



## Review of the Federal Railroad Administration Research and Development Program: Letter Report February 2010

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# TRANSPORTATION RESEARCH BOARD

OF THE NATIONAL ACADEMIES

February 12, 2010

The Honorable Joseph Szabo  
Administrator  
Federal Railroad Administration  
1200 New Jersey Avenue, S.E.  
Washington, DC 20590

Dear Mr. Szabo:

The Transportation Research Board's (TRB's) Committee for Review of the Federal Railroad Administration (FRA) Research and Development (R&D) Program held its fifth meeting on December 7–8, 2009, in Washington, D.C. At the request of FRA's Office of R&D, the meeting on December 7 was structured as an "FRA Research Review," to which individuals from the R&D program's key stakeholder groups were invited. Attending committee members are listed in Enclosure 1, and participating FRA and Volpe staff at the meeting on December 8 are listed in Enclosure 2.

This committee is charged with conducting an annual review and evaluation of FRA's R&D program covering such topics as program management structure and approach, allocation of resources among program areas, outreach to the program's customers and stakeholders, project selection criteria, and project management. The committee is also asked to review the major research directions of the program, as well as the content of the research program areas, for applicability to the needs of the program's customers and stakeholders both within and external to FRA.

For this meeting, FRA requested that on the first day the audience for FRA's R&D project reports be expanded. The FRA R&D staff wanted to combine the committee meeting with an outreach session for stakeholders. The Research Review was attended by approximately 70 invited guests, the committee members, and FRA R&D staff and Volpe Center researchers who work on FRA research projects.

On the second day of the meeting, the committee discussed its reactions to the Research Review with the FRA R&D leadership and future directions for the R&D program. FRA management, including R&D management, asked the committee to look to the future and emphasized FRA's need for advice and counsel from the committee on R&D activities that can support new

investments in incrementally higher-speed and true high-speed rail passenger service developments. The meeting concluded with the committee's executive session to formulate the findings and recommendations that are provided in this report.

## **FINDINGS**

Times for rail transportation and FRA have changed dramatically. FRA now has an opportunity to reassess (and potentially expand) its role in order to demonstrate that the agency can meet new challenges. The committee concludes that the FRA R&D program is at a crossroads and has identified three factors that together demand a strategic reassessment of the program as the committee has come to know it: accomplishments of prior objectives, changes in the railroad industry's external markets, and dramatic changes in federal policy toward rail passenger service. In turn, these factors require a nimble approach to R&D directions and a continuing search for solutions to the challenges presented by the need for freight and passenger operations to share use of critical corridors.

### **1. Accomplishments of Prior R&D Objectives**

First and most immediate is that the program has accomplished many of the objectives laid out in the last 5-year R&D strategic plan.<sup>1</sup> New staff have been recruited; more meaningful project evaluation and monitoring tools have been developed; and critically important support has been provided for FRA's safety regulatory functions, including positive train control (PTC) rulemaking, crashworthiness standards, and tank car safety designs, to name a few. In addition, new human factors analysis capabilities have been developed. (Although much has changed and been accomplished, several key topics presented during the Research Review are relevant to the future R&D agenda, including, for example, braking algorithms to support PTC, grade crossing safety, wireless communication for PTC, and wheel-rail interaction.)

### **2. Rapid Change in the Railroad External Environment**

The second key theme influencing the committee's findings for this letter report is the remarkable changes that have taken place in the railroad industry's external market since preparation of FRA's last 5-year R&D plan in

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<sup>1</sup> *Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations*. FRA, 2002.

2002 and even since the 2006 workshop on priorities intended to provide useful input for FRA's next 5-year plan.<sup>2</sup>

The current recession, in some respects the worst since the 1930s, has hit railroads hard. Traffic levels have declined 25 percent or more in many lines of business. Automotive business, both finished automobiles and parts, reflects the conditions of that sector, where unemployment runs deep and no turnabout is in sight. Metals and chemicals businesses, which are highly correlated with the automotive industry, have weakened substantially. Traffic related to lumber and building products reflects the crash of new residential and commercial construction. Paper is in a decline that is compounded by apparently permanent changes in the structure of newspaper, periodical, and advertising businesses. International container business, critically dependent on both the strength of the U.S. dollar and personal consumption demand for imported goods, has fallen to about 75 percent of prerecession levels. Further structural changes in international container flows may accompany expansion of the Panama Canal, which is scheduled for completion in 2014.

In short, the outlook for rail freight is very different from what it was in 2006. We are not declaring the end of the "rail renaissance" only 10 years after it seemed to have bloomed, but major market shifts are under way, and the degree to which these shifts might become permanent is not fully understood or predictable. Almost certainly, however, the railroads and their suppliers are not ready for the major adjustments that may become necessary. FRA must be nimble above all else and avoid commitments to research that may become detached from reality. Even with respect to safety, there are external factors that must be considered. Safety-related R&D has frequently focused on issues related to commodity-specific equipment or operational issues, but as traffic flows decline in some commodities the relevance of such R&D is diminished. Issues related to the railroad external environment are potential topics for "contextual" and policy research (see Recommendation 3 and the related discussion below).

### **3. A Sea Change in Rail Passenger Service Priorities**

The third reason why the committee believes that FRA must make a strategic reassessment of its R&D objectives and priorities is perhaps the

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<sup>2</sup>TRB Conference Proceedings on the Web 3: *Research to Enhance Rail Network Performance* is available at <http://onlinepubs.trb.org/onlinepubs/conf/CPW3.pdf>. On the basis of discussion with FRA R&D leadership at the Research Review postmortem on December 8, 2009, it appears that the new 5-year plan is drafted and is awaiting final coordination with the Office of the Secretary and the Research and Innovative Technology Administration, which has its own mandate to publish a 5-year strategic research plan.

most obvious. Congress and the Obama administration have effected what can accurately be called a sea change in federal policy toward rail passenger service. In place of the past 30 or more years of attention to peripheral issues related to Amtrak funding, route structure, and management changes, there appears to be a fundamental new commitment to making rail passenger service a more important option for American commuters and intercity travelers. The new direction has already had a powerful impact on the shape and magnitude of FRA's R&D program. The FRA R&D budget had been shrinking in recent years. For it now to become part of the institutional framework supporting \$8 billion of federal stimulus funding, with the prospect of more billions of dollars of rail passenger investment annually, is remarkable and beyond what many of us ever thought we would see. It is time for FRA R&D staff—and the committee—to identify roles and responsibilities that must be undertaken to implement the new rail passenger initiatives successfully.

The committee had not expected that the FRA Research Review would make these dramatic changes and opportunities apparent. However, its strong consensus now is that FRA's previous research agenda needs to be replaced by a new strategic R&D plan that aligns project priorities with the new realities facing the railroad industry.<sup>3</sup>

## RECOMMENDATIONS

FRA and the U.S. Department of Transportation (USDOT), with the support of this committee, need to define what must be done both *technologically* and *economically* to make higher-speed; safer; and more convenient, accessible, and reliable rail passenger services possible. The committee sees a set of logical next steps to bring about this vision.

**RECOMMENDATION 1.** The R&D program should be driven by the administration's policy direction for high-speed passenger rail.

FRA must proceed, of course, with its mandated review of the high-speed development proposals put forth by states and their partners in response to the \$8 billion provided in the American Recovery and Reinvestment Act (ARRA) for improvements in intercity rail passenger services and development of high-speed services. The committee expects that as a result

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<sup>3</sup> The committee understands that a new 5-year R&D plan is in the final stages of review. In the more detailed recommendations that follow, the committee highlights factors that should receive consideration and that perhaps have already been included in the plan.

of this review and accompanying decisions, a clearer picture of the promise of rail passenger development for the next decade will emerge. A national policy consensus with regard to the FRA–USDOT–White House recommendations, if it develops, will create the proper context for setting new FRA R&D priorities. This new policy direction builds on the administration’s judgment that (a) passenger rail services are more environmentally sustainable than are highway or air services; (b) the United States is behind the curve in exploiting the potential of modern high-capacity, high-speed passenger railroads; and (c) investment in both higher- and high-speed passenger rail makes sense now, when it can provide the nation with additional benefits for economic recovery. It is understood, of course, that a way forward for vastly improved passenger rail services must be structured within the context of significant national issues with regard to budget deficits, public spending priorities, and public–private partnerships.

The research priorities accompanying such a program will require taking into account the fact that higher-speed passenger corridors developed outside the existing Boston–New York–Washington, D.C., corridor will necessarily run on tracks shared with heavy-haul private freight railroads. Two issues must be addressed in detail and in the context of long-term operating contracts: (a) the technologies involved in sharing assets between faster passenger trains and heavy freight trains (such issues as interoperable PTC; agreements on curve superelevation; resolution of dispatching conflicts; optimal scheduling of maintenance-of-way work windows; and decisions on grade separations, flyovers, and bypass tracks in congested areas) and (b) the financial arrangements for sharing cost responsibility between passenger service providers and landlord freight railroads.

The required technologies outlined above may be subjects within the R&D agenda, while the financial arrangements (including consideration for liability) may require policy research or program development.

**RECOMMENDATION 2.** FRA should emphasize in the R&D agenda the technologies required to support joint passenger and freight operation over the same right-of-way—in particular in the areas of (a) capacity management for mixed operations and (b) rail design and maintenance given the mixing of heavy freight rail cars and higher-speed passenger rail. Although valuable lessons may be learned from overseas, research on heavy freight–high-speed passenger joint operations cannot be imported, because the circumstances are unique to the U.S. operating and engineering environment. R&D programs, such as those based on the Facility for Accelerated Service Testing program of the Transportation Technology Center, Inc., will

become more critical as research into the safety and economic performance of mixed passenger and freight operations progresses.<sup>4</sup>

Testing capabilities in a nonrevenue environment are needed to evaluate designs developed within the United States and to ensure train safety. FRA should investigate potential business models and build policy scenarios for use by the administration in developing a sustainable national rail infrastructure to support high-speed passenger operation, in accordance with the objective set in the ARRA.

**RECOMMENDATION 3.** In the past, the committee has made recommendations for “contextual” research, which can be defined as policy research that provides a context for development of the R&D agenda. There are subject areas, however, that require true policy analysis beyond contextual. The committee recommends that FRA undertake policy research into the implications of policy directions related to energy and the shifting of more freight from highway to rail. Achieving such shifts will likely require quantum improvements in service reliability and in the capacity of the national rail system. Contextual research should explore the impacts of major changes in the railroad industry’s external environment on R&D directions and place safety-related R&D within the context of the railroads’ cost and revenue structure.

Policy makers concerned about climate change and energy dependence have renewed discussion about saving petroleum fuel, and perhaps reducing fatalities and injuries, by diverting some freight and automobile traffic from congested highways to rail. Diverting traffic, both freight and passenger, will be a daunting task. For example, the margins on shorter-haul domestic intermodal traffic are razor thin, so a focus on the cost side (capital and expense) is critical to the rail industry’s ability to handle such traffic. Attention to industry margins is essential in general; even “cost-effective safety solutions,” in the words of one committee member, face marketplace constraints on deployment, in a revenue-constrained environment.

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<sup>4</sup> The committee’s letter report of April 22, 2009, ([http://onlinepubs.trb.org/onlinepubs/reports/frar&d\\_April\\_2009.pdf](http://onlinepubs.trb.org/onlinepubs/reports/frar&d_April_2009.pdf)) contained a section on “Funding for the Facility for Accelerated Service Testing” and stated the following: “The committee notes the coming increase in intercity passenger trains, many of which will operate jointly with heavy axle load (HAL) freight traffic, for which FAST testing will be critical. The FAST research directly addresses the safety of track components under heavy axle loads and is relevant for higher-speed passenger train operations.”

Questions that might be addressed by contextual research include the following: What are the proper policy tools to engage and implement ideas related to diverting traffic from highway to rail, and should they encompass incentives (for example, green credits—a sort of bonus for taking actions determined to have favorable impacts on air quality, energy conservation, land use, etc.) or penalties (such as congestion tolls or higher motor fuel levies)? More reliable rail freight operations and faster, safer scheduled passenger trains may require grade separation investments vastly greater than what America is used to providing. How will those new “replacement Interstate” investments be made? Will they require an overhaul of federal and state transportation policy? Who would champion such a fundamental shift in transportation policy? How will workforce development and education be provided to support rail developments by both the private and public sectors?

Some of these questions may become topics for the proposed Rail Cooperative Research Program, authorized by the Passenger Rail Investment and Improvement Act of 2008 and to be administered by TRB. FRA asked the committee to recommend topics to be addressed under this program, and the committee discussed the topic areas outlined in the following recommendation.

**RECOMMENDATION 4.** In developing a research agenda for the new Rail Cooperative Research Program, the committee recommends that FRA consider the following topics: sustainable business models for new passenger operating agencies and authorities, the benchmarking of international systems (the United Kingdom might be most appropriate because it has reasonably heavy freight on its passenger trunk lines, which operate at 125 mph), evaluation of electrification options for the long run (drawing upon past research and program initiatives as well as international experience), strategies to meet safety standards for mixed traffic including adjustments required to make available passenger equipment compliant with U.S. buff strength and crashworthiness standards, whether and how to jump-start the domestic passenger rail manufacturing industry given how far behind these manufacturers are, the potential for fostering strategic partnerships between U.S. and international manufacturers, management of mixed traffic (capital support for capacity to allow for passing trains or for separation of freight and passenger trains and how to determine where such investments would fit into the network and make financial sense), and how to build professional workforce capacity given

the small number of educational programs in rail engineering and economics.

The committee and FRA staff discussed the desirability of an interim meeting in the spring 2010 to cover in more detail topics including (a) the critical need for professional workforce capacity building and increased support for academic research; (b) implications of and priorities for increased R&D appropriated funding, (c) responses to findings and recommendations in this report, and (d) FRA's preliminary plans for another Research Review and subsequent committee meeting.

## **PROCEDURAL COMMENTS ON THE FRA RESEARCH REVIEW**

The committee's meeting on December 8 began with a review of the December 7 event. The Research Review on December 7 consisted of several sessions, each made up of four or five presentations on specific research projects. At the conclusion of each session, the presenters selected and addressed written questions submitted by attendees. Opportunities for individual feedback to the presenters occurred only during the frequent breaks in the formal program, but not in the plenary session.

The committee recognizes the benefits of sharing the results of FRA's R&D with a wider audience of stakeholders, but it has some comments about the chosen format that may be helpful to FRA as it contemplates undertaking such an event on its own in future years. The main concern about the design of the event relates to the intent. If the format was designed simply to share information about ongoing and completed projects, the day was certainly useful. If the format was intended to elicit stakeholder feedback on ongoing research, however, the design suffered from inadequate discussion time in plenary session. There was no real opportunity for the group to hear comments of individual stakeholders or to discuss them. There was little opportunity to ask attendees to give their suggestions for shifts in emphasis, ideas for project enhancements, or proposed refinements aimed at increasing the likelihood of successful commercial deployment. Some feedback of this sort can be obtained with follow-up interviews, but the opportunity to engage the attendees as a group was missed.

For future events, FRA might consider a design that (a) has more opportunity for discussion in plenary session and (b) includes opportunities for breakout groups, where participants with specific expertise and interest can interact with FRA researchers in small groups. The design could also

facilitate stakeholder comments by having the breakout groups report back to the participants in plenary session at the end of the day.

A correctly structured periodic review with a broader audience could bring substantial benefit to FRA research priorities. The timing of the event should be arranged so that FRA is able to synthesize and incorporate lessons learned in advance of the next TRB committee review. Summary report-outs to the committee should be in a format that will provide ample time for feedback and direction.

In the session on December 7, the committee was looking for evidence of the use of the FRA-developed evaluation criteria and of the efforts that FRA has undertaken in securing stakeholder engagement with and buy-in to the nonregulatory research projects. Perhaps because of the format of the event, the committee did not see evidence of progress in either of these issues. The committee, therefore, encourages FRA to ensure that its evaluation process and choice of means for realizing stakeholder engagement and buy-in are much more clearly embedded in the routine processes supporting research.

## **CONCLUSION**

FRA leadership has major tasks ahead in setting goals that are reasonable, supporting levels of improvements that are foundational for future research activities, working with collaborators in innovative ways, identifying work that can be done incrementally, and identifying which increased efficiencies will pay for themselves. This difficult process will call for new and broader strategic thinking, building on past accomplishments and changing the focus dramatically to address the challenges emerging from the ARRA. The committee supports FRA's R&D team in carrying out its current heavy workload and planning an R&D program for the future.

The committee thanks those who participated in and contributed to the meeting, including Mark Yachmetz, Magdy El-Sibaie, Kevin Kesler, Gary Carr, Sam Alibrahim, other members of the FRA R&D staff, and Research

and Innovative Technology Administration staff at the Volpe National Transportation Systems Center. Without the full cooperation of FRA management and staff, the committee would be unable to fulfill its charge.

Sincerely yours,

Robert E. Gallamore  
Chair, Committee for Review of the FRA Research and Development Program

Enclosures

## Enclosure 1

### Committee Roster Meeting Attendance, December 7–8

#### Chair

Robert E. Gallamore  
The Gallamore Group, LLC  
December 7–8

#### Committee

Christopher P. L. Barkan  
Professor and Director, Rail Engineering  
Program  
University of Illinois  
December 7–8

Vernon W. Graham  
President  
Dakota, Minnesota and Eastern Railroad

Craig Hill  
CII Global  
December 7–8

Anson C. R. Jack  
Director of Policy, Research, and Risk and  
Deputy Chief Executive Officer  
Rail Safety and Standards Board  
December 7–8

Charles R. Lynch  
Vice President and Operations Manager South  
Gannett Fleming Transit and Rail Systems  
December 7–8

James W. McClellan  
Vice President  
Woodside Consulting Group  
December 7–8

Audrey L. Milroy  
Director, Transportation Systems  
QTEC, Inc.

Richard W. Pew  
Principal Scientist  
Raytheon BBN Technologies  
December 7–8

Ian P. Savage  
Distinguished Senior Lecturer  
Northwestern University  
December 7–8

Patrick B. Simmons  
Director, Rail Division  
North Carolina Department of Transportation  
December 7–8

James A. Stem, Jr.  
National Legislative Director  
United Transportation Union  
December 7–8

Gerhard A. Thelen  
Vice President, Operations Planning & Support  
Norfolk Southern Corporation  
December 7–8

#### Liaisons

Roy A. Allen  
President  
Transportation Technology Center, Inc.  
December 7–8

Gary A. Carr  
Chief, Track Research Division  
Federal Railroad Administration  
December 7–8

**Enclosure 2**

**Invited Speakers and Guests at  
December 8, 2009, Meeting**

**Federal Railroad Administration**

Mark Yachmetz, Associate Administrator for Railroad Development

Gary A. Carr, Chief, Track Research Division, Office of R&D

Sam Alibrahim, Chief, Signal, Train Control and Communications Division, Office of R&D

Kevin Kesler, Chief, Equipment and Operating Procedures Research Division, Office of R&D

**Volpe National Transportation Systems Center, Research and Innovative Technology  
Administration**

Robert Dorer, Director, Physical Infrastructure Systems Center of Innovation

Michael Coltman, Chief, Structures and Dynamics Division

John McGuiggan, Chief, Systems Engineering and Safety Division