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High-Speed Rail Projects in the United States: Identifying the Elements of Success Part 2

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November 2006

Allison L. C. de Cerreño, Ph.D.
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16. Abstract

In August 2005, the Mineta Transportation Institute issued the report, *High-Speed Rail Projects in the United States: Identifying the Elements for Success*. The report noted that since the 1960s, high-speed ground transportation (HSGT) has "held the promise of fast, convenient, and environmentally sound travel for distances between 40 and 600 miles." After briefly discussing the different experiences with HSGT between the United States and its Asian and European counterparts, the report proceeded to review three U.S. cases—Florida, California, and the Pacific Northwest—as a means for identifying lessons learned for successfully implementing high-speed rail (HSR) in the United States.

This report is, in essence, volume 2 of the previous study. Also using a comparative case study approach, this effort adds to the earlier work with three additional cases—the Chicago Hub, the Keystone Corridor, and the Northeast Corridor (NEC). As with the earlier report, the goal of this study is to identify lessons learned for successfully implementing HSR in the United States. Given the early stages of most of these projects, "success" is defined by whether a given HSR project is still actively pursuing development or funding. However, in the case of the Northeast Corridor, a fuller discussion of success is provided since HSR has been implemented on that corridor for some time now.

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EXECUTIVE SUMMARY

In August 2005, the Mineta Transportation Institute issued the report, *High-Speed Rail Projects in the United States: Identifying the Elements for Success*. The report noted that since the 1960s, high-speed ground transportation (HSGT) has "held the promise of fast, convenient, and environmentally sound travel for distances between 40 and 600 miles."[1] After briefly discussing the different experiences with HSGT between the United States and its Asian and European counterparts, the report proceeded to review three U.S. cases—Florida, California, and the Pacific Northwest—as a means for identifying lessons learned for successfully implementing high-speed rail (HSR) in the United States.

This report is, in essence, volume 2 of the previous study. Like the first study, this report also used a comparative case study approach based on an extensive literature review as well as interviews with primary and secondary sources. Sources in the literature review were drawn from historical, governmental, and legal documents, as well as business plans, feasibility studies, and related media articles.

This effort adds to the earlier work with three additional cases—the Chicago Hub consisting of eight lines in eight states; the Keystone Corridor between Philadelphia and Harrisburg, Pennsylvania; and the Northeast Corridor (NEC) mainline between Washington DC and Boston. As with the earlier report, the goal of this study is to identify lessons learned for successfully implementing HSR in the United States. Given the early stages of most of these projects, "success" is defined by whether a given HSR project is still actively pursuing development or funding. However, in the case of the Northeast Corridor, a fuller discussion of success is provided since HSR has been implemented on that corridor for some time now.

Some of the key findings and lessons learned from the previous study are bolstered by these three cases. Furthermore, this study provides several additional themes for consideration, the following in particular:

1. The Keystone Corridor and Northeast Corridor experiences call into question whether they can be replicated in areas where Amtrak (National Railroad Passenger Corporation) does not own the line.
2. The cases in the report help highlight the tension between needing to keep costs low and finding the needed funds so that goals can be met.

3. Finally, together with the examples from the first study, the cases in this study suggest that an important discussion needs to occur about whether efforts aimed at incremental HSR (that is, rail that uses existing technologies and rights-of-way [ROW], but undergoes improvements to allow for speeds up to 150 mph) are more likely to meet with success in the current political climate than are those aimed at new HSR (rail requiring new ROW and technologies imported from Europe or Asia that typically allow for speeds in excess of 200 mph). The answer to this question could change the course of both policies and funding aimed at instituting HSR in the United States.

KEY FINDINGS AND LESSONS LEARNED

While each case summary provides a discussion of key findings and lessons specific to that corridor, the cases presented in this report, along with those of the first report, provide several broader findings and lessons. This section highlights these findings, along with lessons that will prove important for HSR initiatives around the country.

Leadership, Means, and Authority

Leadership coupled with means and authority are required to implement change. HSR projects are expensive, take many years to complete, and require coordination among and between a number of key actors and stakeholders. The case studies of this report and its predecessor, which included California, Florida, and the Pacific Northwest, suggest that a key criterion for successful implementation of HSR is the combined presence of leadership and the means and authority to implement change.

In the Keystone Corridor, this set of factors has been the most important in contributing to its current success. In earlier attempts at HSR in Pennsylvania, leadership was in place, but authority was clearly lacking; in the most recent attempt, the leadership, the means, and the authority to implement change were all present. Looking to Florida, again, leadership has been present, but the means and authority to implement change have been lacking. Interestingly, in the case of the Pacific Northwest, the means and authority appear to be present, but leadership is lacking. Finally, the NEC has demonstrated both situations, with leadership, means, and authority all present in its earliest years (though as will be seen, there were still some serious challenges), but a lack of leadership in more recent years.

Given the need for the combination of these three factors to be present for successful HSR outcomes, the Chicago Hub faces several obstacles. First, despite the support of several

state legislators and state department of transportation (DOT) officials, as a whole, the Hub has lacked strong and consistent leadership. Second, funding for the Hub has not been secured (though two small segments have funding for certain improvements). Third, no formal authority or structural process that would make HSR-specific improvements has been identified. The end result is that while some coordination exists, specific roles and responsibilities are unclear, and overall, the states and other stakeholders are not moving in concert with each other to implement HSR.

Who Should Play These Roles?

The actors providing the leadership, the means, and the authority to implement change may vary according to specific circumstances and factors. On the NEC, the federal government and Amtrak played the central roles, while on the Keystone Corridor, the Commonwealth of Pennsylvania; the Pennsylvania Department of Transportation (PennDOT); and Amtrak, under the leadership of David Gunn, played these critical roles. In both cases, Amtrak could provide authority since it owned the lines, or in the case of the NEC, most of the line. On the Keystone Corridor, because the costs associated with the modifications were not extensive, the state government and Amtrak could include them in their annual budgets, thus providing the means and avoiding the need for political campaigns to build support.

On the NEC, the costs were more significant as were the challenges faced by multiple owners, multiple states, and many more operators. Thus, the involvement of the federal government was more important. On the Chicago Hub, progress has been piecemeal, with only two relatively small segments progressing forward at this point—one between Dwight, Illinois, and Springfield, Illinois, and the other between Kalamazoo, Michigan, and the Indiana State Line—for a combined 198 miles of the total 2,313 miles. In the former case, Illinois has provided the leadership, while the authority and the means have been derived not only from the state but also from Union Pacific, which owned the segment, and the Federal Railroad Administration (FRA). In the latter case, Michigan and Amtrak (who owns the segment in this case) provided the leadership and the authority, with the means provided by these entities as well as by the FRA and private industry. However, in the absence of either a serious regional authority or equal commitment by each of the states involved, successful implementation of HSR across the full Chicago Hub will likely necessitate a strong federal role akin to what was seen on the NEC.

Need for a Federal Vision

The Keystone Corridor demonstrates the potential for HSR improvements without major federal support. Nevertheless, given the experience on the Northeast Corridor and the overall lack of progress on HSR in the United States over the past four decades, there is good reason to believe that a federal vision for HSR is needed along with a national network strategy for rail that combines passenger, freight, non-HSR intercity, and HSR rail, and addresses how each also links to nonrail modes of transportation. Along with this, federal funding is also important, especially for the larger and multistate projects. Indeed, as the experience of the NEC demonstrates, without the public funding provided by the federal government, even the successes that have been realized would not have occurred.

Reiterating the findings in the first study, without a broad vision, or at least guidance and standards, states will continue to fill the void with multiple types of models—constitutional amendments and legislation (like Florida and California), multistate compacts (like the Chicago Hub), public-private partnerships (like what was envisioned during the 1980s in Pennsylvania)—without a sense of what is most likely to succeed. Worse, without a national network strategy for rail, the United States will continue to miss opportunities to improve its overall transportation system for passengers and freight.

Clear Identification of Goals and Benefits

The goals for any major capital investment project are rarely unidimensional. However, in the case of HSR, the goals are not only multidimensional but also sometimes conflicting. While some focus on the need for the highest speeds, others argue that accessibility, frequency, and on-time performance are more important (basically, more efficient and reliable intercity rail). These different goals lead to very different markets, technologies, funding sources, and overall outcomes, with those focusing on speeds proposing new HSR and those focusing on other attributes looking toward incremental HSR.

Developing clear and consistent goals around which to build a consensus is important for successful outcomes in HSR. On the Keystone Corridor, the unsuccessful effort in the 1980s that resulted in a recommendation for magnetic levitation (Maglev) had multiple goals—economic development, higher rail share of travel, travel-time savings—with no clear prioritization among them. Indeed, a substantial minority of those involved in the effort did not fully support the final recommendation, believing that lower cost alternatives should be considered. In contrast, the most recent effort on the Keystone

Corridor stressed two much more straightforward goals—bringing the line up to a state of good repair and improving trip times.

Equally important, all the key stakeholders (in this case, operators) along the Keystone Corridor see some benefit accruing from the goals and related projects entailed in the current effort. Amtrak will increase and enhance its service, with corresponding ridership and revenue increases. PennDOT will be able to fulfill several objectives related to its broader transportation goals for the corridor. Southeastern Pennsylvania Transportation Authority (SEPTA) will benefit from increased capacity and infrastructure improvements. Finally, Norfolk Southern Corporation will benefit from being able to use heavier cars over the bridges, and from increased efficiency in operations resulting from the track, communications, and signal improvements.

The NEC's experience has been somewhat mixed in terms of goals and benefits. The earliest goals were identified in terms of reducing trip times, but they were negotiated based on political need rather than objective criteria or analysis, and whether they were fully agreed upon by all the stakeholders involved is not clear. In terms of benefits, as early as 1978, the Federal Railroad Administration and Amtrak came under criticism for not addressing the concerns and needs of the various stakeholders along the corridor, notably the commuter and freight railroad operators. Under the later electrification project on the north-end of the corridor, similar concerns were raised as well as additional concerns by other nonoperating stakeholders along the NEC, and as was seen, finding operational support and funding for those improvements that do not clearly benefit certain stakeholders has proven difficult.

To date, the overarching goals of the Midwestern states are to increase connectivity, reduce trip times between major Midwestern cities, and provide multimodal connections to improve system access. These goals have meant that the Midwestern states have moved toward a more regional framework to plan for HSR, which, critics point out, has meant inclusion of corridors that have little potential to attract ridership, and an estimated project cost that, in light of limited funding, is almost impossible to finance. Further, the matrix of benefits in the Chicago Hub remains very much unclear. For the Chicago Hub to have any opportunity for success, it is critical that the private railroad companies that own the majority of the ROW, Metra (the commuter rail), and the environmental groups be included in the planning process so they can work together to develop and prioritize goals and identify benefits.

THEMES FOR CONSIDERATION

In addition to the findings and lessons learned, some important themes for consideration bear mentioning.

Private ROW Ownership and Success

Can the NEC and the Keystone Corridor be replicated without ownership of the ROW by a single passenger rail entity?

On both the NEC and the Keystone Corridor, ownership of the ROW by Amtrak proved critical. Ownership of the ROW allowed Amtrak the authority to more easily deal with capital investment decisions, signaling, dispatching, power distribution, and maintenance decisions to implement HSR. It also reduced costs since there was no need to purchase new ROW and, in the case of the Keystone Corridor Improvement Program (KCIP), allowed the avoidance of certain environmental requirements because most of the improvements occurred in the current ROW and did not reflect a new service in themselves.

In contrast, except for one relatively small segment, the Chicago Hub is not owned by Amtrak, and unlike the NEC on which the other owners were public entities, the Chicago Hub's spokes are primarily owned by various private railroad companies. The result is similar to what is seen on the western portion of the Keystone Corridor, between Harrisburg and Pittsburgh—there is no clear authority for implementing HSR, and the costs to do so will be much more significant since in many cases separate tracks will be required for passenger trains operating at higher speeds. In fact, the only section of the Chicago Hub that has been upgraded in speed in recent years (95 mph) is the Amtrak-owned segment from just outside of Chicago to Kalamazoo.

The Cost of Keeping Costs Lower

Keeping costs lower helps, but there are costs to "doing it on the cheap."

Among the key findings on the Keystone Corridor was that because the costs to implement change in the most recent effort were reasonable, they were more easily accepted and achieved. This was also seen on the two segments of the Chicago Hub where track improvements have been made to eventually allow for 110 mph service; associated costs were relatively low and could be budgeted within an already existing program. However, as the experience on the NEC demonstrates, trying to reduce costs too much can lead to

the situation where the goals are left unmet. From the earliest years of the Northeast Corridor Improvement Project (NECIP) through the later electrification project on the north-end, there was a reluctance to commit the necessary funding to fully complete the project. The end result of this lack of commitment was difficulty in meeting many of the goals that were set. Worse, without the necessary funding, the plans had to be redrawn and revised numerous times, leading to delayed implementation and higher costs in the long term. Finally, making decisions based on the trip-time savings and costs of each project individually ignored the possibility of reaping greater savings by combining the projects.

Moving Beyond U.S. Reluctance

Is the United States ready for new HSR?

The first study suggested that there were opportunities for both incremental and new HSR in the United States, noting a 1997 Federal Railroad Administration study that concluded that high-speed ground transportation (including HSR and Maglev) could develop appreciable ridership.[2] A number of experts have suggested in recent months that with concerns rising over fuel prices and the damage cause by greenhouse gases, people may be more willing and likely to turn to rail for travel. However, in the United States to date, the only two cases that even come close to having HSR implemented are the NEC and the Keystone Corridor. Many other efforts around the country—notably Florida and Texas, which were pursued for decades—have failed to move past the planning and initial engineering phases.

Should the focus be on incremental HSR?

Perhaps the most resounding theme for consideration is that in the United States, incremental HSR may have the best chance for success. This is not to say that all incremental HSR solutions will be successful. The Ohio and Chicago Hubs have been pursued for many years without approaching implementation beyond the upgrades to the tracks on the two small segments noted earlier. Nor is this to say that incremental HSR is the preferred approach. Indeed, while the NEC is successful in some ways, it also clearly demonstrates the difficulties in attempting true HSR operations on a ROW, that is also heavily used by commuter and freight rail.

Nevertheless, this is a point worth serious consideration, given the costs of new HSR; current political apathy (and in some cases outright antipathy) surrounding rail more broadly and new HSR more specifically; the perceived risks associated with "unproven"

HSR technologies in the United States; and the fact that the few places where success has occurred (even if modest in many respects) have implemented incremental HSR. While incremental rail may be viewed by some as "settling" for the second-best choice, without stronger and consistent financial and political commitment on both the part of the federal government and the states, it may be the only means for having any HSR in the United States for some time.

INTRODUCTION

In August 2005, the Mineta Transportation Institute issued the report, *High-Speed Rail Projects in the United States: Identifying the Elements for Success*. The report noted that since the 1960s, high-speed ground transportation (HSGT) has "held the promise of fast, convenient, and environmentally sound travel for distances between 40 and 600 miles."[3] After briefly discussing the difference in experiences with HSGT between the United States and its Asian and European counterparts, the report proceeded to review three U.S. cases—Florida, California, and the Pacific Northwest—as a means for identifying lessons learned for successfully implementing high-speed rail (HSR) in the United States.

This report follows and adds to the earlier study, also using a comparative case study approach, with three additional cases—the Chicago Hub, the Keystone Corridor, and the Northeast Corridor. While some of the lessons learned and themes for consideration from the previous study are bolstered by these three cases, additional lessons are more apparent, particularly as one looks to the two cases—the Keystone Corridor and Northeast Corridor—in which higher speeds have been achieved.

GOALS, DEFINITIONS, AND METHODOLOGY

As with the earlier report, the goal of this study is to identify lessons learned for successfully implementing HSR in the United States. With respect to methodology, the study used a comparative case study approach based on an extensive literature review as well as interviews with primary and secondary sources. Sources in the literature review were drawn from historical, governmental, and legal documents, as well as business plans, feasibility studies, and related media articles.

Given the early stages of most of these projects, "success" is defined by whether a given HSR project is still actively pursuing development or funding. However, in the case of the Northeast Corridor, a fuller discussion of success is provided, since HSR has been implemented on that corridor for some time now.

With respect to other definitions, HSR in the United States has multiple definitions. HSR has been defined in terms of faster speeds (110 miles per hour [mph] and above) and in terms of market penetration (competing with aviation and highway modes).[4] Because of these different definitions, different types of HSR have been sought over the years:

- Incremental HSR—uses existing technologies and rights-of-way (ROW) but makes improvements to allow for speeds up to 150 mph (though most projects in the United States aim for 110 mph) and uses either electrified or nonelectrified systems
- New HSR—requires new ROW and technologies imported from Europe or Asia that typically allow for speeds in excess of 200 mph (though in practice they tend to have maximum speeds around 185 mph).[5]

Additionally, some efforts have been aimed at implementing an entirely new type of technology—magnetic levitation (Maglev)—now in revenue service in Shanghai, China, with several other Asian countries exploring this option. As the name suggests, Maglev does away with steel-wheel-on-steel-rail, using magnetic fields for movement and allowing for speeds in excess of 300 mph. While incremental and new HSR generally compete with airplanes and automobiles between distances of 100 to 500 miles, Maglev can compete between 40 and 600 miles.

Update on Earlier Cases and HSR Initiatives

Since the publication of the first report, there has been little movement on HSR in the Pacific Northwest. According to the Washington Department of Transportation (WSDOT), while completed track, signal, and rolling-stock improvements allow for higher speeds and frequencies, "the lack of a stable source of state multimodal funding, and to date little federal support, has slowed the implementation of this vision and is leading WSDOT to reassess its high-speed intercity passenger rail plan."[6] Florida's attempts at implementing HSR also appear to have ended for the time being, and California's plans remain in doubt. In the meantime, planning for the Southeast Corridor has moved ahead and the Ohio Regional Rail Network has experienced some new interest. Nevertheless, none have moved to the implementation phase.

At the time the work was being conducted on the first report, the situations in Florida and California looked promising, even if HSR in the Pacific Northwest seemed to lag. Indeed, Florida appeared closer than it had been in over thirty years to implementing a new HSR system (i.e., new right-of-way and dedicated tracks as opposed to incremental HSR, which utilizes current right-of-way and tracks). However, in the November 2004 general elections, two-thirds of Florida's citizens voted to repeal a constitutional amendment requiring implementation of new HSR in Florida.

Florida

In 2006 the Florida High Speed Rail Authority (FHSRA) issued its report to the governor and legislature. The report noted that although the amendment had been repealed, the FHSRA continued negotiations with Fluor-Bombardier, which had provided the first-ranked proposal responding to FHSRA's 2002 Request for Proposals. The negotiations have centered on certain potential changes to the proposal that would incorporate several attributes of the second-ranked proposal, including the addition of a second track in certain locations. At the same time, FHSRA has remained in discussions with Global Rail Consortium, which submitted the second-ranked proposal and has solicited additional information from them, specifically related to the levels of private participation in the project.[7]

In addition to continuing negotiations and discussions with Fluor-Bombardier and Global Rail Consortium, the FHSRA also changed its preferred route option for the new HSR, which would connect Tampa and Orlando, to facilitate and expedite the formal Record of Decision on the Final Environmental Impact Statement (FEIS) by the Federal Railroad Administration. The FEIS was signed in July 2005 and formally released in August 2005, but the Record of Decision is still pending.

No new recommendations were offered by the FHSRA to the governor and legislature, though the Authority reiterated the 2005 recommendation to complete the two key memoranda of agreement—one with Florida Department of Transportation and one with the Greater Orlando Aviation Authority—which are needed before the Record of Decision can be finalized. FHSRA believes that these steps need to be taken to preserve the ability to locate a new HSR system in the existing public right-of-way along a key section of the corridor, even if HSR is not pursued at this time.[8]

Nevertheless, given that funding for HSR was cut by Governor Jeb Bush in fiscal year (FY) 2004 and has not been reintroduced, and that the Governor's office remains not only unsupportive but also actively opposed to HSR, at the moment the situation appears rather bleak, at least for new HSR in Florida.

California

In some ways California is now at a crossroad similar that of Florida in November 2004. Unlike Florida, where the state administration is openly antagonistic to HSR, California, appears to have support in both the administration and legislature. Indeed, several

legislators, particularly Senator Dean Florez (D-Shafter), are championing HSR in the state. There is also support among key stakeholders such as the airlines, which are being looked to as members of the consortium that will operate service in many locations not currently served well by the aviation industry.

In November 2005, the California High Speed Rail Authority (CHSRA) unanimously approved the certification of the final Environmental Impact Statement. This was followed by the Federal Railroad Administration's issuance of a Record of Decision. Yet, after more than a decade of working toward the implementation of a 700-mile, new HSR system in California, the first section of which will connect San Francisco and Los Angeles, HSR's future in the state is still in doubt.

In January 2006, Governor Arnold Schwarzenegger announced a $222 billion, 10-year public works bond, which while mentioning HSR, did not include any funding for it. As a result, members of the Legislature began discussing postponing a $9.95 billion HSR bond measure from November 2006 to November 2008 (it had already been postponed from the November 2004 ballot).[9] On June 29, 2006, the legislature voted unanimously to postpone the vote again.[10]

According to Dan Leavitt, Deputy Director of the CHSRA, postponing the ballot has serious consequences for HSR in California. A two-year delay will likely raise costs for an already expensive project and could result in a missed opportunity for preserving the ROWs needed for new HSR.[11] Leavitt suggested that the effects of a postponement of the bond measure could be mitigated if the state were to provide funding for the CHSRA's work over the next two years (estimated at $116 million), so it could move ahead on preliminary engineering for the project and acquire and preserve the needed ROW. However, the 2006–2007 enacted budget only provided $14.3 million "to begin project implementation." While the funding will allow the CHSRA to move ahead with "completion of a financial plan, project management, identification of critical right-of-way acquisitions, development of a simulator for planning system operation and public information, and the beginning of detailed project design and related environmental studies," bond funding must still be authorized in 2008.[12]

THE CURRENT CASES

The three cases together in this report provide some interesting comparisons to each other and to the earlier cases as well. While the Chicago Hub remains in the planning stages

(and significantly behind California and Florida), the Keystone Corridor is in the midst of incremental improvements to increase speeds up to 110 mph (with potential additional increases over time), and the Northeast Corridor (NEC) is the closest the United States comes to true HSR, with speeds of up to 150 mph in certain locations.

Like Florida and California, the Keystone Corridor is situated fully within a single state; the Chicago Hub is more like the Northeast Corridor and to some degree the Pacific Northwest, though the latter links only three states, while the former two include many more. Similar to the Northeast Corridor, HSR on the Chicago Hub is more important to some states and less important to others, making it difficult to find consensus at times.

Unlike California and Florida's most recent attempt at HSR, all three of the current cases are pursuing or have implemented incremental HSR (Florida has also pursued incremental rail at different times). However, the Chicago Hub differs from the Keystone Corridor and NEC in several critical respects:

- The Chicago Hub (2,313 miles) is significantly larger than either the NEC (456 miles) or the Keystone Corridor (104 miles). There are two segments of the Chicago Hub that are roughly the same length as the Keystone Corridor (118 miles and 80 miles) and on which some improvements are being made. However, each of these segments is significantly smaller than the full Hub, each represents only a portion of two different spokes of the Hub, and unlike the Keystone Corridor, they do not connect the end-point cities.
- The costs associated with change on the full extent of the Chicago Hub are significantly higher than with the most recent efforts on the Keystone Corridor (though on the segments mentioned above, the costs are comparable).
- The ROW is largely owned by private freight operators on the Chicago Hub; on the Keystone Corridor, Amtrak (National Railroad Passenger Corporation) owns the portion of the corridor on which incremental improvements are being made; and on the NEC, Amtrak owns the majority of the line, with public agencies owning the remainder.
- There is no clear overall authority or dominant player on the Chicago Hub, while on the Keystone Corridor, Amtrak and the Pennsylvania Department of Transportation clearly played the lead role.

- Owing in part to its multistate nature, there is no formal institutional framework on the Chicago Hub as one sees on the Keystone Corridor or even on the NEC.
- Who benefits and by how much is less clear with the Chicago Hub than with the Keystone Corridor or the NEC. Worse, while on the Keystone Corridor all the stakeholders see some benefit, on the Chicago Hub some stakeholders may see a negative impact if HSR is implemented.

As will be seen after reviewing the experiences on the Keystone Corridor and Northeast Corridors, all of these points call into question the ability of the Chicago Hub to move from early planning to full implementation of HSR.

CHALLENGES IN IMPLEMENTING HSR IN THE STATES

In an October 1994 article by Louis Thompson, "High-Speed Rail (HSR) in the United States—Why Isn't There More?," he notes that there are several important advantages over air and automobile travel that are brought by HSR. Among them are the following:

- HSR carries large volumes of people using limited space.
- HSR consumes less energy and emits less pollution than automobiles and airplanes under certain conditions.
- HSR can operate directly in and out of city centers, unlike airplanes.
- HSR's marginal operating cost per person is small once the infrastructure is built, so that if volumes are high enough, this mode can provide the lowest-cost travel.[13]

On the other hand, Thompson also notes several disadvantages:

- HSR can be extremely expensive to build (particularly for new HSR).
- HSR is limited in coverage, since it can only go where there are tracks (and finding those tracks and ROW today is increasingly difficult).
- HSR is not a proven mode in the United States (which increases risk for investors).[14]

Additional challenges for HSR in the United States revolve around institutional arrangements. Thompson notes that current institutional arrangements are not "well-suited" for the type of centralized action that is needed to implement HSR. With many HSR markets and, therefore, initiatives located within a single state (California, Florida, Texas in earlier years), it is difficult to find national support and corresponding funding. However, for those that represent multistate efforts (Chicago Hub, Pacific Northwest,

Southeast Corridor), there is no well-established system of regional governance and authority.[15]

To date, in most attempts to implement HSR in the United States, the disadvantages have far outweighed the advantages and have led to multiple failures to progress. The three cases in this report provide insights on why this has occurred and how, despite this, some progress has been made on at least the NEC and Keystone Corridors.

Outline of the Report

The subsequent pages of this report explore the cases in depth, tracing historical efforts aimed at implementing high-speed rail as well as the most recent challenges and status of each of the corridors. The next section of this report covers the Chicago Hub and Midwest Regional Rail Initiative, describing the initiatives being taken by each state to move HSR forward in the region and providing an assessment of the various stakeholder interests that will need to be taken into account as the effort progresses. The fourth section explores the Keystone Corridor, tracing several unsuccessful attempts aimed at implementing HSR in the Commonwealth of Pennsylvania as well as assessing the most recent effort led jointly by Amtrak and the Pennsylvania Department of Transportation. The fifth section investigates the experience on the Northeast Corridor, juxtaposing the experiences on the north-end and south-end to discern additional findings and lessons. Finally, the report concludes by describing the findings, lessons learned, and themes for future consideration that are derived from the study results.

THE CHICAGO HUB AND MIDWEST REGIONAL RAIL INITIATIVE

The Midwest, with Chicago as a hub and several major cities within a 600-miles radius, presents an opportunity for the development of a regionwide high-speed rail (HSR) system in a hub-and-spoke fashion. The lines connecting Chicago to the other major Midwestern cities form the spokes. These major cities, spread over more than half a dozen states, include Milwaukee, Madison, Kansas City, Detroit, Omaha, Cincinnati, St. Louis, and Minneapolis/St. Paul. Most of the right-of-way (ROW) and the tracks in the Midwest are owned by the private railroad companies. A large proportion of these tracks are used both for freight and passenger rail.

The Midwest's efforts at providing HSR are multilayered; concurrent with the regional-level involvement in planning and advocating for HSR are state-specific attempts at planning and implementing HSR-related projects. Thus, using the definition utilized in this report, the HSR efforts of the Midwest can be considered successful because the Midwestern states are actively planning for incremental HSR.

Nevertheless, the Chicago Hub and Midwest Regional Rail Initiative (MWRRI) together serve as a counterpoint to the experiences of the Keystone Corridor and Northeast Corridor. The Chicago Hub and MWRRI demonstrate the difficulty in moving HSR initiatives forward without the combined presence of leadership, means, and authority. They also demonstrate the difficulty in trying to implement an HSR network that crosses multiple states in the absence of significant political and financial support from the federal government.

HISTORY OF HSR IN THE MIDWEST

Historically, the motivation to plan for HSR in the Midwest has primarily come from the potential to realize two opportunities. The first is to provide HSR between Chicago and other major Midwestern cities like St. Louis, Detroit, Milwaukee, and Minneapolis/St. Paul. Thus, Illinois, Michigan, Wisconsin, and Minnesota—states where the majority of the routes would fall—are actively planning for HSR. The second opportunity, primarily explored by Ohio, is to link the major cities of Ohio—Cincinnati, Cleveland, and Columbus—with each other, and with Ohio as a hub, to link the Midwestern rail system

with those in the Northeast. Hence, in the last three to four decades, several studies have been conducted and compacts formed to realize these opportunities.

However, development of HSR in the Midwest is also constrained in several ways. These constraints include automobile-dominated passenger travel; lower population densities (which means fewer people and larger spaces in between cities); and private ownership of rail ROW. Passenger rail, in particular HSR, does not have the same kind of support and ridership in the Midwest as in other regions of the United States, such as the Northeast. While Chicago is a large and densely developed metropolitan area, the other cities are much smaller with less concentration of population. Finally, most of the rail ROW in the Midwest is owned by a number of private freight railroad companies. These private railroads, currently in a growth phase, are wary of sharing their already congested right-of-way with HSR. The Wisconsin Rail Issues and Opportunities Report notes: "The Chicago Metropolitan Area is one of the busiest freight rail hubs in the United States. About one-third of the rail traffic in the United States originates, terminates, or passes through this area."[16] The report further notes that 35,700 freight cars move through the Chicago metropolitan area each day. Furthermore, the average train speed is less than 12 mph (while the average truck speed is 15 mph), and there are 1,953 at-grade roadway/railway crossings.

The Early Attempts

One of the first attempts to examine the feasibility of HSR in the Midwest was a 1974 study conducted by the Illinois Department of Transportation (IDOT). The study examined the feasibility of a new 150 mph double-track HSR service between Chicago and St. Louis. The study found the cost of new high-speed rail to be prohibitive.[17] During the same period, the Ohio General Assembly created the Ohio Rail Transportation Authority (ORTA) to prepare a statewide, long-term comprehensive HSR plan. The plan, completed in 1980, proposed a 600-mile system to be funded by a 1 percent sales tax. The sales tax initiative was defeated in the state's 1982 general election ballot. Meanwhile, during the 1970s and 1980s, several studies were commissioned or conducted by Midwestern state departments of transportation (DOTs) or other public or private entities to assess the technical and financial feasibility of HSR in the Midwest. They include the 1978 study *Ohio High Speed Intercity Rail Passenger Program: Phase I Feasibility Study*; the 1980 study *Ohio High Speed Intercity Rail Passenger Program: Phase I Feasibility Study,* commissioned by the ORTA; the 1981 study *Michigan High Speed Intercity Rail Passenger Development Study: Market Analysis*, and the 1983 study *Back on Track—Program for High Speed Transportation:*

The Detroit-Chicago Corridor, both commissioned by the Michigan Transportation Department; the 1984 Federal Reserve Bank of Chicago's study *High Speed Rail in the Midwest: An Economic Analysis;* and the 1985 study *Market Analysis of High Speed Rail Services in Ohio,* commissioned by Ohio DOT.

All of these studies were conducted in parallel with and sometimes as a result of regional-level efforts to develop HSR in the Midwest. Such a regional effort was the "Interstate High Speed Intercity Rail Passenger Network Compact." Between 1979 and 1992 the states of Ohio, Illinois, Indiana, Kentucky, Michigan, Missouri, Pennsylvania, New York, Tennessee, and West Virginia joined the compact. The State of Missouri's compact document noted that:

> Because the beneficial service of and profitability of a high speed intercity rail passenger system would be enhanced by establishing such a system which would operate across state lines it is the policy of the states party to this compact to cooperate and share jointly the administrative and financial responsibilities of preparing a feasibility study concerning the operation of such a system connecting major cities in Ohio, Indiana, Michigan, Pennsylvania, Illinois, Missouri, and any other State which subsequently becomes a participant through enactment of the compact.[18]

The compact further noted that:

> The states of Ohio, Indiana, Michigan, Pennsylvania, Illinois, Missouri and all other states which subsequently enter into this compact, hereinafter referred to as "participating states," agree to, upon adoption of this compact by the respective states, jointly conduct and participate in a high speed intercity rail passenger feasibility study by providing such information and data as is available and may be requested by a participating state or any consulting firms representing a participating state or the compact. It is mutually understood by the participating states that such information shall not include matters not of public record or of a nature considered to be privileged and confidential unless the state providing such information agrees to waive the confidentiality.[19]

Although the compact did not result in actual development of regional HSR, and was ultimately repealed by many of the participating states, it represented the first formal attempt by a group of Midwestern and Eastern states to study the feasibility of developing a regional HSR system.

Interest in HSR in the Midwest received a boost in 1990 when a group of high-level public and government officials toured Europe. The group gained first-hand HSR travel experience riding the X2000 in Sweden and the TGV in France. Among others, this group included senators and legislators from the State of Illinois; Illinois' lobbyists in Washington DC; the secretary of IDOT; and the chairman of Metra (commuter rail operating in the nine-county region of Northeastern Illinois).[20] The information gathered from this tour helped IDOT to develop a conceptual plan for incremental HSR for the Chicago-St. Louis corridor. The conceptual plan, prepared in 1991, was heavily influenced by the incremental speed and geographical coverage increases of the French TGV and sought to incrementally build up the existing Amtrak (National Railroad Passenger Corporation) service on the Chicago-St. Louis route. The incremental nature, it was opined, would also help to build public support for HSR. Meanwhile the states of Illinois, Minnesota, and Wisconsin were also interested in exploring the potential of HSR in the Chicago-Milwaukee-Minneapolis/St. Paul corridor. The states signed a Memorandum of Understanding in 1990. In 1991, TEMS/Benesch HSR Consultants presented their report, *Tri-State HSR Study: Chicago-Milwaukee-Twin Cities Corridor*, to the DOT's of the three states.

The purpose of the report was, "to investigate the economic and financial potential for constructing and operating a HSR system in one of two corridors…between Chicago and Minneapolis-St. Paul." The corridors examined were a southern corridor linking Chicago, Milwaukee, and the Twin Cities via Madison, and a northern corridor linking the same cities via Green Bay. The study concluded that the southern corridor appeared very promising in terms of ridership, revenues, and economic benefits and recommended using existing rights-of-way and 125 mph services.[21]

Similar interest in exploring the potential for HSR in the Chicago-Detroit line led the DOTs of Illinois, Indiana, and Michigan to commission a feasibility study. In 1991, the consultants, URS Consultants/Parsons Brinckerhoff, Inc. presented their report, *Detroit-Chicago Rail Passenger Corridor Development Blueprint*. The report examined the relative costs and benefits of developing new right-of-way versus using the existing one. The study recommended the use of the existing right-of-way and upgrading of the railroad infrastructure to 125 mph standards. The study noted that population densities along the corridor from Chicago to Detroit were similar to Paris-Lyons, France.

Federal Action—Chicago Hub

In 1991 the federal government, under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) called for selection of not more than five corridors to be designated as HSR corridors. These included the California, Chicago Hub, Florida, Pacific Northwest, and Southeast corridors. In 1992, three lines—Chicago-Detroit, Chicago-St. Louis, and Chicago-Milwaukee—were designated part of the Chicago Hub. In 1998, the Chicago-Milwaukee line was extended to Minneapolis/St. Paul. The Chicago-Indianapolis-Cincinnati line and the Chicago-Toledo-Cleveland line were added to the Chicago Hub in 1999 and 2000, respectively. At present the Chicago Hub consists of eight lines covering 2,313 miles of track (Table 1).[22]

Table 1 Lines Comprising the Chicago Hub

Lines	Mileage	Top Speed (goal)	Travel Time (goal)	Date Designated
Chicago-Milwaukee, extension to Minneapolis/St. Paul	445	110 mph	5:52 hr	10/15/1992 12/11/1998
Chicago-Detroit	279	110 mph	3:49 hr	10/15/1992
Chicago-St. Louis	282	110 mph	3:50 hr	10/15/1992
St. Louis-Kansas City	283	90 mph	4:14 hr	1/19/2001
Chicago-Indianapolis-Cincinnati	319	110 mph	4:03 hr	1/28/1999
Chicago-Toledo-Cleveland	341	110 mph	4:23 hr	10/11/2000
Cleveland-Columbus-Cincinnati (3-C Corridor)	254	110 mph	3:28 hr	10/11/2000
Indianapolis-Louisville	111	79 mph	4:00 hr	10/11/2000

Source: Allison L. C. de Cerreño, et al., *High-Speed Rail Projects in the United States: Identifying the Elements for Success*, MTI Report 05-01 (San José, CA: Mineta Transportation Institute, October 2005), p. 15.

While the earlier regionwide effort—through the Interstate High Speed Intercity Rail Passenger Network Compact—was unsuccessful, renewed regional efforts were made in the form of the Midwest Interstate Passenger Rail Commission (MIPRC) and the Midwest Regional Rail Initiative (MWRRI).

Renewed Regional Efforts—MIPRC and MWRRI

Under the auspices of the Midwestern Legislative Conference (MLC), the pro-HSR legislators of several Midwestern states formed a task force in December 1996. A regional

association of state legislatures representing 11 Midwestern states (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin), the MLC fosters regional intergovernmental cooperation in the Midwest. It does this through the several mechanisms, including joint consideration of common problems, exchanging of information and ideas, sharing of knowledge and experience, and the pursuit of some collaborative efforts to improve state government.[23]

Over the next four years, the task force decided to create the Midwest Interstate Passenger Rail Commission (MIPRC) through the Midwest Interstate Passenger Rail Compact drafted by the task force. The states of Indiana, Minnesota, and Missouri joined the compact in 2000. Later Nebraska, North Dakota, and Ohio joined the compact. The compact aimed to "promote, develop, and implement plans and improvements for passenger rail services in the Midwest."[24] Until now the MIPRC's primary function has been one of advocacy for HSR in the Midwest.

While the legislators were garnering political support for HSR, the state DOT officials joined efforts to prepare a regional plan for HSR. This effort gave rise to a loose consortium of state DOT officials called the Midwest Regional Rail Initiative (MWRRI), of which the MIPRC is supportive. The MWRRI "began in 1996 under the auspices of the Mississippi Valley Conference—a regional division of the American Association of State Highway and Transportation Officials (AASHTO)."[25] The representatives of the state DOTs of Indiana, Illinois, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin constitute the steering committee of the MWRRI. The rationale for the consortium was that together they would have more political clout and resources to plan and raise funds for HSR than they would otherwise have alone. The MWRRI was instrumental in the development of the Midwest Regional Rail System (MWRRS), a business plan for HSR in the Midwest.

The MWRRS Plan

The MWRRS plan, as per its latest version prepared in 2004, envisions trains carrying passengers between the region's big cities at speeds up to 110 mph. This speed was picked as the upper limit, because the Federal Railroad Administration (FRA) dictated that no at-grade crossings would be allowed at speeds at or over 125 mph, and that "some positive barrier device" would be required for train speeds from 110–125 mph. No such barrier system was found to be practical.[26] An estimated 13.6 million passengers are expected to annually travel on this system with the full implementation of the MWRRS by the year 2025.[27] The MWRRS Plan elements include the following:

- Use of 3,000 miles of existing rail right-of-way that is largely owned by private freight railroads and to a much smaller extent by Amtrak and Metra.
- Operation of a hub-and-spoke passenger rail system with Chicago at the center.
- Introduction of modern, high-speed trains operating at speeds up to 110 mph.
- Provision of multimodal connections to improve system access.[28]

The overarching goals of the MWRRS plan are to increase connectivity, reduce trip times between major Midwestern cities, and provide "multimodal connections to improve system access."[29] The plan proposes to achieve the goals through a network of 110 mph high-speed rail lines connecting major Midwestern cities. Additional networks of 90 mph and 79 mph lines and feeder bus routes would link passengers to the 110 mph lines and improve system access. Figure 1 shows a map of the Midwest Regional Rail System with the rail lines and bus feeder routes proposed in the MWRRS plan.

The first of the series of business plans for MWRRS was published in 1998. Since then the plan has been updated twice—in 2000 and 2004—with additional work done each time to fine tune the plan elements and estimate its economic benefits. The latest report in this series is due in 2007. A major component of the 2007 report will be the assessment of economic benefits at the micro (community) level. The report will identify the monetary value of the economic benefits to each community served by the system. According to the Approved Project Briefing,

> The Midwest Regional Rail Initiative (MWRRI) Steering Committee has requested and received FRA planning funds in response to a $250,000 earmark in the FY 2004 Transportation Appropriation. These funds require a 50/50 state/federal match and generate $500,000 in effort. The funds will provide consultant support for MWRRI planning, public involvement, engineering, and environmental work during a three-year period from January 1, 2005 through December 31, 2008. The project costs under this Approved Project Briefing will fund and support the work of the MWRRI Steering Committee as it pursues additional funding and the implementation of the plan at the state and federal level. In addition to the $250,000 FRA funds, each of the eight participating states has agreed to contribute $31,250 over three years.[30]

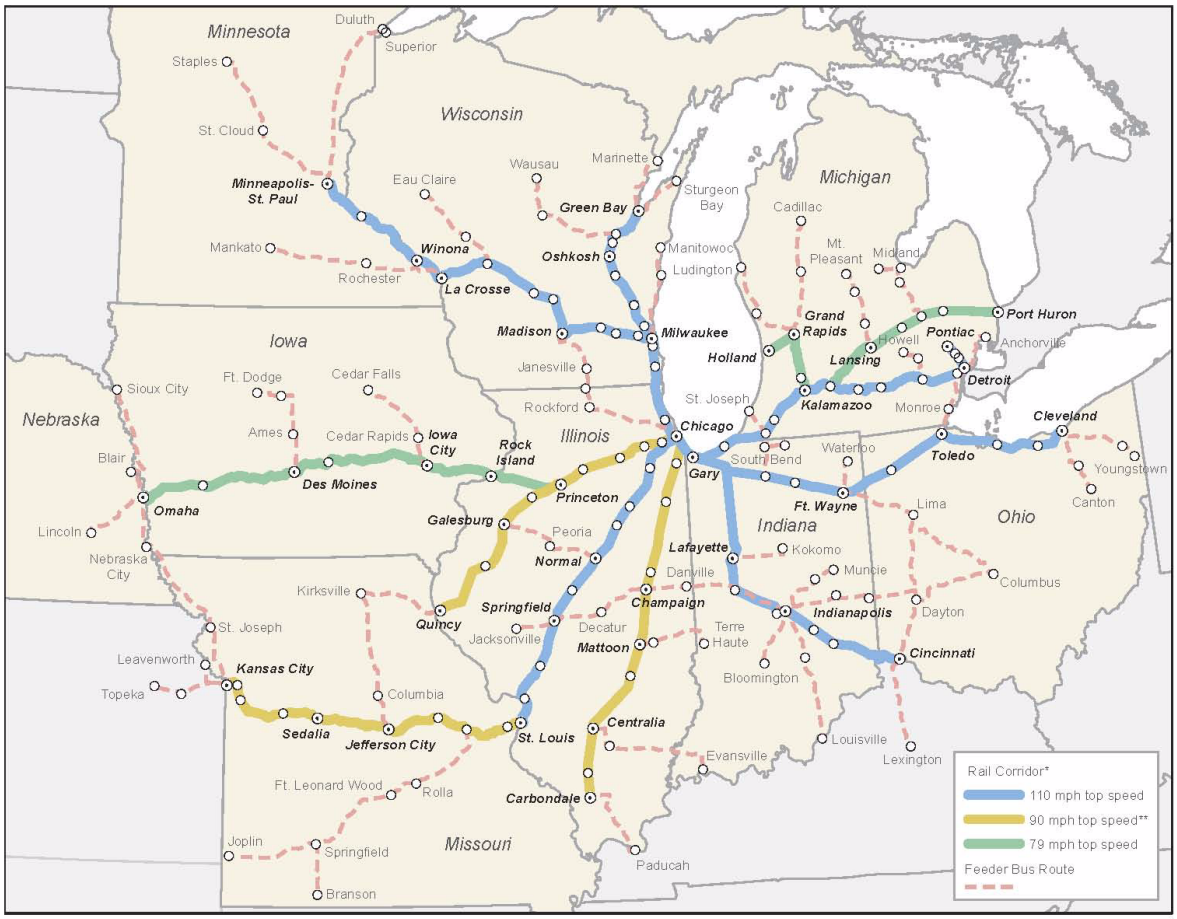


Figure 1 Map of Proposed Midwest Regional Rail System

Source: Midwest Regional Rail System: A Transportation Network for the 21st Century, Executive Report, 2004, p. 6.

The majority of the lines identified in the MWRRS plan are part of the federally designated Chicago Hub. However, there are several key differences as follows:

- The Chicago Hub only includes federally designated high-speed lines, while the MWRRS, apart from including all the high-speed lines of the Chicago Hub (except for the Cincinnati-Columbus-Cleveland line) also proposes other rail lines with speeds ranging from 79 mph to 110 mph. The additional lines in the MWRRS include: Chicago-Green Bay (110 mph); Chicago-Quincy (90 mph); Chicago-Carbondale (90 mph); Kalamazoo-Port Huron (79 mph); Kalamazoo-Holland (79 mph); and Princeton-Omaha (79 mph).

- The MWRRS plan is multimodal in nature. It seeks to link the HSR network with the bus system through the feeder bus routes (Figure 1).

The 2004 MWRRS plan, titled "Midwest Regional Rail System: A Transportation Network for the 21st Century," aims to achieve substantial travel-times savings, as shown in Table 2.

Table 2 MWRRS Plan: Train Travel Times

City Pairs	MWRRS	Current Service	Time Reduction
Chicago-Detroit	3 hr 46 min	5 hr 36 min	1 hr 50 min
Chicago-Cleveland	4 hr 22 min	6 hr 24 min	2 hr 02 min
Chicago-Cincinnati	4 hr 08 min	8 hr 10 min	4 hr 02 min
Chicago-Carbondale	4 hr 22 min	5 hr 30 min	1 hr 08 min
Chicago-St. Louis	3 hr 49 min	5 hr 20 min	1 hr 31 min
St. Louis-Kansas City	4 hr 14 min	5 hr 40 min	1 hr 26 min
Chicago-Omaha	7 hr 02 min	8 hr 37 min	1 hr 35 min
Chicago-St. Paul	5 hr 31 min	8 hr 05 min	2 hr 34 min
Chicago-Milwaukee	1 hr 04 min	1 hr 29 min	25 min

Source: Midwest Regional Rail System: A Transportation Network for the 21st Century, Executive Report, 2004, p. 11.

The plan projects the system as a whole to be financially sustainable at the operating level (see Table 3 for projected operating revenues, costs, and operating ratio) and calls for a mix of funding sources for financing the capital costs. The plan calls for an 80/20 share of the federal and state funds to finance the capital costs. The other funds include those generated from the system-related economic activities.

The plan has identified two major components of the capital costs—infrastructure and train equipment. The total capital investment is estimated to be $7.7 billion (in 2002 dollars), of which $1.1 billion will be for train equipment and the remaining $6.6 billion for infrastructure. The total cost is projected to be phased over a 10-year period. The "major capital improvements include track replacement and upgrades, additional sidings, signal and communication systems, and highway-railroad grade-crossing improvements as necessary to support intercity passenger speeds of up to 110 mph as well as concurrent freight and commuter rail operations."[31] Table 4 identifies the capital investment by corridor.

Table 3 MWRRS Plan: Operating Revenues, Costs, and Operating Ratio

MWRRS Summary Financial Statistics	Operating Revenue (Millions of 2002 $)		Operating and Maintenance Cost (Millions of 2002 $)		Operating Ratio[a]	
	2014	2025	2014	2025	2014	2025
Chicago-Detroit/Grand Rapids/ Port Huron	$113	$129	$95	$97	1.18	1.32
Chicago-Cleveland	$50	$66	$56	$58	0.88	1.15
Chicago-Cincinnati	$53	$61	$40	$41	1.32	1.49
Chicago-Carbondale	$22	$25	$22	$22	0.99	1.11
Chicago-St. Louis	$61	$71	$47	$49	1.30	1.46
St. Louis-Kansas City	$35	$47	$34	$35	1.05	1.32
Chicago-Quincy/Omaha	$53	$61	$59	$60	0.90	1.02
Chicago-Milwaukee-St. Paul/Green Bay	$141	$172	$99	$104	1.42	1.65
Midwest Regional Rail System Total	$528	$632	$453	$466	1.17	1.36

Source: Midwest Regional Rail System: A Transportation Network for the 21st Century, Executive Report, p. 13.

a. Operating revenue divided by operating and maintenance costs

Table 4 MWRRS Plan: Capital Investment by Corridor

Corridor	Infrastructure	Train Equipment	Total
Chicago-Detroit/Grand Rapids/Port Huron	$873	$234	$1,106
Chicago-Cleveland	$1,187	$152	$1,338
Chicago-Cincinnati	$606	$101	$707
Chicago-Carbondale	$232	$51	$283
Chicago-St. Louis	$445	$115	$560
St. Louis-Kansas City	$893[a]	$86	$980
Chicago-Quincy/Omaha	$638	$167	$806
Chicago-Milwaukee-St. Paul/Green Bay	$1,638	$222	$1,860
Chicago Terminal and Waterford Shop	$60	–	$60
TOTAL	$6,572	$1,128	$7,700

Source: Midwest Regional Rail System: A Transportation Network for the 21st Century, Executive Report, p. 15.

a. Estimate is subject to additional analysis and refinement.

The MWRRS plan calls for a phased implementation and identifies this as a reason for flexible management and institutional structures. It identifies several potential models for the institutional structure that would be ultimately needed for the multistate coordination. These models include ad hoc multistate committees, committees established by multistate agreement, or a joint-powers authority established through legislative action. The plan also calls for forging cooperative relationships with the private railroad companies (they own most of the rail rights-of-way) and the commuter railroads. Lastly, it exhorts the participating states to be "funding ready." The activities that the states may perform include the conduct of environmental impact assessments and preliminary engineering studies; advocacy for the 80/20 federal/state share; and gaining federal funding to conduct systemwide environmental review to satisfy National Environmental Policy Act (NEPA) and to "position the MWRRS project for receipt of federal grant funds and Transportation Infrastructure Finance and Innovation Act (TIFIA) loans."[32]

The MWRRS plan is a notable achievement in that it is a collaborative effort of the Midwestern state DOTs to plan for HSR in the absence of significant federal support. The plan outlines the contours of HSR in the Midwest and exhorts the states to be "funding ready" should federal funds for HSR become available in future. However, the plan is

primarily a product of efforts by mid-level officials of state DOTs and its creation did not directly involve elected officials or surrounding communities. Hence, it does not enjoy the broad-based political support required for successful implementation.

Apart from the regional-level efforts through the MIPRC and the MWRRS plan, the Midwestern states, either individually or in groups, are also engaged in planning and developing HSR. The next section documents the state-level efforts to develop HSR in the Midwest.

HSR Efforts within the States

At present, nine Midwestern states, through participation in the planning process and/or conduct of physical improvements, are working toward the development of HSR in the Midwest. Among these states, three—Illinois, Wisconsin, and Michigan—are further along than the rest, because they have conducted more advanced planning and engineering studies and/or have actually made some physical HSR-related improvements. The lines that are natural candidates for HSR, by virtue of higher rail ridership and greater public and political support for rail travel, primarily fall in one of these three states. The fourth state, Ohio, is unique because, apart from having Chicago Hub lines running within the state and being actively involved in the MWRRI, it has also conducted separate studies to explore the potential of connecting the Chicago Hub with the East Coast rail corridors. (More about the Ohio Hub initiative is provided later in the case study.) The remaining five states—Indiana, Missouri, Iowa, Minnesota, and Nebraska—though part of the regional-level efforts to develop HSR in the Midwest, have not been very active in taking up HSR-related projects at the state level. These states either have less to gain from the provision of HSR or lack the political support of their elected officials.

Illinois, Michigan, and Wisconsin

Illinois, Wisconsin, and Michigan share a strong willingness to develop HSR. For more than two decades, these states have worked together to conduct HSR-related studies. They also share federally designated HSR lines that are part of the Chicago Hub. For example, the Chicago-Minneapolis/St. Paul line passes through Madison or Milwaukee in Wisconsin, while the majority of the Chicago-Detroit line falls in Michigan. These three states also subsidize existing Amtrak service.

Illinois

Several of the proposed high-speed lines (speeds up to 110 mph) pass through Illinois. They include Chicago-Milwaukee, Chicago-St. Louis, Chicago-Cincinnati, Chicago-Cleveland, and Chicago-Detroit lines. The Chicago-Milwaukee line is owned by Canadian Pacific (CP). CP also operates freight trains on this line. Additionally, Amtrak operates seven daily trains on it. Thus the line at present is very congested and would require extensive double-tracking to run HSR. The Chicago-Detroit line, owned by Norfolk Southern (NS) and Canadian National (CN), is also congested. Apart from freight traffic operated by NS and CN, Amtrak also operates three to five daily trains on this line. The Chicago-Cincinnati line owned by CSX is not very busy. The Chicago-Cleveland line (Chicago-Gary-Fort Wayne-Toledo-Cleveland) is owned by NS (between Fort Wayne and Toledo) and CSX (the remainder of the route), and is heavily congested with freight. Additionally, fourteen to sixteen trains daily run on this line.

Lastly, the Chicago-St. Louis line, for the first forty miles out of Chicago, is owned by CN. The rest of the line is owned by Union Pacific (UP). The line has very low freight traffic and runs three Amtrak trains per day (round-trip). The potential for new HSR on the Chicago-St. Louis line was first studied by the IDOT in 1974. The prohibitive cost ($2.2 billion in 1994 dollars) of the project led to the conclusion that upgrade of existing passenger rail service would be a more viable option. A 1994 IDOT study concluded that "110 to 125 miles per hour (180 to 200 kilometers per hour) HSR diesel-powered service operating on existing rail lines would be viable from both a ridership and financial perspective."[33] The Final Environmental Impact Statement (FEIS), prepared in January 2003, proposed a HSR service with maximum operating speed of 110 mph south of Dwight, Illinois, and maximum operating speed of 79 mph (existing speed) north of Dwight, Illinois. The FEIS further recommended utilization of existing track. However, it noted that 12 miles of double track, 22 miles of freight siding, one grade-separated highway-railroad grade crossing, and enhanced warning devices at 174 grade crossings would be required.[34] The entire line falls within Illinois, which has started making improvements to the line. In 1999, the Illinois General Assembly passed the $6.3 billion Illinois Fund for Infrastructure, Roads, Schools, and Transit (Illinois FIRST) Program to fund infrastructure, roads, schools, and transit. One hundred million dollars of these funds were earmarked for railroad projects, including $90 million for HSR. Of the $90 million, $20 million were dedicated to trains and $70 million to track and signal work. The State of Illinois contracted with UP railroad to upgrade the 118-mile track between Springfield, Illinois, and Dwight, Illinois, from FRA Class IV (79 mph limit) to Class VI (110 mph

limit).[35] Fifty million dollars of Illinois FIRST funds were paid by Illinois to UP for this work. The track upgrade allows passenger operations at speeds up to 110 mph.

This track work is complete and involved several track-related improvements such as installation of ties, turnouts and concrete highway crossing surfaces, and construction of quad gates where train speeds are projected to exceed 90 mph. The gate construction was done as per the Illinois Commerce Commission's guidelines. The Commission paid approximately $18 million for the construction of gates. Vehicle detection loops were also installed. On this same corridor, IDOT, the FRA, and the Association of American Railroads are jointly developing and implementing a Positive Train Control (PTC) system. This technologically advanced system utilizes global positioning satellites to accurately determine train location. Advanced Train Control systems are a requirement mandated by the FRA whenever passenger service speed is in excess of 79 mph. The PTC system will allow safe operation at high-speeds and prevent a train from exceeding the authorized speed. The original contract for this project was $60 million, and the state's share was $12 million spread over several years.[36] The entire state share has been obligated. The FRA contributed to this project through its "Next Generation HSR Program" for $48 million, and the nation's major freight railroads contributed $20 million.[37] The work on the PTC project is still going on. The existing maximum speed on this line is 79 mph.[38]

Parallel with HSR-related improvements are the efforts of the consortium comprised of the City of Chicago, the State of Illinois, and six of the seven major national private railroads to reduce freight and passenger rail traffic congestion in the Chicago area. As mentioned earlier, the Chicago area is heavily congested with freight. The private railroad companies that are part of the consortium include CN, UP, Burlington Northern and Santa Fe (BNSF), NS, CSX, and CP. The Final Feasibility Plan for the project was prepared in August 2005. The ten-year, $1.5 billion plan is known as the Chicago Region Environmental and Transportation Efficiency (CREATE) program. The largest share of funding is expected to come from the federal government ($800–$900 million). The private railroads ($212 million) and Metra ($20 million) are also expected to fund the plan and the rest is expected to come from the State of Illinois and the City of Chicago.

> The plan calls for the creation of 5 rail corridors, including one primarily for passenger trains; 25 new grade separations to eliminate many commuter delays; and the opening for commercial development of a key corridor in downtown Chicago.[39]

The passenger line will also have a footprint for HSR.[40] However, the plan has faced initial financial hurdles with only $100 million authorized by the federal government under the Safe, Accountable, Flexible, Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU).[41] Furthermore, CN, fearing that the project may never get completed, has insisted on accelerating its portion of the program.[42] Successful implementation of this plan may augur well for the future of railway operations, including HSR, in the Midwest. However, at this time the plan's success is far from certain, and like similar other rail-related initiatives, is tied to the availability of federal funds.

Michigan

The Chicago-Kalamazoo-Detroit line, part of the Chicago Hub, is the only federally designated high-speed line to pass through Michigan. Two 90 mph lines identified in the MWRRS plan—Kalamazoo to Holland and Kalamazoo to Port Huron—also lie within Michigan. While the track from Kalamazoo to Chicago is owned by Amtrak, the Kalamazoo-Detroit track is owned by NS, Kalamazoo-Port Huron by CN, and Kalamazoo-Holland by NS (from Kalamazoo to Grand Rapids) and CSX (from Grand Rapids to Holland). Amtrak operates three trains daily on the Chicago-Detroit line.[43] The HSR improvements are focused on the Chicago-Detroit line's Amtrak-owned portion. The sidings, ties, and turnover-related improvements have been undertaken west of Kalamazoo to enable speeds in excess of 90 mph. Some engineering studies have been conducted on the Chicago-Detroit line, including a demonstration and installation of the Intermittent Train Control System (ITCS) "on an 80-mile segment of the Amtrak-owned portion of the corridor between Kalamazoo, Michigan, and the Indiana state line. Installation is complete on the demonstration territory: 45 miles have been in service at 90 mph since January 2002, cutover testing is underway on the remainder. Safety verification is underway to permit speeds up to 110 mph."[44] The speed was increased to 95 mph in fall 2005.[45]

Wisconsin

Wisconsin, unlike other Midwestern states, was fortunate in finding a great champion for HSR in Governor Tommy Thompson. In 1999, Governor Thompson created a task force on Passenger Rail. The task force report, *Governor's Blue Ribbon Task Force on Passenger Rail Service*, came out in February 2001. It supported the Midwest's MWRRI efforts. The task force urged the state government to use the state's bonding capacity and other broad-based revenue sources to fund passenger rail in Wisconsin. However, by that time Governor Thompson had moved to Washington as Secretary of Health and Human Services. Since

then, Wisconsin and the Midwest have been unable to find a HSR political champion of his stature.

Two proposed HSR lines—Chicago-Milwaukee-Madison-Minneapolis/St. Paul and Chicago-Milwaukee-Green Bay—pass through Wisconsin. Both are 110 mph lines. While the former is a federally designated high-speed line as part of the Chicago Hub, the latter is not. The latter has been identified as a high-speed line in the MWRRS plan. On the Chicago-Milwaukee-Madison-Minneapolis/St. Paul line, the Chicago-Milwaukee stretch is owned by Metra and CP. Currently, seven passenger trains daily on weekdays, and six on Sundays, operate on this stretch. On the Milwaukee to Madison stretch, the Milwaukee-Watertown leg is owned by CP, and the Watertown-Madison leg is owned by the State of Wisconsin. At present, there is no passenger rail service on the Milwaukee to Madison stretch. The Watertown-Madison leg is in very bad condition and would need substantial physical improvements before it is ready for HSR.[46] Wisconsin has completed its environmental assessment and preliminary engineering work for 110 mph service on the Milwaukee-Madison line. The FRA has issued a "Finding of No Significant Impact" (FONSI) for this study. The Madison-Minneapolis/St. Paul leg (via La Crosse, Wisconsin) is owned by CP. In the Chicago-Milwaukee-Green Bay Corridor, the Milwaukee-Green Bay leg is primarily owned by CN. The stretch between Westbend, Wisconsin, and Eden, Wisconsin, is presently out of service and would need major physical improvements.

Wisconsin DOT has projected the volume of freight on the private owned railroad line in Wisconsin and found that:

> By 2020, 1,550 miles of Wisconsin's privately owned lines will be part of corridors carrying less than 3 million gross tons annually. These "light density" lines would require financial assistance to preserve rail service and avoid abandonment of the track.[47]

All the proposed high-speed corridors, except for the Watertown-Madison and Milwaukee-Green Bay, are "high density" lines (annual tonnage more than 3 million).

Wisconsin subsidizes existing Amtrak service. It has asked Amtrak to look into the cost implications of increasing the frequency of Hiawatha trains between Chicago to Milwaukee from the existing 7 per day to 8, 9, or 10. It is hoped that increased train frequency would lead to an increase in passenger base for HSR. As mentioned earlier, in 1991 the *Tri-State High-Speed Rail Study: Chicago-Milwaukee-Twin Cities Corridor* found the corridor promising in terms of ridership, revenues, and economic benefits and recommended using existing rights-of-way and 125 mph services. This corridor will not

only connect the two major cities in Wisconsin (Milwaukee and Madison), but will also connect them to Chicago and Minneapolis/St. Paul.

Other improvements include the purchase of the Milwaukee Amtrak Station for $1.4 million. A public-private sector venture to rehabilitate and improve the Milwaukee Station is underway. The project is being funded with $2.6 million from the Federal Transit Administration, state matching funds, and $1.4 million in equity from Milwaukee Intermodal Partners LLC (MIP), a private developer. A $2.9 million Congestion Mitigation and Air Quality Improvement Program (CMAQ) grant has also been obtained to "rehabilitate the platforms and train shed."[48] The station, apart from the transportation facilities, will also include retail and food service, and office space. As per the contract signed between Wisconsin DOT and MIP, MIP will remodel, redevelop, and manage the station.[49] The project is scheduled for a 2007 completion and is a "centerpiece of a downtown development program."[50] Construction work was completed for the $6.5 million passenger rail station project at the General Mitchell International Airport in Milwaukee. The station opened in January 2005. The station currently serves Amtrak's Hiawatha trains but is also meant to serve HSR. Wisconsin DOT and Canadian Pacific Railway have also completed a $2 million Positive Train Control study.[51]

Some additional HSR-related studies have been conducted. A study of alternate routes from Milwaukee to Green Bay was among them. A collection of elected officials, business leaders, and citizens of the City of Eau Claire requested the state to look into the possibility of a route through their city (connecting to Minneapolis-St. Paul and possibly to Madison, Milwaukee, and Chicago).[52] The state conducted the study and found the route to be a possibility in the future. The state DOT has not conducted high-speed-rail-related outreach on its own, but the Wisconsin Association of Rail Passengers conducted a survey and found that three out of four people wanted HSR.[53]

Furthermore, Illinois and Wisconsin have worked cooperatively with Amtrak to develop a specification for trainsets specifically designed for high-speed corridor service in the Midwest.[54]

Ohio

Several portions of the federally-designated Chicago Hub run through the state of Ohio:

- Chicago-Toledo-Cleveland

- Chicago-Indianapolis-Cincinnati
- Cleveland-Columbus-Cincinnati (not included as part of the MWRRI plan)

Each of these lines has a proposed train speed of up to 110 mph. CSX owns and operates the Chicago-Indianapolis-Cincinnati line and the Chicago-Gary leg of the Chicago-Toledo-Cleveland line. NS owns the leg between Gary and Cleveland. On the Chicago-Indianapolis-Cincinnati line, there is heavy freight traffic (more than 50 million gross ton miles per mile) on the CSX-owned portion and very light freight traffic (less than 5 million gross ton miles per mile) on the rest of the line.[55] Amtrak operates the passenger rail service on both these corridors, with two daily trains on the Chicago-Cleveland line and one on the Chicago-Cincinnati line.[56]

Ohio has undertaken some infrastructure upgrade work in the 25–30 mile stretch of the Chicago-Cincinnati line that falls within Ohio. On the Chicago-Toledo-Cleveland line, upgrades have been made from border to border. These include installation of state-of-the-art warning lights and gates. Some gates have been closed and moved. A few local communities, including Lima, Galion, and Toledo, have made significant improvements to their train stations.[57]

The State of Ohio has a unique position in the Midwest and has been interested in HSR for more than thirty years. Its geographical location and the existing rail networks provide it with an opportunity to serve as a rail link between the Midwest and the Northeast. In the past, Ohio, along with the states of Pennsylvania and New York, was part of the "Interstate High Speed Intercity Rail Passenger Network Compact." More recently, Ohio has been included in the MIPRC and MWRRI. Nevertheless, little progress has been made in over three decades. Executive Director of the Ohio Rail Development Commission James Seney explains why.

> In part it is a consequence of the high cost associated with the development of high-speed passenger rail systems, which has led many policy makers to conclude that this business can best be handled by the private sector. Other explanations can be found in public doubts about the ability of intercity rapid rail systems to attract choosy travelers. And for some, the notion of fast trains and improved railbeds is little more than choochoo nostalgia.[58]

Ohio Hub

In addition to being part of the Chicago Hub and MWRRI, Ohio has also been planning the nonfederally designated Ohio Rail Hub for three decades. The most recent effort began

in 1994 with the establishment of the Ohio Rail Development Commission (ORDC). Together with Ohio DOT (ODOT), ORDC initiated a feasibility study—with input from the DOTs of Michigan, New York, and Pennsylvania; Amtrak; VIA Rail of Canada; and the CSX and NS railroads—to examine an Ohio Hub that would link the HSR systems in the East (Empire, Keystone Corridor, and Northeast Corridors) and the VIA Rail's Toronto-Montreal-Quebec City line in Canada with the Chicago Hub/MWRRI (Figure 2).[59]

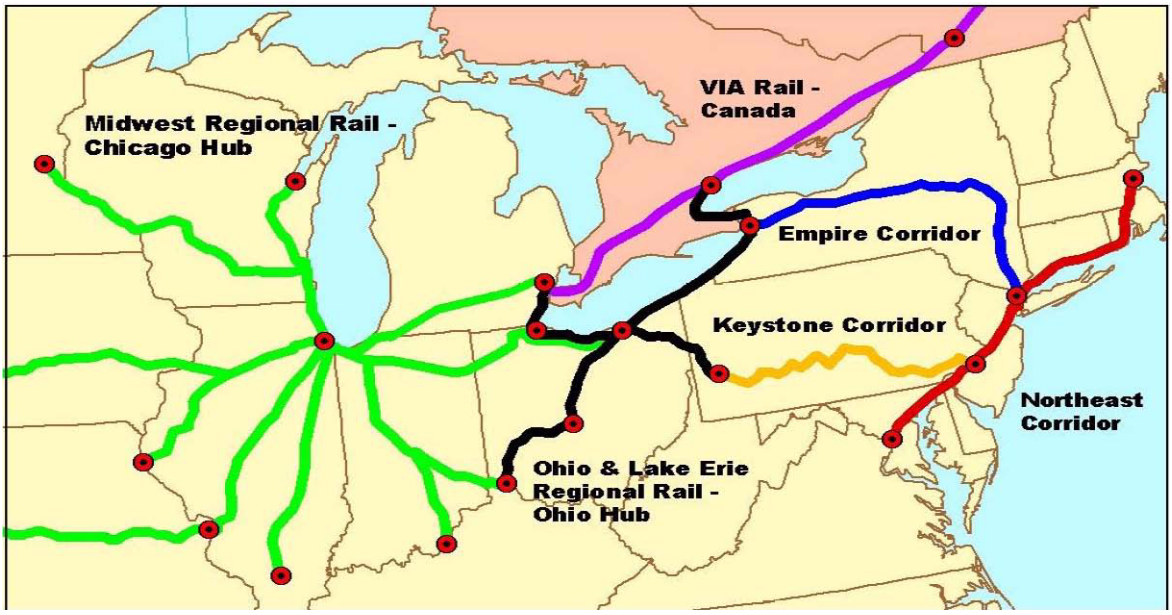


Figure 2 Ohio Rail Hub

Source: ENGAGE Communications, Ohio Hub Passenger & Freight Rail Study: Public and Agency Involvement Report, prepared for The Ohio Rail Development Commission, August 2005, p. 18.

The feasibility study, *The Ohio & Lake Erie Regional Rail Ohio Hub Study*, prepared by TEMS, Inc., and HNTB, Inc., proposes an 860-mile system consisting of four intercity rail corridors that would serve 22 million people in the four states of Ohio, Michigan, Pennsylvania, and New York. The lines would be as follows:

1. Cleveland-Columbus-Dayton-Cincinnati (included in the Chicago Hub)
2. Cleveland-Toledo-Detroit (the Toledo-Detroit portion is included in the Chicago Hub and MWRRI)

3. Cleveland-Pittsburgh
4. Cleveland-Buffalo-Niagara Falls-Toronto (Figure 3)

The study assumes a 20/80 state and federal financing share and notes that the "implementation is contingent upon establishing a national program with funding for federal funding for freight and passenger rail improvement projects."[60] The total cost of the project is approximately $3.2 billion.[61]

The Ohio Hub Plan has not yet been officially recognized by the U.S. DOT. That will not happen until the Tier 1 Programmatic Environmental Impact Study is prepared. ORDC hopes to begin that study later in 2006 or early in 2007.[62]

By connecting the Chicago Hub/MWRRI with the Empire, Keystone Corridor, and Northeast Corridors, the Ohio Hub has the potential to realize the dream of interregional HSR in the United States. At present, no tensions are visible between the proponents of the Chicago Hub/MWRRI and the Ohio Hub, with both hoping for a national HSR program.

Figure 3 Ohio Rail Hub Lines

Source: Transportation Economics & Management Systems, Inc. and HNTB, Inc., *The Ohio & Lake Erie Regional Rail—Ohio Hub Study: Draft Technical Memorandum and Business Plan, Executive Summary*, prepared for The Ohio Rail Development Commission and the Michigan, New York and Pennsylvania Departments of Transportation, October 2004, p. 1.

Indiana, Missouri, and Minnesota

The states of Indiana, Missouri, Minnesota, Iowa, and Nebraska form a group of states that are part of the regional-level high-speed efforts in the Midwest. However, these states have not conducted advanced planning or engineering studies. They have also not made any HSR-related physical improvements. A substantial part of the proposed Chicago-Princeton-Iowa City-Des Moines-Omaha MWRRS line passes through Iowa. The Chicago to Princeton, Illinois, leg of the line would operate trains at speeds up to 90 mph, while the maximum speed from Princeton, Illinois, to Omaha, Nebraska, would be 79 mph—not high enough to qualify as high-speed. Thus the part of the line falling in Iowa is not high-speed. Hence this report will not study Iowa's passenger-rail-related efforts in greater detail. Moreover, Iowa, apart from participating in the MWRRS-related studies, has not conducted any other study or made any line-specific improvements.[63] Similar to Iowa is Nebraska. A very small part of the proposed Chicago-Princeton-Iowa City-Des Moines-Omaha MWRRS line falls in Nebraska, in and around the city of Omaha. The Princeton, Illinois-Omaha, Nebraska leg has a maximum speed of only 79 mph—like Iowa, not enough to qualify as high-speed. Nebraska, like Iowa, apart from participating in the MWRRS-related studies, has not conducted any other study or made any line-specific improvements.[64] The HSR-related efforts in Nebraska are primarily led by the state DOT. Nebraska's passenger-rail-related efforts will not be studied further in this report.

Indiana

Three proposed HSR lines pass through Indiana. They are Chicago-Detroit, with a small part passing through northwest Indiana; Chicago-Cincinnati; and Chicago-Cleveland. All three are included in the MWRRS plan. Chicago-Cincinnati and Chicago-Cleveland were described previously in the section on Ohio. Amtrak operates three daily trains on the Chicago-Detroit line.

Indiana has conducted several public outreach meetings to garner support for HSR in the state. However, it has not made any line-specific infrastructure improvements. Furthermore, Indiana, along with Amtrak and ORDC, was involved in an alternative route study. The study analyzed two different routes between Gary, Indiana, and Toledo, Ohio, in order to determine the best and most cost-effective corridor. The southern route through Fort Wayne was selected as it was found to be most cost effective.[65]

In 2003 the state legislature passed legislation supporting HSR specific environmental impact assessment.[66] The state is currently seeking funding for it.[67]

Missouri

The proposed Chicago-St. Louis-Kansas City line passes through Missouri. It is part of the Chicago Hub as well as the MWRRS. The Chicago-St. Louis leg (only a very small part of it falls within Missouri) has proposed speeds of up to 110 mph. The St. Louis-Kansas City leg has proposed speeds of up to 90 mph. This line is highly congested with freight. Fifty freight trains run on this line per day. Amtrak is the passenger rail operator and operates four trains per day.[68] The train service is supported by the state. It goes along the Missouri river for half the route. Substantial improvements like track expansion will be needed to make it ready for HSR. UP owns the line. UP is primarily concerned about the effect the proposed HSR will have on congestion on this line, although they have not directly raised their concerns with the state of Missouri. They also do not have an official policy on HSR. They have three of their own infrastructure improvement initiatives currently underway or proposed along this route. Two of them are bridge conversion from single to double line. The third involves provision of another yard track in Jefferson City, Missouri. Jefferson City is presently a choke point for freight. While these improvements cannot be attributed to HSR, it may eventually benefit from them.

The St. Louis to Kansas City line is a part of the Chicago Hub. The Missouri DOT is working along with UP to conduct preliminary capacity studies of the line.

Other improvements made by the State of Missouri include the conversion of the St. Louis train station to a multimodal station. The station will serve Amtrak, Metrolink (the light rail), Greyhound, and the city bus. The MWRRS plan, with its higher future ridership estimates, helped in this conversion. All other train stations are owned by cities, except for St. Louis and Jefferson City. Some rehabilitation projects are currently underway in these stations. However these improvements cannot be attributed to HSR.[69]

Missouri DOT is active in the MWRRI and the States for Passenger Rail Coalition. Some of the state legislators are involved in the Midwest High Speed Rail Association. In sum, the state is involved in high-speed-related initiatives because it does not want to be left out as other neighboring states move toward a better passenger rail system. The state would also want to be "in the know" of any new developments in state-supported passenger rail.[70]

Minnesota

HSR-related efforts in Minnesota are primarily led by the state DOT. Part of the proposed Chicago-Milwaukee-Madison-Minneapolis/St. Paul line passes through Minnesota. It is a 110 mph line and part of both the MWRRS and the Chicago Hub. As mentioned

previously, the Madison-Minneapolis/St. Paul leg (via La Crosse, Wisconsin) is owned and operated by CP. It is a "high density" freight line, with more than 3 million annual tons carried. At present there is no passenger rail traffic on this line. According to the Midwest Interstate Passenger Rail Commission,

> Station area planning efforts are taking place in the cities of St. Paul, Cottage Grove and Red Wing where the local agencies are investigating how the expanded rail service can benefit their communities through improved transportation options, economic development opportunities and integration with other passenger rail investments. Federal High Speed Rail safety funding is being used to eliminate five at-grade crossings along the Twin Cities to Chicago Corridor.[71]

Assessment of the Case

As defined in this report, the Midwest's HSR efforts are successful because HSR-related planning continues at the state and regional level. While some states—notably Michigan, Illinois, and Wisconsin—are in the process of implementing HSR-related physical improvements, others have concentrated more on planning and community outreach.

The Goals

The overarching goals of the Midwestern states are to increase connectivity, reduce trip times between major Midwestern cities, and provide multimodal connections to improve system access. The states have done a good job of conducting planning-related studies so that several of the Midwestern rail lines have succeeded in becoming part of the Chicago Hub. As a result, they are now recognized as lines of national significance and are eligible to obtain further federal grants. As several of the lines pass through multiple states, the Midwestern states have moved toward a more regional framework to plan for HSR. These efforts are reflected in the MWRRS and the Ohio Hub plans. The vision and the cooperation at the regional level can help in obtaining broad-based support for HSR. The support, in turn, can help in attracting national attention. However, the critics point out a couple of shortcomings of this vision, including the following:

- High project cost—the present cost of funding the MWRRS plan is $7.7 billion (year 2002 estimates). Similarly, the estimated cost of the Ohio Hub plan is $3.2 billion.

The high-cost result of the regional-level vision is a big stumbling block in obtaining funding for these plans.[72]

- Difficulty buying into the whole plan—some of the lines identified in the plans (for example, Chicago-St. Louis) are logical choices as high-speed lines. However, as Drew Galloway and Merrill Travis suggest, several other lines included in the Hub may not be good candidates for HSR, since they are unlikely to achieve the projected ridership. They propose that instead of pushing forward with the entire regional HSR plan, the Midwestern states would be better served by identifying the most promising city-pairs and demonstrating the feasibility of HSR by actually running high-speed trains on these corridors.[73] This demonstration, they believe, will help in garnering support for HSR in the Midwest. Concentrating on a few city-pairs will also bring the cost of the project down.

Measures of Success

Apart from the revenue generated by proposed high-speed train service, Midwest HSR-related feasibility studies also typically point to such benefits as increased transportation alternatives, mobility, jobs, and real-estate values for the users. However, even proponents of Midwest HSR disagree on which of these benefits will accrue from HSR, which makes it difficult to effectively advocate for the high-speed rail system.[74] Moreover, disagreement on the key benefits may affect the kind of funding the consortium can pursue and could lead to the public and elected officials questioning the success of the project before it has had a chance to prove itself.

An important issue related to the benefits of HSR is credibility. Critics like John Bennett and Joby Berman point out that the HSR-related feasibility studies often exaggerate the benefits while underestimating the costs.[75] They note that the estimated ridership of several of the HSR lines is also suspect.[76]

Funding Sources and Strategies

In addition to affecting the actual implementation of the project, the kind of funding also affects the measures of success. For example, if funding from the "Job Access and Reverse Commute Program" is sought, then the number of jobs the rail system provides access to would determine the potential of success in getting the funding. There are several aspects to funding—federal funding, state and local funding, and private funding. This section reviews how the Midwestern states have fared in obtaining them.

Federal Funding

Until now the federal government has primarily funded HSR efforts in the Midwest through the Federal Railroad Administration (FRA), which has required a 50/50 state and federal match. The FRA has provided technical and financial support to the various corridor-specific and regionwide studies. In 2004, when the MWRRI Steering Committee requested and received FRA planning funds in response to a $250,000 earmark in the fiscal year (FY) 2004 Transportation Appropriation, each of the eight participating states also agreed to contribute $31,250 over three years.[77] These monies have helped the Midwestern states reach a level of preparedness where they are now "funding ready" should further funding be found to move toward implementation.

Importantly, most of the states have not shown the political will to move ahead and fund HSR without federal support. Further, the MWRRS plan is based on the assumption of an 80/20 federal/state match, even though this is unlikely to occur.[78] Finally, it is also important to note that Midwest HSR will require operating subsidies during the initial "ramp-up period." Those opposed to the federal government providing operating subsidies point to the fact that the federal government does not provide operating subsidies to other modes like air and highway (although this excludes the Federal Aviation Administration, with its 100,000-plus employees, providing the nation's air traffic control system for free to the airlines).[79]

Another recent source of federal funding for transit, the Safe, Accountable, Flexible, Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU), represents a case of missed opportunity for rail funding. SAFETEA-LU, which authorizes federal transit and highway programs through FY 2009, was signed into law by President Bush on August 10, 2005.[80] The four aspects of the act important to HSR include the following:

1. Provides a record level of federal transit investment: $52.6 billion over six years, an increase of 46 percent over the amount guaranteed in TEA 21
2. Increases annual guaranteed transit funding from a level of $7.2 billion in FY 2003 (the last year of TEA 21) to $10.3 billion in FY 2009
3. Retains annual funding guarantees to ensure long-term funding stability
4. Improves program delivery[81]

Thus, "even though funds are present, they are not dedicated to passenger rail and there is no mention in the bill about a state rail plan."[82] The interviews conducted with state

department of transportation representatives show that almost none of the SAFETEA-LU money will be spent on the HSR lines in the Midwest.

State Funding

As per the 80/20 federal and state share advocated by the MWRRS and Ohio Hub plans, the funding from the states makes up 20 percent of the project cost. The ability and willingness of the states to come up with their share is important, because in its absence, the possibility of obtaining federal funding is bleak. Getting together their share of the 20 percent is not going to be an easy task for some states that may have to face significant opposition from other organizations within the state and convince an unsupportive legislature.[83] Some states are waiting for the federal money, which they hope will create incentive for obtaining local funding.[84] The problem is further compounded by the fact that the MWRRS and the Ohio Hub plans are primarily technical documents prepared for the state DOTs. Hence, they do not necessarily reflect the states' political leadership's commitment to contribute the 20 percent states' share.

Private Funding

In a few cases, public-private partnerships have been forged to obtain local private funds for HSR-related improvements. A public-private sector venture to rehabilitate and improve the Milwaukee Station is underway. The project is being funded with $2.6 million in Federal Transit Administration and state matching funds along with $1.4 million in equity from Milwaukee Intermodal Partners, a private developer. Another example of private funding and collaboration is the joint contributions of over $20 million by Michigan DOT, Amtrak, and Harmon Industry to share costs of the train control tests on the "Amtrak-owned portion of the corridor between Kalamazoo, Michigan, and the Indiana State line."[85] Likewise, Illinois obtained a $20 million commitment from the nation's freight railroads toward the cost of developing PTC. While some of the Midwestern states, like Illinois, Michigan, and Wisconsin, have been able to leverage private funds, the rest of the consortium members have yet to garner them in any substantive way.

Stakeholders

There are two types of stakeholders—internal and external. Internal stakeholders are the groups and people directly involved in the project. In the case of HSR in the Midwest, they include the federal, state, and local governments; Amtrak; FRA; and private railroad

companies. Internal stakeholders interpret the policy and oversee its implementation. Hence, the role of internal stakeholders is critical to the success of HSR in the Midwest. External stakeholders are the groups and people affected by the project. In the case of the Midwest, they include public and citizen groups, elected officials, special interest groups such as rail passenger and environmental groups, the media, airline companies, bus companies, the automobile lobby, and other local transit agencies. Detailed examination of the roles of each of the stakeholders follows.

Internal Stakeholders

A number of internal stakeholders are involved in the Chicago Hub and MWRRI. The following paragraphs describe them and their roles.

Federal Government

The federal government is a key player. A relevant example is the Northeast corridor, in which Amtrak took the lead and acted as the representative of the federal government. The federal government has two major roles in the provision of HSR in the United States: funder and regulator. While the federal government is playing the latter role through the FRA, it is the former role that is crucial to the success of HSR in the Midwest and the rest of the United States.

Amtrak

Amtrak is a federally subsidized railway company that owns some of the rail right-of-way and runs almost the entire passenger rail service in the United States. In the case of the Northeast corridor, Amtrak was one of the main advocates of the system, and as the direct representative of the federal government, helped fund the system. This is indicative of the potentially important role it can play in the provision of HSR in the Midwest. Amtrak is also an important stakeholder for the following reasons:

- Public opinion of HSR—For a large proportion of people, Amtrak is synonymous with intercity rail. Thus, public perception of Amtrak affects how people perceive HSR in general. Several Midwestern states have had a lukewarm relationship with Amtrak. In several cases, for reasons right or wrong, the public has a low opinion of Amtrak. This low public opinion, in turn, hinders the case of HSR in the Midwest.
- Advocate/partner/stakeholder—In the initial stages of HSR in the Midwest, Amtrak was one of the strongest advocates of the system. This advocacy, over time, turned into a passive partnership. Amtrak at present is not part of any HSR-related efforts in the

Midwest. Amtrak's reticent attitude can be partially attributed to its own failure and partially to the realization that federal funding for HSR is not forthcoming. With its own funding in jeopardy, the role of Amtrak in the provision of HSR in the Midwest is unclear.[86] Moreover, the lack of right-of-way ownership may also be a reason for Amtrak's restricted role in the Midwest. In the case of the Northeast Corridor, Amtrak owns almost all the ROW. This enhanced its ability to implement HSR-related improvements. However, in the Midwest, Amtrak owns very little ROW (96 miles in Michigan), which makes it very difficult to make the improvements necessary for HSR operations. In contrast, on the section for which Amtrak does own the ROW (from near Chicago to Kalamazoo), the improvements made have allowed speeds to increase from 79 mph to 95 mph.

- Operator of HSR—Amtrak owns all the maintenance facilities and the ROW on 96 miles in Michigan. Furthermore, it is the only intercity train operator in the Midwest. It thus becomes one of the foremost contenders likely to operate HSR in the Midwest. There are several reasons for this. First, Amtrak is the only operator in the United States experienced in operating trains at high speeds. Second, it can cross state lines and can do scheduling work.[87] Third, Amtrak already owns infrastructure such as repair yards. It would not make sense for them to lease it out to some other entity.[88] Fourth, Amtrak is the only provider with the right to operate on freight railroad tracks. Additionally, private railroads may like to work with Amtrak since they already work with it.[89]

States and Local Governments

States will play a major role in the implementation of HSR in the Midwest. State and local funding can affect the project on two levels. First, without local financial support, obtaining federal funding would be impossible. Second, several of the states subsidize Amtrak. On one hand, if the states already subsidize Amtrak, spending more on another rail project (albeit a HSR project this time) will not raise much local opposition. Conversely, the states may not be willing to dedicate funds to HSR-related projects if they have already committed substantial funds to subsidizing Amtrak's existing service. In addition to the funding, the following three areas would also need to be addressed.

1. Partnership potential—This is the measure used by the FRA to designate a project as a Federal HSR Corridor. The partnership potential takes into account the kind of agreements between the private ROW owners and the state department of transportation. It also accounts for the ability of these entities to sustain the project

without further subsidy and to achieve a benefit-cost ratio of more than one. The Midwest has the distinction of having several of the lines included in the federally designated Chicago Hub high-speed corridor. This inclusion is indicative of very strong partnership potential.

2. Role of each state and its level of interest and gain from the project—As mentioned earlier, in the Midwest the HSR lines frequently pass through several states. Moreover, the regional HSR plans, such as the MWRRS and Ohio Hub plans, require multiple-state cooperation and coordination for their implementation. Some states, namely, Illinois, Michigan, and Wisconsin, are actively pursuing HSR-related projects, while other states are moving relatively slowly.[90] For example, Illinois and Michigan have been proactive in undertaking HSR-related infrastructure improvement projects, but Minnesota and Indiana have not. This difference in level of activity and interest is reflective of the states' perception of the value of HSR, and the support of their elected officials.
3. Agreements among the states—Several concrete agreements have to be reached amongst the participating states for successful implementation of HSR in the Midwest. First, the states need to decide how they will share the cost of building the system. For example, the Michigan-Detroit-Chicago route crosses Indiana. What should be Indiana's share of the cost? Second, the states need to decide how they are going to collectively run the system—is it going to be a loose confederation of states; a joint power agreement, like Washington DC's Metro; or a firm compact by legislative action? Third, the states would need to find answers to such questions as who will run the system—AMTRAK or some other entity? Who will be responsible for farebox recovery? Will the fares be set at the regional level? How will maintenance affect the system? Who will be responsible for the maintenance? These issues have not been addressed in great detail in any existing policy document (for example, the MWRRS plan). The resolution of all these issues would expedite the implementation process once the funding is obtained.

Private Railroad Companies

Private railroad companies such as UP own or lease almost all the rail lines on which HSR is proposed. These lines are currently used to carry freight and several of them are already congested. Addition of more frequent and high-speed passenger traffic will increase congestion on these rail lines. Furthermore, the freight rail industry is in a growth phase. In the early 1980s, the freight rail industry was deregulated so the onerous fee and rate structure was gone. Globalization of the economy saw the manufacturing industry shift to

Asia. Goods from Asia now come to the West Coast and from there are distributed to the rest of the country via rail. Energy prices too have gone up. Consequently, trains are cheaper than trucks for much long-haul transportation of goods.[91] Furthermore, there is a shortage of long-distance truck drivers because of a high turnover rate. Hence, congestion on the existing freight rail lines is forecast to increase. This congestion can cause delays to the passenger rail. Such a problem currently exists in the St. Louis to Kansas City Amtrak line where 95 percent of the delays occur because of the freight carrier and not Amtrak.[92] Moreover, considerable track upgrades will be needed, and in some cases, new tracks would need to be laid before HSR can run on these lines.

The states would need to enter into detailed agreements with the private railroad companies to address the issue of congestion, and sharing of capital, maintenance, and operating costs. Several of the private railroad companies are wary of the Midwestern states' HSR efforts. Merrill Travis notes that the private railroad companies' reaction to the designation of federal high-speed corridors was a mix of skepticism and concern.[93] NS was concerned about the liability and sharing of the tracks. CSX had seen enormous expansion of commuter rail on its tracks in Virginia and Maryland. As a result, they were concerned about the same thing happening in the Midwest. They insisted on separate tracks for HSR and a high level of liability insurance. UP has been cooperative in the Chicago-St. Louis stretch, because the route does not have heavy freight traffic. The situation is different on the very busy St. Louis-Kansas City line where UP has not cooperated in the HSR efforts. A potentially agreeable though financially expensive situation can be one in which the development of HSR adds more capacity to the already congested freight lines.

Moreover, private railroad companies compete for rail-related funding. Historically, passenger rail was not funded and most of the limited rail funding went to freight rails. This trend is still seen in the way federal funds are allocated. In Missouri, the SAFTEA-LU has money allocated for UP to eliminate highway crossings but nothing specifically set aside for HSR. In Iowa, SAFTEA-LU money will be specifically spent on three freight railroad projects.[94] There is no funding for HSR.

External Stakeholders

In addition to the internal stakeholders, there are also several external stakeholders in the process.

Public and Citizens Groups

Public and citizens groups are among the most powerful stakeholders. They can influence the design of the project by requesting more stations or they can try to change the station design or location. For example, one of the stops on the Chicago-Milwaukee-Madison-Minneapolis/St. Paul corridor is the Madison, Wisconsin, station. The proposed station is in Dane County and the plan is to incorporate the local airport into the station thus making the station multimodal. A group called Dane Alliance for Rail Transit is supportive of the station but wants its location changed to the downtown area.[95] Studies have shown that the airport location is best.[96] This local alliance would have preferred the downtown location to allow better access for local residents (thus making the station similar to a commuter train station). The airport location on the other hand is planned to reduce the air traffic burden on the airport and encourage HSR use.

Some of the Midwestern states like Wisconsin and Indiana have conducted public outreach and found that most people are supportive of the project. Indiana's public outreach meetings were so successful that people wanted to know when the train was coming and why it was taking so long. The ability of Illinois to use the Illinois FIRST bonds for HSR-related upgrades is another gauge of public support for passenger rail. Until now, HSR efforts have not seen any large-scale, organized opposition, but there has also not been widespread public support. Some small communities have opposed HSR if the proposed service does not have a stop in their city.

Elected officials

HSR in the Midwest needs political champions. The Midwest's HSR efforts are primarily led by representatives of the state DOTs. While this leadership makeup might be useful for the initial planning and design stage, the system as a whole needs strong political support if it wants to lobby for federal funding. As mentioned earlier, Tommy Thompson, during his tenure as the governor of Wisconsin (1987–2001), was a strong advocate of HSR. Since then the Midwest has been unable to find a political champion of his stature. At present, some state legislators support and advocate for HSR in the Midwest. As mentioned earlier, the pro-HSR legislators of the Midwestern states, under the auspices of the MLC, came together to form a task force. The task force over the next four years created the MIPRC, which advocates for HSR in the Midwest. The Midwest would need to build upon this political support to be successful in its HSR efforts. Apart from lobbying for federal dollars, political leadership would be needed to form the multistate compacts required to implement HSR.

The role of the elected officials is also important as they have the potential to negatively impact the performance of the system. The low average speed of Amtrak trains is frequently attributed to its politically driven route scheduling. "Most senators treat Amtrak as a low-grade entitlement program," notes one congressional staff member.[97] In the case of HSR in the Midwest, if a train would stop multiple times between Chicago and St. Louis, the chances of it providing a high-speed service would be low. In Europe, high-speed rail serves, on the average, stations located approximately 60 miles apart. This was the rule assumed by Illinois and Michigan DOTs as they planned their services' stopping patterns.[98]

Special Interest Groups

Rail passengers and environmental groups are two influential special interest groups. Rail passengers are playing a vital role as advocates of the system. They have been responsible for wooing the elected officials and conducting outreach. A notable example of their work is the outreach done by the Wisconsin Association of Rail Passengers (WISARP) in Wisconsin. The outreach effort showed a strong support for HSR. "76% of respondents who expressed an opinion said they would be very or somewhat likely to use the train if it were available; 24% with an opinion were very or somewhat unlikely to use the train."[99]

Environmental groups also are important stakeholders in HSR projects. California's example illustrates their influence. In the case of California High Speed Rail, the environmentalists were against the project because the proposed route passed through state parks.[100] Considering the opposition, the California High Speed Rail Authority (CHSRA), in September 2004, decided to postpone making the final route alignment decision.[101] Furthermore,

> the bullet-train proposal and particularly the California HSR Authority have been embroiled in controversy. When CHRSA released its Draft Environmental Impact Report and Environmental Impact Statement in January, 2004, it was immediately criticized for deficiencies and inaccuracies. Critics claimed that CHRSA had paid foreign environmental consultants for supporting opinions of various recommendations included within the report. Accusations of other possible conflicts of interest have brought CHRSA under scrutiny and further complicated the bullet-train proposal.[102]

In the case of the Midwest, collaboration with the environmental groups will be helpful as the states move ahead with the environmental impact studies. The support of the

environmental groups will also help the states gain support for the regional HSR plans (MWRRS and Ohio Hub). Several environmental groups support the MWRRS plan.

Media

The CHSRA example illustrates the importance of using the media. The CHSRA devised a plan for public outreach. In addition to conducting surveys and running focus groups and town hall meetings, the CHSRA has a website and publishes quarterly updates. These efforts have increased public awareness and support for HSR in California. Additionally, "a key element in communicating the Authority's work has been the effort to inform the state's print and electronic media about the project. Nearly 300 print and electronic stories on the Authority and the high-speed train project have appeared since January 1998."[103] In the case of the Midwest, several newspapers already support the project, but this support has to be cultivated further.

Airline Industry

HSR is a potential threat to the airports and airline companies. Over medium distances of 300 to 600 miles, HSR and air travel times may be comparable. The ticket prices can be lower in the case of rail and a train also may offer a more sociable and comfortable environment compared to an aircraft. The chances of a working HSR system are higher if both the modes are compatible and the relationship between them symbiotic. However, such a relationship rarely exists. The French TGV is a classic example of how ridership in trains increased and the air-passenger-traffic volume decreased upon the introduction of HSR (although, at the time of implementing the first French HSR project from Paris to Lyons, the French government was able to order the then state-owned airline to reduce its available seat-miles by 40 percent, which is not an alternative in today's deregulated environment).[104]

Similar fears from Southwest Airlines halted the HSR effort in Texas. In fact, Southwest Airlines was initially an investor and an advocate of HSR in Texas. However, when travel times became comparable, it felt threatened and withdrew support. Similarly, Chicago O'Hare could lose its business to HSR. However, Merrill Travis notes that Chicago O'Hare is heavily congested with a high latent demand. Hence, any effort that eases its congestion is not likely to be opposed by the City of Chicago. He further notes that a large majority of its passengers are traveling from one part of the country to another, not from one Midwestern city to another. In the Midwest, therefore, the airline industry does not stand to lose its traditional customer base to HSR.[105] Moreover, there are opportunities to develop symbiotic relationships between the two modes. A case in point is the General

Mitchell International Airport in Milwaukee. The airport will have an HSR station. This rail station will increase the regional connectivity of the airport, thereby inducing greater demand for air travel. The Midwestern states so far have been successful in forging good relationships with the airports and airline industry. However, the lack of opposition from the airline industry can partly be attributed to the fact that in the Midwest the airline industry does not consider HSR to be an immediate threat.[106]

Bus Companies and Automobile Lobby

HSR-related efforts in the Midwest have been successful in integrating the bus system into its proposed rail network. An example is the multimodal station in St. Louis, Missouri. The station is expected to serve Amtrak intercity rail, Metrolink light rail, Greyhound, and the city bus.[107] This station has come about because of HSR's high future ridership estimates.

The automobile lobby has always very forcefully represented the interests of its constituents. This lobby will stand against investing large sums of money in transit, especially if the funds come at the expense of highways. There has been no visible opposition from this lobby so far. However, this silence does not mean acceptance of HSR by the automobile lobby, but rather is an indication that the automobile lobby, at the moment, does not consider HSR a serious threat.[108]

Other Local Transit Agencies

One of the main transit agencies is the Metra, the commuter rail that operates in the six-county Northeast Illinois region.[109] While on the one hand Metra can increase the local connectivity of HSR and induce ridership, on the other hand it is actively pursuing funding for more commuter lines and, hence, might be considered a competitor for limited rail funding.[110] Furthermore, the Chicago Metropolitan area is very congested with freight, commuter, and intercity passenger rail. HSR will add further congestion unless the number of rail lines increase. CREATE strives to do so by leaving a footprint for HSR. However, at present the future of CREATE is uncertain.

Possible Issues and Next Steps

Looking forward, two areas stand out in which issues probably will arise and next steps need to be addressed. These are the areas of (1) liability and eminent domain and (2) the impact of the design and number of stations on train speed.

Liability and Eminent Domain

Since the HSR lines in the Midwest frequently span several states, the operator of such an HSR service should have the ability to cross these borders and work with multiple private railroad companies. The only entity with the authority to run passenger rail service on private right-of-way without worrying about the liability or eminent domain issues is Amtrak. However, the status of Amtrak is in a state of flux and at present the Midwestern states have no structure, agreement, or policy in place to address this issue.

Station Planning and Train Speed

The design and number of stations has a significant impact on train speed. HSR works best if the end-communities are 300 to 600 miles apart. However, communities that will not be served by HSR or where the train may not stop are likely to oppose it. States could potentially address this issue with more public outreach and education aimed at illustrating the negative effects of frequent stoppages and the positive effects of augmented connections to stations.

THE KEYSTONE CORRIDOR

In terms of the definition utilized in this report, the Keystone Corridor provides a successful example of the development of incremental high-speed rail (HSR) in the United States. Tracing its history with HSR efforts dating back to the 1960s provides a clear picture of the importance of the combined presence of the leadership, the means, and the authority to successfully implement HSR. The Keystone Corridor is illustrative of the role that clear identification of goals and benefits plays in determining successful outcomes.

First designated by the U.S. Department of Transportation (U.S. DOT) as a federal HSR corridor in December 1998, the Keystone Corridor serves as a central connector between the Commonwealth of Pennsylvania's largest city and its capital—Philadelphia and Harrisburg, respectively. The initial designation for the Keystone Corridor covered 104 miles between Philadelphia and Harrisburg and was considered a branch line or "spine" of the Northeast Corridor (NEC), with which it connects at Zoo Interlocking, north of Philadelphia's 30th Street Station (Figure 4). Actually, the two lines developed in tandem during the early 1900s under the ownership of the Pennsylvania Railroad.[111]

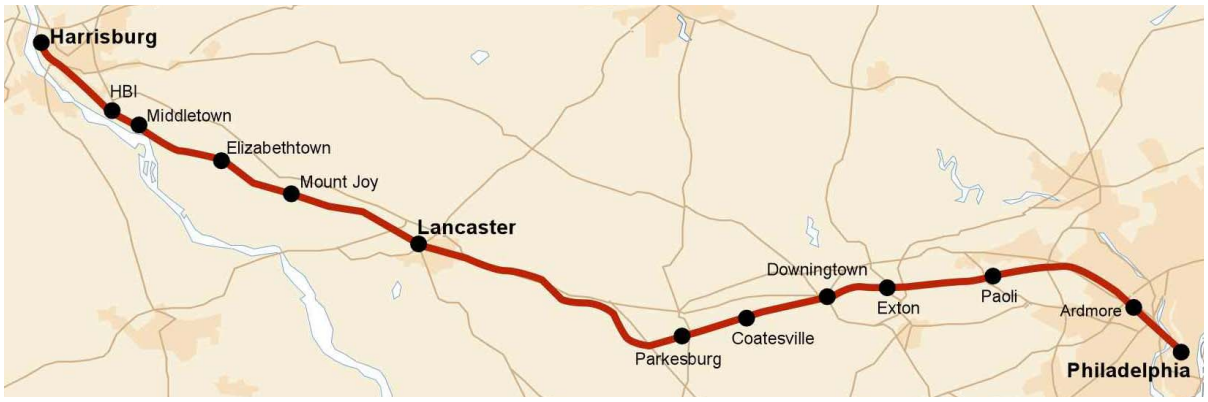


Figure 4 The Keystone Corridor, Philadelphia to Harrisburg

Source: U.S. Department of Transportation, Federal Railroad Administration, *Technical Monograph: Transportation Planning for the Philadelphia-Harrisburg "Keystone" Railroad Corridor*, volume 2 (Washington DC: FRA, March 2004).

An extension of the federal designation to Pittsburgh was approved by U.S. DOT in 2000, for a total corridor length of 349 miles. While Figure 5 depicts the entire federally-designated corridor, in regular usage related to HSR, "Keystone Corridor" refers only to the portion shown in Figure 4. Thus, throughout the remainder of this section, unless

otherwise specified, "Keystone Corridor" will refer to the 104-mile section between Philadelphia and Harrisburg.

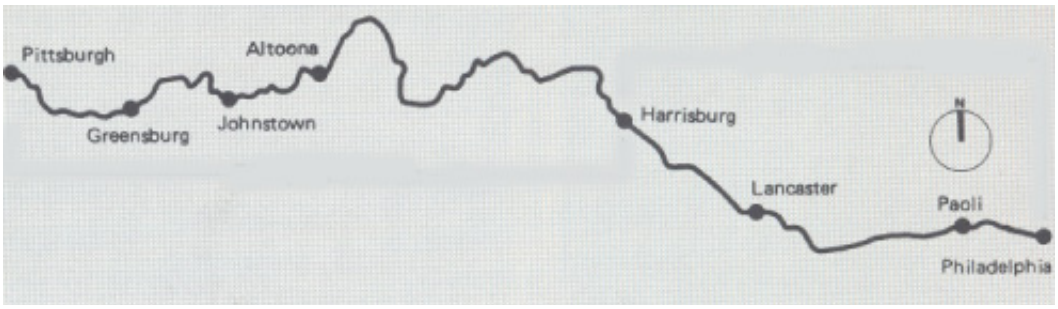


Figure 5 The Keystone Corridor, Philadelphia to Pittsburgh

Note that the current maximum mph on the section between Philadelphia and Harrisburg is 110 mph.

Source: Parsons Brinckerhoff/Gannett Fleming, *Pennsylvania High Speed Rail Feasibility Study: Executive Summary, Phase 1*, prepared for the Pennsylvania High Speed Intercity Rail Passenger Commission (February 1985), p. 4.

THE CONTEXT

Current high-speed efforts are focused on the 104 miles of track between Philadelphia and Harrisburg. This portion of the line, which also serves Lancaster and nine other intermediate cities, is owned by Amtrak (National Railroad Passenger Corporation), electrified, and almost completely grade-separated from highway traffic. There are currently eleven daily Amtrak trips between Harrisburg and Philadelphia, eight of which continue to New York City, running along the NEC main line (from Washington DC to Boston). Amtrak's Keystone Corridor ridership (which includes those traveling from Harrisburg to New York City) increased by over 20 percent between fiscal year (FY) 2003 and FY 2005, rising from 886,003 riders to 1,068,572.[112] (Amtrak's fiscal year runs from October 1 through September 30 of the following year.) Also using the line is the Pennsylvanian service, connecting New York and Pittsburgh, which had 213,413 riders in FY 2005.[113] Until recently, Amtrak also ran the Three Rivers service—linking New York City, via Philadelphia and Pittsburgh, with Chicago—along the corridor, but this service was terminated in March 2005 as part of a broader effort aimed at reducing mail and express trains to save money and focus on passenger service.

Between Philadelphia and Harrisburg, Amtrak has full operating control over the line, including dispatching, transportation supervision, and maintenance of way. Several other entities also use the line or sections of it. In terms of passenger rail, the most heavily

trafficked portion of the corridor is the easternmost section between Philadelphia and Thorndale (just west of Downington). Southeastern Pennsylvania Transportation Authority (SEPTA) has operating rights for its commuter rail system between Philadelphia and the Cork Interlocking near Lancaster and pays a monthly fee for use of the corridor and traction power. In FY 2005 (July 1 through June 30 for SEPTA), SEPTA paid Amtrak approximately $9 million for access to the Keystone Corridor; it paid an additional $13.4 million for access to the NEC. These fees are derived from monthly payments based on a fixed number of train miles (85,000 ±10 percent) plus a cost for excess miles beyond the specified limit. In addition, SEPTA also pays separately for the purchase of electric propulsion power provided by Amtrak. In FY 2005, this amounted to an additional $7.5 million combined for the Keystone Corridor and NEC.[114]

By an agreement between SEPTA and Pennsylvania Department of Transportation (PennDOT), revenue service is prohibited west of Parkesburg and actual commuter rail service runs between Philadelphia and Thorndale. While Amtrak runs 11 daily trains along the entire corridor, SEPTA runs roughly 100 trains each day along the easternmost section of the corridor, between Philadelphia and Thorndale or Paoli. This translates into a daily weekday ridership of 23,284.[115] Thus, annual ridership levels for SEPTA on this portion of the line were well over six times that of Amtrak's entire Keystone Corridor service in 2005.

Along the section beginning at Philadelphia and ending at Thorndale, Amtrak makes stops at 5 stations—Philadelphia, 30th Street, Ardmore, Paoli, Exton, and Downington. SEPTA makes stops at 23 stations, which are leased by Amtrak. In fact, Amtrak owns all the stations along the entire Keystone Corridor between and including Philadelphia's 30th Street Station and Harrisburg.

Two freight railroads also have operating rights on all or part of the corridor: Norfolk Southern (NS), which owns the nonelectrified portion of the corridor from Harrisburg to Pittsburgh as well as all the nearby branch lines, and Delaware & Hudson/CP Rail, which has operating rights between Roy Interlocking near Middletown and the Division Post at Harris Interlocking in Harrisburg.[116] Norfolk Southern's principal activities on the Philadelphia-Harrisburg portion of the corridor are centered around Lancaster, servicing primarily local freight moving along the corridor. NS does not operate freight east of the Glen Interlocking (Milepost 25.3, just east of Exton), but it has and maintains the rights to do so in the future.

Though NS freight traffic is variable, there are between 5 and 12 train movements daily over parts of the corridor between Philadelphia and Harrisburg, again mainly around Lancaster. West of Harrisburg, the freight picture is markedly different, with 75 daily trains moving over this section of the corridor. Roughly two-fifths of these (34 to 36 daily) are intermodal trains, the fastest growing portion of NS business. Another way to compare the two segments is in terms of gross tonnage. In 2003, NS reported 4 million gross ton miles (gross ton mile = one ton hauled one mile) in Lancaster, and 107 million in Altoona, Pennsylvania (90 miles northwest of Harrisburg).[117]

History and Development of the Corridor

The Keystone Corridor traces its roots to the early 1800s and was initially envisioned as a means for competing with New York's growing success in tapping the Midwest via the newly built Erie Canal.[118] Electrification of the line came roughly a century later. In the early 1900s, the Pennsylvania Railroad (PRR) conducted a feasibility study of electrification of the line between Philadelphia and Pittsburgh, but the work was postponed as other priorities emerged.[119] In 1915 the PRR electrified the section between Philadelphia and Paoli, the main commuter rail area. When the decision was made to pursue electrification on the remainder of the line, the PRR determined that the most cost-effective approach would be to electrify the line to Harrisburg, but not beyond. By 1938 the eastern section of the Keystone Corridor between Philadelphia and Harrisburg was fully electrified.

The First Attempt at HSR

In the mid-1960s, in response to the Federal High Speed Ground Transportation Act, the Commonwealth of Pennsylvania began exploring opportunities for high-speed ground transportation in the state. In February 1967, Westinghouse Air Brake Company (WABCO) presented to the Pennsylvania Commerce Department a study on HSR. The study proposed implementing HSR service between Philadelphia and Ohio, with trains that could run up to 150 mph, on a right-of-way (ROW) that would parallel the Pennsylvania Turnpike and use the Pennsylvania Railroad ROW. The plan was never implemented, but the commonwealth and the PRR did agree to jointly fund the purchase of electric-powered "Capitaliner" coaches, identical to the "Metroliner" coaches being implemented on the NEC.[120]

The commonwealth agreed to provide $2 million, while the PRR would provide the remaining $2.5 million for the purchase of the coaches. While awaiting the new coaches (the Metroliner became available on the Northeast Corridor in 1969), the PRR would utilize electrified commuter cars from SEPTA. The latter part of the agreement was instituted, but before the coaches could be delivered, the PRR merged with the New York Central Railroad, becoming Penn Central. When Penn Central declared bankruptcy on June 21, 1970, the agreement fell apart and the Capitaliner coaches came to be used as part of the Metroliner service on the NEC. Ironically, though the SEPTA commuter cars remained in usage for several more years, they were eventually replaced by the original Metroliners as upgrades were made on the NEC.[121]

On April 1, 1976, the Philadelphia-Harrisburg portion of the Keystone Corridor was conveyed by the Penn Central Transportation Company to Consolidated Rail Corporation (Conrail) by the U.S. Railway Administration. One month later, it was transferred to Amtrak as a branch line of the NEC. In the initial years following the transfer, Amtrak spent roughly $30 million on improvements which allowed the maximum authorized speed to be raised to 90 mph on sections of the line.[122] Nevertheless, overall service on the corridor remained poor and ridership dropped significantly between FY 1980 and FY 1990, from 1,024,700 to 334,963.[123]

Though most of this decrease in ridership occurred before 1988, ridership fell further as a result of Amtrak's decision that year to substitute diesel locomotives on most of its Philadelphia-Harrisburg trains, because it was experiencing a shortage of electric-powered locomotives. The change necessitated a shift in the end-point of the line within Philadelphia, from Suburban Station, which was more centrally located but could only be accessed by electrified service, to 30th Street Station. Those riders who wanted to continue to Suburban Station now had to transfer trains. Between 1987 and 1989, almost 100,000 additional riders were lost.[124]

As Amtrak ridership plunged, expenses on the corridor continued to outpace revenues. According to a U.S. General Accounting Office (U.S. GAO) fact sheet developed for Senators Arlen Specter and John Heinz, in FY 1985, based on fully allocated costs (including depreciation, overhead, corporate costs, and retirement), the Philadelphia-Harrisburg line lost $26.8 million.[125] It is no surprise that by the late 1980s, Amtrak was considering ending its intercity service between Philadelphia and Harrisburg.

A Second Attempt at High-Speed Rail

While Amtrak was deciding what to do with its service on the corridor, the Pennsylvania legislature entered into an Ohio-led, multistate compact on high-speed rail on June 22, 1980. Other states in the "Interstate High Speed Intercity Rail Passenger Network Compact" included Illinois, Indiana, Kentucky, Michigan, Missouri, New York, Tennessee, and West Virginia. The member states would "share jointly the administrative and financial responsibilities of preparing a feasibility study concerning the operation of such a system" connecting the major cities in these states.[126] The vision was for a networked HSR system that would link the Northeast through Pennsylvania and Ohio to the Midwest.

Pursuant to the discussions with the other compact members, State Representatives Rick Geist (R, 1979–) and Joseph Kolter (D, 1969–1982) sponsored legislation to establish a Pennsylvania High Speed Intercity Rail Passenger Commission (PHSIRPC) as a means for fulfilling the commonwealth's obligations to the Compact. The legislation, which was adopted unanimously and signed into law (Act 144) by Governor Dick Thornburgh (R, 1979–1987) on December 22, 1981, stipulated that the commission would have "overall responsibility, power and duty to investigate, study and make recommendations concerning the need for and establishment and operation of a high-speed intercity rail passenger system in the commonwealth." It further noted that the commission, "without limiting its authority to study related subjects," would address the following issues:

- Need and demand for high-speed intercity rail in Pennsylvania
- Level of HSR service required to meet that demand
- System, equipment, roadbed, ROW, and other technical and technological options
- Location and extent of specific routes
- Cost of implementation
- Economic impact
- Financing, ownership, and operating options
- Impact and interaction of HSR on existing freight rail and existing or proposed passenger rail systems
- Present or proposed operation of similar systems in the United States and abroad
- Issues and problems relating to local and commuter rail service, including funding[127]

Two years later, the PHSIRPC began its work when Robert J. Casey became the Executive Director on February 14, 1983. With $4.2 million in state, federal, and international funding, the commission issued a Request for Proposals (RFP) on April 23, 1983, for a general engineering consultant to perform a feasibility study that would address need, demand, levels of service, system equipment and ROW requirements, cost, economic impacts, and financing. On June 28, 1983, Parsons Brinckerhoff/Gannett Fleming (PBGF) was selected to do the study, with the contract formally executed two months later. In addition, the commission also hired STV Engineers, Inc., to serve as an oversight consultant to assess PBGF's findings.[128]

The feasibility study was split into three phases that would take place over roughly three years. Phase 1 would provide a broad framework and assess the feasibility of various HSR options. Phase 2 would develop a detailed market survey, along with cost estimates and technical requirements based on a more detailed evaluation of the ROW and technology options presented in Phase 1. Phase 3 would focus on implementation, with a financial package, an assessment of the resulting economic development that could be spurred by HSR in the corridor, and recommendations related to ownership, operations, and coordination with other agencies.[129]

The Phase 1 report was released in February 1985. It presented the results of an examination of five alternatives, identified as Alternatives A through E. Alternative A was the baseline, "do nothing" alternative and was used only as a reference point for the others. Alternative B described the best service that could be achieved with minor improvements on the existing ROW without dedicated high-speed passenger tracks. This alternative was eventually dropped because it fell short of the commission's goals. Alternatives C, D, and E all described various types of HSR service on different alignments as shown in Table 5.

Table 5 Attributes Related to HSR Alternatives C, D, and E

Feature	C: Best Service on Existing ROW	D: Best Service on New ROW w/ Steel-Wheel on Steel-Rail Technologies	E: Best Service on New ROW with Maglev
ROW	Existing alignments but dedicated passenger tracks	Existing alignments for portion; new alignments elsewhere	Existing alignments for portion; new alignments elsewhere
Power Type	Diesel or Electric	Electric	Electromagnetic suspension (EMS) or Electrodynamic suspension (EDS)
Fleet Type Possibilities	Canadian LRC (tilt-body)—diesel British HST—diesel American AEM-7 Canadian Electric LRC W. German ET 402 Italian ETR 401 British APT	French TGV Japan series 961 German Intercity Experimental (IC-E)	West German-built EMS Japanese- or Canadian-built EDS
Speeds	120–155 mph	180 mph	250 mph
Trip Time—Pittsburgh to Philadelphia[a]	4 hours	3 hours, 15 minutes	2 hours, 15 minutes
Ridership Projections, Year 2000 (base/high)	4.2 million/10.3 million	5.1 million/11.7 million	5.9 million/12.7 million
Capital Cost—Target Estimates[b]	$1.85B–$2.20B (depending upon diesel or electric option)	$8.7B	$12.1B
Source: PBGF, *Pennsylvania High Speed Rail Feasibility Study: Preliminary Report, Phase 1*, prepared for the Pennsylvania High Speed Intercity Rail Passenger Commission (February 1985).			

a. The trip time between Pittsburgh and Philadelphia on the then-current service offered by Amtrak was 7 hours.

b. Capital Cost Estimates are for base demand in 1983 dollars and include track/guideway and structures, stations, electric traction, signals and communication, maintenance facilities, vehicles, and engineering & construction management.

Alternative D was assessed both with and without a stop at State College. (The table shows information without State College.) While this stop would have resulted in an additional 10 to 12 minutes for the overall trip times and cost an additional $77 million to build, it was estimated that it could add as many as 616,850 riders annually, with corresponding revenues of up to $155.9 million in its first year of operation (estimated for 1997).[130]

The preliminary financial analysis provided in the Phase 1 report suggested that Alternative C, with the diesel option, would provide a 9 percent risk-free rate of return.[131] Alternative C with the electric-powered option was slightly less but still acceptable. However, Alternatives D and E had much higher risk and much lower rates of return associated with them. As the Executive Summary of the report suggested, "…with their greater total public benefits but only somewhat greater cash revenues, [Alternatives D and E] are more suitable to a public financing viewpoint."[132] Alternative C, on the other hand, had the potential for a public-private partnership that could leverage available public support and tax benefits to woo private investment. Thus, Phase 1 scoped out a preliminary financing strategy for Alternative C.

The Phase 1 report suggested that a private enterprise would construct, own, and operate the HSR service under Alternative C. The commonwealth could provide a $350 million loan, with an interest rate of 7 percent over 38 years. Other institutions, which were not identified, would provide loans of $1.1 billion, with interest rates of 13 percent over 38 years. The private enterprise would make an equity investment equal to the loan provided by the commonwealth, assuming base demand, with another $40 million needed to meet the high demand projections. Funding for new and/or enhanced stations along the route would be derived from real estate developers and/or local governments.[133]

Seventeen months after the Phase 1 report was issued, PBGF presented their report, *Pennsylvania High Speed Rail Feasibility Study: Market Demand,* supplemented by *Market Demand: Technical Memorandums,* as part of the work being conducted under Phase 2. The analysis followed the "Standard Guidelines for Revenue and Ridership Forecasting" that were concurrently being developed by the High Speed Rail Association (and were approved in September 1986) in response to the varied quality and comprehensiveness of earlier HSR revenue and ridership forecasts.[134]

The market demand analysis reviewed the different market segments, including trips made for the purposes of commuting, business, tourism, schools, or other types of trips. It assessed travel behavior and the likelihood of new HSR being able to change that behavior. Two items stand out from this report:

- First, the estimated ridership for these alternatives was modified after this additional analysis. New projections for base demand in the year 2000 increased, while projections for high demand decreased. The new projections for HSR (Alternative D in Phase 1) were 5.5 million (up from 5.1) for base demand and 7.8 million (down from

11.7) for high demand; for Maglev (Alternative E in Phase 1), the revised projections were 6.2 million (up from 5.9) and 8.8 million (down from 12.7), respectively.[135]

- Second, and more interesting in terms of the broader dynamics involved with HSR planning in the commonwealth, though the earlier Phase 1 report suggested that Alternative C was the only one conducive to private investment given the rates of return and levels of risk, the market demand report focuses on Alternatives D and E (though they are not labeled as such), further noting that "it was assumed that public and private support will be necessary to actually implement a major transportation improvement…."[136]

Why there is an apparent disconnect between the Phase 1 initial analysis and the discussion in the market demand study is unclear. *Market Demand* was only part of Phase 2, which was never fully completed, so there may have been other information that was not included in the document. More likely, however, this apparent disconnect reflected different views and priorities within the commission, and a shift in the perceived prospects for financing that occurred after the drafting of the Phase 1 Report.

Some evidence for this latter conjecture is apparent in the commission's final report. As one of its last official acts, the PHSIRPC voted for Maglev as its first choice; however, it recognized that "a substantial minority" of the commission's members believed the commonwealth should consider alternatives strategies if financial assistance was not forthcoming. Among the findings, the report notes "a modest upgrading of Amtrak service would offer significant travel-time improvements and may be least expensive, but it provides the least economic benefit among the options studied."[137] This reveals the different goals and objectives, which likely were prioritized in differing orders by the various commission members. Finally, the Chairman's report provided at the beginning of the final report noted that "speed sells," while later discussion regarding financing suggested that there had been overtures made by the West German magnetic levitation consortium, Transrapid International. The commission recommended that the commonwealth authorize negotiations with Transrapid on financial assistance.[138]

Regardless, the recommendations were "dropped" even before they were formally announced in the commission's final report. The final report was published two years after Governor Robert Patrick Casey (D, 1987–1995) entered office and terminated the commission's staff, in effect halting the work on the HSR study. Interestingly, the Governor felt the need to take this action four months before the commission's mandated

expiration date of December 31, 1987.[139] No reason was publicly stated; there was speculation that airline interests may have been involved, but this was always denied.[140]

The actual reason behind the governor's decision to close down the project may never be known. However, it is clear that the combined presence of the leadership, the means, and the authority to implement HSR was missing in Pennsylvania's earlier HSR initiatives. This would continue to remain a challenge for the next decade.

The Most Recent Attempt—Incremental Rail

By the early 1990s, the situation had improved somewhat in terms of overall losses, but operating ratios for Philadelphia-Harrisburg in fiscal years 1994 and 1995 were still as high as 4.23 and 5.76, respectively.[141] Operating ratio is defined as expenses divided by revenues. Thus a ratio less than 1 means a line was profitable and more than 1 means a line lost money. In the case of the Philadelphia-Harrisburg line, Amtrak's expenses were over four times more than revenues in FY 1994 and over five times higher in FY 1995. During those same years, Amtrak's direct operating costs outpaced revenues by $8.4 million (FY 1994) and $8.6 million (FY 1995).[142] Further, as a result of deferred maintenance (in excess of $170 million by the mid- to late-1990s), the infrastructure continued to deteriorate. Maximum authorized speeds dropped as low as 70 mph in several locations along the line, with actual speeds significantly lower.[143]

In 1995, believing the corridor to be strategically important to the state's overall transportation system, the Commonwealth of Pennsylvania entered into an agreement with Amtrak to increase the state's operating assistance on the Keystone Corridor. Pursuant to the agreement, PennDOT increased its operating subsidies to $2.6 million per year primarily to increase frequency of service on the Keystone Corridor and to make capital improvements.[144] (The agreement is now updated on an annual basis.) Even with the subsidies from PennDOT, the operating ratio for Philadelphia-Harrisburg in FY 1997 was 2.15, with a $22 loss per passenger ($41 without the subsidy).[145]

During this same period, PennDOT began to develop a vision for incremental improvements on the corridor, believing that the Keystone Corridor was a "diamond in the rough." PennDOT undertook several surveys to determine what passengers on the line wanted and found that new equipment would be most welcome. They also contracted with R. L. Banks & Associates to conduct a study on the corridor that would provide additional background and assessment on what needed to be done and what could be done.[146]

In 1997, R.L. Banks & Associates, et al. submitted to the Commonwealth of Pennsylvania the *Keystone Corridor Assessment & Business Plan*. The report provided an assessment of the infrastructure at the time, the value and potential value of the corridor as a transportation and economic development resource, various institutional options for management, operations, and ownership, and a draft business plan. It determined that the Keystone Corridor was "a unique resource, requiring only improved maintenance and expanded service to realize its potential more fully."[147]

The report described the corridor's state of disrepair, noting that scheduled trip times between Philadelphia and Harrisburg were 10–12 minutes longer in 1997 than in 1950. The report provided cost estimates for bringing the line to a state of good repair (SOGR), identifying both priority and other necessary improvements. It provided additional estimates for initiating 90-minute service at 110 mph, as well as for service at equal to or greater than 125 mph (Table 6).

The resulting business plan was premised on four potential scenarios that included frequencies and service levels rather than just speed. The plan reviewed SOGR with 10 daily round-trips and SOGR plus improvements to allow 110 mph service, with 10 daily round-trips (4 express); 12 daily round-trips (5 express); or 14 daily round-trips (6 express) (Table 7).

Organizationally, the business plan suggested that the Commonwealth of Pennsylvania should seek ownership of and management responsibility for the Keystone Corridor's intercity passenger rail service between Philadelphia and Harrisburg, and that it should contract out operations of passenger rail service. It further suggested that the physical assets of the corridor acquired from Amtrak be placed under the ownership of a new public entity, with local municipalities operating and maintaining stations along the route. The report recognized the need for negotiating the ROW with Amtrak and the possibility that federal legislation would be necessary to allow this to occur.[148]

Revenues and financing for the capital improvements would come from several sources. First, ridership was expected to increase over the next decade, and with the proposed changes, it was expected that it would range anywhere from just below 400,000 to just over 845,000 by 2005, depending upon whether improvements included SOGR only or 110 mph service, and whether the low estimate, best estimate, or high estimate was used.[149] Capital projects would be financed with 30-year bonds, and federal and state government grants were also expected. Additional revenue sources would derive from the parking facilities at a number of the stations on which it was expected that a fee would be

levied, from utility occupations of the railroad ROW, and from advertising and concessions.[150] Table 6 shows the estimated costs to bring the Keystone Corridor to SOGR and then potentially add high-speed rail service.

Table 6 Costs of SOGR and High-Speed Service (millions of 1996 $)[a]

Component	SOGR	110 mph Service (incremental cost)	125 mph Service (incremental cost)
Track	$93.4	$9.4	$19.3
Structure	16.1	3.9	8.2
Stations	0.9	26.7	0
Signals/Communications	33.8	0.5	12.4
Power Supply/Distribution	3.6	0.6	0.7
Engineering (7%)	10.3	2.9	2.8
Contingency (10%)	15.8	8.8	8.7
Total	$173.9	$52.8	$52.1
Source: R.L. Banks & Associates, et al., *Keystone Corridor Assessment and Business Plan: Executive Summary*, Submitted to the Commonwealth of Pennsylvania DOT, December 23, 1997, pp. 6–7.			

a. Excludes rolling stock.

Table 7 Service Alternatives under SOGR

	SOGR	110 mph	110 mph	110 mph
Frequency (round-trips/day)	10 local no express	6 local 4 express	7 local 5 express	8 local 6 express
Trip time savings (minutes)	4 local	13 local 33 express	13 local 33 express	13 local 33 express
Ridership, Best Estimate 2005 (trips)	576,300	635,000	748,600	807,700
Annual Fare Revenues, Best Estimate 2005 ($ millions)[a]	$5.1	$5.9	$6.9	$7.4
Annual Operating Expenses, 2002 ($ millions)[a]	$11.1	$11.5	$13.0	$13.2
Source: R.L. Banks & Associates, et al., *Keystone Corridor Assessment and Business Plan: Task IV Business Plan*.				

a. in 1996 dollars

With respect to the final recommendations of the business plan, the general feeling within PennDOT at the time was that unless Amtrak was going to stop their services or end in some fashion, the state would prefer to work with Amtrak on the corridor and resulting services, rather than taking them over. Thus, while utilizing some of the information from the business plan and strengthening its focus on more modest improvements to enhance overall service, PennDOT entered into formal discussions with Amtrak regarding the future of the corridor.

Keystone Corridor Improvement Plan—Memoranda of Agreement

In December 1998 the Keystone Corridor received designation by U.S. DOT as a federal HSR corridor, providing the possibility of reinvigorating the line. In September 1999 the Federal Railroad Administration (FRA) allocated $500,000 to begin preliminary designs to eliminate the three remaining at-grade public crossings on the corridor between Philadelphia and Harrisburg. In the same year, Amtrak and the Commonwealth of Pennsylvania entered into a Memorandum of Agreement (MOA) and a Supplemental MOA, which together outlined the objectives and general responsibilities of PennDOT and Amtrak (then being led by George Warrington) in the Keystone Corridor Improvement Program (KCIP).

Based on the MOA, Amtrak and the Commonwealth of Pennsylvania announced a joint $140 million infrastructure and equipment upgrade program to reduce trip times from over 2 hours to 90 minutes by 2004; enhance stations at Harrisburg, Elizabethtown and Lancaster; and improve the overall reliability of service in the corridor.[151] Both the commonwealth and Amtrak would share the costs equally, with $56 million (80 percent) of Pennsylvania's portion funded by the Federal Transit Administration (FTA).[152]

At the time, the Keystone Corridor and other HSR efforts around the country were viewed by Amtrak as supporting its five key business strategies, which were the following:

1. Building a market-based network
2. Developing corridor services
3. Delivering consistent quality service
4. Revitalizing the Amtrak brand
5. Leveraging public-private partnerships[153]

Work on the track improvements was to begin in 2000, with the first AEM-7 locomotive trainsets placed in service by the end of the year. However, it quickly became clear that

Amtrak might have difficulty upholding its part of the Agreement, given its worsening financial crisis and the possibility of a shut-down of Amtrak service. In fact, on January 13, 2000, PennDOT provided close to $3 million in emergency funding to finance Amtrak's internal costs in administering the planned work.[154]

Keystone Corridor within PennDOT's Statewide Planning

During this same period, PennDOT was reviewing its overall statewide transportation planning process, with a view toward developing an integrated multimodal plan involving highways, rail, aviation, waterways, and freight and passenger services. In January 2000, PennDOT issued *PennPlan Moves! Pennsylvania Statewide Long-range Transportation Plan, 2000–2025*, which identified ten statewide goals:

1. Promote the safety of the transportation system.
2. Improve the environment.
3. Retain jobs and expand economic opportunities.
4. Make transportation decisions that support land-use planning objectives.
5. Maintain, upgrade, and improve the transportation system.
6. Inform and involve the public, and improve customer service.
7. Advance regional and corridor-based planning.
8. Develop transportation alternatives and manage demand.
9. Promote smooth, easy connections between transportation alternatives.
10. Ensure accessibility and reliability of the system for everyone.[155]

The plan identified a number of specific objectives and potential projects tied to these goals. Among them were several directly related to the Keystone Corridor:

- Objective 14—Improve physical and service upgrades on the Keystone Corridor
- Objective 19—Eliminate grade crossings
- Objective 20—Develop a passenger rail needs assessment

Of note, the improvement of the physical and service upgrades on the corridor was believed to serve all the above goals except for number six.[156]

In December 2001, the *Pennsylvania Statewide Passenger Rail Needs Assessment* (Objective 20) was formally issued. Its purpose was to provide a broad evaluation of the need for statewide intercity passenger rail in key transportation corridors. The plan prioritized the corridors; developed a baseline comparison across the corridors; developed profiles for those with

high potential; and identified needs and opportunities, as well as future policy considerations for intercity passenger rail service within the commonwealth.[157]

After reviewing existing intercity rail services within the commonwealth—Keystone Corridor (Harrisburg-Philadelphia); the Northeast Corridor (Boston-NYC-Philadelphia-Washington DC); the Capitol Limited Corridor (Chicago-Pittsburgh-Washington DC); the Lake Shore Limited Corridor (Chicago-Toledo-Erie-Buffalo-Albany-NYC/Boston); and the Pennsylvanian-Three Rivers Corridor (Chicago-Pittsburgh-Harrisburg-Philadelphia-NYC)—the assessment evaluated existing, proposed, and potential intercity rail corridors. It established five criteria with varying weights for comparing corridor potential. In descending order of import, the five criteria included the following:

1. Infrastructure and ROW availability
2. Major destinations and trip generators
3. System continuity and connectivity
4. Market size, population, employment trends
5. Transportation patterns and conditions[158]

The Philadelphia-Harrisburg Keystone Corridor was given a high rating on all five factors. It was already heavily used by intercity and commuter rail, particularly between Philadelphia and Paoli. Outside of Philadelphia, which experienced a decrease, population had grown along the entire corridor between 1990 and 2000, with the largest increases in Chester (15.2 percent); Lancaster (11.3 percent); and Montgomery (10.6 percent) counties.[159] The trend was expected to continue. The report made an oblique reference to the discussions between PennDOT and Amtrak, noting that electric-powered Metroliner trainsets were expected to be placed in use on the line, providing for higher speeds.

Of note, the report gave mixed marks for the Harrisburg-Pittsburgh portion of the Keystone Corridor, scoring it high on ROW, system continuity, and transportation patterns, but medium on major destinations and market size, noting that the line primarily served through passengers traveling between Chicago and Philadelphia, rather than intrastate traffic. It also noted that most of the counties along this corridor were experiencing population declines and that there were serious challenges in terms of steep grades and shared use of the tracks by passenger and freight trains.[160]

Several months after the report was issued, in April 2002, the Commonwealth of Pennsylvania and Amtrak entered into a formal agreement based on the earlier MOA and Supplemental MOA. The terms of the agreement included the following:

Funding

- PennDOT and Amtrak would jointly fund the KCIP, with specific program elements identified. (Table 8 shows the funding share; Table 9 shows the funding schedule.)
- That station construction, reconstruction, renovation, and rehabilitation would be dealt with under a separate agreement, though the total contributions were delineated in the agreement.[161]

Table 8 Funding Share of KCIP Program Elements ($ millions)

Program Element	Amtrak	PennDOT	Total
Equipment	$36.5	$5.0	$41.5
Stations	3.3	1.7	5.0
Infrastructure			
Track[a]	11.0	36.4	47.4
Communication & Signals (C&S)	3.0	15.3	18.3
Electric Traction (ET)	8.0	3.0	11.0
Buildings & Bridges (B&B)	2.6	2.0	4.6
Program Management	3.6	4.6	8.2
Contingencies	2.0	2.0	4.0
Program Total	$70.0	$70.0	$140.0

Source: "Agreement Between the Commonwealth of Pennsylvania Department of Transportation and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program," April 4, 2002, Exhibit A.

a. PennDOT's share of the track work includes $2,986,535 provided in January 2000 as emergency funding.

Responsibilities

- Amtrak would be responsible for managing the implementation of the program and all related construction work.
- Amtrak would be responsible for performing all project work associated with the program elements identified.
- Amtrak would provide necessary labor and materials.
- An annual capital plan, specifying the sources of program funding and the specific elements, would be agreed upon for each 12-month period, beginning October 1 of each year.[162]

Table 9 Funding Schedule ($ millions)

	3/18/02–9/30/02	10/1/02–9/30/03	10/1/03–9/30/04	10/1/04–9/30/05	10/1/05–9/30/06	Total
Amtrak	$0	$20	$20	$15	$15	$70
PennDOT	$30	$10	$10	$15	$5	$70
Total	$30	$30	$30	$30	$20	$140

Source: "Agreement Between the Commonwealth of Pennsylvania Department of Transportation and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program," April 4, 2002, Exhibit A.

Program Design and Implementation

- Amtrak would develop the overall KCIP and would define program element parameters and goals in consultation with PennDOT, the freight railroads, SEPTA, FTA, and FRA.
- Amtrak would be responsible for providing or coordinating the planning and design of the program, with PennDOT actively facilitating or obtaining required governmental approvals on behalf of Amtrak.
- Certain provisions allowed Amtrak to make changes to program elements or projects either unilaterally or in consultation with PennDOT, depending upon increased costs.[163]

Marketing, Advertising, and Publicity

- PennDOT and Amtrak agreed to cooperate in planning and designing signage and other informational materials needed to disseminate information about the project and partnership. Related costs would be allocable to each party's share of funding.
- While Amtrak would consult with PennDOT on marketing strategies for the Keystone Corridor service, Amtrak would be responsible for "advertising, marketing, pricing, and promoting" the service to maximize revenue, "including marketing the service under the Acela brand."
- Amtrak would have full control over the interior design and passenger amenities, as well as exterior design of the equipment.[164]

Amtrak approved a $20 million capital plan and, as per the agreement, developed a separate agreement to close the three remaining public highway-grade crossings by 2006. (There are still three private crossings and one pedestrian crossing.) The Commonwealth of

Pennsylvania budgeted $9 million for this part of the effort.[165] Design work for the grade crossings began in 2004, several years behind the schedule developed in *PennPlan Moves!*, which had initially targeted December 31, 2003, as the date by when all the crossings would already be closed. (The current time frame for these closures is 2008/2009.)

Much Perseverance, Some Serendipity, and the Real Work Begins

By September 2003 only $21.38 million had been spent of the $60 million that had been scheduled, $14.14 million by PennDOT and $7.24 million by Amtrak. According to David Gunn, former CEO and president of Amtrak, the key reasons for this delay stemmed from the lack of a firm managerial commitment to the KCIP on the part of Amtrak, as evidenced in part by the vague timetable in the Agreement which did not clearly and firmly outline timetables for specific projects within the overall program.[166] In other words, the combined presence of leadership, authority, and means were still lacking.

The delay in this program exacerbated PennDOT's already existing frustration with the project, which stemmed from an earlier set of discussions in which PennDOT had approached Amtrak about upgrading the catenary system on the corridor so it could place electric-powered locomotives back in service. Amtrak responded with cost estimates that were significantly higher than those provided by several independent contractors and refused to modify their figures. As a result, PennDOT decided to forego the upgrade to the catenary and issued an RFP for new diesel units, only to have Amtrak come back to them several years later with a revised and lower-cost proposal that would make use of Amtrak's cars and locomotives.[167]

Recognizing the continued importance of the corridor and the need for improvements regardless of Amtrak's ability and/or willingness to move forward, Governor Edward Rendell (D, 2003–) announced in October 2003 that another $3 million would be directed to passenger rail service between Harrisburg and Philadelphia as part of a broader $125 million capital budget aimed at improving public transportation.[168] In the meantime, the leadership at Amtrak had changed, with David Gunn taking over as president and CEO of the corporation in May 2002.

PennDOT remained committed to improvements on the Keystone Corridor while Gunn was focused on bringing all of Amtrak up to an "adequate level of maintenance and service" across the entire system. In the early months after taking over at Amtrak, Gunn took a trip to Pittsburgh on the Keystone Corridor and "for the first time really sat back and looked at the corridor." He was, in his words, "embarrassed by what I saw—it was

absolute chaos. There was junk everywhere, there was garbage in the ditches, the ROW was overgrown, and because the track was in bad shape, the ride was rough."[169]

Upon returning to Washington, Gunn approached Drew Galloway, Senior Director of Strategic Planning at Amtrak, and told him that something had to be done on the corridor and that Amtrak needed to develop a plan. Gunn was aware of PennDOT's long-time interest in improving service on the Keystone Corridor. Working closely with Richard Peltz, then Deputy Secretary for Local & Area Transportation at PennDOT, who had been leading the effort on the corridor for some time, Amtrak developed a plan that would improve service and infrastructure along the corridor, and would also fit the budget under the earlier agreement between PennDOT and Amtrak. SEPTA was also brought into the discussion with the hope that they would finance improvements on the local commuter tracks between Paoli and 30th Street Station in Philadelphia.[170]

In July 2004 a joint announcement was made by Governor Rendell and Gunn of an amended $145.5 million plan under which costs would be split equally between Amtrak and PennDOT.[171] As with the original agreement, the key goals of the project were to reduce local trip times from 2 hours to 1 hour and 45 minutes (now by fall 2006); introduce ninety-minute express service; and increase the number of Amtrak trains from nine to thirteen.[172]

The amendment provided a formal set of production goals and objectives and added a new section for additional planned improvements as follows:

- Amtrak and PennDOT would work with SEPTA to "develop an interim stabilization program of short-term improvements to Tracks 1 and 4" (the outside local tracks) of the corridor between Paoli and Philadelphia's 30th Street Station, to be performed during FY 2005 and FY 2006. Thereafter, the three agencies would develop a long-term program to ensure the reliability of the infrastructure in SEPTA territory.
- Amtrak and PennDOT would work with Norfolk Southern Railroad to "develop policies and a program of short-term improvements to the Keystone Corridor which would enable increased utilization of the corridor by Norfolk Southern."
- Amtrak and PennDOT would work together to develop a long-term plan of capital improvements for the corridor.[173]

The total funding for program elements, as well as the funding schedule, shifted under the Amendment (Table 10 and Table 11). Given the tremendous needs in infrastructure, it was decided that the monies previously identified for other purposes would be reprogrammed

under Track; Communication and Signals; Electric Traction; and Structures (formerly Buildings and Bridges). Equipment and station improvements would be dealt with through separate agreements, and likely separate funding sources. Moreover, beyond FY 2004, though Amtrak remained responsible for overall program management, it no longer budgeted monies out of the $145.5 million for this, again reallocating these funds to other needs while absorbing the related costs.

Table 10 KCIP Program Element Costs, 2002 vs. 2004 ($ millions)

Program Element	2002 Agreement	2004 Amendment
Equipment	$41.5	– –
Stations	5.0	– –
Infrastructure		
Track[a]	47.4	$104.88
Communication and Signals (C&S)	18.3	21.40
Electric Traction (ET)	11.0	8.96
Buildings and Bridges (B&B) (2002)/ Structures (2004)	4.6	10.26
Program Management	8.2	– –
Contingencies	4.0	– –
Program Total	$140.0	$145.5

Source: "Amendment No. 1 to the Agreement Between the Commonwealth of Pennsylvania and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program," Exhibit A.

a. PennDOT's share of the track work includes $2,986,535 provided in January 2000 as emergency funding.

More importantly, specific projects within each of the program elements were also identified, along with clear time lines for each and expenditures tied to them (Table 12). For example, replacement of jointed rail with continuously welded rail (CWR) along key stretches of the line was planned primarily for FY 2004 and FY 2005, while final track installations at the Cork and Roy Interlockings were scheduled for FY 2005–FY 2007 and FY 2006, respectively.[174]

With this commitment from the highest levels of Amtrak and PennDOT, the program began to move more swiftly, and in December 2004, based on a financial analysis of planned and actual expenditures, the funding schedule was again revised (Table 13). This time, a number of expenditures were moved ahead and the time line for project completion looked like it would not only be met, but would likely finish ahead of schedule for at least some elements.

Table 11 Revised Funding Schedule ($ millions)

	10/1/99–9/30/03	FY 2004	FY 2005	FY 2006	FY 2007	Total
Amtrak	$7.60	$2.58	$30.96	$28.56	$3.05	$72.75
PennDOT	$14.20	$10.62	$23.64	$21.24	$3.05	$72.75
Total	$21.80	$13.20	$54.60	$49.80	$6.10	$145.50

Source: "Amendment No. 1 to the Agreement Between the Commonwealth of Pennsylvania and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program," Exhibit A.

Table 12 Program Elements: Total Expenditures per Time Period ($ millions)

	10/1/99–9/30/03	FY 2004	FY 2005	FY 2006	FY 2007	Total
Track	$15.364	$8.584	$45.070	$33.860	$2.000	$104.878
C&S	$3.206	$0.496	$5.700	$9.500	$2.500	$21.402
ET	$1.406	$0.954	$2.000	$3.000	$1.600	$8.960
Structures	$1.819	$3.171	$1.870	$3.400	$0.00	$10.260
Total	$21.795	$13.205	$54.640	$49.760	$6.100	$145.500

Source: "Amendment No. 1 to the Agreement Between the Commonwealth of Pennsylvania and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program" Exhibit A-1, pp. 1–3.

Table 13 December 2004 Revised Funding Schedule ($ millions)

	10/1/99–9/30/03	*FY 2004*	**FY 2005**	**FY 2006**	**FY 2007**	**Total**
Amtrak	*$7.24*	*$12.26*	$33.08	$18.55	$1.65	$72.75
PennDOT	*$14.14*	*$8.63*	$29.77	$18.55	$1.65	$72.75
Total	*$21.38*	*$20.89*	$62.85	$37.10	$3.30	$145.50

Source: "Amendment No. 1 to the Agreement Between the Commonwealth of Pennsylvania and National Railroad Passenger Corporation for The Keystone Corridor Improvement Program" Amtrak Financial Analysis, December 22, 2004. (Columns with italics are actual expenditures, others are planned expenditures.)

Planned improvements summarized under the $62.85 million budgeted by Amtrak for work in FY 2005 are summarized in Table 14.

Table 14 Planned Work on the Keystone Corridor in FY 2005

Item	Unit(s)
Automatic Block Signal (ABS)	14 track miles
Catenary Hardware Renewal	9.5 miles
Concrete Ties Installed	164,000
Interlockings Improved/Reconstructed	2
Rail Replacement	65 miles
Substations Improved	3
Turnouts Replaced	25
Undergrade Bridges Improved	5

Source: Amtrak, *FY05 Comprehensive Business Plan*, p. 19, http://www.amtrak.com/pdf/fy05businessplan.pdf (accessed 12/8/05).

A Federal Review of the Keystone

While Amtrak and PennDOT moved forward on the KCIP, a separate exercise was being pursued at the FRA. The 1996 Appropriations Act mandated a comprehensive transportation plan for the southern end of the NEC, between Washington and New York City. In 1998, the FRA, in conjunction with Amtrak, PennDOT, and SEPTA undertook a technical study of the Keystone Corridor between Philadelphia and Harrisburg that could serve as a resource document for planning on the NEC main line as well as for the Keystone Corridor branch.

The final technical monograph was released in March 2004, while the current KCIP was well underway. Nevertheless, some of the findings bear mentioning. Focusing on the Keystone Corridor as a branch of the NEC, and recognizing that a number of trains already connect from Harrisburg, through Philadelphia, to New York City, the study noted that the link between the Keystone Corridor and the NEC could be made much smoother and the Keystone Corridor could take further advantage of potential capacity. The study identified two broad categories of improvements—corridor-wide improvements and site-specific improvements—which would help to further reduce trip times and make the transition to the NEC easier. The report estimated a cost of just over $680 million (1998 dollars), but that tally did not include all of the suggested improvements described in the report, nor did it provide for a funding mechanism for these enhancements.

Many of the corridor-wide improvements—track geometry; track structure; highway/railroad grade crossings; electrification; signaling and train control; support facilities; and stations—are being addressed under the current project, at least partially if not fully. However, several site-specific improvements were recommended that would further enhance HSR operations. Among them were the following:

- Reactivation and upgrading of the existing bypass (Figure 6) of the 30th Street Station for Harrisburg-New York City trains—The bypass, referred to as the New York-Pittsburgh Subway was used as recently as 1994 by Amtrak, but has since been abandoned. Reintroducing it would allow faster trip times between Harrisburg and New York City.

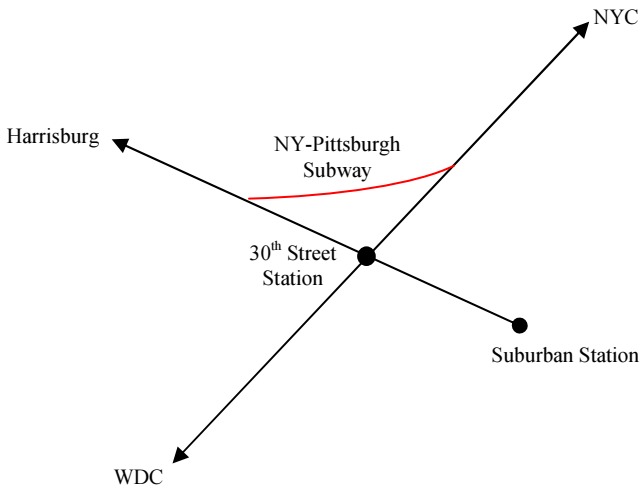


Figure 6 Bypass of 30th Street Station

Source: U.S. DOT, FRA, *Technical Monograph: Transportation Planning for the Philadelphia-Harrisburg "Keystone" Railroad Corridor, Volume 1* (Washington DC: FRA, March 2004), p. ES-6.

- Upgrade interlockings with high-speed crossovers—The goal would be to raise the speed limits from 30 mph to 45 mph, reducing overall trip times for HSR and improving reliability. The KCIP is addressing interlockings at Cork and Roy; the FRA technical monograph suggested reconfigurations at Bryn Mawr and Glen, as well as several new interlocking locations.
- Track realignments—Between Philadelphia and Paoli, the line has four tracks; between Paoli and Parkesburg, there are two or three tracks, depending upon location; and between Parkesburg and Harrisburg, the corridor has two tracks. As is typical, in the four-track area, faster HSR and express commuter trains primarily utilize the center two tracks, with slower local trains utilizing the outer two tracks. However, express trains moving in both directions must change tracks repeatedly in the area of Zoo Interlocking in order to access the upper level of 30th Street Station. According to the FRA study, this results in a loss of about 1 1/2 minutes for each track change. To reduce the number of track changes, the westbound express track (Track 3) would need to be restored and extended through Zoo Interlocking and a high-speed connection would have to be created between the eastbound local and express track (Tracks 1 and 2).[175]

Additional changes would be needed at Paoli station, which is accessible only from the local tracks, and immediately beyond which the center two express tracks from Philadelphia end. Currently, express trains continuing past Paoli must also make several

track changes, as must those coming from Harrisburg through Paoli. Reducing the number of track changes, by creating new passenger platforms accessible from the express tracks, would again reduce trip times. Similar steps would be needed at Lancaster and Harrisburg stations, again to reduce divergent moves.[176]

The monograph ends by reaching several of the same conclusions that formed the basis for the KCIP already in progress. The monograph notes that "reliable, frequent 90-minute service… between Harrisburg and Philadelphia's Suburban Station would be feasible…" and that "establishment of high-speed intercity services would not degrade, and could in fact improve, existing or proposed Keystone Corridor commuter services…."[177] Interestingly, the report's final conclusion states the following, differing somewhat in focus from the current effort:

> The proposed 90-minute Harrisburg-Philadelphia schedule, while an achievable goal, is not immediately essential to the implementation of meaningful Keystone Corridor service improvements. Intermediate upgrades—including, for example, higher-performance electric-powered equipment, direct through trains between Harrisburg and New York, and service to Center City Philadelphia—would represent tangible progress to the traveling public and might be achievable much sooner than a 90-minute timing.[178]

Unlike the KCIP, the federal report does not develop a formal plan for reaching these goals.

Current Status of the KCIP

On September 12, 2006, Governor Rendell and Amtrak jointly announced the completion of the major components of the Keystone Corridor upgrade. At that time, 264,000 ties had been installed (roughly four-fifths concrete and the remaining wood); roughly 200 miles of CWR had been installed; 14 miles of the catenary had been renewed; and over 20 miles of new signal cable had been installed.[179] The interlocking at Lancaster identified for improvement or reconstruction in FY 2005 was close to finished, as was the interlocking at Roy. The track layout to be rebuilt at Lancaster Station to separate freight and passenger operations, and the installation of Automatic Block Signaling (ABS) were all on track for completion, as were plans for finishing installation of the fiber optic system that will support high-speed communications along the corridor.[180] This last component, combined with the new signal system, will allow much more efficient use of the line. In

the past, each track was signaled in only one direction and multiple separate towers managed train movements along the line. The signal and communications improvements, once made, will allow for centralized management of the system, which will make more efficient use of the tracks in both directions and be less prone to human error. Considerable operational cost savings will also be achieved since the outdated system of towers and operators will no longer be needed.

While initial progress had been somewhat slower than initially planned, as a result of inadequate Amtrak cash flow and insufficient commitment, work during the past few years has progressed more quickly. Not only are the upgrades practically complete, but electric-powered trains will be placed in revenue service and three additional trips will be added on October 30, 2006. Speeds will be increased to 110 mph for much of the line, with corresponding trip times of 90 minutes for express trains and 105 minutes for local trains between Philadelphia and Harrisburg.[181] (In comparison, it takes roughly two hours without traffic to drive the same route.)

In terms of the goals that were added under the amendment for additional improvements, a joint SEPTA/Amtrak Capital Program has been agreed to in principle, with an estimated cost of $380 million. A portion of the work that will complement work already programmed in the KCIP by Amtrak and PennDOT commenced in FY 2006, with a four-year time line for completion. SEPTA's share of the cost of this portion is $81 million (equal to what PennDOT and Amtrak are spending on their related KCIP programmatic component).[182]

Amtrak and PennDOT have also been working with the freight railroads along the corridor to address their needs and concerns. Freight movements and freight rail movements continue to increase across the country and within the region. Moreover, more freight is now being moved with intermodal doublestack and truck trailers on flat cars (TOFC), which require higher and wider vertical clearances as well as greater weight allowances than previously. If these three areas are not sufficiently addressed, freight rail providers could see themselves "frozen out" of potential capacity expansion along the corridor.

This is of particular concern for Norfolk Southern, which maintains its rights to carry rail freight east to Philadelphia along the Keystone Corridor should it so desire in the future.[183] For this reason, NS was willing to add $2 million to the current KCIP. Amtrak agreed that if NS provided this investment in bridge improvements, Amtrak would lift the current 263,000-pound weight restriction on rail cars and allow for the contemporary

weight limit of 296,000 pounds. (The restriction is expected to be lifted by the end of 2006.) In the meantime, PennDOT is currently involved in a study to determine where along the line current clearances do or do not allow for doublestack (typically requiring 20'6" clearances) and TOFC (typically requiring 17'6" clearances), and what might need to be done.

Continued Challenges

Two key areas remain outstanding in terms of the agreement and *PennPlan Moves!*, and each poses some challenges for Amtrak, PennDOT, SEPTA, and the freight railroads. First, the remaining grade crossings still have not been closed. To address this issue and try to advance the plans and implementation process, Amtrak and PennDOT recently signed a separate MOA on the grade crossings that will allow Amtrak to work directly with PennDOT's engineering districts in the areas in which the grade crossings exist. PennDOT hopes that this will help move the project forward more quickly; its new goal is to have these grade crossings closed within the next two to three years.[184]

Second, the station enhancements are still being designed and debated. Several key concerns have arisen based on earlier designs, particularly related to horizontal clearances. At least two NS customers in the area require "dimensional" loads (that is, wider than the typical rail car, or in trucking parlance, "over-dimensional"): a steel mill in Coatesville that produces and ships plate steel, and Hyde Park Foundry, which is located east of Lancaster and receives dimensional steel shipments.

Currently, the three stations under review have ground-level boarding. Thus, there are no horizontal clearance limitations. However, because of requirements under the Americans with Disabilities Act (ADA), newly built or refurbished train stations must now provide full-length high-level platforms to allow for access, as well as ADA-compliant means for reaching these platforms. Such platforms would limit horizontal clearances, and dimensional loads would not be able to pass these stations. To date, all the plans have these features.

There are methods for accommodating ADA passenger requirements as well as dimensional freight rail. In Newark and Cranford, New Jersey, along the Raritan Valley Line, for example, there are two stations with full-length raised-level island platforms with gauntlet tracks, which allow two sets of tracks within the same structure. Though it does not provide a pictorial with an island platform, Figure 7 depicts a gauntlet track in Germany to provide a sense of how such tracks function. Gauntlet or interlaced tracks are

treated as a single track operationally (since two trains cannot occupy the tracks at the same time), but they can allow passenger trains to use the set of tracks closer to the platform while freight trains utilize the set further away to allow for wider clearances. Gauntlet tracks, however, are expensive to maintain.

Figure 7 Example of Gauntlet Tracks

Source: Transit Cooperative Research Program, Research Results, Digest 47 (March 2002), p. 18.

Also, according to the FRA's technical monograph on the Keystone Corridor, FRA policy on gauntlet tracks is as follows:

> Only if the railroad has historically handled (typically in the last ten years) wide-load clearances and the wide loads must use a track adjacent to a high-level platform, need a gauntlet track be constructed; and in that case, only one gauntlet track is needed.[185]

On September 1, 2005, the Federal Transit Administration issued disability law guidance, which included the following language:

> In cases where there are concerns about accommodating freight trains (including over-dimensional loads) through commuter or intercity rail stations, commuter and intercity rail operators should employ solutions that accommodate both types of traffic in the presence of full-length high-level platforms, such as gauntlet or bypass tracks, unless doing so is technically or operationally infeasible.[186]

A less expensive alternative is the use of bridge plates, but it appears that these may not meet newly proposed federal requirements (February 2006) for intercity rail stations. Another potential solution is a hinged-edge platform (often combined with a mini-high platform: a small raised platform that allows individuals with disabilities to board the train at car level) whereby a several-inch width of the platform can be lifted up for passenger rail and then put down to provide additional width to accommodate freight rail.

How the new federal requirements plays out in terms of the three scheduled station enhancements and other stations in the future, and what the implications are for freight rail along the corridor, remain to be seen.

Assessment of the Case

As defined in this report, the Keystone Corridor is a success—plans for incremental HSR continue to move forward and steps are being taken to fully implement an HSR system along the line. While the initial goal is for 110 mph service, many of those involved suggest that once this service is fully running, there is potential to increase maximum authorized speeds to match those on the NEC, (up to 150 mph in places). Further, while it is still too early to determine whether all of the original program goals will be met, many of them have been met ahead of the final schedule or soon will be successfully addressed. It is worth nothing that in terms of service improvements, which is what all the other improvements ultimately support, the frequency of trains has already increased from nine to eleven, with two additional trains on schedule for service in fall 2006. Electric-powered trainsets are on schedule to be introduced at the end of October 2006 with 90-minute express service and 105-minute local service.

A number of factors have contributed to this success. However, before reviewing them, it is helpful to briefly discuss one additional attribute that, while not necessary or sufficient, may still have contributed to success in this particular case: the existence of the Keystone Corridor within one state.

From the earlier Pennsylvanian experiences in the mid-1960s and again in the mid-1980s, it is clear that the existence of the corridor in only one state was not in itself sufficient for HSR to be successfully implemented along the Keystone Corridor. This finding is borne out by the experiences of other potential HSR Corridors contained within one state such as Florida, Texas, and California. In each of these cases, the existence of the corridor within one state was not sufficient to help in implementing HSR. Given the experience of the NEC, which involves multiple states, it is likely that existence of the corridor within one state is also not necessary. Nevertheless, while not necessary or sufficient, the fact that the Keystone Corridor is contained within one state may have contributed to success by greatly simplifying the political, economic, and technical coordination involved with implementing HSR once other factors fell into place.

Those factors that clearly contributed to the success of the Keystone Corridor and hold lessons for other HSR initiatives are explored in the following paragraphs.

Leadership, Means, and Authority

Leadership, coupled with the means and the authority to implement change, is perhaps the most important set of factors contributing to the current success of this HSR effort. Any one of them alone would have been insufficient to implement the program currently underway. Indeed, part of what makes the most recent experience with HSR in the Keystone Corridor different from earlier attempts in the 1960s and 1980s is that all three of these factors came into play at the same time. In the earlier years, there was some leadership, but either the means and/or the authority was lacking. In the 1960s, even the leadership was questionable, but certainly, as the various railroads declared bankruptcy, the authority and means were lacking. In the 1980s experiment, the commission was mandated to expire even as it was established, which called into question its authority and again, while it might have had the means to pursue incremental rail, it did not clearly have the means to pursue the recommended Maglev.

In the most recent case, however, David Gunn at Amtrak, Richard Peltz at PennDOT, and Governor Edward Rendell played key roles in galvanizing support and demonstrating a serious commitment to HSR. The funding was available and the authority was present. Amtrak owned the line and viewed the Keystone Corridor improvements as fitting into its broader goals for the nationwide system. The Commonwealth of Pennsylvania, via PennDOT, was already actively providing financial support for Amtrak operations along the corridor. (In FY 2006, PennDOT will be supplying $6.5 million in operating

assistance to Amtrak.) Further, PennDOT had been exploring opportunities for the Keystone Corridor for some time and had the support from the Governor based on the broader goals and objectives identified under the 25-year transportation plan.

Clear Benefits and Roles for Operators

All of the key operators along the Keystone Corridor see some benefit accruing from the project, even though they maintain concerns. Among these benefits, Amtrak will be able to increase and enhance service on the corridor, with potential corresponding ridership and revenue increases. PennDOT will be able to realize several key objectives related to its broader transportation goals for the corridor and for the commonwealth. Norfolk Southern Corporation remains watchful of the vertical and horizontal clearance and weight restrictions, but recognizes that the signal, communications, and track improvements along the line will also aid their operations by making the entire corridor more efficient. Similarly, SEPTA remains concerned about overall capacity as the numbers of intercity trains also increase and the lack of incentives for on-time performance, but again, it recognizes the benefits to its own services as track, communication, and signal improvements are made.

With respect to roles, in the most recent effort, there has been a clear division of responsibilities in implementing the program and related elements. The KCIP, as ultimately developed, designated agency responsibilities, in terms of both payments and overall management of the project. The additional $2 million funding solicited from NS was tied specifically to work that would benefit the freight railroad by allowing for greater weights; the additional funding contributed by SEPTA has also been specifically tied to improvements that will help commuter rail.

ROW Prepared for High-Speed Service

The Keystone Corridor was already electrified and almost fully highway-grade separated. Though Amtrak had begun using diesel trains on the corridor in 1988, the catenary remained in place. As a result, the opportunity already existed, at a much lower cost than would otherwise have been the case. Further, according to the FRA, the corridor "does not represent a new service, and as the contemplated improvements lie mainly within the existing right-of-way, many of the potential betterments may ultimately prove to be exempt from environmental requirements."[187] Avoiding such environmental requirements

can reduce time and costs for implementation of additional improvements, while helping to reduce political and/or community opposition.

A clear counterpoint for this is provided by the remainder of the corridor, from Harrisburg to Pittsburgh. This portion of the line is characterized by numerous curves, steep grades, at-grade crossings, and no electrification. Just bringing the tracks and power supply up to current standards for HSR service would be significantly more difficult and therefore more expensive.

Amtrak Owns the ROW

In contrast, not owning the ROW has been a key difficulty for HSR in Florida. With full operational control of the Keystone Corridor between Philadelphia and Harrisburg, Amtrak is able to more easily deal with signaling, dispatching, power distribution, and maintenance decisions affecting this segment of the line. Further, when the agency implementing the changes is the actual operator of the service, the direct benefits from investment are often easier to surmise.

The western portion of the Keystone Corridor again provides a counterpoint. Norfolk Southern owns the corridor between Harrisburg and Pittsburgh and as a matter of policy requires separate tracks for passenger trains operating in excess of 90 mph. According to NS,

> No heavy-duty rail freight line has 110 mph passenger trains operating over it today. Where freight trains do operate over 110 mph track (Northeast and Empire Corridors, for example), the penalties imposed on freight trains are substantial. In a heavy-duty freight environment (Cleveland-Chicago is one example), high-speed passenger trains must operate over tracks dedicated to their use.[188]

Making such changes would significantly add to the cost of implementing HSR along this portion of the line and there are fewer incentives for doing so.

Reasonable Costs Budgeted

The costs to reach the 90-minute trip-time and 110 mph speed goals were considered reasonable. This, along with the factors previously discussed—Amtrak ownership of the ROW, electrification, and grade separation—and the decision to pursue modest changes resulting in incremental HSR rather than new HSR or Maglev, enabled both Amtrak and PennDOT to fit the costs of the program into their annual budgets. They thereby avoided

the need for major political campaigns to raise financial support for the project. When it became clear that some of the infrastructure costs were greater than anticipated, they had the flexibility to allow a redistribution of the budget to cover these costs from other line items that would be dealt with in future years.

THE NORTHEAST CORRIDOR

As defined in this report, the Northeast Corridor (NEC) is clearly a successful example of incremental high-speed rail in the United States. Indeed, it is one of the few examples of HSR actually being implemented and the only case that reaches a maximum authorized speed of 150 mph. (Typically, incremental high-speed rail [HSR] in the United States aims at 110 mph or occasionally at 125 mph.) The NEC case illustrates the importance of federal political and financial support when implementing HSR across multiple states as well as the difficulties that arise when there are multiple goals. The NEC is also helpful in demonstrating the importance of the combined presence of leadership, means, and authority for implementing HSR. While there was a period in which all three components were present, the NEC has also lacked one ore more of these components at different times throughout its history.

Because HSR has been running for some time along the NEC, the following discussion goes a step further than those of the other cases examined (in the current and previous studies) and examines whether the NEC is successful in terms of the full complement of HSR goals initially developed for it. On that score, it appears "success" is more mixed.

Indeed, whether service on the NEC constitutes true HSR is still debated. While the maximum authorized speed (MAS) is as high as 150 mph in three sections of the corridor (a combined total of 33.9 miles in Rhode Island and Massachusetts), there are also segments where the MAS is well short of that. Maximum authorized speeds are 90 mph or below for just over half (127.1 out of 226.9 miles) of the section between New York City (NYC) and Boston. To provide a frame of reference, even if trains could run at maximum speed for all segments along the line between New York City and Boston, they would average only 82 mph.[189] Further, because trains need to decelerate and accelerate around curves and when entering and leaving stations, and because on any given day there may be additional speed restrictions, actual speeds are often slower.

DEFINITIONS AND CONTEXT

Before providing the geographic and operational context of the Northeast Corridor, it is helpful to provide a brief background of the policy context in terms of what the NEC means for HSR more broadly in the United States. As the only location within the United States that has high-speed service with maximum authorized speeds of 150 mph even if in

a relatively short segment, the NEC has been viewed as the critical test for HSR. As Michael Saunders of the Federal Highway Administration (and formerly with the Federal Rail Administration) noted, many believed that if HSR could be shown to work on the NEC, especially between New York City and Boston, it could help generate support for HSR elsewhere. Conversely, if HSR could not succeed on the NEC, even after the tremendous investment, we would be unlikely to see the development of true HSR in other U.S. locations."[190]

Geographic and Operational Context

Legally, the NEC is composed of three segments: the main line right-of-way (ROW) between Washington DC and Boston, Massachusetts; the branch line referred to as the "spine segment" between Philadelphia and Harrisburg, Pennsylvania (also referred to as the Keystone Corridor); and the branch line referred to as the "nonspine segment" between New Haven, Connecticut, and Springfield, Massachusetts. At times, the New York City-Albany, New York corridor, referred to as the Empire Corridor, is also included. However, in common usage, NEC tends to refer to the main line only. For the purposes of this study, since the Keystone Corridor is assessed as a separate case, *the NEC is defined strictly as the main-line ROW* unless otherwise noted.

Running between Washington DC and Boston, Massachusetts, the NEC is the busiest rail line in the United States, as well as one of the most complex operationally. Crossing eight states and the District of Columbia, the NEC is used by over 700,000 intercity and commuter riders daily (200 million annually).[191] At the geographic center of the 456-mile corridor is New York City, the most populated city in the United States.

Amtrak (National Railroad Passenger Corporation) service on the NEC connects with its service on the Keystone Corridor (Philadelphia-Harrisburg, Pennsylvania) and the Empire Corridor (New York City-Albany, New York). The NEC also hosts or connects with other long-distance intercity rail service to Chicago, Montreal, Richmond, New Orleans, and Miami. Amtrak routes that run fully or in part along the corridor include Acela Express, Metroliner, Regional, Keystone Corridor, Carolinian, Piedmont, Silver Star, Silver Meteor, Palmetto, and Crescent. In fiscal year (FY) 2005, combined ridership on the Acela, Metroliner, and Regional services was 9.5 million, just over 37 percent of the total U.S. Amtrak ridership (25.4 million).[192]

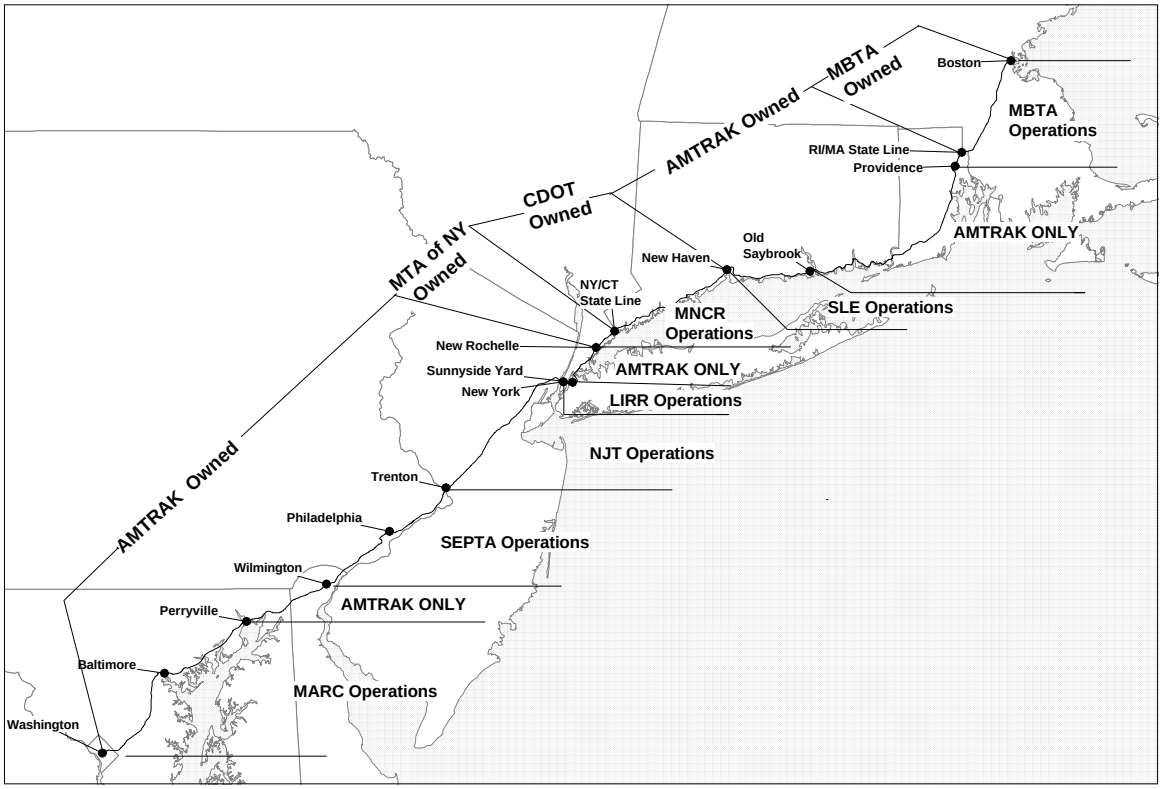


Figure 8 Ownership of and Operations on the NEC

Source: U.S. Government Accounting Office, *Northeast Rail Corridor: Information on Users, Funding Sources* and Expenditures, GAO/RCED-96-144 (Washington DC: GAO, June 1996), p. 8.

In common usage, the 231 miles between New York City and Boston is referred to as the north-end while the 225 miles between New York City and Washington DC is referred to as the south-end. Because operations are somewhat different on the two segments, they are described separately in the following paragraphs.

On the south-end of the corridor, Amtrak owns and has full operating control over the line, including dispatching, transportation supervision, and maintenance of way. Several other entities also operate along different sections of the south-end, including four commuter rail operators (Figure 8). Virginia Railway Express connects Alexandria, Virginia, with Washington DC, making use of Union Station in Washington DC. Maryland Rail Commuter Service (MARC) runs service between Washington DC and Perryville, Maryland. MARC is administered by Maryland Department of Transportation's Transit Administration, but it is operated under contract with CSX and Amtrak, depending upon the line being used. Southeastern Pennsylvania Transportation Authority (SEPTA) operates

between Wilmington, Delaware, and Trenton, New Jersey, with Philadelphia as the center of its regional commuter railroad operations. Finally, New Jersey Transit Corporation (NJ Transit) operates between Trenton, New Jersey, and Penn Station in New York City.

On the north-end of the NEC, as with the south-end, there are multiple commuter passenger operators. However, the north-end of the corridor is also owned, operated, and maintained by multiple agencies (Figure 8). Amtrak owns 15.2 miles from New York Penn Station to New Rochelle, New York, and 117.9 miles between New Haven and the Massachusetts state line. From New Rochelle to the Connecticut state border (9.8 miles), the line is owned by New York's Metropolitan Transportation Authority (MTA) and operated and maintained by MTA Metro-North Railroad (MNR). From the Connecticut state border to New Haven, Connecticut (46.8 miles), the line is owned by Connecticut Department of Transportation (ConnDOT) but still operated and maintained by MNR. The remainder of the corridor, from the Massachusetts state border to Boston's South Station (37.9 miles) is owned by the Massachusetts Bay Transportation Authority (MBTA), which contracts out to Amtrak for dispatching and maintenance.[193] Two additional passenger commuter operators provide service on the north-end. MTA Long Island Railroad (LIRR) operates along the 4-mile segment from New York City's Penn Station through the East River tunnels. While a very small portion of the overall corridor, the LIRR carried almost 80 million passengers in 2004, and the vast majority of them traveled across this segment.[194] Shore Line East also operates along a 33-mile segment in southern Connecticut between New Haven and New London. The service is funded by ConnDOT but is operated by Amtrak under contract.

Figure 9 provides a pictorial of the number of total weekday revenue-producing passenger-train movements on the NEC. (These figures do not include train movements to and from the yard, nor do they include freight train movements.)

While intercity and passenger commuter service are by far the most extensive type of rail service on the NEC, several Class I and Class II freight railroads operate roughly 38 trains per day along segments of the corridor.[195] On the north-end, the Class II Providence & Worcester Railroad Company runs 4 local service freight trains daily between Providence, Rhode Island, and New Haven, Connecticut. Two additional trains are added seasonally, from March until Thanksgiving—one runs between Rhode Island and South Norwalk, Connecticut; the other all the way south to New York City. CSX Corporation also runs along the north-end, from New York City to New Haven, Connecticut, and in the Boston area, but the traffic is primarily local, relatively light, and tends to run in the evening

hours. Of note, though freight trains run along the Amtrak ROW on the north-end, they do not use the passenger rail tracks; there is a third track dedicated to freight rail.

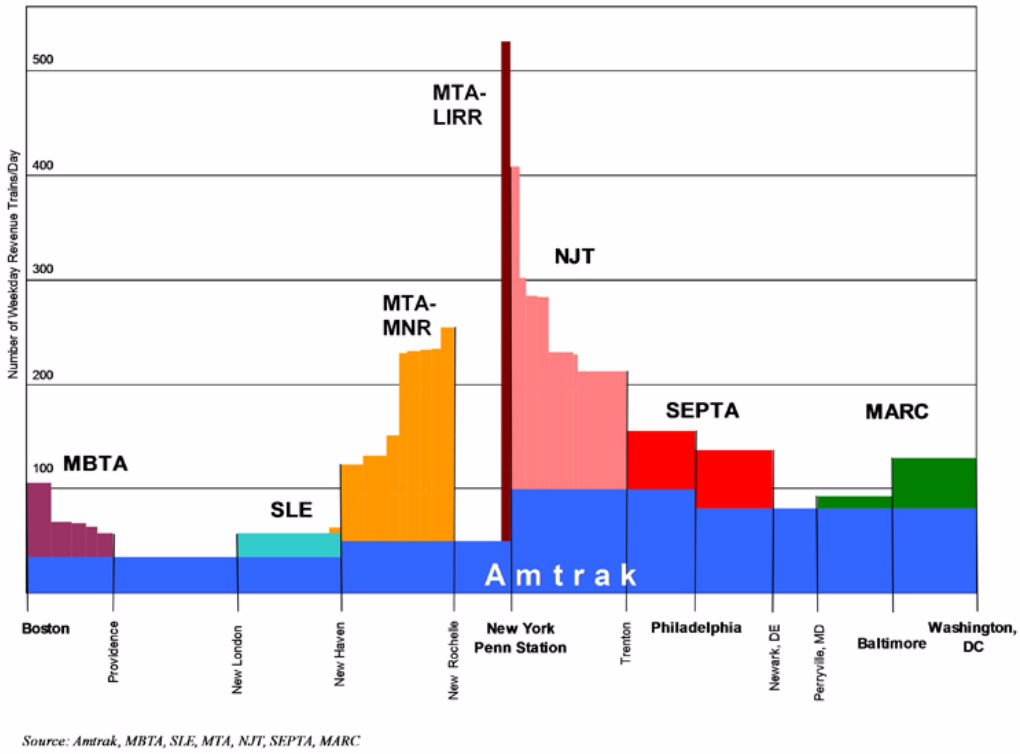


Figure 9 NEC Weekday Revenue Passenger Train Movement, 2006

On the south-end, Delaware & Hudson/CP Rail operates between Landover and Perryville, Maryland. Norfolk Southern (NS) operates local freight trains along three segments of the line: between Landover and Philadelphia, between Perryville and Baltimore, and between Perryville and Wilmington, Delaware. On average, there are two to four daily freight train movements between Landover and Philadelphia, and eight daily freight train movements on the other two segments on which NS operates. CSX and NS also operate—via Consolidated Rail Corporation (Conrail), which serves as their terminal and switching agent—between New York City and Philadelphia, Pennsylvania. Again, these are primarily local train movements and on average there are from two to four daily.[196]

History and Development of the Corridor

The history and development of HSR on the NEC is, in some ways, a tale of two segments—the south-end and the north-end. Development of HSR on both the north-end and the south-end pre-dates the formation of Amtrak and has its roots in the High Speed Ground Transportation Act (HSGTA) of 1965. Introduced (and in part, written) by Senator Claiborne Pell (D-RI), the act authorized $90 million for high-speed demonstration projects, of which $51.8 million was allocated for the NEC.[197] The Act also established the Office of High Speed Ground Transportation (OHSGT) within the Department of Commerce, directing them to plan, organize, fund, and evaluate demonstration projects to determine how high-speed ground transportation systems could contribute to more efficient and cost-efficient intercity rail. Pell understood the Northeast's unique mobility issues and had a vision in which the large cities were linked together to facilitate cooperative interaction rather than competition.[198] (Indeed, two years prior to the HSGTA, Congress had appropriated $625,000 for the Northeast Corridor Project to gather data and facts about travel needs and the condition of existing facilities in the Northeast.)

Mixed Experiences with Metroliner and TurboTrain

The south-end of the Northeast Corridor was quickly identified for a demonstration project. In his book examining passenger rail policy, Anthony Perl notes that the south-end had three advantages to other potential corridors:

- The route between New York City and Washington DC, with intermediate stops in Philadelphia, Wilmington, and Baltimore, was the busiest intercity travel market (for all modes) in the United States, and one that was still growing. Thus, the Metroliner had the potential to woo new travelers as well as those who were using other modes.
- The line between New York City and Washington DC had the most developed and most modern rail infrastructure in the country at the time. Moreover, it was already electrified (the Pennsylvania Railroad had electrified the system during the Depression in the early 1930s), so it could more easily accommodate the new-generation of electric-powered trainsets.
- Pennsylvania Railroad executives were willing to work together with the federal government on the initiative since they believed this would eventually help them in their bid for governmental approval for a merger with New York Central Railroad.[199]

The OHSGT signed a contract with the Pennsylvania Railroad, initially committing $6.7 million (later increased to $11 million) to support the acquisition of new-generation, electric-powered, self-propelled passenger cars that could travel at speeds of up to 160 mph.[200] The trainsets were to be built by a consortium of three companies: General Electric (GE), Westinghouse, and Budd Company. Budd Company would supply the car bodies, and GE and Westinghouse would supply the propulsion systems. The total cost for the three companies would eventually reach $60 million.[201] Another $45 million was spent to make upgrades to the ROW that would be needed to run the new trains.[202]

Initial service was delayed roughly 15 months from the planned start-up of fall 1967, but the program still proceeded relatively quickly. The first Metroliner was placed into service on January 16, 1969, just four years after the 1965 act. The new service reduced by an hour the trip time between New York City and Washington DC and was well received by passengers. According to a 1978 U.S. Department of Transportation (U.S. DOT) report on the NEC, prior to the introduction of the Metroliner, intercity rail service on the line was characterized by poor frequencies, poor service, long travel times, and falling ridership.[203] Immediately after the introduction of the Metroliner service, ridership began to improve markedly (Table 15).

However, by 1975 performance had again begun to suffer. The infrastructure on which the trains ran remained outdated and under-maintained. Initially, as Perl points out, even the overhead catenary system did not function well with the pantograph (current collector) on top of the cars so the trains repeatedly lost power as they moved along the track, causing difficulties with the trains' electrical systems.[204] Of greater import were the track deficiencies. The track was not up to high-speed standards and was increasingly deficient, even for conventional rail travel. In April 1976, because of safety concerns resulting from these deficiencies, new speed restrictions were introduced. Where the Metroliner had been able to run at speeds over 100 mph, it now was limited to 80 mph, which severely hampered operations with resulting decreases in performance and ridership. Indeed, by the end of 1976 only 25 percent of the Metroliner trains were arriving on time.[205]

Table 15 NEC Ridership: DC-NYC, 1968–1976 (thousands)[a]

Year	Metroliner	Conventional	Total DC-NYC
1968	n/a	576	576
1969	255	558	812
1970	388	339	727
1971	452	288	720
1972	547	307	854
1973	585	396	980
1974	668	497	1,165
1975	600	470	1,070
1976	547	671	1,218

Source: U.S. Department of Transportation, Two-Year Report on the Northeast Corridor (Washington DC: U.S. DOT, February 1978), p. 6.

a. Although it is not specified in the table, from the remainder of the discussion, these appear to be passenger trips.

With the infrastructure deficiencies, the Metroliner service could not run at the speeds it was designed to and could only reduce the travel time between New York City and Washington DC to three hours. Thus, according to Perl, the Metroliner did not offer a decisive advantage over air travel, and it never managed to capture more than half the travelers between these two cities. Nevertheless, the Metroliner experience is still viewed by many today as a success since "it has been the only regularly scheduled passenger train on this continent to post consistent [operating] profits."[206] It was also a success in terms of demonstrating the possibilities of utilizing public-private partnerships for implementing high-speed rail initiatives.[207]

While the Metroliner was introduced on the south-end of the NEC, a separate demonstration project was being instituted on the north-end, involving the introduction of the TurboTrain, a nonelectrified train (since the NYC-Boston ROW was not yet electrified) developed by United Aircraft Corporation (UAC). UAC was awarded a contract in January 1966 to build two TurboTrains that it would lease to the United States for use on the New York City-Boston segment of the NEC.[208]

Built using technologies previously employed in the aviation industry, the TurboTrain featured a "lighter, faster, quieter, smoother" ride than conventional trains. With a pendular banking suspension system similar to the Talgo trains utilized in Spain, the

TurboTrains would be able to round curves up to 40 percent faster than conventional trains and travel at speeds of up to 170 mph.[209] With engines and driving compartments in the cars at either end of the three-car train (later, two additional center cars were added), the TurboTrains could be run in either direction without turning around.

Introduced into revenue service with one daily train on April 8, 1969, and operated by the Penn Central Railroad, the TurboTrain reduced the travel time between New York City and Boston by about 30 minutes, though the goal had been a reduction of one hour. While it attracted a loyal clientele (as many as 87,000 in its first year of service), the U.S. TurboTrain experiment was plagued with problems from the beginning.[210] (Canada experienced similar difficulties with its TurboTrains, which ran between Montreal and Toronto from 1968 to 1982.)

Originally to be placed into revenue service in the fall of 1966 under New Haven Railroad, the first cars arrived almost three years late due to various production problems. Once in service, on what was now owned by the Penn Central Railroad, the trains were beset with mechanical difficulties and broke down frequently; in fact, the first TurboTrain did not even appear for its scheduled inaugural run because of a mechanical failure.[211]

In 1970, the Rail Passenger Services Act was enacted, creating the National Railroad Passenger Corporation (Amtrak) to provide intercity passenger rail on a national basis. Amtrak began managing the national intercity passenger rail system on May 1, 1971 and took over responsibility for implementation of demonstration projects under the 1965 HSGTA.[212]

Upon taking over TurboTrain operations, at least one of Amtrak's directors commented that it was not "operating satisfactorily."[213] At the time, there was still one round-trip train running daily. (In previous years, there had sometimes been two daily round-trips.) Many of the mechanical problems were said to be fixed by 1971, but problems remained. In July 1973, there was a fire in an engine of a TurboTrain that caused power to be shut down for one hour on the line near Pennsylvania Station, disrupting all trains utilizing the tracks (including the LIRR).[214] On June 10, 1976, an engine "burst into flames" in Stonington, Connecticut, this time delaying service on the line for three hours.[215] Three months later, on September 9, 1976, Amtrak took the TurboTrain out of service.

The Metroliner and the TurboTrain had both demonstrated the potential for high-speed rail, but neither achieved the stated goals. The Metroliner was severely limited by ongoing infrastructure deficiencies, and the TurboTrain failed as a result of its mechanical difficulties as well as infrastructure problems.

While the demonstrations were proceeding, the Secretary of Transportation released "Recommendations for Northeast Corridor Transportation" (September 1971), which urged action in the corridor, pointing to the travel forecasts and the overall lack of capacity in all modes. The report suggested that high-speed rail was one of the best alternatives for both short- and long-term travel in the corridor and urged implementation of HSR service with nonstop running times of 2 hours between Washington DC and New York City and 2 hours, 45 minutes (2:45) between New York City and Boston. The estimated cost for this was $460 million.[216]

Two years later, this report was followed by an updated and extended version, titled *Improved High-Speed Rail for the Northeast Corridor*. The report again pointed to current deficiencies and travel trends, and urged specific improvements as well as providing a financial plan for achieving them. The estimated cost was now substantially higher—$700 million ±10 percent, including new vehicles.[217] In that same year, Congress passed the Regional Rail Reorganization Act of 1973, primarily aimed at reorganizing the now bankrupt Penn Central Railroad and several other bankrupt freight railroads around the country. Though focused on freight rail, the act made specific note of the need for improved passenger service in the NEC and directed the secretary of transportation to begin engineering studies needed to implement improved rail service along the corridor. Moreover, the act established the U.S. Railway Association and, among other responsibilities, tasked it with designating for lease or acquisition by Amtrak those properties needed for improved NEC passenger service.

On June 28, 1974, the Federal Railroad Administration (FRA) contracted with Bechtel Incorporated to provide several tasks associated with a larger program to develop detailed plans for improved high-speed rail service in the NEC. One of these tasks was development of an improvement plan for the physical plant between Washington DC and New Haven, Connecticut. The improvement plan was released in August 1975 with an estimated cost of $946 million (1974 dollars), including contingency, engineering, and management—just for the section between Washington DC and New Haven.[218] The plan provided a schedule of seven years for the completion of the work. Thus, when the appropriations under the High Speed Ground Transportation Act ended in 1975, the stage was already set for congressional efforts to shift to correcting the deficiencies on the NEC in order to significantly improve service on the line.

Northeast Corridor Improvement Project–Phase 1

In 1976, Congress passed the Railroad Revitalization and Regulatory Reform Act (4R Act) through which Amtrak became the primary owner of the NEC right-of-way by purchasing it from Penn Central at the time the latter was being restructured into Conrail. The Act also authorized the Northeast Corridor Improvement Project (NECIP). With $1.6 billion authorized for improvements on the NEC spine (Washington DC to Boston, Massachusetts) and $150 million (to be matched equally by state and/or local sources) for fencing and other nonoperational station improvements, equalling a total of $1.75 billion, the NECIP represented the largest federal investment in intercity passenger rail in the 20th century.[219]

The main program objective laid out in the 4R Act was to have, by 1981, "the establishment of regularly scheduled and dependable" intercity rail passenger service of 3 hours, 40 minutes (3:40) between Boston and New York City, and of 2 hours, 40 minutes (2:40) between New York City and Washington DC, including intermediate stops.[220] Responsibility for implementation of the NECIP resided with the newly created Northeast Corridor Project Office under the FRA, directly under the secretary of transportation. Amtrak was given the following responsibilities under the NECIP: (1) directing project development, construction, oversight, and testing acceptance and (2) initiating and managing construction assigned to Amtrak while acting in a separate capacity as one of the construction contractors to the Northeast Corridor Project Office.[221] Of note, no specific responsibilities were assigned to either the states or the commuter operators along the Corridor; indeed, at least in the written record, there is no discussion about this possibility.

The FRA contracted with DeLeuw, Cather/Parsons & Associates (DCP), its principal architect and engineering contractor, for management support, system engineering, design, cost estimates, construction supervision, and inspection.[222] Additional contractors involved in the program included Bechtel Incorporated, which supported the FRA engineering and operations staff; Dynatrend, Inc., which, in turn, supported the FRA's project control division; and Arthur Andersen and Company, which worked with Amtrak in developing managing systems.[223]

Of note, the trip-time goals were debated within Congress and the FRA. In fact, additional wording was included in the 4R Act as follows:

> Within 2 years after February 5, 1976, the submission by the Secretary to the Congress of a report…considering engineering and financial feasibility and market demand, of the establishment of regularly scheduled and

> dependable intercity rail passenger service between Boston, Massachusetts, and New York, New York, operating on a 3-hour schedule, including appropriate intermediate stops, and regularly scheduled and dependable intercity rail passenger service between New York, New York, and Washington, District of Columbia, operating on a 2 1/2-hour schedule, including appropriate intermediate stops.[224]

According to a report issued in March 1978 on a larger study conducted by the National Academy of Public Administration, the trip-time goals were the result of negotiations between the executive and legislative branches of the federal government. The Senate wanted trip times identified in earlier U.S. DOT reports of 2 hours nonstop and 2 hours, 30 minutes (2:30) with intermediate stops between Washington DC and New York City, and 2 hours, 45 minutes (2:45) nonstop and 3 hours with intermediate stops to Boston. However, because the total federal funding provided ($1.75 billion) was less than what was believed to be needed, an agreement was reached to add 10 minutes to the Washington DC-NYC trip and 40 minutes to the NYC-Boston trip.[225] In other words, the finally agreed-upon times were not based on any formal and objective analysis. Worse, it was questionable whether the longer trip times would be competitive with air and automobile, making it more difficult for any rail system to attract ridership away from the other modes.

The NECIP Final Programmatic Environmental Impact Statement (FPEIS), circulated as a draft for comment in September 1977 and released as final in June 1978, identified several additional program goals. Of particular interest, among them was mention of "minimum future service level improvements" to be considered, specifically, trip times between Boston and New York City of 3 hours and between New York City and Washington DC of 2 hours, 30 minutes (2:30), each with five intermediate stops.[226]

Of additional importance, the Programmic Environmental Impact Statement (PEIS) assessed the alternative routes on the north-end between New Haven, Connecticut, and Boston, Massachusetts, looking at three potential alignments:

- The Inland Route, linking Hartford, Connecticut; Springfield, Massachusetts; and Worcester, Massachusetts
- The Airline Route, linking Middletown, Connecticut; Willimantic, Connecticut; Woonsocket, Rhode Island; and Walpole, Massachusetts
- The Shore Line realignment, between Old Saybrook, Connecticut, and Westerly, Rhode Island[227]

The ROW for the Inland Route existed, but there was limited service. The Airline Route had no ROW or service at the time. Thus, while the Inland and Airline Routes were found to mitigate or eliminate certain negative impacts associated with the Shore Line realignment (particularly the visual obstructions that would be caused by the new catenary and poles), the FRA found that these benefits would be "offset by the significant impacts associated with the construction of these new routes as well as the transfer of many of the operational impacts to other areas."[228] Additionally, the FRA argued that the additional time needed to obtain the required approvals and permits on these other two routes would "substantially delay" any environmental benefits resulting from high-speed rail service between New York City and Boston. Finally, the Inland and Airline Routes would have been considerably more costly and, without the necessary capital, the Shore Line realignment was chosen as the preferred route.

Eleven program elements for the NECIP were identified in the PEIS, with the assumption that on the north-end the Shore Line realignment would be used: route realignments (including curve realignments; rail/rail grade separations; additional tracks; and increasing the center-to-center distance between tracks), track structures, bridges, electrical, signals, communications, fences, grade crossings, stations, service facilities, and tunnels. The expected cost breakdown by state in which the work would occur is shown in Table 16.

U.S. DOT estimated that $647 million of the total $1.825 billion was directly associated with elimination of deferred maintenance.[229] Roughly 79 percent of this ($510.31 million) was directed at track structures and bridges. The remainder of the deferred maintenance costs was associated with signals and traffic control ($53.95 million); stations ($29.82 million); electrification ($29.29 million); tunnels ($22.29 million); and communications ($1.37 million).[230]

Table 16 Cost of Program Elements by State ($ millions)[a]

State	Route Realignments	Track Structure	Bridges	Electrical	Signals	Communications	Fences	Grade Crossings	Stations	Service Facilities	Tunnels	Total
MA	$6.81	$116.10	$0.80	$44.89	$22.07	$1.67	$8.07	$0.11	$41.23	$23.41	$0	$256.16
RI	5.10	55.34	20.72	49.30	19.13	2.46	2.94	0.23	15.53	1.66	0	172.41
CT	12.35	80.43	65.83	77.17	39.20	5.58	2.85	4.24	37.98	4.35	0.47	329.45
NY	0.22	43.92	8.36	14.54	9.10	1.74	4.84	0	6.89	13.09	12.27	114.97
NJ	2.12	83.40	53.70	30.80	22.90	4.34	4.06	0	46.91	3.28	0	251.51
PA	4.78	55.70	26.91	27.42	31.77	4.63	10.41	0	13.37	16.57	0	191.56
DE	0.48	37.89	13.39	11.94	9.40	1.05	2.42	0	13.23	13.09	0	102.89
MD	11.64	126.65	25.53	47.11	48.40	5.85	12.50	0	29.99	4.81	9.55	322.03
WDC	0	10.44	0	2.52	1.68	0.15	5.00	0	38.59	21.64	0	75.02
Total	$43.50	$609.87	$215.24	$305.69	$202.65	$27.47	$48.09	$4.58	$243.72	$101.90	$22.29	$1,825.00

Source: U.S. DOT, FRA, *Northeast Corridor Improvement Project, Final Programmatic Environmental Impact Statement*, volume 1 (Washington DC: U.S. DOT, June 1978), p. 1–10.

a. includes state/local matching funds

Narrowing the Program

The proposed actions under the NECIP were developed during an iterative process, beginning with a baseline (unconstrained) plan that included all the possible program elements on the corridor. The total cost for all of these enhancements was $3.5 billion. Recognizing the limitations imposed by funding, an effort was made by the FRA to narrow the program to "arrive at the optimum program which would meet the intent of the 4R Act within the funding level authorized by Congress."[231] Several variables were developed to help prioritize projects within each program element:

- Accomplishment of the goals of travel time and reliability designated by the 4R Act
- Uniformity of the entire system
- Compatibility with possible future expansion
- Geographic distribution of facilities
- Minimizing environmental impacts of the improvements
- Minimizing impacts on other rail system users
- Economic stimulus
- Time necessary to complete the improvement

Determining how each project addressed these factors, resulted in a proposed action plan of roughly half the cost of the baseline plan. The changes of greatest significance were as follows:

- Route realignments—In the baseline plan, 32 major curves, 291 minor curves, and 4 flyovers were identified at a cost of $432.2 million. The FPEIS proposed taking action on 76 minor curves at a cost of $43.5 million, a reduction of 90 percent of the baseline costs.
- Track structures—The baseline plan suggested installing CWR and concrete ties on 900 miles of dedicated track and on 450 miles of nondedicated track, as well as installing 10 new interlockings and relocating or reconfiguring 19 others. The FPEIS proposed installing CWR on 513 miles of track and concrete ties on 400 miles, while replacing wood ties on 615 miles and reconfiguring 58 interlockings. The total cost of $609.9 million was roughly two-thirds the original baseline plan.
- Bridges—Initially, the baseline plan recommended 34 bridges for replacement, 228 for major rehabilitation, 317 for minor rehabilitation, and 176 for minor repairs at a cost

of $432.9 million. The FPEIS recommended 31 replacements, 107 upgrades, and 114 repairs at a cost of $215.2 million, roughly half.

- Electrification—The baseline plan recommended installation and upgrading of the system to provide a uniform 25 kV, 60 Hz system for the entire corridor at a cost of $462.1 million. The FPEIS suggested upgrading to 25 kV, 60 Hz between Washington DC and Shell, with a new 25 kV, 60 Hz system installed from New Haven to Boston at a cost of $305.7 million, two-thirds the original cost.[232] (In other words, the entire line with the exception of MTA Metro-North territory.)

Redirection Study—Changing Direction before It Began

While the FPEIS was not issued until June 1978, in January of that year, Secretary of Transportation Brock Adams initiated the *Northeast Corridor Improvement Project: Redirection Study*. Led by U.S. DOT, with input from Amtrak, commuter rail agencies, and Conrail, the redirection study aimed at a comprehensive review of the NECIP. In justifying his actions, which included changing the FRA's NECIP management, Secretary Adams voiced two concerns based on the August 1977 implementation plan, which had already been narrowed substantially from the earlier baseline plan and was circulated as part of the draft PEIS (DPEIS) in September 1977:

1. That service needs of commuter and freight operators had not received sufficient consideration along with intercity rail service
2. That the project scope, schedule, and budget had deficiencies[233]

Adams suggested further that the planning that had led to the implementation plan (estimated cost $1.82 billion) was "unrealistic and untenable," pointing to the compromises between Congress and the administration that led to the five-year program with $1.75 billion in funding, noting that such a short period required concurrent development, design, and construction.[234]

A number of comments received on the DPEIS reveal some basis for Adams' concerns. Among the issues voiced by the Urban Mass Transportation Administration (UMTA), for example, were the following:

- Effect on commuter service of dedicated track in parts of the corridor—pointing to a statement in the DPEIS that noted "wherever possible, use of mainline tracks by other than intercity passenger trains will be minimized," the UMTA suggested that further clarification was needed since such exclusion of commuter access to express tracks

would "adversely affect the quality of local commuter service in this region." Further, UMTA noted that the DPEIS made no attempt to quantify these adverse affects.

- Commuter rail locomotive and car conversion—UMTA noted concern related to who would bear the costs of converting the commuter fleets so they could be used on the proposed 25 kV, 60 Hz electrical system.[235]

These concerns were also echoed by Frederick Salvucci, Secretary of the Office of Transportation for the Commonwealth of Massachusetts. Salvucci noted that his staff was "convinced that we will end up with a situation where a single peak-hour intercity train could make commuter rail service impossible on the Boston-Attleboro-Providence route, and seriously disrupt service on our other routes south and west of Boston."[236] Similar concerns were raised in New Jersey and New York.

Led by the Northeast Corridor Project Office, the redirection study again examined various program elements and projects in light of their ability to address trip-time goals and other NEC needs. The study reached the following conclusions:

- That the original $1.75 billion authorization would not enable development of the NEC as initially conceived;
- That to come closer to the initial vision, an additional $654 million was needed, for a total federal authorization of $2.404 billion; and,
- That a new schedule was needed that would that would spread the work over seven years, closer to the original schedule discussed prior to the final PEIS.[237]

Table 17 shows the DPEIS implementation plan, the redirection study recommended program, and the FPEIS proposed action including state and local shares. Figure 10 shows the proposed time line from the redirection study.

Table 17 PEIS and Redirection Study Program Elements and Costs ($ millions)[a]

Program Element	*DPEIS (8/77) (as cited in FPEIS)*	DPEIS (8/77) (with PM/SE broken out)	Redirection Study (1/78)	FPEIS (6/78) (with PM/SE broken out)	*FPEIS (6/78) (as cited in FPEIS)*
Route realignments	*$165.0*	$151.2	$84.60	$38.0	*$43.50*
Track Structures	*$498.0*	$448.2	$722.0	$532.7	*$609.87*
Bridges	*$264.0*	$242.5	$239.6	$188.0	*$215.24*
Electrification	*$256.0*	$234.8	$349.9	$267.0	*$305.69*
Signaling	*$178.0*	$163.3	$259.7	$177.0	*$202.65*
Communications	*$27.0*	$24.7	$33.6	$24.0	*$27.47*
Fences	*$53.0*	$48.5	$49.4	$42.0	*$48.09*
Grade Crossings	*$4.0*	$4.0	$16.0	$4.0	*$4.58*
Stations	*$242.0*	$222.2	$214.7	$212.8	*$243.72*
Service Facilities	*$113.0*	$103.8	$159.9	$89.0	*$101.90*
Tunnels	*$20.0*	$18.4	$29.7	$19.5	*$22.29*
PM/SE (DCP and FRA)[b]		$158.4	$297.9	$231.0	
Total	*$1820.0*	$1,820.0	$2,457.00	$1,825.00	*$1,825.00*

a. Includes nonfederal matching funds

b. DCP-DeLeuw, Cather/Parsons & Associates; PM-Program Management; SE-Systems Engineering, from: U.S. DOT, FRA, *Northeast Corridor Improvement Project: Redirection Study* (Washington DC: U.S. DOT, January 1979), p. 8; figures with PM/SE identified from: U.S. GAO, *Problems in the Northeast Corridor Railway Improvement Project*, p. 36.

Organizational Problems Revealed

In March 1979, the Comptroller General of the United States issued a report detailing a number of problems in the NECIP, noting at the outset that the $1.75 billion program ($1.82 billion, with local match) would not be completed within the original time frame or within the original budget. Further, the report assessed the January 1979 redirection study proposed plan, suggesting that even with the increase in the overall cost estimate, certain line-item changes would result in increased future maintenance costs, decreased passenger comfort, decreased on-time reliability, and decreased safety.[238]

Of greatest concern, the comptroller concluded three years into the five-year project, the NECIP was challenged organizationally, had wasted resources, and had still not completed the planning for the program.[239] In terms of planning, the report noted that the

redirection study did not contain sufficient detail on scopes, schedules, and costs, and that the full scope of work continued to shift and be revised.

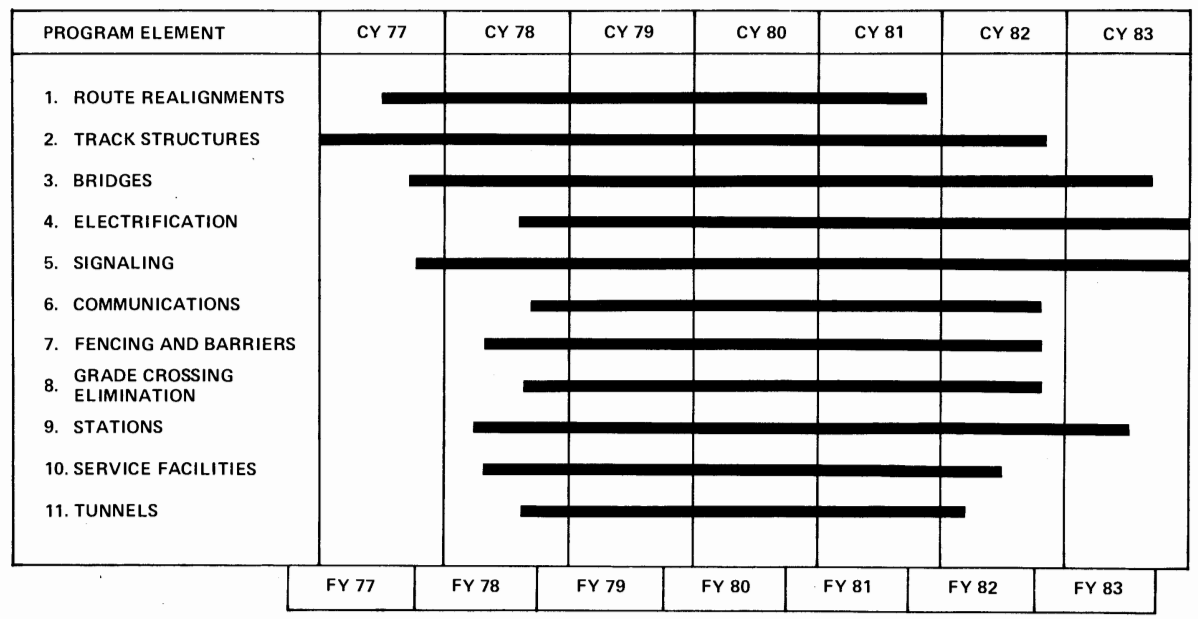


Figure 10 Recommended Time Line from Redirection Study

Source: U.S. DOT, FRA, *Northeast Corridor Improvement Project: Redirection Study* (Washington DC: U.S. DOT, January 1979), p. 9.

Moreover, the planning and control element goals had all missed their original due dates (Figure 11), and all individual projects were falling behind. Ninety-eight percent of the work elements were delayed relative to the August 1977 schedule, and even with a new time line in March 1978, roughly two-thirds (62 percent) remained delayed.[240] The U.S. GAO attributed the project delays to a cumbersome and time-consuming process of defining, delineating, negotiating, and approving work for Amtrak to undertake.[241]

Planning element	Original due date	Jan. 1979 Status
System documentation:		
System performance specifications	2/77	Not finalized
Program requirements	4/77	Not finalized
Implementation master plan	5/77	Not finalized
Cost estimating system	2/77	Not finalized
Scheduling system:		
Construction phasing and scheduling	4/77	Not finalized
Logistics plan	3/77	Not accepted
System safety program plan	6/77	Not implemented

The major control elements and their original due dates and status as of January 1979 are as follows:

Control element	Original due date	Jan. 1979 Status
Integrated cost system:		
Management planning and control system	1/77	Not finalized
Quality assurance system:		
Quality assurance plan	4/77	Not finalized
Quality control plan	8/77	Not finalized
Change control system:		
Configuration management and change control	2/77	Finalized 1/78

Figure 11 Status of NECIP Planning and Control Elements, 01/79

Source: U.S. GAO, *Problems in the Northeast Corridor Railway Improvement Project*, pp. 65–66.

According to the comptroller, the roles and responsibilities of the three key actors—Amtrak, the FRA, and DCP—remained unclear and several key issues (interactions with other corridor operators and indemnification of DCP against third-party liability, among them) remained unresolved. As a result of the insufficient clarity in roles and scope of work, as well as poor oversight regarding the multiple contractors, resources were being spent inefficiently or wasted. As a glaring example, the comptroller pointed to a $2 million purchase of hopper cars and a $3 million purchase of materials by Amtrak, which DCP later found might not be needed.[242]

The report argued that the NECIP project management was "not effective and has contributed to the project's problems," arguing that the three-party management structure (FRA, Amtrak, contractor) was ill-equipped to handle the program.[243] Moreover, the comptroller concluded that the problems faced by the NECIP would not be resolved until the management structure was simplified. To do this, the report suggested that full

responsibility and authority for construction should reside with Amtrak, without FRA involvement. To the extent that the FRA might remain involved, the comptroller argued that its role should be "one confined to top-level funding and monitoring responsibilities."[244]

In the meantime, based on the redirection study, the FRA developed a draft corridor master plan (CMP) based on the $2.404 billion federal contribution, that it issued in March 1979. The NECIP Project Director then requested a revised estimate that resulted in a cost estimate of $2.869 million, based on changes in initial cost estimates, changes in the scope of work, and additional escalation.[245] During the next two years, ongoing budget revisions (made at times by the FRA alone and, at other times by the FRA, Amtrak, and DCP) revealed an underlying tension as additions were made based on a combination of increases in cost estimates, changes in scope, and escalation, while reductions often followed to keep overall costs down and within the parameters specified by Congress. Table 18 provides some highlights of the revisions from March 1979 through February 1982 to give a sense of the volatility of the work plan and related budget.

Table 18 NECIP Budget Revisions, 04/79–01/82 ($ millions)[a]

Program Element	Based on Redirection Study 3/79	Revised Budget 3/79	Final CMP 3/80	Revised Budget 11/80	Final Program as of 2/82
Section Improvements	$84.6	$63.2	$70.1	$188.8	$169.2
Track	722.0	911.9	809.1	705.8	691.3
Bridges	239.6	316.5	255.4	272.9	178.8
Electrification	349.9	405.3	298.5	310.4	85.1
Signals	259.7	365.1	391.3	578.8	339.3
Communications	33.6	33.1	9.3	8.1	4.8
Fencing	46.6	40.8	21.3	11.5	6.5
Grade Crossings	16.0	16.2	16.0	16.0	14.0
Stations	166.8	195.0	195.0	215.9	191.1
Service Facilities	159.9	187.6	148.1	206.6	174.2
Tunnels	29.7	37.0	30.6	63.8	54.2
PM/SE	295.6	297.3	281.3	283.4	281.5
Total	$2,404.0	$2,869.0	$2,526.0	$2,862.0	$2,190.0

Source: U.S. DOT, FRA, Northeast Corridor: Achievement and Potential (Washington DC: U.S. DOT, November 1986), Table A-1.

a. Note that the state/local matches are not included here.

In 1980 the Passenger Railroad Rebuilding Act called for the managerial responsibility of the NECIP to be transferred to Amtrak from the FRA by 1985. In that same year, Congress amended the 4R Act, specifying September 30, 1985, as the new deadline for establishment of "regularly scheduled and dependable service" between Boston and New York City, and New York City and Washington DC. The trip times remained 3 hours, 40 minutes (3:40), and 2 hours, 40 minutes (2:40), respectively.[246] In 1982 a decision was made to drop this element from the current plans and reprogram the associated monies.[247] This decision resulted from two factors: (1) recognition that electrification of the corridor between New Haven and Boston would be much more costly than anticipated and (2) concession to pressure from the Reagan administration, which had reduced funding for the NECIP after President Ronald Reagan (R, 1981–1989) entered office the previous year. Interestingly, according to Louis Thompson of Thompson, Galenson and Associates, LLC,

and formerly director of the NECIP, even if Reagan had not reduced funding, it is unclear that the electrification could have been completed with the monies left at the time.[248]

The Results

In 1985 responsibility for managing the NECIP was formally transferred from the FRA to Amtrak as the 1977 comptroller's report had recommended. In November 1986, the FRA released the report *Northeast Corridor: Achievement and Potential*, noting that the work of the NECIP was "substantially complete by the end of calendar 1984." Remaining work to further reduce trip times would continue, according to the report, through 1986. The report further suggested that the project was completed at a cost beneath that authorized by Congress (this cost was based on the program as of February 1982).[249]

When comparing the achievements with several of the program elements specified in the FPEIS and redirection study, some major modifications become apparent. (Table 19 compares the program elements recommended in the redirection study and FPEIS with the actual improvements made by 1984, as identified in the 1986 FRA report.) In particular, and as noted by the report, the largest rehabilitation items remaining were replacement of the existing power generation and supply system (i.e., the catenary system was not fully upgraded between Washington DC and New Rochelle, New York, nor was a new system installed between New Haven and Boston) and complete modernization of the signal system (i.e., centralized traffic control [CTC] and reverse [bidirectional] signaling was not yet installed on the entire system).

By 1986, progress had been made on implementing high-speed rail on the NEC. Modifications to the system were sufficient to meet the trip-time goals for Washington DC-New York City as specified by the amended 4R Act (2 hours, 40 minutes [2:40] by the end of September 1985). Indeed, as reported by the FRA, the trip time to Washington DC from New York City was 2 hours, 36 minutes (2:36) in 1986, down from 2 hours, 59 minutes (2:59) in 1981.[250] Nevertheless, although the leadership, the authority, and the means to implement change existed during the early years, funding still remained short of what was truly needed for HSR on the entire line, who actually held authority was not always clear, and leadership was waning.

These difficulties were reflected in continuous revisions of the scope and budget as well as the failure to realize goals on the north-end of the corridor. While trip times had improved with the introduction of Metroliner service between New York City and Boston in October

Table 19 Redirection Study/FPEIS Recommendations vs. Actual Improvements[a]

Program Element	Redirection Study (1/78)	FPEIS (6/78)	FRA 1986 Report, Elements Completed by 1984
Route realignments	Unknown (page missing from document)	212 curves realigned	22 curves realigned
Track Structures	230 miles CWR 430 miles concrete ties 50 interlockings reconfigured	513 miles CWR 400 miles concrete ties 615 miles wood tie replacement 58 interlockings reconfigured	535 miles CWR 410 miles concrete ties 650 miles wood ties 36 interlockings new or reconfigured; 7 removed
Bridges	29 replacements 249 upgraded/repaired	31 replacements 221 upgraded/repaired	10 replacements 202 upgraded/repaired
Electrification	Upgrade DC-New Rochelle New system New Haven-Boston	Upgrade DC-New Rochelle New system New Haven-Boston	Selective repairs of critical elements DC-Queens; Major rehabilitation Queens-New Rochelle
Signaling	CTC DC-Wilmington and New Haven-Boston 100% reverse signaling on designated tracks and outside tracks south of NY	CTC on all 2-track systems 100% system reverse signaling	CTC DC-Wilmington and in Boston vicinity 56% of system reverse signaling
Tunnels	6 upgraded	8 upgraded (CT, NY, MD)	Track replacement and structural improvements on 1 tunnel in MD; Track rehabilitation in NYC tunnels

a. As identified in the FRA 1986 report

1982 (from 4 hours, 24 minutes [4:24] to 3 hours, 57 minutes [3:57]), they were still falling short of the 4R Act trip time goal (3 hours, 40 minutes [3:40]) by 1986.

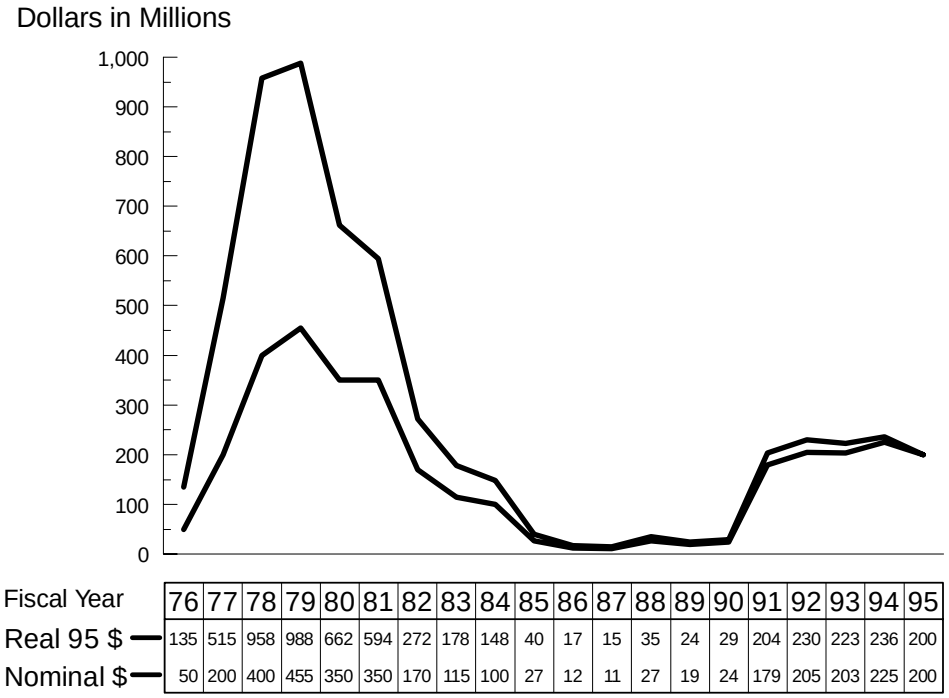
Northeast Corridor Improvement Project—Phase 2

The FRA's assessment that the bulk of the work for the NECIP was complete by 1986 was reflected in the levels of federal appropriations for the NECIP during FY 1985 through FY 1990 (Figure 12). However, the Coalition of Northeastern Governors (CONEG) continued to promote the need for reduced trip times between New York City and Boston, and also in 1986, directed the creation of a task force to prepare a feasibility study of high-speed rail in the corridor.

The study was released in October 1990 with the following key conclusions:

- Three-hour travel by rail between New York City and Boston could be attained in the near-term through a program with public-private funding.
- Diversion of trips from air and roads to rail would help reduce fuel consumption and air pollution.
- A high-speed rail project would generate new regional activity throughout the Northeast and the rest of the United States, with many new jobs and increased productivity.[251]

The study stressed the importance of HSR for the overall transportation system in the region, noting that it would play an integral role in also freeing up air space. Specifically, the CONEG study predicted that 80 percent of the additional ridership wooed from alternative modes (total estimated at 2.82 million) would come from air, and primarily from shuttle traffic between Boston/Providence and New York City/Newark. The resulting decline in air travel would permit reducing daily shuttle trips by up to 50, freeing up eight to ten gates for longer flights.[252]



Fiscal Year	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Real 95 $	135	515	958	988	662	594	272	178	148	40	17	15	35	24	29	204	230	223	236	200
Nominal $	50	200	400	455	350	350	170	115	100	27	12	11	27	19	24	179	205	203	225	200

Figure 12 Appropriations for NECIP, FY 1976–1995

Source: U.S. GAO, *Amtrak's Northeast Corridor: Information on the Status and Cost of Needed Improvements*, GAO/RCED-95-151BR (Washington DC: GAO, April 1995), p. 24.

During this same period, Senator Frank Lautenberg (D, NJ 1982–2000/2002–) played a critical role in jump-starting renewed funding for the NEC by placing $100 million in the FY 1991 appropriations bill. Efforts were refocused on increasing speeds and decreasing north-end trip times, an endeavor referred to at times by Amtrak as the Northeast High-Speed Rail Improvement Project (NHRIP).

In FY 1991, Congress appropriated $25 million for engineering associated with electrification of the north-end between New Haven, Connecticut, and Boston, Massachusetts.[253] The 1991 appropriation was followed by additional increases over the next few years, with the bulk of the NECIP funding (76 percent) spent on the NHRIP between fiscal years 1991 and 1994.[254]

Of note, there was discussion at the time about the needs along the section of the corridor between NYC and New Haven, which was owned by MTA and ConnDOT, and operated by MTA's Metro-North commuter rail. Several projects were identified for this section, including the New Rochelle flyover (which was later changed to a new at-grade

interlocking configuration at Shell), the Stamford center island platforms, and reconfiguration of the New Haven Interlocking.

In terms of electrification, however, changing the electrified system in Metro-North territory to the same voltage as the rest of the corridor would have required new commuter rail trainsets, which would have placed undue burden on the commuter rail system and likely would not have been acceptable to ConnDOT and MTA, the owners of the segment. The option of replacing the electrified system using its existing voltage in Metro-North territory was never explored since Amtrak did not feel it urgent to include these additional costs in the overall project. Thus, a decision was made to exclude this section of the line from the electrification project—instead, Amtrak would ensure that its new trainsets could also run on Metro-North's system.[255] Excluding the replacement of this critical segment from the overall planning and related financing for electrification has had lasting consequences in terms of the ability to meet the specified trip-time goals, frequency, and reliability.

Draft Environmental Impact Statement/Report

Scoping for the project began in September 1991 and in April 1992, the FRA issued its formal Scoping Document for the Northeast Corridor Improvement Project Electrification between New Haven, Connecticut, and Boston, Massachusetts, as the first step in a formal environmental impact statement process. The document noted several alternatives:

- Project as proposed—"To electrify the NEC main line between New Haven and Boston using an overhead 25,000 volt, 60 hertz single phase catenary system" so that electric-powered trains could run from Washington DC through to Boston, Massachusetts. The project would include installation of substations and switching stations, improvements to signal and communications systems, and either lower tracks or modified overhead bridges to provide sufficient clearance.
- Electrification with increased vertical clearance—This alternative would be identical to that proposed, but with increased minimum vertical clearances to accommodate double-stacked intermodal container rail freight.
- Other forms of electrification—This alternative would examine whether there were any significant environmental differences between the system proposed by Amtrak and the

one already in use by MTA Metro-North (11,500 volt, 25 hertz). It would also examine the alternative of a third rail system.

- No build—this alternative involved examining nonelectric powered trains for the NEC, including gas turbine hydraulic drive locomotives similar to the Turboliner used on the Empire Corridor; diesel-electric locomotives so that the corridor need not be electrified, but locomotives would not have to be switched in New Haven; liquefied natural gas (LNG) locomotives that would still necessitate a switch at New Haven; and finally, the no-action alternative.[256]

In October 1992, Congress passed the Amtrak Authorization and Development Act which amended Title VII of the 4R Act of 1976 to include a new section, stipulating that the Secretary of Transportation submit a program master plan for the establishment of "regularly scheduled, safe, and dependable" service between New York City and Boston of three hours or less, including intermediate stops. (Trip times for the north-end of the corridor had slipped back to roughly 4 hours, 30 minutes [4:30] by this point.) The act also authorized $470 million during FY 1993 and FY 1994 for the NECIP.[257]

In September 1993, the Draft Environmental Impact Statement/Report (DEIS/R) for the New Haven-Boston project was released. At the time the report was issued, roughly 60 percent of the design for the system was complete and Amtrak was estimating that construction could begin as early as spring 1994.[258] The full proposal to reduce express trip times to less than three hours included the following elements:

- Installation of a constant-tension simple overhead catenary system ("constant-tension" catenary is mandatory for speeds above 125 mph. Weights are hung at intervals along the system to counter the weather effects that cause wires to sag when the weather is warm and tighten when the weather is cool. The result is maintained alignment of the catenary and better contact with the surface of the trains.)
- Four substations and overhead or underground utility supplies to provide electricity from the local utility companies to the substations. Each of the substations would "consist of a fenced area of approximately 0.5 acres."
- Three switching stations and 18 paralleling stations
- Bridge modifications— either lowering of the tracks, raising the bridges, or replacing the bridges.[259]

Amtrak also proposed increasing current service from 10 round-trips daily to 26 round-trips daily—16 express service trains, with speeds up to 150 mph, and 10 local trains in

each direction. Ridership was projected to increase by over 93 percent by 2010, and forecasts assumed 37.8 percent of automobile riders in the corridor would shift to the intercity service.[260]

In addition to the alternatives specified in the scoping document, the DEIS/R also proposed two route alternatives: (1) the Shore Line Route, which ran adjacent to the coast in Rhode Island and Connecticut and (2) the Inland Route, which ran via Hartford, Springfield, and Worcester. The DEIS/R concluded that the Shore Line Route was preferable because of greater travel-time reductions, fewer freight operations and grade crossings, and better vertical alignment.[261]

Comments and Responses—Frequently Cited Issues

The comments and responses to the DEIS/R raised a number of concerns. Several of the most frequently cited issues, and how they were addressed by the Final EIS/R (FEIS/R), are discussed briefly in the next few paragraphs.

Freight rail. The greatest concerns related to freight rail were expressed by the Providence & Worcester Railroad Company (P&W), which would be most affected by HSR on the north-end of the NEC. Broadly, P&W noted that while the DEIS had stated the electrification "could" have a negative effect on freight rail, it did not offer a "thorough or accurate assessment of the impacts and fails to identify or evaluate the mitigating measures necessary to ameliorate the adverse impacts." More specifically, P&W's concerns had several facets, including the following:

- Negative impacts on existing freight service, resulting from delays caused by both the proposed construction and narrower operating windows as a result of increased passenger rail and HSR activities
- Limitations on future rail freight growth resulting from narrower overall operating windows and the proposed restriction of freight rail to nighttime operations
- Limitations on the growth of new rail-oriented industry along the corridor which would not be able to increase capacity since they would not be assured of "dependable and flexible" freight rail service on the corridor; and,
- Insufficient vertical clearances, which again would adversely affect current and future rail freight operations on the line.[262]

The FEIS/R responded to some of these concerns, noting that several measures, "primarily the reinstallation of previously existing side tracks," had been included in *The Northeast*

Corridor Transportation Plan to incorporate capacity improvements that addressed freight rail concerns.[263]

Electromagnetic fields (EMF). A number of letters were received from residents along the Connecticut portion of the proposed route who were concerned about the potential link between cancer and exposure to electromagnetic fields, particularly in children. Several respondents pointed to earlier scientific studies, particularly one conducted in Sweden, which demonstrated a correlation between EMF levels and leukemia in children. The FEIS/R response was that the studies were re-evaluated and that there was no consensus in the scientific community about these health effects. Further, the FEIS/R noted that "residential exposure levels associated with the proposed electrification project are not different from levels found in the environment" and that even the areas with highest exposure would have levels similar to exposures in urban areas.[264]

Moveable bridges/marine traffic. Criticism expressed by the boating community in southeastern Connecticut, the Coast Guard, and the Connecticut Department of Transportation revolved around the opening and closing of four moveable bridges and the potential impact on marina traffic accessing Long Island Sound. Broadly, the concern was that with more trains running along the corridor, the bridges would have to be closed for longer periods of time, which would narrow the window for boats to cross.

Under Section 401 of the Clean Water Act, Amtrak needed to obtain a Water Quality Certification from the Connecticut Department of Environmental Protection (DEP). As a condition of obtaining the certification, Amtrak agreed to a cap on the number of trains it could run along this section of the corridor, and it committed to a change in policy that would allow the default position of the bridges to be open for marine traffic. In other words, unlike most locations around the country (including the ConnDOT-owned portion of the NEC within Connecticut) where bridges remain closed and open for marine traffic at specified times of the day, along this section of the NEC, the bridges are kept open for marine traffic, and they are closed a certain number of times each day for the railroads to cross.

The DEP issued the certification to Amtrak in 1996, with a cap of 34 trains per day. (Amtrak was running 17 trains per day at the time.) This cap is limited to passenger trains; it does not include freight trains.[265] Nevertheless, this cap has been pointed to as one of the key constraints on high-speed rail along the corridor.[266]

Grade crossings. Comments suggested that closing the grade crossings would affect access between properties adjacent to the rail tracks and the shoreline. The FEIS/R noted that "no

grade crossing eliminations are planned or required as part of the Proposed Action." Further, "Under NECIP, the States are responsible for elimination of public grade crossings. As a consequence, it is the States' decision whether and when to implement the plan."[267]

Also mentioned in the comments were concerns related to noise and vibration caused by HSR, negative visual impacts and obstructions related to the poles and catenary wires, as well as discussion over whether the forecasts for modal shifts from air and automobile to HSR were valid, and whether the alternative routes had been thoroughly investigated and assessed.

On this last point, the earlier assessment of the three route alternatives—the Shore Line realignment, the Inland Route, and the Airline Route—provided in the NECIP's DPEIS and FPEIS of the late 1970s proved particularly helpful in fending off this criticism. Amtrak and the FRA were able to point to the earlier documents and the analysis that was done, as well as the investments made in the intervening years based on that assessment, to counter legal challenges that were raised regarding alternative routes.

The Program Master Plan

In July 1994, in response to the earlier Amtrak Authorization and Development Act, Secretary of Transportation Federico Peña issued *The Northeast Corridor Transportation Plan: New York City to Boston*. This program master plan not only covered the electrification and trip-time goals, but also included capacity improvements and recapitalization projects to bring the line up to a state of good repair. The FRA estimated that the trip-time goals could be achieved by 1999, with an estimated cost of $1.255 billion in FY 1993 dollars (Table 20).

Table 20 Estimated Cost of Trip-Time-Related Improvements ($ millions)

Program Element	Cost (constant 1993 $ millions)
High-Speed Trainsets	$186
Electrification	360
Reconfiguration of Major Junctions	230
High-Speed Signal System	170
Track Upgrading	255
Elimination of Grade Crossing Hazards	30
Other Trip-Time-Related Projects	25
Total	$1,255

Source: U.S. DOT, FRA, Office of Railroad Development, *The Northeast Corridor Transportation Plan: New York City to Boston*, Report to Congress—volume 1 (Washington DC: U.S. DOT, July 1994), p. I–5.

An additional $606 million would be needed for capacity improvements to ensure efficient operation and growth of freight and commuter services on the line (Table 21).[268] Finally, funds of roughly $1.2 billion would be needed for recapitalization related to the north-end (Table 22). The total for these three components was $3.1 billion (in 1993 $).[269]

Table 21 Capacity Improvements

Program Element	Cost (constant 1993 $ millions)
Penn Station Improvements	$27.6
Reconfigure Harold Interlocking	124.1
South Station Capacity Improvements	48.9
Devon-New Haven 4th Track	25.4
SLE Passing Sidings	36.3
SLE Both Sides Fully Accessible	18.3
N. London-Providence Passing Sidings	15.9
Providence-Boston Passing Sidings	61.5
Reconfigure Existing Interlockings	32.6
HS Universal Interlockings	16.3
Gauntlet Tracks	15.6
New Interlockings	14.9
Canton Jct.-Boston Signal Modifications	2.6
Construct High-Level Platforms	25.7
3rd Track Boston Switch-Cranston	18.1
Medium/Heavy Overhaul Facility	38.6
Amtrak Boston Service Facility	40.1
Cab Signal Equipment Modifications	43.9
Total	$606.40

Source: U.S. DOT, FRA, *Final Environmental Impact Statement/Report and 4(f) Statement, Volume 1: Northeast Corridor Improvement Project Electrification—New Haven, CT to Boston, MA* (Washington DC: U.S. DOT, October 1994), p. 1–8.

According to the master plan, Amtrak would be responsible for managing the program. Because some of the elements would benefit other stakeholders as well, responsibility for implementation would be shared by Amtrak, the commuter railroads, the freight railroads, and state governments.[270]

In terms of scheduling work, expected completion for the entire program was estimated at 2010, with electrified operations between New Haven and Boston beginning in 1997 and three-hour trip-time service between New York City and Boston beginning in 1999. Specific projects were prioritized as follows:

1. Projects directly affecting three-hour trip times for NYC-Boston service
2. Projects that increased capacity to enable operation of planned commuter and freight services through 2010 while maintaining the three-hour trip time for intercity rail
3. Projects critical to achieving a state of good repair, with priority given to safety issues and/or facilities in advanced stages of deterioration[271]

Table 22 Recapitalization

Program Element	Cost (Constant 1993 $ millions)
Bridge Replacements	$393.2
Open Deck Bridge Conversions	338.0
Deteriorated Bridges and Culverts	95.7
Rhode Island Overhead Bridges	33.8
Hell Gate Line Hanging Beam Replacement	11.1
Substation and Catenary Replacement	188.3
Commuter Equipment Testing	4.6
Fence Selected Sensitive Areas	16.7
Penn Station/E. River Tunnel Fire Safety	145.5
Step & Touch Traction Return Mitigation	3.6
Total	$1,230.50

Source: U.S. DOT, FRA, *Final Environmental Impact Statement/Report and 4(f) Statement, Volume 1: Northeast Corridor Improvement Project Electrification—New Haven, CT to Boston, MA* (Washington DC: U.S. DOT, October 1994), p. 1–9.

According to the report, roughly $594 million was already appropriated for the trip-time improvements and $60 million was already programmed by the commuter agencies for portions of the corridor not owned by Amtrak. The remainder would be derived from subsequent authorizations.[272]

By 1995, Congress had appropriated $3.3 billion for the NECIP (including all monies under the earlier program begun in the mid-1970s) and the funds had been obligated as

shown in Table 23.[273] While many improvements were made on the north-end between FY 1991 and FY 1995, key improvements remained outstanding. Most notably, the electrification system still needed to be constructed, the signal system needed to be modernized, and bridge clearances had to be increased. Construction of the electrification system was scheduled to begin in fall 1995, with timing contingent on obtaining certifications and approvals from Connecticut, Rhode Island, and Massachusetts regarding environmental, wildlife, historic preservation, and land-use laws and regulations.[274]

Before moving ahead, it is worth spending a moment on Table 23. The dollar amount shown for the north-end electrification appears very high (more than double that obligated for the south-end), given that electrification on the north-end remained outstanding at the end of FY 1995. The design phase for the north-end was 90 percent complete at this time, but no construction had occurred.[275] Indeed, in April 1995, Kenneth Mead, then director of transportation issues at the U.S. GAO, reported to Senator Mark Hatfield that an additional $133.2 million was still needed through FY 1999 to complete the north-end electrification.[276]

Table 23 Funds Obligated under NECIP, FY 1976–1995 ($ thousands)[a]

Cost Category	South-end	North-end	Total
Bridge Repair/Replacement	$99,294	$166,432	265,726
Signal/Traffic Control	359,740	189,352	549,092
Electrification (electric traction system)	144,459	366,425	510,884
Track/Track-Related	651,496	575,153	1,226,649
Tunnels	127,928	25,126	153,054
Service Facilities	171,177	59,668	230,845
Stations	80,465	138,603	219,068
Equipment/High-Speed Trainsets	14,193	109,792	123,985
Other	22,704	17,253	39,957
Total	$1,671,456	$1,647,804	$3,319,260

Source: U.S. GAO, *Resources, Community, and Economic Development Division, Amtrak's Northeast Corridor Funding Needs*, GAO/RCED-95-152R, p. 2.

a. Note that the GAO report does not specify whether these are FY 1995 dollars or FY 1976 dollars.

This apparent incongruence in the federal obligations appears to have resulted from the following scenario. In May 1992, the original contractor, Morrison-Knudsen (Boise, Idaho)

was awarded a $312 million contract to design and build the electrification system. In October 1995, however, as a result of serious financial problems at Morrison-Knudsen, the contractor and Amtrak jointly agreed to terminate the contract.[277] (Morrison-Knudsen formally won approval for its bankruptcy plan in August 1996.) The $312 million under this contract is included in Table 23 as having been obligated on the north-end, even though only $16 million of that contract was actually expended.[278] A second contractor—actually a joint effort between London-based Balfour Beatty Construction, Inc., (main U.S. office in Atlanta, Georgia) and Massachusetts Electric Construction Co. (BBC/MEC)—was then hired, causing Amtrak to lose additional time as well as money on the project. Of note, to avoid losing additional time on the project, Amtrak did not seek new proposals but went back to BBC/MEC, which had been the next lowest bidder to respond to the original RFP for the project.[279]

In the meantime, according to U.S. GAO reports to both the Senate Committee on Appropriations and the Committee on Commerce, Science, and Transportation, while the focus for the past two decades had been on improvements needed for HSR along the corridor, substantial investment was also needed to "correct the deterioration" of the south-end of the corridor. The cost for this rehabilitation was estimated to be between $2.5 and $3.5 billion over a 10–15 year period, and included rehabilitation of the electric traction system; rehabilitation of the Baltimore and Potomac Tunnel in Baltimore City; rehabilitation and/or replacement of several bridges, interlockings, and track structures; and rehabilitation of the signal system.[280] Of the $200 million federal appropriation in FY 1995, Amtrak allocated 57.5 percent ($115 million) to the south-end to begin this work.[281]

Delays on the North-end

Back on the north-end, in December 1995, Amtrak awarded a $321 million fixed-price contract to BBC/MEC to build the electrification system between New Haven and Boston, with an estimated completion date of June 1999. As a result of subsequent modifications, the contract was raised to $486.5 million.[282] In May 1996, Amtrak executed contracts with Bombardier-Alstom to design and manufacture 20 new Acela HSR trainsets and 15 electric high-horsepower locomotives, construct 3 maintenance facilities, and provide maintenance services for the trainsets once placed into service.[283]

The groundbreaking ceremony for the electrification was held two months later in July 1996, a little over two years after the estimated dates given in the DEIS/R. Project delays began almost immediately, both in the electrification work and on the trainsets. In terms

of the electrification, delays resulted from numerous sources, including unanticipated conditions, slow production, and safety incidents.[284] In October 1997, BBC/MEC submitted a revised schedule, with an end date for the completion of the electrification that was three months later than initially projected. However, by March 1999, it was clear that the building and testing of the electrified line was sufficiently delayed to push completion out to June 2000. Amtrak announced new timing projections, suggesting that limited service would be introduced in December 1999, with full completion of the electrification in June 2000.[285]

BBC/MEC faced difficult working conditions in the Boston area as a result of the Central Artery Project, known as the "Big Dig," in Boston. According to a report by the U.S. DOT Office of the Inspector General, the consultant faced large volumes of rail traffic, making it difficult to schedule outages (taking tracks out of service) to work on the electrification project. Further, as a result of tunnel construction related to the Central Artery Project, Amtrak's tracks sunk by more than a half foot at one point along a 500-foot stretch. Additional work and time was needed to correct this.[286] Beyond the Boston area, five moveable bridges in Connecticut (two horizontal swing bridges and three draw bridges) were causing unexpected difficulty, since each necessitated a unique design and construction solution.

According to Amtrak, however, not all the delays and cost overruns (which, by the end of the project had more than doubled the original contract to $680 million) were caused by unanticipated and difficult working conditions. In August 1999, Amtrak documented "numerous occasions" in which the contractor failed to have necessary equipment, personnel, and/or supplies in place to conduct the work in a timely fashion.

In that same year, a former BBC/MEC employee filed a lawsuit in U.S. District Court under the whistle-blower provision of the False Claim Act, charging noncompliance and unsubstantiated and questionable claims on the part of BBC/MEC as well as an additional contractor, J.F. White Contracting Co. Additional allegations included the intentional use of defective materials.[287] On June 7, 2000, the Federal Bureau of Investigations (FBI) raided the BBC/MEC office in Old Saybrook, Massachusetts that was overseeing the project, taking computers, financial statements, and other documents related to the lawsuit. (The suit was eventually settled in October 2005, with BBC/MEC and J.F. White Contracting Co. agreeing to pay Amtrak $24.75 million while not formally admitting any wrongdoing.[288])

In September 1999, Amtrak announced that in addition to the electrification delays, the Acela trainsets would not be ready until Spring 2000, owing to additional design modifications. Nevertheless, Amtrak was committed to beginning limited HSR service in January 2000, with two daily round-trip trains using refurbished Metroliner trainsets.[289]

The Results

Though three years behind the schedule identified in the *1994 Northeast Corridor Transportation Plan*, in January 2000, Amtrak introduced limited HSR service between New York City and Boston. By March 2003, $3.2 billion (2003 $) had been spent by Amtrak ($2.6 billion) and the other stakeholders ($625 million) on the north-end of the NEC. Neither had all the projects identified in the 1994 master plan had been completed, nor had all the goals been met.[290] In particular, Amtrak had not yet met the goal of three-hour service between New York City and Boston.

According to a U.S. GAO report issued in February 2004, only 5 of the 17 work elements required to achieve the three-hour train service had been completed by March 2003. Fewer than one-third of the elements (21 of 72) intended to improve infrastructure and enhance track capacity had been completed; the remainder were either determined to be incomplete or their status was unknown. Furthermore, according to the U.S. GAO, while work continued in some areas, "…there does not appear to be an effort to complete the project or meet the trip time goal."[291]

The U.S. GAO further suggested that there were four shortcomings in Amtrak's overall management that led to its inability to meet all the goals specified:

1. While Amtrak may not have adopted the FRA plan, neither did it develop its own comprehensive plan, instead managing individual project components and losing sight of the overall program objectives.
2. Similarly, Amtrak's financial management was not comprehensive; it focused on the short-term with "spend plans" focused on specific work elements and based on annual appropriations and spending.
3. While Amtrak worked with stakeholders, it did not fully integrate their interests into the project goals.
4. Amtrak was unable to effectively make use of information to manage problems that arose during the course of the work.[292]

Interestingly, while an earlier criticism of the NECIP had been the management of the process by the FRA, in the case of the NHRIP, the FRA was criticized in the U.S. GAO report for not providing enough oversight of the process.

According to Amtrak, it had never intended that the FRA master plan serve as a blueprint for its efforts on the north-end of the corridor, and it had never formally adopted the plan nor managed its projects in accordance with it.[293] One former Amtrak employee noted that the master plan was helpful in helping Amtrak and the states think through what could be done for the entire corridor given sufficient funding. However, because the master plan did not focus specifically on HSR, there were items that conflicted with projects needed for HSR and some that just did not contribute to HSR implementation.

Indeed, in fairness to Amtrak, the October 1994 FEIS/R did make clear that the projects identified in the master plan were "separate and distinct from the electrification project that is the subject of [the] FEIS/R.…To the extent that they have not been addressed in the PEIS or in previous site-specific environmental reviews, they will become the subject of additional site-specific reviews…at times consistent with project development."[294] Whether these site-specific reviews were ever conducted is unclear.

Current Status and Challenges

Incremental high-speed rail on the Northeast Corridor has already been implemented, and has existed for a number of years now, but several challenges remain both for high-speed service and intercity rail service more broadly. Moreover, some of the institutional and funding decisions that may be taken in the next few years could either spell a future of sustained and strengthened HSR or the end of it on the corridor.

Institutional Challenges

The Northeast Corridor is currently caught up in the larger debate, still being played out, over the future of Amtrak itself and whether the NEC should remain part of the national passenger network system, either as separate from the rest of the system, or with ownership of the infrastructure and operations split apart. In many ways, the reasons for the institutional difficulties stem back to the creation of Amtrak itself. According to Thomas Till, Managing Director of the Cascadia Center for Regional Development at Discovery Institute in Seattle, and formerly Executive Director of the Amtrak Reform Council, the purpose "was not to create a good national passenger service, but to reduce the burden on the railroads so they would not go bankrupt."[295] Coupled with this was the fact that

Amtrak was initially envisioned as solely an operating company; it was not expected to own infrastructure.[296] Thus, when it inherited an infrastructure that already was seriously deficient because of many years of deferred maintenance, it was not in a strong position to address these needs.

According to the Northeast Corridor Action Plan, produced by the Alan M. Voorhees Transportation Center at Rutgers University, there are several broad institutional weaknesses that make the current situation on the NEC untenable, including the following:

- Lack of public accountability and transparency—Even though the NEC functions very differently from much of the Amtrak network, financial reporting of NEC operations and maintenance activities is often combined with the rest of Amtrak's operations, making it difficult to discern actual costs on the line.[297] Amtrak's current Board of Directors has recently moved to address this lack of transparency on the NEC by providing separate capital and operating figures for the NEC's train operations and infrastructure costs.[298]
- Financial and institutional instability—Chronic and continuing underfunding by the federal government and the resulting threats of bankruptcy have plagued Amtrak in recent years and brought a great deal of uncertainty.[299]

Complicating this, as Thompson points out, is the fact that Amtrak has three different functions around the United States. It provides high-density and frequent intercity service on the NEC, a disconnected series of low-density intercity services around other parts of the country, and long-haul sleeper services with very low frequencies. Because it performs such varied functions, support for Amtrak is derived from a political coalition that requires agreement from supporters of each of the three types of service, making it difficult to make changes to any one since that might lead to less funding or service on the others.[300]

In February 2002, the Amtrak Reform Council, an independent federal commission established to review Amtrak's performance, submitted its recommended action plan for Amtrak to Congress. It called for a "new business model for Amtrak and the introduction of competition in train operations." Specifically, it recommended splitting Amtrak into three separate entities: a federal oversight agency, a government-owned and operated corporation to control the NEC infrastructure currently owned by Amtrak, and a passenger railroad operating company.[301] The goal was to provide a situation in which Amtrak could "focus on its core business of running trains and not be forced to focus on maintaining the Northeast Corridor…[or] its government functions."[302]

In 2003, the Bush Administration incorporated many of these ideas into the Passenger Rail Investment Reform Act, which was introduced in the House of Representatives (H.R. 3211) by Representative Don Young (R, AK) and in the Senate (S. 1501) by Senator John McCain (R, AZ). The Act was intended to make "key reforms to transition Amtrak into a purely operating company, create a federal-state partnership to support passenger rail, introduce market-based competition to the system and set up an interstate compact to maintain the heavily used Northeast Corridor service."[303] There was insufficient support for the act to be passed. The bill was reintroduced in Congress in 2005, but in April of that year, the U.S. GAO released a report suggesting that it was "premature to separate management of Northeast Corridor infrastructure from operations."[304] Again, the bill did not pass.

In the meantime, Amtrak released its own proposal in April 2005 calling for "reform from all sides," and agreeing that "business as usual [is] not sustainable."[305] The proposal identified three basic principles:

- Roles of intercity passenger rail and of Amtrak must be uncoupled
- Future of passenger rail depends on federal capital funding match program
- Realizing full potential requires competition of services and functions[306]

It then outlined several structural, operating, and legislative initiatives to help achieve these, including state-led corridor development, funding of NEC backlog needs, and creation of a capital matching program similar to matching programs for highways and transit. Looking forward, Amtrak also proposed changes in railroad retirement and in labor rules, believing them both to be essential to the future economic well-being of Amtrak.[307]

It is unclear which of these proposals, if any, will be ultimately pursued. Equally uncertain is the future of HSR on the corridor, particularly since in many discussions the HSR component gets lost in the overall debate.

Operations and Maintenance Challenges

At the same time as it is facing these broader institutional issues, Amtrak's HSR operations and overall capacity on the NEC continue to be hampered as well. On the north-end, HSR operations through MTA Metro-North territory continue to be challenged by narrow track centers, which prevent the tilt mechanism from being used, and high commuter rail volumes, which limit frequency and speeds. (While the need to update the catenary in this section is also important, it is currently being addressed by

ConnDOT.) As a result, maximum authorized speeds through this section of the corridor remain significantly lower than what is typically thought of as high-speed rail.

Also important on the north-end are the issues revolving around the water-borne traffic and the demands imposed by the boating community on the Connecticut moveable bridge crossings. As mentioned earlier, in 2004 Amtrak applied to the Connecticut DEP to increase the number of trains to 38 trains per day on weekdays and to 25 trains per day on the weekends. The DEP approved the additions in September 2004 and specified that the restrictions only need to apply between May 15 and October 15 of each year—the period during which there is waterborne traffic.[308] Three moveable bridges in Connecticut—the Thames River (1918); the Niantic River (1907); and the Connecticut River (1907) Bridges—are all currently in the process of reconstruction or are programmed for reconstruction. The Thames River Bridge is currently being reconstructed on the original footprint, but as a vertical lift bridge instead of a bascule-style (like a drawbridge over a moat) bridge. The Niantic River Bridge is currently in the design phase—it will be reconstructed on a new footprint. The Connecticut River Bridge, the busiest in terms of marina traffic and the time spent open, is currently undergoing a feasibility study. However, to date, each of these bridges is being replaced or reconstructed with another moveable bridge since replacing them with high-level bridges would represent a much more costly investment.

Thus, while the policy change allows an increase in the number of trains and therefore an increase in train traffic, the bridges remain a key obstacle for HSR, since they still will be moveable with the default position "open" to accommodate marine traffic. The bridges will close only for those 38 trains per day. This makes it more difficult at best, and possibly highly unlikely, to meet the trip-time goal of three hours between New York City and Boston. Unless the bridges are allowed to remain closed, as is done in most of the country, speeds and frequencies will be seriously constrained on the north-end of the corridor, regardless of other infrastructure changes that are made.

On the south-end of the corridor, capacity remains very much constrained, with insufficient infrastructure to handle the high volumes of commuter and intercity rail traffic (not to mention freight). In addition, many years of deferred maintenance have led to deterioration of the infrastructure that does exist. In 2005, the cost to bring the entire corridor to a state of good repair (SOGR) was estimated at roughly $5 billion (the bulk of which is on the south-end).[309] Together, these challenges have led to an increase in trip times on the south-end so that, while the goal of 2-hour-40-minute service was realized

some years ago, the trip time between New York City and Washington DC has again lengthened by roughly nine minutes.

The Acela Technology

The centerpiece of Amtrak's NEC system is the Acela. By FY 2004, the Acela program on the NEC accounted for almost 25 percent of the total Amtrak ridership on the corridor and 44 percent of the revenues.[310] Nevertheless, there has also been much discussion, debate, and litigation regarding the Acela trainsets that were purchased as part of the overall electrification program.

With the exception of the Talgo trainsets introduced in the Pacific Northwest in the 1990s, until the Acela, there had not been a new intercity passenger rail design for trains in the United States since the 1960s. At the time, some believed that Amtrak should try to leap ahead in the technology, utilizing articulated or fixed-consist trains similar to those used for the Trains à Grand Vitesse (TGV) and Talgo HSR operations, while others believed that locomotives with conventional coaches would be easier and less costly to manufacture and maintain. In 1993, Amtrak tested the Swedish X2000 and the German Intercity Express (ICE), both of which have coaches that can be coupled and uncoupled, allowing the operator to remove coaches for maintenance without taking the entire trainset out of service.[311] However, safety standards for HSR being established by the FRA required modifications that the manufacturers of these trainsets were unwilling to make.

Beyond the debate over the type of trainset, the final decision to contract with Bombardier-Alstom also remained a source of contention, particularly when it was disclosed in March 2000 that the attractive financial package offered had included a $1 billion loan to Amtrak from Canada's Export Development Corporation.[312] In an interview several years later, Gunn confirmed that the financial package was important in the final decision made by his predecessor. However, Gunn also said that the federal government should consider modifying its safety standards so that European designs could be imported more easily.[313]

In a 2005 report, the U.S. GAO cited several problems that plagued the development of the Acela and continue to present difficulties.

Manufacturing and production delays. Bombardier-Alstom did not deliver the first Acela until October 2000, one year behind schedule. Within the next two years, multiple lawsuits were filed by Bombardier-Alstom (November 2001) and Amtrak (November 2002) as each charged the other was not fulfilling its obligations under the contract.

According to Bombardier, Amtrak "repeatedly changed its design specifications, supplied defective designs, meddled in the design and construction process, and withheld progress payments." Amtrak argued that Bombardier "violated the terms of the contracts by delivering the trainsets late."[314]

In March 2004, Bombardier and Amtrak executed a settlement agreement that resolved their differences and dismissed the outstanding litigation between the parties. Pursuant to the settlement, Bombardier agreed to "complete specified modifications to the equipment, resolve outstanding technical issues, extend the warranty, and made certain commitments regarding the reliability of the equipment." Agreement was also reached to transition the maintenance of the equipment to Amtrak in October 2006, seven years earlier than previously agreed. Commitments were also made by Bombardier to "turn over source code, train employees, and provide options to Amtrak for the purchase of parts and inventory needed to maintain the equipment for the ten years following settlement." For its part, Amtrak agreed to pay Bombardier up to $42.5 million of the funds previously withheld as milestones were met leading up to October 2006.[315]

The use of new technologies. Much of the technology utilized for the Acela was new and those technologies that had been utilized previously (e.g., the tilt mechanism) had not been used in the combination planned for the Acela.

New safety standards to accommodate HSR. Between 1996 and 2000, the period during which the Acela was being developed, the FRA and Amtrak were involved in discussions regarding safety regulations pertaining to HSR. New rules were issued regarding track safety, passenger safety, and train control. In particular, "push-pull" operations, those in which a locomotive is placed at one end of the train with an unpowered cab control car at the other, were prohibited for HSR. The ruling resulted in Amtrak having to purchase additional locomotives at a cost of roughly $100 million.[316]

Abbreviated testing of the trainsets prior to their placement into revenue service. However, within two years of the first trainset being placed into revenue service, Amtrak had to remove all the Acelas due to equipment problems in August 2002. Though service was restored within two months, less than three years later, in April 2005, the trainsets were again removed from service due to brake problems, and not fully restored until the fall of that year.[317]

The overall outcome was that the vehicles that were developed were heavier and wider than intended and were thus, unable to meet the final goals as established by the program. For example, within the Metro-North territory, the tilt mechanism cannot be used because the

track centers are too narrow for the widths of the trains. (It should be noted that there is some debate about whether using the tilt feature would have been possible even with more narrow trains since the FRA requires track centers of at least twelve feet for tilting to be used and there are many locations within Metro-North territory where track centers are less than this.) Nevertheless, it is important to point out that from a marketing standpoint, the Acela brand has been well received and continues to woo new passengers.

Assessment of the Case

By the definition utilized in this research, the Northeast Corridor is a successful case of incremental HSR in the United States. It is implemented and is running with maximum authorized speeds of up to 150 mph on the north-end and up to 135 mph on the south-end in certain locations. Amtrak also made the necessary improvements to allow for these maximum authorized speeds while continuing full operations, a significant achievement in itself. Further, according to David Carol, Project Manager of the Charlotte Area Transit System, and formerly VP of High Speed Rail Corridor Development at Amtrak, the service offered by the Acela trains is a "faster, better alternative" to air travel than was provided previously. In his view, the NECIP and NHRIP, "rebuilt a railroad which was truly crumbling," and managed to do it while continuing operations. The majority of the line was rebuilt and resignaled, the north-end was fully electrified, and the service put in place has been very popular with customers.[318] John Bennett, Vice President of AECOM Consult, echoes Carol, pointing out that there has been significant progress on the NEC with the electrification, the new trainsets, and an overall improved level of service.[319]

However, if one delves a bit further into the initial goals for the corridor and whether they have been realized, success is less definitive and some potential lessons become more apparent.

The Goals

The goals for the original NECIP and the later electrification project were not, according to Thompson, unidimensional. There were direct goals for the project, and other, less obvious goals for U.S. DOT, like supporting minority and women businesses and pursuing environmental mitigation while implementing the NECIP, the largest project directly managed by U.S. DOT in its history.[320]

The following paragraphs assess several different goals specific to HSR for both the NECIP and for the later electrification project to provide a sense of which goals were met and which were not.

Trip Times, Frequency, and Reliability

When all is said and done, the keys to success for any rail project relate to service provided as measured by trip times, frequency, and reliability. Nevertheless, the most enduring of the various goals identified throughout the thirty-plus years of HSR-related initiatives on the NEC related to trip times. The answer to whether this was helpful or harmful to the overall project is mixed. Some practitioners have suggested that while the focus on trip times appears to have been a successful way of garnering political support for the NECIP, it also led to decisions on specific projects that increased costs unnecessarily and diverted resources from other potential projects that might have had a more enduring and positive effect on overall operations along the corridor. Others argue that the focus on lower trip times was truly necessary since reduced trip times are the key to HSR effectively competing with air and automobile travel.

There is some truth in both assessments: the early vision was for HSR on the NEC to compete with air and automobile traffic, so trip times were an important part of the mix of factors (including frequency and reliability) that would help woo those who would otherwise opt for plane or car. However, for what was ultimately an incremental rail program on a ROW shared with commuter and freight rail—characterized by insufficient funding and capacity to make the changes truly needed to enable the highest speeds along the majority of the line—frequency and reliability were truly the more critical factors in increasing ridership. Perhaps the greatest failing was in not recognizing this difference.

Based on the 4R Act, the NECIP originally stipulated trip-time goals for express service with limited stops of 3 hours, 40 minutes (3:40) between New York City and Boston, and 2 hours, 40 minutes (2:40) between New York City and Washington DC. However, the Amtrak Authorization and Development Act reduced the trip-time goals for the north-end electrification project to 3 hours or less, as reflected in the 1994 master plan and FEIS/R (Table 24).

Trip time goals for the south-end were realized as early as 1986, when trip times were reported at 2 hours, 36 minutes (2:36). However, trip times soon began to increase again and two decades later, primarily as a result of deferred maintenance, trip times on the

south-end are significantly slower, with most express trips scheduled for 2 hours, 50 minutes (2:50).

Express trip times between New York City and Boston are currently between 3 hours, 30 minutes (3:30) and 3 hours, 40 minutes (3:40), well short of three hours or less, and not a decisive advantage over the airlines (to borrow Perl's description of the earlier Metroliner experience) in terms of market penetration. Further, as Peter Cannito, President of MTA Metro-North, points out, the nature of the competition changed during the development and implementation of the electrification project, making HSR less valued and potentially reducing receptivity. In particular, when the initial discussions for the north-end began, there was no serious competition from the airlines flying from Providence to Baltimore, but by the time HSR was placed into service, Southwest Airlines had recognized a potential market and had begun flights between Providence and Baltimore, making it even more difficult for rail to effectively penetrate the market.[321]

Table 24 NEC Goals for and Current Status of Trip Times and Frequencies

Corridor Segment	Washington DC-New York City			New York City-Boston				
Goals/Actual	Goals		Actual	Goals				Actual
Document (date) Where Goals Were Specified	4R Act	FPEIS (1978)	Status as of March 2006	4R Act	FPEIS (1978)	Master Plan (1994)	FEIS/R (1994)	Status as of March 2006
Date Given to Achieve Goal	1981	1990		1981	1990	2010	2010	
Trip Times (Hr:Min)	2:40	2:40	2:49	3:40	3:40	3:00	3:00	3:30
Frequency (Trains/ Weekday)	n/a	76	Acela: 28 Regional: 53 Total: 81	n/a	22	54	Express: 32 Regional: 20 Total: 52	Acela: 16 Regional: 18 Total: 34

Sources: U.S. DOT, FRA, *Northeast Corridor Improvement Project, Final Programmatic Environmental Impact Statement, Volume 1* (Washington DC: U.S. DOT, June 1978); U.S. DOT, FRA, *Office of Railroad Development, The Northeast Corridor Transportation Plan: New York City to Boston, Report to Congress—Volume 1* (Washington DC: U.S. DOT, July 1994); *U.S. DOT, FRA, Final Environmental Impact Statement/Report and 4 (f) Statement, Volume 1: Northeast Corridor Improvement Project Electrification—New Haven, CT to Boston, MA* (Washington DC: U.S. DOT, October 1994); Amtrak timetables.

Thus, on the north-end, although the original goal of 3 hours, 40 minutes (3:40) identified in the NECIP has been met, the goal set out under the electrification project remains unfulfilled. There are four years remaining in which to fulfill this trip-time goal, and there are some additional improvements still being made that may shave time off the current trip. Thus, whether Amtrak will eventually meet the trip time goal on the north-end by 2010 is unknown at this time.

In terms of frequencies, Table 24 shows that the goals for both the south-end and north-end that were specified in the 1978 FPEIS have been met. However, the north-end goal was revised in later years and a new completion date of 2010 set; it has not yet been met. Given the continuing cap on the number of daily trains and the "open" default position for the area's moveable bridges—both due to the waterborne traffic in Connecticut—it is unlikely that either of the two 1994 goals will be met within the next four years.

Finally, though not continuously acknowledged as a goal in discussions on the NECIP and NHRIP, a third area in which the success of HSR on the NEC is questionable is reliability of service. The March 1979 U.S. GAO report, *Problems in the Northeast Corridor Railway Improvement Project*, noted that the FRA had the following on-time performance goals for the NEC once the NECIP was completed: 75 to 80 percent on-time performance on the south-end and "somewhat higher" on the north-end.[322] Between FY 1994 and FY 2002, Amtrak appears to have exceeded that goal: on-time performance for the entire NEC averaged 82–89 percent.[323] However, primarily related to deteriorating infrastructure on the corridor, overall on-time performance fell to only 80 percent in FY 2003. In FY 2004, it dropped again, with the Acela service averaging only 74 percent.[324] Finally, in FY 2005, on-time performance for the NEC averaged 81.6 percent for Metroliner service, 77.2 percent for regional service, and 76.4 percent for the Acela.[325] (While the problems with the Acela trainsets are generally pointed to for this decrease in Acela on-time performance during FY 2005, it is worth noting that FY 2005 on-time performance for the Acela was actually a bit higher than in FY 2004, and, as of March 2006, fiscal-year-to-date performance on the Acela averaged 83.1 percent with Metroliner service at 85.5 percent.[326])

Some, like Carol, suggest that the Acela is still within the five-year period when many new technologies need to have the "kinks" worked out. However, the fact that overall on-time performance has been declining since FY 1994 suggests that the problem stems from additional and potentially more costly factors like deferred maintenance. More importantly perhaps, as Cannito points out, "success begets success," while failures make it difficult to find continued funding.[327] In the political context within which the NEC is situated, falling on-time performance, coupled with the fact that Acela service has been stopped twice since its inception and continues to have reliability problems, is a serious impediment to further HSR support.

Cost Estimates and Project Schedules

Meeting targeted completion dates and cost estimate goals was another way in which implementation of HSR on the NEC was not successful. From the very beginning of the NECIP through the electrification of the north-end, Amtrak and the FRA repeatedly underestimated time and financial needs, often setting completion deadlines and cost estimates, only to find themselves unable to meet those goals. For example, as Carol points out, Amtrak created the goal of "HSR by 2000." When the trainsets were delayed a year,

the press coverage was very negative even though it is not uncommon for new trainsets to be delayed much longer than one year.[328]

The U.S. GAO report pointed out that a number of project goals remain outstanding, and some, like the flyover at Shell Interlocking (where eastbound Amtrak trains join the MNR-owned ROW) may never occur. However, many individuals involved in the NECIP and NHRIP at different times over the years have suggested that the flyover was not cost-effective anyway. It would have been extremely expensive and would not have necessarily resulted in significant time savings since upon joining the commuter-rail line, Amtrak trains would still need to wait at times for commuter trains to pass. As a much less costly alternative, MTA Metro-North is currently reconfiguring the Shell interlocking with Amtrak funding so trains will be able to move through the interlocking at 45 mph instead of 15 mph. Other project elements, like the replacement of the catenary system (from a static system to constant tension) along the MTA Metro-North-owned portion of the corridor in Connecticut, are behind schedule but still proceeding. Of note, this work was originally included and budgeted as a component within the NECIP, and was scheduled for completion in December 1983. However, not only was it not completed under the original NECIP, but as noted previously, this section of the catenary was excluded from the NHRIP and all later discussions of the north-end electrification. Thus, the work is now being conducted and funded by ConnDOT.

Other Lessons

The NEC is one of the few examples (the Keystone Corridor potentially being a second and the Empire Corridor an arguable third) of HSR in the United States, and certainly the only one with maximum authorized speeds approaching true HSR levels. Unlike the Keystone Corridor and the Empire Corridors, however, the NEC offers lessons on a more national scale. While the Keystone Corridor and Empire Corridors are each situated within one state, the NEC crosses multiple states. Though all are examples of incremental HSR, the costs involved in the implementation of HSR on the NEC were significantly higher, the political stakes were greater, and the publicity has been more intense, high-profile, and far-reaching. As a result, the NEC offers some particularly interesting lessons for future HSR initiatives.

The Role of the Federal Government

While the role of the federal government, and the FRA in particular, has been debated from time to time, and while the degree of federal support for HSR on the NEC wavered

from time to time (indeed, some would argue sufficient commitment never fully existed), one fact remains clear: without the public funding provided for the corridor by the federal government, even the successes that have been realized would not have occurred.

Leadership also proved important in the process, particularly the leadership provided by Senator Pell in the earliest years and by Senator Lautenberg and by CONEG in the 1990s. However, just as leadership was important for obtaining funding at key moments, the lack of continuous leadership is also reflected in the inconsistent federal support during both the early years of the NECIP and the later electrification project. One could also argue that this lack of continuous leadership is reflected in the ability of the Connecticut marina interests to supersede the goals of the NHRIP. In the current political environment, there is no single person or group that champions HSR in the corridor.

Multiple Owners and Operators

The existence of multiple owners and operators along the NEC ROW, each with its own set of concerns and thoughts about who should bear the costs, made implementing HSR significantly more challenging (even though the other owners were all public entities) and made the federal government's role that much more important. Intercity high-speed rail and commuter passenger rail (not to mention freight rail) have different goals and objectives. While some improvements benefited several stakeholders, others did not, making it difficult to find the operational support and funding streams needed to complete the projects to allow HSR operations along the entire segment.

An example of this is the replacement of the catenary on the north-end. In the early years of the NECIP, when the FRA had the primary responsibility for the project, rehabilitation of the entire corridor was programmed in the NECIP. However, in later years, once Amtrak had taken primary responsibility, the catenary improvements in the MTA Metro-North territory were excluded from both the planning and the program budget. Excluding this key segment of the corridor has added to the difficulties Amtrak has had in fulfilling the original NECIP and overall NHRIP goals.

Looking forward, according to Bennett, the future of HSR on the NEC is intricately tied to two key issues:

1. How to maintain and replace expensive infrastructure to bring the entire corridor, from Washington DC to Boston, regardless of ROW ownership, to a state of good repair
2. How to invest in and add to the capacity and functionality of the corridor to improve the quality and level of service

The answers to both of these issues require a larger vision for the NEC, in order to determine its role in the broader transportation system in the Northeast, with respect to Amtrak's overall operations and HSR.[329]

The Cost of "Doing it on the Cheap"

Funding was, and remains, a fundamental challenge on the NEC in several ways. First, on both the north-end and south-end, it is clear that funding was a key driver of which improvements were made and which ones were not. This tension between financial needs and the lack of commitment to provide full funding is evident in the earliest discussions leading up to the $1.825 billion NECIP when actual need to meet the proposed goals was estimated at almost double that figure. The same tension was also seen during the NHRIP on the north-end of the NEC. Trying to "do it on the cheap," as one former Amtrak official pointed out, led to the mixed success evident today.

Ironically, doing it on the cheap, often led to increased costs over time since plans had to be constantly redrawn, timing changed, and resulting implementation decisions did not always meet the original goals. Worse, the result of this project-by-project examination was the relegation of the broader vision to an incremental process. Those involved were so focused on the specific projects that the decisions made sometimes conflicted with the original goals and intent.

This incremental process was clearly apparent in the back-and-forth funding and scope discussions as projects were added in, leading to rising costs, and then taken out when Amtrak was told by Congress and/or the FRA to reduce costs. This same process occurred, though not as clearly in the record, during the electrification between Boston and New York City. Amtrak again examined the "take-aways," in essence looking at each project component and how much time could be reduced and at what cost.[330] For example, realigning and redesigning curves and the spirals leading into and out of them can improve trip times by allowing higher speeds through them—trains need not take time decelerating into and accelerating out of them. Tilting mechanisms on trains can also aid in allowing higher speeds by providing the necessary "cant deficiency" or underbalance. *Cant deficiency* is defined as the height that the outside rail in a curve would have to be raised, so that a train car moving through the curve would experience no lateral acceleration. (In more simple terms, it is what prevents the passengers from being pushed against the windows as the train moves through a curve at high speeds.) In the United States, federal regulations allow a maximum of six inches of actual superelevation on

railroad tracks. Thus, for high-speed rail, which often needs superelevations of nine inches or above to perform at top speeds, cant deficiencies of at least three inches are needed.[331]

Making decisions based on the trip-time savings and costs of each project individually, however, ignored the possibility of reaping greater savings by combining the projects. The incremental process did not allow for this kind of assessment and decision-making.

Finally, a broader question related to who should fund HSR on the NEC remains. As with other corridors around the country with limited funding sources, the central issue revolves around who benefits from HSR service. Amtrak maintains the tracks along most of the NEC and thereby keeps service running for all the operators using its ROW. Thus, the federal government argues that the states should take more of a role in funding. However, most of the states along the NEC prefer not to provide funding for services on the corridor. Further, not all states benefit to the same degree from intercity HSR on the NEC. Regardless of how the question of funding streams is resolved, one lesson from the early years of the NECIP is that, assuming the authority and capability exists, the fewer institutions responsible for the overall programming and implementation, the better.

FINDINGS, LESSONS, AND THEMES

The previous sections assessed each case, highlighting individual findings and observations. The following paragraphs review the three cases more comprehensively, identifying common findings, lessons learned, and themes for consideration.

KEY FINDINGS AND LESSONS LEARNED

The cases presented in this report, along with those of the first report, provide several important lessons for those trying to implement HSR in the United States. The paragraphs below highlight several of the key findings along with the lessons that will prove important for HSR initiatives around the country.

Leadership, Means, and Authority

HSR projects are expensive, take many years to complete, and require coordination among and between a numbers of key actors and stakeholders. The case studies of this report and its predecessor, which included California, Florida, and the Pacific Northwest, suggest that a key criterion for successful implementation of HSR is the combined presence of leadership and the means and authority to implement change.

Section 4 demonstrated that in the case of the Keystone Corridor each one of these factors alone proved insufficient for successful implementation of HSR. In the mid-1960s, the means were available, but the authority and leadership were lacking. In the early 1980s, leadership was in place, but again, clear authority was lacking. Although the PHSIRPC had been established it was mandated to phase out after a certain period of time and it was never clear who would be responsible for implementing the changes they recommended. Only in the most recent effort were leadership (the Commonwealth of Pennsylvania, PennDOT, and David Gunn at Amtrak); the means (funding provided by both Amtrak and the commonwealth and Amtrak able to perform the work); and the authority (the commonwealth, PennDOT, and Amtrak) all present. The result has been successful implementation, to date, of the KCIP.

Similarly, section 5 demonstrated that implementation of HSR on the NEC was moved forward most successfully when the federal government provided the leadership (via Congress), the means (federal funding with Amtrak able to implement operational and

infrastructure modifications), and the authority (via Congress and U.S. DOT) to implement change. This is not to say that other difficulties did not arise. Indeed, the 1979 report by the comptroller general of the United States further identified the need for clear delineation of these roles and responsibilities, noting that the lack of such clarity of roles among the three key actors in the NECIP—Amtrak, FRA, and DCP (the contractor)—led to delays and wasteful expenditure of funds. Nevertheless, without these three combined factors, the progress that was achieved would not have occurred.

In contrast, during the later effort on the north-end of the NEC, leadership was not as strong or consistent, though it existed in the form of Senator Lautenberg and, to some degree, CONEG. Further, while Amtrak had some authority to implement change, it was very much limited, in part by the fact that it did not own the entire corridor on the north-end. In the absence of the combination of these three factors, while the north-end was eventually electrified, not all infrastructure changes were made and, more importantly, specific external stakeholder interests (notably the Connecticut marina interests) were able to supersede the needs of HSR.

Given the need for the combination of these three factors to be present for successful outcomes in HSR, the Chicago Hub faces several obstacles. First, in spite of the support of several state legislators and state DOT officials, as a whole, the Hub has lacked strong and consistent leadership. Second, full funding has not been secured. Third, no formal authority that would make HSR-specific improvements has been identified. The end result is that while some coordination exists, specific roles and responsibilities are unclear, and overall, the states and other stakeholders are not moving in concert with each other to implement HSR.

Who Should Play These Roles?

The actors providing the leadership, the means, and the authority to implement change may vary according to specific circumstances and factors. On the NEC the federal government and Amtrak played the central roles, while on the Keystone Corridor the Commonwealth of Pennsylvania, PennDOT, and Amtrak under the leadership of David Gunn, played these critical roles. In both cases, Amtrak could provide authority since it owned the lines (or at least most of the line in the case of the NEC). On the Keystone Corridor, because the costs associated with the modifications were not extensive, the state government and Amtrak could include them in their annual budgets, thus providing the means. On the NEC, the costs were more significant as were the challenges faced by multiple owners, multiple states, and many more operators, so the involvement of the

federal government was more important. In terms of the Chicago Hub and other efforts where multiple states are involved, in the absence of either a serious regional authority or equal commitment by each of the state involved, successful implementation of HSR will likely necessitate a strong federal role akin to what was seen on the NEC.

Need for a Federal Vision

The Keystone Corridor demonstrates the potential for HSR improvements without major federal support. Nevertheless, given the experience on the Northeast Corridor and the overall lack of progress on HSR seen over the past four decades, there is good reason to believe that a federal vision for HSR is needed. Needed additionally is a national network strategy for rail that combines passenger, freight, non-HSR intercity, and HSR rail, and addresses how each also links to nonrail modes of transportation. Along with this, federal funding is also important, especially for the larger and multistate projects. Indeed, as the experience of the NEC demonstrates, without the public funding provided by the federal government, even the successes that have been realized would not have occurred.

Reiterating the findings in the first study, without a broad vision, or at least guidance and standards, states will continue to fill the void with multiple types of models—constitutional amendments and legislation (like Florida and California); multistate compacts (like the Chicago Hub); public-private partnerships (like what was envisioned during the 1980s in Pennsylvania)—without a sense of what is most likely to succeed. Worse, without a national network strategy for rail, the United States will continue to miss opportunities to improve our overall transportation system for passengers and freight.

Clear Identification of Goals and Benefits

The goals for any major capital investment project are rarely unidimensional. However, in the case of HSR, the goals are not only multidimensional but also sometimes conflicting. While some focus on the need for the highest speeds, others argue that accessibility, frequency, and on-time performance are more important (basically, more efficient and reliable intercity rail). These different goals often lead to very different markets, technologies, funding sources, and overall outcomes, with those focusing on speeds proposing new HSR and those focusing on other attributes looking toward incremental HSR.

Developing clear and consistent goals around which to build a consensus is important for successful outcomes in HSR. On the Keystone Corridor, earlier efforts aimed at new HSR

noted multiple goals—economic development, higher rail share of travel, travel-time savings—without prioritizing them. Indeed, when the commission's final report was issued suggesting that Maglev was the best option, it noted that a substantial minority believed that lower cost alternatives should be considered if monies were not forthcoming. The report also notes that while modest upgrades to Amtrak's service would yield significant trip-time savings, such upgrades provided the least economic benefit. Finally, the chairman focused on travel speeds, noting that "speed sells." Even within the commission, the goals were not clear, making it more difficult to reach consensus among other stakeholders. In the most recent effort, the goal was much more straightforward—fix the line and improve trip times.

Related to this, all the key stakeholders (in this case, operators) along the Keystone Corridor see some benefit accruing from the goals identified in the KCIP. Amtrak will increase and enhance its service, with corresponding ridership and revenue increases. PennDOT will be able to fulfill several of its own objectives related to broader transportation goals for the corridor. SEPTA will benefit from increased capacity and infrastructure improvements. Finally, Norfolk Southern will benefit from being able to use heavier cars over the bridges, and from increased efficiency in operations that will result from the track, communications, and signal improvements.

The NEC's experience has been somewhat mixed in terms of goals and benefits. The earliest goals were identified in terms of reducing trip times, but the exact goals were actually negotiated rather than based on objective criteria or analysis, and whether they were fully agreed upon by all the stakeholders involved is not clear. In terms of benefits, as early as 1978 the NECIP was coming under criticism for not addressing the concerns and needs of the various stakeholders along the corridor, notably the commuter and freight railroad operators. Under the NHRIP, similar concerns were raised as well as additional concerns by other nonoperating stakeholders (e.g., the marina interests) along the NEC and, as was seen, finding operational support and funding for those improvements that do not clearly benefit certain stakeholders has proven difficult.

To date, the overarching goals of the Midwestern states are to increase connectivity, reduce trip times between major Midwestern cities, and provide multimodal connections to improve system access. These goals have meant that the Midwestern states have moved towards a more regional framework to plan for HSR, which, critics point out, has meant inclusion of corridors that have little potential to attract ridership and an estimated project cost that, in light of limited funding, is almost impossible to finance. Further, the matrix of benefits in the Chicago Hub remains very much unclear. For the Chicago Hub to have

any opportunity for success, it is critical that the private railroad companies that own the majority of the ROW; Metra (the commuter rail); and the environmental groups be included in the planning process so they can work together to develop and prioritize the goals and identify benefits.

THEMES FOR CONSIDERATION

In addition to the findings and lessons learned, some important themes for consideration bear mentioning.

Private ROW Ownership and Success

Can the NEC and the Keystone Corridor be replicated without ownership of the ROW by a single passenger rail entity?

On both the NEC and the Keystone Corridor ownership of the ROW by Amtrak proved critical. Ownership of the ROW allowed Amtrak the authority to more easily deal with signaling, dispatching, power distribution, and maintenance decisions to implement HSR. It also reduced costs since there was no need to purchase new ROW and, in the case of the KCIP, also allowed the avoidance of certain environmental requirements since most of the improvements occurred in the current ROW and did not reflect a new service in themselves.

In contrast, except for one relatively small segment, the Chicago Hub is not owned by Amtrak, and unlike the NEC on which the other owners were public entities, the Chicago Hub's spokes are primarily owned by private railroad companies. The result is similar to what is seen on the western portion of the Keystone Corridor—there is no clear authority for implementing HSR, and the costs to do so are much more significant since in many cases separate tracks will be required for passenger trains operating at higher speeds. In fact, the only section of the Chicago Hub that has been upgraded in speed in recent years is the Amtrak-owned segment from just outside of Chicago to Kalamazoo.

The Cost of Keeping Costs Lower

Keeping costs lower helps, but there are costs to "doing it on the cheap."

Among the key findings on the Keystone Corridor was that because the costs to implement change in the most recent effort were reasonable, they were more easily accepted and

achieved. Similarly, in the Chicago Hub area—the one area where the tracks have been upgraded to 110 mph maximum allowable speed (though speeds remain lower because other upgrades are still not in place)—it was relatively inexpensive and costs could be covered under a broader statewide infrastructure initiative in Illinois. However, as the experience on the NEC demonstrates, trying to reduce costs too much can lead to the situation where the goals are left unmet. In fact, on the NEC, the constant tension between what was needed to realize the goals of the NECIP and the NHRIP, and the funds that were provided often led to increased costs over time as plans were continuously redrawn and revised, and implementation delayed. Worse, making decisions based on the cost of each project individually ignored the possibility of reaping greater savings by combining the projects.

Moving Beyond U.S. Reluctance

Is the United States Ready for New HSR?

The first study in this series suggested that there were opportunities for both incremental and new HSR in the United States, noting a 1997 Federal Railroad Administration study that concluded that high-speed ground transportation (including HSR and Maglev) could develop appreciable ridership.[332] A number of experts have suggested in recent months that with concerns rising over fuel prices and the damage cause by greenhouse gases, people may be more willing and likely to turn to rail for travel. However, in the United States to date, the only two cases that even come close to having HSR implemented are the NEC and the Keystone Corridor, and whether they are truly HSR remains debatable. The Keystone Corridor still will only be traveling at speeds of up to 110 mph, and while trains on the NEC can travel at speeds of up to 150 mph on the north-end and 135 mph on the south-end, average speeds fall much below that. However, they are at least implemented, which is more than can be said for many other efforts around the country—Florida, Ohio, Chicago Hub—that have been pursued for decades but have not moved past the planning phases.

Beyond the fact that Amtrak owns the lines for both the Keystone Corridor and the NEC, another factor that stands out is that they are both incremental rail initiatives that build upon what already exists. In contrast, earlier attempts at HSR on the Keystone Corridor that stressed new HSR or Maglev technologies failed as did Florida's and Texas' attempts at new HSR. Many other initiatives that focus on new HSR have also failed to progress.

Should the Focus Be on Incremental HSR?

Perhaps the most resounding theme for consideration is that in the United States, incremental HSR may have the best chance for success. This is not to say that all incremental HSR solutions will be successful. The Ohio and Chicago Hubs have been pursued for many years without approaching implementation beyond the upgrades to the tracks on the two small segments noted earlier. Nor is this to say that incremental HSR is the preferred approach. Indeed, while the NEC is successful in some ways, it also clearly demonstrates the difficulties in operating true HSR on a ROW shared with heavy commuter and freight rail traffic.

Nevertheless, this is a point worth serious consideration given the costs of new HSR; current political apathy (and in some cases outright antipathy) surrounding rail more broadly and new HSR more specifically; the perceived risks associated with "unproven" HSR technologies in the United States, and the fact that the few places where success has occurred (even if modest in many respects) have implemented incremental HSR. While incremental rail may be viewed by some as "settling" for the second-best choice, without stronger and consistent financial and political commitment on both the part of the federal government and the states, it may be the only means for having any HSR in the United States for some time.

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ABBREVIATIONS AND ACRONYMS

4R Act	Railroad Revitalization and Regulation Reform Act
AASHTO	American Association of State Highway and Transportation Officials
ABS	Automatic Block Signalling
ADA	Americans with Disabilities Act
Amtrak	National Railroad Passenger Corporation
BBC/MEC	Balfour Betty Construction, Inc. and Massachusetts Electric Construction Company
BNSF	Burlington Northern and Santa Fe
CHSRA	California High-Speed Rail Authority
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CMP	Corridor Master Plan
CN	Canadian National
CONEG	Coalition of Northeastern Governors
ConnDOT	Connecticut Department of Transportation
Conrail	Consolidated Rail Corporation
CP	Canadian Pacific
CREATE	Chicago Region Environmental and Transportation Efficiency
CSX	A company providing rail, intermodal and rail-to-truck transload services
CTC	Centralized traffic control
CWR	Continuously welded rail
DCP	DeLeuw, Cather/Parsons & Associates
DEP	Department of Environmental Protection
DEIS/R	Draft Environmental Impact Statement/Report
DPEIS	Draft Programmatic Environmental Impact Statement
DOT	Department of Transportation
FBI	Federal Bureau of Investigation
FEIS	Final Environmental Impact Statement
FEIS/R	Final Environmental Impact Statement/Report
FHSRA	Florida High-Speed Rail Authority

FONSI	Finding of no significant impact
FPEIS	Final Programmatic Environmental Impact Statement
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	Fiscal year
GE	General Electric
HSGT	High-Speed Ground Transportation
HSR	High-Speed Rail
ICE	German Intercity Express
IDOT	Illinois Department of Transportation
Illinois FIRST	Illinois Fund for Infrastructure, Roads, Schools, and Transit
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITCS	Intermittent train control system
KCIP	Keystone Corridor Improvement Project
LIRR	Long Island Rail Road (MTA)
LNG	Liquefied Natural Gas
Maglev	Magnetic levitation
MARC	Maryland's Commuter Rail Service
MAS	Maximum authorized speed
MBTA	Massachusetts Bay Transportation Authority
Metra	Commuter rail operating in the nine-county region of Northeastern Illinois
MIP	Milwaukee Intermodal Partners, LLC
MLC	Midwestern Legislative Conference
MNR	Metro-North Railroad (MTA)
MWRRI	Midwest Regional Rail Initiative
MWRRS	Midwest Regional Rail System
MIPRC	Midwest Interstate Passenger Rail Commission
MOA	Memorandum of Agreement
mph	Miles per hour
MTA	Metropolitan Transit Authority (New York City)
NEC	Northeast Corridor
NECIP	Northeast Corridor Improvement Project

NEPA	National Environmental Policy Act
NHRIP	Northeast High-Speed Rail Improvement Project
NJ Transit	New Jersey Transit Corporation
NS	Norfolk Southern
ODOT	Ohio Department of Transportation
OHSGT	Office of High Speed Ground Transportation
ORDC	Ohio Rail Development Commission
ORTA	Ohio Rail Transportation Authority
PBGF	Parsons Brinckerhoff/Gannett Fleming
PennDOT	Pennsylvania Department of Transportation
PEIS	Programmatic Environmental Impact Statement
PHSIRPC	Pennsylvania High Speed Intercity Rail Passenger Commission
PRR	Pennsylvania Railroad
PTC	Positive Train Control
P&W	Providence & Worcester Railroad Company
RFP	Request for Proposals
ROW	Right-of-Way
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act
SEPTA	Southeastern Pennsylvania Transportation Authority
SOGR	State of good repair
TGV	Train à Grande Vitesse (HSR in France)
TIFIA	Transportation Infrastructure Finance and Innovation Act
TOFC	Truck trailers on flat cars
UAC	United Aircraft Corporation
UMTA	Urban Mass Transportation Administration
UP	Union Pacific
U.S. DOT	United States Department of Transportation
U.S. GAO	United States General Accounting Office
WABCO	Westinghouse Air Brake Company
WisARP	Wisconsin Association of Rail Passengers
WisDOT	Wisconsin Department of Transportation
WSDOT	Washington State Department of Transportation

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