



TRANSPORTATION RESEARCH BOARD

OF THE NATIONAL ACADEMIES

May 17, 2005

The Honorable Robert D. Jamison
Acting Administrator
Federal Railroad Administration
1120 Vermont Avenue, N.W.
Washington, DC 20590

Dear Administrator Jamison:

The Transportation Research Board (TRB) Committee for Review of the Federal Railroad Administration (FRA) Research, Development, and Demonstration Programs held its sixth meeting on November 4–5, 2004, and its seventh and final meeting on April 7–8, 2005, both in Washington, D.C. The committee members who attended each of these meetings are listed in Enclosure 1; the speakers and guests at each meeting are listed in Enclosure 2.

The committee thanks Mark Yachmetz, Jo Strang, Jane Bachner, Magdy El-Sibaie, Claire Orth, and other FRA and Volpe Center staff for their continued cooperation and substantial participation in these meetings. The presentations and materials they have provided have been essential to the committee's work.

THE COMMITTEE'S CHARGE

FRA's overall charge to the committee is to conduct periodic peer reviews of three programs:

- The Railroad Research and Development (Railroad R&D) Program
- The Next Generation High-Speed Rail Technology Demonstration (NGHSR) Program
- The Magnetic Levitation Technology (Maglev) Deployment Program

These peer reviews are intended to address (1) the agency's R&D management structure and approach; (2) the current direction of, and allocation of funds to, the

various program areas; and (3) whether the programs reflect an appropriate balance of federal, state, and private-sector input and cost sharing.

As its initial term will conclude on May 31, the committee begins this fourth and final letter report with a brief summary of the major themes of its discussions with FRA staff and its related recommendations in letter reports over the past 3 years. The second section of this report provides the committee's concluding comments on its review of the FRA R&D Program. The final section addresses FRA's request to TRB that the committee plan and conduct a railroad research needs conference in 2006; this additional task is part of a 2-year extension of the R&D review project.

SUMMARY OF THE COMMITTEE'S PAST MEETINGS AND LETTER REPORTS

Overall program assessment and the review process. Following up on the work of two prior TRB committees,¹ FRA requested that this committee be formed to continue to provide an external, independent review of the agency's research, development, and demonstration programs. FRA staff have devoted significant resources to the preparation and presentation of information on the agency's R&D program and its many individual projects for the committee's review. The committee has repeatedly commented on the valuable work being done by the FRA staff and on their skill and professionalism; together they represent a valuable asset and powerful repository of knowledge within FRA. Staff members have also been responsive to the committee's recommendations, for example, in addressing issues related to the program's policy framework and contextual research, the possible transition to performance-based safety regulations, and improvements to the FRA R&D strategic planning process (the first two of these topics are discussed below). Some issues that concern the committee may in fact need to be addressed by other offices within the agency. For example, progress in moving forward with performance-based safety regulation depends more on the Office of Safety than on the Office of R&D. Moreover, the committee believes that both the projects and priorities of the R&D program would be improved by a better overall view of industry trends in traffic and technology, as well as future safety issues.

Policy framework and contextual research. In assessing program directions and resource allocations, the committee has long been concerned about the need for a policy framework related to directions and trends in the railroad industry or FRA's own policy development. Echoing similar recommendations from its predecessor TRB committee, this committee has made numerous recommendations that FRA conduct contextual research on technological and operational developments within the industry

¹ The TRB Committee for an Assessment of Federal High-Speed Ground Transportation R&D reviewed the Next Generation High-Speed Rail Program (NGHSR) during 1996 and 1997. That committee was followed by the Committee for Review of the FRA Research and Development Program, which conducted reviews of the safety-related Railroad R&D program and the NGHSR Program from 1998 to 2001. Both of these committees were congressionally mandated.

that could influence the need, and particularly the priorities, for safety R&D. The committee was pleased when contextual research was first included in the R&D program in 2002. The committee also concluded that a better policy framework and contextual research could help focus FRA's *Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations* by providing well-defined research goals and objectives and the justification for selected research topics and priorities. In 2003, FRA produced two useful white papers on trends in rail transportation of grain and coal, and the committee encouraged the agency to undertake a similar study related to intermodal freight traffic (not undertaken) in light of the tremendous, continuing growth in this area. Last year, the Office of Policy was considering a study on changes in the railroad workforce, and the committee recommended that this work be done to provide a view of changing job functions in the industry and related implications for human factors research.

Performance-based safety regulations. An overarching topic critical to assessing directions in FRA's research, development, and demonstration programs is the potential application of performance-based safety regulations (as opposed to today's reliance on prescriptive regulations) as a way to encourage and facilitate the implementation of new technology and more efficient use of resources within the industry. As the prior TRB committees also found, implementation of R&D results is frequently stalled because the process of establishing safety regulations cannot keep up. The committee therefore supported FRA's including in the R&D program research on a possible strategy for transitioning to performance-based safety regulations. An FRA-funded project, conducted by the Kennedy School of Government, took a broad look at the potential benefits and limitations of performance-based regulations.² This committee devoted portions of two meetings to presentations on the Kennedy School project, on industry-supported development of "risk-based" performance standards, and on the Office of Safety's work on "risk-informed" regulations. These presentations provided examples of various approaches for developing performance-based regulations. The committee encouraged the Office of R&D and the Office of Safety to continue working together on new regulatory processes to facilitate the implementation of new technology.

Nationwide Differential Global Positioning System (NDGPS). The committee has continued to recommend that FRA and other agencies within the U.S. Department of Transportation (USDOT) complete the NDGPS network to support the development and deployment of positive train control (PTC) systems and other applications for transportation and security. This program has continually been underfunded, and the committee was pleased to learn that adequate funding has now been requested, starting in the fiscal year (FY) 2006 budget.

² A report on this project is available as follows: *Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Protection*. Regulatory Policy Program Report No. RPP-03 (2002). Coglianese, C., J. Nash, and T. Olmstead. Cambridge, Massachusetts: Regulatory Policy Program, Harvard University, John F. Kennedy School of Government.

Next Generation High-Speed Rail Program. The NGHSR program, established primarily to demonstrate technologies required to support new high-speed rail (HSR) operations in the United States, consisted of a number of large projects. The committee repeatedly found, however, that for a variety of reasons, some major development projects progressed slowly from year to year. The committee was concerned that in some cases, the size and complexity of these projects exceeded the demonstration concept, and their completion was becoming unlikely. Moreover, FRA's passenger service priorities began to shift away from HSR and toward more conventional, shorter-haul applications. The committee therefore urged FRA to conclude the existing NGHSR projects. In 2003 and 2004, FRA asked the committee for recommendations on how the NGHSR program might be restructured. The committee responded that the program needed to be refocused to be more in line with the changing needs of states seeking incremental improvements in passenger services on existing lines (frequently owned by freight railroads) in regional corridors. As FRA was developing plans for new directions for the program, the NGHSR funding was eliminated in the administration's FY 2006 budget proposal.

Magnetic levitation. The committee has recommended that FRA complete its existing maglev commitments and restrict any further effort in this area. Further R&D in maglev does not appear to address any goals of FRA's R&D strategic plan.

Critical areas of safety research. Areas of particular and continuing concern to the committee are highway-rail grade crossings and human factors. Grade crossing and trespasser accidents account for the majority of railroad-related fatalities each year, and defining how research can help reduce these fatalities is a continuing challenge. FRA has sponsored some effective work in the development and demonstration of low-cost crossing improvements. Human factors are contributing causes in many rail accidents, including some high-cost collisions and derailments. Because limitations of accident reporting data could prevent accurate assessment of root causes and problem resolution, however, actions needed to reduce accidents due to human factors are frequently not properly understood in a prescriptive sense. As a result, the committee has repeatedly expressed concern as to whether scarce resources for human factors research are being allocated to the highest-priority issues. The "close-call" research initiative now being undertaken by FRA may provide better insight into causality.

CONCLUDING COMMENTS ON THE R&D PROGRAM REVIEW

In response to FRA's presentations at its April 2005 meeting, the committee makes the following observations:

- As mentioned above, the committee is encouraged to see progress being made and resources being allocated to completion of the NDGPS network, which is vital to the full development and deployment of PTC, among many other potential transportation applications.

- Although there are needs to be addressed in support of incremental improvements to intercity passenger services, elimination of funding for many of the major NGHSR projects reflects recognition of the shift to new priorities. The development of PTC, however, continues to be a critical element in achieving the incrementally higher speeds (above 79 mph) and shorter trip times envisioned in many state plans for passenger rail corridors. To the extent possible, FRA needs to finish the residual NGHSR projects and report on their results so that the staff and resources involved can be redeployed elsewhere.
- Many details of the relationship between FRA's Office of R&D and the new Research and Innovative Technology Administration within USDOT are not yet clear. The committee hopes, however, that, while FRA maintains independence, the two offices will work cooperatively to address industry needs.
- Based on the presentation by Magdy El-Sibaie, the committee is encouraged by the development process for the new 5-year strategic plan for R&D and believes FRA is formulating its safety research in an appropriate way by using measures of harm³ (ranked by cost and probability of occurrence) to set priorities. The committee encourages FRA to develop more explicit definitions of harm that take into account, among other things, the possible intermodal effects of its actions. Some safety countermeasures, for example, could result in diversions of traffic to other modes that, in turn, could generate other sources of harm. The new 5-year plan could also include explicit discussion of planned outreach to customers and stakeholders, as well as clear measures of the effectiveness of research results. FRA is making progress in refining the scope of its audience. The agency recognizes that improvements are needed in the dissemination of research results; these improvements might include, in particular, updating the FRA website, including accelerating the process of entering research reports.
- Capacity analysis of the railroad system is critical to addressing congestion issues (which potentially bear on safety issues). It is not clear, however, what role FRA plays in understanding these issues and who has primary responsibility in this area within FRA or USDOT. Perhaps this is a function for FRA's Office of Policy or the Office of the Secretary in USDOT, but in any case, it is clearly a high-priority area with potentially major safety implications. Railroad congestion issues are being addressed in proposals from public-private groups, such as the CREATE program,⁴ which ultimately may involve FRA and perhaps other agencies within USDOT. FRA staff are asking important questions, such as:

³ "Harm" is a measure of all combined losses resulting from an accident, including damage to property and equipment and monetized values of fatalities and injuries.

⁴ The Chicago Region Environmental and Transportation Efficiency Program (CREATE) is a joint effort among North America's freight railroads, the Chicago Department of Transportation, the Illinois Department of Transportation, and Metra Commuter Rail to improve operations on rail corridors within and through the Chicago area.

Broadly, what is the relationship among traffic levels, capacity, and safety? Will safety improvements accrue as the result of congestion relief efforts? Where will future flows of hazardous materials take place? Answering these questions will help identify appropriate R&D projects in this area.

In its May 13, 2004, letter report, the committee recommended an improved customer focus and cooperative efforts. The committee followed up on this recommendation at its November 2004 meeting with invited presentations and panel discussion on customer relations and stakeholder involvement in the R&D program. The panel included representatives of other federal modal research programs and international and U.S. rail industry experts. In response, and to ensure a broad range of customer and stakeholder input to the 2007 update of the 5-year R&D strategic plan, FRA has (as noted above) asked the committee to continue its efforts and conduct a railroad research needs conference.

PLANNING A RAILROAD RESEARCH NEEDS CONFERENCE FOR 2006

During its April 2005 meeting, the committee discussed in some detail the approach to planning a railroad research needs conference for spring 2006. The conference will most likely be held either in Washington, D.C., or in Chicago in conjunction with a railroad industry research group to ensure the participation of this important group of stakeholders. The objective of the conference is to strengthen the framework for the development of FRA's update of the 5-year R&D strategic plan (which will cover the period 2007–2012), and to take an even longer-term view of industry developments as appropriate. Invitees will be drawn from all relevant communities—freight and passenger rail, management and labor, industry, and state and local governments—and encompass knowledge and expertise in related technologies and disciplines.

The conference program will comprise commissioned papers, discussion panels, and group discussions among appropriate experts. The focus will be on critical themes for future research, with the highest priorities as follows:

- **Background commissioned papers.** These papers should provide essential background for the themes of the conference. Tentatively, they will address the following topics: a projection of broad industry trends for the next decade, including analysis of likely flows by commodity (hazardous materials in particular); analysis of the history and effectiveness of FRA's R&D efforts; analysis of the R&D efforts of the Association of American Railroads; and analysis of FRA safety statistics to develop the best possible understanding of safety experience (including the root causes of accidents), problems, and trends.
- **Passenger rail.** The committee sees a clear need for research on the most effective ways to increase capacity for commuter and short-haul passenger rail services in regional corridors, usually on existing freight lines. In particular, many

state agencies have indicated a need to improve the modeling tools available for analyzing capacity investment needs and clarifying the relative responsibilities of the parties involved. Joint operation of freight and passenger services will benefit from new PTC R&D, a critical area discussed below. Conference program plans will not include HSR and Amtrak because the future of both is unclear.

- **Hazardous materials.** Transportation of hazardous materials by rail will be addressed at a broad level, including exposure measures, hazard reduction, and outcomes of accidents. The focus should include scenarios of hazmat flows by commodity, route, and location.
- **Grade crossings.** Issues related to grade crossing safety will be addressed broadly, with primary emphasis on understanding and measuring risks to aid in the development of countermeasures and the assignment of priorities to crossing safety improvements, while recognizing the need for continued cooperative efforts with the Federal Highway Administration.
- **Confidential Close Call Reporting System Demonstration Project.** This project will just have begun in January 2006, so the conference will still provide an opportunity to discuss ways of obtaining maximum benefit from the project, improving our understanding of accidents, and identifying what can be learned from the project to demonstrate the advantages of this reporting system to all concerned parties. Those who have implemented similar programs may also be invited to discuss lessons learned and resultant safety improvements; these invitees could include representatives from Norway and the United Kingdom and from the Federal Aviation Administration (which has an Aviation Safety Reporting System). Discussion of this topic will also focus on possible follow-on research needs, as well as how FRA's accident reporting can improve our understanding of the deeper causes of accidents due to human factors.
- **Performance measures.** Given the current lack of agreement among all parties on the definition of and the desirability—as well as the capability—of transitioning to performance-based regulations, a number of issues in this area could be discussed. An example is ways to improve safety exposure measures by identifying better measures of the output of the rail industry than train-miles.
- **Train control and communications.** This integrating issue has moved out of NGHSR into R&D. As yet, though, the Office of R&D does not have a fully developed plan for further R&D activities in this area. Issues include how to improve the effectiveness and drive down the costs of new PTC systems, particularly the element with the highest costs and greatest functionality—communications. PTC involves additional research issues, including the critical need to develop improved braking algorithms and the importance of interoperational crew performance in such areas as vigilance and crew response to any type of signal interruptions.

CONCLUSION

On behalf of the committee, I again want to thank the FRA and Volpe staff who continue to work so cooperatively with the committee. We look forward to a continued cooperative association with Mark Yachmetz, Jo Strang, and the FRA staff in planning and conducting the railroad research needs conference for 2006 and performing additional reviews of R&D activities.

Sincerely yours,

Louis S. Thompson
Chair, Committee for Review of the FRA Research, Development, and Demonstration Programs

Enclosures

Enclosure 1

**Committee for Review of the Federal Railroad Administration
Research, Development, and Demonstration Programs**

**Committee Members Attending November 4–5, 2004,
and April 7–8, 2005, Meetings**

Chairman

Mr. Louis S. Thompson
Principal
Thompson, Galenson and Associates, LLC
November 4–5
April 7–8

Dr. Gerard McCullough
Associate Professor, Applied Economics
University of Minnesota
April 7–8

Members

Ms. Anna M. Barry
Director of Railroad Operations
Massachusetts Bay Transportation Authority
April 7–8

Dr. Thomas H. Rockwell
President
R&R Research, Inc.
November 4–5
April 7–8

Mr. Christopher J. Boon
President
Boon, Jones, and Associates, Inc.
November 4–5
April 7–8

Mr. Thomas P. Schmidt
Vice President
TranSystems Corporation
November 4–5
April 7–8

Dr. Sherwood C. Chu
Bethesda, MD
November 4

Mr. Gerhard A. Thelen
Vice President, Mechanical
Norfolk Southern Corporation
April 7–8

Dr. William J. Harris, Jr.
Arlington, VA
November 4
April 7–8

Mr. William C. Thompson
CREATE Program Manager
Association of American Railroads
November 5
April 8

Mr. Craig Hill
Vice President, Chief Systems
Maintenance Officer
Burlington Northern Santa Fe Railway
November 4–5
April 7–8

Liaison Representative

Claire L. Orth
Chief, Equipment/Operating Practices Res. Div.
Federal Railroad Administration
November 4–5
April 7

Mr. David D. King
Deputy Secretary for Public Transportation
North Carolina Department of Transportation
November 4–5

Mr. Kenneth L. Lawson
Bluemont, VA
November 4–5
April 7–8

Enclosure 2

Invited Speakers and Guests at November 4-5, 2004, and April 7-8, 2005, Meetings

Federal Railroad Administration

Mark Yachmetz, Associate Administrator for Railroad Development (November and April)

Jo Strang, Deputy Associate Administrator for Railroad Development (November and April)

Jane Bachner, Deputy Associate Administrator for Policy (November)

Claire Orth, Chief, Equipment & Operating Procedures Research Division, Office of R&D (November and April)

Magdy El-Sibaie, Chief, Track Research Division, Office of R&D (November and April)

Sean Mehrvarzi, Program Manager/Railroad Security (November)

Sung Lee, Program Manager/Track and Structures (November)

John Punwani, Program Manager/Train Occupant Protection (Locomotives) (November)

Monique Stewart, Program Manager/Rolling Stock & Component Safety (November)

Tom Tsai, Program Manager/Train Occupant Protection (Passenger) (November and April)

Thomas Raslear, Program Manager/Human Factors, Office of R&D (November and April)

Michael Coplen, Program Manager/Human Factors, Office of R&D (November and April)

Robert McCown, Acting Chief, Program Development Division, Office of Railroad Development (November)

Leonard Allen, Program Manager/Intelligent Railroad Systems (November and April)

Mahmood Fateh, Program Manager/Track and Structures (November)

Ali Tajaddini, Program Manager/Track/Train Interaction (November)

Don Plotkin, Program Manager/Track and Structures (November)

Steve Sill, Program Manager/HSR, Technology (November)

Terry Tse, Program Manager/Train Control (April)

James Smailes, Program Manager/ HSR, Grade Crossing (April)

Ronald E. Ries, Crossing Safety & Trespass Prevention Program, Office of Safety (November)

Volpe National Transportation Systems Center

Robert Dorer, Acting Deputy Director, Office of Safety and Security (November and April)

Michael Coltman, Chief, Structures and Dynamics Division (November)

Transportation Technology Center, Inc.

Roy A. Allen, President (April via teleconference)

Invited speakers (November)

Anson Jack, Director, Standards, UK Rail Safety and Standards Board

Semih Kalay, Senior Assistant Vice President, Corporate R&D, Transportation Technology Center, Inc.

Barbara Sisson, Associate Administrator for Research, Demonstration and Innovation, Federal Transit Administration

Randy Stevens, Office of Aviation Research, Federal Aviation Administration