Intercity Rail Passenger Systems Update

Current Research and Development in Intercity Rail Passenger Systems

Contents

From the Chair .................................................................2

Editor’s Introduction ..........................................................3

Railenergy: The European Approach to the Improvement of Energy Efficiency in Railways .................................................5

New Research on the Mobility Impacts of Intercity Passenger Rail .................................................................8

High-Speed Rail in the Southeast Corridor Revisited ..........10

Nothing for Intercity Passenger Rail in MAP-21 .................13

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The Transportation Research Board’s Committee on Intercity Passenger Rail (AR010) is concerned with research that will lead to better planning and implementation of intercity rail passenger systems, with particular emphasis on the full range of high-speed systems including new technology. This research will include demand analysis, financial considerations, economic impacts (including consideration of user and social benefits), and institutional arrangements including public–private partnerships. The research should also address impacts on other rail operations, coordination with other modes, rail–highway interfaces, corridor versus system concerns, technology assessment, environmental impacts, and implementation strategies.

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From the Chair .................................................................2

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New Research on the Mobility Impacts of Intercity Passenger Rail .................................................................8

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Intercity Rail Passenger Systems Update is published intermittently by the Transportation Research Board to disseminate information about current research and development in intercity rail passenger systems. Penny E. Eickemeyer, Editor; David P. Simpson, Chair, TRB Committee on Intercity Passenger Rail; Thomas M. Palmerlee, TRB Associate Division Director, Data and Information Services. Any findings and conclusions are those of the authors and not of TRB. TRB Publications office: Lea Camarda, Editor; Paul deBruijn, Design. Submit news items to Thomas M. Palmerlee, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, telephone 202-334-2907, or e-mail tpalmerlee@nas.edu.

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TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
FROM THE CHAIR

Dear Friends and Colleagues:

Plans are in full swing for the 2013 TRB Annual Meeting. Held, as always, in the “Zoo District” of our nation’s capital, the meeting features a wide range of quality presentations and workshops—both domestic and imported—and promises an intellectual feast for those interested in rail transportation. The topic of intercity passenger rail continues to generate considerable interest among young members and researchers—the 29 papers submitted for review this fall constitutes a new record for our committee. My sincere thanks to Genaro Mejia, who stepped up to coordinate the review process, as well as to all the friends and members who generously devoted serious time and brainpower to critiquing and offering comments on these submissions.

Eric Peterson’s article summarizes the current state of federal funding and the treatment—or nontreatment—of passenger rail in the Moving Ahead for Progress in the 21st Century Act (MAP-21) of 2012. In previous newsletters I’ve noted the importance of remembering the long-term context—that rail continues to grow in the public consciousness as an important element of our investment framework. Some exciting new initiatives are seeking alternative approaches to rail development, such as the Texas Central High-Speed Railway and All Aboard Florida, a program for passenger rail development along Florida’s east coast. These and other topics will be explored in a workshop organized in collaboration with the Mineta Transportation Institute on Sunday, January 13, just before the Annual Meeting, on the topic of intercity and high-speed rail.

Thanks for listening. I hope to see most of you in January!

–David Simpson, Chair
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We are getting close to the 2013 TRB Annual Meeting and a new round of papers, presentations, and workshops have been selected. As in past years, the Intercity Passenger Rail Committee (AR010) is doing its part to inform attendees—professionals, researchers, and students—about the latest innovations and schools of thought on intercity passenger rail worldwide. Each TRB Annual Meeting cycle contributes to a continuum of information that we hope will offer sufficient knowledge for decision making to those who fund and implement transportation programs. As we move forward, prior research provides further guidance worthy of consideration; therefore, this issue contains articles on recent research of value in meeting our educational goals.

Our lead article presents a technology-related topic from Europe. Valerio Recagno of D’Appolonia S.p.A., which is based in Genova, Italy, discusses a multiyear, multicountry study that began in 2006 to investigate and determine a system approach to measuring energy efficiency in the railway sector and assessing the impacts of innovation in new technologies and operational measures. His article, “Railenergy: The European Approach to the Improvement of Energy Efficiency in Railways,” is quite informative.

We also have two articles that discuss research on the feasibility of intercity passenger and high-speed rail. These articles focus on two separate U.S. Department of Transportation (DOT)–designated high-speed rail corridors:

- In “New Research on the Mobility Impacts of Intercity Passenger Rail,” Ben Sperry and Curtis Morgan of the Texas A&M Transportation Institute (TTI) discuss TTI’s research on the mobility impacts of the Hiawatha Amtrak route, which runs between Milwaukee, Wisconsin, and Chicago, Illinois—one hub in the Midwest (Chicago Hub Network) Corridor. One stop on this Hiawatha service is at the Milwaukee Airport Rail Station; according to the article, this is one of only four stations in the country with a direct link between the Amtrak rail system and an airport. A survey of passengers provides insight into the impact of this connection on ridership.
- In the second article, Curtis Bradley discusses research that he performed as a master’s degree student at South Carolina State University. The article, “High-Speed Rail in the Southeast Corridor Revisited,” highlights points from his research paper, “A Revisit of the Feasibility of the High-Speed Rail in the Southeast Corridor,” which evaluates criteria such as population, terrain, proposed distance of high-speed rail, and existing rail, to assess the potential for successful high-speed rail in the southeastern United States.

The fourth, and last, article refers to MAP-21, the long-awaited sequel to SAFETEA-LU that was signed by President Barack Obama on July 6, 2012. The author, Eric Peterson, points out that funding for intercity passenger rail or high-speed rail was not included in the final bill, but that the possibility of future federal funding for this service still is up for debate among legislators. The continuation of this discussion underscores the importance of the role of TRB, its committees, and its members in providing as
much new, innovative, and objective information as possible.

With this in mind, please consider contributing articles to this newsletter on your recently completed research during the next year. Also, please keep an eye out for a survey that will be posted on the AR010 website in the next few months to solicit your suggestions for ideas for an article or offers to author an article.

Thanks, and I hope to see you at the 2013 Annual Meeting.

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RAILENERGY: THE EUROPEAN APPROACH TO THE IMPROVEMENT OF ENERGY EFFICIENCY IN RAILWAYS

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Over the past decade, the European railway market has been challenged by different factors: open-market competition within the railway, among operating companies, and among other modes of transportation; the security of the energy supply; and the impact of greenhouse gas emissions on the climate.

From a strategic point of view, the whole railway industry has identified energy efficiency as the prime consideration in addressing all the above challenges at once. For this reason, major players of the European railway sector established the Railenergy project in 2005. Partly financed by the European Commission under the Sixth Framework Programme of Research and Technological Development, Railenergy has investigated and determined a system approach to measure energy efficiency in the railway sector and to assess the impacts of innovation coming from new technologies or operational measures.

The project officially started in September 2006 and ended in December 2010. It comprised 27 partners—railway operators, manufacturers, suppliers, consultancies, and universities—bringing along more than 100 researchers from 15 European countries. The direct participation of the International Union of Railways (UIC); UNIFE, the Association of the European Rail Industry; and major project stakeholders created the critical mass needed to ensure the market uptake of project results and their use in the business arena.

Railenergy has demonstrated that it is possible to reduce the specific energy consumption of the rail system by 6 percent by 2020, through the application of a holistic approach comprising different railway systems, subsystems, and components. The project results include the following:

1. Contribution to technical standardization (technical recommendation: a bilateral UIC–UNIFE standard as an input for the European standards),
2. Tools for the calculation of energy consumption in a defined railway system, and
3. New technical components and recommendations for their use.

One of the most important results from Railenergy is its contribution to the European standardization processes, in particular the preparation of joint UIC–UNIFE Technical Recommendations (TecRecs). A TecRec is a joint standard that aims to accelerate the standardization process, thereby improving the competitiveness of the European railway system. The first TecRec, “100_001: Specification and Verification of Energy Consumption for Railway Rolling Stock,” was developed by Railenergy to support procurement

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Examples of Railenergy Calculator energy-saving assessments.

Railenergy: The European Approach to the Improvement of Energy Efficiency in Railways

-TECRec 100_001 is recommended for new projects in the tendering process as the basis for evaluating the energy performance of new technologies or design options.

Railenergy also delivered a second proposal for a TecRec, which provides a voluntary standard as a guide when implementing reversible electrical substations (ESS) in direct current (DC). This TecRec is suitable for newly manufactured ESS, as well as upgrading and renewal, taking into account the dedicated economic analysis that must be provided in both cases. It also provides indications for the design phase to maximize energy efficiency by correctly installing the technology. This project also was involved in the preparation and delivery of the Railenergy Calculator, a software-based decision support tool for railway decision makers to assess various energy-efficiency strategies. The tool, openly accessible at www.railenergy.eu, supports manufacturers’ assessment of technologies for rolling stock and infrastructure components. Railway operators and infrastructure managers also benefit by being able to evaluate the operational, technical, and strategic investment opportunities for energy-efficiency solutions in procurement, leasing, operation, and maintenance activities.

The strategic evaluation is based on a simplified cost-benefit–cost-effectiveness methodology that includes a strong lifecycle perspective. The Railenergy Calculator...
defines the optimal mix of energy-efficiency strategies at the vehicle or network level, accounting for energy efficiency and costs, such as investments and payback time. It features a sensitivity analysis module to include the effects of uncertainties in traffic volumes, energy prices, and tariffs for strategic assessment purposes. By using a consistent methodology in the technical, operational, and economic assessment phases, industrial partners can screen energy-efficiency measures in a transparent, functional manner. The figure on page 6 shows an example of the technical results of the calculator.

Manufacturers’ and operators’ joint efforts to investigate the energy-saving potential of different technologies made it possible to draw recommendations for their possible application in different systems. This represents a significant advance, as historically deep differences between the former national railways in Europe have blocked the integration and interoperability of trains across European Union member states’ borders. Though this is still somewhat the case, the Railenergy approach has enabled comparisons across various railway systems. Railenergy examined the potential for energy saving in the four main traction systems on the European continent—DC railway services, alternating current (AC) conventional railway services, AC high-speed railway services, and diesel railway services. The approach offered strategic recommendations for such service types as regional traffic or high-speed services; for dedicated technologies such as the medium-frequency transformation of waste heat; and for operational measures, including energy-efficient driving or parked-train management. Although Railenergy offers benchmarks for energy-saving potential in existing rail systems, it does not recommend a specific traction system.

NEW RESEARCH ON THE MOBILITY IMPACTS OF INTERCITY PASSENGER RAIL

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Outside of the Northeast Corridor, there are very few corridors in the United States where intercity passenger rail could be considered truly well-integrated into the multimodal transportation system. One such corridor is between Milwaukee, Wisconsin, and Chicago, Illinois. Operating between the two cities, which are approximately 90 miles apart, is an Amtrak route known as the Hiawatha Service. In January 2011, researchers from TTI, with financial support from the University Transportation Center for Mobility and Wisconsin DOT, initiated a research project to examine the mobility impacts of the Hiawatha Service route. In the first phase of this project, TTI and Wisconsin DOT developed and implemented an onboard survey of Hiawatha Service passengers.

One stop on the Hiawatha Service is at the Milwaukee Airport Rail Station—one of only four such stations in the country with a direct link between the Amtrak rail system and an airport. Passengers wishing to travel between the rail station and the airport terminal use a circulating shuttle bus. In the second phase of this project, TTI researchers designed and implemented a two-part survey that examined the passengers utilizing the air–rail intermodal interface at the Milwaukee Airport Rail Station.

Results from the onboard passenger survey showed that, on weekdays, a majority of passengers traveled on the Hiawatha Service for business-related purposes or for work commutes. This included travelers commuting to or from work on a daily or less-than-daily basis. Conversely, nearly 80 percent of weekend passengers were traveling for personal reasons—visiting family or friends, leisure or entertainment, vacation, or shopping. Weekday passengers cited the convenience of the rail service as a main influence on their decision to use the rail service instead of other modes, while weekend passengers rated the connections between the rail service and other Amtrak trains, intercity buses, or airlines as more influential.

The automobile was the primary alternative to rail service, with approximately 70 percent of passengers reporting that they would use an automobile if the rail service was not available. Other alternatives to the Hiawatha Service included intercity bus, Metra commuter rail, airplane, and local transit bus. The alternative, “I would not have made this trip,” was selected by 14 percent of passengers, indicating a small amount of induced travel on the route. As an alternative to the Hiawatha Service, commuter rail was slightly higher for weekday travelers, while the intercity bus alternative to rail service was higher for weekend travelers. Applying these findings to overall Hiawatha Service ridership, researchers estimated that more than 521,000 annual vehicle trips are shifted from the region’s highways onto the Hiawatha Service, resulting in an estimated annual savings of more than 41.7 million vehicle miles traveled.
Most passengers connecting between the Hiawatha Service and the Milwaukee airport were traveling for personal reasons, such as to visit family and friends (36 percent) or for leisure and vacation (20 percent). Approximately 35 percent of connecting passengers were traveling for business purposes. While most Hiawatha Service passengers were from the Milwaukee area, Milwaukee-area residents comprised only 7 percent of airport shuttle ridership. This contrast was not surprising, as residents of the Milwaukee area were more likely to have other options for accessing the Milwaukee airport. Chicago-area residents accounted for 32 percent of shuttle passengers and 23 percent of overall Hiawatha Service ridership. A majority of passengers on the airport shuttle—55 percent—were from other states than Wisconsin or Illinois. By contrast, only 9 percent of all Hiawatha Service passengers reported a home residence outside of Wisconsin or Illinois.

One interesting finding from the shuttle survey was that not all passengers riding the shuttle were connecting between the Hiawatha Service and a flight at the Milwaukee airport—rather, 19 percent of passengers reported that they used the shuttle to connect to such transportation options as airport-based rental car facilities. Another interesting finding from the survey was that if the air–rail connection was not available, one-third of shuttle passengers would have used one of the two Chicago-area airports instead of Milwaukee for their flight. In this context, the Hiawatha Service strengthens the synergy between the Milwaukee airport and larger travel markets in the Chicago central business district and helps extend the market area for the Milwaukee airport into the Chicago region.

For more information about this research project and for a PDF copy of the final report, visit http://utcm.tamu.edu/publications/final_reports/Morgan_11-10-75.pdf.
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This article will discuss analysis and findings from “A Revisit of the Feasibility of the High-Speed Rail in the Southeast Corridor,” presented January 24, 2012, at the TRB Annual Meeting. This paper was written following the Obama Administration’s 2008 announcement that transportation improvements would be funded through the American Recovery and Reinvestment Act of 2009 and, specifically, that $8 billion would be invested in high-speed rail initiatives across the country. The Southeast High-Speed Rail (HSR) Corridor was funded by the federal government at $620 million. Two questions arise from this news: (1) what case could be made for the Southeast HSR Corridor to receive future funding and (2) whether funding for the Southeast HSR Corridor is a good investment in comparison to other corridors in the United States.

Introduction

The Southeast HSR Corridor is comprised of a combination of several rail lines; since 1995, these lines have been connected through the formation of extensions. The original Piedmont Corridor connected Washington, D.C.; Richmond, Virginia; and Raleigh, Greensboro, and, before 1995, Charlotte, North Carolina. According to the Federal Railroad Administration (FRA), it has been extended several times since to make up the current Southeast HSR Corridor, as shown on page 11.

Research has shown that population, existing railroad infrastructure, terrain, and speed all have an impact on the performance of high-speed rail. This paper will briefly document and analyze the effects of these four factors on the Southeast HSR Corridor.

Population

In comparison to other cities with successful high-speed rail, it could be determined that the southeastern United States do not have the sufficient population density to generate the level of demand that would lead to positive performance in terms of ridership. Data from the 2010 U.S. Census present interesting information on the future population of the Southeast HSR Corridor: the southern portion of the United States grew at a faster rate than the rest of the United States between 2000 and 2010. According to the data, the population of the South has grown by 14.3 percent in comparison to other corridors, the population of the Northeast by 3.2 percent, the West by 13.8 percent, and the Midwest by 3.9 percent. Census data showed evidence that the trend of population growth is shifting to the southern United States.\(^1\) The census documentation further shows that, over the past 10–12 years, the most significant growth in this region served by the

\(^1\) Observed census data took into account other states and cities that were not considered part of the Southeast HSR Corridor.
Southeast HSR Corridor occurred in the major metropolitan areas of Raleigh and Charlotte. This information could be interpreted as the beginning of a trend toward continued population and economic growth of the Southeast HSR Corridor; historically, this growth has justified the provision of high-speed rail service, particularly when major metropolitan markets can be connected. While the population of the Southeast HSR Corridor is an important factor in the consideration of high-speed rail services, the cost of the rail service is particularly important to the metropolitan area and potential investors.

Use of Existing Rail

The high cost of high-speed rail has been well-documented. One way to reduce the cost of high-speed rail is to alleviate land acquisition and construction costs. Different plans referencing the Southeast HSR Corridor have indicated that, to accomplish this, they will utilize the existing railroad infrastructure. By using existing track owned by CSX and Norfolk Southern for freight and passenger service, construction costs will be reduced significantly and land acquisition costs will be nearly eliminated, compared to the cost of new construction.2,3 Consequently, maintenance costs most likely will rise because of increased stress on the rail, but estimates have shown that the costs for upgrade and maintenance are still less than that of constructing completely new track.4

Terrain

The terrain of the area also has a distinct impact on cost of high-speed rail infrastructure. This trend generally is supported by existing high-speed rail systems in other

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countries. A 2009 U.S. Government Accountability Office (GAO) report, *High Speed Passenger Rail: Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role*, compares the cost of high-speed rail construction in Spain to that of Japan, a mountainous and dense country, in which construction costs range from $82 to $143 million per mile. In Spain, a less dense and less mountainous country, the costs of high-speed rail construction are between $37 and $53 million per mile. Flat terrain also is beneficial to the design flexibility of new lines should that option become necessary. The GAO report points out that decisions must be made on the appropriate balance between construction cost savings and the use of a design and operating model that allows for successful operating performance, which can encourage increased ridership and better speed performance.

**Speed**

The intended speed of trains is a factor in determining the feasibility of the Southeast HSR Corridor; the GAO report cited this as a significant factor in the decision to invest. The projected speed of high-speed rail in this corridor (a maximum of 110 mph) actually is lower than the UIC definition of high-speed rail (at least 125 mph). The Southeast HSR Corridor’s speed is a result of its reliance on existing track and of sharing the rail with passenger and freight lines. The number of stops between each station could have a significant impact on the overall operating speed and time of high-speed rail and so should be factored into the performance of the Southeast HSR Corridor.

**Conclusion**

In summary, the Southeast HSR Corridor rates favorably for investment in high-speed rail, based on GAO-defined criteria of acceptable population, rail road infrastructure, terrain, and speed. The corridor shows evidence of an increasing population, which will contribute to the growth and economic stability experienced by current cities and metropolitan areas that currently utilize high-speed rail. What makes the Southeast HSR Corridor unique is the opportunity for relatively minimal investment costs and the potential for significant revenues and profits.

The economic success of the Southeast HSR Corridor is contingent upon a suitable business plan, along with other potential factors that were not discussed in this paper. Regardless of the critiques of investment in high-speed rail technology, this study shows that investment in the Southeast HSR Corridor should be seriously considered and that the corridor has the potential for real and significant transportation and financial successes.

*To access the original paper discussed in this article, contact the author or, for attendees of the 2012 TRB Annual Meeting, visit http://amonline.trb.org.*

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NOTHING FOR INTERCITY PASSENGER RAIL IN MAP-21

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On July 6th, 2012, President Obama signed MAP-21 (H.R. 4348) into law, ending a two-year stalemate with Congress over the reauthorization of the nation’s surface transportation programs. The new authorization expires at the end of fiscal year (FY) 2014.

The bill totals $105 billion for FYs 2013 and 2014 and primarily covers surface transportation highway provisions. Although the Senate’s version of the legislation included provisions that would direct the U.S. Transportation Secretary—in collaboration with stakeholders—to develop a long-range national rail plan and requirements for implementing positive train control; refining Surface Transportation Board authorities; and amending and updating Amtrak’s environmental review, capital planning and financing, and inspector general authorities, the MAP-21 conferees dropped all of these provisions.

At this time, government officials indicate that the administration’s passenger rail program will continue to operate under the Passenger Rail Improvement and Investment Act of 2008, which is due for reauthorization next year and which currently authorizes federal rail programs through September 30, 2013. An aide to U.S. Rep. John Mica (R-Fla.), chair of the House Transportation and Infrastructure Committee, informed this author that the Committee plans to hold hearings throughout the remainder of this year on authorizing the funding of rail programs in the future, however.

Amtrak P370 heads into a St. Joseph, Michigan, train station. Congress passed a joint resolution on September 10, 2012, continuing Federal Railroad Administration and Amtrak funding at FY 2012 levels through March 2013. (Photo: Russell Sekeet)
Though the pending FY 2013 transportation appropriation bill contains funding for Amtrak, no money has been approved for other high-speed and intercity passenger rail projects or for the administration’s highly popular transportation infrastructure grants.

In the House version of the FY 2013 transportation appropriation, FRA would receive $2 billion, with $1.8 billion dedicated to Amtrak. The FY 2013 Senate transportation appropriations bill offers $1.76 billion for FRA, with $1.45 dedicated to Amtrak. But because the full Senate has yet to take up the FY 2013 Transportation, Housing, and Urban Development Appropriations Act, on September 10 Congress passed a joint resolution continuing FRA and Amtrak funding at FY 2012 levels through March 27, 2013. President Obama signed the resolution into law on September 28.

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**Newsletter Comments**

We look forward to your feedback on the format and the content of this publication. Comments on this newsletter, and most especially, continued contributions by committee members, friends of the committee, and others can be sent to the editor:

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