative or budget-level) that reduce short-cycle appropriation risk and enable multi-year contracts and procurement.

- Enable investment-grade crowd-sourced financing and alternative instruments. Pilot securities-based crowdfunding / retail bonds as a supplemental source (not replacement) to leverage public support and capture distributed capital; take advantage of JOBS Act pathways for regulated offerings.

- Design staged funding packages for network integration investments. For multimodal integration (RNIS items), develop phased packages combining federal grants, local assessments, and regional contributions to cover the $2.0–$3.3B RNIS scale while retaining implementable phases.

B. Fix governance, authority, and procurement friction

- Clarify and strengthen statutory authority for acquisition, permitting, and enforcement. Amend relevant codes to give CHSRA clearer authority for time-bounded permits, standardized negotiation frameworks with utilities, and expedited eminent domain processes while preserving due process. Experts link these reforms directly to reduced downstream cost and delay.

- Standardize contract templates and risk allocation language. Prioritize contract clarity over choice of PDM; adopt contract forms that allocate utility / third-party risk cleanly and set measurable performance milestones.

C. Use value capture and land-assembly strategically

- **Pilot a California adaptation of land-readjustment / value-capture in targeted station areas.** Use graduated tools (special assessment districts, negotiated land pooling, joint development and reserve-land sales) in one or two station areas as testbeds; paired with strong outreach and binding benefit-sharing. Japan's successes and limits are instructive: legislation, consensus building, and patient timelines are required.

D. Advance multimodal integration measures (operations & rider experience)

- **Adopt a regional integration playbook:** (a) unified wayfinding and station retrofits, (b) interoperable fare / payment architecture and revenue-sharing protocols, (c) first / last-mile programs (micro-mobility, shuttles, active-travel investments), and (d) standardized real-time data feeds. LA Metro's RNIS identifies these as high-benefit items but notes financing and agency alignment hurdles.

E. Improve delivery sequencing and risk mitigation

- Require readiness gating before major construction starts. Enforce "no major works until ROW, utilities, and key permits are secured" to avoid the multi-year inefficiencies experts described (construction starting before acquisition caused years of inefficiency).

- Establish a dispute-resolution and acceleration unit (inside CHSRA or a joint state office) to fast-track disputes with utilities, counties, and private owners under defined timelines.

F. Risks, limits, and expected outcomes

- Risk of legal and political opposition to statutory changes: reforms to eminent domain, revenue capture, or new finance tools will require strong stakeholder outreach and careful legal drafting.

- Pilot finance mechanisms are supplemental, not a solution: crowd-investment and value capture can help close gaps but cannot replace core, long-term public funding.

- Integration requires multi-agency commitment: operational gains appear significant (ridership, GHG reduction, equity), but realization depends on sustained institutional coordination and shared governance for revenue sharing and standards.

Conclusion

The report concludes that CHSR's technical design is not the principal obstacle; addressable governance, financing, and sequencing problems are the core bottlenecks. International and domestic comparisons (including Japan's land-readjustment experience and LA Metro's RNIS) provide practical models that California can selectively adapt. Implementing a combination of (1) statutory and governance reforms to reduce pre-construction uncertainty, (2) staged, pragmatic financing pilots (crowd investment and value capture), and (3) a focused multimodal integration program will materially increase the probability that CHSR delivers the public benefits envisioned while controlling cost and schedule risk.

1. Comparison Between Various High-Speed Rails Around the World

California High-Speed Rail (CHSR) is frequently discussed in terms of its cost, schedule, and political controversy, but those discussions often lack a consistent benchmark. This chapter situates CHSR within an international context by comparing it to prominent high-speed rail (HSR) programs in Europe and Asia, as well as selected U.S. intercity rail investments. The purpose of this comparison is to establish a more "apples-to-apples" understanding of how CHSR aligns with and differs from peer systems on the dimensions that most strongly influence project feasibility, service quality, and long-term performance.

To support that benchmarking, the chapter compiles and synthesizes publicly available information on representative HSR projects and evaluates them using a common set of comparison lenses. Specifically, the chapter examines (1) construction cost per mile, (2) speed, travel time, and corridor distance, (3) passenger costs, (4) the extent to which systems rely on new track construction versus upgrades to existing infrastructure, and (5) broader operating context, including rail culture, feeder networks, and auto-oriented travel behavior. Together, these measures help identify where CHSR's challenges are typical of large HSR megaprojects and where they are uniquely shaped by California's governance, geography, and delivery context.

The sections that follow present these comparisons in sequence, beginning with unit costs and then moving through operational performance, pricing, infrastructure strategy, and contextual factors that affect ridership and network effectiveness.

1.1 Cost Per Mile

Some of the most prominent high-speed rail (HSR) networks discussed in this chapter come from Austria, China, France, Germany, Italy, Japan, South Korea, the United Kingdom, and the United States. Table 1 compiles representative corridor-level construction costs for these systems using the best available published figures, including costs in local currency, construction period, exchange-rate conversion to U.S. dollars (at the time of construction), and the resulting cost per mile metric.

Across the sample, unit costs vary dramatically. On the high end, California High-Speed Rail (Merced–Bakersfield EOS) is estimated at ~$196 million per mile (Feb. 2025 dollars), which is the highest value in Table 1. The next-highest examples in the table are South Korea's Seoul–Busan corridor at ~$167.23 million per mile and the UK's HS1 (London–Channel Tunnel) at ~$153.3 million per mile, both of which are also major, infrastructure-intensive projects.

At the low end, several well-known systems appear far less expensive on a per-mile basis—for example, Japan's Tōkaidō Shinkansen (~$3.30M / mi), France's LGV Sud-Est (~$5.53M / mi), and the U.S. Acela corridor (~$1.86M / mi)—highlighting how strongly unit costs can differ by era, scope, and delivery context. Figure 1 visualizes these differences to make the spread and outliers apparent.

Because the cost figures are drawn from varied sources and project accounting practices, Table 1 should be interpreted as a benchmarking comparison, not a precise "ranking." Reported costs may reflect different inclusions (e.g., some sources may include primarily capital construction while others may include additional elements such as land acquisition, rolling stock, or financing), and project context (e.g., structures / tunneling, procurement approach, and reporting standards) can materially influence unit costs.

Figure 1. Cost / Mile Comparison of HSRs Around the World

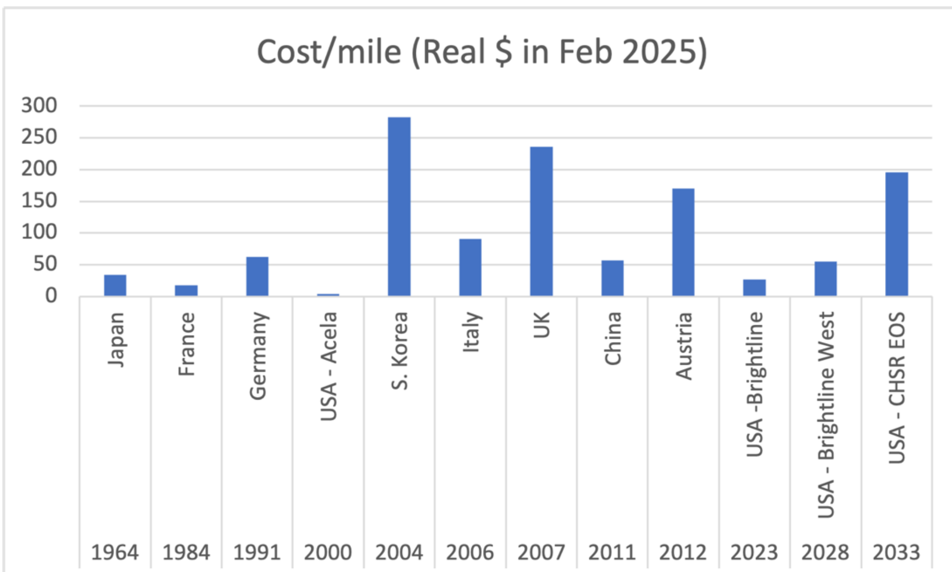


Table 1. Cost Per Mile Comparison of HSRs around the World

Country	Route	Construction Period	Cost in Local Currency	Average Exchange Rate (Local Currency to USD)	Cost in USD (at time of construction)	Distance (miles)	Cost per Mile in Millions (USD)	Sources
Austria	Vienna to St. Pölten (Lower Inn Valley)	2006–2012	€2.8 billion	• 0.793 EUR / USD	$3.79 billion	31	$122.2	Reidinger (2013), UIC (2023)
China	Beijing to Shanghai	2008–2011	¥220.9 billion	N / A	$33.45 billion	819	$39.68	Reuters (2011)
France	Paris to Lyon (LGV Sud-Est)	1976–1984	₣ 7.85 billion	5.67 EUR / USD	$1.38 billion	250	$5.53	Guardian (1981), Decomotiv (2010)
Germany	Hanover to Würzburg (ICE)	1973–1991	DM 11.87 billion	2.22 DEM / USD	$5.35 billion	203	$26.37	Bundestag (1994), Trainline (n.d.)
Italy	Rome to Naples	1992–2006	$7.37 billion	N / A	$7.37 billion	129	$57.13	Albalate and Bel (2012)
Japan	Tokyo to Osaka (Tōkaidō Shinkansen)	1959–1964	¥380 Billion	360 JPY / USD	$1.06 billion	320	$3.30	Jun (2024), Briginshaw(2014)
South Korea	Seoul to Busan (KTX)	1992–2004	₩18.43 trillion	1039.68 KRW / USD	$17.73 billion	106	$167.23	Kim (2005)
UK	London to Channel Tunnel (HS1)	1996–2007	£6.2 billion	0.604 GBP / USD	$10.27 billion	67	$153.3	NAO (2012)
USA	Boston to Washington, D.C. (Amtrak Acela)	1996–2000	$850 million	N / A	$850 million	457	$1.86	Dao et al. (2005), Black (2005)

Country	Route	Construction Period	Cost in Local Currency	Average Exchange Rate (Local Currency to USD)	Cost in USD (at time of construction)	Distance (miles)	Cost per Mile in Millions (USD)	Sources
USA	Miami to Orlando (Brightline)	2019–2023	$6 billion	N / A	$6 billion	235	$25.53	Brightline (2023)
USA	Rancho Cucamonga to Las Vegas (Brightline West)	2024–2028 (expected)	$12 billion	N / A	$12 billion	218	$55.1	Clay (2025)
USA	Merced to Bakersfield EOS (California HSR's P50 Estimate)	2015–2033	$33.815 billion	N / A	$33.815 billion	171	$196	California High-Speed Rail Authority (2024)

1.2 Speed, Travel Time, and Distance

Several authors have discussed the combinations of distance and speed that support effective high speed rail service. Rutzen and Walton (2011) classify high speed rail systems based on the speeds they can achieve and the distances they cover, and they emphasize that high speed projects are most effective when they connect large urban centers where rail can compete on total travel time with both automobile and air travel. Campos and de Rus (2009) similarly review experience from more than one hundred high speed rail projects and note that conventional high-speed services operating at about 155 to 220 miles per hour have been especially successful where they can significantly reduce travel times on intercity corridors.

The Federal Railroad Administration has also described the markets where high speed rail is most competitive. The Congressional Research Service reports that federal policy has generally considered high speed rail to be time competitive in passenger markets between about 100 and 500 miles (Peterman, Frittelli, & Mallett, 2013). Within that broad range, high speed rail can substitute for both auto and air trips. The same report notes that high speed rail can compete directly with air travel when city pairs are around 400 to 500 miles apart, provided that rail can offer similar or better total travel times once access and waiting times are included (Peterman et al., 2013).

Regional planning work in the United States supports this distance range. The Regional Plan Association, working with the America 2050 program, developed a corridor ranking matrix that gave the highest weights to city pairs between 150 and 300 miles and still assigned substantial weight to distances between 100 and 500 miles (Hagler & Todorovich, 2009). In that work, rail corridors shorter than about 100 miles were treated more like commuter or regional markets, while corridors longer than about 500 miles were generally expected to continue to rely on air service.

These distance ranges describe the length of the intercity corridor, not the distance between individual stations. However, the spacing between stations strongly affects the speeds that trains can achieve in practice. These patterns are summarized for a set of international routes in Table 2, which lists corridor length, number of stations, average distance between stations, and average speed for selected high speed and higher speed services.

Table 2. High Speed Rails Around the World

Region / Country	Company	Route	Distance (mi)	Stations Covered	Average Distance Between Stations (mi)	Average Speed (mph)	Source
Austria	OBB Railjet	Vienna to Salzburg	192	4	64	81	AustrianRailways.com. (n.d.)
China	Shanghai Maglev	Shanghai to Pudong Int. Airport	19	2	19	163	Nilson (2023)
France	SNCF (TGV inOui)	Paris Lyon to Marseille Saint-Charles	411	2	411	136	Rail Europe (n.d.)
Germany	Deutsche Bahn	Hanover to Berlin	153	5	38	96	Trainline (n.d.)
Italy	Italia Rail	Florence to Rome	162	2	162	108	ItaliaRail.com (n.d.)
Japan	Joetsu Shinkansen	Tokyo to Niigata	168	12	15	82	Shinkansen-ticket.com (n.d.)
South Korea	KTX	Seoul to Busan	259	4	86	115	Train-Spread.com (n.d.)
UK	HS1	London to Channel Tunnel	68	4	23	30	Institute of Civil Engineers (n.d.)
Northeast, US	Acela	Boston to Washington	457	12	42	71	Amtrak (2024), Dao et al. (2005)
Florida, US	Brightline	Miami to Orlando	235	6	47	69	Brightline (2024), Brightline. (n.d.)
California & Nevada, US	Brightline West	Rancho Cucamonga to Las Vegas	218	4	73	101	Brightline West (n.d.)
California, US	CHSR	IOS (Bakersfield to Merced)	171†	5	43†	200*	California High-Speed Rail Authority (2024)
California, US	CHSR	PHASE 1 (San Francisco to Anaheim)	494†	12	45†		
Average			214※	5	83※	95※	

Notes

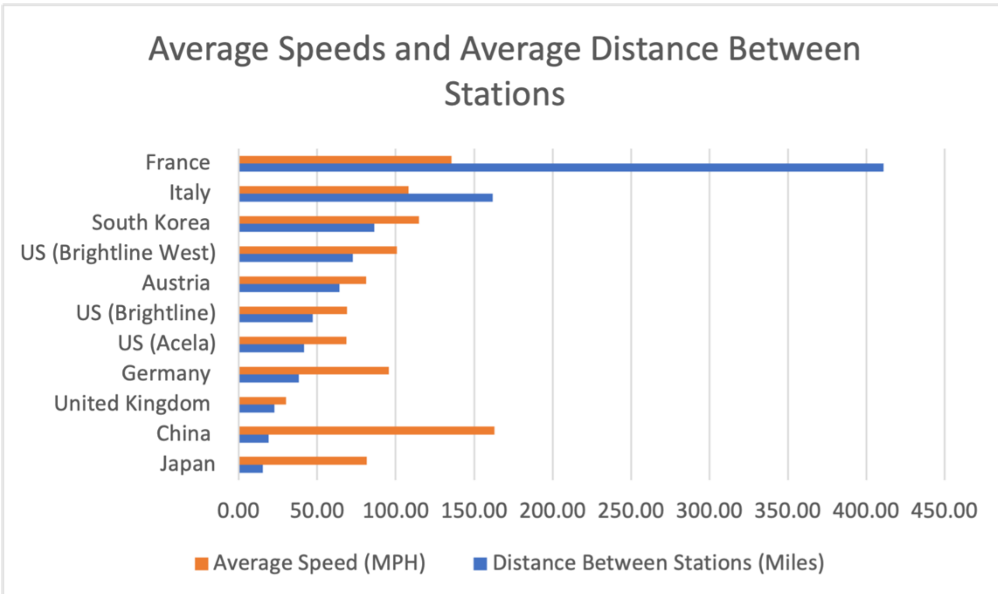
* CHSR trainsets will attain speeds up to 220 mph. It is expected to run on average speeds of 200 mph.

† These are anticipated numbers for CHSR

※ These do not include anticipated numbers.

International experience helps illustrate how corridor length and station spacing interact. Figure 2 shows the relationship between average distance between stations and average speed for selected high speed and higher speed corridors in China, Japan, France, Italy, Germany, the United States, and California.

Figure 2. Comparison of HSRs – Average Speeds and Average Distance Between Stations



On Beijing to Shanghai, one of China's flagship high speed rail lines, the line length is about 820 miles and was designed for regular operation at about 217 miles per hour, with the aim of providing an average commercial speed close to 205 miles per hour between the two cities (Beijing–Shanghai High-Speed Railway Co., 2009, as summarized in Zhang, 2009). China's national high speed rail network generally uses dedicated infrastructure, avoids level crossings, and is designed so that long stretches of the route allow sustained operation at very high speeds (Campos & de Rus, 2009). This allows China to maintain high average speeds even where there are multiple intermediate stations, as many trains run limited-stop patterns and bypass some stops.

Japan shows a similar pattern, but on shorter, denser corridors. The Tokaido Shinkansen between Tokyo and Osaka is roughly 320 miles long and operates at maximum speeds up to about 200 miles per hour on a fully separated, standard-gauge dedicated alignment (Japan Ministry of Land, Infrastructure, Transport and Tourism, 2014; Shinkansen, n.d.). The Shinkansen network is built on dedicated tracks that do not carry freight trains or conventional narrow-gauge services and was designed to maintain high speeds with relatively gentle curves and moderate gradients (Campos & de Rus, 2009; Mediarail, 2024). On the Tokaido corridor, some services (such as Kodama) stop at many stations, often at spacing on the order of 20 to 25 miles in certain segments, while others (Hikari and Nozomi) skip intermediate stops to preserve high average speeds between the main cities (Kodama, n.d.; Hikari, n.d.). This combination of dedicated infrastructure, high design speeds, and multiple stopping patterns allows Japan to maintain high average speeds even though the spacing between stations on parts of the corridor is relatively short.

It is important to note that these Japanese and Chinese services are almost entirely conventional steel-wheel high speed rail. The Shanghai maglev is a separate 19-mile airport express line that operates at up to about 268 miles per hour but is not part of the national high speed rail network and is not representative of most Chinese or Japanese intercity services (Shanghai Maglev Train, n.d.; Fastest Trains in China, n.d.). In other words, the strong performance of China and Japan in Figure 2 reflects well-designed conventional high-speed rail, not widespread use of maglev technology.

France and Italy offer a different contrast. On the corridor between Paris and Marseille, trains cover about 410 miles in as little as about 3 hours on high-speed services, corresponding to an average speed on the order of 130 to 140 miles per hour (Trainline, n.d.; Rail Europe, n.d.). The station spacing between these two major cities is large, with relatively few intermediate stops on the main high-speed route. Italy's Rome to Florence corridor is shorter, at about 160 miles, but high-speed trains commonly cover this distance in about 1 hour and 20 to 30 minutes, yielding average speeds around 110 miles per hour on trains that make only a small number of intermediate stops (ItaliaRail, n.d.; Trainline, n.d.). In both France and Italy, high average speeds are supported by long sections of dedicated high-speed track, large distances between major stops on intercity services, and limited slow segments near the largest terminals.

Germany's Hanover to Berlin corridor is an informative outlier. The distance between Hanover and Berlin is about 150 to 155 miles, and high-speed trains regularly complete this trip in roughly 1 hour and 35 to 50 minutes, for average speeds around 90 to 95 miles per hour (Trainline, n.d.; Omio, n.d.). This is comparable to the projected average speed for Brightline West between Las Vegas and Rancho Cucamonga, which plans to cover about 218 miles in about 2 hours and 10 minutes at top speeds near 186 to 200 miles per hour, giving an average speed of about 100 miles per hour (Nevada Department of Transportation, n.d.; Brightline West, n.d.). However, the average spacing between stations on the Hanover to Berlin corridor is much closer to the spacing found on the Northeast Corridor than to the spacing on French or Italian high-speed lines.

The reason Germany can sustain such high average speeds with relatively short station spacing lies in infrastructure and operations. The Hanover to Berlin line is largely a high standard line designed for 155 miles per hour operation, with long straight sections, no level crossings, and modern cab signaling and train control systems (International Union of Railways, 2010; Deutsche Bahn, as summarized in Campos & de Rus, 2009). Many trains operate limited-stop patterns and use the high-speed sections intensively. By contrast, Amtrak's Acela service between Boston and Washington runs on an older alignment with sharper curves, multiple movable bridges, and long segments where maximum speeds are well below 125 miles per hour, even though the corridor length (about 450 to 460 miles) and the average spacing between stations are similar to some European examples (Railway Technology, n.d.; Peterman et al., 2013).

The planned California high speed rail system sits within this same international context. The full system is planned as an approximately 800-mile network connecting San Francisco, Los Angeles, and other major cities, with the initial San Francisco to Los Angeles segment designed for operating speeds up to 220 miles per hour on dedicated high-speed infrastructure (California High-Speed Rail Authority, 2016; WSP, n.d.; High Speed Rail Alliance, n.d.). Technical memoranda for the project specify design standards for 220 miles per hour operation and provide acceleration data showing that high speed trains require a substantial distance to reach their maximum speed and to break down to station speeds (California High-Speed Rail Authority, 2016). In many sections of the initial operating segment, planned station spacing appears to be on the order of a few tens of miles rather than hundreds of miles, which is closer to the Japanese and German practice than to the French or Italian examples.

Because of basic physics, shorter distances between stations make it harder for any high-speed rail system to run at full speed. Guidance from the International Union of Railways indicates that a typical high-speed train may require roughly 6 to 12 miles to accelerate from a stop to about 185 miles per hour and several miles to brake safely back to a stop, depending on the specific trainset and gradient (International Union of Railways, 2010). California's own design memoranda provide similar order-of-magnitude distances for trains designed for 220 miles per hour (California High-Speed Rail Authority, 2016). If stations are spaced too closely, trains will spend much of each segment accelerating and braking and will have only a short distance at or near maximum speed, reducing the average speed between stations.

Taken together, these examples suggest several implications for California. First, the overall San Francisco to Los Angeles corridor length falls within the 100-to-500-mile range where federal policy and regional planning studies expect high speed rail to be most competitive with air travel (Hagler & Todorovich, 2009; Peterman et al., 2013). Second, to achieve average speeds closer to those observed in Germany and Japan rather than those on Acela, California will need to protect long, high speed segments between its main stations, minimize slow sections on approach to major cities, and consider operating patterns that allow some trains to skip intermediate stops. Third, while shorter distances between stations can improve access for more communities, they also limit the distance available for acceleration and braking, which can prevent trains from using the full design speed over much of the line. The experience from Japan, Germany, France, Italy, and China suggests that California's choices about station spacing, line geometry, and service patterns will be as important as the nominal maximum speed in determining whether the system operates as an effective high speed rail service.

1.3 Passenger Costs

Passenger fare levels shape ridership, perceived value, and the degree to which high-speed rail (HSR) is competitive with driving and flying. Unlike construction cost comparisons, which reflect capital investment, passenger costs reflect a combination of fare policy, market conditions, and pricing practices (e.g., peak / off-peak, yield management, discounts, and service class). To provide a consistent cross-system snapshot, this section benchmarks observed ticket prices for representative HSR corridors and converts them into a comparable cost-per-mile measure.

For each HSR system discussed earlier, one representative route was selected and one-way fares for one adult were collected for departures on June 30, 2025 using the operator's booking channel or a well-established ticketing partner (Table 3).

The fare dataset for each route included the set of available departures shown for that date, and the analysis computed an average fare for the day to reduce sensitivity to any single departure time. The comparison metric reported in Table 3 is:

Passenger cost per mile ($ / mi) = average one-way fare (USD) ÷ route distance (miles)

This is a deliberately simple benchmark intended to show broad differences in passenger price levels across systems using a common unit.

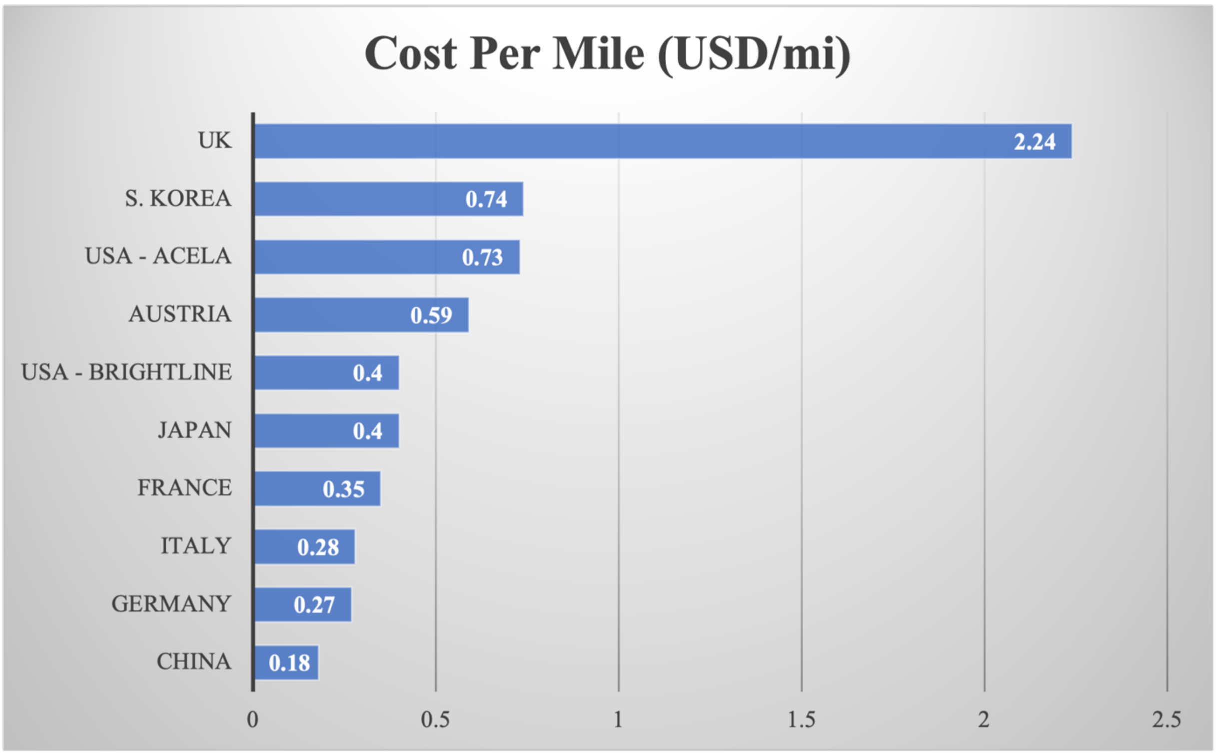
Table 3. Passenger Costs Per Mile

Country	Route	Cost	Distance (mi)	Cost per Mile ($ / mi)	Source
Austria	Vienna to St. Pölten (Lower Inn Valley)	€16 ($18.20)	31	0.59	ÖBB (n.d.)
China	Beijing to Shanghai	$143.94	819	0.18	Rail Ninja (n.d.)
France	Paris to Lyon (LGV Sud-Est)	87.85	250	0.35	Trainline (n.d.)
Germany	Hanover to Würzburg (ICE)	€48.25	203	0.27	Deutsche Bahn (n.d.)
Italy	Rome to Naples	$36	129	0.28	ItaliaRail (n.d.)
Japan	Tokyo to Osaka (Tōkaidō Shinkansen)	$129.14	320	0.40	Shinkansen-ticket.com (n.d.)
South Korea	Seoul to Busan (KTX)	$78	106	0.74	Rail Ninja (n.d.)
UK	London to Channel Tunnel (HS1)	$150	67	2.24	Eurostar (n.d.)
USA	Boston to Washington, D.C. (Amtrak Acela)	$333	457	0.73	Amtrak (n.d.)
USA	Miami to Orlando (Brightline)	$95.17	235	0.40	Brightline (n.d.)
USA	Rancho Cucamonga to Las Vegas (Brightline West)	TBD	218	NA	
USA	Merced to Bakersfield EOS	TBD	171	NA	

Notes: CHSR ticket prices not finalized yet, so not included here

Because rail pricing is dynamic and varies with purchase timing, seat class, refundability, demand, and discount programs, the values in Table 3 should be interpreted as a point-in-time snapshot, not a definitive statement of typical fares across the year. Shorter routes can also appear more expensive on a $ / mi basis because fixed components of pricing (and premium service positioning) are spread over fewer miles.

Figure 3. Comparison of Passenger Cost Per Mile for HSRs Around the World



The results show substantial variation in passenger cost per mile. UK HS1 (London–Channel Tunnel / Eurostar) is a clear outlier with the highest cost per mile, while China (Beijing–Shanghai) reports the lowest cost per mile in the dataset. Across the remainder of the sample, most systems cluster in a mid-range that suggests broadly comparable passenger price levels once distance is accounted for, even though they operate in very different institutional and market contexts.

CHSR fares are not yet published, so Table 3 does not report a passenger cost-per-mile value for the Merced–Bakersfield early operating segment. When fare policy is established, CHSR will need to balance multiple objectives, e.g., revenue sufficiency, affordability, ridership growth, and competition with auto and air travel. Importantly, higher project costs or schedule changes do not translate directly into a predictable $ / mi fare outcome, because fares can be shaped by policy decisions, operating plans, and the degree of ongoing subsidy or cross-support. Accordingly, the most defensible way to benchmark CHSR passenger costs at this stage is to evaluate fare scenarios (e.g., low / medium / high) anchored to peer systems and to CHSR's stated service goals, rather than to infer fares from project delivery conditions.

International experience also shows that pricing structures vary widely: some systems rely on tiered fares and differentiated service patterns, while others emphasize affordability and broad access. These choices influence not only ridership, but also the public's perception of whether HSR functions as a premium service or a mass-mobility option. In France and Spain, ticket prices are tiered, often with subsidies or low-cost carriers operating on high-speed lines (Rutzen & Walton, 2011). In China, where the system covers a wide range of regions and socioeconomic groups, fares are structured to reflect trip distance and train category, offering affordability to a broader base (Ren et al., 2020).-The California system faces a delicate balance. On one hand, it must recover costs; on the other, it is intended as a sustainable and socially inclusive alternative to car and air travel. If fares are too high, the system may lose potential riders, particularly from lower-income groups or those outside of major urban centers. If set too low, financial viability may be strained. International experience shows that fare policy must align with the system's broader goals for mobility, equity, and modal shift.

1.4 New Tracks vs. Upgrading Existing Tracks

The decision to install new tracks or upgrade existing tracks has a significant impact on any HSR's costs. As a result, this research was also extended to learn about which HSRs were able to utilize their existing tracks by upgrading them compared to those that needed to lay new tracks.

As shown in Table 4, Austria was the only international country that used their existing tracks. All other countries had to lay new tracks. For the U.S.'s Acela, the existing tracks could be utilized. That should have reduced the overall costs that could have incurred for issues such as ROW, utility transfer and permitting. Similar benefits could have benefitted Brightline. For CHSR, the Phase 1 between San Francisco to Anaheim includes a blended strategy which includes both upgrading old tracks and laying new tracks. According to the CHSRA, the tracks between Burbank and Los Angeles will be upgraded for high-speed rail, and the segment between San Francisco and Gilroy will share tracks with Caltrain (CHSRA, n.d.). As seen in Table 4, the CHSR is not directly comparable to other high-speed rail systems because it is the only one that uses a blended approach.

Table 4. Track Availability

Country	Route	New Tracks	Upgrading Existing Tracks	Source
Austria	Vienna to St. Pölten (Lower Inn Valley)		Yes	keep.eu
China	Beijing to Shanghai	Yes		Railway Gazette
France	Paris to Lyon (LGV Sud-Est)	Yes		RetoursEU
Germany	Hanover to Würzburg (ICE)	Yes		Bundestag (1994)
Italy	Rome to Naples	Yes		Railway Technology (2000)
Japan	Tokyo to Osaka (Tōkaidō Shinkansen)	Yes		Watson (2021)
South Korea	Seoul to Busan (KTX)	Yes		Kim (2005)
UK	London to Channel Tunnel (HS1)	Yes		Bechtel (n.d.)
USA	Boston to Washington, D.C. (Amtrak Acela)		Yes	
USA	Miami to Orlando (Brightline)		Yes	
USA	Rancho Cucamonga to Las Vegas (Brightline West)	Yes		Puckett (2024)
USA	EOS (Merced to Bakersfield)	Yes		HSRA (n.d.)
USA	PHASE 1 (San Francisco to Anaheim)	Yes	Yes	Mass Transit (2011)

Building new tracks designed specifically for high-speed trains allows systems to operate at full potential. Countries such as Japan and France have adopted this model, focusing on dedicated corridors for maximum speed and reliability. Others, such as Spain, have blended new high-speed lines with upgraded conventional tracks to manage costs and improve network integration (Rutzen & Walton, 2011). Germany introduced mixed-use tracks, allowing freight during off-peak hours. California has followed the dedicated track model for large segments, especially in the Central Valley, to support long-term speed and service goals. However, there are also sections where blended use is planned, particularly near urban centers. This reflects a pragmatic compromise. It reduces capital costs while maintaining strategic speed targets. Yet, blending comes with challenges, including scheduling conflicts and speed limitations. International experience suggests that hybrid designs require careful planning to ensure that operational efficiency is not compromised.

1.5 Rail Culture, Feeder Network, and Car-Centric Behavior

The success of a high-speed rail (HSR) system depends not only on the performance of the trains themselves, but also on the broader travel culture and the quality of the feeder networks that connect passengers to and from HSR stations. Rail culture refers to the extent to which travelers are accustomed to using rail as a routine mode of daily, regional, and intercity travel. Feeder networks comprise the set of complementary transportation services such as commuter rail, metro, light rail, buses, bicycles, and pedestrian infrastructure, that enable seamless access to HSR stations. Together, rail culture and feeder networks play a central role in shaping ridership outcomes.

A critical manifestation of weak feeder networks is the first-mile / last-mile (FMLM) problem, which describes the difficulty travelers face in reaching an HSR station from their trip origin (the first mile) and completing their journey from the destination station to their final endpoint (the last mile). Even when high-speed rail provides fast and reliable intercity travel, poor access at either end of the trip can significantly reduce its overall attractiveness. If travelers must rely on long car trips, expensive parking, infrequent local transit, or inconvenient transfers to access stations, the time and effort savings offered by HSR can be eroded.

The Northeast Corridor, served by Amtrak's Acela, illustrates how strong rail culture and mature feeder networks mitigate the FMLM problem. The East Coast benefits from a dense and long-established rail ecosystem in which intercity rail is tightly integrated with commuter rail systems, subways, buses, and walkable urban environments. Many stations are located in central business districts with direct connections to multiple transit modes, allowing passengers to complete door-to-door trips with minimal reliance on automobiles. As a result, car dependency is relatively lower, and rail travel is embedded in everyday mobility patterns.

In contrast, California's transportation landscape presents greater challenges for high-speed rail. Much of the CHSR corridor is characterized by auto-oriented land use patterns, dispersed development, and limited regional transit coverage. In many cities, future HSR stations are located in areas where local transit service is infrequent or incomplete, pedestrian and bicycle infrastructure is underdeveloped, and land uses are not concentrated around stations. These conditions intensify the FMLM problem, forcing many potential riders to rely on private automobiles for station access. High levels of car dependency, especially solo driving can reduce the convenience advantage of HSR, discourage ridership, and increase demand for parking rather than transit-oriented access.

International experience highlights the importance of addressing these challenges. In countries with strong rail cultures such as Japan and France, travelers are accustomed to multimodal journeys in which local and regional rail, buses, and metros reliably feed into high-speed corridors. Station areas are typically planned as transit hubs, with coordinated schedules, integrated ticketing, and dense, mixed-use development that supports walking and short transfers. Similarly, China's HSR system has achieved widespread use not only through affordability but also through systematic integration with regional rail and urban transit networks, even in less-developed regions (Ren et al., 2020).

For California, the absence of a comparable rail culture and feeder network represents a structural risk to CHSR's long-term performance. Without sustained investment in first- and last-mile connectivity, such as improved local transit service, safe pedestrian and bicycle access, coordinated schedules, and transit-oriented land use, HSR may struggle to attract its full potential market. International lessons suggest that successful HSR systems are built not as standalone projects, but as the backbone of an integrated mobility ecosystem. Addressing the FMLM problem through coordinated planning and investment will therefore be essential if CHSR is to shift travel behavior, reduce car dependency, and realize the broader mobility, equity, and environmental benefits envisioned for the system.

1.6 Common Challenges Faced by HSRs Around the World

When high-speed rail systems are discussed in an international context, Japan is often cited as the archetype of success, with China and France also frequently referenced as leading examples. These cases naturally invite comparisons and attempts at replication. Italy's experience, however, offers a contrasting and instructive narrative. Rather than emerging fully formed, Italy's high-speed rail network evolved through an initial quasi–high-speed system on the Florence–Rome corridor, which later served as the foundation for the modern Rete Alta Velocità/Alta Capacità (AV/AC) network. This trajectory illustrates that successful HSR development can be incremental, shaped by transitional phases and adaptive learning rather than a single, flawless implementation.

Construction of Italy's Florence–Rome HSR (aka Direttissima) was started in 1970 and lasted for five years. The rails began partial operation in 1977 and were fully operational after 1992. Albalate and Bel (2012) mentioned the following about the Florence–Rome HSR:

> While it was a significant improvement given the typical quality of the offer at the time in Italy, its technical characteristics are not comparable to those of high-speed rail, the Rete Alta Velocità/Alta Capacità (AV/AC). (p. 130)

Some sources identify the Florence–Rome corridor as Europe's first high-speed rail service (Cascetta et al., 2011; Cascetta et al., 2020). Its relevance lies not in its "first" designation, but in its role as an evolutionary precursor to Italy's modern high-speed rail network. The Florence–Rome line was initially developed as a quasi–high-speed service with technical characteristics that fell short of later HSR standards. Over time, however, it became the foundation upon which Italy's Rete Alta Velocità/Alta Capacità (AV/AC) system was built. This progression demonstrates that large rail systems can mature through staged development, allowing early investments to inform subsequent upgrades and network-wide improvements.

Equally instructive is Italy's shift in system design philosophy. Although the country initially pursued a fully independent high-speed rail system inspired by Japan, France, and Spain, it transitioned by the mid-1990s toward an integrated rail model that connected high-speed services with the conventional rail network. While this integration increased costs in the short term, it ultimately improved system utilization, operational flexibility, and financial sustainability. Integration thus emerged not as a compromise, but as a strategic adjustment to institutional, financial, and demand realities.

This experience provides a useful point of comparison for California High-Speed Rail (CHSR). Unlike Italy's incremental approach, CHSR pursued a large, technically advanced, and geographically expansive system from the outset. The contrast highlights a central policy question: whether gradual scale-up and adaptive integration may offer greater resilience than launching a fully built-out system under uncertain funding, legal, and institutional conditions. Although detailed cost data for the early Florence–Rome project were not available, the Italian case underscores the potential value of phased development and strategic flexibility; lessons that are directly relevant to California's ongoing experience with HSR delivery.

California's project began with a design that envisioned dedicated high-speed infrastructure through the Peninsula corridor rather than sharing tracks with commuter rail. The 2008 business plan described a four-track configuration that would allow high-speed trains to operate separately from Caltrain services (CHSRA, 2008). In 2012, the state changed its approach of having exclusive high-speed infrastructure to a blended system. The revised business plan introduced a blended system in which high-speed rail would share upgraded Caltrain infrastructure, including electrification and modernized signaling (CHSRA, 2012). This evolution shows that shared operations were a later policy adjustment influenced by cost concerns and regional integration needs, not part of the project's original vision. In that way, it parallels the Italian case, where initial ambitions were reshaped to reflect more grounded logistical realities.

- Austria currently has several HSRs. As per multiple sources, the first section of HSR was from Linz to Wels and it was operational in 1990. This line already existed before the HSRs were introduced on this section and it was modernized for HSR network (Houserová, 2021). But there is not enough information about when the construction began. Compos and De Rus (2009) mentioned the following:

- Austria currently operates several high-speed rail (HSR) corridors. According to multiple sources, the Linz–Wels segment, often cited as Austria's earliest HSR-related section, became operational for higher-speed services around 1990. Importantly, this corridor did not originate as a purpose-built high-speed rail line. Instead, it was an existing conventional railway that was subsequently upgraded and modernized to support higher-speed operations as part of Austria's evolving high-capacity / high-speed rail network (Houserová, 2021). While the modernization timeline is documented, detailed information on the original construction date of the line prior to its upgrade is limited in the available literature. Brezina and Knoflacher (2014) mentioned the following:

- In the Austrian case the alternative concept of high-capacity lines (HCL) was adopted. The initial HCL guidelines (ÖBB, 1992) allow for moderate HSR speeds of 200 km and less. In combination with studies of economic viability that suggested to limit the maximum to 160 km/h (Veit, 1993, 2001), this lead to major investments along the Danube corridor since then, eg. By doubling tracks from two to four and improving to moderate HSR standards. Only in late 2012 the newest HSR link that enables maximum operational speeds of 230 km/h between Vienna and St. Pölten has been opened. (p.122)

- Austria's case illustrates how early attention to economic constraints can encourage incremental upgrades rather than full-scale investment, while still delivering meaningful improvements.

- Acela was given the name in 1999 which was drawn out as a combination of acceleration and excellence (Black, 2005; Dao et al., 2005). While the name was given in 1999, the work to connect Boston with D.C. began in 1996. The project was supposed to be completed by 1999, but it was delayed by one year. Throughout the process, no new tracks were laid. Upgrading of tracks and construction of three maintenance facilities was done in Washington, D.C.; New York; and Boston (Black, 2005; Dao et al., 2005).

- The project experienced delays primarily due to design changes requested by Amtrak and the Federal Railroad Administration related to passenger car interiors and safety requirements, as well as errors in train width that resulted in vehicles being built four inches wider than specifications (Black, 2005; Dao et al., 2005). Such technical missteps and administrative complications show that even mature economies are not immune to project management and oversight challenges in HSR development.

1.7 Conclusion: CHSR Compared with Other Countries' HSRs

The global experience with high-speed rail shows a pattern of evolution over perfection. While some systems such as Japan's advanced rapidly with strong central support, others such as Italy and Austria followed more adaptive paths. They responded to financial, geographic, and institutional constraints. These examples show that high-speed rail success does not require a flawless launch. What matters is the willingness to revise plans and invest for the long term.

California's project, ambitious in scope, reflects this same global learning curve. The shift toward a blended system was not just about managing costs. It was about making the project more feasible.

It shows how projects must adjust to local infrastructure, politics, and funding conditions, while still aiming for broader transformation.

As CHSR continues, the international examples shared here suggest that success may not come from replicating others. It may come from asking better questions. Where can integration work better than separation? When should ambition give way to pragmatism? And how can trade-offs made early support resilience later? These are the policy lessons hidden inside the technical details. They are just as important for building a high-speed rail system that endures.

Limitations and Future Work

- Data Variability: Construction cost data is sourced from government publications, news articles, academic research, and industry reports. Variations may exist due to differing accounting practices, reporting standards, and project scope.

- Cost Reporting Practices: Some reported figures may include only capital construction costs, while others might encompass additional expenses such as land acquisition, rolling stock procurement, and financing costs.

- Topographical Considerations: This report does not include topographical considerations such as tunnels, bridges, and other natural features that could have adversely impacted the reported construction costs.

- Language Barriers: Searching, identifying, downloading, and reviewing documents became extremely difficult because many of them were published in foreign languages (e.g., French, Japanese, Italian, German). Further research could enhance the understanding about how other countries achieved and maintain high average speeds despite closer station spacing. This operational profile is not typical for high-speed rail and may reflect unique rolling stock, signaling design, or phased infrastructure upgrades that support sustained velocity under more frequent stopping conditions.

2. Japan's Land Readjustment Act and High-Speed Rails

Land acquisition and right-of-way assembly are among the most persistent challenges facing large-scale transportation infrastructure projects, particularly high-speed rail (HSR). In many countries, these challenges have led to cost escalation, delays, litigation, and political opposition. How governments structure land policies and align stakeholder incentives therefore plays a critical role in determining whether major rail investments can be delivered efficiently and equitably.

Japan provides a distinctive and instructive example of how land policy can be leveraged to support rail infrastructure development. Rather than relying primarily on compulsory acquisition, Japan has long used land readjustment as a planning and financing tool to reorganize land parcels, fund infrastructure, and share the benefits of development among public agencies and private landowners. This approach has been applied extensively to urban development and has also played a significant role in the delivery of rail and high-speed rail projects.

The purpose of this chapter is to examine Japan's Land Readjustment Act and its application to high-speed rail development, with particular attention to its connection to value capture strategies. The chapter explains how land readjustment operates in practice, reviews examples of rail projects that have successfully employed this mechanism, and identifies the institutional and cultural factors that have enabled its sustained use in Japan. By doing so, the chapter seeks to distill lessons that may inform policy discussions in the United States, where land acquisition for major rail projects, such as California High-Speed Rail, has proven to be complex, costly, and contentious.

2.1 What is Value Capture?

The Federal Highway Administration (FHWA) defines Value Capture (VC) as an innovative strategy that enables funding for infrastructure projects by leveraging the expected future economic benefits and increased land values to pay (or plan) for an infrastructure project (D'Angelo et al., 2019). VC strategies are applied to transit or highway infrastructure projects, where the enhancements in accessibility and connectivity are expected to increase property values and economic activities in adjacent areas (Natzke & Bishop, n.d.). Some of the leading VC mechanisms used in the US include tax increment financing, special assessments, joint development, and right-of-way use agreements (FHWA, n.d.; Gordon, 2003; Farooqui, 2025).

2.2 Introduction to Japan's Land Readjustment Act

Japan's Land Readjustment Act, enacted in 1954, is a legal framework designed to facilitate urban development and infrastructure projects by reorganizing fragmented land parcels into more functional configurations (OECD, 2022). This process enhances land use efficiency and supports the development of public facilities, including transportation networks and residential areas. The

Act enables local governments and private stakeholders to collaborate in restructuring land without requiring large-scale expropriations (Sorensen, 2000).

2.3 Connection with Value Capture Methodology

The Land Readjustment Act aligns closely with value capture methodologies that we recognize in the US. The US's VC approach is to finance infrastructure improvements by leveraging the anticipated increase in land values due to public investments. In Japan, during the process of land readjustment, authorities designate a portion of reorganized land as "reserve lands," which are later sold or leased to generate revenue for funding infrastructure projects (OECD, 2022).

The act is so central to Japan's way of managing land as a scarce resource that in 2003, nearly 30% of the total metropolitan area of Tokyo was involved with land readjustment (UCLG, n.d.). According to the OECD (2022), an average about 870 land readjustment projects are conducted every year. This system ensures that landowners benefiting from public projects contribute to their costs, creating a sustainable and equitable financing model (Suzuki et al., 2015).

2.4 Mechanism of the Land Readjustment Process

Japan's land readjustment process follows a coordinated sequence through which land is reorganized, infrastructure is financed, and development benefits are shared among stakeholders. The process begins with the designation of a project area, in which public authorities identify locations requiring development or redevelopment. This step is typically undertaken in collaboration with affected landowners and other stakeholders, establishing a defined boundary within which land readjustment activities will occur (Sorensen, 2000).

Once a project area is designated, individual land parcels within the boundary are pooled and treated collectively for planning purposes. Through a process known as replotting, these parcels are reorganized into a more functional spatial layout that can accommodate infrastructure needs such as transportation facilities, roads, utilities, and public spaces, while also improving overall land-use efficiency (Suzuki et al., 2015).

A defining feature of the land readjustment mechanism is the allocation of reserve land. As part of the replotting process, a portion of the reorganized land is set aside as reserve land, which is subsequently sold or leased by the implementing authority. Revenues generated from reserve land are used to finance infrastructure installation, urban development, and other project-related costs, reducing the need for direct public expenditure (OECD, 2022).

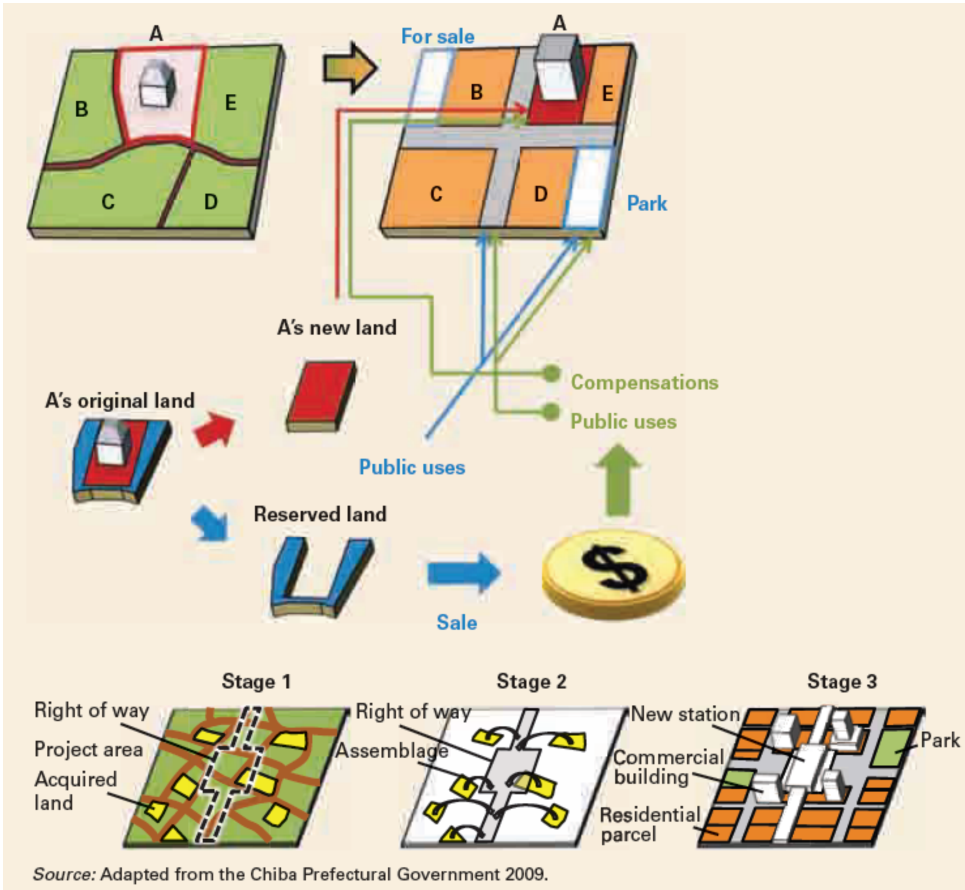
Infrastructure development then proceeds within the reorganized area, including the construction of rail facilities, roads, utilities, and related public improvements. After these investments are completed, land is redistributed to the original owners. Although the returned parcels are typically smaller than the original holdings, they are enhanced in value due to improved access, infrastructure, and proximity to transportation investments (Suzuki et al., 2015). This approach minimizes reliance on compulsory land acquisition and allows landowners to directly share in the long-term benefits of redevelopment.

Figure 4, adapted from Suzuki et al. (2015), illustrates the application of land readjustment for the Tsukuba Express under Japan's Housing–Railway Integration Law of 1989. In the example shown, multiple individual landowners' properties are identified for redevelopment. One landowner, referred to as the owner of Parcel A, contributes their original, larger parcel to the pooled project area and receives a smaller replotted parcel in return. The remaining land becomes reserve land, which is sold to generate revenue for funding public infrastructure, urban development, and related improvements. Portions of this revenue may also be used to compensate affected landowners for costs associated with building relocation, personal property relocation, temporary housing, and other relocation-related impacts (Tokyo Metropolitan Government, 2024). The replotted parcel received by the landowner typically benefits from closer proximity to the railway facility and improved urban amenities, resulting in a higher overall land value despite its reduced size.

The land readjustment process operates through several key steps:

- Designation of Project Area
- Pooling and Replotting of Land
- Allocation of Reserve Lands
- Development and Infrastructure Installation
- Redistribution to Original Owners

Figure 4. The Concept of Japan's Land Readjustment



Source: Suzuki, Hiroaki; Murakami, Jin; Hong, Yu-Hung; Tamayose, Beth. 2015. Financing Transit-Oriented Development with Land Values: Adapting Land Value Capture in Developing Countries. Urban Development. © http://hdl.handle.net/10986/21286)

2.5 Examples of Rail Projects Using Land Readjustment

While the preceding section explains the institutional and procedural mechanics of Japan's land readjustment system, its practical value is best understood through real-world applications. This section presents selected examples of rail and rail-adjacent projects in which land readjustment was used to facilitate infrastructure delivery, urban redevelopment, and value capture. These cases illustrate how the land readjustment mechanism has been applied in different contexts, ranging from new rail corridors to station-area redevelopment and post-disaster reconstruction, and demonstrate its flexibility as a tool for financing and coordinating rail-oriented development. Together, these examples provide concrete insight into how land readjustment has supported rail projects in Japan and why it remains a central component of the country's approach to integrating transportation investment with urban development.

Misato City

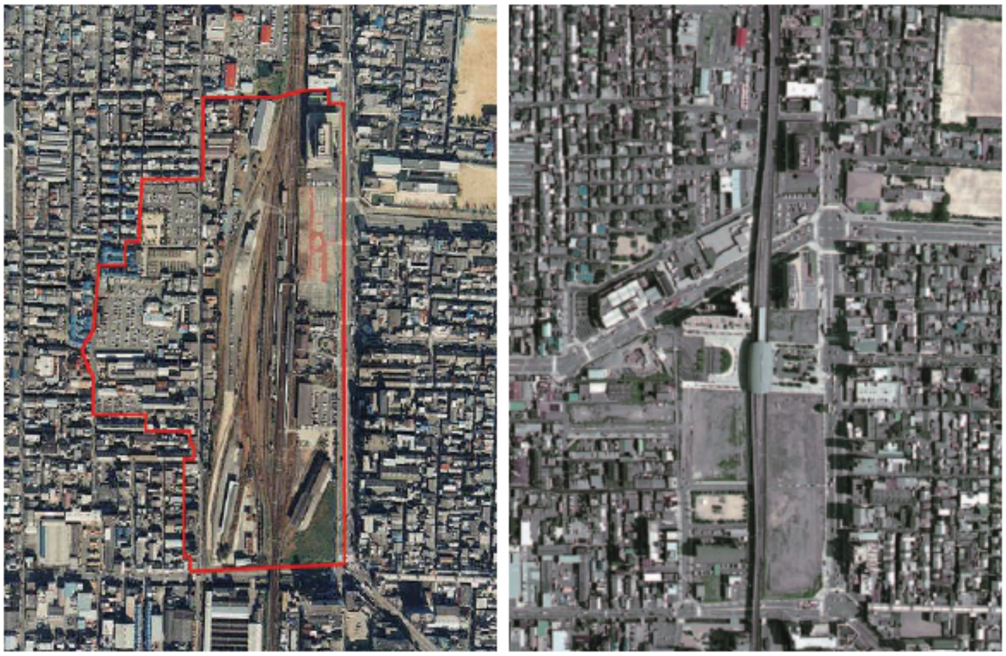
The city of Misato only had a freight serving marshalling yard, a school, and farmlands in the 1980s (Sah & Ram, 2019). This city was on the Tsukaba Express (TX) route, and today, there is significant development in that city. The city now hosts a new Misato–Chuo Station, and the surrounding landscape is covered by residential construction, malls, banks and public sector facilities. Figure 5 shows the before (left side) and after (right side) change in city's landscape within a span of 30 years.

Figure 5. Case of Misato City Land Readjustment

Nijo Area (Kyoto Prefecture) Source: Sah, R., and Ram, K. E. S. 2019. Land readjustment in Japan: Beyond the myth of Japanese consensus and harmony. *Asia Pathways*, ADB Institute. Retrieved on May 14, 2025. https://www.asiapathways-adbi.org/2019/11/land-readjustment-in-japan-beyond-the-myth-of-japanese-consensus-and-harmony

Through land readjustment, the Nijo area in Kyoto Prefecture was transformed from a degraded zone along the railway (visible on the left-side insert of Figure 6) into a district with more complex and better-organized urban infrastructure (visible on the right-side insert of Figure 6). Between 1998 and 2007, the project altered the shape and conditions of lots and installed or improved public facilities so that the area could function more efficiently and support higher, more effective land use.

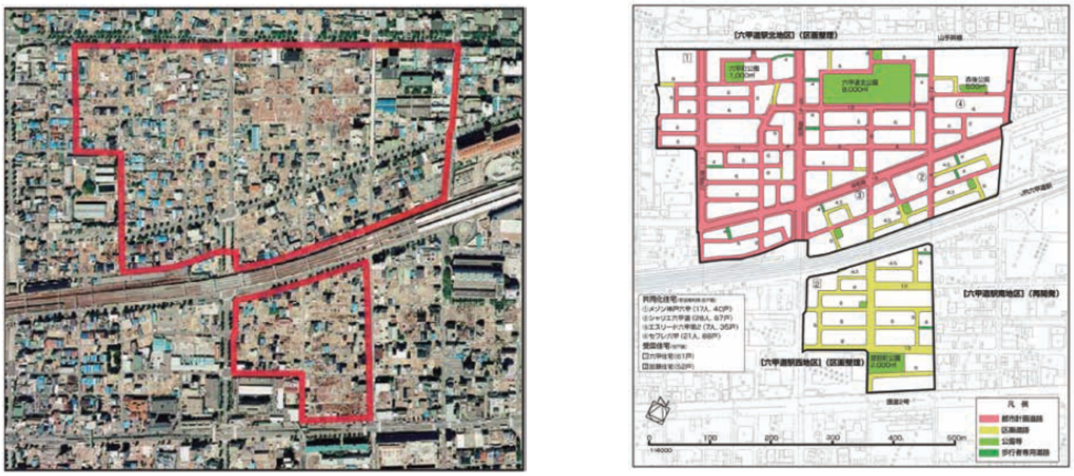
Figure 6. Case of Nijo Area



Kobe City's Rokkomichi Station. Kyoto Prefecture) Land Readjustment (Source: De Souza, F. F. 2018. Concepts on land readjustment. In F. F. Souza, T. Ochi, and A. Hosono (Eds.), *Land Readjustment: Solving Urban Problems Through Innovative Approach*. Japan International Cooperation Agency Research Institute.

Around Rokkomichi Station in Kobe, a land readjustment project was carried out from 1995 to 2007 as part of post-earthquake urban reconstruction and disaster prevention measures. In this case, land readjustment was used to recover an area damaged by the disaster (visible on the left-side insert of Figure 7), reorganizing land parcels, and renewing public facilities (visible on the left-side insert of Figure 7) to create a safer, more resilient urban structure with improved disaster-prevention performance.

Figure 7. Case of Kobe City's Rokkomichi Station Before Earthquake and After Land Readjustment



Source: De Souza, F. F. 2018. Concepts on land readjustment. In F. F. Souza, T. Ochi, & A. Hosono (Eds.), *Land Readjustment: Solving Urban Problems Through Innovative Approach*. Japan International Cooperation Agency Research Institute.)

In both locations, the core changes involved replotting land and upgrading infrastructure and public facilities, but in Nijo this was driven by the need to improve a degraded railway-side urban environment, while in Rokkomichi it was explicitly tied to reconstruction after a major disaster and strengthening of disaster preparedness.

Tsukuba Express Line

Japan has effectively utilized the Land Readjustment Act to support the development of high-speed rail (HSR) systems. A notable example is the Tsukuba Express Line, which commenced operations in 2005, connecting Akihabara in central Tokyo to Tsukuba Science City. To facilitate this project, approximately 2,903 hectares of land across 13 stations were designated for special land readjustment projects. This initiative allowed for the efficient acquisition and reorganization of land necessary for the railway while promoting transit-oriented development in surrounding areas (Suzuki et al., 2015).

2.6 Reasons for Japan's Successful Implementation of the Readjustment Act

Housing-Railway Integration Law

Besides the Land Readjustment Act, Japan also has the Housing-Railway Integration Law which specifically focuses on Transit Oriented Development (TOD) projects. It enables the government agencies to do work on real estate projects and infrastructure project simultaneously, thus increasing the efficiency of projects.

A Highly Evolved and Mature Program

The current Land Readjustment Act is highly refined. The law was initially introduced in 1875 under the name "Regulations for Purchase Procedures of Lan for Public Use." The law changed gradually to cater to situational needs and provide resilience during unfavorable circumstances such as natural disasters, lack of resources, and other constraints (Yanase, 2013; De Souza, 2018). Due to the extensive use and adoption of the process, Japan has the knowledge base to execute the Act efficiently.

The Government of Thailand attempted to adopt Japan's approach, but it faced many difficulties. One of the difficulties was that people would not give up their land as easily. As per Sah and Ram (2019), the following is commonly assumed:

> Japan has a tradition of consensus in participation and decision making and that Japanese people are less individualistic and more cooperative. However, the reality is that Japanese landowners are just as demanding, and also do not agree to land readjustment so easily. Take the example of stalled land readjustment cases in Japan. In 2015, there were 138 projects that had been stalled for more than 10 years. These accounted for more than 27% of all land readjustment projects (Imanishi 2016: 239). The reason for such delays, according to the government (Ministry of Land, Infrastructure, Transport and Tourism 2007), was the lack of finance and lack of consensus. This shows that the Japanese government has also faced difficulty in gaining permission from landowners. (para. 5)

Similar opinions about non-cooperation have also been expressed by Sorensen (2007). Furthermore, due to the initial denials of landowners to give their lands, it took 16 years for the Misato–Chuo land readjustment project to be completed (Sah & Ram, 2019). Even after pushback from landowners, the government was patient and determined to work with landowners to convince them. The legislation also provides adequate communication approaches for convincing landowners to contribute with their land (OECD, 2022).

In cases when the landowners do not agree, the government can do the following (Sah & Ram, 2019):

- apply sanctions
- emphasize the significance of the project and the need for readjustment
- demote the urban land zone to non-urban zone, reducing the land prices
- Other factors

Several other factors contribute to Japan's success while doing readjustments. The most important factors include the following:

- Citizens are expected to contribute and citizens do (Sah & Ram, 2019; Sorensen, 2007)
- Well-established communication procedures are laid out in legislation which enables the Japanese bureaucrats to achieve better outcomes when convincing landowners (OECD, 2022)
- To proceed with acquisition, the government needs a 2/3rds majority. This provision prevents an individual stakeholder from using their voting right as a veto power.
- The stakeholders whose properties are acquired remain part of the project for which LR was implemented. This makes an affected stakeholder a partner of the project, so they can share in the long-term benefits realized from the LR.

2.7 Comparable Laws in the United States

As per Brooks and Lutz (2016), the process of acquiring land from smaller land owners and using the assembled land toward developing newer assets is referred to as "Urban Renewal" in the U.S. In practice, urban renewal projects not only reconfigure parcels and replace obsolete uses, they also tend to increase surrounding land values by improving accessibility and urban amenities. These value gains create opportunities for land value capture mechanisms, whereby a portion of the uplift is redirected to help finance the infrastructure and other public investments associated with the project. The U.S. has several laws supporting VC strategies at federal and local levels (FHWA, n.d.; D'Angelo et al., 2019), but they are not as comprehensive as Japan's Land Readjustment Act. The Act is legally binding in Japan, but the comparable laws in the U.S. allow for non-participation. However, certain mechanisms share similarities:

- Special Assessment Districts: In the United States, special assessment districts represent a form of land value capture in which a local government designates a defined district and imposes an additional tax or fee on properties that are deemed to receive a special benefit from a particular public improvement, with the resulting revenue dedicated to that investment (Ingram & Hong, 2012; OECD, 2022; Harmon, 2017). In contrast to broad-based betterment levies, these districts clearly delineate the impact area and are typically structured so that assessments are linked to the magnitude of benefit, strengthening the connection between those who gain from the project and those who pay for it (Ingram & Hong, 2012; OECD, 2022; Harmon, 2017). In practice, special assessment districts have been used to finance local infrastructure and portions of major transit projects, including the NoMa–Gallaudet University Metrorail infill station in Washington, D.C., the Portland Streetcar, and Seattle's South Lake Union Streetcar, and infrastructure associated with the Dulles Corridor Metrorail extension (OECD, 2022; Harmon, 2017).

- “Urban Renewal” Programs: As per Brooks and Lutz (2016), the process of acquiring land from smaller land owners and using the assembled land toward developing newer assets is referred to as “Urban Renewal” in the U.S. Through the Urban Renewal program, the government has used its power of “eminent domain” wherein it takes private property for public use (Brooks & Lutz, 2016; Shoup, 2007). The U.S. implemented urban renewal initiatives in the 1960s and 1970s that involved land assembly for redevelopment. However, these programs faced criticism for displacing communities and were eventually halted (Brooks & Lutz, 2016). An alternative way to encourage private landowners to support transit-oriented redevelopment is to adopt what we term “graduated zoning density”: a zoning pattern in which allowed residential or mixed-use density is intentionally highest in areas closest to the transit station or center and then systematically reduced in bands as distance increases. This approach is conceptually related to Shoup’s “graduated density zoning” (2007), which ties higher permissible densities to larger assembled parcels in order to incentivize voluntary land assembly, but here the graduation is based on proximity to transit rather than parcel size. In Shoup’s formulation, tying higher permissible densities to larger assembled parcels creates a fear of being left out of development and thus encourages landowners to contribute to redevelopment (Shoup, 2007).

Despite these mechanisms, fragmented landownership can be considered as a major reason for the U.S.’s lack of a comprehensive framework similar to Japan's Land Readjustment system.

2.8 Lessons for the United States

Many infrastructure projects have successfully utilized VC in the U.S., and there are efforts to make it commonplace. In 2019, the FHWA published the *Value Capture Implementation Manual*, providing valuable information about various Value Capture mechanisms application in the U.S. (D’Angelo et al., 2019). However, the U.S. can still derive valuable insights from Japan's Land Readjustment Act by considering the following:

- Promoting Collaborative Development

- Encouraging landowner participation in redevelopment projects can lead to more equitable and accepted outcomes.

- Implementing Value Capture Strategies

- Leveraging the increase in land values resulting from public infrastructure investments can provide sustainable funding for projects.

- Enhancing Urban Planning

- Adopting systematic land reorganization practices can improve urban layouts, infrastructure efficiency, and overall livability.
- Increasing Outreach and Communication
- Not every land owner would willingly give their land for redevelopment and effective communication from officials would help with the process.
- Planning for the Worst
- Acquiring land could take significant time and the projects must be planned to navigate such challenges.
- Legislative Framework with Flexibility

The lack of a legislative framework makes land acquisition difficult and time consuming in the U.S. Laws that balance between mandatory (forceful) land acquisition and flexibility (encouraging the landowners to gain benefits) should be introduced.

By integrating these principles, the U.S. could enhance its urban development strategies and infrastructure financing mechanisms.

2.9 Conclusion

This study focused on Japan's Land Readjustment Act. The Act has gone through several versions, and today's stands as an exemplary model forming the backbone of urban planning and financing in the country. This chapter has shown how Japan leveraged this legal framework to reorganize fragmented land parcels, fund HSR infrastructure, and enabled TOD. The integration of land readjustment with the Housing-Railway Integration Law demonstrates Japan's commitment to harmonizing transportation and land use policy, allowing for more efficient urban growth.

The Japanese approach, particularly through the use of "reserve lands" and collaborative planning, offers a sustainable mechanism that benefits both the government and the public. It minimizes the need for compulsory land acquisition while ensuring equitable distribution of the gains from infrastructure improvements. However, the process is not without challenges. Delays caused by landowner resistance reveal the necessity of strong communication, flexible governance, and institutional maturity.

While the United States has employed value capture tools, it lacks a holistic framework comparable to Japan's Land Readjustment Act. The U.S. experience with urban renewal through "eminent domain" often led to criticism, highlighting the need for more inclusive, consensus-driven models. The preceding section translated these contrasts into specific lessons for the United States, emphasizing the institutional and design choices required to adapt elements of Japan's approach rather than replicate its legal framework wholesale.

More broadly, this chapter establishes a benchmark case of a mature land readjustment and value capture system against which the broader study's analysis of high-speed rail, land assembly, and transit-oriented development can be assessed.

3. Benefits and Challenges of Integrating Rail Networks

California's rail landscape is served by many small and large operators that often run independently. This fragmentation creates operational inefficiencies, most notably longer door-to-door travel times for riders, and limits the ability of the system to deliver fast, reliable, and convenient journeys. This chapter examines those inefficiencies by reviewing three bodies of evidence: the existing rail network on the U.S. East Coast, international case studies of rail-network integration, and the findings of LA Metro's recently completed Rail Network Integration Study (RNIS).

An ideal integrated transportation network enables seamless transfers: passengers disembark from one service and can immediately access the next with minimal waiting, or with reasonable time to walk between platforms. When timed transfers, consistent wayfinding, common fare arrangements, and coordinated operations are in place, public transit becomes noticeably more attractive and usable. Improved integration benefits communities that rely on transit, increases overall ridership, reduces passenger inconvenience, and strengthens the public value of rail investments.

This chapter first synthesizes international examples from systems where high-speed rail is tightly connected to dense local networks to regions where timetable coordination is used to simplify transfers to highlight both benefits and recurring obstacles. It then compares those lessons with a study of interconnectivity on the U.S. East Coast, where multiple operators and legacy infrastructure create particular coordination challenges. Finally, the chapter summarizes LA Metro's RNIS, which translates the general lessons into a set of potential improvements, benefits, costs, and implementation challenges specific to Los Angeles County.

Taken together, the three analyses inform a set of practical recommendations for reducing transfer times, improving passenger experience, and aligning institutional arrangements. The remainder of this chapter presents the international case studies, the East Coast interconnectivity analysis, the LA Metro RNIS findings, and policy and operational recommendations to move California toward a more seamless, efficient rail network.

3.1 International Experience on Integrating Rail Networks

Countries that have successfully developed high-speed rail (HSR) systems often integrate them with strong multimodal networks. These interconnected systems extend the benefits of HSRs beyond station platforms by ensuring passengers can easily transfer to metros, commuter rails, buses, and even airports. As a result, the generally beneficial effects are experienced throughout the corridor served. Table 5 outlines selected countries where HSR is successfully integrated with other transport modes, including evidence of benefits and challenges.

For example, Japan's Shinkansen demonstrates how integration with dense commuter and metro lines can dramatically reduce travel times and stimulate regional economic vitality. Direct-through operations between urban and intercity rails lower transfer costs for passengers, but coordination is complicated by the fragmented nature of railway ownership and management (MLIT, 2016; Kato, 2016). Germany has embraced a nationwide regular-interval timetable, the Deutschlandtakt, which synchronizes long-distance, regional, and urban rail services.

This approach is intended to make transfers predictable and journeys more seamless. Yet, despite the policy framework, reliability suffers because of widespread construction and the strain of maintaining an aging infrastructure (BMDV, 2018; Deutschlandtakt Office, 2025; Reuters, 2025). In France, multimodality is reinforced through both Parisian hubs and integrated products such as TGV AIR, which allows single-ticket connections between trains and flights at Charles de Gaulle Airport. While these initiatives reduce reliance on short-haul flights, the RER network that feeds HSR services is often congested and prone to incidents, undermining the effectiveness of integration (European Parliament, 2012).

Spain, on the other hand, has illustrated how infrastructure upgrades can transform multimodality. The cross-city tunnel linking Atocha and Chamartín now allows high-speed trains to serve both hubs, improving north-south connectivity. However, the same construction programs that deliver these benefits frequently cause temporary disruption to Cercanías commuter services, showing the dual effect of capacity expansion projects (IRJ, 2022; Railway Gazette, 2024; Euro Weekly News, 2025; Trenvista, 2025). Finally, South Korea integrates its KTX high-speed system with city metros and air-rail service. In Seoul, the Seoul Station City Airport Terminals (CAT) offer in-town check-in and immigration services, reducing transfer burdens for travelers. However, a separate attempt to run KTX directly to the airport failed because ridership was too low compared to the dedicated AREX service, demonstrating that integration efforts must be carefully aligned with demand and operations (Incheon Airport, n.d.; Lufthansa Group, 2024; Korea JoongAng Daily, 2018).

Table 5. Countries with Multimodal Networks Connected to HSR

Country	Reason(s) Why the HSR Multimodal Network is Successful	Evidence of Benefits	Evidence of Challenges
Japan	Shinkansen is tightly linked to dense urban / commuter rail; policy and operations emphasize seamless transfers (MLIT, 2016; Kato, 2016).	HSR delivers time savings and regional economic gains; direct-through urban rail reduces transfer costs and increases passenger benefits (MLIT, 2016; Kato, 2016).	Fragmented responsibilities mean services and stations are not always well coordinated (Kato, 2016).
Germany	Nationwide Deutschlandtakt (integrated regular-interval timetable) aligns long-distance, regional, and urban services (BMDV, 2018; Deutschlandtakt Office, 2025).	Regular timetable improves capacity, speed, punctuality and simplifies transfers (BMDV, 2018; Deutschlandtakt Office, 2025).	Reliability undermined by ageing infrastructure and widespread construction (Reuters, 2025).
France	TGV is anchored into Paris' RER / metro; CDG's TGV AIR integrates air–rail ticketing / operations (European Parliament, 2012).	Integrated ticketing enables single-ticket multimodal trips and reduces short-haul flights (European Parliament, 2012).	RER network is fragile, congested, and affected by recurrent incidents (Cour des comptes, 2023 / 2024).
Spain	Madrid's cross-city tunnel links north–south HSR axes and allows through-running between Atocha and Chamartín (IRJ, 2022; Railway Gazette, 2024).	Tunnel enables high-speed trains to serve both stations and strengthens connectivity (IRJ, 2022; Railway Gazette, 2024).	Construction works disrupt Cercanías access and cause service interruptions (Euro Weekly News, 2025; Trenvista, 2025).
South Korea	KTX integrates with metros; City Airport Terminals at Seoul Station and Gwangmyeong enable in-town check-in and immigration (Incheon Airport, n.d.).	In-town check-in reduces transfer friction; airlines confirm its use (Incheon Airport, n.d.; Lufthansa Group, 2024).	Airport KTX service was withdrawn due to low ridership and conflicts with AREX operations (Korea JoongAng Daily, 2018).

These findings suggest that early and sustained coordination with regional and local rail operators are critical to maximizing system benefits. CHSR stations should be planned as integrated mobility hubs, with synchronized schedules, clearly designed transfer pathways, and fare systems that minimize friction between services. Equally important is the establishment of governance mechanisms that incentivize cooperation among agencies rather than competition. By incorporating these principles during the planning and implementation phases, CHSR can reduce transfer penalties, expand its effective catchment area, and function not only as a standalone high-speed corridor but as the backbone of a fully integrated statewide rail network

3.2 Interconnectivity on the East Coast

A comparative, door-to-door travel-time analysis was conducted to examine intercity interconnectivity along selected East Coast corridors using three travel modes: private automobile, scheduled intercity rail, and intercity bus. The analysis was designed as an illustrative case study intended to quantify how transfers, station access / egress, and schedule coordination shape total travel time, and to identify practical integration gaps relevant to multimodal planning.

Two origin–destination corridors were evaluated: Moynihan Train Hall (New York City, NY) to Atlantic City Rail Terminal (Atlantic City, NJ) and Atlantic City Rail Terminal to Union Station (Washington, D.C.). These endpoints were selected because they represent distinct roles within the intercity passenger network (a major regional hub, a leisure-oriented terminal with multimodal interfaces, and a national rail interchange). To maintain comparability across modes, the same corridor endpoints were used for automobile, rail, and bus assessments.

Data sources

Rail and bus itineraries were developed from publicly available, operator-published schedules and timetables (e.g., Amtrak, NJ Transit, relevant commuter rail operators, and major intercity bus carriers). Where multiple operators could plausibly serve a segment, schedules were queried for each carrier and candidate itineraries were assembled accordingly. Automobile travel times were estimated using standard travel-time calculators for the same origin–destination corridor endpoints; peak and off-peak examples were captured to reflect congestion-related variability.

Station access, egress, and transfer movement times were estimated using mapping tools and station layout information. Walking distances between relevant points (station entrances, platforms, concourses, and adjacent bus stops) were measured using Google Maps distance tools and station maps where available. Distances were converted to time using nominal walking-speed assumptions consistent with mapping tools (approximately 3 mph), with additional allowances applied when stations exhibited large internal circulation requirements (e.g., long concourses, vertical circulation).

Sampling framework and time-of-day coverage

Because scheduled connectivity and transfer opportunities vary by time of day and travel direction, the study employed a structured sampling approach. For each corridor, services were sampled in four time windows (morning, afternoon, evening, and late evening), and analyses were conducted separately for each direction of travel (northbound vs. southbound). Within each window, candidate rail and bus itineraries were identified that would plausibly be used by a typical traveler; extremely early or late services producing atypical connection patterns (e.g., unusually long waiting times or impractical sequences) were excluded to avoid overstating transfer penalties that are not representative of routine travel.

Itinerary construction and connection feasibility criteria

For scheduled modes (rail and bus), itineraries were constructed by combining one or more legs into a door-to-door trip. A connection was defined as feasible when the scheduled arrival of the inbound leg allowed at least the operator-recommended minimum transfer time (when specified), plus a conservative buffer intended to reflect realistic passenger movement and routine operational variation. In this analysis, the buffer was implemented as operator minimum + 5 minutes. Candidate itineraries requiring unusually burdensome transfer movements—operationalized here as transfers involving inter-station walking or routing that would exceed approximately 30 minutes of walking time—were excluded as atypical for standard intercity travel.

When multiple feasible outbound departures existed within a given time window, the analysis selected the itinerary with the shortest feasible layover to represent that window. This choice reflects the best-coordinated option available under published schedules while maintaining the conservative feasibility constraints described above. Window-level values were then aggregated across the sampled windows for summary statistics.

Travel-time components and computation of door-to-door time

The principal outcome metric was total door-to-door travel time, defined as the sum of access, circulation, in-vehicle travel, transfer, and egress components. Specifically, total travel time included: (1) time from the origin point to the departure station entrance, (2) time from the entrance to the boarding platform or stop, (3) scheduled in-vehicle travel time for each leg, (4) transfer time (scheduled layover plus intra-station walking / circulation time), and (5) time from the arrival platform or stop to the destination point.

Layover time for transfers was calculated as the scheduled difference between inbound arrival and outbound departure. To reflect within-station movement, measured or inferred walking / circulation times between platforms, concourses, and bus stops were added to scheduled layovers. Walking travel times were derived using an assumed speed of approximately 3 mph, with an additional 2–5 minutes added in stations known to require substantial internal circulation (e.g., vertical circulation via stairs / elevators, long concourse traversal), as indicated by station maps and mapping-path evidence.

Automobile travel time estimates were recorded for the same corridor endpoints using typical time-of-day assumptions (including peak and off-peak examples where available) and were used as a contextual comparator rather than a definitive performance estimate.

Reporting and summary statistics

For each corridor, mode, and travel direction, the study summarizes door-to-door travel times across the four time windows using the mean and median and reports the minimum–maximum range to illustrate variability attributable to schedule coordination and transfer structure. Directional results are reported separately because timetable patterns, connection opportunities, and transfer burdens often differ between northbound and southbound travel.

Assumptions, limitations, and reproducibility

This analysis is based on published schedule times and mapping-derived movement estimates and therefore represents scheduled-service performance rather than observed real-time reliability. No explicit on-time performance adjustment or stochastic delay model was incorporated in the base calculations; reliability considerations are addressed separately in the discussion / sensitivity sections. Further, internal station routing can vary materially across travelers and may be imperfectly captured by mapping tools, and the analysis does not explicitly model additional time required for travelers using accessible routes beyond noting that such routing can increase access and transfer durations.

To support reproducibility, replications should: (1) archive the exact schedule sources and note schedule effective dates and access dates; (2) preserve mapping measurements (distances, assumed walking speed, and any circulation add-ons); and (3) apply the same time-window sampling approach, connection feasibility criteria (operator minimum + 5 minutes), and itinerary selection rule (shortest feasible layover per window).

Findings

Applying this door-to-door method to the two corridors shows that, even where rail options exist, the need to make scheduled transfers and traverse complex station layouts materially increases door-to-door travel time relative to private automobile travel and, in many sampled windows, relative to intercity bus itineraries that provide simpler end-to-end routing. Figures 8 and 9 summarize mean and median travel times by mode and illustrate the contribution of access, in-vehicle, and layover components to total time. The directional averages (northbound vs. southbound) demonstrate that transfer opportunities and layover durations vary substantially by direction and time of day, an outcome that underscores the potential benefits of timetable coordination, improved wayfinding, and station design changes to minimize transfer penalties.

The first route selected was from Moynihan Train Hall in New York City (NYC) to the Atlantic City Rail Terminal in Atlantic City, New Jersey. Moynihan Train Hall is a busy transportation hub, and Atlantic City is a well-known coastal destination for tourism and entertainment. The second route continues from Atlantic City to Washington, D.C. Washington, D.C., is a major national transportation center, and Union Station is one of the busiest rail terminals in the country, connecting Amtrak, commuter rail, and local transit.

As there is no direct train route dedicated to cover the routes selected, a rider wanting to do this trip would need to have a layover and wait. The layover times were calculated by cross referencing the schedules and mapping out times that work. An average was created using times from morning, afternoon, evening, and a late evening service. Averages were calculated for both Northbound and Sound bound trains to create a more realistic aspect to a layover time. Walking times from the entrance of the station to the tracks or stops were also considered using Google Maps' Measure Feature. Google Maps also calculates walking speed as 3mph.

Figure 8. Average Travel Times Across Different Transportation Modes
NYC to Atlantic City

Figure 9. Average Travel Times Across Different Transportation Modes
Washington, D.C. to Atlantic City

From both route comparisons, driving is the fastest option, but it is not feasible or practical for everyone (e.g., people without access to a car or who cannot afford the costs of driving). For example, there are people without cars, people who prefer to sit back and relax, or people who would opt for public transportation. For riders who rely on public transit , the best alternative to driving is the bus (Figure 8). In terms of time and inconvenience it would consist of 3 different buses. As shown in Figure 9, the best form of public transportation would be the bus system, not the rails.

The East Coast comparison demonstrates that even in regions with extensive rail infrastructure, door-to-door travel times are often dominated by transfer delays, station access complexity, and lack of coordination between operators rather than by in-vehicle travel time alone. For CHSR, this finding underscores that system performance and ridership will depend not only on achieving high operating speeds but also on minimizing transfer penalties through coordinated timetables, integrated station design, and seamless connections to regional and local services. Without deliberate planning for schedule alignment, clear wayfinding, and efficient first- and last-mile access, CHSR risks replicating the same integration gaps observed on the East Coast, where rail services are present but not optimally connected. Conversely, by embedding integration requirements into station planning, operating agreements, and service design from the outset, CHSR can function as the backbone of a statewide network rather than a standalone corridor, significantly improving its competitiveness and overall user experience.

3.3 Recommendations, Benefits, and Challenges – East Coast Findings and RNIS Context

The East Coast comparisons and LA Metro's Rail Network Integration Study (RNIS, 2024) together show clear opportunities to reduce transfer penalties and improve the passenger experience but they also demonstrate that meaningful integration requires coordinated policy, modest operational changes, and substantial capital investment. Below is a concise set of recommended actions derived from the East Coast illustrative analysis and the RNIS findings, followed by a summary of the principal benefits and the key implementation challenges that any integration effort should anticipate. The recommendations are ordered to help planners prioritize quick, low-cost wins that build momentum while also identifying larger investments and institutional reforms needed to realize full system integration.

Table 6. Recommendations for Integrating Rail Networks

Recommendation	Rationale / What it fixes	Expected benefit(s)	Typical cost & complexity	Suggested lead / partners
1. Timetable coordination pilots at key interchanges	Reduces layovers caused by poorly aligned schedules	Lower average times; fewer missed connections; higher ridership	Low–medium (staff+ software)	Regional operators + state rail authority; short pilot window
2. Station mobility-hub design upgrades (wayfinding, shorter transfers)	Addresses long internal walks, confusing signage, and platform gaps	Faster transfers; improved safety and accessibility; better user experience	Medium (design + moderate construction)	Host agency (station owner) + local transit; integrate in capital programs
3. Integrated fares / through-ticketing pilots	Eliminates multiple apps and payment steps	Simpler trip planning; reduced boarding friction; increased mode shift	Low–medium (back-end integration; revenue sharing)	Fare authorities, major operators, payment vendors
4. First / last-mile solutions (micro-mobility, shuttle partnerships)	Tackles access / egress time that expands effective station catchments	Larger ridership catchment; reduced access barriers	Low (pilots) to medium (infrastructure)	Cities, micromobility firms, transit agencies
5. Accessibility & luggage-handling protocols	Reduces extra transfer time for mobility-impaired and luggage-carrying travelers	More equitable access; better intermodal customer experience	Low–medium (policy + some facilities)	Operators, station managers, accessibility advocates
6. Data-sharing & real-time integration (APIs, GTFS-RT)	Enables coordinated platforming, rebooking and passenger information	Less uncertainty; better missed-connection handling; performance monitoring	Medium (IT work; governance)	Agencies, regional data hub, vendors
7. Governance & funding mechanisms (MOUs, joint bodies)	Aligns incentives across many agencies to implement and maintain integration	Sustained coordination, clearer roles, leverage for funding	Low (policy) to high (institutional reform)	State agencies, regional councils, operators
8. Targeted capital investments (walkways, platform changes, line connections)	Fixes physical barriers that cannot be solved by operations alone	Substantial, long-term reductions in transfer times and improved network resilience	High (multi-year projects)	Federal / state / local funding partners; host agencies

Recommendation	Rationale / What it fixes	Expected benefit(s)	Typical cost & complexity	Suggested lead / partners
9. Parking & demand-management policies to deter solo driving	Encourages mode shift once integrated transit becomes viable	Reduced VMT; higher transit mode share	Low–medium (policy and enforcement)	Local governments, parking authorities, transit agencies

Benefits and implementation challenges of rail-network integration

Improved integration across intercity and regional rail systems can produce benefits that extend beyond faster scheduled travel times. In practice, integration reduces the "transfer penalty" by lowering uncertainty, shortening or stabilizing connection times, and making trips easier to understand and complete. These effects can increase the functional reach of the network, particularly for trips requiring multiple operators, while supporting broader environmental, equity, and economic goals.

Anticipated benefits:

- Improved rider experience: Streamlined transfers, consistent wayfinding, and unified trip information reduce uncertainty and improve perceived reliability and comfort.
- Increased ridership and reduced GHG emissions: More reliable, lower-friction connections improve transit competitiveness and can shift some trips from private vehicles to rail / bus, reducing emissions and congestion.
- Social equity gains (when targeted): Prioritizing integration in underserved corridors and station areas can expand access to jobs and services for lower-income and transit-dependent travelers.
- Operational efficiency and better infrastructure utilization: Timed transfers and coordinated operations can reduce wasted capacity, improve vehicle / crew productivity, and limit redundant or poorly sequenced capital investments.
- Economic uplift: A legible, reliable rail network can support event travel and tourism and improve labor-market accessibility, contributing to longer-term regional development.

Achieving these outcomes, however, is often constrained by governance fragmentation and physical and digital interoperability limitations. Integration requires coordination across multiple agencies and infrastructure owners, and the benefits of schedule coordination can be undermined if stations are difficult to navigate, fares are not interoperable, or first / last-mile access is weak. Data standardization and sustained funding are also central determinants of whether integration efforts can be implemented and maintained over time.

Key implementation challenges:

- Multi-agency coordination: Dozens of stakeholders with differing priorities, standards, and budget cycles can slow alignment on service planning, capital delivery, and performance targets.

- Inconsistent station layouts and wayfinding: Many transfer points require retrofits (e.g., circulation improvements, clearer passenger flows, co-located stops) to enable short, reliable transfers.

- Fragmented fare systems and payment platforms: Technical compatibility and revenue-sharing agreements are complex and can delay integrated fare products.

- Weak first / last-mile infrastructure: Inadequate sidewalks, bike facilities, micromobility parking, and pick-up / drop-off management can increase access / egress time and reduce the practical value of integrated line-haul service.

- Data and system gaps: Limited standardized real-time feeds and shared performance metrics hinder diagnosing recurring transfer failures and implementing continuous operational improvements.

- Funding constraints and phasing: RNIS estimates substantial capital needs (aggregate order-of-magnitude $2.0–$3.3B in 2022 dollars for recommended LA projects), implying phased implementation and cross-jurisdictional financing strategies focused on high-impact transfer nodes.

3.4 Challenges with Integrating Rail Services in LA County

While the expected benefits are abundant, there are challenges that must be overcome before the benefits can be realized. The following section presents details about the challenges faced while integrating the rail services.

The following challenges have been identified by the LA Metro (2024):

- Conundrum with Multi-Agency Coordination: Rail services are highly fragmented in the region. Many agencies will be involved whenever the integration is pursued. The report lists 19 agency stakeholders that were involved with the study, but there is anticipation that several others will get involved (if and) when integration related work begins. The fragmentation could make it extremely difficult when dealing with things such as standardization of signage, fare systems, and maintenance.

- Inconsistent Wayfinding and Signage: Using images, the report points out many situations showing poor conditions, insufficient locations, and lack of unified branding that would cause confusion and safety issues among riders.

- Complexities with Fares Structures and Payments: Currently, multiple fare structures and payment systems exist across the rail agencies. These add to the complexity and create barriers – especially for new and / or infrequent riders

- Lack of FMLM Infrastructure: The county's bike lanes, sidewalks, and pedestrian infrastructure are currently limited in extent and poor in condition.. These alternatives along with the micro mobility devices could be utilized toward the addressing the FMLM issue, but currently the infrastructure needs an upgrade.

- Poor Station Amenities: Many stations lack basic amenities such as restrooms, seating, shade canopies, and security.

- Data and System Gaps: Integration of rail networks would require sharing data between rail service providers. This would require data integration between various platforms, sharing risks of data breaches and security. Even at the current fragmented operation level, the digital trip planning and real-time alerts are inconsistent or unavailable across providers. Therefore, creating a one-point solution by integrating all the rail service providers seems to be an uphill and costly task.

- Funding Constraints: The integration is expected to be complex and costly. The RNIS provides aggregate order-of-magnitude capital cost estimates of approximately $2.0–$3.3 billion (2022 dollars) across its recommended improvements, including multi-billion-dollar line items.. For example, the proposed Metro C Line connection to the Norwalk / Santa Fe Springs Metrolink Station is estimated at approximately $1.3–$2.6 billion (2022 dollars), illustrating the substantial scale of investment required. These projects are large in scope and lack dedicated funding sources, requiring coordination across jurisdictions, agencies, and grant cycles.

3.5 Conclusion

An integrated rail network makes trips simpler, faster, and more reliable. The international case studies show that when services connect well, such as Japan's Shinkansen with dense commuter lines, Germany's regular-interval timetable, France's TGV tied to RER and air–rail options, Spain's cross-city tunnel, and South Korea's city check-in, riders save time and can move easily between modes. They also present challenges, including fragmented responsibilities, aging or congested infrastructure, incidents, and disrupted service during construction. In some cases, low ridership makes it difficult to justify frequent service which can limit connectivity benefits.

The East Coast comparison points to the same issue. Even in places with many transit options, separate operators and poorly timed transfers can make buses or cars faster for door-to-door travel. That means rail users face longer travel time and inconvenience.

For Los Angeles County, LA Metro's Rail Network Integration Study (RNIS) lays out clear benefits: improved rider experience, increased ridership with reduced GHG emissions, better access for underrepresented communities, support for major events and regional economic growth, improved operational efficiency, shared use of infrastructure, and better accessibility and wayfinding. The study also lists the main challenges: many agencies to coordinate, inconsistent signage and branding, complicated fares and payment systems, weak first / last mile infrastructure, poor station amenities, data and system gaps, and funding constraints.

The path forward is to start with practical steps that deliver visible gains: unify branding and wayfinding, create common fares and payment, coordinate schedules for timed transfers, upgrade first / last mile options (including micromobility), and improve basic station amenities such as restrooms, seating, shade, and security; build the tools for trip planning and real-time alerts across providers; and set up a clear approach for multi-agency coordination. With these early actions, larger projects through-running, additional stops, and "tripper" services can follow. Done together, these steps reduce travel time, raise ridership, and make the network easier to use for everyone.

4. Challenges Faced by CHSR

Chapter 4 synthesizes the document-based evidence on the primary challenges confronting the California High-Speed Rail (CHSR) program and establishes the empirical foundation for the expert interviews presented in Chapter 6. Using a structured review of government-issued reports, oversight documents, and related public records, this chapter identifies which challenges are most consistently emphasized across sources and summarizes how those challenges are characterized in the literature. The results are then used to translate the document findings into a focused set of interview prompts, designed to validate the documented issues, probe underlying causes, and elicit practitioner-informed strategies that could mitigate similar risks in future high-speed rail initiatives.

4.1 Methodology

This chapter uses a structured document review to identify the challenges most consistently emphasized in public records associated with the California High-Speed Rail (CHSR) program. The document set was intentionally limited to government-issued and adjudicatory sources because these materials (e.g., agency plans and reports, oversight audits, legislative analyses, federal correspondence, and court decisions) provide formal statements of constraints, risks, and implementation barriers that are both policy-relevant and traceable. The sources cited in Section 5.2 represent the subset of documents in the database that contained sufficient, challenge-specific content to support systematic coding and reporting.

A database of CHSR-related documents was compiled through targeted searching and screening. Searches focused on the California High-Speed Rail Authority and other public entities with direct oversight or decision-making roles (e.g., federal agencies, state oversight bodies, and legislative committees), as well as key litigation records relevant to environmental review and delivery constraints. Documents were included if they: (1) directly addressed CHSR project delivery, governance, funding / finance, permitting, environmental review, right-of-way, utilities, cost, or schedule; (2) provided substantive discussion of constraints or risks (rather than brief references); and (3) were sufficiently specific to allow consistent classification of challenges. Documents were excluded if they were duplicative, lacked CHSR-specific content, or focused primarily on topics outside project implementation challenges.

The analysis employed a qualitative content review with a structured coding framework to identify recurring challenge themes. Each document was read and screened for text describing barriers to delivery (e.g., funding gaps, permitting delays, litigation complexity, third-party coordination issues, cost uncertainty, or right-of-way constraints). A challenge was coded as present when the document contained an explicit statement or discussion indicating that the issue materially affected CHSR implementation (e.g., by increasing cost, delaying schedule, constraining scope, or introducing uncertainty). Coding was applied at the document level to support comparability across sources.

To avoid inflating results due to repeated mentions within a single source, challenge frequency was calculated as a binary count per document: if a challenge appeared one or more times in a document, it contributed a single count to that challenge's frequency. Frequencies therefore represent the number of distinct documents in which a challenge was identified, not the total number of times the challenge was mentioned across all text.

The coded results were aggregated to identify the most frequently documented challenges, which are reported in Table 6 and briefly interpreted in Section 5.3. These documented challenges then served as the empirical basis for developing the semi-structured interview questions used in Chapter 6, where expert perspectives are used to validate, contextualize, and identify potential solution strategies for the issues most consistently highlighted in the public record.

4.2 Findings

Our findings are displayed in Table 7. Funding shortfalls and financing uncertainty was the most frequently cited challenge (6 mentions), tied with three other issues related to utility relocation, environmental requirements, and cost-related uncertainties, each also cited six times (Table 6). ROW Acquisition and Property Impacts were found 5 times.

Table 7. Top Five Challenges Face by CHSR

#	Challenge	Document Frequency	Source
1	Funding shortfalls & financing uncertainty	6	CHSRA (2024); CHSRA (2025a); CHSRA (2025b); FRA (2025b); U.S. House T&I Committee (2024); California Senate Transportation Committee (2024)
2	Utility relocation & third-party permits / agreements	6	OIG-HSR (2024); CA Assembly Utilities & Energy (2025); CA Assembly Transportation (2025); CA Assembly Appropriations (2025); FTA (2022); FTA (2025)
3	Environmental review & CEQA / NEPA litigation complexity	6	CHSRA (2018); FRA (2017); CHSRA (2024); Town of Atherton v. CHSRA (2014); Friends of the Eel River (2017); CA Senate Budget Subcommittee No. 2 (2015)
4	Cost escalation & uncertainties impacting estimates	6	CHSRA (2024); CHSRA (2025a); CHSRA (2025b); OIG-HSR (2024); California State Auditor (2018); FRA (2025a)
5	Right-of-way (ROW) acquisition & property impacts	5	California State Auditor (2018); OIG-HSR (2024); CHSRA (2025a); CHSRA (2018); California Senate Transportation Committee (2024)

4.3 Brief Description of the Challenges

The top challenges identified in Table 6 are described briefly in the following paragraphs:

- Funding Shortfalls & Financing Uncertainties: Even with state bond and Cap-and-Trade revenues, the program faced gaps between available funds and segment capital costs. The funding gap was a key factor in the Federal Rail Authority (FRA) terminating its agreements and in the HSR program being placed under increased legislative scrutiny, reflecting uncertainty about the federal funding share and the timing of funds (CHSRA, 2024; CHSRA, 2025a; CHSRA, 2025b; FRA, 2025b; U.S. House T&I Committee, 2024; California Senate Transportation Committee, 2024).

- Utility Relocation & Third-Party Permits: The CHSRA Inspector General's findings were that delays in utility relocation and late third-party approvals delayed construction packages. The issue was significant; to address this issue, a legislative bill (SB 445) has been proposed which aims to streamline approvals and reduce the delay related risks during relocations (OIG-HSR, 2024; CA Assembly Utilities & Energy, 2025; CA Assembly Transportation, 2025; CA Assembly Appropriations, 2025; FTA, 2022; FTA, 2025).

- Environmental Review & CEQA / NEPA Litigation Complexity: All project sections required extensive EIR / EIS covering biological, wildlife, community, and noise / vibration impacts. It is well documented that the CEQA-related litigation extended schedules and influenced design choices (CHSRA, 2018; FRA, 2017; CHSRA, 2024; Town of Atherton v. CHSRA, 2014; Friends of the Eel River, 2017; CA Senate Budget Subcommittee No. 2, 2015). All such issues increased project schedules and costs.

- Cost Escalation & Uncertainties Impacting Estimates: Updated business plans and findings from the oversight committee reviews indicate that the capital costs increased as designs matured, market prices rose, and early estimates proved optimistic. The federal correspondence in 2025 also flagged unresolved risks contributing to higher projected costs (CHSRA, 2024; CHSRA, 2025a; CHSRA, 2025b; OIG-HSR, 2024; California State Auditor, 2018; FRA, 2025a). The cost escalations are not only attached to the issues mentioned above but are also due to the delays caused by slow permitting, utility relocation, and ROW acquisition. The escalations are also expected due to uncertainties such as finding endangered species during construction. In other words, cost escalation would happen if any risk becomes a reality.

- Right-of-Way (ROW) Acquisition & Property Impacts: Oversight reports and CHSRA program documents have documented the scale as well as complexity of parcel acquisition and displacement mitigation. Sometimes the process requires iterative design changes affecting timing. These factors have contributed to schedule delays and cost overrun risk in the past (California State Auditor, 2018; OIG-HSR, 2024; CHSRA, 2025a; CHSRA, 2018; California Senate Transportation Committee, 2024). Unless a solution is found for this issue, it will be difficult to reduce the negative impacts emanating from this risk.

4.4 Conclusion

This chapter shows that the challenges confronting CHSR are not isolated technical issues; they form a tightly coupled set of institutional, regulatory, and delivery risks that repeatedly appear across independent government and oversight sources. The most frequently documented challenges are: funding and financing uncertainty, utility relocation and third-party approvals, environmental review and litigation complexity, and cost escalation / estimate uncertainty, each of which occur in six of the reviewed documents, indicating broad agreement that these factors are persistent and program-defining rather than episodic. Right-of-way acquisition and property impacts, while slightly less frequent, emerges as a consequential downstream constraint that can be amplified when the other issues delay decisions, require redesign, or shift schedules.

Importantly, the findings suggest a reinforcing dynamic: uncertain and discontinuous funding complicates contracting and sequencing; permitting, utility, and third-party coordination delays prolong delivery; extended timelines increase exposure to inflation and market volatility, contributing to cost escalation and estimate instability; and design or schedule changes increase the complexity of ROW acquisition and mitigation. In other words, several of the most cited challenges are best understood as system interactions, where delays and uncertainty in one domain propagate into others rather than as stand-alone problems that can be solved independently.

Taken together, the document record indicates that future high-speed rail programs are most likely to reduce risk by prioritizing strategies that stabilize financing and improve delivery certainty early by establishing durable funding pathways and clear federal–state commitments; accelerating third-party utility and permit agreements; strengthening environmental review and litigation risk management through early issue resolution and defensible documentation; and implementing cost-estimating and risk-management practices that explicitly account for uncertainty and schedule sensitivity. The patterns identified here directly inform Chapter 6 by defining the themes for expert interviews, which are used to validate these documented relationships, identify root causes, and surface actionable solution approaches that can improve the deliverability of CHSR and other large rail programs.

5. Expert Interviews and Reflexive Thematic Analysis of Challenges Faced by CHSR

Based on the findings from earlier chapters, specifically Chapter 5, the research team identified several challenges faced by CHSR. These challenges informed the development of open-ended interview questions for experts. This chapter presents the interview transcripts and analyzes expert perspectives on why these challenges emerged and how they affect delivery outcomes. Using reflexive thematic analysis, the chapter documents the full six phases of Braun and Clarke's approach to ensure transparency and rigor (Braun & Clarke, 2006; Braun & Clarke, 2021; Byrne, 2022). The chapter also translates expert insights into a policy relevant narrative intended to inform legislators, regulators, and senior decision makers who may shape future high speed rail development in California.

5.1 Methods and analysis approach

Experts were selected based on their current or former senior roles within the California High-Speed Rail Authority (CHSRA) or closely related government agencies with direct or indirect influence on CHSR decision-making. All interviewees were upper-management personnel with institutional knowledge of planning, delivery, funding, and legal oversight of large infrastructure programs. To ensure confidentiality, all identities were concealed.

Interview questions were derived from findings in earlier chapters and focused on three core areas:

- Legal and legislative challenges affecting timely project delivery
- Funding challenges and strategies for improving financial sustainability
- Project Delivery Methods (PDMs) and opportunities for reform

Follow-up questions were used to probe issues raised by the experts, allowing deeper exploration of causal mechanisms and institutional constraints.

Familiarization with the data: All interviews were transcribed verbatim and reviewed multiple times by the research team. The purpose of this phase was to gain a clear understanding of the content, context, and emphasis of expert responses. Particular attention was paid to how experts described authority, funding, environmental processes, negotiations, and delivery outcomes. During familiarization, experts repeatedly emphasized that CHSR challenges were not primarily technical. Instead, they were institutional and structural. Issues related to legal authority, funding certainty, and third-party control appeared consistently across interviews. These early observations guided the coding process.

Generating initial codes: Initial coding was conducted in NVivo using an inductive approach. Codes were generated directly from the interview transcripts, allowing expert language to shape the analysis. A light deductive orientation was present, as coding was guided by the three interview questions on legal challenges, funding, and project delivery. This approach is consistent with reflexive thematic analysis.

Coding remained flexible throughout the process. Codes were refined as new insights emerged. No fixed codebook was imposed in advance. The final set of codes reflected both challenges faced by CHSR and strategies suggested by experts.

The NVivo codebook shows variation in the number of files and references associated with each theme, indicating differences in emphasis across interviews.

Generating initial themes: Codes were reviewed and grouped into broader patterns of meaning. Initial themes closely followed the NVivo codebook structure to maintain transparency and traceability. The themes reflect how experts organized their own explanations rather than being imposed by the research team.

The following themes were identified:

- Comparison with Other Infrastructure
- Project Delivery Methods (PDMs)
- Project Inefficiencies
- Stakeholder Relation Management
- Eminent Domain Update
- Environmental Regulations
- Funding Challenge
- How to address non-funding issues
- How to Get Funding Issue Resolved
- Legal Challenges Faced by CHSR
- Negotiations
- Differing Views from Federal Government Affecting Project Management

These themes provided the foundation for further refinement and interpretation.

Reviewing and refining themes: Themes were reviewed against the full data set to ensure internal consistency and clarity. Closely related themes were retained as distinct where experts treated them as separate issues. For example, legal challenges, eminent domain, and environmental regulations were kept separate due to their different legal and procedural implications.

Funding challenges were distinguished from strategies to resolve funding issues. Experts consistently separated descriptions of funding gaps from proposed solutions such as long-term commitments and innovative financing.

Project inefficiencies were treated as outcomes rather than causes. These inefficiencies were traced back to upstream issues related to authority, funding, and negotiations.

Defining and explaining themes: This section explains each theme using NVivo descriptions, dominant codes, and interview data. Each theme is illustrated with a small number of verbatim quotations. Quotations are used as examples. The themes represent patterns across the full set of interviews. The remaining interpretation is provided through analytic narration.

Theme 1: Comparison with other infrastructure programs

This theme captures expert comparisons between CHSR and other infrastructure projects, particularly highways and privately delivered rail systems. Experts emphasized that highways benefit from established institutions, clear authority, and continuous funding streams, while CHSR lacked these structural advantages. Experts described these differences as important because they shape delivery outcomes. For example, one expert noted that highways succeed because they have "a predictable and sustained funding mechanism" (Expert 4). Experts also referenced projects such as Brightline West to illustrate the value of flexibility in alignment, scope, and delivery decisions.

Theme 2: Project delivery methods

This theme reflects expert views on the selection and use of PDMs for CHSR. Experts generally agreed that CHSR had the ability to use different delivery methods. Experts also emphasized that delivery methods alone could not compensate for unresolved legal, funding, and right-of-way constraints. Experts linked delivery performance to clarity of scope and risk allocation. For example, one expert explained that "the PDM labels are less important than contract clarity and risk allocation" (Expert 2).

Theme 3: Sources of project inefficiency

This theme captures delays, cost escalation, and inefficiencies experienced by CHSR. Experts consistently linked these outcomes to construction starting before land acquisition and utility relocation were complete. One expert noted that "construction beginning before acquisition caused seven years of inefficiency" (Expert 1). Other experts described schedule uncertainty, increasing costs, and ambitious requirements under Proposition 1A as contributing factors.

Theme 4: Managing stakeholder relationships

This theme focuses on CHSR's interactions with agencies, utilities, and private landowners. Experts emphasized that stakeholder engagement was unavoidable given the project's scale. However, limited authority weakened the Authority's position. One expert observed that third parties demanded infrastructure upgrades as a condition for cooperation, increasing costs and delays (Expert 3). Experts noted that effective stakeholder management requires enforceable timelines and clearer authority.

Theme 5: Property acquisition and eminent domain

This theme addresses challenges related to property acquisition. Experts agreed that CHSR's inability to acquire property in a timely manner was one of the most significant constraints on project delivery. One expert stated that "property acquisition caused the biggest legal problem" for the project (Expert 4). Several experts suggested that changes to eminent domain procedures and faster court processes would reduce delays.

Theme 6: Environmental review and regulatory processes

This theme reflects expert concerns related to CEQA. Experts described CEQA as a source of uncertainty that increased project timelines and costs. One expert noted that CEQA enabled local agencies and residents to misuse the process to favor local interests (Expert 4). While experts supported environmental protection, they emphasized the need for clearer timelines and reduced post-approval risk.

Theme 7: Funding uncertainty and financial constraints

This theme captures CHSR's long-standing funding challenges. Experts highlighted large funding gaps, limited federal support, and lack of funding certainty. One expert explained that "funding uncertainty increases cost every year" (Expert 1). Experts noted that without predictable funding, it was difficult to commit to schedules or manage costs effectively.

Theme 8: Addressing non funding institutional issues

This theme summarizes expert recommendations to improve project delivery beyond funding. Suggestions included faster legal processes, clearer project scope, value-driven decision-making, and greater flexibility. Experts emphasized that flexibility was critical for future HSR success, particularly during early planning and sequencing.

Theme 9: Strategies to improve funding stability

This theme captures expert proposals to address funding challenges. Experts highlighted long-term funding commitments, innovative financing approaches, and stronger federal participation. One expert noted that globally, most successful rail projects benefited from sustained federal backing (Expert 3).

Theme 10: Legal authority and institutional constraints

This theme reflects the Authority's limited legal power to enforce permitting, right-of-way acquisition, and utility relocation. Experts linked lack of authority directly to delays and increased costs. One expert stated that CHSR lacked authority to enforce streamlined permitting and acquisition processes (Expert 2).

Theme 11: Negotiations with third parties

This theme addresses negotiations with third parties such as utilities, counties, and landowners. Experts described negotiations as unbalanced due to limited authority. One expert noted that negotiations often benefited third parties at the expense of CHSR funds (Expert 3).

Theme 12: Effects of federal policy and funding uncertainty

This theme captures the impact of shifting federal support. Experts noted that changes in federal priorities created funding uncertainty and affected schedule certainty. One expert observed that lack of federal commitment created problems for schedule certainty (Expert 5).

5.2 What the interviews suggest for future high speed rail policy

This section synthesizes the interview findings for policy developers. It focuses on the institutional conditions that shape cost, schedule, and delivery outcomes. The discussion uses themes as interacting factors rather than standalone issues.

Legal and institutional conditions shaping project outcomes: A strong causal relationship was observed between Legal Challenges Faced by CHSR, Eminent Domain Update, and Project Inefficiencies. Experts explained that limited statutory authority delayed property acquisition and utility relocation. These delays led to idle contractors, schedule slippage, and cost escalation.

One expert emphasized the effect of sequencing construction before securing right of way, noting that "construction beginning before acquisition caused seven years of inefficiency" (Expert 1). Experts also linked delivery inefficiency to funding risk. One expert explained that "without funding certainty we cannot commit to a schedule or a true capital estimate" (Expert 1).

Regulatory processes and their effects on schedule and cost: Experts described Environmental Regulations as a source of ongoing uncertainty, particularly under CEQA. Experts emphasized that risk can reappear after approvals. One expert explained that "any new findings can restart the process" (Expert 1). When this occurs, projects often return to negotiation stages with third parties.

Experts also described how regulatory delays often lead to prolonged Negotiations, especially with utilities and local agencies. One expert explained that negotiations became unbalanced when third parties faced no time pressure, which can increase scope and cost (Expert 3).

Governance context and decision making: Experts described politics and law as upstream conditions that shape downstream performance. Politics Affecting Project Management and Legal Challenges Faced by CHSR influenced funding commitments, institutional flexibility, and the ability to enforce timelines.

Experts used Comparison with Other Infrastructure to explain why this matters. For example, one expert contrasted CHSR with highway programs and noted that highways benefit from stable institutional frameworks and funding, stating that they succeed due to "a predictable and sustained funding mechanism" (Expert 4).

Experts also treated Project Delivery Methods (PDMs) as an implementation tool rather than a solution to structural constraints. One expert stated that "the PDM labels are less important than contract clarity and risk allocation" (Expert 2).

Stakeholders, negotiations, and delivery risks: Experts frequently discussed Negotiations and Stakeholder Relation Management together. Limited authority weakened the Authority's negotiating position, which increased reliance on stakeholder cooperation rather than enforceable timelines. One expert observed that negotiations often benefited third parties at the expense of CHSR funds (Expert 3).

5.3 Implications for future high speed rail policy in California

The interview findings suggest that future HSR efforts should address institutional conditions early. Clear authority, predictable funding, and enforceable timelines reduce risk. They also improve the effectiveness of delivery methods and stakeholder engagement. One expert noted that projects struggle when agencies lack both power and funding certainty (Expert 4).

Policy changes that reduce pre-construction uncertainty can improve outcomes. Experts emphasized the importance of reforms related to permitting timelines, eminent domain procedures, and negotiation frameworks. These reforms can reduce downstream inefficiency and cost escalation.

Funding strategies should be designed as long-term commitments rather than short cycle appropriations. Experts highlighted the role of sustained federal participation in successful rail programs. For example, one expert noted that globally, most successful rail projects benefited from sustained federal backing (Expert 3).

5.4 Conclusion

This chapter presented findings from expert interviews using reflexive thematic analysis. The analysis focused on how authority, funding certainty, regulatory processes, and negotiations shaped delivery outcomes for CHSR. Experts described these factors as interacting conditions that influence cost and schedule performance.

For policy developers, the core message is that delivery methods and technical decisions operate within a larger governance environment. Strengthening statutory authority, improving predictability in funding, and reducing avoidable delay in land acquisition and regulatory processes can improve the feasibility of future HSR projects in California.

This study has limitations. The number of interviews was small. The interviewees were senior experts with direct institutional knowledge. This provided depth, but it does not represent all stakeholder perspectives. The findings are interpretive and are not statistically generalizable. The themes reflect consistent patterns across expert accounts and are intended to inform policy design rather than to measure public opinion.

6. Summary & Conclusions

This research examined the California High-Speed Rail (CHSR) program through multiple lenses: international high-speed rail benchmarking, Japan's land-readjustment / value-capture experience, multimodal network integration case studies (including LA Metro's Rail Network Integration Study), legislative and policy context, a synthesis of oversight and agency documents, and expert interviews analyzed using reflexive thematic analysis. The central conclusion across these lines of evidence is consistent: CHSR's most persistent barriers are not primarily technical, but institutional, rooted in the interaction between funding continuity, legal authority, third-party control, and pre-construction uncertainty that cascades into schedule delay and cost escalation.

Rather than treating challenges as isolated project-management problems, the evidence suggests CHSR is best understood as a system in which governance and financing conditions shape the effectiveness of every downstream tool (procurement method, contracting strategy, construction sequencing, stakeholder engagement, and the feasibility of multimodal integration outcomes). The remainder of this chapter elaborates seven key findings and then translates them into a set of policy- and implementation-oriented recommendations, organized under six thematic areas to reflect the structural-to-operational logic used throughout this report.

6.1 Key Findings

CHSR's principal problems are structural and institutional, not primarily technical.

Across expert interviews and the document record, the most consistent explanation for delay and escalation was the interaction of funding uncertainty, constrained or fragmented authority, and third-party leverage (utilities, permitting agencies, local jurisdictions, litigants, and property owners). These conditions reduce the program's ability to enforce timelines, sequence work efficiently, and lock in cost and scope early. The practical implication is that technical design quality alone cannot solve CHSR's delivery risk if the institutional environment continues to generate unpredictable starts, stops, and renegotiations.

CHSR exhibits an unusually high unit-cost profile paired with ambitious operational targets, creating compounded risk.

The program's cost profile and design objectives should be understood together. Very high-speed targets and relatively close station spacing can introduce tradeoffs: more complex civil works, urban interfaces, and utility conflicts can push costs upward, while operational realities may limit the extent to which maximum speeds can be sustained between stops. The takeaway is not that performance goals are inherently wrong, but that high performance objectives must be matched with delivery conditions that protect schedule reliability and reduce late-stage scope churn.

The blended approach can support integration and cost control, but it raises governance and operations complexity.

The mix of new dedicated infrastructure and upgraded or shared segments can be pragmatic and can strengthen connections to existing services. However, blended systems also introduce additional coordination burdens: rights-of-way are controlled by multiple parties, operating agreements and dispatch priorities must be negotiated, and signaling or platform constraints can ripple across multiple operators. Blending can be a rational strategy—but only if institutional arrangements are strong enough to manage shared-risk interfaces over decades.

Oversight and agency documents converge on five recurring, program-defining constraints, and they reinforce each other.

The most consistently emphasized constraints are funding and financing uncertainty; utility relocation and third-party permits and agreements; environmental review and litigation complexity; cost escalation and estimating uncertainty; and right-of-way acquisition and property impacts. These constraints do not operate independently. Unstable funding complicates contracting and sequencing; regulatory and third-party delays extend schedules; extended schedules increase exposure to inflation and market volatility; and redesigns or time pressure amplify acquisition and mitigation complexity. Interventions should therefore target system interactions, not only one-off fixes.

Rail-network integration can produce strong public value, but it requires coordination capacity and real capital.

International experience and integration case studies indicate that integration reduces transfer penalties and improves rider experience through coordinated schedules, unified wayfinding, integrated ticketing, and first / last-mile improvements; supporting ridership growth and environmental and equity outcomes. However, integration is not costless: it depends on multi-agency alignment and can require large capital programs. Integration therefore functions as both an operational program and a governance program.

Japan's land-readjustment and value-capture tools offer real lessons, but direct transplantation to California is unlikely without adaptation.

Japan demonstrates how reserve land, land pooling, and benefit-sharing can align property owners and support rail investment. California has partial analogs, but implementing comparable tools at scale would require tailored enabling legislation, sustained outreach, and administrative capacity. Value capture can be part of a financing portfolio, but it cannot substitute durable core funding.

Delivery method choice matters less than contract clarity, risk allocation, and governance conditions.

Experts emphasized that procurement labels are not a solution by themselves. Outcomes hinge on whether contracts clearly allocate risk, whether agencies can enforce commitments, and whether funding and authority are predictable enough for contractors and partners to plan rationally. Procurement debates should be reframed to focus on the institutional prerequisites that allow any delivery method to perform as intended.

6.2 Recommendations

The recommendations below follow a thematic structure (A–F), that translate the findings into an implementable action agenda. Together, they prioritize reducing upstream uncertainty, strengthening enforceable authority at interfaces, and treating integration as a governance-and-capital program rather than a purely operational aspiration.

- Strengthen funding certainty and diversify the financing toolbox

- Pursue long-term, committed funding streams to reduce stop–start delivery. Discontinuous funding is a delivery risk multiplier. When funding is uncertain, agencies hesitate to award multi-year procurements; contractors price risk higher; schedules become conditional; and unresolved interfaces (utilities, ROW, permits) linger until money is firm. Durable commitments should be designed to support multi-year contracting, protect cash flow for critical-path enabling work, and reduce midstream rescoping that drives cost escalation.

- Enable investment-grade crowd-sourced financing and alternative instruments as supplements, not substitutes. Alternative instruments can diversify sources and build public buy-in, but they should not be framed as a replacement for stable public funding. The most actionable pathway is to pilot a tightly scoped instrument tied to a well-defined outcome (e.g., a station-area improvement package or an integration upgrade at a transfer hub), then evaluate uptake, administrative burden, and political feasibility before scaling.

- Create staged funding packages for multimodal integration investments. Integration benefits are compelling but capital-intensive. Build phased packages that pair high-impact, near-term improvements (wayfinding, timed transfers, real-time information) with larger capital items, and use funding stacks that match each tier (federal grants, regional contributions, and local tools where appropriate). Early wins build credibility and can support ridership growth while larger projects mature.

- Fix governance, authority, and procurement friction

- Clarify and strengthen statutory authority for acquisition, permitting, and enforcement while preserving due process. The objective is not simply more authority; it is time-bounded, predictable processes that reduce uncertainty without undermining safeguards. Target reforms where the current system creates 'no one has to decide' dynamics situations where third parties face limited time pressure and CHSR bears the cost of delay.

- Standardize contract templates and risk allocation language; prioritize clarity over delivery-method labels. Delivery methods perform when contracts translate governance reality into enforceable responsibilities. Standardization should define scope boundaries, allocate third-party risk explicitly, set measurable milestones linked to ROW, utilities, and permits, and provide dispute-resolution pathways that prevent slow-rolling from becoming the default.

- Use value capture and land assembly strategically

- Pilot a California adaptation of land-readjustment / value-capture in targeted station areas with binding benefit-sharing. Start with pilots, not statewide transformation. Select station areas where land assembly challenges and uplift potential are both high; establish transparent benefit-sharing rules; and pair the pilot with credible outreach. The goal is to test whether these tools can reduce ROW friction, help fund station-area improvements, and align local incentives before attempting broader replication.

- Advance multimodal integration measures

- Adopt a regional integration playbook (wayfinding, fares / payment, first / last mile, and real-time data standards). Treat integration as a program with accountable leadership and measurable outputs to reduced transfer time variability, fewer missed connections, improved station legibility, and higher multimodal ridership. A playbook provides shared standards and routines that make integration durable rather than episodic across agencies.

- Improve delivery sequencing and risk mitigation

- Require readiness gating before major construction starts (ROW, utilities, and key permits secured). Beginning construction without secured ROW / utilities / permits often produces prolonged inefficiency such as work stoppages, remobilizations, redesign, and claims. Readiness gating formalizes a simple rule: do not convert uncertainty into sunk cost. Implementation requires clear readiness criteria, transparent reporting, and the willingness to delay starts to avoid multi-year inefficiencies.

- Establish a dispute-resolution and acceleration unit to fast-track third-party conflicts under defined timelines. Many CHSR delays arise at interfaces. A dedicated unit should convene parties, use standard templates and escalation pathways, and apply defined deadlines so negotiations do not drift indefinitely. The purpose is to reduce the transaction cost of resolution so schedule risk does not accumulate until it becomes a crisis.

- Implementation guardrails, limits, and expected outcomes

- Address legal and political opposition risk through early outreach and careful drafting for statutory reforms. Reforms related to acquisition, revenue tools, or new finance mechanisms will face resistance. Treat opposition risk like any other megaproject risk: identify it early, allocate responsibility, and design mitigation measures that reduce surprise and backlash.

- Treat pilot finance mechanisms as gap-closers, not replacements for durable core funding. Value capture and crowd investment can help close gaps or accelerate discrete packages, but they cannot replace stable public funding for a megaproject-scale system. Build pilots with realistic expectations and evaluate them against administrative complexity and feasibility, not just nominal dollars raised.

- Create and sustain multi-agency integration governance so benefits remain achievable over time. Integration can generate ridership, equity, and GHG benefits, but only if agencies stay aligned on standards, revenue-sharing, and long-term operations. Formal agreements, shared metrics, and durable coordination routines help ensure integration does not collapse under shifting priorities.

6.3 Closing Synthesis and Study Limitations

Taken together, the evidence supports a clear conclusion: the path to improving CHSR's deliverability runs first through institutional reform and sequencing discipline, then through operational integration and responsible financing diversification. The recommendations intentionally start with stabilizing funding and clarifying authority because those actions reduce upstream uncertainty, making subsequent decisions (procurement, contracting, stakeholder negotiation, integration investment) more predictable and less costly. If California can pair governance reforms with pragmatic pilots (value capture in targeted station areas; integration packages staged to deliver early wins; supplemental finance instruments used responsibly), the probability of achieving CHSR's intended public benefits increases materially while controlling the drivers of cost and schedule risk emphasized throughout the report.

This study has limitations. The expert interview sample is small and composed of senior practitioners with deep institutional knowledge; that provides depth and insight into governance and delivery dynamics, but it does not represent all stakeholder perspectives, and the findings are interpretive rather than statistically generalizable. Even with those limits, the convergence across independent evidence streams such as oversight documents, comparative international cases, integration research, and expert testimony, strengthens confidence that the core issues and solution directions identified here are robust and policy-relevant.

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Dr. Deepak Sharma holds a Ph.D. in Civil Engineering from the University of Maryland, College Park. He is a Professor in the Department of Civil and Environmental Engineering at California State University, Fullerton (CSUF). He has been involved with several research projects focusing on PDMs and procurement since 2007. While doing his MS, he researched the financial feasibility of P3 projects and published multiple papers. During this time, he also contributed to developing an MS Excel-based toolkit named P3 Feasibility Analysis Toolkit (P3FAST). He continued his involvement in PDMs and procurement beyond his academics and has published six high-quality journal articles, two reports, and nine conference papers. He has also presented at two TRB meetings in the area of PDMs and procurement. He also has expertise in conducting surveys and statistically analyzing data. He is an active researcher and continues researching in the area of PDMs. Before coming to CSUF, he taught Statistics and Operations Research for two years at the University of Baltimore. Lastly, as a faculty member at CSU Fullerton, he teaches several courses that touch upon project delivery methods, legal issues, quality control, cost estimation, modeling, and research.

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