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Advancing High-Speed Rail Policy in the United States

MTI Report 11-18

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REPORT 11-18

ADVANCING HIGH-SPEED RAIL POLICY IN THE UNITED STATES

Senanu Ashiabor, Ph.D.
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16. Abstract

This report builds on a review of international experience with high-speed rail projects to develop recommendations for a High-speed rail policy framework for the United States. The international review looked at the experience of Korea, Taiwan, China, and several countries in Europe. Countries in Asia and Europe have pursued high-speed rail (HSR) to achieve various goals, which include relieving congestion on highway networks, freeing up capacity on rail network for freight train operations, and reducing travel time for travelers. Some of the key rationales do not work well in the US context. As an example, in the US, freight companies own most of the rail network and, hence, do not need government intervention to free up capacity for their operations.

We concluded that the potential to reduce travel times, coupled with improved travel time reliability and safety, will be the strongest selling points for HSR in the US. HSR lines work best in high-density, economically active corridors. Given that there are a limited number of such corridors in the US, this study recommends that the US HSR project funding mix be skewed heavily toward state bonds guaranteed by the federal government. This will ensure that the states that benefit directly from the projects pay most of the costs, making it more palatable to states that may not have HSR projects. For the projects that span multiple states, member states may have to negotiate the level of financial responsibility they will bear, and this will require detailed negotiations and financial setups that are not addressed in this report.

Other measures that the federal government needs to put in place include designating a key agency and dedicated funding source, and developing regulations and specifications for HSR design and construction. States that embark on HSR projects should start with formal legislation and put in place structures to ensure sustained political support throughout the planning and construction of the project. The federal government also needs to move quickly to foster educational and training centers to build up the HSR workforce in the country.

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EXECUTIVE SUMMARY

This report looks at the current state of high-speed rail (HSR) policy in the US, juxtaposing it against international HSR experience in Asia and Europe. The aim is to identify basic steps that need to be put in place if an HSR system is to be developed in the US. The international review showed that countries implementing HSR had a few key, focused reasons for developing their HSR systems. Korea and Taiwan viewed HSR as a means to relieve congestion on both their conventional rail and road networks. Europe has used HSR to relieve congestion on its conventional rail lines by providing additional capacity with improved quality of service and, in some cases, to spur economic development. China is using HSR to spur economic development, and free up capacity in its rail network for freight trains.

The US, on the other hand, seems to be struggling to justify the need for HSR. Public statements of the current president, his vice president (an avid train enthusiast), and the secretary of transportation indicate the executive branch believes HSR needs to be integrated into the mix of transportation options for the US going forward. However, some of the key rationales for HSR in Europe and Asia do not make a strong case in the US situation. For example, highway congestion for intercity travel is not at critical levels because of the well-developed, limited-access interstate highway system. Also, a rail ownership structure in which freight companies own most of the rail network in the US means there is no pressing need for government to intervene to free up capacity for freight operations, though there is a need, in some cases, to provide more capacity for joint operation of freight and conventional passenger trains.

The extensive development of the interstate highway network and airports makes it harder to justify additional investment in HSR in the US. The fact that several states in the US do not have the high-density, economically active population corridors along which HSR systems are successful makes it politically challenging to generate support at the federal level for funding of HSR lines.

Though congestion levels on intercity highways are not at unbearable levels most legislators know additional capacity will be needed to support the increased demand generated by population growth in the future. HSR will be one of the key options on the table for addressing this need. We believe one of the reasons the US continues to lack a firm HSR policy framework is that advocates have not developed a few key, compelling arguments that politicians can coalesce behind to push for HSR development. In our view on-time reliability, improved speeds (shorter travel times), and relatively greater safety of HSR compared to other modes of travel are the strongest selling points for HSR in the US. Other benefits of HSR that have been promoted in literature but are not fully addressed in this report include reduced energy use, emissions, and congestion vs. other modes of travel, and the potential to spur urban regeneration and attract commercial development in the station areas.

HSR should be funded using a mix of grants, loans and bonds, with the mix heavily skewed towards bonds. The bonds should be state sponsored but guaranteed by the federal government. The benefit of using state bonds is that the states that benefit most from HSR pay for it, making it more palatable to states that do not have HSR projects. In addition, state bonds lighten the burden on current taxpayers and equitably assign the greatest share of the cost to those who will benefit most: future generations.

At the federal level, a key agency needs to be designated. Though Amtrak appears to be advocating for that role, the Federal Railroad Administration appears to be the best suited to manage an HSR program, especially as it is likely to be federally funded. A dedicated funding source is needed so private capital and stakeholders can commit to the HSR program. Federal government needs to move quickly to develop regulations and specifications for HSR design and construction, as the different performance characteristics make them incompatible with the current specifications for rail in the US.

States also have a role to play. Given the massive amount of investment involved, most HSR projects will need some form of political support. States must have a well-thought-out plan and a dedicated position (or body) that will work with the various legislative and political arms of government to build and sustain support for their projects through the development and construction phase. A team that can work closely with legislators will help avoid the rollercoaster rides other state projects have experienced. States that decide to embark on HSR should make sure there is formal legislation in place. States should incorporate private-public partnerships into their development plans as early as possible.

A huge issue facing the nascent HSR industry is the lack of HSR expertise in the US. The Mineta Transportation Institute – in collaboration with the California High-Speed Rail Authority, the California State University system, and several private and public agencies – has begun work on the issue. The federal government needs to quickly begin to focus on developing educational and training centers to build up the HSR workforce capacity in the US.

I. INTRODUCTION

The United States has had a long-running interest in high-speed rail (HSR). A year after Japan launched its now-famous Shinkansen bullet train in 1964, the US Congress authorized $90 million under the High Speed Ground Transportation Act to develop and demonstrate HSR technologies.[1] Europe and several countries in Asia followed Japan's lead and introduced their own HSR trains in the 1980s. Europe now has more than five thousand miles of HSR lines, while Asia has more than six thousand. By contrast, the closest the US has to an HSR project (by the end of 2011) is Amtrak's Northeast corridor Acela Express – a high-speed train running on rail tracks that restrict the train's 150-miles-per-hour maximum speed to an average of about 84 miles per hour.

The current Administration has aggressively advocated for HSR in the US. President Obama repeatedly raised the issue during his 2008 Presidential election campaign. After entering office, he was quick to set aside $8 billion for HSR in the American Recovery and Reinvestment Act[2] (ARRA) that was passed during the economic recession in 2009.

The $8 billion commitment may appear to be a drop in the bucket when one considers the estimate of more than $500 billion[3] that may be needed to build out the ten federally designated HSR corridors in the US. However, the $8 billion is significant, given it is the only explicit and dedicated funding for construction of actual HSR to date. Prior to that, the only HSR-related funding was $5 million set aside in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)[4] for projects to eliminate hazards at railway-highway crossings.

Though the current steps appear laudable, to date the US has no clear-cut policy on HSR development. Current efforts are very ad hoc at both the federal and state levels and lack clearly defined goals. Given that HSR projects are multibillion-dollar initiatives that require substantial lead times from planning through completion, a more structured and long-term policy framework with clearly defined goals and a stable source of funding is needed.

This report looks at the current state of US HSR policy against the backdrop of international HSR experience, mainly in Asia and Europe. The focus of this report is not to address the question of whether or not HSR is needed in the US; much has been published on both sides of that issue, and that debate that will continue even if HSR projects are built. The focus is rather on what needs to be done if HSR is to succeed in the US.

The aim is to identify some of the basic structures that need to be put in place in developing an HSR system for the US. The next chapter is a review of existing US HSR projects. Chapter III reviews HSR projects on the international front, mainly Europe and Asia. The review identifies motivations for development of HSR projects in those countries, measures put in place to ensure the projects were successful, and costs and benefits derived from implementing HSR. Chapter III looks at the broad lessons from the international experience. Chapter IV and V use the findings as a basis for outlining policies and strategies the US government should pursue to build a more solid HSR policy framework. We provide specific recommendations and identify areas where further research is needed to develop US HSR policy.

II. CURRENT STATE OF US HIGH-SPEED RAIL

Even though there is still a vigorous ongoing public debate about whether HSR is right for the US, from public statements made by the current president, his vice president (an avid train enthusiast), and the secretary of transportation, the stance of the current administration is clear: It has decided it is necessary to integrate HSR into the mix of transportation options for the US going forward.

This decision comes on the heels of a long trail of legislation. In 1965, Congress passed the High Speed Ground Transportation Act, authorizing $90 million to develop and demonstrate HSR technologies.[5] Five years later, in 1970, President Nixon signed the Passenger Rail Service Act, which created the National Rail Passenger Corporation (Amtrak). One of Amtrak's key roles was to take over intercity passenger rail service from freight rail companies, which found it unprofitable.[6]

One of the routes to which Amtrak devoted substantial resources was the northeast corridor (NEC), from Washington, DC to Boston. According to the Federal Railroad Administration, by 1997 Amtrak had spent up to $3.3 billion on improvements to the northeast corridor. In November 2000, Amtrak finally rolled out their Acela Express trains, with an inaugural trip from Washington, DC to Boston. The Acela train is the closet the US has to a functioning HSR. A timeline of the major HSR legislation since 1965 is shown in Figure 1.

FEDERALLY DESIGNATED HIGH-SPEED RAIL CORRIDORS

Section 1010 of the 1991 ISTEA Act[7] set aside $5 million annually for elimination of hazards at railway-highway crossings at five high-speed railway corridors, to be designated by the Secretary of Transportation. The Act defined high-speed rail corridors as locations where trains could attain maximum speeds of 90 miles per hour, or greater. The first five HSR corridors were designated as a result of stipulations included in the Surface Transportation Efficiency Acts.

Later, in June 1998, six additional corridors were authorized under the Transportation Equity Act for the 21st Century (TEA-21)[8] leading to the current eleven designated US HSR corridors. A list of the eleven corridors designated by the secretary of transportation, along with their descriptions, is shown in Table 1. Figure 2 shows the spatial location of the HSR corridors.

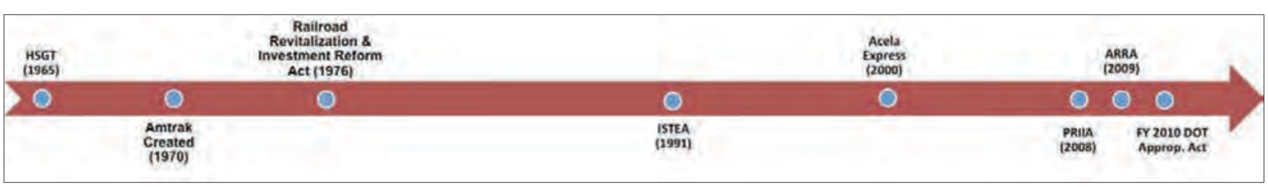

Figure 1. Historical Timeline of Major High-Speed Rail Legislation in the United States

Until recently, the Northeast Corridor, where the Acela Express operates, was not considered a federally designated corridor, as it was funded separately under various legislative instruments, including Northeast Corridor Improvement Project.[9] In March 2011 US Transportation Secretary Ray LaHood designated it as an HSR corridor. The Secretary also extended the scope of the California corridor to Las Vegas, Nevada, in July 2009.

Figure 2. Spatial Locations of Proposed US High-Speed Rail Corridors

Table 1. Federally Designated High-Speed Rail Corridors

First Batch - Five Initial High-Speed Rail Corridors	Chicago Hub Network	Initially designated on October 15, 1992 as the Midwest corridor, it consisted of three spokes emanating from Chicago, IL, westward to Milwaukee, WI, east to Detroit, MI, and south to St. Louis, MO. In December 1998, the Milwaukee link was extended to Minneapolis/St. Paul, MN and a new spoke to Indianapolis, IN and Cincinnati, OH was added. The Indianapolis/Cincinnati link has been extended through Ohio in a closed loop running from Cincinnati to Columbus, Cleveland, and Toledo and back to Chicago. The Indianapolis link has also been extended to Louisville, KY.
	Florida Corridor	Initially designated on October 16, 1992, runs from Miami in the south to Orlando and westward to Tampa.
	California Corridor	Also designated October 19, 1992. Runs mainly north-south along the state, linking the major metropolitan areas of San Diego, Los Angeles, the San Francisco Bay Area and Sacramento via the San Joaquin Valley. On July 2, 2009, US Transportation Secretary Ray LaHood announced extension of the California high-speed rail corridor to Las Vegas, Nevada.
	Southeast Corridor	Designated in October 2000 as a link between Charlotte NC, Richmond, VA, and Washington, DC. In December 1995, it was extended all the way to Macon, GA, passing through Greenville, SC, and Atlanta, GA. The Richmond link was also extended to Hampton Roads, VA. In December 1998, the Macon, GA, loop – passing through Jacksonville, FL, Savannah, GA, and Columbia, SC back to Raleigh, SC – was closed. The Southeast corridor in its final form in 1998 is better characterized as a network. The corridor now covers six states: Florida, Georgia, South and North Carolina, Virginia and Washington, DC.
	Pacific Northwest Corridor	Designated in October 1992. Links Eugene, OR, to Vancouver, BC, Canada, passing through Portland, OR, and Seattle, WA, on the way north. The corridor is 466 miles long.
Second Batch - Six Additional Corridors	Gulf Coast Corridor	Designated November 18, 1998. Another of the multi-state corridors, it traverses six states: Texas, Louisiana, Mississippi, Alabama, Georgia and New Orleans. There are three legs originating from New Orleans, LA. The westward leg goes to Houston, TX, the eastbound leg to Mobile, AL, with an intermediate stop in Biloxi, MS, and a third leg runs northeast to Atlanta, with major stations in Meridian, MS, and Birmingham, AL.
	Keystone Corridor	Designated in December 1998. A planned, multi-state corridor with the west/east link from Pittsburg, PA through Harrisburg to Philadelphia. The north/south link starts in Washington, DC, and runs through Baltimore, MD, Wilmington, DE, Philadelphia, PA, Trenton and Newark, NJ, and ends in New York.
	Empire State Corridor	Designated in December 1998. Planned to run from west to east end of New York State, Buffalo to New York City, with stops in Rochester, Syracuse, Utica and Albany.
	Northern New England Corridor	Set up to connect Boston to various states in the Northwest. Boston, MA, is the center, with connections to Portland/Auburn, VT, and Montreal, PQ Canada, Albany, CT and New Haven, CT.
	South Central Corridor	Designated in 2000, it is another of the multi-state corridors. The Texas link is from San Antonio, TX, in the south, to Dallas-Ft. Worth in the north. Dallas Ft.-Worth is then linked to Tulsa, OK and Little Rock, AK.
	North-East Corridor	In March 2012, the Transportation Secretary officially designated the existing Northeast Corridor, from Washington, DC, to Boston, MA, a high-speed rail corridor.

FUNDING FOR HIGH-SPEED RAIL

Despite ISTEA and earlier acts designating high-speed rail corridors, the acts did not appropriate any funds for constructing HSR lines on the corridors. So, while the transportation secretary was enthusiastically designating HSR corridors until 2008, the only funding available was tied to improving safety at locations where trains crossed highways at high speeds. The ARRA is the first time the federal government committed a substantial amount of public funds for the construction of HSR projects in the US.

The Federal Railroad Administration (FRA) under the US Department of Transportation was in charge of disbursing the ARRA HSR funds. The FRA initially disbursed the bulk of ARRA funds to six major corridors as shown in Table 2. At the time ARRA was set up, in 2008, California appeared to be the only state with a potentially viable HSR line after voters endorsed a $9.95 billion state bond to fund the California High-Speed Rail Project. The projects of the remaining states were slowly grinding to a halt due to an absence of funding.

Interestingly, when the first round of ARRA funds was allocated, Florida raced past California with an allocation of $1.25 billion, and, soon after, additional funds, bringing the total to $2.4 billion. The $2.4 billion would have covered 99 percent of the estimated construction cost for the Tampa-Orlando HSR line.

Later, the governors of Florida, Ohio and Wisconsin returned their ARRA funding saying it represented wasteful federal government spending. The secretary of transportation reallocated the funds to other projects. After the reallocation, Florida's HSR, which appeared to be the most promising HSR project, came to a screeching halt. Once again, California ended up with the bulk of more than $3 billion in federal funds for HSR projects in the US.

As of the writing of this report (2010), only $5.8 billion dollars of the ARRA funds have been obligated. Table 3 lists both ARRA and other federal rail-related funds (those that can be used for high-speed-rail-related projects) that have been allocated to states at the beginning of July 2011.*

*Assembled from data on the FRA website.

Table 2. Initial Funding for US High-Speed Rail Corridors

No.	Corridor Name	ARRA Funds ($ millions)	Miles of Track				$/Project Track Mile	Speed (mph)	States	Extent	ARRA Awardees	Benefiting States	Main Stations
			Total	New	Upgraded	Planned							
1	Pacific Northwest	598	467		437	30	1.37	150	2	Multi-state		Oregon, Washington, Vancouver, B.C.	Eugene - Portland - Seattle - Vancouver, B.C.
2	Southeast	620	480		480		1.29	110	4	Multi-state	North Carolina DOT, Virginia DOT	North Carolina, Virginia, Washington, D.C.	Charlotte - Raleigh - Richmond - Washington, D.C.
3	Florida	1,250	324	84	240		3.86	168	1	Single	Florida DOT	Florida	Tampa - Orlando
4	California	2,344	1,955	800	880	275	1.40	220	1	Single		California	San Diego - Los Angeles - San Francisco Bay Area - Sacramento
5	Chicago Hub Network	2,200	1,321	32	1,014	275	2.10	110	8	Multi-state	Multiple States	Multiple States	
6	Empire State	485	2,353	84	1,542	727	0.30		1	Single	Multiple States	Multiple States	Multiple Stations
7	Northeast	706	0						6	Multi-state			
8	Keystone		0						1	Single			
9	Northern New England		0						3	Multi-state			
10	South Central		0						3	Multi-state			
11	Gulf Coast		0						4	Multi-state			
	TOTAL	**8,203**	**6,900**	**1,000**	**4,593**	**1,307**		**152**	**34**				
Chicago Hub Network		400	250		250		1.60	79		Multi-state	Ohio DOT	Ohio	Cleveland - Columbus - Dayton - Cincinnati
		244	300		300		0.81	110		Multi-state	Michigan DOT, Indiana DOT, Illinois DOT	Michigan, Indiana, Illinois	Pontiac - Detroit - Chicago
		1,133	570		570		1.99	110	5	Multi-state	Illinois DOT, Missouri DOT	Illinois, Missouri, Kansas	Chicago - St. Louis - Kansas City
		823	451	32	144	275	1.82	110		Multi-state	Wisconsin DOT, Minnesota DOT	Minnesota, Wisconsin, Illinois	Minneapolis/St. Paul - Madison - Milwaukee - Chicago

Table 3. Disbursement of ARRA and High-Speed Rail Funds in 2009/10

State	Description	ARRA	FY09	FY10 Planning	FY10 SDP	Grand Total
CA	California High-Speed Rail + Other State Projects	2,908,371,742	6,400,000		116,000,000	3,030,771,742
IL	Chicago to St. Louis: 2010 Early Construction Projects, Englewood Flyover	1,268,310,998	1,250,000			1,269,560,998
WA	Pacific Northwest Corridor: Service Block 2-SEA-PDX 6 RTs- ARRA Redistributed	735,458,912				735,458,912
NC	Piedmont/Charlotte/Raleigh	520,000,000			22,000,000	542,000,000
MD	BWI Airport Station Improvements	69,400,000				69,400,000
FL	Tampa to Orlando: Program Management and Preliminary Engineering	66,660,000				66,660,000
VT	Vermonter New England Central Railroad Route Improvements	50,000,000	500,000			50,500,000
CT	New Haven to Hartford to Springfield Corridor	40,000,000				40,000,000
ME	Several projects	38,385,495		600,000		38,985,495
NJ	Portal Bridge	38,500,000				38,500,000
WI	Milwaukee to Madison Corridor	30,000,000				30,000,000
NY	Empire Corridor + Rochester Station	5,545,733	1,000,000			6,545,733
OR	Pacific Northwest Corridor: Union Station Roof	5,900,000				5,900,000
DC	Union Station Access Improvements		4,270,500			4,270,500
MO	Missouri State Rail Plan + additional projects	3,338,800		500,000		3,838,800
MI	Chicago to Detroit	3,620,552				3,620,552
CO	Colorado State Rail Plan + Denver Interregional Study		1,400,000			1,400,000
WV	West Virginia HSIPR Planning		1,000,000			1,000,000
GA	Various Studies		750,000			750,000
PA	Keystone Corridor: Keystone West		750,000			750,000
DE	Delaware Intercity Rail Connection		450,000			450,000
KS	Kansas Service Development Plan (SDP)		250,000			250,000
NM	New Mexico State Rail Plan		100,000			100,000
Grand Total		**5,783,492,232**	**8,120,500**	**1,100,000**	**38,000,000**	**5,940,712,732**

Note: FYO9 Fiscal Year 2009.
FY10 Fiscal Year 2010.
FY10 SPD Fiscal Year 2010 Service Development Program.

The back-and-forth between the states and the federal government on ARRA funds indicates the federal government has not arrived at a clear plan for growing the US HSR industry. A recent report from the Government Accountability Office (GAO) points out that FRA had been mainly concerned with rail safety until it was suddenly given the task of disbursing ARRA funds and drawing up a national HSR plan on short notice. The report gives FRA credit for handling the situation but notes that it was understaffed. The FRA HSR office had only 23 staff members. It had to hire additional staff and also pull staff from other DOT projects to handle the workload.

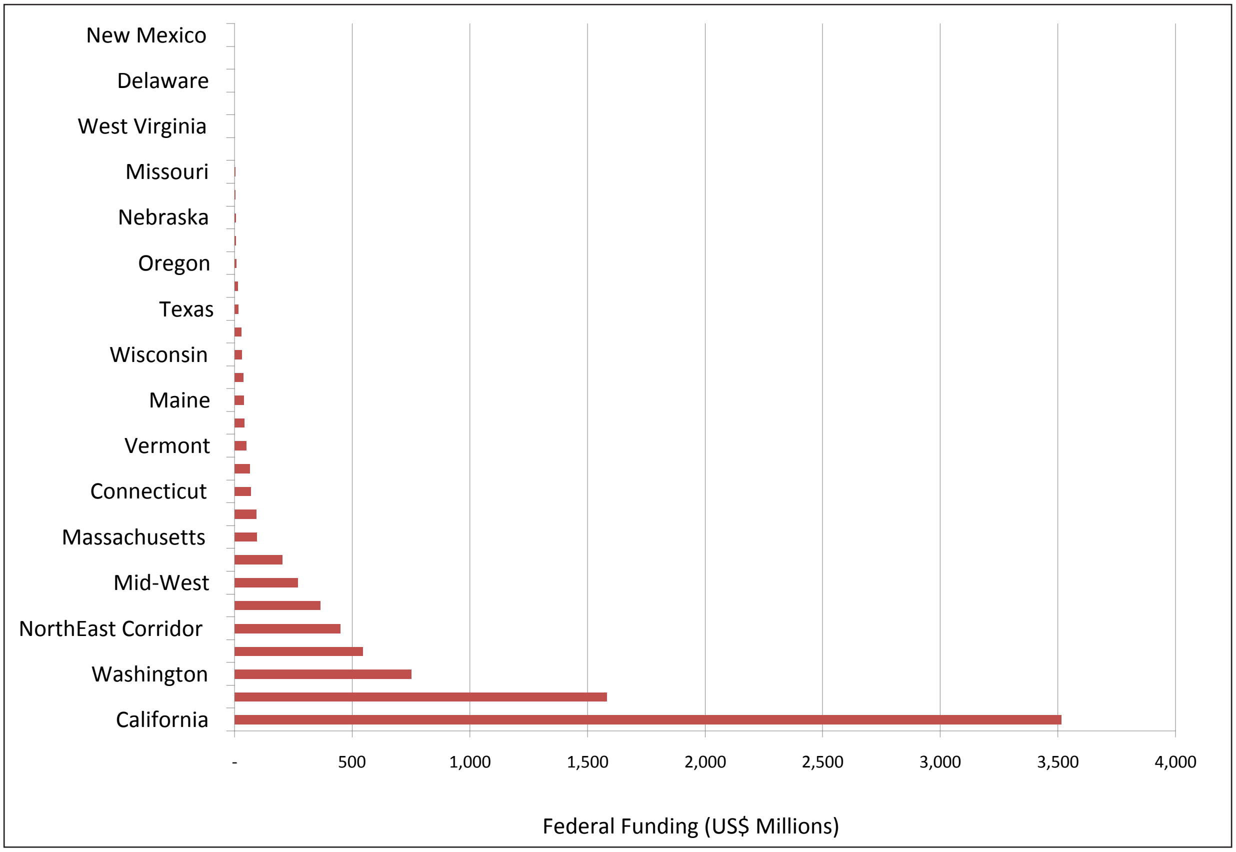

Figure 3. Breakdown of Federal HSR Funding by State HSR Projects in 2010

In fact, if additional funds are set aside for HSR, the agency is in the unenviable position of having to staff up and manage several multibillion-dollar projects in several states and a technology with which it has limited experience.

Despite these challenges, the GAO continues to support the initiative of developing HSR in the US. In their review of how ARRA HSR funding was disbursed the GAO wrote "In summary, we found that while the potential benefits of high-speed rail projects are many, these projects—both here and abroad—are costly, take years to develop and build, and require substantial up-front public investment, as well as potentially long-term operating subsidies. Determining which, if any, high-speed rail projects may eventually be economically viable will rest on factors such as ridership potential, costs, and public benefits."

HIGH-SPEED RAIL POLICY

Over the period during which the HSR corridors were designated, the GAO continued to emphasize the need for dedicated HSR funding,[10] leadership, clearly defined goals and structural framework[11] if HSR is to be implemented as a feasible transportation alternative in the United States. In a 2009 report to Congress the GAO noted the need to:

- Develop a written strategic vision for high-speed rail, particularly in relation to the role high-speed rail systems can play in the national transportation system, clearly identifying potential objectives and goals for high-speed rail systems and the roles federal and other stakeholders should play in achieving each objective and goal.

- Develop specific policies and procedures for reviewing and evaluating grant applications under the high-speed rail provisions of PRIIA*[12] that clearly identify the outcomes expected from the award of grant funds and include performance and accountability measures.

- Develop guidance and methods for ensuring reliability of ridership and other forecasts used to determine the viability of high-speed rail projects and support the need for federal grant assistance. The methods could include such things as independent, third-party reviews of applicable ridership and other forecasts, identifying and implementing ways to structure incentives to improve the precision of ridership and cost estimates received from grant applicants, or other methods that can help improve the reliability of such forecasts.

The report also noted that "the infusion of up to $8 billion in Recovery Act funds is only a first step in developing potentially viable high-speed passenger rail projects. Several issues that have hampered development of these projects remain and will need to be resolved to effectively spend Recovery Act funds. Surmounting these challenges will require federal, state, and other stakeholder leadership to champion the development of economically viable high-speed corridors and the political will to carry them out. It will also require clear, specific policies and delineations of expected outcomes, and objective, realistic analysis of ridership, costs and other factors to determine the viability of projects and their transportation impact."

Several policy issues including those highlighted below continue to handicap the development of HSR at the federal level in the US:

- **There is no clearly articulated US HSR policy framework at the federal level.** The "Preliminary National Rail Plan"[13] developed as part of PRIIA broadly discusses high-speed rail and its potential, and summarizes the results from outreach surveys that were conducted with various stakeholders. It falls short on specifics and does not set forth any real "plan". Another federal document, the "Vision for High-speed Rail in America"[14] lays out the anticipated plans for developing HSR in the US. It is, however, narrowly focused on how funds from recent legislation like PRIIA and

* Passenger Rail Investment and Improvement Act of 2008 (PRIIA): Reauthorizes Amtrak and tasks Amtrak, US DOT, FRA, states, and other stakeholders to improve intercity passenger rail and work toward the development of high-speed rail corridors.

ARRA will be used to start up HSR development in the US. It has no clear long-term policy or framework beyond PRIIA and ARRA. As the GAO has noted, for the government to succeed in the development of both intercity passenger rail and HSR it needs a plan that, at minimum, describes a) how intercity passenger rail fits into the national transportation system, b) defines the vision and goals for HSR in the country and within that context, c) clarifies the federal role in achieving these goals.[15] Also, most states do not have a documented rail plan, and this will hamper the development of HSR, as there is no policy on how the existing rail systems will interact with HSR.

- **The lead agency (FRA) is not positioned to handle HSR development.** Amtrak was created to take over operation and development of intercity passenger rail in the US from freight operators, while FRA has been responsible for regulating safety of both passenger and freight rail operations as well as overseeing rail transport policy within the national framework. Though FRA developed the first US HSR project (NECIP), this was eventually transferred to Amtrak for completion. Since FRA was later tasked with distributing ARRA funds, it seems likely that it will be lead agency in charge of HSR development. Also PRIIA tasked FRA, not Amtrak, to develop the National Rail Plan and assist states in developing state rail plans because the state plans involve freight as well as passenger issues and because Amtrak is an operating entity, not a policy agency. The federal government needs to come out clearly on this issue and staff the FRA-HSR office accordingly. The agency had to request support staff from other DOT agencies to handle the ARRA fund applications and is ramping up its passenger rail staff from 23 to 46. Though laudable, these staffing adjustments cannot transform it from a rail safely regulatory agency to one managing multiple multibillion-dollar construction projects.

- **There is no functional legislation guiding the development of HSR.** Though ISTEA provided for designation of HSR corridors and PRIIA mandates the development of a National Rail Plan, both legislations are very broad and do not provide much specificity. For example PRIIA required funding be provided to only states that had state rail plans but there are no defined criteria for what should be in a state rail plan. Neither PRIIA nor ARRA provides a comprehensive framework within which HSR could operate. Until Congress buys fully into the current administration's push for HSR, it is unlikely the legislative gap will be bridged in the near future. This will create challenges for HSR development in the US.

- **There is no reliable source of funding for HSR.** The former ARRA funding was a boon to the HSR industry, but it was ad hoc and was passed by Congress as part of an economic stimulus package, not because of a decision by the legislature to support HSR development. Follow-up legislation such as Hon. James Oberstar's* $50 billion proposal for high-speed rail in 2010[16] did not make it through the legislative maze, encountering strong opposition from Republicans responding to pressure from the Tea Party movement to push for cutbacks in government size and spending.[17] The governors from Wisconsin and Ohio returned HSR-ARRA funds in the midst of a recession. Both governors had campaigned against high-speed rail

* Honorable James Oberstar was Chairman of the House Committee on Transportation and Infrastructure from 2007 to 2011.

funding and wanted to divert the funds to other transportation (road and freight) projects. The transportation secretary, however, refused and reallocated their funds to other states, noting the ARRA law does not allow HSR funds to be used for other transportation modes. The Tea Party has been very vocal in their opposition for HSR, and both of these governors came into power with strong support from the movement. North Carolina also recently passed a law barring the state from accepting any additional federal HSR funds. Without a stable and reliable source of funding, the HSR initiative will not succeed in the US. It is not farfetched to imagine a scenario where a new administration could abandon the decision to build HSR altogether.

III. INTERNATIONAL HIGH-SPEED RAIL DEVELOPMENT

This section provides a survey of HSR developments in Asia and Europe. It looks at the motivation for adoption of HSR, development costs, level of patronage of the system, revenue generated and profitability of selected projects. The aim is to provide a context to discuss the potential pathways HSR implementation could take in the United States.

JAPAN: A WORLD LEADER

No discussion of HSR is complete without a mention of Japan, the first to develop a commercial high-speed rail train and a leading nation in HSR railway technology worldwide. Built in 1964, Japan's Tokyo-to-Osaka high-speed rail line was the first, and is still the busiest, high-speed rail line in the world. The line is usually referred to as the *Tokaido Shinkansen*. Tokaido is the name of the Tokyo-Osaka corridor and Shinkansen means "new trunk line" (referring to its status as the world's first).

Motivation and Development of HSR System

In 1939, the Japanese government began acquiring land for a proposed "bullet train" that was to run from Tokyo to Osaka, and on to Shimonoseki at the western tip of the Honshu Island, at speeds of up to 124 mph (200 km per hour). However the project was shelved due to the World War II. It was revived again after the war when the main Tokyo-Osaka corridor was experiencing increasingly heavy congestion, with 186 passenger trains and 124 freight trains traveling the corridor each day. The highways were also heavily congested and the fastest way to travel between Tokyo from Osaka was a one-hour flight by air.

The densely populated corridor is a highly active economic region that accounts for 50 percent of Japanese GDP; hence, efficient movement of goods and passengers along the corridor is a national priority. The key motivation of the project was the need to ease congestion and improve capacity on both the rail and highway corridors.

Japan National Railways then-president Shinji Sogo and vice president of engineering Hideo Shima are credited with being influential in convincing the government to pursue the Shinkansen option. Three development options were under consideration at the beginning of the project: a parallel, narrow-gauge line next to existing rail lines; a narrow-gauge line on a new route; or a standard-gauge* line on a new route. The Shinkansen project was eventually built to the standard gauge specification. This meant other Japanese trains could not share its tracks. Additional distinguishing features in are the use of lightweight electric multiple unit (EMU) train sets† and separate stations for the Shinkansen. The actual operating speed of the Shinkansen of 130 miles per hour over the 500-km route put the Tokaido Shinkansen on a firm footing to compete with automobile and rail in terms of travel time along the length of the corridor.

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* Gauge is the distance between rails: the narrow gauge then was 1,067 mm (based on British standard gauge), while the worldwide standard gauge was 1,435 mm.

† EMU stands for Electric Multiple Units, which are trains where each carriage had its own electric motor unit, in contrast to trains where the carriages were drawn by a locomotive unit at the end.

The $3.2 billion project was financed partially by a $80 million World Bank loan.[18] Kasai[19] and Wakuda[20] both report that Shinji Sogo made a strategic decision to obtain a World Bank loan in order to ensure the Japanese government did not back out of the project midstream. Sogo eventually had to resign over controversies that he was funneling funds from other railway projects to the Shinkansen project when the project's initial $1.6 billion estimate ballooned to $3.2 billion. Kasai and Wakuda both state the initial low estimate was intentional, as Sogo knew the government would not have approved the project at full cost. The project was finally completed in October 1964 and opened just in time for the Tokyo Olympics. Published documentation of this kind has been used by opponents of high-speed rail in the US. Given that most of the loan packages for Japan's later HSR lines had to be restructured and some of the debt written off, the issue of the reliability of projections for HSR demand and construction costs is not trivial. Since several of the proposed US HSR lines could be built within the same decade, the government could find that by the time it has enough data to credibly estimate costs and evaluate projections; most of the HSR funding will have been disbursed and spent.

Achievements

The Tokaido Shinkansen initially reduced the six-hour-and-forty-minute conventional rail trip time to four hours. Future vehicle upgrades to the Tokaido Shinkansen reduced the travel time to less than three hours. The latest published schedules,[21] indicate the new N700 train sets makes the Tokyo-Osaka trip in 2 hours 33 minutes at a speed of 270 km per hour. The train has a very high level of reliability with reported average delay of 0.6 minutes per train (over the entire year), even counting uncontrolled circumstances, such as natural disasters.[22] The project has been hailed as a success because of its high level of ridership and revenue generation.

Competition with Air Travel

The various Shinkansen lines are very competitive with air travel at distances of 200 miles or more (three hours by auto) as illustrated by three typical trips below:

- Tokyo-Osaka (320 miles): both the Shinkansen system and the airlines make this journey in two-and-a-half hours (including boarding time), but the Shinkansen system offers 238 departure times per day (approximately once every 10 minutes*) while airlines offer only 110. The Shinkansen has more than 80 percent market share.

- Tokyo-Okayama and Tokyo-Hiroshima lines: Air and rail travel times are again the same, as is the greater frequency of Shinkansen departures. However, due to flexible air ticket fares and occasional promotions, the market share is approximately equal for both.

- Tokyo-Fukuoka (665 miles): The Shinkansen takes about five hours with the fastest model, while the flight takes only two hours. The frequency of the Shinkansen is less than the airlines as well. Most of these passengers prefer to fly because of the substantial difference in travel time.

* Nozomi use the N700 Series trains that are capable of speeds of 300 miles per hour and is the fastest service on the Sanyo and Tokaido Shinkasen lines.

Travelers prefer the Shinkansen because of the high departure frequency, high on-time schedule reliability, low fares, convenience and safety. There are also a high number of local transit lines connecting to the system, making it easy to conveniently access the system. For trips greater than four hours, airlines become more attractive because the time saved provides greater value than the cost savings of rail.

System Expansion

Spurred on the by the high level of patronage of the Tokaido Shinkansen, the Japanese government passed the Nationwide Shinkansen Railway Development Act[23] to develop a nationwide Shinkansen railway system connecting the major urban areas. The act served as the basis for extending the Shinkansen lines to cover the whole nation. The law establishing the act states “the goal is to boost the national economy, expand the livelihood domain of the citizenry, and promote regional development.” Shinkansen railways are defined as railway lines that could attain speed of 200 km per hour, or more, in predominant sections along the line.

The first expansion was the Sanyo Shinkansen, which extended the Osaka end southwestward 389 miles to Hakata. Next, the Tokyo end was expanded 335 miles northward to Morioka as the Tohuku Shinkansen. The next extension was the 200-mile Joetsu line from Tokyo to Niigata. Plans for other Shinkansen lines include the Kyushu (westward from Hakata to Kagoshima-Chou), the Akita (Morioka to Shin-Aomori), the Nagano (Tokyo-Omiya-Nagano), and the Yamagata, and Hokkaido Shinkansen.

The development act gave the Ministry of Land, Infrastructure, Transportation, and Tourism responsibility for development of the HSR lines. Once the *Basic Plan* was outlined by the Infrastructure Ministry, the Japan Railway Construction, Transport and Technology Agency (JRTT), in conjunction with the ministry, selected the contractor and operator. The act also allowed for JRTT to be appointed as a contractor. Construction costs were to be shared between the National government and the municipalities through which the lines passed, and municipalities were responsible for land acquisition related to the project.

Current State

The Shinkansen system now comprises a network of high-speed railway lines operated by six companies under the Japan Railways Group. In addition to reducing travel time, the system has improved energy efficiency. HSR is four times as efficient as automobile travel and five times as efficient as airline travel. According to Okada,[24] the per capita emission of CO_2 by the Shinkansen is one-fifth that of automobiles and one-sixth that of airlines.

Cost

The gains in speed and convenience came at a high price. Construction costs were very high due to the high cost of land acquisition and the rugged topography of Japan[25], which required extensive tunneling, and bridge building. More than 140 miles of the project involved expensive infrastructural features that accounted for 45 percent of the project costs.

The Tokaido line has 80 tunnels (totaling more than 38 miles), and the Tanna Tunnel, the longest, is close to five miles in length. The line has eleven miles of bridges, a mile-and-a-half-long subway and expensive, elevated tracks. The Sanyo and Sanyo Shinkansen also have a similar profile, with Taniguchi[26] putting the final infrastructure and land costs at 58 and 25.8 percent of the project, respectively.

The total cost and cost-per-mile for newer Shinkansen lines have increased with each line. When the Tokaido line was built, the construction cost was $2.66 million per mile, the Joetsu line ended up costing $32 million per mile.

Table 4. Cost per Mile of Shinkansen Systems[27]

	Million (US$)	Section Length	Cost/Mile
Tokaido	920	346	2.66
Sanyo	2950	389	7.58
Tohoku	11,020	335	32.90
Joestu	6690	209	32.01

Revenue and Profitability

Demand for the Tokaido Shinkansen is high, as it is built along a heavily travelled and congested rail and air corridor. Annual ridership for the Tokaido line in 2009 was 149 million passengers, or approximately 409 thousand passengers daily. Though the project overran its budget, the high level of ridership on the dense corridor generated enough revenue within ten years to pay for both construction and operating costs.[28] Though the Tokaido Shinkansen was profitable, the mismanagement of the Japanese National Railways (JNR), which was in charge of the country's railway system, cast a shadow over its success.

JNR began to experience deficits in 1966, shortly after the Tokaido Shinkansen was completed. The operating losses continued to rise due to a combination of factors: the government rejected multiple requests by JNR to increase rail fares overall; politicians pushed for the construction of local railway lines in their districts despite the fact that existing lines were losing money; and the government approved legislation to provide subsidies to JNR but never issued the funding and instead pushed the agency to borrow money from the private sector via bonds. These and several other factors, including overstaffing, a heavily subsidized fare system,[29] and a push to build new Shinkansen lines, eventually led to JNR accumulating an unsustainable level of debt.

Multiple reorganization and restructuring plans were initiated starting in 1996 but the Japanese government sidestepped the issue of raising fares until 1976. By then it was "too little too late." Even though fares doubled on some commuter routes between 1978 and 1982 JNR's losses continued to accelerate until, in 1988. Taxpayers had to shoulder $233 billion of the company's debt as part of a restructuring plan. The original JNR was broken up and privatized. The Shinkansen systems were split into several Japanese railway companies, each responsible for a given section of the Shinkansen system.

The Tokaido line has continued to be profitable and even has supported $41 billion of the debt of the Sanyo, Tohoku and Joetsu Shinkansen lines. The island Japanese Railway (JR) lines (JR Hokkaido, JR Shikoku, JR Kyushu) continue to be subsidized by the government, so the low-density unprofitable lines with low travel volumes can continue operations. Kasai's book the Japanese National Railways – Its Breakup and Privatization chronicles the factors that led to the demise of the JNR in relation to the development of Japan's Shinkansen System. Matsuda[30] also published an excellent discussion on the system in "Making the Impossible Possible: One Man's Mission to Reform the Japanese Railways."

TAIWAN AND KOREA: PRIVATIZATION VERSUS PUBLIC FUNDING

We compare the Taiwan and Korea high-speed rail projects because they were built at nearly the same time and the respective governments took different funding approaches. Taiwan pursued a "build-operate-transfer" model, which was a first for HSR projects, while Korea used the standard public funding approach. Korea wanted to gain expertise in the technology, while Taiwan wanted the system built with minimum involvement from the government. The comparison will be of interest to states in the US as they consider different funding mechanisms.

The Taiwan HSR (THSR) was built to ease increasing congestion on the highway network due to intercity travel between Taipei and Kaohsiung. Construction on the HSR line began in March 2000, and the project was completed and put into service in January 2007.

The THSR is based on Japan's Model 700 Shinkansen system and has a top speed of 186 mph along the 214-mile line. Its mechanical and electrical systems are built to European standards. It was co-developed by Central Japan Railway Company and West Japan Railway Company as a modification of the Shinkansen 700-E series trains. The completed HSR train reduced the travel time between Taipei and Kaohsiung from 4.5 hours to just 90 minutes.

The THSR system currently has eight stations – Taipei, Banciao, Taoyuan, Hsinchu, Taichung, Chiayi, Tainan, and Zuoying – with five more planned for the future (in Nangang, Miaoli, Changhua, Yunlin and Kaohsiung). THSR reached the 5-million-passenger milestone five months after it was launched and by September 2007 had sold more than ten million tickets.[31] The system carried more than 15 million passengers in its first year of operation, an average of 65,000 per day. Train schedules have been ramped up from 19 per direction per day to 60. The system currently provides 91 services per day, about the half capacity of the line.

Thirteen billion dollars was to be invested in the Taiwan HSR project using a build-operate-transfer (BOT) strategy. The reported total construction cost, however, was $18 billion.

The high-speed rail system generated revenues of $18.3 and $20.39 million in its first two months of operation, far below the monthly expenditure of over $304 million.[32] After nine months of operation the reported sales was a total of US $279.6 million. Table 5 gives a breakdown of monthly revenue from January 2007 through May 2009. It shows revenue almost doubled from 2007 to 2008 and was gradually increasing in 2009.

Table 5. Monthly Revenue from Taiwan's High-Speed Rail System

	2007 NT$ (millions)	2008 NT$ (millions)	2009 NT$ (millions)
January	599.3	1,551.0	2,230.9
February	669.3	1,728.6	1,735.1
March	867.7	1,903.9	1,908.8
April	1,030.3	2,100.0	1,856.1
May	1,078.2	1,903.5	2,040.4
June	1,136.0	1,875.9	
July	1,282.2	2,038.4	
August	1,260.0	2,168.6	
September	1,268.3	1,816.1	
October	1,320.4	2,109.9	
November	1,414.0	2,028.7	
December	1,578.3	1,991.6	
Total	**13,503.8**	**23,216.0**	

Korea also recently completed construction of new high-speed rail lines. The 256-mile Korean HSR connects the capital, Seoul, to Busan in the south. The project was developed in two Phases: Phase 1 from Seoul to Daegu, began in 1992 and was completed in 2004, while Phase II from Daegu to Busan was completed in November 2010. Upgrades were also made to the conventional rail line from Daejeon to Mokp'o in the southwestern portion of the country.

Private versus Public Investment

The two countries, Korea and Taiwan, chose very different approaches to building their projects because they had different objectives. Korea went with a publicly funded project administered through the Korean High-Speed Rail Construction Authority, while Taiwan took the private track, using a build-operate-transfer funding mechanism to fund the project.

Both countries were building to relieve congestion on their road networks, but Korea had an additional objective of acquiring the technical knowledge and capability to build high-speed rail lines. For Taiwan, the absence of the latter objective made it easier to privatize their project in the form of a 35-year build-operate-transfer contract. Privatization was to bring several benefits, including:

- Minimizing the extent of political interference in the project (the public agency, which can be easily influenced by politicians, operated more in an administrative role, with limited decision-making power politicians had limited influence once terms of the contract were finalized and executed)

- Having the contractor source project funds from the private sector freed up public sector funds that would otherwise have been tied up on the project

- Using private sector funds additionally reduced the level of risk facing public sector funding (HSR for Taiwan is high risk in the sense that they had no prior technological knowledge and would be learning on the project)

- Sourcing of private sector capital puts pressure on the BOT contractor to make judicious use of the funds in order to both minimize interest payments, and maximize any returns over the life of the project

- The contractor had a high incentive to complete the project in a timely manner, as the 35-year contract concession period included the construction phase

In choosing this approach, Taiwan sacrificed the ability to acquire HSR technology capability. This is understandable; given the size and shape of the country, it is unlikely many HSR lines will be built in the future. Korea, on the other hand, has the potential to expand and upgrade several of their existing rail lines around the country.

In retrospect, the Taiwanese did not achieve most of their goals. Kien-hong and Johannesson document how the ridership projections for the project never materialized. Within two years (in 2009) the government had to take over the project.[33] The government also allowed the system to be built to European standards and then forced the use of Japanese rolling stock. The resulting incompatibility caused major cost increases and schedule delays. Initial ridership projections of 140,000 passengers per day never materialized. In the first year the ridership numbers were abysmal at 50,000 passengers – a little more than one-third of the original projection. By 2010, almost four years after service started, ridership was at 101,000 passengers per day.[34]

CHINA: USING HIGH-SPEED RAIL TO DRIVE DEVELOPMENT

China has achieved remarkable progress in building up its high-speed rail system. The China high speed rail program was launched in 2003, and the first line – the D460, from Shanghai to Suzhou – went into service in 2007.

Motivation and Development of HSR System

The key initial motivation behind China's HSR program was boosting economic development by connecting key major cities, and freeing up capacity on overcrowded freight corridors. In line with this objective, technology transfer has been a core component of the nation's high-speed rail development program. China insisted from the onset that all foreign companies that won contracts to build HSR lines form joint ventures with local companies and commit to technology transfer. The proposed massive market of more than 8,000 miles of HSR lines in one country gave China a very strong negotiating position, as there was no single concentrated purchase of HSR technology.

China's HSR program rollout has been accelerated recently, and by the end of 2008, the nation had more than 3,986 miles of HSR lines with speeds above 124 miles per hour. The current plan is to expand the system to 8,077 miles lines by 2012, with 4,900 of those miles traveled by trains that operate at speeds above 217 mph.

China has 2,191 km of high-speed rail tracks, with design speeds of 350 km per hour. In 2010, China's HSR led the world in network size. The country also has the world's longest line: 1,069 km, running from Wuhan to Guangzhou.[35] The Beijing-Tianjin line is China's most heavily used line. It began commercial service on August 1, 2008, seven days before the Olympics. It shortened the 75-mile trip from 2 hours to half an hour and was the first train model completely developed in China. The model, called "Dongchezu," set a new speed record of 217 miles per hour for a commercially running train.

Acquiring Technology

Most of the major international high-speed rail train makers, including Alstom (France), Bombardier (Germany), and Kawasaki (Japan), transferred technology to China that the Chinese integrated to eventually build their local CRH (China High-speed Rail) train sets. Several models have been developed from the technology gained. Most of the parts for CHR trains are manufactured locally. The fastest CRH train set as of the time of this writing was the CRH380 series, which can achieve design speeds of up to 380 km per hour.

China has been so successful in adapting the technology; it has begun competing for projects on the international scene. The China Railway Construction Corporation (CRCC) has won contracts to build HSR lines in several countries. Both Siemens and Alstom have teamed up with CRCC to build HSR in Saudi Arabia, and China recently put in a bid to construct and finance California's high-speed rail project.

China's Maglev train between Shanghai International Airport and Pudong was the first commercial service line in the world. The train completes the 18-mile journey in less than 8 minutes at speeds of 268 miles per hour. Ridership, however, has been very low – about 20 percent of capacity – as the train only terminates at an airport and most travelers are not willing to pay the $7 one-way fare. A map of the China High-Speed Railway network is shown in Figure 4.

Profitability

The construction cost of HSR lines in China have varied widely from approximately 8 to 55 million US dollars per mile in 2011. This wide variation is very typical of HSR lines, as construction costs are affected by the number of tunnels and bridges, terrain, land acquisition costs, and passage through densely populated areas and downtown districts. The variation is not unexpected given the size of the network. Compared to Japan, China's land acquisition costs are at the low end, and the government does not need to buy land as most of the land in China is publicly owned and managed by provincial governments.

The China high-speed rail program has faced some challenges recovering cost. Though limited publicly published reports could not be accessed for this study, it appears the HSR is mainly attracting premium air and business travelers rather than travelers from auto and rail modes. Two lines from Beijing to Jinan in Shandong province and from Tianjin to Jinan had to be suspended in July 2011,[36] as ridership levels were at 20 percent capacity. It appears several of the Chinese HSR lines have not been profitable.

Figure 4. Main Lines in China's High-Speed Rail Network

Source: TransportPolitic (modified by author).

Setbacks

Despite early successes China's high-speed rail has suffered some setbacks. In July 2011, 39 people died when a high-speed train ran into the back of another, which had stalled, on a viaduct near Wenzhou after lightning cut its power supply. Six carriages derailed and four fell from the viaduct 20 to 30 meters (65 to 100 ft.), killing 32 people and injuring nearly 200 people.[37] In addition, the Railway's minister was forced to resign in February 2011 over corruption allegations related to the development of China's high-speed rail system.

The Chinese have slowed their trains, partly because of the accident, but also to save energy: the extra demand is not worth the extra energy. The government will need to act quickly and responsibly to improve safety and public confidence in the system if it wants to sustain and increase demand on HSR lines in the country.

EUROPE: BUILDING UP AN INTERCONNECTED HIGH-SPEED RAIL NETWORK

This section gives an overview of the HSR projects in major countries in Europe. The countries with the most developed HSR networks in Europe are France, Germany, Italy and Spain.

France

France kicked off the HSR race in Europe when it launched the Paris-to-Lyon TGV (*Train à Grand Vitesse*) HSR train line in 1983. The project was motivated by the need to increase capacity on congested sections of their existing network. It involved developing a completely new alignment that shortened the existing track length from 520 to 120 km (323 to 74 miles). New, lighter train sets that needed less expensive infrastructure were developed for the system.

Achievements

As in Japan this first (for France) HSR project was very successful in many respects total traffic on the corridor almost doubled from 12.5 to 22.9 million passengers between 1980 and 1992, 18.9 million of whom rode the TGV-HSR (Vickerman 1997).[38] The TGV both generated new trips and diverted trips from other modes. It reduced travel times between Paris and Lyon to two hours from four hours. Air travel between Paris and Lyon fell by 50 percent from 1980 to 1984, while car traffic on the A6, a parallel motorway, grew at about one-third the rate of other nearby motorways.

Expansion

The project was financed by the national railway SNCF and was fully amortized by 1993. Due to the resounding success of the Paris-Lyon project the government teamed up with SNCF to develop and extend the network in France.

The network was extended westward and southwest as the TGV-Atlantique in 1989. The southern portion of TGV-Atlantique connects Paris to Bordeaux through Tours, reducing the Paris-Bordeaux journey from four hours to three. Two years after the line opened, rail travel between and Paris and Bordeaux had increased by 17 percent while air travel had dropped by 50 percent. The westward link connected Paris to Nantes. The government funded 30 percent of the construction cost for TGV-Atlantique.

Next to be built was TGV-Nord in 1993, which connected Paris to Lille in the north. The link was developed in anticipation of the Paris-Lille-London line through the Channel Tunnel. Traffic grew by 25 percent in the first three years. Other extensions to the TGV network include the TGV Rhône-Alpes (1992/1994), which extended the Lyon line southward, creating connections to Spain at Beziers and into Italy at Nice.

It is worth noting that, as in Japan, the expanded lines have not been as profitable as the initial line. Vickerman induced demand by examining the impacts of the three-pronged

French network on business traffic. He found the effects varied significantly and are very context-specific. For example, in the case TGV- Paris-Lyon, the traffic growth was in both directions. Along the TGV-Atlantique there were mixed results. Tours, which is an hour from Paris by TGV, witnessed a 24 percent reduction in business traffic while Nantes, two hours from Paris, saw business traffic grow 66 percent. However the growth was unbalanced, with a 99 percent increase in traffic originating from Paris but only 55 percent increase in the traffic originating from Nantes. From Paris to Toulouse (5 hours), even though business traffic grew 21 percent, the increase was mainly due to the market share grabbed from airlines. Thirty-five percent of the growth was from Toulouse, while traffic originating from Paris actually fell by 5 percent.

The key takeaway is that, aside from the much-trumpeted potential of HSR to grab market share from airlines, depending on how much economic activity occurs between specific origin-destination pair, some regions tend to benefit more than others. According to Vickerman[39,40] regional studies in Europe seem to indicate HSR leads to a concentration of economic activity at the already-developed economic centers. In a review, Chapulut, Jean-Noel and Jean-Pierre Taroux note that several TGV projects have overestimated demand and underestimated costs and few have achieved their target rates of return.[41]

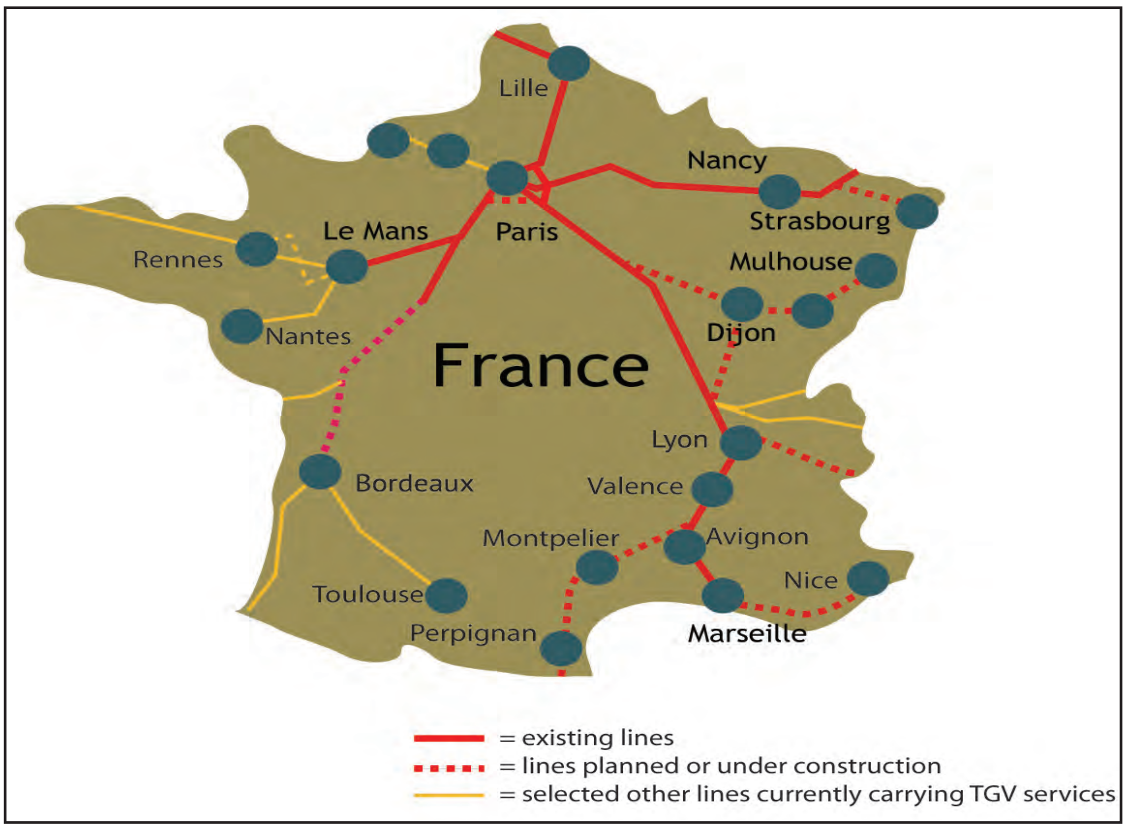

Figure 5. France National High-Speed Rail Network

Germany

Germany tested an EMU train with speed of 124 miles per hour in 1903 but did not put their Inter-City-Express (ICE) trains in service until 1990. High-speed rail was introduced in

Germany to increase capacity for both passenger and freight trains and free up bottlenecks on north-south routes. In developing their HSR system, Germany opted to build the tracks to serve both freight and passenger trains. According to Giovani, “This feature turned out to be a disadvantage since it led to high construction costs (to support the higher load of freight trains) and low utilization of the lines (since freight trains operate at much lower speeds).”[42]

Due to the presence of several medium-sized cities spread out around the country, HSR development in Germany is more diffuse compared to France, with an emphasis on upgrading speeds on existing lines rather than building new dedicated HSR lines. In general, the German network has lower speeds compared to the system in France. Passenger load factors* in the German system are averaging 50 percent compared to 70 percent in the French network.[43]

Spain

The Spanish AVE (Alta Velocidad Espanola, or “Spanish high-speed”), network is similar to that in France in that it is centered on Madrid. According to Boras, et al (2011), the 1979 General Railway Master Plan for Spain had proposed the construction of three new lines to resolve capacity constraints in the existing network.[44] One of the constrained corridors was the Getafe-Córdoba section between Madrid and Seville. It was built to the international gauge of (1,435 mm) instead of the Iberian one (1,668 mm). The line was then extended to Seville as the country’s first HSR line. The key HSR route in Spain, from the south, is Seville-Madrid-Barcelona which then connects to the network in France (see Figure 5). Service is available westward from Madrid to Valencia and then north to Barcelona. There are plans to develop the network to cover the western portion of the country and also connect to Portugal.

A unique feature of Spain’s network is the fact that the existing rail is built to the Iberian gauge (i.e., the distance between the two parallel rails) of 1,672 m (5 ft. $5^{5}/_{6}$ in.), which is different from the international standard gauge of 1,435 mm (4 ft. $8^{1}/_{2}$ in.). The HSR trains in Spain are thus designed to run on both gauges. Newly constructed HSR lines in Spain use the international gauge; however a section of the Madrid-to-Barcelona track (from Zaragoza to Huesca) is constructed to be used by both standard-gauge high-speed trains and Iberian-gauge Spanish trains. The additional engineering to implement such links increases the cost of the HSR system.[45]

Developing a System-Wide Network in Europe

As shown in Figure 6, the HSR network in Europe has its core in the cities of Brussels and Lille. The three-pronged network in France has been a central link in the bid to build up a European high-speed rail network. Lille is connected to London to the west and Paris in the south, while Brussels is connected to Amsterdam in the north and Cologne to the east.

* Load Factor – percent of available seat capacity utilized. If on a given trip a train with 200 has seats 120 seats filled then load factor is 102/200=0.6.

Though France, Italy, Spain and Germany have the most extensive high-speed rail networks, they are not the only countries pursing HSR development in Europe. Several countries, namely Sweden, Norway, Poland, Finland, Turkey, and the United Kingdom, are all at various stages of either building HSR lines or upgrading their existing lines to speeds between 100-155 miles per hour.

These upgraded lines are sometimes referred to as accelerated–rail to distinguish them from high-speed rail. Despite the name, these projects still require substantial investments and significantly improve the door-to-door travel times of travelers, ultimately attracting travelers from other modes to rail, which is the core motivation for developing HSR.

In 1996 the European Union (EU) decided to get involved in HSR development and issued its first directive[46] on HSR. The directive noted that there are major differences between the regulations of each nation and the internal rules of the national railways in the Union. The internal rules incorporate techniques that are specific to the national industries. These internal rules tend to prescribe specific dimensions and devices and special characteristics that create situations that made it difficult for high-speed trains to run normally throughout community territory.[47]

The EU also noted that this setup creates "very close links between the national railway industries and the national railways, to the detriment of the genuine opening-up of contracts."

- The directive defined essential technical specifications for interoperability (TSIs) to ensure interoperability in the fields of infrastructure, energy, control-and-command and signaling, and rolling-stock for the trans-European high-speed train system.

- The directive also defined HSR as "specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h, or specially upgraded high-speed lines equipped for speeds of the order of 200 km/h, or - specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case."

- The directive created a body with a director and staffs to check and ensure national rail organizations and operators were abiding by the directive. The directive was further updated in 2002.[48] Among other things, the update extended the rules to apply to renewals or maintenance-related replacement. In addition the directive states that, upon request, "Member State informs the other Member States and the Commission of the relevant national technical rules in use for achieving interoperability and meeting the essential requirements of Directive 96/48/EC."

The EU's initial efforts to develop a Trans-European Rail Network (TEN) have been focused on formulation of policies to ensure interoperability of equipment. However, the current system is very inefficient for travelers making trips across multiple countries because ticketing is handled by multiple entities that have overlapping jurisdiction. For example, Thalys operates lines between Paris-Brussels-Cologne-Amsterdam, this overlaps with SNCF (France) and Eurostar (joint UK, French and Belgian) services between Lille and

Brussels, and ICE (German) services between Brussels and Cologne.[49] This is because the European HSR networks were developed and operated by individual countries before the EU began developing TEN. The development of the TEN remains a work in progress and much needs to be done to make the system truly trans-European, especially from the perspective of travelers.

Figure 6. High-Speed Rail Network in Europe in 2010

IV. TOWARD A MORE COHERENT US HIGH-SPEED RAIL POLICY FRAMEWORK

The review of international HSR experiences shows that countries that have implemented HSR have very focused reasons for pursuing HSR systems. Korea and Taiwan used HSR to relieve congestion on both their conventional rail and road networks. Europe has used HSR to relieve congestion on their conventional rail lines by providing additional capacity with improved quality of service and, in some cases, to spur economic development. France built separate, new HSR lines that took the passenger trains off the freight lines to improve passenger travel times and also free up capacity for freight trains. Germany also built their HSR systems to improve passenger travel times. Freeing up capacity for freight was not as crucial in the case of Germany as the HSR trains are built to share tracks with the conventional and freight trains. China is using HSR to spur economic development, and free up capacity in their rail network for freight trains. These justifications, however, do not work as well for HSR in the US.

MAKING THE CASE FOR HIGH-SPEED RAIL IN THE US

The issues that will drive development of HSR in the US are different from those in Europe and Asia. Intercity travelers benefit from the well developed interstate highway system and mainly experience congestion close to their origin and destination cities. Areas like the Northeast Corridor, where several urban areas lie close together along an extensive stretch, are the exception. Due to the large area encompassed by the US, and long distances between major population centers (compared to Europe), most roadway congestion in the US is experienced by commuters making short trips (less than 100 miles) during the morning and evening peak periods[50] rather than long distance trips in the 100- to 500-mile range where HSR has the highest payoff. Hence, the case for implementing HSR to reduce current congestion levels on the road network is weak.

In fact, extensive investment in the interstate highway and airport system in the US has made it harder to build a competitive case for additional investment in HSR.

The ownership structure of the rail network in the US is the opposite of most of the countries reviewed. In the US, freight companies own most of the rail network and Amtrak, the passenger train operator, has to negotiate with them for use of their lines. Hence, there is no pressing need to free up capacity for freight companies. Amtrak owns the Northeast Corridor tracks from Washington, DC to New York and from New Haven to the Massachusetts.

Unlike airports and roads that are built in all states, HSR systems perform best along corridors passing through clusters of high-density-population centers with significant economic activity. An examination of Figure 2 shows that several US states do not have designated HSR corridors because they do not have these high-density, economically active population centers. This has implications when HSR policy and funding is debated at the federal level. Representatives from states that will not have HSR lines may adopt stances ranging from lukewarm to opposing HSR projects. Some level of negotiation will be needed to iron out the HSR funding level and source.

We believe one of the reasons why the US continues to lack a firm HSR policy framework is that advocates have not developed a few key, compelling arguments that politicians can coalesce behind to push for HSR development. HSR advocates in the US tend to tout the environmental benefits, job creation potential, safety and high travel time reliability of HSR.

The job creation benefit, though appealing in the current recessionary environment, may not sound very attractive to policymakers (legislators) once the recession turns around and the economy is on the mend. ARRA is a typical example. It was easy to set aside $8 billion for HSR in the bill based on its job creation potential; however, James Oberstar's follow-up proposal for $50 billion did not materialize. Job creation is a benefit that will be realized as HSR projects are built, but it is not a good justification for investing in HSR because, inter alia, the same jobs would be created from any transportation infrastructure of other investment programs.

The environmental impact benefits, though acceptable, are much harder for the average everyday traveler to perceive. Most travelers make their daily choice of transportation modes based on economic/cost constraints rather than environmental considerations; hence, there is limited pressure on legislators from constituents to invest in HSR for its environmental benefits. It is also worth mentioning that other researchers question the environmental benefits of HSR, arguing that the benefits change based on whether emissions from the construction are included, and also on the no-build case used in each context.[51]

The on-time reliability, improved speeds (shorter travel times), and safety of HSR may be the strongest selling point for HSR in the US. The challenge is that these benefits are best seen when one rides or experiences an HSR system. Most travelers in the US currently have no conventional rail service available, and there is no HSR train for them to ride either. This makes it hard to rally enthusiasm among the current populace to push for HSR investment.

Though congestion levels on intercity highways are not at unbearable levels, most legislators are aware they need to develop additional capacity to support the growth in demand that will come with population growth in the future. HSR will definitely be a strong contender in meeting some of the future capacity needs. The challenge in solving future congestion problems is lower on the totem pole for many local public agencies that have their hands full grappling with rush-hour gridlock within and on the periphery of their jurisdictions. Dealing with HSR intercity, travel-related issues that span multiple regions and, in some cases, states is not high on the list of most transportation agencies and legislators and, is no simple matter in the context of the US Constitution which requires Congressional approval for interstate compacts.*

Until HSR advocates can agree on a coherent and focused rationale, or congestion becomes a problem on intercity routes, it appears that most HSR initiatives in the US will face an uphill battle.

* Interstate compacts are agreements between two or more states of the United States of America. They are regulated by Article I, Section 10 of the United States Constitution which states that no state shall "enter into any agreement or compact with another state, or with a foreign power" without the consent of Congress.

LEADERSHIP CHALLENGE

In the most recent MTI report on HSR, "leadership coupled with means and authority" was identified as a critical ingredient for success of HSR projects.[52] For example, though political leaders in Pennsylvania were enthusiastic about HSR early on, they made almost no headway until 1999 when Amtrak and the State entered into a joint Memorandum of Understanding (MOU). The MOU provided $140 million for infrastructure and equipment upgrades on the Philadelphia Harrisburg line to reduce trip times to 90 minutes (shortest current rail trips is 1 hour 40 minutes and drive time is 1 hour 56 minutes). This is an arrangement whereby leadership, authority to execute the project, and the financial means came together.

HSR projects also face opposition from specific communities that may be impacted or even perceive a negative impact from an HSR project. This is played out very clearly in the case of California where there is stiff opposition from communities along the HSR project line, such as Palo Alto and Orange County. The most formidable obstacle at the state level has been political support.

Florida's HSR has never lacked for champions (leaders) for its HSR initiatives. These have included Governor Bob Graham (1979-1987) and recent avid advocates, such as Doc Dockery, who spent his personal funds to draft and promote a constitutional amendment directing the legislature to develop a high-speed rail system. Due to difficulty getting buy-in from Florida governors and legislators, the state has lacked the means and authority. Recently, even after federal funds were allocated to fully pay for the Tampa-Orlando project, it was shut down when the governor returned the funds to the federal government.

Clearly, all three ingredients – leadership, means and authority – are key to the success of HSR initiatives, but leadership with authority appears to be the most critical ingredient for HSR initiatives to survive. Even with careful planning, a well-laid-out legislative framework and adequate funding from the federal government, the governor was able to scuttle the Tampa-to-Orlando project simply by rejecting the federal funds.

> ***Florida Example:*** *Chen[53] believes a series of political and strategic factors came together for Florida being given such a large sum. He notes that the I-4 corridor population played a key role in Obama's 2008 victory, and also Florida's electoral representatives actively lobbied the transportation secretary. However, he also acknowledges Florida's State legislature worked hard to put together a cost sharing package that made it clear to the federal government they wanted the project. Additional strategic factors that played a role in the decision were:*
>
> - *The federal government needs a showcase project that it can use to trumpet its policy decision to invest in HSR, in that sense the Tampa to Orlando corridor is one of the shortest that could be completed quickly*
> - *Florida's flat topography will aid a fast construction of the project as it does not have to deal with tunneling and steep slopes (all factors that Campos and de Rus[54] and several others have pointed out increase construction costs)*

- *Building the project along the along the Interstate 4 median significantly reduced the cost of land acquisition as the Federal government already owns that right of way*

- *Building on the median also reduces amount of environmental impact as the existing freeway already has created the major impacts*

- *Florida's State legislature worked hard to put together a package in which they voted to contribute $300 million to the project as cost sharing*

There may be some merit to Chen's theory of political factors weighing in if one considers some of the comments of a recent GAO report. The report states that FRA followed all the standard procedure for allocating such a contract, but noted that there was no clear documentation why some of the projects were chosen above others.

SUSTAINED FUNDING FOR HIGH-SPEED RAIL

The cost of developing a high-speed rail system is so high that very few states have the means to fund the initial construction, even for potentially profitable lines; hence, federal funding is needed. At the federal level, most funding bills have floundered and failed.

A key factor has been that the federal government is overextended simply maintaining the current transportation system and other sectors of the economy, as are most state governments. As mentioned earlier, HSR systems perform best in areas with closely-spaced, high-density population centers. This means that several states, particularly those in the Midwest, will not have HSR lines. Hence, any federal funding scheme should be structured so that it is acceptable to states that will not benefit directly.

The funding should be a mixture of grants, loans and bonds, but should be heavily skewed towards bonds. The bonds should be state-sponsored but guaranteed by the federal government. (The appropriate mix of grants, loans and bonds in the funding scheme is beyond the scope of this project.) This will ensure that those states that benefit directly bear most of the financial burden, reducing the likelihood of resistance from states without HSR projects. The federal government must establish criteria as to which HSR lines they will support and finance. As revealed from the review of international HSR in Europe and Asia, only the first couple of HSR lines developed by most nations were profitable. The subsequent lines that were built to expand the systems were not financially sustainable in most cases. The federal government should pay close attention this finding and require projects that receive federal support to show that ticketing revenue will cover operating costs plus a percentage of capital costs.

For projects spanning multiple states, member states may have to negotiate what level of financial responsibility they will bear, and this will require detailed negotiations and financial setups that are not addressed in this report. States that do not benefit directly from HSR will still contribute to the HSR systems through taxpayer-funded loans and grants, and this is equitable, since some of these citizens will, at one point or another, use the HSR systems. Moreover, as with urban mass transit, citizens of one state may well benefit from improved economic efficiency in any other state through increased business interchange.

Also given that intercity travelers are not currently experiencing severe congestion, the greatest beneficiaries of the HSR systems are those who will use them ten to twenty-five years down the line. So having a setup where those beneficiaries pay off the bonds (cost of the system) in the future is more equitable than having current taxpayers fully fund the system.

The federal funding going forward should be initiated and set at the by Congress rather than the Executive branch. The funds should come from a dedicated, long-term source, such as an extended fuel tax. This is needed so to instill confidence in private investors and other stakeholders, such as train set manufacturers, that the resources they allocate to HSR development are a wise investment. Without a dedicated funding source and support from the government, these third parties will consider HSR too risky and their incentive to allocate capital to such projects will be minimal.

V. CONCLUSIONS

William Vickrey proposed road congestion pricing* in the US by 1952, but no project was ever implemented in the states. In the 1960s the UK developed a congestion-pricing scheme for downtown London but did not implement it. Rather, it was Singapore that implemented the first project in 1975. It took 28 years, until 2003, for London to finally implement their downtown congestion-pricing project. Only recently has the US begun to put into place a hodge-podge of freeway pricing projects using congestion pricing principles.

When looking at HSR development worldwide, one is uncannily reminded of how often history repeats itself. In a sense, the US was a leader in the HSR race with the efforts to build faster interurban trains. In the early 1900s the St. Louis Car Company built a 100 mile-per-hour train, “the private car Alabama,” for Henry Huntington’s train network in Southern California.[55]

However, once again, it was Japan an Asian country that built the first commercial HSR train for the 1964 Olympics before other nations began to take HSR seriously. It took 11 years after the Shinkansen was introduced for the first commercial service train to become operational in Europe. Though America passed the High Speed Ground Transportation Act in 1965, it still does not have a fully functional HSR system. Though they are capable of attaining speeds of 150 miles per hour, the Acela train sets currently run at an average of approximately 84 miles per hour. This is due to electrification and issues related to the alignment of the track on the Northeast Corridor.

HSR, like most capital infrastructure projects, is expensive: current estimates of construction costs are in the range of $35 million to $70 million per kilometer.[56] Most projects take several years to build, and if the projected ridership does not materialize, the project will suffer substantial financial losses. If projects are funded by the government, a substantial amount of taxpayers’ money is at risk. Given the above, it is not surprising that HSR has both supporters and detractors.

Supporters point to its reliability, convenience, speed, social and environmental benefits, revitalization of the rail industry, and job-creation potential. Detractors question the high sunk costs, with the accompanying high risk of public funds, and the fixed nature of rail. They also assert that HSR serves only a limited demographic of the population on a given route. As the HSR network in Europe has been developed, several studies have explored both sides of these debates, trying to understand the impacts of HSR and also to learn whether the benefits outweigh the costs.

Clearly the federal government is moving to address the financial gap. However, several other challenges persist. Even with private advocates like Doc Dockery in Florida and the full heft of the federal government, the Florida project was still shut down. The federal government has been forced to make a correction mid-course has delayed any hopes of having HSR in the Florida for some time to come.

* Road Congestion Pricing involves charging road users a fee during peak periods in order to reduce the number of vehicles that will opt to use a facility during that time. This helps reduce the level of congestion without building more roads to accommodate the congestion during peak periods.

HSR has been advocated in the US based on to its ability to reduce travel time and the potential to create jobs and generate economic activity. The latter two justifications were high on the agenda when ARRA was passed. Since then, the Obama administration has been struggling to motivate Congress to commit to substantial funds to HSR. The downside of the jobs creation pitch is that, as the economic environment improves, it becomes a harder sell. Also, HSR has no greater potential to create jobs than any other project of similar size. To overcome resistance, policymakers need to come up with rational, long term justification for investment in HSR.

Currently, the federal government lacks a coherent policy on HSR. There is no clear-cut legislation like the Passenger Rail Service Act (which created Amtrak) that commits the government to developing HSR. There is no clarity about which agency will be in charge of developing HSR. FRA would be the logical entity, but it has been focused on rail safety rather than development. As mentioned earlier, it had to scramble to put together staffing to disburse ARRA HSR funds. Amtrak is interested in taking a leadership role, as evidenced by its recent decision to create a dedicated department within the agency that focuses exclusively on HSR,[57] but it does not have a legal mandate to administer federal funds for HSR projects. It is likely FRA will be the lead agency in managing HSR in the US.

VI. RECOMMENDATIONS

The US should consider creating a large scale, federally funded program to give it leverage in negotiations with foreign agencies that possess HSR technology. The nature of HSR is such that it is likely to be successful on selected corridors that have high population density and significant economic activity. The currently identified HSR corridors are adequate. The eleven corridors designated have very high levels of intercity travel demand and, if current trends continue, are likely to experience high levels of congestion in their highway networks due to increased population growth and high economic activity. The airports in most of these regions are already experiencing high levels of traffic.

Even though the designated corridors have high traffic, the current levels of congestion are manageable. However, since HSR involves multibillion-dollar projects that will span more than ten years from planning through construction, HSR projects need to begin now if they are to meet future needs. A large part of most HSR investment costs go into construction that needs to be funded long before the system begins to function and generate revenue. Private capital for such investments is limited due to the high uncertainty of completion, high risk of unprofitability and long waiting period before any revenue is generated. federal funding is needed because the states where these corridors are located do not have resources to raise such huge sums.

FEDERAL ROLE

To effectively invest such a massive amount of capital in multiple HSR projects the federal government needs a more structured policy framework than is currently in place. At minimum, the federal government needs to do the following:

1. Develop a policy framework.

   Designate the key agency that will be focused on planning, development and management of multiple HSR systems in the United States. The mandate of the agency should be clearly spelled out in a legislative instrument like the Passenger Rail Service Act that created Amtrak.

   The Federal Railroad Administration is a good candidate but will need additional staff in order to maintain its current legislative rail safety mandate and function. The agency staff will, at minimum, need expertise in **project management** due to the size of the project, strong **financial management** due to the massive amount of capital involved, and past **experience building HSR projects** due to the differences between HSR and mainline rail.

   The agency should be under (or at least affiliated with) the Department of Transportation so it can tap in the institutional project development and management capacity the DOT and Federal Railroad Administration have developed over the years.

2. Establish dedicated funding.

   A dedicated funding source should be created for the construction of HSR projects, otherwise very few states and almost no private-sector investors will be willing to initiate projects.

3. Provide guiding legislation.

   Federal government needs to move quickly to develop regulations and specifications for HSR design and construction, as the different performance characteristics make them incompatible with the current specifications for rail in the US. When the California High-Speed Rail Authority wanted to consider tilt technology, for example, they had to independently work with FRA to discuss its feasibility, because the existing guidelines written for conventional trains do not cover this technology. Allowing this situation to continue will create a legal minefield and high insurance costs when these HSR systems need to be insured after construction.

   Federal rules on legal challenges and insurance costs will help reduce the level of risk for HSR development and encourage private sector participation in the development process. Without the federal government's involvement most private entities will be slow to participate in public-private partnerships due to the high risks to capital and possible escalation of insurance costs due to lawsuits.

   Almost all rail tracks in the US are owned by freight rail companies. States with HSR projects that want to build along those tracks or, in rare cases, use them, will have to negotiate with the freight rail companies directly. A law extending or defining the terms under which such negotiations should take place will be helpful to states entering into this process. The law creating Amtrak defined a framework of the track-sharing relationship between Amtrak and the freight companies. Federal legislation is needed to define the infrastructure sharing agreements between freight companies and HSR entities.

4. Support a demonstration project.

   Given the absence of HSR in the United States and the partisan nature in which the debate over HSR has evolved, the federal government should consider supporting a corridor as a demonstration project. This demonstration project should be along a highly trafficked route, be relatively inexpensive and have a short construction timeline.

   The Tampa-Orlando project in Florida that was shut down when the governor rejected and then returned ARRA funds would have been an ideal demonstration project. The HSR line was a good candidate as a demonstration project. The construction cost of $2.4 billion was covered by the allocated ARRA grant, and the location – in a highly visited tourist destination – promised the opportunity for a lot of US citizens to see and probably a ride on an HSR system. It was slated to be built along the median of Interstate-4 and therefore had few right-of-way acquisition hurdles.

   In fact if one closely looks at the way the HSR funds were disbursed, the initial $2.4 billion allocated to Florida may have been an astute strategic decision. By allocating such a large proportion of funds to one of the most feasible projects, a showpiece HSR project would have been completed in a highly visited tourist location, thereby exposing several million US citizens to the technology. With the Florida project cancelled and a large amount of the funding allocated to California's system, which will take a long time to complete, it appears the window of opportunity to build such a demonstration project is almost closed.

STATE ROLE

The high costs and long lead times needed to develop HSR projects mean that states wanting to begin new projects need careful planning and guidance. The lessons enumerated from the Florida experience and the California project (see Appendix A) are anecdotal but very instructive.

California started with a legislative mandate that specified the role of the California High-Speed Rail Authority, while Florida depended on a political champion and then followed up with the legislative mandate. Both have had rollercoaster rides trying to maintain support for their projects through changing administrations. Florida has had their project shut down and restarted at various turns, while, for California, the greater difficulty has been getting policymakers to fund CHSRA consistently. Both a political champion and a legally mandated entity are important, but given the experience of both states, it is critical the legislative body be established early on.

Acquiring right-of-way in the US is a more tenuous task than in Europe and Asia, as most of the land and tracks in the US are privately owned. The CHSRA is having a firsthand experience as it has had to negotiate with various freight providers and deal with several environmental issues with regard to land traversed by the project. States should seriously consider building their HSR lines within the median of existing freeways wherever the alignment will permit in order to minimize environmental impacts and also because the right-of-way within most of these medians already belongs to the state.

Most states have limited financial resources and, unlike the federal government, cannot run large deficits to fund project. Hence, states that want to significantly fund their projects need to put in place a plan to bring in private capital as early as possible.

States that decide to embark on HSR should make sure there is formal legislation is in place. Given the massive amount of investment involved, most HSR projects will need some form of political support. States must have a well-thought-out plan, and a dedicated individual (or body) that will work with the various legislative and political arms of government to build and sustain support for their projects through the development and construction phases.

FUTURE OF THE INDUSTRY

In addition to the policy measures recommended, a huge issue facing the nascent industry is the lack of HSR expertise in the US. This lack of expertise is noted in a recent GAO report in which potential train set manufacturers say it would take a minimum of two years to ramp up capacity to test and build train sets in the US.

The Mineta Transportation Institute, in collaboration with the California High-Speed Rail Authority, California State University, and several private and public agencies, has begun work on the issue. The federal government needs to quickly begin to focus on developing educational and training centers to build up capacity to develop the HSR workforce in the US.

APPENDIX A: WHITE PAPER ON CALIFORNIA HIGH-SPEED RAIL PROJECT

California voter's approval of a $9.95 billion State bond for California's high-speed rail (HSR) project in 2008 and the Obama Administration's decision to set aside $8 billion in the 2009 American Recovery and Reinvestment Act (ARRA) for HSR projects have propelled HSR into the forefront of discussions on how to meet the nation's future transportation needs.

Prior to the designation of the ARRA funds most state HSR initiatives had slowly ground to a halt. Other than the Northeast corridor *Acela Express* from Washington, DC to Boston, it began to look like California was the only state on track to build a high speed train system. This paper takes a look back at California's experience in keeping its project alive despite several challenges, and the hurdles the HSR authority had to surmount to keep the project alive. The lessons learned are instructive for other States pursuing high-speed rail initiatives.

INTRODUCTION

Even though the debate about whether high-speed rail (HSR) is right for the US will continue, the stance of the current administration is clear. From public statements by the president, his vice president (an avid train enthusiast), and the secretary of transportation, it is apparent the executive branch has made a decision to integrate HSR into the mix of transportation options for the US going forward.

This paper takes a look at the development of HSR projects in the United States, with a focus on California's experience to date. Prior to the designation of ARRA funds, most state HSR initiatives had slowly ground to a halt. Other than the Northeast Corridor Acela Express from Washington, DC to Boston, it began to look as if California was the only state on-track to build a high-speed train system. This paper takes a look back at California's experience in keeping its project alive despite several challenges, the current status of the project, and plans of the California High-Speed Rail Authority going forward. The lessons learned will serve as guide for other states pursuing high-speed rail initiatives.

US HIGH-SPEED RAIL PROJECTS

Before the passage of the ARRA the Government Accountability Office (GAO) in several reports noted the federal government's limited leadership role in promoting HSR projects in the United States in contrast to Europe and Asia. The United States continues to lag behind other nations in developing HSR networks. Europe has more than 5,000 miles of HSR lines, while Asia, with more than 6,000 miles already, plans to build more in the coming years.

GAO has consistently documented the need for the federal government to define a clear role of how high-speed rail fits into plans to meet the nation's transportation needs. In their 2009 report to congress, the GAO noted that although the $8 billion in ARRA funding was a step in the right direction, it is a relatively small down payment considering California alone is expecting $18 to $21 billion in federal support to build the Los Angeles-to-San Francisco line. In testimony supporting the report, the GAO representative noted that "High-speed rail projects are costly, risky, take years to develop and build, and require substantial up-front public investment as well as potentially long-term operating subsidies."[58]

Other challenges facing states are the reliability of ridership forecasts, determining and quantifying public benefits, sustaining public support over long construction periods, and obtaining stakeholder consensus. These are all issues that have plagued California's project at various stages. The GAO says there is a need for a dedicated funding source, leadership, clearly defined goals and a structural framework if HSR is to be implemented as a feasible transportation alternative in the United States.

In fairness, the federal government has made several attempts to investigate the feasibility of high-speed rail projects. As far back as 1965, Congress passed the High Speed Ground Transportation Act[59] authorizing $90 million to develop and demonstrate HSR technologies. Five years later, in 1970, President Nixon passed the Passenger Rail Service Act,[60] which created Amtrak to take over the intercity passenger rail service that freight rail companies found unprofitable.

According to the Federal Railroad Administration, it had spent up to $3.3 billion on improvements to the North East Corridor by 1997.[61] Amtrak, in collaboration with the Federal Railroad Administration, has been responsible for developing the Acela Express, the only functioning HSR project in the United States to date, on the Northeast Corridor. The Acela Express train sets are capable of attaining speeds of 150 miles per hour; however, they operate at top speeds of only 150 miles per hour between New York and Boston and 135 miles per hour between New York and Washington. Currently, the average operating speed between Washington, DC and Boston is approximately 83 miles per hour due to electrification- and track-related issues on the corridor.

Legislators have included high-speed rail in the Railway Safety Improvement Act (RISA),[62] and in 2010 the House Committee on Transportation and Infrastructure set aside $50 billion for high-speed rail in the Authorization Bill, but this did not pass.

The FRA designated 11 HSR corridors in the continental US. These corridors were selected as a result of stipulations included in the Surface Transportation Efficiency Acts. According to the FRA website, the first five HSR corridors were designated under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).[63] A list of the corridors designated under the ISTEA is provided in.

The Northeast Corridor, from Washington, DC to Boston, MA, was, until recently, technically not a federally designated corridor, as it is funded under a different legislative instrument, the Northeast Corridor Improvement Project.* In March 2011, US Transportation Secretary

* FRA financed the Northeast Corridor Improvement Project (NECIP) between FY 1976 and FY 1998 for a total cost of $3,937.3 million, including $12 million for the Penn Station Redevelopment project in FY 1998. Amtrak has invested in the corridor itself, though that figure is not readily available. Nevertheless, certain of Amtrak's appropriations have been directed specifically to Northeast Corridor expenses, including $7.9 million in FY 1976 and $293.1 million in FY 2003 (FRA Website).

Ray LaHood designated it an HSR corridor. The Secretary also extended the scope of the California corridor to Las Vegas, Nevada, in July 2009.

The FRA allocated the bulk of ARRA funds to six major corridors as shown in Table 7. However, several developments have changed the actual amount of funds disbursed and the recipients.

Table 6. White Paper: Federally Designated High-Speed Rail Corridors

First Batch - Five Initial High-Speed Rail Corridors	Chicago Hub Network	Initially designated on October 15, 1992 as the Midwest corridor, it consisted of three spokes emanating from Chicago, IL, westward to Milwaukee, WI, east to Detroit, MI, and south to St. Louis, MO. In December 1998, the Milwaukee link was extended to Minneapolis/St. Paul, MN and a new spoke to Indianapolis, IN and Cincinnati, OH was added. The Indianapolis/Cincinnati link has been extended through Ohio in a closed loop running from Cincinnati to Columbus, Cleveland, and Toledo and back to Chicago. The Indianapolis link has also been extended to Louisville, KY.
	Florida Corridor	Initially designated on October 16, 1992, runs from Miami in the south to Orlando and westward to Tampa.
	California Corridor	Also designated October 19, 1992. Runs mainly north-south along the state, linking the major metropolitan areas of San Diego, Los Angeles, the San Francisco Bay Area and Sacramento via the San Joaquin Valley. On July 2, 2009, US Transportation Secretary Ray LaHood announced extension of the California high-speed rail corridor to Las Vegas, Nevada.
	Southeast Corridor	Designated in October 2000 as a link between Charlotte NC, Richmond, VA, and Washington, DC. In December 1995, it was extended all the way to Macon, GA, passing through Greenville, SC, and Atlanta, GA. The Richmond link was also extended to Hampton Roads, VA. In December 1998, the Macon, GA, loop – passing through Jacksonville, FL, Savannah, GA, and Columbia, SC back to Raleigh, SC – was closed. The Southeast corridor in its final form in 1998 is better characterized as a network. The corridor now covers six states: Florida, Georgia, South and North Carolina, Virginia and Washington, DC.
	Pacific Northwest Corridor	Designated in October 1992. Links Eugene, OR, to Vancouver, BC, Canada, passing through Portland, OR, and Seattle, WA, on the way north. The corridor is 466 miles long.
Second Batch - Six Additional Corridors	Gulf Coast Corridor	Designated November 18, 1998. Another of the multi-state corridors, it traverses six states: Texas, Louisiana, Mississippi, Alabama, Georgia and New Orleans. There are three legs originating from New Orleans, LA. The westward leg goes to Houston, TX, the eastbound leg to Mobile, AL, with an intermediate stop in Biloxi, MS, and a third leg runs northeast to Atlanta, with major stations in Meridian, MS, and Birmingham, AL.
	Keystone Corridor	Designated in December 1998. A planned, multi-state corridor with the west/east link from Pittsburg, PA through Harrisburg to Philadelphia. The north/south link starts in Washington, DC, and runs through Baltimore, MD, Wilmington, DE, Philadelphia, PA, Trenton and Newark, NJ, and ends in New York.
	Empire State Corridor	Designated in December 1998. Planned to run from west to east end of New York State, Buffalo to New York City, with stops in Rochester, Syracuse, Utica and Albany.
	Northern New England Corridor	Set up to connect Boston to various states in the Northwest. Boston, MA, is the center, with connections to Portland/Auburn, VT, and Montreal, PQ Canada, Albany, CT and New Haven, CT.
	South Central Corridor	Designated in 2000, it is another of the multi-state corridors. The Texas link is from San Antonio, TX, in the south, to Dallas-Ft. Worth in the north. Dallas Ft.-Worth is then linked to Tulsa, OK and Little Rock, AK.
	North-East Corridor	In March 2012, the Transportation Secretary officially designated the existing Northeast Corridor, from Washington, DC, to Boston, MA, a high-speed rail corridor.

Table 7. White Paper: Initial Funding for US High-Speed Rail Corridors

No.	Corridor Name	ARRA Funds ($ millions)	Miles of Track				$/ Project Track Mile	Speed (mph)	States	Extent	ARRA Awardees	Benefiting States	Main Stations
			Total	New	Upgraded	Planned							
1	Pacific Northwest	598	467		437	30	1.37	150	2	Multi-state		Oregon, Washington, Vancouver, B.C.	Eugene - Portland - Seattle - Vancouver, B.C.
2	Southeast	620	480		480		1.29	110	4	Multi-state	North Carolina DOT, Virginia DOT	North Carolina, Virginia, Washington, D.C.	Charlotte - Raleigh - Richmond - Washington, D.C.
3	Florida	1,250	324	84	240		3.86	168	1	Single	Florida DOT	Florida	Tampa - Orlando
4	California	2,344	1,955	800	880	275	1.40	220	1	Single		California	San Diego - Los Angeles - San Francisco Bay Area - Sacramento
5	Chicago Hub Network	2,200	1,321	32	1,014	275	2.10	110	8	Multi-state	Multiple States	Multiple States	
6	Empire State	485	2,353	84	1,542	727	0.30		1	Single	Multiple States	Multiple States	Multiple Stations
7	Northeast	706	0						6	Multi-state			
8	Keystone		0						1	Single			
9	Northern New England		0						3	Multi-state			
10	South Central		0						3	Multi-state			
11	Gulf Coast		0						4	Multi-state			
	TOTAL	**8,203**	**6,900**	**1,000**	**4,593**	**1,307**		**152**	**34**				
Chicago Hub Network		400	250		250		1.60	79		Multi-state	Ohio DOT	Ohio	Cleveland - Columbus - Dayton - Cincinnati
		244	300		300		0.81	110		Multi-state	Michigan DOT, Indiana DOT, Illinois DOT	Michigan, Indiana, Illinois	Pontiac - Detroit - Chicago
		1,133	570		570		1.99	110	5	Multi-state	Illinois DOT, Missouri DOT	Illinois, Missouri, Kansas	Chicago - St. Louis - Kansas City
		823	451	32	144	275	1.82	110		Multi-state	Wisconsin DOT, Minnesota DOT	Minnesota, Wisconsin, Illinois	Minneapolis/St. Paul - Madison - Milwaukee - Chicago

Three state governors – of Florida, Ohio and Wisconsin – returned their ARRA funding as a politically motivated protest of government spending. Due to their actions, the secretary of transportation reallocated the funds to other projects. To date, only $5.8 billion dollars of ARRA funds have been obligated. Table 8 lists both ARRA and other federal rail-related funds (that can be used for high-speed-rail-related projects) that have been allocated to states at the beginning of July 2011. The data was compiled from information on the FRA website.

CALIFORNIA HIGH-SPEED RAIL CASE STUDY

Comparing Table 7 and Table 8, California is now set to receive over $3 billion in federal funding; not counting the remaining $5 billion in ARRA funds left to be disbursed. This puts them in line to be one of the first fully dedicated HSR projects likely to be completed in the United States.

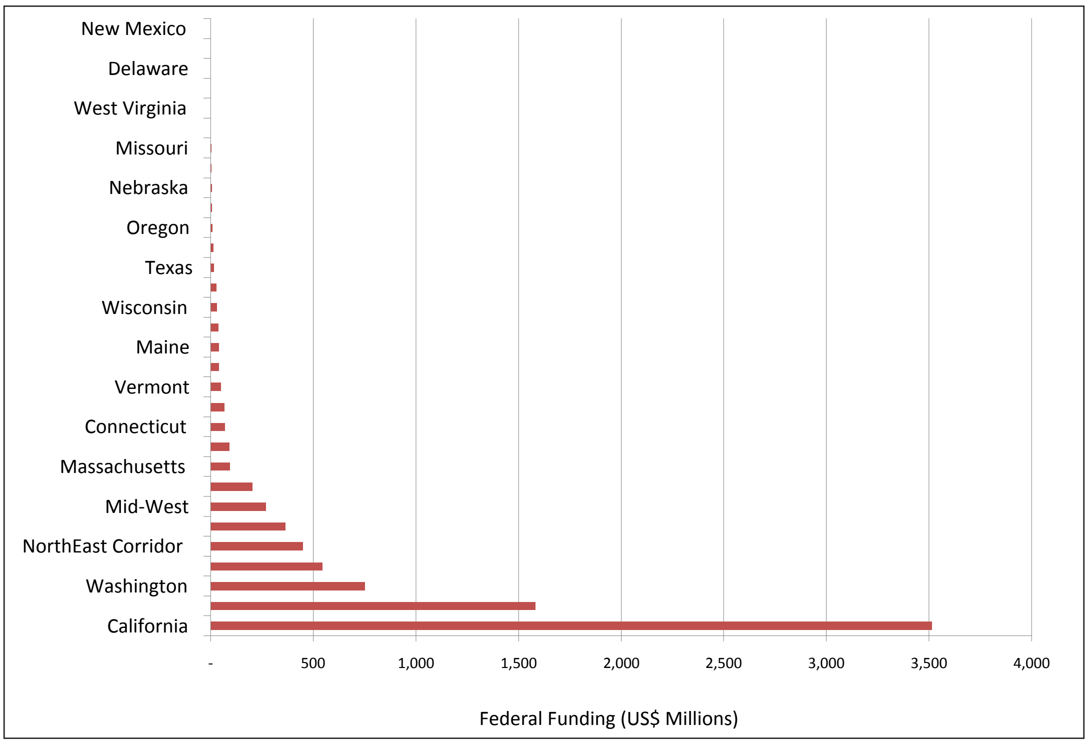

Figure 7. White Paper: Breakdown of Federal HSR Funding by State HSR Projects in 2010

The California High-Speed Rail Authority (CAHSRA) is responsible for construction of California's high-speed rail project. CHSRA came to life under the California High-Speed Rail Act (SB 1420)[64] sponsored by Senators Kopp and Costa in 1996. Prior to that, the state's high-speed rail ambitions had been nurtured by the Intercity High-Speed Rail Commission created in 1993. SB 1420 gave CHSRA the legislative mandate to implement intercity high-speed rail in the state. The Authority was to be composed of nine members, with five appointees by the governor, two by the Senate Committee on Rules and two by the Speaker of the Assembly. A lively documentation of the development of the California high-speed rail project is chronicled at the University of California, Davis website.[65]

Table 8. White Paper: Disbursement of ARRA and High-Speed Rail Funds in 2009/10

State	Description	ARRA	FY09	FY10 Planning	FY10 SDP	Grand Total
CA	California High-Speed Rail + Other State Projects	2,908,371,742	6,400,000		116,000,000	3,030,771,742
IL	Chicago to St. Louis: 2010 Early Construction Projects, Englewood Flyover	1,268,310,998	1,250,000			1,269,560,998
WA	Pacific Northwest Corridor: Service Block 2-SEA-PDX 6 RTs- ARRA Redistributed	735,458,912				735,458,912
NC	Piedmont/Charlotte/Raleigh	520,000,000			22,000,000	542,000,000
MD	BWI Airport Station Improvements	69,400,000				69,400,000
FL	Tampa to Orlando: Program Management and Preliminary Engineering	66,660,000				66,660,000
VT	Vermonter New England Central Railroad Route Improvements	50,000,000	500,000			50,500,000
CT	New Haven to Hartford to Springfield Corridor	40,000,000				40,000,000
ME	Several projects	38,385,495		600,000		38,985,495
NJ	Portal Bridge	38,500,000				38,500,000
WI	Milwaukee to Madison Corridor	30,000,000				30,000,000
NY	Empire Corridor + Rochester Station	5,545,733	1,000,000			6,545,733
OR	Pacific Northwest Corridor: Union Station Roof	5,900,000				5,900,000
DC	Union Station Access Improvements		4,270,500			4,270,500
MO	Missouri State Rail Plan + additional projects	3,338,800		500,000		3,838,800
MI	Chicago to Detroit	3,620,552				3,620,552
CO	Colorado State Rail Plan + Denver Interregional Study		1,400,000			1,400,000
WV	West Virginia HSIPR Planning		1,000,000			1,000,000
GA	Various Studies		750,000			750,000
PA	Keystone Corridor: Keystone West		750,000			750,000
DE	Delaware Intercity Rail Connection		450,000			450,000
KS	Kansas Service Development Plan (SDP)		250,000			250,000
NM	New Mexico State Rail Plan		100,000			100,000
Grand Total		**5,783,492,232**	**8,120,500**	**1,100,000**	**38,000,000**	**5,940,712,732**

Note: FYO9 Fiscal Year 2009.
FY10 Fiscal Year 2010.
FY10 SPD Fiscal Year 2010 Service Development Program.

SB 1420 allowed for CHSRA to be terminated at the end of December 2000 if a financial plan for the implementation of HSR had not been approved by state voters. As stipulated by the legislation, CHSRA presented its business plan in June 2000.[66] The plan placed the cost of constructing a high-speed rail line linking San Diego to the San Francisco Bay Area and Sacramento at a cost of $25 billion (1999 dollars). Some of the issues the plan addressed are:

- **Train systems:** it deferred selection of train technology to the environmental impact report and environmental impact statements (EIR/EIS) but it did recommend a system capable of attaining speeds of 200 miles per hour, driven by electric propulsion, and grade separated, with state of the art signaling technology.

- **Route/alignment:** it recommended a preliminary highest return on investment but deferred actual selection of the final route to the EIR/EIS study. The route was from San Diego, through Ontario Airport, Los Angeles and then San Francisco via the Peninsula, with a separate leg from Merced to Sacramento.

- **Ridership:** ridership was forecast at 32 million passengers annually, of which 12.2 million would be business travelers. The majority of the trips – 11.2 million – were projected to be from the Los Angeles region to the San Francisco Bay Area. The analysis assumed 45 percent of the ridership would be diverted from air transportation and 42 percent from private automobiles.

- **Revenue:** was projected at $888 million based on the expected ridership, with $465 million of this coming from business travelers.

- **Benefits:** a benefit/cost analysis put the ratio at 2.06. This was based on benefits of $44.4 billion and costs of $21.5 billion.

The plan recommended that the governor and legislature take steps to initiate a formal Environmental Impact Report (EIR) and an Environmental Impact Statement (EIS), make funding available to improve access rail to the potential high-speed rail network, and step up advocacy at the federal level for funding for high speed trains in California. It also asked legislators to encourage state, regional and local entities to include high-speed trains in their planning.

In response to the 2000 business plan recommendations, the California legislature passed bills to fund both the high-speed rail project and the environmental impact studies for the project. The Safe, Reliable High-Speed Passenger Train Bond Act (Senate Bill 1856[67]) was promulgated in 2002 to raise funds for construction of the HSR by issuing $9.95 billion in general bonds in California. The act required that $9 billion be used in conjunction with federal funds for planning and construction of the high-speed train system. The $950 million was to be used to improve rail access to the high-speed train system, as recommended by the business plan. The legislature also provided $20 million in 2004 for CHSRA and the FRA to conduct a programmatic level EIR/EIS study.

Though Governor Gray Davis signed SB 1856 into law in 2002 for voters to ratify in the November 2, 2004, general election, the vote did not take place until 2008 in the form of Assembly Bill 3034. SB 1856 was first delayed by Senate Bill 1169 that postponed the vote to November 7, 2006, because of California's fiscal situation. Then in June 2006, the vote was again moved – to the November 4, 2008, general election – and modified to Assembly Bill 713. Finally, in 2008, AB 3034 modified some of the provisions in the original SB 1856 legislation, and voters passed it in the November 4, 2008 election.

Among others, AB 3034 stipulated:

- The high-speed train system was to be built to specifications of the EIR/EIS reports (certified November 2005 and July 2008) rather than the business plan.

- Excess revenues generated from operation of the high-speed train system (beyond operating and maintenance costs and financing obligations) were to be used for construction, expansion, improvement, replacement and rehabilitation of the system. If excess revenues exceeded the amount needed to maintain the system they, were to be deposited in the General Fund.

- The amount of the $9 billion bond that could be used for planning and environmental studies was limited to 10 percent ($900 million), and the amount that could be spent on administrative expenses to 2.5 percent.

- Priority was to be given to corridors expected to require the least amount of bond funds as a percentage of total cost of construction when selecting corridors for construction.

- The high-speed rail project was to be built as quickly as possible in order to maximize ridership and mobility of Californians.

- The ballot measure was renamed to Proposition 1A as it is widely referred to in the media.

Proposition 1A was put to the ballot on November 4, 2008, and passed with a majority vote of 52.6 percent (6.5 million of 12.4 million votes). A revised business plan in 2008 increased the cost of the Los Angeles-to-San Francisco line to $33 billion (2008 dollars). The 2009 Report to the legislature updated the cost to $35.7 billion 2009 dollars, with a Year-of-Expenditure cost of $42.6 billion. In the current 2012 Updated Draft business plan, the cost of Phase 1 alone of the project is in the range of $68 billion.

The aim of California's HSR project is to link the major San Francisco Bay Area cities to the Central Valley and Southern California (Los Angeles/San Diego). The three major population centers in the Bay Area are San Francisco, San Jose and Oakland. Until the completion of the EIR/EIS in 2007, two major alignments – the 'Pacheco Pass' and the 'Altamont Pass' – had been hotly advocated for by different parties to connect the Bay Area to the Central Valley.

After extensive analysis of the two major alternatives (6 alignments on the Pacheco Pass and 11 alignments on the Altamont Pass), the 2007 EIR/EIS recommended the Pacheco Pass to San Francisco (via San Jose) for the proposed HSR system. The CHSRA board accepted the recommendation and the EIR/EIS (completed in 2007 and certified in 2008) selected this alternative and put an end to the debate, at least for CHSRA. At this point, it seemed as if the California high-speed rail project was about to take off smoothly. However, in recent times the project has been challenged on several fronts.

Challenges

Community Opposition: Cities along the Peninsula, from San Francisco to San Jose perceive the train tracks will split their communities and negatively impact their property values. CHSRA staff says they are conducting additional outreach to better explain need and impacts of the project to affected communities. The City of Orange on July 28, 2010, voted on a resolution to oppose the project based on worries CHSRA might use 'eminent domain' legislation to acquire land for the project. CHSRA in response issued a public statement voicing disappointment in the city's unwillingness to work with them on the project. The statement said CHSRA will continue to reach out to residents of Orange County.

Legal Challenges: Other groups have taken CHSRA to court over the EIR/EIS. Based on the court ruling, CHSRA rescinded the Merced-to-San Francisco section of the EIR in order to re-evaluate the corridor between San Jose and Gilroy where Union Pacific stated that it did not want to allow the HSR line to use their right-of-way. Also, general review of noise and vibration data is being undertaken for specific locations based on the court ruling. On a positive note the judge didn't allow a restraining order on the project (the Merced to San Francisco Program Environmental Review was recertified identifying the same preferred corridor on September 3, 2010). Though there are still threats of legal action, the attorney general's office has promised to defend the project.

Ridership Estimates: The University of California completed a review of the California HSR project ridership forecasts for the California Senate Transportation and Housing Committee.[68] The University had strong objections about how CHSRA's consultant, Cambridge Systematics, developed the ridership estimates. Some of the issues the University of California team had, included the fact that the survey to calibrate the model had a disproportionately high number of air travelers (78 percent), neglecting the nearly 90 percent of long-distance (over 100-mile) business passenger trips that are made by car in California. They also questioned the way the "stated preference" survey results were analyzed when developing forecasts. UC felt the process used did not take into account the fact that travelers using different modes have different perceptions of values of travel time, cost, service frequency, and service reliability. They disagreed with the CS approach of adjusting modeling constants to replicate observed market shares for the existing travel modes in the year 2000 to correct the issue.

They questioned the CS changes of key parameters, such as headways after the model development phase, using *a priori* expectations, and they also did not like the fact that the model did not have station choices for high-speed rail stations. They felt this exaggerated the importance of the Pacheco. It was their contention that if their recommended corrections were implemented, the ridership difference between the Pacheco and Altamont alignments would be minimal.

Cambridge Systematics provided a spirited response to each of the comments, pointing out that, in practice, adjustments need to be made to some of the theoretical constructs in order to arrive at credible results. In conclusion, the review team felt the issues they identified could significantly affect the ridership estimates, and reduce the projected profits, leading to the possibility of significant revenue shortfalls. The CHSRA strongly disagreed and pointed out that the report had not provided any analysis or estimates to prove this. Given that this was a review, the review team would usually not conduct additional analyses, so the question about the validity of estimates remains unanswered.

Project Funding and Administration: The state auditor also released a report in April 2010 raising concerns about the ability of the Authority to raise funds for the project, especially the level of federal and private funding. CHSRA maintains the project plan has always anticipated some level of federal funding and is working with the state auditor to address some of the issues raised. The auditor report was followed a year later by the State Legislative Analyst Office[69] report that raised concerns about the level of autonomy granted the CHSRA and its ability to manage such a large multibillion-dollar project. The report recommended dissolving the existing CHSRA board and bringing the project under Caltrans so it could benefit from Caltrans' expertise in managing large transportation infrastructure projects. The same report was quick to admit that Caltrans has no expertise in HSR and Caltrans also may not have had experience managing such a large project multibillion dollar project.

The above are a few of the challenges CHSRA has faced while trying to get the actual project construction started.

Large infrastructure projects like HSR will negatively impact some communities and the environment. Opposition to such projects from those impacted is not uncommon. CHSRA admits to initially doing a lackluster job with outreach. They had multiple outreach firms that sometimes delivered conflicting messages. The program has now been brought under a single consultant, and, according to the Authority, this has brought more consistency and uniformity to their message.

SUCCESSFUL STRATEGIES

Until recently CHSRA has mainly been a planning, policy and advocacy team for HSR that has relied heavily on consultants to do most of any technical work. The small structure provided great flexibility in coordinating activities and decision making. The fact that appointments to the CHSRA board are made collectively by the governor, state Senate and state Assembly enables each of the appointees to reach and communicate with the political and legislative arms of government. The small size of CHSRA allowed the body to keep working when budget was low in certain years. More importantly, the small size of the organization meant critical decisions could be made quickly on short notice with minimum bureaucracy.

Based on discussion with CHSRA board members and staff, some of the key factors that have helped them push the project so far include:

- A strategic decision was made early on to put in place formal legislation at the state level. This gave the HRS credibility and stability.
- The decision to operate as a separate entity was intentional, as there was apprehension an agency like Caltrans, which is predominantly focused on highways, would not devote as much attention to a mode like HSR that did not even exist in the US. There are still discussions about bringing the Authority under Caltrans.
- Having board members appointed by various arms of government has provided great leverage when there has been the need for advocacy.
- The board kept studies moving along even in years when funding was low. This put them in a very strong position when opportunities like the ARRA funding came along.
- Over the years, a strong stakeholder-support community has been developed. The board engages with groups like the California HSR Coalition and the Sierra Club so they can tap into support from their constituents if needed.

CHSRA is working feverishly to meet Notice of Determination and Record of Decision deadlines (by September 2011) stipulated conditions to receive the $2.34 billion from the ARRA stimulus package. A contract for construction has to be in place by September 2012 as part of the requirements to obligate federal funds.

CONCLUSION

CHSRA hired a new chief executive officer in June 2010 and has begun hiring and expanding its staff in preparation for project construction. When the initial ARRA funds were allocated, it appeared that Florida was in the lead to complete the first HSR project in the US, but with the rejection of their funds, California may be the first to complete a project in the US.

The HSR scene in the US continues to be in flux. The current administration still supports the program, but those in opposition have also made gains, as evidenced by the decision of three states to return their funding. The recent accidents on China's HSR lines will also taint HSR's reputation as one of the safest modes of travel.

The review has shown building HSR will be very challenging. Even with funding in place, relationships with politicians, stakeholders and affected communities need to be managed carefully, otherwise projects could be suddenly delayed or derailed.

Other states embarking on the HSR development path can take a few lessons from CHSRA's experiences:

- Legislative Support is important: Once political support has been secured it should be quickly solidified with some form of written legislation at the state level, as political climates change frequently.

- Work hard to maintain support from all the branches of government, especially the legislature and executive. Any support gained must be continuously nurtured. Even with a legislative mandate and a shovel-ready project with almost 80 percent of federal funds, the Florida Orlando-to-Tampa project was still killed by a change in leadership that was opposed to the project.

- Continuously work to keep project studies going even when funding is low or prospects appear dim. In this sense, the approach adopted by California to have an authority made up of five members provided a low-cost body to manage the early stages of the project.

- It is also crucial to build support with stakeholders in the community, as they are indispensable advocates in generating support from the public.

- Lastly, large-scale projects like HSR will always negatively impact some members of the community and the environment. Mitigating and managing the impacts on affected communities and the environment is not a trivial task. Next to political leaders, impacted communities can be one of most likely agents to derail a project. The ‘outreach’ to these communities needs to be managed carefully, and transparency is needed to gain the trust of those affected.

HSR has several benefits, but given the costs, careful planning, credible evaluation of the project and experienced managers are needed to handle such huge multibillion-dollar investments that involve substantial amounts of taxpayers’ money.

ABBREVIATIONS AND ACRONYMS

ARRA	American Recovery and Reinvestment Act
CHSRA	California High-Speed Rail Authority
DOT	Department of Transportation
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
HSR	High-Speed Rail
ISTEA	Intermodal Surface Transportation Efficiency Act

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