Committee for Review of the Federal Railroad Administration (FRA) Research, Development, and Demonstration Programs Letter Report: May 31, 2012

DETAILS

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Committee for Review of the Federal Railroad Administration (FRA) Research, Development, and Demonstration Programs

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

May 31, 2012

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

Dear Administrator Szabo:

The Transportation Research Board's (TRB's) Committee for Review of the Federal Railroad Administration (FRA) Research, Development, and Demonstration Programs met on February 6 and 7, 2012, and again on March 27, 2012, in Washington, D.C.

The committee was organized by TRB at the request of FRA. It succeeds the committee that reported to you in its letter of March 9, 2011, and TRB committees that reviewed the FRA research program in earlier years. The statement of task (Enclosure 1) directs the committee to review and to assess the effectiveness and impacts of major FRA research and development (R&D) program areas. The assessment is to consider the FRA R&D program's alignment with U.S. Department of Transportation (DOT) goals, procedures for setting program priorities, program development, project selection, program management, program reporting, and practices for maximizing and measuring program impact. The statement of task specifies that the committee report to FRA on these assessments. The committee also may provide recommendations on how to improve processes for selecting, executing, and delivering value from the R&D program and may suggest future directions for the program. This letter presents the committee's findings and recommendations in response to that charge.

Enclosure 2 is a list of the committee members, and Enclosure 3 lists the FRA staff members participating in the meetings.

SUMMARY ASSESSMENT

The committee recognizes a strong institutional commitment to continuous improvement in the management of the FRA R&D program. Practices that the committee examined and that demonstrate this commitment include the following:

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- Organization and presentation of the program according to categories of risk rather than by divisional offices. The committee expects that this organization will prove to be a valuable management approach. It highlights R&D objectives, helps to concentrate resources on attaining them, and allows R&D management to track progress toward them.
- Alignment of the program with the strategic goals of the Department of Transportation.
- Further development and application of a risk model and a process for prioritizing R&D projects. These tools will be useful to R&D managers in assessing the likely outcome and value of proposed and ongoing research projects.
- Strategic planning. The release of the R&D strategic plan will be an important milestone in the development of FRA's research capabilities.
- Contributions to workforce development. Through its research grants, the Office of R&D has established a connection between the rail industry and the universities and therefore contributes to maintaining the skilled workforce necessary to the health of the industry.

Among the selected projects that FRA described to the committee, a recent example that demonstrates the value of FRA R&D is the successful development and testing of a rail passenger car crash energy management model. The model is a necessary tool supporting performance-based safety regulation and is a signature achievement of FRA.

The committee believes that additional improvements could be made through:

- Further focusing future resources on projects addressing the highest-risk categories with the largest potential safety benefit
- Development and reporting of program performance indicators
- More complete evaluations and reporting of project outcomes.

Future directions to consider for R&D include continuing work on performance-based standards; research to aid the deployment, in-use evaluation, and refinement of new signaling and train control technologies; and research on operation of shared-use corridors for intercity passenger and freight service.

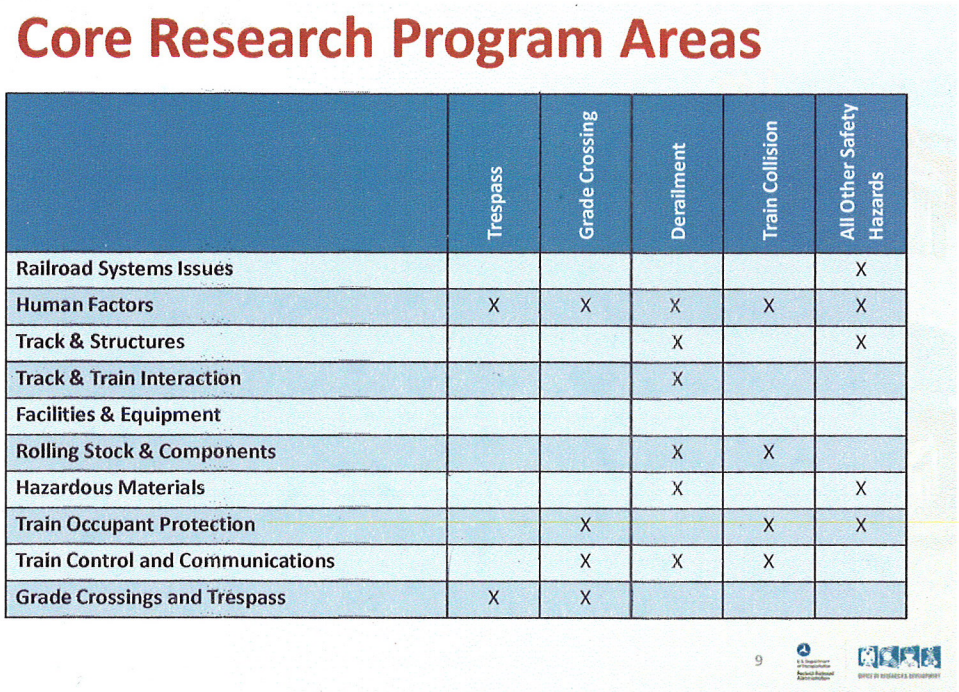
The committee's findings and recommendations are presented in full below.

MEETING FORMAT

At the February 6 and 7 meeting, FRA R&D managers presented highlights of the past year's research activities and summarized projects from each of the technical program areas. This briefing was organized around five major risk categories (trespassing, grade crossing collisions,

other collisions, derailments, and all others) that FRA analysis has identified as accounting for the largest shares of accident losses, rather than around the divisional organization of the Office of R&D as in the past. The presentations described how FRA's research projects are aimed at reducing each of the major risks. Figure 1 shows FRA's slide summarizing this framework.

FIGURE 1



	Trespass	Grade Crossing	Derailment	Train Collision	All Other Safety Hazards
Railroad Systems Issues					X
Human Factors	X	X	X	X	X
Track & Structures			X		X
Track & Train Interaction			X		
Facilities & Equipment					
Rolling Stock & Components			X	X	
Hazardous Materials			X		X
Train Occupant Protection		X		X	X
Train Control and Communications		X	X	X	
Grade Crossings and Trespass	X	X			

Note: Column labels are major risk categories. Row labels are FRA R&D budgetary categories. X in a cell indicates that the budgetary category funds projects in the indicated risk category.

At the March 27 meeting, FRA responded to committee requests for additional information on particular aspects of the R&D program (as identified by the committee in closed session at the February meeting), especially project prioritization and selection procedures, other elements of program management including measurement of program impact and stakeholder engagement in program development, and examples of how the Office of R&D directly supports the missions of other FRA offices. In addition, the committee met in closed session to formulate its findings and recommendations.

FINDINGS

Alignment with DOT Goals

The R&D office's alignment of projects to address the five major risk categories is an important step in rationalizing the R&D program. FRA explained to the committee that its research must also support DOT's five strategic goals of improving public health, safety, and security; ensuring that infrastructure is maintained in a state of good repair; fostering policies and investments that bring economic and social benefit to the nation; fostering livable communities; and advancing environmentally sustainable policies. The information that FRA presented to the committee on the content of the R&D program demonstrates how the benefits of the current research program support the five DOT strategic goals. The continued tracking and documentation of research products that further the DOT goals will serve to ensure alignment of the R&D program with DOT priorities. For example, the 2011 TRB review committee's letter suggested that research on track integrity monitoring supports the DOT goals of maintaining a state of good repair and increasing the economic benefits of rail service. Because the core R&D program's legislative mandate directs it to safety research and because Congress has not provided consistent long-term direction or funding for high-speed and intercity passenger rail research, safety improvement remains the primary research goal.

R&D Strategic Planning

The committee understands that the as yet unreleased FRA R&D strategic plan will be consistent with the cross-disciplinary organization of the R&D program around the major risk categories. The committee expects that this organization will prove to be a valuable management approach. It highlights the objectives of the research, helps to concentrate resources on attaining these objectives, and allows R&D management to track progress toward the objectives. The committee appreciates the challenges of effecting such a change, given the legacy of rail research activities organized around engineering disciplines and the constraints imposed by established staffing and budgeting practices.

FRA described its risk model, that is, the procedure it uses to analyze accident data to identify the major risk categories that frame its efforts. The analysis is forward-looking, projecting how the importance of each risk category will change in the future. The committee expects this analysis to provide important guidance in research planning.

Program Priorities, Program Development, and Project Selection

The committee expects that the Office of R&D's improved project prioritization process (as described in its presentation at the March 27 meeting) will be useful to R&D managers in identifying and systematically assessing the factors that determine the outcome and value of proposed and ongoing research projects. The procedure also is potentially useful as a means of clarifying to others (FRA and DOT management, Congress, industry, and researchers) the basis for project funding decisions. The recent addition of the stakeholder involvement rating in the procedure should serve to highlight an important predictor of success.

The weights assigned to each of the factors for scoring projects express the goals and values of FRA. Therefore, the weighting is essentially a matter of judgment and requires regular review by FRA senior management. Once appropriate weights are assigned, changes should be infrequent, to ensure consistency and maintain the ability to compare project scores over time. The committee recognizes that the quantitative evaluations alone do not determine project selection, but are guides to senior management in deciding research priorities and which projects proceed.

Using the prioritization process to assess projects that are under way, as well as proposals for new projects, is a worthwhile exercise because understanding of likely outcomes will change as a project progresses and because, if a project or series of projects is of long duration, agency objectives or external circumstances may have changed. However, the process is not ideal for evaluating completed projects. To complement the prioritization procedure, FRA needs an ongoing and systematic procedure for evaluating the impact of its completed R&D projects.

FRA presented excellent examples of evaluations of individual projects to the committee. However, evaluation should be routine and comprehensive (addressing all program areas if not each individual completed project). The committee did not consider evaluation methods sufficiently to allow it to recommend a specific procedure. Various alternative methods are available that have been used successfully by research organizations to evaluate their output. These include such methods as external peer review of the technical quality of individual completed projects, stakeholder surveys, case studies of project impact, and systematic tracking of the implementation of results.

To complement its existing prioritization procedure and the needed evaluation procedure, the Office of R&D is in need of a third management tool: a systematic procedure for generating research ideas and proposals arising from FRA's safety improvement objectives. The committee understands that FRA intends to develop such a procedure. FRA explained to the

committee that the initial list of research proposals that are subjected to the prioritization procedure now comes from a variety of sources, including the Office of Safety, industry, researchers, and the Office of R&D program managers. These are all appropriate sources of project proposals, but a major source should be the strategic planning process. FRA planning should identify research and development needed to meet the agency's safety objectives, and Office of R&D strategic planning should identify research topics that hold potential for reducing the major risk categories that FRA analysis has identified.

When all three of these procedures (the project prioritization process, a procedure for evaluating the impact of completed projects, and a procedure for generating research proposals arising from the safety improvement objectives) are in place, FRA will have strengthened its ability to produce research that improves rail safety and furthers DOT's other strategic goals and will be better able to demonstrate to senior management, Congress, and stakeholders the value of the R&D program.

FRA presented to the committee data on approximate levels of R&D spending for each of the five major risk categories. The distribution of spending by risk category differs markedly from the distribution of expected accident costs arising from each category. This disparity is not an indication of misallocation of effort (for example, the highest-risk category, trespassing, is difficult to address through research); however, FRA should be prepared to account for the sources of the differences.

Internal Coordination in Program Development

FRA described to the committee the regular engagement between R&D staff and FRA safety and enforcement staff. The FRA field organization also is an appropriate source of input on research opportunities and on the effectiveness of rules and of commercially deployed technologies that have flowed from previous FRA-sponsored research.

External Coordination and Collaboration in Program Development

FRA reported that the Office of R&D engages in cross-agency collaboration on a project-specific basis with agencies such as the Pipeline and Hazardous Materials Safety Administration, the Research and Innovative Technology Administration, the Federal Transit Administration, the Department of Energy, and the Department of Homeland Security. Such collaboration appears to occur where the nature of the safety target or opportunity crosses jurisdictional lines (e.g., highway grade crossing safety).

Routine coordination with other external stakeholders includes participation in joint oversight groups such as the Rail Safety Advisory Committee. Coordination also occurs with the Association of American Railroads through participation in its Railway Technology Working Committee and operations at the Transportation Technology Center. Active cultivation of opportunities for engagement with all public- and private-sector stakeholders is necessary for ensuring the relevance and productivity of the R&D program.

Program Management

The committee recognizes the advances made by R&D management in developing disciplined and transparent program management practices. Further development of program metrics would enable the committee and R&D program stakeholders to provide more constructive input to FRA on areas of concern and opportunities and could help FRA to increase the productivity of the R&D program. Specific recommendations for such enhancements are given below.

Program Reporting; Measurement of Program Impact

FRA research efforts that focus on development and demonstration of new technologies rely on private stakeholders and partners for commercial deployment. As a consequence, the benefits associated with the deployment of sponsored technologies have not been tracked systematically. This lack of reporting weakens support for the R&D program and hinders understanding among stakeholders of the critical role that is played by FRA R&D.

The committee notes one example of a research product that demonstrates the value of FRA R&D and should be promoted as such an example. The successful development and testing of a rail passenger car crash energy management model are signature achievements of FRA. The model is a necessary tool supporting FRA's laudable migration to the use of performance-based safety regulation. Development of this robust, simulation-based technical tool should be seen as an example to be replicated, as appropriate, for other safety areas. Such an approach will facilitate development of new rail technologies, reduce lead times, and promote the physical testing required for commercial deployment of new applications.

Workforce Development

FRA acknowledged in its presentation that the R&D office is in a favorable position to contribute to rail industry workforce development. Workforce development has become an acute industry problem because a surge in retirements has coincided with the need for staff to implement advances in the train control and signaling architectures that increasingly will

govern much of the nation's rail network. Implementation and management of these new technologies will require that rail operators recruit and retain technical staff whose skills are generally in short supply across the North American business environment.

Through its research grants, the Office of R&D has established a connection between the rail industry and the universities that are the source of the technical and management staffing of the railroads. FRA research grants are a significant source of support for academic programs that can produce qualified workers for the industry. The committee endorses the R&D office's efforts, described at the meeting, to provide input to DOT workforce development planning and to expand its involvement with schools and universities.

High-Speed Rail

The R&D office's approach to high-speed rail reflects the continuing uncertainty of future funding streams for this area. Current research efforts are funded by virtue of a one-time injection of $25 million through the 2009 American Recovery and Reinvestment Act. This uncertainty has led the R&D office to focus, appropriately, on projects of relatively short duration.

RECOMMENDATIONS

Research Structure

As explained above, the committee expects that the cross-disciplinary organization of the R&D program on the basis of major risk categories will prove valuable in helping to clarify objectives and accomplishments and to focus resources efficiently. The committee encourages FRA to build on this foundation to achieve any needed reallocation of R&D resources through a comparison of effort expended with the priorities accorded the targeted risk categories. The committee appreciates the challenges associated with departmental budget and staffing realignment and the need to phase in such changes as opportunities arise.

Program Priorities

As noted above, the Office of R&D's project prioritization process has developed into a useful management tool. As an adjunct to this process, FRA should develop a systematic procedure for identifying research topics and developing research projects that is driven by FRA's objective of mitigating the targeted major risk categories. Identifying the research that will be needed to bring about progress in reducing the targeted risks should be an element of the Office of R&D's strategic planning.

The R&D office should test how varying the weights of factors in the project prioritization process affects project rankings and should present a summary of test results to senior FRA management for review, as a check to ensure that the outcome of the project scoring process reflects the agency's values and goals.

FRA reported to the committee that it has considered steps for obtaining additional stakeholder input to R&D plans and priorities. The committee encourages FRA to develop an arrangement for obtaining such input on a regular basis. The activity would complement the work of this committee and would be designed to obtain input on specific research project proposals, projects under way, and technological opportunities. As one option, R&D planning workshops could be effective if they were well organized, geared to senior decision makers, and afforded participants influence over FRA's priorities. A worthwhile possible outcome of increased interaction between FRA and its R&D stakeholders in identifying research opportunities would be development of new pooled-resource projects.

Program Management

As noted in the findings above, developing and maintaining a suite of high-level reporting metrics for tracking progress in the R&D program could lead to increased productivity and improved communication with the program's stakeholders.

For each active and recently completed project, FRA should record and track a set of standard attributes and performance metrics that includes: project source and stakeholder support, objectives, duration, progress milestones, products, and implementation or commercialization status. Tracking information on the mechanisms of implementation—for example, whether research products are being deployed through conventional commercial channels or via FRA rule-making—might also shed light on future directions for the program.

Evaluation of Program Impact

FRA should develop the ability to evaluate regularly and systematically the safety and other benefits, including commercial benefits, and the contribution to DOT strategic goals of the products of its R&D program. One step toward strengthening evaluation might be to provide for participation in post-research tracking of implementation and impact as a condition of collaborative efforts with other stakeholders.

Strategic Plan

The committee urges the earliest possible release of the FRA R&D strategic plan and encourages FRA to publicize the plan in a high-profile manner. The plan should include a road map for the definition, prioritization, and achievement of the Office of R&D's research objectives.

Collaboration Within FRA

The R&D office should leverage the resources accessible to other FRA offices to provide information and feedback on research priorities and on the safety impact of newly commercialized technologies. FRA's field inspection staff is a resource for supporting such efforts. Similarly, FRA staff engaged in managing corridor grant programs for high-speed rail should be made aware of high-speed rail research efforts.

Collaboration with Other Agencies

The committee encourages FRA to explore opportunities for greater collaboration with other DOT administrations in identifying research, development, and demonstration projects that would benefit the rail mode along with other user groups and transportation modes. Such collaboration today appears to occur mainly where the nature of the safety target or opportunity crosses jurisdictional lines. Technical advances may have significant value to several modes independent of the commingling of modal assets. Examples include developments in intelligent transportation systems applicable to new train control installations, digital data communications advances, geographical information collection and storage systems, and developments in construction materials and in drainage and soils research applicable to both rail corridor and highway construction environments.

Opportunities for collaborative research may exist with the Federal Transit Administration on community impact and trespasser issues. Trespass casualties and suicides constitute a broad area of common interest and common risk factors, and collaboration could aid both agencies in confronting these problems. Collaboration opportunities may exist also with the National Institutes of Health on the difficult challenge of suicides on rail properties.

Future Directions for Research and Development

Performance-Based Standards for Safety Regulation

FRA R&D has a critical role in developing the tools needed to support performance-based safety regulation. The performance-based approach will lead to greater innovation and development of more cost-effective means of improving safety on the nation's rail system. Further progress will hinge on continued development of robust technical support (such as for the new Crash Energy Management car evaluation tool) and development of a waiver process that, while protecting safety, reduces delay and uncertainty in bringing innovations to the marketplace.

Signaling and Control Technologies

The committee suggests that FRA consider research, development, and demonstration initiatives that aid the deployment, in-use evaluation, and refinement of new signaling and train control technologies. Deployment of these technologies will demand a major share of the industry's attention and capital investment over the next several years.

High-Speed Rail and Intercity Passenger Rail

The R&D office's selection of high-speed rail research projects is consistent with the recommendation of the 2011 TRB review committee that issues associated with shared-use corridors be given preference over those unique to physically isolated high-speed rail systems. We suggest that this focus continue, particularly in light of the scarcity and uncertain nature of future appropriations.

Should a more stable funding commitment to this area be made, the committee encourages FRA to develop a strong stakeholder outreach strategy. The outreach program would serve to educate the industry, public transportation agencies, and the public as to the value of FRA's high-speed rail research efforts; broaden support for resource commitments to this area; and help in identifying research needs.

Arrangements for coordination between FRA's high-speed research efforts and the activities of those charged with managing FRA's grant program for high-speed rail were not evident to the committee. While the committee acknowledges the challenges facing FRA in the quick start-up of the high-speed rail grant program, it encourages broader dialogue among the constituent subgroups within FRA.

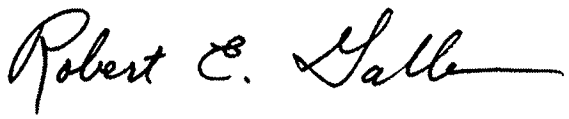
Workforce Development

The Office of R&D's engagement on workforce development was noted in the Findings section above. The committee recommends that the office play a collaborative role, working with the Association of American Railroads and other stakeholder groups in fostering development of rail programs within the nation's universities and technical colleges.

IN CONCLUSION

This committee and its predecessor TRB review committees have had an excellent vantage point from which to observe the continued development of FRA R&D staff capabilities and improvements in program management and focus. While the challenges the FRA R&D program faces will not be surmounted easily, the committee sees a strong institutional commitment to continuous improvement and excellent rapport among the teams whose efforts will be needed to accomplish the objective. The release of the R&D strategic plan will be an important milestone in the development of FRA's research capabilities.

Sincerely,



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

Enclosures

ENCLOSURE 1

Transportation Research Board

Review of Federal Railroad Administration Research, Development, and Demonstration Programs

Statement of Task

The committee appointed for the study will conduct a review and evaluation of major program areas in the research and development (R&D) program of the Federal Railroad Administration (FRA) of the U.S. Department of Transportation (DOT). Congress funds FRA R&D to contribute to the DOT's strategic goals, the principal of which is improved safety.

The committee will review and assess the effectiveness and impacts of major research program areas in FRA R&D. The assessment will include consideration of:

- The alignment of the program with DOT's strategic goals
- Procedures for setting program priorities
- Program development—the overall direction of major research programs, clarity of program performance measures, stakeholder identification and engagement strategies
- Project selection—feasibility, timeliness, alignment with major harm categories, potential impact (severity and frequency), and likelihood of successful implementation
- Program management—FRA practices for assessing program performance throughout the program life cycle, management of contractors and grantees, evidence of stakeholder engagement, other iterative improvements
- Program reporting—quality of outputs such as technical reports and conference papers, other communications to stakeholder community (conferences, industry meetings, etc.)
- Program impact—FRA practices for maximizing and measuring the impact of the program, evidence of program success (e.g., changes in industry safety practices, regulations, and industry safety policies due to R&D efforts)

The committee will prepare a letter report, addressed to the FRA Administrator, that will include descriptive assessments and constructive comments on the above topics and may provide recommendations to FRA on how to improve its processes for selecting, executing, and delivering value from its R&D program. The report may also suggest future directions for the FRA R&D program. It will not make recommendations about overall funding levels.

ENCLOSURE 2

Transportation Research Board

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

Chair

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National Legislative Director
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ENCLOSURE 3

Federal Railroad Administration Speakers
Committee Meeting of February 6 and 7, 2012

Paul Nissenbaum, Associate Administrator for Railroad Policy and Development
John Tunna, Director, Office of Research and Development
Sam Alibrahim, Office of Research and Development
Gary A. Carr, Office of Research and Development
Kevin Kesler, Office of Research and Development
Tom Raslear, Office of Research and Development
Cam Stuart, Office of Research and Development