TRANSIT COSTS PROJECT

How to Improve Domestic High-Speed Rail Project Delivery

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Background Image: Umberto Boccioni. *States of Mind I: The Farewells*. 1911 from: https://www.moma.org/collection/works/78648

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Executive Summary

Five Recommendations to Speed Up Domestic High-Speed Rail Project Delivery

The purpose of this report is to make concrete recommendations at the federal, local, and project-sponsor level to speed up the delivery of *true* high-speed rail in the United States.[1] This report is based on an extensive review of existing and planned high-speed rail projects, original data collection on costs and project timelines, and in-depth interviews with 66 experts across the international high-speed rail industry, including project sponsors, suppliers, agency officials, consultants, contractors, lawyers, advocates, scholars, and others. Below, we outline five core recommendations (in blue), and the intended audience (in gray) beneath each recommendation.

1. Federal Direction and Nurturing Local Experimentation

Congress, United States Department of Transportation, Amtrak, or Other Entity

First, at the national scale, the United States Department of Transportation and Congress need to make an affirmative decision to support a financially sustainable intercity passenger rail plan

[1] According to the International Union of Railways, true high-speed rail begins at 155 miles per hour.

that includes true high-speed rail. This includes establishing dependable funding, developing staff familiar with high-speed rail, committing to building an intercity passenger rail network, and nurturing experimentation at the subnational level.

2. Technical Standards

United States Department of Transportation

Second, at the federal level and likely in coordination with an international or national standards association, the Federal Railroad Administration, or another entity empowered to adopt high-speed rail design standards should create them. These standards should not be *sui generis*. They should borrow from existing standards in the United States, Europe, and East Asia. Standards help maintain production quality, reduce costs, ensure interoperability, simplify interfaces with other components, maximize longevity, and encourage suppliers to enter the high-speed rail market.

3. Stronger Links to Universities and Industry

Universities and Industry

Third, bolster university education and strengthen linkages to industry by expanding training opportunities to develop the specialized education, skills, and experience to plan, design, and deliver high-speed rail. Additionally, this recommendation helps enlarge the constituency advocating for high-speed rail.

4. Project Management, Procurement, and Risk

Project Sponsors

Fourth, project sponsors need to invest in internal capacity to develop well-defined projects, manage consultants and contractors, and coordinate across multiple manageably sized contract packages. Hiring consultants for specialized tasks is necessary, but failing to manage them because of a lack of staff or being wholly reliant on them is counterproductive.

5. Permitting, Third-Party Agreements, and Planning

United States Department of Transportation, State Governments, and Project Sponsors

Fifth, project sponsors, ultimately, need governors, state legislatures, and the federal agencies awarding them billions of dollars in grants to construct nationally significant high-speed rail projects to support them by separating planning from environmental review, and help manage schedule and scope risks that emerge during environmental review and local permitting. Concerns about environmental review, specifically, subsumes planning and pre-construction activities because environmental clearance is the key to unlocking federal funding. By separating planning from environmental review, project sponsors can define their projects *before* starting environmental review.

Introduction

The dream of high-speed rail in the United States has been long deferred. Since the 1960s, the federal government has created, funded, and reshuffled new organizations within its bureaucracy; states have stood up new public authorities and dissolved franchise agreements with optimistic private operators; voters have approved and voted down tax measures to fund construction; and the private sector has promoted projects, none of which have reached revenue service. Metroliner and Acela service on the Northeast Corridor and Brightline's recent launch in Florida are the glowing embers that have fanned the dream of a renewed national passenger rail network featuring *true* high-speed rail.

Despite these efforts to bring high-speed rail to the United States, however, the larger issue remains: who will prioritize improved intercity passenger rail? We are not the first to ask this question, but no one in authority has yet answered it. So long as this question remains unanswered or the answer is ambiguous and policy translation garbled, the domestic passenger rail sector will struggle to replicate successes found abroad. Again, there is, in the present tense, positive news to buoy the faithful. President Biden's administration has handed out billions in grants to California High-Speed Rail and Brightline West, Representatives Seth Moulton and

Suzan DelBene have introduced a bill that would radically increase high-speed rail funding by re-authorizing moribund sections of the United States Code, and projects like Texas Central and Brightline West have generated positive news coverage. Even better than headlines, Brightline West broke ground on April 22, 2024 with an anticipated service revenue date in 2028.

As exciting as these developments are, what is the American vision for the intercity passenger rail network, and how does the current slate of disparate projects fit into a cohesive national network? Internationally, countries like Japan, Korea, Spain, and France have developed highly centralized high-speed rail networks that concentrate service to core cities with good transit networks. In Germany, by contrast, the high-speed network is less focused on the capital city, and, instead, has a national network of high-speed and higher-speed services spanning much of the country. Additionally, in many of these countries, high-speed rail wasn't the sole focus of their passenger rail plans (Vickerman 1997; Givoni 2006; Ineco 2023; Chitti and Beria 2024). As these nations introduced high-speed rail, they also upgraded the existing network, and introduced new schedules, higher speed services, and extensions. In order to introduce transformative change, change that creates tangible transportation benefits, decarbonizes the transportation network, promotes higher densities, enables less auto-centric lifestyles, and provides new opportunities for research, construction, and design and engineering expertise, all levels of government need to change how they approach intercity passenger rail. Specifically, we recommend changes to governance, advocacy, funding, infrastructure, domestic supply chains, and high-speed rail capacity.

It is also worth recognizing how the United States' context differs from other nations. The United States has a rich railroading history, but the vast majority of intercity rail tracks are owned by private freight railroads. Amtrak, the national passenger operator, struggles to deliver reliable service while negotiating access and priority on these privately owned tracks. Unlike European or East Asian high-speed rail networks, there is not a public national network of track waiting to be upgraded, augmented, and managed more efficiently for passenger service. The United States also lacks large, dense metropolitan areas with good transit connections to serve the intercity rail market that are within a few hundred miles of one another. Unlike Seoul and Busan or Tokyo and Osaka, there are no domestic city-pairs that can serve a quarter or more of the country's population in under 250 miles. These are not fatal flaws. Beijing and Shanghai, for instance, are nearly 700 miles apart. The Houston and Dallas metropolitan areas are only 240 miles apart, but, more importantly, contain roughly 50% of Texas' 30 million residents.[2]

The purpose of this report is to make concrete recommendations to speed up the delivery of true high-speed rail, high-speed rail achieving a minimum speed of 155 miles per hour in accordance with the International Union of Railroads' definition of high-speed rail , in the United States. As noted above, to do that, we need to recognize that the task ahead of us is distinct from what we have accomplished to date and requires a departure from what we are doing. When speaking to high-speed rail experts who have worked in Spain, France, China, Taiwan, Germany, Turkey, and Japan, all mentioned that there was uniform agreement that high-speed rail was a national priority, and that national intervention, be it in terms of establishing design standards,

[2] It is important to think about the appropriate catchment area from stations.

creating space within a national ministry to carry out planning, or a recognition that technology transfer from successful systems was needed to catalyze their domestic market, there was broad enough political support to complete projects.

Framing

In this report, we highlight five key recommendations to speed up high-speed rail project delivery. The majority of these recommendations are organized across two general themes that help organize them: scale and management.[3] Recommendations also address the broader domestic high-speed rail market, which is influenced by scale and management, but also can be thought of somewhat independently.

Scale: Scale refers to administrative and geographical focus. Recommendations about national standards, Amtrak, the National Environmental Policy Act (NEPA), or congressional actions likely operate at the national scale. At a finer geographical scale, there are ideas that target specific corridors at the regional or state scale rather than the larger national network. Projects like California High-Speed Rail operate at the subnational scale, though it does receive federal funding; thus, blurring the boundaries.

Management: Management refers to the entity leading the project. There are public agencies leading or involved with projects, such as Amtrak or the California High-Speed Rail

[3] Perl (2002) used a similar framework to explore intercity passenger rail recommendations.

Authority, and private entities, the defunct American High Speed Rail Corporation that proposed bringing Japanese Shinkansen trains to California in the 1980s is one example. In between these two poles, there are also blends of the two management approaches. Brightline West, for one, received a $3 billion grant from the United States Department of Transportation, but is a private company building privately-owned infrastructure on a public right of way (United States Department of Transportation 2024). Amtrak and Texas Central Partners are working together to develop a high-speed rail corridor between Houston and Dallas.

While these two frames help organize recommendations into more coherent, workable solutions, it is clear that they are not black and white binaries—either 100% national or 100% private. They operate along a continuum.

Recommendations

1. Federal Direction and Nurturing Local Experimentation

Congress, United States Department of Transportation, Amtrak, or Other Entity

The first, and most important recommendation, is painfully obvious and has been for more than 50 years: at the national scale, the United States Department of Transportation (US DOT) and Congress need to make an affirmative decision to support a financially sustainable intercity passenger rail plan that includes true high-speed rail. While there have been attempts to advance more holistic intercity passenger and high-speed rail visions, such as the "High-Speed Ground Transportation for America" (Federal Railroad Administration 1997) or "Vision for High-Speed Rail in America" (Federal Railroad Administration 2009), it appears that beyond an initial burst of enthusiasm, these programs have not maintained continuous support, which has diminished planning efforts at the national and state level. Plans and projects have never been institutionalized in the ways that highway, airport, and public transit development programs are both authorized in legislation and tied to public finance through trust funds.

This start and stop approach to intercity passenger rail planning and policy is in part a product of more than 50 years of debate regarding Amtrak, the putative national passenger rail operator. This is in stark contrast to the nationally and European Union planned and funded networks in Europe and Asia (European Court of Auditors 2018; Lawrence et al. 2019, p.57; Alff 2024, p.175; Chitti and Beria 2024, pp.9-10). In the United States there has not been broad, uniform agreement that intercity passenger rail and high-speed passenger rail should be national priorities. In fact, President Ronald Reagan (1985) actively lobbied to defund Amtrak because he viewed it as an endless money pit:

> When Amtrak leaves the station, they're being fueled by $35 in subsidies for every passenger. They just keep shoveling in those tax dollars, but it's you, the people who are getting railroaded. What theoretically started out to be only a 2-year trial period, which was supposed to have provided Amtrak time to become self-sufficient, ended up as a mobile Federal money-burning machine. We can't afford it anymore. Amtrak and other programs like it are taking us on a one-way trip to the poorhouse.

Amtrak's fortunes have always been uncertain. Phyllis Scheinberg (2003, p.26), from the U.S. General Accounting Office closed her congressional testimony on Amtrak oversight underscoring the importance of making a decision about the future of domestic intercity passenger rail, and Amtrak's role in that future more than twenty years ago: "My final point today is that no matter whether Amtrak succeeds or fails in reaching self-sufficiency, important decisions will need to be made about the future of Amtrak, the scope of intercity passenger rail service in the United States, and the levels of federal support."[4] Amtrak does receive operating subsidies and capital grants that have kept it afloat; however, until it joined Texas Central Partners' grant application, it had been universally excluded from recent high-speed rail

[4] For more dire quotes about the state of intercity rail policy see Thompson (2003).

expansion plans. The US DOT had instead opted to seed capital projects through discretionary grants at the corridor level while remaining agnostic about public or private operations, and develop safety standards and guidelines without codifying design standards. This tentative approach to high-speed rail policy has created uncertainty, delay, interoperability challenges, and additional costs as existing projects extend timelines and suppliers fail to participate in an active domestic market for the specialized inputs needed for high-speed rail, such as rolling stock, rail, ballast, and turnouts.

While Congress has approached intercity passenger rail tentatively, it has provided Amtrak with more than $125 billion in operating subsidies and capital grants since its inception.[5] Despite these outlays, it has not resolved Amtrak's largest issues: sustainable funding, greater control over the infrastructure it operates on, or a clear picture of how intercity rail fits into the national transportation policy framework (Perl 2003, p.186). This is not how other high-speed networks have been built in Spain, France, China, and Japan. It is clear that there has been little intention of committing to Amtrak as the national high-speed rail carrier or addressing the national network at the national scale. Amtrak, to its credit, has elbowed its way into the high-speed rail fray by hiring Andy Byford as a Senior Vice President for High-Speed Rail Development Programs and resurrecting the Texas Central project. These moves signal Amtrak's desire to expand beyond its existing services. This project, if it is ever completed, will be operated by Amtrak in a newly constructed right of way. California High-Speed Rail and Brightline West, on the other hand, the two most mature domestic high-speed rail projects will likely not be operated

[5] Based on the author's calculations in 2024 constant dollars.

by Amtrak (California High-Speed Rail Authority 2024, p.36). Despite the near certainty of different operators, design standards, and rolling stock, the US DOT has committed funding, at different scales, to all three projects without requiring interoperability or joint procurement of common items that could reduce costs and help catalyze a domestic market for key high-speed rail components.[6]

Rather than continuing along this path, the Federal Railroad Administration (FRA), a new entity within the US DOT, or Amtrak should develop an intercity rail plan that reflects national priorities, specifically weighing trade-offs against other modes and prioritizing competitive travel times vis-à-vis driving and flying, rather than trying to assimilate state rail plans of varying quality or relying solely on grant programs to stitch together a vision. Grant programs, in particular, are ill suited to integrated planning because they rely on grantees to determine projects in an uncoordinated fashion. This *may* work for transit, but it is easy to see how this would not work at the national scale.[7] This plan should target upgrades to existing routes, identify new corridors, and emphasize service via a schedule.

Within the context of this national plan, there is room for experimentation along both the scale and management axes mentioned earlier. The development of new transportation networks has often come from the local level rather than the federal level. With the advent of canals, railroads, and highways, it was states and public-private partnerships, not the federal government, that initiated the transition to these new networks. Instead, Aggarwala (1998, p.65)

[6] Brightline West and California High-Speed Rail did sign an interoperability agreement in 2023.
[7] The Federal Transit Administration's Capital Investment Grants Program also follows a grant-making approach based on project sponsor applications. In theory, transit networks are more likely to be self-contained rather than connected to other transit networks.

writes, “The federal government has not historically taken a leading role in implementing the first parts of a new-mode network. Rather, it has played the role of completing a national system once key components have already been constructed by state and/or state-private ventures.” With this in mind, if states or private ventures take the steps to develop and invest in intercity rail projects, there should be enough flexibility to nurture those projects, as US DOT has done with California High-Speed Rail and Brightline West. At a minimum, design and interoperability standards and some other basic rules, like a regulated utility company must follow, provide a good framework to integrate local projects. If these projects are successful, over time, it is reasonable to assume that the federal presence will increase as public interest in high-speed rail grows.

Maintaining managerial flexibility is important, but it is not a substitute for national direction and vision. First, while multiple transit agencies plan, maintain, and operate their own systems, as the national passenger rail network is re-imagined, it is critical that there be consistent standards that ensure interoperability and make the process of planning and design more streamlined and consistent. Second, one of the key lessons from the California High-Speed Rail Authority is that creating a new organization to plan and deliver a new high-speed rail line is difficult. Finding the right leaders and staff takes time, and, with limited domestic high-speed rail experience, it is unlikely that there are enough people to credibly lead fifty different organizations in each state. At this early stage in domestic high-speed rail deployment, it would be better to concentrate resources and recruit and empower domestic experts who have demonstrated an ability to deliver these projects and foreign experts rather than support dozens of diffuse, lightly

staffed organizations that are overly reliant on consultants. Third, while recent history has shown that it is possible for states and private actors to start building these projects, there is a longer history of unsuccessful efforts in Texas, Ohio, California, and Florida (Perl 2002; Cohen 2016).

2. Technical Standards

United States Department of Transportation

The second recommendation relates to the first, but requires additional emphasis. At the federal level and likely in coordination with an international or national standards association, FRA, or another entity should create national high-speed rail design standards. [8] These standards should not be *sui generis*. They should borrow from existing standards in the United States, Europe, and East Asia.[9] For new construction, in particular, this will speed up design and bring greater certainty to the emerging supply chain. For projects that tie into existing rights of way, such as freight or commuter rail corridors, there will be necessary adjustments to ensure interoperability.

Texas Central, Brightline West, and California High-Speed Rail use different technical standards to guide design decisions about rail, signals, turnouts, right-of-way dimensions, ballast, and traction power facilities. If high-speed rail were a fledgling technology one could see the benefit of testing different designs before selecting a specific standard. When standards are

[8] There are many national and international associations that develop and maintain transportation standards like the American Railway Engineering and Maintenance-of-Way Association (AREMA), International Union of Railways (UIC), American Association of State Highway and Transportation Officials (AASHTO), and Society of Automotive Engineers (SAE) International.

[9] These standards should be revisited as projects enter into revenue service so that experiences learned in the field can be applied to updated standards.

mixed, as is the case with California High-Speed Rail and Brightline West, there is concern that designs that work on paper will not work in practice because of unanticipated interface challenges. This mixing and matching approach also leads to time consuming design, coordination, and testing efforts. One senior engineer working on domestic high-speed rail projects, with international high-speed rail experience, told us that "I cannot guarantee that [Japanese rolling stock] can run on European standard track" (Personal Interview A 2024). In a separate interview with a standards expert, we were told that rather than patching together foreign standards that may work when combined, the goal should be to adopt high-speed rail standards that move the industry "from confusion to alignment" (Personal Interview B 2024).

Standards create guidance for suppliers and help grow markets and supply chains by enabling modularity and scale. Instead of manufacturing multiple types of rail, manufacturers can tune their machinery to produce, and produce at scale, the *standard* rail. American freight railroads have a standard, and high-speed rail in Europe and East Asia have a standard (image 1).

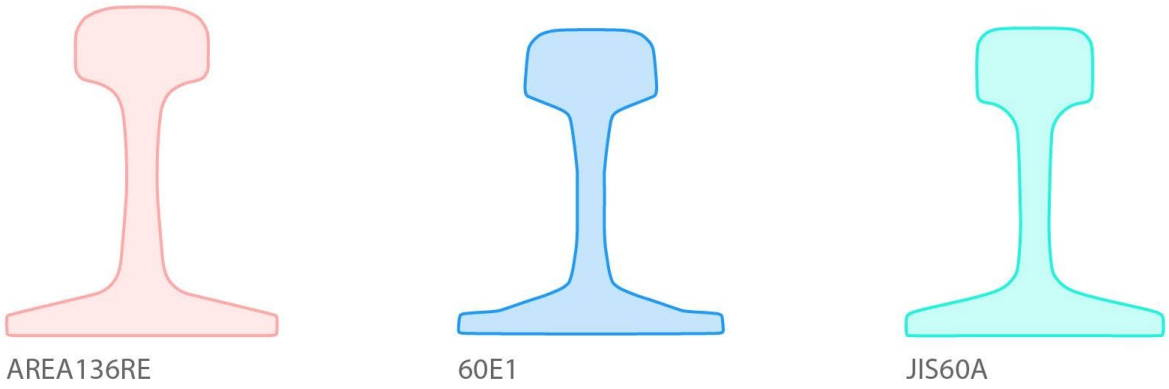

Image 1: American, European, and Japanese Standard Rail

This helps maintain production quality, reduces costs, ensures interoperability, simplifies interfaces with other components, maximizes longevity, and incentivizes suppliers to enter the high-speed rail market. None of this should come as a surprise to railroaders. In 1886, railroads across the South narrowed their railroad gauge from 5 feet to 4 feet and 9 inches; thus, harmonizing with Northern railroads. Gross (2020, p.5683) explains that "the gauge change instantly integrated the South into the national transportation network, making it possible for goods and passengers to move effortlessly into and out of the region without costs and delays of interchange." Without standards, however, we run the risk of producing one off solutions that interact poorly, and are costly to retrofit (Image 2).

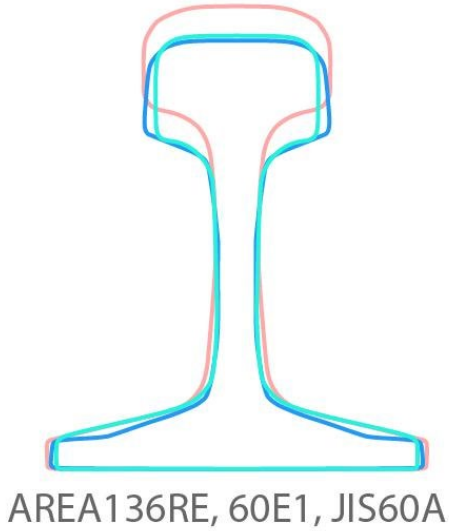

Image 2: Overlaying different standards to highlight differences and interoperability challenges.

In practice this recommendation has two main components. First, at the federal level these standards should not be overly prescriptive. One senior engineer with decades of high-speed rail experience in the United States and Europe explained that there should "be a minimum standard at the federal level that is mandatory. States can add other rules. The rail is part of that minimum standard. How the signaling system works and transfers information from trackside equipment to train should be spelled out" (Personal Interview 2024 C).

Second, after establishing basic standards, the FRA should develop a high-speed rail testing area at its Transportation Technology Center in Pueblo, Colorado. This facility currently does not support testing beyond 165 miles per hour. These types of facilities and research centers exist in China, Japan, Germany, England, and elsewhere. They are useful for research and innovation, but also allow project sponsors and suppliers to address interface challenges ahead of commissioning, such as vehicle-track interaction. The more systems integration work that can be done during construction, the faster the commissioning process will be. This is especially important for challenging connections to existing facilities and for testing new systems combinations and products (Brown 2023; Board of Directors Meeting 2023, p.46; Personal Interview D 2024).

3. Creating Stronger Links to Universities and Industry

Colleges and Universities and Industry

The third recommendation addresses workforce development and cultivating a broader high-speed rail community that includes universities and industry. In multiple interviews, we were told that there is limited domestic high-speed rail experience and expertise

across the entire labor spectrum, from craft labor to engineers (Personal Interview A 2023; Personal Interview B 2023; Personal Interview C 2023; Personal Interview C 2024; Personal Interview E 2024). This is not a novel finding. In fact, FRA has been working with universities to develop courses and train the next generation of engineers, operators, and craft laborers (Federal Railroad Administration 2018). While these efforts have been underway for over a decade, it is clear that people working in the industry today still think that the overall labor pool is insufficient. This is important for two reasons: First, there needs to be a labor force to carry out these projects. Second, Dunn and Perl (1996) argue that France and Germany succeeded in developing high-speed rail technology and political acceptance by linking university-led research and the manufacturing sector's profit motive with transportation policy at the national and subnational levels. If it is true, as our interviews suggest, that there is a lack of high-speed rail expertise in the United States, it is not surprising that existing high-speed rail advocacy has been unable to capitalize on the federal money that has been available for decades. To address these shortcomings, this recommendation focuses on bolstering university education and strengthening linkages to industry by expanding training opportunities to develop the specialized education, skills, and experience to plan, design, and deliver high-speed rail. It should be noted that a more robust domestic high-speed rail industry would likely catalyze these efforts.

. The Bipartisan Infrastructure Law allocated $120 million dollars to 35 university transportation research centers drawing on faculty and students at hundreds of universities and

community colleges (United States Department of Transportation 2024a). After reviewing recent projects that each center posted on its website, only two produced research relevant to high-speed rail. Specifically, Florida International University's Accelerated Bridge Construction center studied high-speed rail bridge/viaduct construction and University of Illinois Urbana-Champaign's Transportation Infrastructure Precast Innovation Center studies precast construction techniques that likely would be applicable to high-speed rail construction. These centers largely study everything else other than high-speed rail, such as electric vehicles, autonomous vehicles, connected vehicles, climate and sustainability, simulation and modeling, data tools, cycling, remote and hybrid work, microtransit, freight, highways, machine learning, safety, construction materials, etc. These topics, by and large, reflect faculty and student interests, federal grant programs, and industry sponsorship.

With more money flowing to intercity rail, transit, and high-speed rail via programs like Corridor Identification, Federal-State Partnership for Intercity Passenger Rail, New Starts, etc. it is likely that research in high-speed rail and rail engineering will increase, and that there is an opportunity to fortify and expand the high-speed rail community. Germany, Spain, China, Japan, England, Hungary, and other countries have research institutes and university partnerships investigating how to plan, design, build, maintain, and improve high-speed rail. In Spain, for instance, there was an explicit goal to unify different strands of research, from traction power to signals, across the engineering curriculum to ensure Spain maintains its engineering advantages (Technical-Scientific Committee for the Study of Improvements in the Railway Sector 2014, p.IX).

This connection between industry and universities is critical to building larger policy communities that have a stake in advocating for rail and high-speed rail. The University of Illinois Rail Transportation and Engineering Center (RailTEC) is one of the few engineering programs in the country that achieves this combination of applied research, practical training, and policy direction. RailTEC offers multiple courses in rail transportation engineering and has a research and innovation laboratory where students, faculty, and industry partners investigate railroad infrastructure components like crossties and joint bars. While there are full-time faculty members teaching courses and doing research, there are also adjunct and affiliated faculty with decades of experience at Amtrak, Taiwan High Speed Rail Corporation, and BNSF sharing real world experience and preparing the next generation of railroad engineers. In addition to semester long courses in Railway Signaling and Control, High-Speed Rail Engineering, etc., there are also short courses, Track Engineering Fundamentals and Railroad Project Design, geared towards professionals looking to deepen their knowledge or pivot into rail engineering.

These kinds of curricula, short courses, and certificate programs, when combined with support and engagement with industry partners, are an opportunity to train and identify the human capital necessary to execute high-speed rail projects. By developing the domestic workforce and expertise, there is the added benefit of cultivating a new, energized advocacy base. Students from this program have secured engineering jobs at Brightline Florida and Brightline West, Arup, HNTB, BNSF, Union Pacific, Chicago Transit Authority, TriMet, HDR, Stantec, Hatch, Alstom, AECOM, Kimley-Horn, New Jersey Transit, Deutsche Bahn, Jacobs, and many other relevant companies and agencies.

4. Project Management, Procurement, and Risk

Project Sponsors

Recommendation four addresses procurement, risk, and project management. This recommendation is for project sponsors operating as public or public-private partnerships at the national or subnational scale. We combine these categories because different procurement strategies are often pitched in terms of allocating risk equitably. Allocating risk equitably is good. Offloading all construction risk onto contractors, on the other hand, is expensive and imprudent. As domestic rail expertise has diminished at public agencies, transit agencies and the California High-Speed Rail Authority have struggled to define their projects and contracted out project management via program management/delivery contracts; thus, it makes sense to address all of these topics here.

We argue that project sponsors need to invest in and cultivate internal capacity to develop well-defined projects, manage consultants and contractors, and coordinate across multiple manageably sized contract packages rather than a few large contracts. Hiring consultants is necessary for specialized tasks, such as tunnel design and systems, but failing to manage them because of a lack of staff or being wholly reliant on them is counterproductive. In interviews with consultants working on high-speed rail and transit projects, we were told that projects "suffer when there isn't a guiding mind at the agency" (Personal Interview B 2023). When project sponsors are tentative or delay making a decision, such as selecting a locally preferred alternative or whether or not to pursue a blended, shared-track alignment, they ask consultants to study myriad alternatives or withhold decisions while continuing to pay

consultants to generate more paper without advancing the project. Goldwyn et al. (2023) found in their research on the cost drivers of transit projects (2023, p.365) that transit agencies also were quick to turn to consultants rather than make a decision: "[Consultants were seen] as an endless resource to study everything…but how many different iterations of transformer do you need to see?" A strong project sponsor that knows what it wants will define the project's goals, direct consultants, and ensure that the work produced serves the project's objectives rather than getting mired in endless cycles of design and redesign. Another consultant with high-speed rail experience thought that she had too much influence over technology solutions and decision making, and that agency staff should adopt the mindset, "Consultants work for me; not instead of me" (Personal Interview D 2023). This sentiment was echoed by other consultants we interviewed and conforms to findings from our previous transit research (Personal Interview E 2023; Personal Interview F 2023; Personal Interview G 2023).

Experience is the primary challenge for American high-speed rail project sponsors. The California High-Speed Rail Authority is the only domestic public sector agency working exclusively on high-speed rail. When the agency was created it was heavily tilted towards consultants, which was perhaps understandable for a new agency. But even by 2018, 22 years after the Authority's creation, there were approximately 190 staff and 485 consultants working on California High-Speed Rail (California State Auditor 2018, p.7). The California High-Speed Rail Authority has learned this lesson the hard way, and, to its credit, has reversed the proportion of consultants to agency staff (California High-Speed Rail Authority 2023a; Personal Interview F 2024).

An experienced, skilled, and empowered project sponsor can successfully manage multiple procurement methods. Goldwyn et al. (2023) found that Metropolitana Milanese (MM) in Italy was adept at delivering projects using design-bid-build, design-build, and public-private partnerships because it maintained strong project oversight throughout all projects. As a point of comparison to the California High-Speed Rail Authority, in 2022, MM had 1,369 full-time employees working on transit, municipal water, and managing Milan's public housing (MM S.p.A 2022, p.140).

Even though some entities can deftly manage multiple procurement methods, high-speed-rail sponsors should procure construction contracts using either design-build or design-bid-build.[10] Since these are long linear projects combining heavy civil works and multiple systems, it is critical that project sponsors and contractors cooperate and work together rather than get ensnared in disputes. For both design-build and design-bid-build, it should be a two-step process where the project sponsor procures 60% design and then 100% design and construction for design-build, or 80% to 90% design for a design-bid-build, but retain some contractor flexibility for innovation without triggering a contentious change order process. It is critical that project sponsors do enough preliminary work (50%-60% design), even if they opt for a design-build procurement, so that they can adequately define the project scope and identify risks, such as utilities or challenging geology, prior to tendering contracts (Lin 2021; Whittington et al. 2023). This can be complicated by tendering a design-build contract after receiving environmental clearance, a process which may require additional, unforeseen mitigations that need to be added

[10] Procuring systems contracts may work well under other procurement methods.

to the contract. Multiple construction managers and contractors we spoke with recommend incentivizing good behavior, such as delivering ahead of schedule, rather than relying on liquidated damages (Personal Interview F 2023; Personal Interview H 2023). We caution against bringing consultants in before determining the project's goals, scope, and basic design guidelines.

When evaluating bids, we recommend scoring them based on cost, schedule, and technical merit, rather than solely on lowest cost. Goldwyn et al. (2023, p.27) found that international project sponsors that achieved lower than average costs placed greater emphasis on schedule and technical merit, sometimes accounting for as much 60% or 70% of the bid evaluation, than cost.

5. Permitting, Third-Party Agreements, and Planning

United States Department of Transportation, State Governments, and Project Sponsors

Recommendation five tackles permitting, third-party agreements, and planning, and provides ideas to disentangle them. Studying, understanding, and mitigating the environmental impacts of large infrastructure projects is necessary. Allowing the threat of litigation to delay project schedules, initiate an unending cycle of design changes, embolden third parties to tack on betterments to project scopes is wasteful. Project sponsors, ultimately, need to be able to carry out planning separately from environmental review to avoid costly mistakes and delays. This requires support from governors, state legislatures, and the federal agencies awarding billions of dollars in grants to construct nationally significant projects.

Support comes in many shapes and sizes. First, states and the federal government should allocate funding for planning that separates planning from the environmental review process. Combining the two distorts incentives, and, invariably, over emphasizes environmental review rather than designing the best project and figuring out the biggest challenges. Second, project sponsors receiving federal money should pursue NEPA Assignment, and take advantage of the FAST Act Section 1309 (2015), currently a pilot program, that allows for state environmental reviews to satisfy NEPA.[11] Third, federal agencies should require governors, state legislatures, or receiving project sponsors to commit in writing to binding processes with clear, unambiguous timelines for coordinating local permitting issues so that project sponsors are not derailed when a municipality files a lawsuit, a utility company delays relocating a cable, or an impacted third party frames an out-of-scope betterment as a necessary mitigation. Fourth, federal agencies and project sponsors need enough experienced staff to review documents quickly and make decisions about on-the-ground challenges as they arise.

Agencies need to plan the best, most cost-effective project before focusing on environmental review and receiving a record of decision and federal money. In interviews for this research and previous research, we were told that since federal grants for capital construction are available only after completing environmental review, project sponsors focus on developing a project on paper that meets those requirements rather than one that is necessarily constructible because they want to make sure they can secure a grant before a potential change

[11] NEPA Assignment delegates all or some of the federal responsibilities regarding NEPA to State Departments of Transportation. In 2019, the Governor of California and FRA administrator signed a Memorandum of Understanding detailing which FRA responsibilities had been assigned to the California High-Speed Rail Authority (2019).

in administration (Goldwyn et al. 2023, p.45; Personal Interview I 2023, Personal Interview G 2024). A consultant working on a high-speed rail project echoed this finding when she told us, "There's pressure to get a final environmental document [as soon as possible]. We end up starving the planning to get to the engineering quicker. But, that's where the lack of [planning] leads to bad decisions" (Personal Interview G 2023). California High-Speed Rail provides numerous cautionary tales that underscore this point:

> The Authority did not complete many critical planning tasks before beginning construction… such as not securing the property on which it intended to build, directly led to cost overruns and project delays. In other instances, the Authority did not sufficiently account for the costs arising from issues it knew it would eventually need to address, such as relocating utility infrastructure…and addressing concerns of external stakeholders (California State Auditor 2018, p.25).

Without greater emphasis on planning, project sponsors focus on satisfying the terms of a grant or rushing to complete the steps required to get a grant agreement finalized. This incentivizes agencies to jump through the hurdles placed in front of them rather than plan a good project with a clear project definition and spend the time and money identifying utilities, completing sound cost estimating, or understanding ground conditions. By locking in decisions prior to planning the project well, there is a risk that when challenges arise and changes need to be made, certain alternatives are no longer available or project leaders decide to "escalate" their commitment to a specific outcome even though it is infeasible according to the original schedule and budget (Cantarelli et al. 2010).

FRA's Corridor Identification and Development program (Corridor ID) is a promising model for how to support good planning and improve existing practice. Corridor ID separates planning from environmental review so that applicants spend time and money figuring out appropriate service levels and developing an inventory of capital investments to achieve service

goals. By allocating funding in stages and covering a large portion of those costs, from 80% to 100% depending on the step, broad, open-ended ideas can be refined into specific projects or disregarded, never advancing to the next step, *before* entering into environmental review in the program's final phase. This approach to planning and environmental review more closely resembles what happens in Europe. Whittington et al. (2023, p.34) explain that "Internationally, experts prefer to conduct environmental review with 50% of engineering complete, for 2 or 3 alternative routes, each capable of performing peak speeds for services, ridership, and associated revenues." Since Corridor ID grants are largely awarded to subnational project sponsors, though Amtrak is eligible, grantees determine the shape of the intercity passenger rail network rather than the US DOT exerting greater control. This is a missed opportunity to shape the network and advance a unified vision for intercity passenger rail.

Environmental review, specifically the National Environmental Policy Act (NEPA), has been cited as an area in need of reform. NEPA is a convenient scapegoat because it is a project development phase that every project must contend with; thus, delays that may not be entirely NEPA related can be blamed on NEPA. One planner working for the federal government on transportation projects told us that "Because NEPA is the sole way to get [federal] money, it drives an irrational process" (Personal Interview J 2023). A former senior-level California High-Speed Rail Authority official approached this issue from a different angle, but came to the same conclusion: "You can't treat [environmental review] the way the NRA treats the Second Amendment" (Personal Interview K 2023). With project funding tied up with getting through environmental review, it becomes the central focus of the project early on, which, in turn, leaves

project sponsors vulnerable to lawsuits or threats of lawsuits that may preclude the project sponsor from getting a Record of Decision and a federal grant to build the project. As noted above, greater separation between planning and environmental review would help project sponsors improve project definition and carry out better calibrated environmental review.

In 2023, the US DOT announced more than $25 billion in grants for rail projects (Bose 2024). California High-Speed Rail and Brightline West received about $3 billion each through the Federal-State Partnership of Intercity Passenger Rail Grant Program (Federal Railroad Administration 2023). When giving billions of dollars to projects, it is reasonable to expect terms and conditions. In addition to ensuring that money is spent legally, the main concern, these kinds of grants should also enshrine commitments to improve project delivery, such as project coordination at the state level to speed up local permitting. In countries like Germany, Spain, Italy, and France, high-speed rail projects, once they are planned, financing is in place, and are deemed to have a public benefit, receive a “declaration of public utility” or “project of national significance” designation that eases local permitting challenges by authorizing these projects to move forward, while local jurisdictions adapt their plans accordingly (Crozet 2013; Personal Interview C 2024; Personal Correspondence 2024). In Canada, the Provinces of Quebec and Ontario enacted laws designed to speed up project delivery by shifting some power from third parties to project sponsors and establishing clear review timelines and the authority to proceed if the project sponsor and third parties were unable to reach an agreement (LégisQuébec 2017; Government of Ontario 2020).

In Québec, the provincial government enacted the Act Respecting the Réseau Électrique Métropolitain (REM) to speed up construction of a new automated light metro that has an alignment that includes tunnels and viaducts. The law lays out different procedures for carrying out the project, from eminent domain to municipal permitting. In the section on occupying local streets for construction activities, the law details the permitting process between the project sponsor and affected municipality. The sponsor must share survey plans, a traffic management plan, work schedule, mitigations, and other relevant documents. If, after all of this, the sponsor and municipality cannot come to an agreement on the relevant permit, the law allows the sponsor to move forward with the project:

> Failing agreement between the local municipality and the [REM], [REM] may, on the expiry of 60 days following the date on which the municipality received the notice required under the first paragraph of section 16, start occupying the roads and, if applicable, commence the work specified in the notice in accordance with the plans and specifications sent to the municipality without having to pay the municipality an amount of money or any other consideration (LégisQuébec 2024).

By including a force mechanism in the law that provides a clear path forward, the provincial government removed the uncertainty it controls from the process, something that is absent from American projects, and inhibits some projects from ever getting started (Personal Interview L 2023).

In contrast to Le REM, the California High-Speed Rail Authority is not empowered by the State of California to manage its permitting risks effectively. The expectation has been that the Authority will navigate these relationships and manage these risks itself. In 2018, the City of Shafter and the California High-Speed Rail Authority settled a four-year old lawsuit that alleged that the Authority failed to adequately mitigate its environmental impacts in Shafter (California

High-Speed Rail Authority 2017, p.S-15 footnote 5; Harvey 2018). This is after developing a Locally Generated Alternative with the City of Bakersfield that included a dozen different alignment alternatives between Fresno and Bakersfield. Despite these efforts to appease local interests and manage third-party risk, the Authority still had to spend more money and agree to additional mitigations. In this specific case, the Authority agreed to grade separate the existing BNSF track that runs through Shafter, track that is *parallel* to the Authority's proposed track and will never host California High-Speed Rail trains (Image 3). Scott Hurlbert, the city manager, explained that the Authority's largesse "provides this very expensive infrastructure for the city, earlier than when we would've been able to accomplish it by ourselves" (Harvey 2018). In 2023, the federal government awarded California High-Speed Rail close to $202 million dollars to pay for six grade separations in the City of Shafter (California High-Speed Rail Authority 2023b).

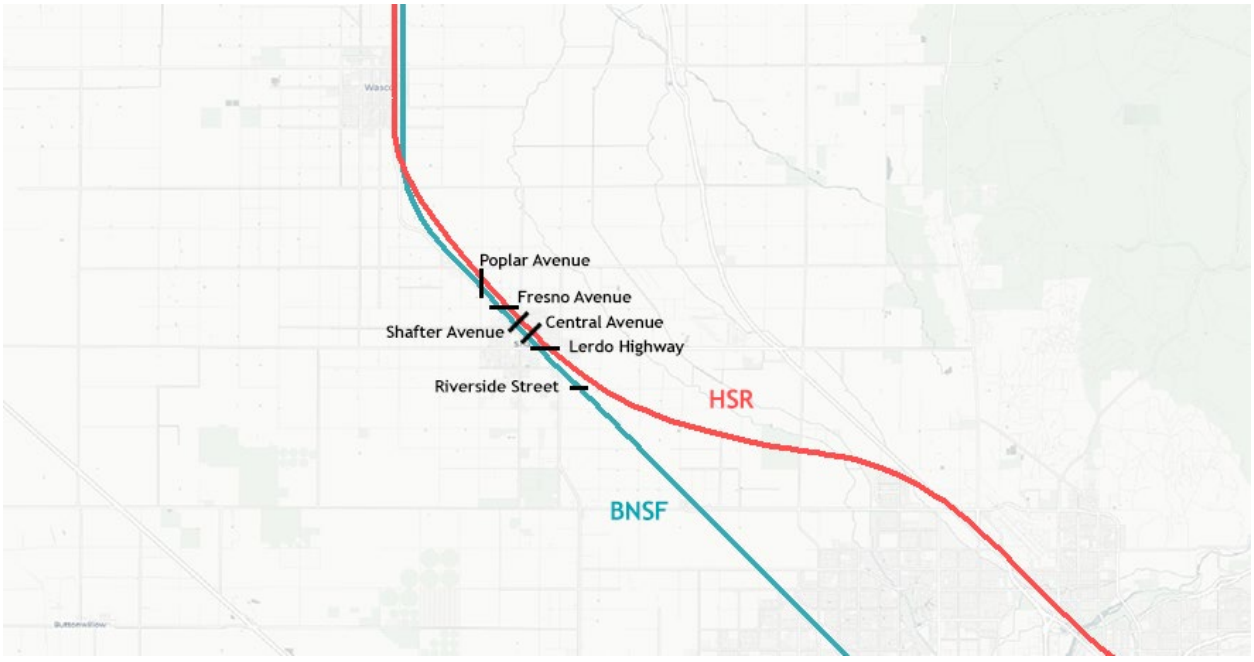

Image 3: Grade separation projects in Shafter.

Separating rail traffic from automobile and pedestrian traffic is good. It speeds up operations and eliminates conflicts. All of this should happen and be celebrated. The question remains: Should a city be allowed to sue the California High-Speed Rail Authority to pay for grade separations that are distinct from the Authority's project? Without rules in place to protect project sponsors from litigation like this, project sponsors have to decide whether it is worth going to court or capitulating. Without state laws in place, federal jurisdiction, or financial commitments from cities, states, utilities, and freight railroads, large infrastructure projects will always provide an opportunity for municipalities, utilities, freight railroads, and other third parties to extract upgrades and improvements with impunity.

Finally, there is no substitute for high-quality, experienced staff reviewing documents, and making determinations about on-the-ground challenges to expedite review times. Multiple interviews addressed this issue. Specifically, we were told that project sponsors and federal agencies were understaffed, which exacerbates the issue focusing on getting through NEPA at the cost of good planning and slows down review times (Personal Interview E 2023; Personal Interview F 2023; Personal Interview G 2023; Personal Interview I 2023; Personal Interview H 2024; Personal Interview I 2024). Environmental review documents go through multiple reviews, consultations, and formal drafts internally and with the federal lead agency before being published (Blum 2019; United States Department of Transportation 2024b). Without enough staff to review these documents thoroughly and quickly, each step in the process takes longer than necessary.

Conclusion

This is a unique moment in the history of domestic high-speed rail. There are two projects under construction, a burgeoning project pipeline, billions of dollars have been allocated, and a developing domestic market. A generation ago, authors like Anthony Perl and Rohit Aggarwala also thought we were on the precipice of developing true high-speed rail. What was missing then, and is still largely absent today, are the federal direction, technical standards, robust linkages between universities and industry, and the institutional arrangements to procure, manage, plan, and permit high-speed rail projects. More money from the federal government helps, but without addressing the recommendations laid out in this report, this generation's contributions to domestic high-speed rail will remain as inchoate and fragmented as previous generations'.

If, however, we can make progress on these issues, there is an opportunity to transform intercity travel and American cities. To do this, we must decide what the future of intercity passenger rail is, and if we want to unlock the development potential created by rail. This goes beyond high-speed rail, and gets to the mission, purpose, and authority of Amtrak and the US DOT. If we affirmatively want to decarbonize intercity travel and shift trips out of cars and

airplanes and develop denser cities, there needs to be a plan that identifies who will lead this effort, how we will pay for it, and what institutional and infrastructural changes are needed. Lines on maps capture imaginations, but service frequency, reliability, span, and travel time relative to alternatives drive ridership.

Technical standards are banal, but central to scaling high-speed rail deployment. Regulators, suppliers, project sponsors, and consultants need to be better aligned as they draft designs and tender contracts. It is duplicative and counterproductive to require each new project to develop track, signal, and rolling stock standards when these design issues have already been tested and proven. High-speed rail is a developed technology, and the United States should simply adopt existing standards that satisfy domestic specifications.

Internationally, academia has played a catalytic role in driving technological breakthroughs and training a workforce capable of delivering high-speed rail and advocating for it. Federal research money, specialized education, and industry-led apprentice programs are critical to developing an active high-speed rail community. This domain, in particular, lags far behind what we have found in other countries with developed high-speed rail networks.

Project sponsors need to develop and nurture enough staff capacity to define projects clearly and manage consultants effectively. While it would be nice to offload all project-related risks, the private sector, rightfully, charges a forbidding premium to carry risks it cannot control. This is an expensive reality for all large, heavy civil engineering projects. This should inform procurement strategies and determine the tasks that project sponsors should self-perform and direct carefully.

High-speed rail projects will never transcend environmental review and local permitting delays, without considerable help from governors, state legislatures, and the federal agencies granting them billions of dollars. Elected officials need to enable new institutional frameworks to match high-speed rail's scale and scope. It is too onerous and risky to translate each municipality's regulations and standards, and develop plans that attempt to make everyone better off while maintaining project goals and budget discipline. Instead, planning and early engineering work should *precede* environmental review so that project sponsors develop sound, constructible projects rather than projects designed to gain environmental clearance and win a federal grant. Finally, new agreements backed by the force of law must be formulated to ensure project sponsors mitigate their impacts, but are also afforded enough authority to execute their projects expeditiously and realize high-speed rail's enormous benefits.

Domestic high-speed rail's future depends on acknowledging that existing institutions and practices have not produced the desired outcomes. Rather than drag one or two high-speed rail projects into revenue service in the coming decades at enormous cost, we need to address the intercity rail market with a holistic vision for rail across the country. This report has laid out five main recommendations to transform the United States' unreliable, patchy intercity passenger network into an integrated network that offers true high-speed rail.

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