



May 4, 2007

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Office of Research, Demonstration, and Innovation
Federal Transit Administration
U.S. Department of Transportation
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Washington, D.C. 20590

Dear Mr. Hynes:

We are pleased to transmit this fourth letter report of the Transportation Research Board's (TRB's) Transit Research Analysis Committee (TRAC). The committee is charged with advising the Federal Transit Administration (FTA) as the agency develops a strategic agenda for transit research and with identifying roles that FTA and industry could play in carrying out that agenda.

Following your request at the TRAC 2006 winter meeting, this report examines the strategic direction and balance of FTA's research, including the importance of rail transit research in the agency's portfolio. Guidance is provided in two major areas:

- Approaches FTA should take to ensure that its overall research portfolio is appropriately balanced and that both the portfolio and individual projects within it are responsive to the goals and objectives articulated in FTA's strategic research plan (1); and
- Activities FTA should pursue to help ensure that its national agenda for transit research engages the attention of a range of stakeholders, including high-level decision makers.

To put this advice in context, this report provides an overview of TRAC activities since the committee's inception in early 2004 and highlights FTA's achievements in its strategic research planning initiative during this period.

In summary, the committee commends FTA on its efforts over the past year to develop a multiyear research program plan responsive to the goals and objectives defined in its strategic research plan. The program plan provides a useful inventory of FTA's current research, thereby highlighting areas in which further work is needed both to fill gaps and to improve the overall balance and focus of the agency's research portfolio. Gaps and opportunities are identified, although considerably more effort is needed to define and develop new projects. The lack of focus and unnecessary duplication in certain areas of FTA's research portfolio are the result largely of congressional earmarks and designations, as is the excessive technological bias. Transit is very much a "people business," and more emphasis is needed on nontechnological and social science research on topics such as travel behavior and workforce development.

The committee recommends that FTA focus on two major and related activities as it continues to develop a national agenda for transit research. First, it should continue to develop its multiyear research program plan by defining and developing new projects linked to the goals and objectives of its strategic research plan. This effort should include refining and developing research strategies, as well as analyzing the existing literature related to these strategies. A critical review of ongoing projects could also be beneficial in highlighting opportunities to redirect resources to efforts more responsive to the strategic research goals. Second, FTA should seek to demonstrate the impact, or potential impact, of transit on national goals such as reducing road congestion, fostering environmental stewardship, and reducing dependence on imported oil. By strengthening the links between both its strategic and multiyear research program plans and high-level national goals, FTA has the opportunity to make its research agenda more compelling to a broad audience, including high-level decision makers. Thus, the committee recommends that FTA devote greater effort in its multiyear program plan to demonstrating how transit research can inform policy decisions relating to national goals.

As indicated in Box 1, the remainder of this report commences with an overview of TRAC activities over the past 3 years. In response to your request, it then addresses the strategic direction and overall balance of FTA's research portfolio, as well as approaches to developing individual projects to fill gaps in the research program plan. The report concludes with the committee's observations and recommendations aimed at assisting FTA in its efforts to engage stakeholders in its national transit research agenda.

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The committee's work throughout the past year has been ably assisted by you and FTA staff, including Bruce Robinson and Walt Kulyk. The committee commends Bruce Robinson in particular for his continued commitment to FTA's strategic research planning efforts and thanks him for his timely and informative responses to committee questions.

OVERVIEW OF TRAC ACTIVITIES

Charge to the Committee

TRAC was convened by the TRB of the National Academies in early 2004 in response to a request from FTA's Associate Administrator for Research, Demonstration, and Innovation, Barbara Sisson. TRAC is modeled on TRB's Research and Technology Coordinating Committee (RTCC), which has provided a continuing, independent assessment of the Federal Highway Administration's research and technology program for the past 15 years. TRAC is charged with advising FTA as the agency develops a strategic agenda for transit research and with identifying the roles that FTA and industry stakeholders could play in carrying out that agenda. In addition, the committee is tasked with advising FTA on (a) the federal role in transit research relative to the roles and activities of others, including the private sector, Transit Cooperative Research Program (TCRP), states, universities, and so on, who are engaged in transit research; (b) high-priority opportunities proposed by the agency; and (c) processes that should be in place to ensure that the FTA receives the input and cooperation of transit research stakeholders in developing a federal research program.

Committee Membership

TRAC, like the RTCC, provides high-level, strategic guidance rather than detailed technical advice on individual research projects.¹ Consistent with the committee's charge of advising FTA on the development of its strategic agenda for transit research, TRAC membership includes general managers of urban and rural transit properties, as well as U.S. and international experts in transit research and technology drawn from the private sector and academia (see Enclosure A). As requested by FTA, a system of rotating committee membership was established following an initial 2-year period during which the committee's modus operandi was developed by TRAC members and staff in conjunction with FTA. The annual membership rotation provides an opportunity to ensure that TRAC draws on the diversity of experience within the transit community and that TRAC's expertise continues to be relevant as committee activities evolve.² For example, as part of the first membership rotation (in 2006), a member with knowledge and experience in labor issues was added to the committee. The labor perspective was deemed important for informed committee discussion of FTA's strategic research goals, notably those targeting improvements in operating efficiencies, safety, and emergency preparedness.

¹ Detailed technical guidance on individual research projects and topics is available to FTA through a variety of sources outside of TRAC. For example, TCRP project panels define the scope of research projects and monitor the research conducted, and standing committees convened under the auspices of TRB's Technical Activities Division provide a forum for discussion of research needs and opportunities.

² TRAC activities are expected to change over time in response to FTA's changing priorities and activities.

Meetings

TRAC has held six committee meetings to date.³ The committee anticipates that it will continue to meet twice a year at 6-month intervals. FTA staff has indicated that a regular meeting schedule helps the agency plan its work so as to maximize the usefulness of discussions with and formal advice from TRAC. Furthermore, experience suggests that intervals of more than 6 months between meetings make it difficult for TRAC members and FTA staff to sustain a productive working relationship.

After the introductory TRAC meeting in April 2004, committee meetings have followed the same general format, with each meeting focusing on two major themes. The first theme—FTA's development of a strategic agenda for transit research—has remained the same, although the activities discussed have changed over time. The early meetings focused on the development and dissemination of the agency's strategic research plan, which was issued in September 2005. Subsequent meetings have addressed FTA's efforts to develop a multiyear research program plan that identifies and describes individual research projects linked to the goals and objectives of the strategic research plan. FTA issued its first multiyear research program plan in October 2006 (2).

The second theme, which is different for each meeting, addresses a topic identified by committee members and FTA staff as relevant to FTA's strategic research plan. Experts in the selected topic area are invited to share their knowledge and insights with committee members and FTA staff through a series of presentations and group discussion. Topics addressed to date are

- Performance measurement in research and development programs (December 2004),
- Research on transit ridership (July 2005),
- Electric drive technologies for transit applications (December 2005),
- Benchmarking as a tool to improve capital and operating efficiencies (July 2006), and
- Rail research at FTA (November 2006).⁴

The last of these topics—rail research at FTA—differs somewhat from the preceding topics in focusing on a single mode and not being linked directly to the goals and objectives of FTA's strategic research plan. The agency has emphasized on a number of occasions that these goals and objectives are "mode neutral." Balance across FTA's research portfolio, including modal balance, is discussed later.

Committee Recommendations and Related FTA Achievements

TRAC provides advice to FTA in annual letter reports produced between the winter and summer committee meetings. The first two letter reports were delivered to FTA in June 2005 and March 2006; the current report is the third in this series (3, 4). A brief out-of-cycle letter report clarifying some of the advice in the second letter report was delivered to FTA in September 2006 (5).

³ TRAC meetings were held in April and December 2004, July and December 2005, and July and November 2006. In addition, an informal working meeting involving a number of TRAC members and FTA staff was held in August 2005 to discuss a draft of FTA's strategic research plan.

⁴ Lists of presenters and panelists at the 2004 and 2005 TRAC meetings were provided in earlier letter reports (3, 4). Presenters and panelists at the 2006 meetings are listed in Enclosure B.

Consistent with the committee's charge, the recommendations to date have addressed FTA's efforts to develop a strategic agenda for transit research. The agency has responded positively to a number of these recommendations. In particular, FTA has

- Added a fifth strategic research goal ("provide transit research leadership") to its plan;
- Issued its strategic research plan, including goals and objectives, by the beginning of FY 2006;
- Issued its 5-year research program plan for FY 2007–FY 2011 (see below); and
- Briefed stakeholders on the strategic research plan and encouraged some of these stakeholders—notably the university transportation centers (UTCs)—to work with the agency in achieving the plan's goals and objectives.

The committee congratulates FTA on these achievements, as well as on its development of research project management guidelines for FTA employees and the receipt of an "effective" rating for its National Research and Technology Program (NRTP) from the Office of Management and Budget's Program Assessment Rating Tool (PART) review. All these achievements are indicative of FTA's renewed vigor in developing and managing an effective research program.

In October 2006, FTA issued its multiyear research program plan for FY 2007–FY 2011 (2). This document represents an important step forward in the agency's efforts to develop a strategic agenda for transit research and is a considerable improvement over the draft document discussed at the TRAC meeting in July 2006. In particular, the discussion of current gaps and opportunities is important in highlighting research areas where further work is required because FTA's current portfolio does not meet the goals and objectives articulated in the strategic research plan.⁵

The research program plan lists ongoing activities within the framework of the strategic research plan. More than 160 projects are assigned to the strategic goals and objectives; a further 14 unaligned projects do not fit under any of these goals and objectives. The project list, which includes information on budgets and time lines, highlights the large number of research efforts within FTA's program and the diversity of the agency's research responsibilities.⁶ Ensuring that all the projects contribute to FTA's strategic research goals and objectives—both individually and as a total portfolio—is a demanding task. The multiyear program plan recognizes the difficulties of evaluating the performance of each project and of the portfolio as a whole and describes an interim method of performance measurement for individual projects based on a series of checklists.

⁵ FTA's multiyear research program plan is a "living document." The agency aims to complete the next version (FY 2008–FY 2012) by the end of FY 2007.

⁶ Potential future projects and time lines are also listed, although budget estimates are not provided for these projects.

FTA'S RESEARCH PORTFOLIO

Strategic Direction

FTA's strategic research plan identifies five high-level research goals:

1. Provide transit research leadership,
2. Increase transit ridership,
3. Improve capital and operating efficiencies,
4. Improve safety and emergency preparedness, and
5. Protect the environment and promote energy independence.

In the committee's judgment, these goals form a sound basis on which to build a national agenda for transit research. The only caveat concerns the formulation of the ridership goal, as discussed below. Also, in view of the increasingly widespread recognition of the potential effects of climate change, including impacts on transportation, FTA may wish to consider broadening the scope of its energy and environment goal (Goal 5) to include climate change. Research on transit's possible role in this area could help establish robust information to inform policy making.⁷

With regard to the ridership goal (Goal 2), research that leads to a comprehensive and thorough understanding of factors affecting ridership is a necessary prerequisite to developing operational strategies aimed at increasing ridership. Nonetheless, while such operational strategies may result in increased ridership, they may not generate the sizable increases that can result from influences beyond the control of transit managers, such as higher gas prices, changes in the price and availability of parking, and regional land use strategies (4). Thus, presenting "Increase transit ridership" as a research goal is somewhat misleading. Research can certainly lead to increased ridership, but other nonresearch strategies may be more effective in achieving the goal.

Further complications arise in using ridership as a performance metric and in assessing the effectiveness of research programs aimed at increasing ridership. In assessing any increase in ridership, factors such as the cost of ridership, revenue recovery ratios, and productivity need to be taken into account. If transit agencies were to stop charging fares, for example, ridership would likely increase significantly. This hypothetical case illustrates clearly that ridership alone is not a valuable indicator and that caution is needed in measuring progress toward achieving the goal of increased ridership. In addition, as noted in the first TRAC letter report, assessing the performance of research programs aimed at increasing transit ridership is complex because ridership is frequently used as a proxy for a range of societal benefits that may derive from increased ridership, such as alleviating traffic congestion and improving access for the transit dependent (3).

In light of the complexities discussed in the preceding paragraphs, the committee suggests that FTA's ridership goal would be more appropriate if it were revised to reflect the potential role of research in informing both operational strategies and policy measures aimed at increasing transit ridership.

⁷ In the committee's view, earmarks for research are inappropriate, but if Congress must earmark, then such information also could influence possible future earmarks relating to climate change and public transportation.

Recommendation FTA should reformulate the ridership goal in its strategic research plan to reflect the potential role of research in increasing transit ridership. In particular, the understanding gained through research can inform both policy measures and operational practices that may lead to increased ridership.

Balance

The balance of FTA's research portfolio can be assessed in a variety of ways. For example, examining the distribution of funding among stated goals and objectives, among research categories (analysis, development, implementation, and training and capacity building), between "hard" and "soft" research areas, and among modes (bus, rail, etc.) yields various indications of balance. In response to questions from FTA, the committee's review of the multiyear research program plan, and discussions at the November 2006 meeting, the following sections address the balance between "hard" and "soft" research, the effects of congressional earmarks and designations on the balance of FTA's research portfolio, and the degree to which modal balance is a useful indicator when developing the multiyear research program plan.

"Hard" Versus "Soft" Research Topics

Transit is very much a "people business," catering to the needs of riders through the efforts of its workforce. With this observation in mind, the committee found FTA's multiyear research program plan to have an excessive technological ("hard") bias, with insufficient attention paid to "soft" social, management, and economic research on topics such as travel behavior, workforce development, human factors and safety, and the effects of demographic changes on travel demand. The projects listed under Objectives 4.1, 4.3, and 3.2 of the program plan illustrate this point.

There is a clear technological focus in the projects listed under Objective 4.1 (Identify solutions to improve transit safety), even though some projects are not well-defined in scope and anticipated outputs. Projects on safety and security training and on information sharing are included, but a sizable proportion of the obligated funding for Objective 4.1 is taken up by a \$2.5 million project to investigate an integrated collision warning system and a \$1 million project on crashworthiness of transit buses. As noted in the committee's third letter report, a systematic hazards analysis, conducted in the context of an overall system safety approach, would be a useful and effective way of determining research priorities, including the appropriate balance between technological and nontechnological/social science projects (5).

Similarly, the projects listed under Objective 4.3 (Identify solutions to improve transit emergency preparedness) are dominated by technological projects, notably a \$6.9 million effort to create computer-based 3-D and 4-D digital visualizations of intermodal transportation, a \$4.2 million project to develop enabling technologies for detection of biological agents in transit environments, and a \$1.7 million project to research the technological feasibility of very high data transmission rates for secure wireless networks in mobile marine environments (passenger ferries).⁸ In the committee's view, systematic and well-informed risk assessments are needed to identify the nature and probability of emergencies and related research needs. For some types

⁸ All three of these projects are congressional earmarks or designations. The effects of earmarked and designated programs on FTA's research portfolio are discussed later.

of incidents, it may be necessary to check the correlation between research and real-life situations, so tabletop drills (also referred to as desk studies or simulations) may need to be supplemented by full-scale drills (real-life rehearsals). Examples may include the important issue of crowd behavior and how to manage it under emergency conditions.

Finally, the projects listed under Objective 3.2 (Identify solutions to control operating costs) are, in the committee's view, overly focused on materials and manufacturing efforts, with insufficient attention given to softer issues.⁹ Service design is an important issue under this objective, and it would be useful to establish cost models for the components of different types of transit services to provide a perspective for individual components. This approach would help identify research priorities and show the impact of various cost control strategies.

*Effects of Earmarks and Designations*¹⁰

The effect of congressional earmarks and designations in limiting FTA's ability to pursue research in support of its strategic goals and objectives has been a recurring theme of TRAC meetings and letter reports [see the June 2005 report (3, pp. 4–5), for example]. As noted in the multiyear research program plan, FTA's discretionary research funds as a percentage of its total research budget range from 18.0% in FY 2006 to 37.0% in FY 2009 (2). The percentages of discretionary funds for FY 2007–FY 2009, however, may well be reduced below the levels cited as a result of earmarks added during annual appropriations.

As discussed in the second TRAC letter report, the high percentage of earmarked and designated research funds “causes difficulties for FTA in redressing any imbalance of funding among the five [strategic] goal areas by using its very limited discretionary funds” (4, p. 5). While equal funding for all five goals may not necessarily be appropriate, the imbalance created by earmarks and designations is nonetheless significant.

Table 1 presents the budget data from FTA's multiyear research program plan (2) by goal area. The amounts of discretionary and earmarked funding are shown for each goal and for the unaligned projects. This table illustrates the predominance of earmarked projects in total funding in all areas except Goal 1, and most notably for the unaligned projects. It also shows the imbalance in funding among the five goals and the effects of earmarking on this imbalance. While funding for Goal 1 is exclusively discretionary, Goals 2, 3, and 4 have each received between \$14 million and \$30 million in earmarked funds, and Goal 5 has received almost \$113 million in earmarks. Discretionary funding for Goal 5 is also relatively high at \$46 million, although this figure includes almost \$44 million designated for the National Fuel Cell Bus Technology Development Program. While FTA awarded research contracts for this program on the basis of a competitive solicitation, the agency is required to spend these funds on fuel cell bus projects.

⁹ As in the preceding example, earmarked and designated projects affect the balance of research projects under Objective 3.2.

¹⁰ As noted in earlier TRAC letter reports, earmarking of research funds is said to occur when Congress designates a research area or project, a funding amount, and a recipient organization that will receive the funds and conduct the research. If such a recipient organization is not specified, the term “designated research” is used, as opposed to “earmarked research.” For example, projects listed in the multiyear program plan as funded under the FTA National Fuel Cell Bus Technology Development Program were selected by FTA from among responses to a request for proposal and are therefore designated rather than earmarked.

TABLE 1 Discretionary and Earmarked Funding for FTA’s Active Research Projects¹¹

Goal	Discretionary Funding, \$ millions (percentage for specified goal)	Earmarked Funding, \$ millions (percentage for specified goal)	Total Funding, \$ millions
1. Provide transit research leadership	2.1 (100)	0.0 (0)	2.1
2. Increase transit ridership	12.7 (40)	19.1 (60)	31.8
3. Improve capital and operating efficiencies	13.3 (31)	29.4 (69)	42.7
4. Improve safety and emergency preparedness	9.4 (40)	14.3 (60)	23.7
5. Protect the environment and promote energy independence	46.2 (29)	112.8 (71)	159.0
Unaligned projects	1.2 (7)	14.7 (93)	15.9
Total funding, \$ millions	84.9	190.3	275.2

The balance and coordination of projects under individual research objectives may also be adversely affected by earmarks and designations. For example, the projects listed in the multiyear program plan under Objective 5.1 (Facilitate development of technologies to improve energy efficiency and reduce transit vehicle emissions) are overwhelmingly earmarked or designated, and, in many cases, receive or have received major funding. The fuel cell projects in particular are a disparate and overlapping set. The committee endorses the observation in the program plan that FTA “has a challenging task of ensuring that these projects [under Objective 5.1] are part of a cohesive approach to improve energy efficiency” (2, p. 66) and suggests that any additional efforts would be best directed toward developing a greater measure of coherence and coordination.

The examples of technological and soft research discussed earlier demonstrate that earmarks and designations affect not only the assignment of funds to individual goals and objectives but also the overall balance of FTA’s research portfolio in terms of “hard” and “soft” projects. In particular, the example of three large (\$6.9 million, \$4.2 million, and \$1.7 million) technological projects under Objective 4.3 illustrates the difficulties FTA may encounter in pursuing a mix of technological and soft projects reflecting research needs. Obligated funds for these three projects alone total \$12.8 million—not far short of the total discretionary funding of \$13.3 million in FTA’s NRTP for FY 2006.

Approaches that could help FTA exert greater influence over congressional earmarks and designations in its research budget are discussed in the final section of the report.

¹¹ The funding amounts include total obligations and approved funding through FY 2006 and are not necessarily indicative of annual funding levels in FY 2007–FY 2011.

Modal Balance

At the November 2006 TRAC meeting, FTA staff reported a lack of rail transit projects in the agency's research portfolio had been identified. The strategic research plan is "mode neutral" and defines goals and objectives to be met through research rather than proposing solutions involving bus, rail, or other modes. The FTA staff was justifiably concerned, however, that the paucity of rail transit projects might be the result of an unintentional bias in the processes used to identify, develop, and review projects. This bias could perhaps be attributed to a lack of rail expertise among FTA staff with responsibility for identifying and assessing research opportunities.

Steps were taken to investigate the apparent modal imbalance. First, FTA used funding from the Intelligent Transportation Systems Joint Program Office (ITS/JPO) portion of its research budget to fund the preparation of a rail transit ITS plan providing strategic direction for the agency's research and deployment of rail transit ITS (6).¹² Second, the agency requested that the November 2006 TRAC meeting focus on rail transit research. Finally, FTA recently hired a new staff member with expertise in rail transit. In the committee's view, it is important that FTA have access to the knowledge and experience needed to identify and evaluate research opportunities across the broad range of transit systems.

Participants in the November 2006 meeting discussed possible reasons for the paucity of rail transit research in FTA's portfolio. While no conclusions were reached, various plausible explanations were proposed. For example, rail transit research may be largely absent from FTA's program because it is being conducted elsewhere and/or by other organizations. Much of the cutting-edge rail research is taking place in Europe and Asia, and also there is extensive exchange of information among rail operators; therefore, the industry may not have identified a need to involve FTA. Major federal participation at the current stage in the technology cycle may be unnecessary because research needs are being met, in large part, by industry both here and abroad. A probable overriding factor, however, is that many of the earmarked and designated programs that dominate FTA's portfolio address bus technologies and not rail.

Regardless of the modal bias resulting from earmarks and designations, there may be value in exploring and documenting the other reasons for the apparent paucity of rail transit research, particularly if such an effort can be undertaken in conjunction with further development of FTA's multiyear research program plan. If other modal agencies are performing applicable research, if informal networks are taking the place of formal research, and if other countries are conducting research needed to fill knowledge gaps, then syntheses of research results and benchmarking studies could not only highlight areas in which research is needed but also educate transit agencies about other sources of useful information.

Guest speakers at the meeting were generally of the opinion that there are gaps in rail transit research that FTA could usefully fill. When asked to suggest areas in which FTA could assist the transit industry through its research program, the rail experts at the meeting proposed research topics that, in many cases, are not limited to rail transit. Examples include paying more attention to workforce issues, helping operators understand how emerging technologies and other research products can benefit their day-to-day operations, and taking advantage of all

¹² The committee's comments on the methods used to develop the technical content of this report are provided later.

modes to solve public transportation problems. Most meeting participants appeared to share the committee's views that (a) research should be determined by need, independent of mode, and (b) FTA should be driven by its larger research vision, as articulated in the strategic research plan.

The committee is not in a position to determine the appropriate balance between bus and rail research in FTA's portfolio. Clearly, an absence of rail research in the portfolio is inappropriate, as is an absence of rail expertise on FTA's staff. The committee encourages FTA, in developing research projects for its portfolio, to select those that best serve the objectives of the strategic research plan and offer the potential for the greatest return on investment. The modal balance of the portfolio should be established in the context of FTA's strategic research goals and objectives and not independently of them.

Recommendation As FTA continues to develop its multiyear research program plan, it should take steps to ensure that its overall research portfolio is comprehensive, balanced, and consistent with its strategic research plan. While congressional earmarks and designations may confound some of these efforts, FTA should nonetheless aim to develop a portfolio of projects that

- **Is appropriately distributed across the five major goals articulated in the strategic research plan, with no major gaps or unwarranted emphasis on individual goals or objectives;**
- **Reflects the importance of people to the transit business through a mix of technological research and nontechnological/social science research; and**
- **Focuses on research that best serves the goals and objectives of the strategic research plan, regardless of mode.**

INDIVIDUAL RESEARCH PROJECTS

While FTA's program plan identifies gaps or opportunities under each research objective and also lists some potential future projects, considerable work still is needed to develop substantive research projects responsive to the agency's strategic research goals. The committee encourages FTA to set a target date—the end of FY 2008, for example—for completing a fully formulated program plan that is capable of easy annual updating.

The committee's third letter report suggests four major steps that could be used to identify and develop individual projects (5):

1. Refine and develop research strategies,
2. Analyze the existing literature related to these strategies,
3. Identify gaps in ongoing research, and
4. Determine promising research projects.

The following sections examine these steps in more depth and also consider the potential value of conducting a critical review of existing research projects.

Refine and Develop Research Strategies

Further examination of potential research strategies to meet the objectives defined in the strategic research plan could be a worthwhile first step toward identifying and developing individual research projects. The value of a systematic hazards analysis to determine research priorities under Objective 4.1 (Identify solutions to improve transit safety) was discussed in the third TRAC letter report (5). A review of the program plan reveals other instances in which careful consideration of strategies could be valuable. For example, the existing projects under Objective 2.2 (Identify and overcome barriers to the adoption of ridership enhancement techniques) do not really focus on barriers. To help explore research needs, it would be useful first to list potential barriers, which might include lack of information, institutional weaknesses, cost, jurisdictional issues, infrastructure inadequacies, environmental factors, lack of suitable technologies, risk aversion, and poor political leadership. Identifying potential barriers would also help in developing substantive research proposals for the new projects listed in the program plan. In the case of Objective 2.2, the proposed projects on empty bus syndrome and unified or seamless transit services delivery do not identify the barriers to be overcome and are too vague for their potential merit to be assessed. The examples cited illustrate the importance, in the case of applied research, of identifying strategies focused on factors that will assist transit agencies in operating more efficiently and effectively.

Analyze the Existing Literature

In the committee's view, analyzing the existing literature is an essential prerequisite to developing new research projects in a particular topic area. As noted in the third TRAC letter report, such analyses could draw on existing publications (5). For example, *TCRP Report 95: Traveler Response to Transportation System Changes* aims to provide "a comprehensive, readily accessible, interpretive documentation of results and experience obtained across the United States and elsewhere from . . . different types of transportation system changes and policy actions" [see, for example, TCRP Report 95, Ch. 11 (7, Preface)]. This series of reports not only contributes to an understanding of factors affecting ridership but also indicates areas in which further work may be needed because research is absent or inadequate. In addition, the ongoing TCRP Project J-7, *Synthesis of Information Related to Transit Problems*, "searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics" (8, p. 2). Almost 70 synthesis reports have been published, many of which contain literature reviews and identify research needs, and more are in preparation. Such reports provide a useful resource to consider in identifying priority research needs.

Literature reviews and analyses could also highlight opportunities for FTA to leverage research conducted outside the agency, possibly for nontransit applications. As noted in the committee's second letter report, for example, fuel cell research funded by the U.S. Department of Energy and the California Fuel Cell Partnership could form a valuable foundation on which to build in developing fuel cells for transit buses (4).

Analyses of the existing literature need not be expensive. Modest grants to researchers active in the field could assist FTA staff in developing an informed assessment of the state of knowledge and an understanding of research opportunities, as well as in helping ensure that important sources of information are not overlooked. Furthermore, there may be opportunities for FTA to channel uncommitted earmarked funds to such literature analyses if a good match can be found between the research area of interest and the expertise of the earmark recipient. Faculty at the

transit-oriented UTCs, for example, already have extensive knowledge of and experience in transit topics.

While recognizing the limitations on FTA's discretionary research budget, the committee is of the opinion that analyses of the existing literature could help the agency make better use of its resources by avoiding unnecessary duplication, focusing on the most promising research opportunities, and identifying areas in which dissemination and application of existing knowledge—as opposed to further research—could help solve problems. Given the limitations on research funding, the committee considers it essential for FTA to leverage scarce resources by promoting the application of existing research and technology from all areas.

Identify Gaps in Ongoing Research

As noted in the third TRAC letter report, “gap analysis needs to focus on identifying gaps in knowledge” (5, p. 4). The Rail Transit ITS Research and Deployment Strategic Action Plan (rail ITS plan), prepared by the John A. Volpe National Transportation Systems Center (Volpe Center) at FTA's request, is a good first step in identifying and exploring possible research needs in the area of rail transit ITS (6). The committee commends FTA on finding an opportunity to use ITS/JPO funding, as opposed to scarce discretionary funding from the NRTP budget, to further the development of its research program. Although the use of ITS/JPO funding means that non-ITS rail transit topics were not considered and will need to be addressed later, the approach taken could serve as a model in filling other gaps in FTA's multiyear research program plan.

The first steps in developing the rail ITS plan involved extensive outreach to industry, notably to general managers and rail operations officers of transit agencies. The information gathered was used to develop five themes on which FTA should focus its projects. The Volpe Center team examined a number of sources to create an initial list of more than 40 research projects within the five theme areas. These projects were then analyzed and prioritized by representatives from rail transit agencies. Because many in the rail transit industry have neither the time nor the resources to explore new technologies and their potential applications, the involvement of researchers from the Volpe Center added value to the initial “bottom-up” process used to generate ideas for new projects.

The committee concurs with the comment from a speaker at the November 2006 TRAC meeting that some of the projects in the rail ITS plan have not been developed sufficiently to show how they could be applied in the rail transit industry. Further work is needed to assess what the proposed research could do to solve specific problems identified by the industry. The committee notes that projects to be included in FTA's research portfolio will also need to be clearly linked to the goals and objectives of the strategic research plan. Without this link, FTA's portfolio risks becoming a disparate assortment of projects that lacks strategic focus and spreads available resources too thinly over too many topics to achieve the substantive results needed to support future funding requests.

Determine Promising Research Projects

As noted in the preceding discussion of the rail ITS plan, industry representatives have a key role to play in identifying problems that research may help solve. Input from these stakeholders can assist FTA in identifying the most important problems faced by industry. Researchers, however, are more likely to understand what research can achieve and whether it can contribute

to solving the problems identified. Some problems may not be tractable as research topics because of methodological issues or lack of data, for example, or because obtaining a result that can be implemented may be extremely difficult. Thus, the involvement of researchers from the Volpe Center in developing the rail ITS plan added considerable value to the initiative.

The committee also welcomes FTA's efforts to engage researchers at the UTCs in identifying possible research projects. While the U.S. Department of Transportation's (USDOT's) Research and Innovative Technology Administration encourages all UTCs to consider engaging in transit research, FTA has been proactive in seeking to establish working relationships with individual UTCs through small focus-group meetings and dialogue sessions.¹³ As in the case of Volpe Center researchers and the rail ITS projects, researchers at the UTCs have much to contribute to the development of FTA's research program plan if their talents can be matched to industry requirements.

Recommendation As FTA continues to identify and develop individual research projects within its multiyear research program plan, it should take measures to ensure that these projects

- **Respond to the needs of transit industry stakeholders;**
- **Leverage research conducted for other applications and modes, when appropriate;**
- **Build on existing knowledge and avoid unnecessary duplication of previous research; and**
- **Are clearly linked to the goals and objectives of the strategic research plan.**

Critical Review of Ongoing Projects

Nonresearch Projects

Each project listed in FTA's multiyear research program plan is assigned to one of four research categories—analysis, development, implementation, or training and capacity building—depending on the project's purpose and stage of development. Classifying research activities on the basis of the phases of the innovation process is widely accepted and used, as discussed in a report from the RTCC (9, Ch. 4). Nonetheless, the committee questions the categories assigned to some of the projects because they do not appear to be research.

Examples of apparent “nonresearch” projects under Goal 2 (Increase transit ridership) include the following: a planning study task procuring the services of an architectural and engineering contractor to evaluate a bus rapid transit project and a technical support project providing assistance to operators in developing a regional fare collection system. These projects are classified as “analysis” and “implementation,” respectively. While case studies can be an important part of research aimed at developing guidance manuals, handbooks, and the like, the examples cited do not appear to form part of such larger research efforts, at least according to the descriptions in the program plan. Similarly, the proposed new project to develop business cases for on-demand transportation services is not a research topic, although collating research results to provide a business planning manual would constitute research. For example, the U.K.

¹³ FTA Developments with the University Transportation Centers. Presentation by Lisa Colbert, FTA, at TRAC winter meeting, November 30, 2006.

Passenger Demand Forecasting Handbook brings together research and information from all quarters of the United Kingdom rail industry and sets out the recommended forecasting framework and demand parameters to be used in assessing the effects of changes in services, facilities, and fares on passenger ridership and revenues.¹⁴ The handbook, which is reviewed and updated regularly to ensure all research is both relevant and the latest available, summarizes understanding of rail demand forecasting developed over a 20-year period.

In addition to the projects identified above, other projects listed in the research program plan also fall outside the scope of activities generally defined as research. The committee is concerned about these expenditures from FTA's research budget on technical support projects, planning study tasks, and the like. While some of the nonresearch projects are congressional earmarks or designations, others are supported as part of the agency's discretionary research program.¹⁵

Relevance of Ongoing Programs

As a result of the committee's review of the multiyear research program plan and discussions with FTA staff at TRAC meetings, the committee determined that a number of the projects listed in the plan have been ongoing for some years. Valuable research projects are frequently multiyear efforts, but it is important for FTA to have mechanisms in place to assess not only the outcomes of ongoing projects but also their continuing relevance to the agency's research goals and objectives.

The program plan includes performance checklists that can be applied to both discretionary and earmarked or designated projects. The relevance of all these projects to the goals and objectives in FTA's strategic research plan also needs to be assessed. A critical review of ongoing projects could provide an opportunity for such an assessment, as well as stimulate efforts to complete projects that, while effective, may be taking longer than necessary to produce the needed output.

Terminating projects that are not producing quality outputs relevant to FTA's strategic research agenda (and are unlikely to produce them in the future) could increase the availability of resources for more useful and relevant projects. However, FTA does not have the authority to terminate earmarked and designated projects that are not meeting performance requirements or, as in the case of many of the unaligned projects listed in the program plan, are not directly linked to the agency's research goals and objectives. The burden on FTA of managing the large number of earmarked and designated projects is significant, particularly given the shortage of administrative funds for this purpose (4).

Recommendation FTA should conduct a critical review of its ongoing projects and, when it has the necessary authority, should terminate projects that are not contributing effectively to the agency's strategic

¹⁴ *Passenger Demand Forecasting Handbook*, Association of Train Operating Companies, London, United Kingdom.

¹⁵ For example, the Bus Rapid Transit (BRT) Project Evaluation (Honolulu) and the Northern Virginia Regional Fare System projects, both of which are supported by FTA's discretionary research funds, appear to be nonresearch efforts—at least on the basis of the brief project descriptions in FTA's multiyear research program plan.

research goals and objectives. Projects retained in the agency's portfolio should exhibit the following characteristics:

- **Be research projects rather than technical support projects, planning study tasks, or the like;**
- **Produce useful, quality outputs or be likely to do so, with applications that the transit industry can understand and use whenever possible; and**
- **Be linked directly to the goals and objectives of FTA's strategic research plan.**

ENGAGING STAKEHOLDERS

FTA's first strategic research goal is to provide transit research leadership. Multiple organizations, both within and outside the federal government, support FTA's transit research program, and the FTA Office of Research, Demonstration, and Innovation (TRI) provides management and oversight for this program, as well as taking responsibility for maintaining the program's national perspective. The following sections address two aspects of TRI's leadership role, namely, the formation of research partnerships and the need to demonstrate the impact of transit on national goals.

Research Partnerships

The strategic research plan states that FTA will seek to leverage research funds by including partners in many of its research projects. During 2006, TRI staff devoted considerable effort to establishing partnerships with one particular group of stakeholders—the UTCs. TRI representatives attended the UTC plenary meeting in April, made presentations at the UTC Region 10 workshop in June and at the Council of University Transportation Centers' summer meeting, and conducted dialogue sessions with small groups of UTC researchers. TRI staff also evaluated all the UTC strategic plans, although these high-level documents generally lack the detail needed to identify areas in which the expertise and interests of UTC researchers match FTA's specific needs.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) resulted in the most significant expansion of the UTC program since its inception in 1988, increasing the number of UTCs from 33 in 1998 to 60 in 2005. Even before this expansion, individual UTCs differed widely in how they were structured and run. As a result of the provisions of SAFETEA-LU, there is now even more variability. While many of the new UTCs are still getting established, others have been functioning for many years and have well-defined procedures for conducting their research programs. This variability poses challenges for FTA in knowing how best to approach the UTCs, as a group and individually, to explore with them possible research partnerships linked to the agency's research agenda.

Anecdotal evidence suggests that small focus-group meetings and dialogue sessions are among the most effective means of matching the expertise and experience of UTC faculty members with the research needs of federal and state government agencies and industry.¹⁶ In

¹⁶ Transit Research at the University Transportation Centers. Presentation by Mohammad Qureshi, Jackson State University, Jackson, Mississippi, at TRAC winter meeting, November 30, 2006.

addition, a relatively detailed description of the goals and objectives of the proposed research helps faculty members identify topics related to their own specialized knowledge and research fields. In the same way as the UTC strategic plans are too high-level to help FTA identify a match with the experience and expertise of faculty members, FTA's high-level strategic research goals (increase transit ridership, improve safety and emergency preparedness, etc.) are too abstract to attract much interest from UTCs. However, the descriptions of research gaps and opportunities in the agency's program plan may be useful in engaging the interest of UTC researchers, particularly as SAFETEA-LU requires that the research and education activities of each UTC support the national strategy for surface transportation research as identified by the programs of FTA's NRTP [Section 5506(h)].

SAFETEA-LU specifies education and technology transfer goals for all UTCs. Thus, there may be promising opportunities to match UTC experience and expertise in these areas with the needs of the transit industry for both workforce training and development and assistance in identifying practical applications of new technologies and research outputs. The UTCs could also contribute to advancing and implementing FTA's research agenda through the development of human capital—that is, new transportation professionals capable of undertaking transit research or taking up positions in the transit industry in which the results of such research could be applied.

As part of its partnering efforts with UTCs, FTA may have a role in bringing together UTC researchers and representatives from state departments of transportation or industry who are potentially willing to provide the necessary nonfederal funding match for UTC programs.¹⁷ Obtaining this match is likely to be an obstacle in some instances, particularly if the UTC does not already have an established working relationship with a nonfederal partner.

As part of its effort to leverage outside research opportunities and make use of research experience within the UTCs, FTA plans to continue its outreach activities in 2007. Workshops will be held at the University of Alabama, Birmingham, and the University of Denver, Colorado, and site visits will be made to UTCs as resources permit. FTA will also participate in individual UTC research advisory boards and conduct dialogue sessions at stakeholder events. The committee commends TRI staff on its proactive approach to involving the UTCs in FTA's research program and looks forward to examining the outcomes of the planned activities at one or both of the 2007 TRAC meetings.

Recommendation FTA should build on its good efforts to date and continue to take a leadership role in exploring opportunities to involve the UTCs in its research program.

Serving Policy Makers

Decision makers in Congress are key stakeholders for TRI, particularly as congressional earmarks and designations continue to complicate efforts to develop a comprehensive and balanced research portfolio responsive to FTA's strategic research goals and objectives. Given that such earmarks and designations are likely to continue at some level for the foreseeable future, FTA's efforts to plan and execute a coherent research investment strategy could benefit from initiatives designed to influence congressional actions affecting the agency's research

¹⁷ The majority of federally funded UTCs require at least a dollar-for-dollar nonfederal match, although Congress exempted the 8 Title III UTCs from this requirement.

budget. As noted in the second letter report, for example, the research program plan “could include a list of research topics that Congress could be encouraged to draw on when it earmarks or designates research funds” (4, p. 5).

For FTA’s list of research topics to attract congressional attention, it needs to be compelling—and understandable—to people who generally are not experts in either transit or research. In the committee’s view, the desired effect could be achieved by demonstrating the impact, or potential impact, of transit on widely discussed national goals, such as reducing road congestion, fostering environmental stewardship, and reducing dependence on foreign oil.

FTA’s multiyear research program plan includes a chart showing how the agency’s strategic goals and objectives are aligned with USDOT’s strategic goals,¹⁸ but the potential impact of transit research on these departmental goals is not discussed. Providing such discussions, with specific examples, could help make FTA’s research agenda more relevant and interesting to policy makers, as well as help nonspecialists relate to the proposed research and understand its potential benefits. For example, the current gaps and opportunities listed in the program plan under Goal 2 indicate that FTA “needs to examine its role in DOT’s new Congestion Relief initiative launched in May 2006” (2, p. 21). Reference to the USDOT *Transportation Research, Development, and Technology Strategic Plan, 2006–2010* (11) may help FTA target its efforts. For example, one of the research, development, and technology strategies under the USDOT goal of reducing congestion is to improve planning, operation, and management of transportation services and assets. Three related research areas are defined, namely, improving the efficiency of operations and investments, improving planning and decision making, and promoting innovations in transportation finance. FTA has research programs in all three of these areas, and explaining how the results of these programs feed into the top-level goal of reducing congestion could highlight the relevance of the agency’s research. The committee urges FTA to seize such opportunities without delay. For an agency such as FTA with a relatively modest research budget, emphasizing the linkage between its research portfolio and USDOT’s strategic goals is particularly important in demonstrating that the limited resources are being allocated judiciously in line with departmental objectives.

TRI staff also needs to ensure that top FTA managers—those who articulate a vision, mission, and goals for the agency—have the information necessary to understand why research is an important tool in achieving these goals. As discussed in the report *Seven Keys to Building a Robust Research Program* (12), research is likely to flourish in an organization if top management believes in the effectiveness of research and sees it as an important instrument in achieving the organization’s mission.

In the committee’s view, FTA could serve its policy-maker stakeholders by devoting more effort to developing and conducting research related to Objective 1.1 of its strategic research plan—ensure transit research supports national goals. Such research would explore the potential impact of transit on goals such as relieving congestion, reducing dependence on foreign oil, and meeting the transportation needs of an aging population. Research outputs could be used to explain and illustrate to high-level decision makers and others the potential value of investing in transit research and to make FTA’s research agenda more compelling by demonstrating its relevance.

¹⁸ USDOT’s strategic goals address safety, reduced congestion, global connectivity, environmental stewardship, security preparedness and response, and organizational excellence (10).

A research area with the potential to affect several national goals is the ability of transit to shape land use and development patterns. Transit-oriented development is often viewed as offering the potential to reduce vehicular traffic, enhance the environment through reduced emissions and energy consumption, and increase walking activity. The latest report in the TCRP series *Traveler Response to Transportation System Changes* highlights some of the difficulties encountered in obtaining reliable data on transit-oriented developments and transferring results from one application to another (13). Thus, there may be research opportunities for FTA in this area. For example, a relationship that is at present poorly established is the degree to which transit-oriented development can reduce vehicle trips and vehicle miles of travel from a regional perspective.

Because research into the impact of transit on national goals has the potential to influence FTA's future research budgets, the committee believes it should be accorded additional resources. FTA is currently developing its multiyear research program plan. As part of this effort, it should seek to interest and engage stakeholders, including high-level decision makers, in its research agenda.

Recommendation FTA should undertake research aimed at demonstrating the impact, or potential impact, of transit on national goals such as reducing road congestion, fostering environmental stewardship, and reducing dependence on imported oil. By strengthening the links between both its strategic and multiyear research program plans and high-level national goals, FTA has the opportunity to make its research agenda more compelling to a broad audience, including high-level decision makers.

CLOSING REMARKS

The committee appreciates the opportunity to contribute to FTA's development of a national research agenda for transit. We hope that our recommendations prove useful as you examine the strategic direction and balance of FTA's research and that the overview of TRAC activities to date will help in identifying areas in which the committee's advice can be of particular value to FTA in the future.

The committee looks forward to continuing to assist you and FTA in the development of the agency's research plans.

Sincerely,



Michael S. Townes,
Chair, Transit Research Analysis Committee

cc: Mr. James S. Simpson, FTA Administrator

Enclosure A: Committee membership

Enclosure B: Presenters and panelists at July and November 2006 meetings

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ENCLOSURE A

TRANSIT RESEARCH ANALYSIS COMMITTEE

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ENCLOSURE B

PRESENTERS AND PANELISTS AT JULY AND NOVEMBER 2006 MEETINGS

Summer Meeting, July 6–7, 2006, Woods Hole, Massachusetts

Update on FTA's Research Activities and Budget

Ron Hynes, Deputy Associate Administrator for Research, Demonstration and Innovation, FTA, Washington, D.C.

FTA's Program Assessment Rating Tool (PART) Review

Bruce Robinson, Transportation Systems Manager and Strategic Analysis Team Leader, FTA, Washington, D.C.

Development of FTA's Multiyear Research Program Plan

David Wagner and Deepak Gopalakrishna, Battelle, Columbus, Ohio

Session on Benchmarking of Capital and Operating Efficiencies

Introduction to Benchmarking

Ray Ellis, Director, AECOM Enterprises, Arlington, Virginia

Metro Rail and Bus Benchmarking Groups

Eric Randall, Imperial College, London, England

Data for Benchmarking of Transit Systems: Issues and Research Opportunities

Brian McCollom, McCollom Management Consulting, Inc., Darnestown, Maryland

Winter Meeting, November 30–December 1, 2006, Washington, D.C.

Update on FTA's Multiyear Research Program Plan

Ron Hynes, Acting Administrator for Research, Demonstration, and Innovation, FTA, Washington, D.C.

Transit Research at the University Transportation Centers

Mohammad Qureshi, Jackson State University, Jackson, Mississippi

FTA Developments with the University Transportation Centers

Lisa Colbert, Transportation Management Specialist, FTA, Washington, D.C.

Session on Rail Research at FTA

Introduction

Ron Hynes, Acting Administrator for Research, Demonstration, and Innovation, FTA, Washington, D.C.

Scope of the Federal Railroad Administration's (FRA's) Research

Magdy El-Sibaie, Chief of Track Research, FRA, Washington, D.C.

Volpe Report on Rail Transit ITS Research Opportunities

Joe Giulietti, Executive Director, South Florida Regional Transportation Authority, Pompano Beach, Florida

Comments from Expert Panelists

Anna Barry, Director of Subway Operations, Massachusetts Bay Transportation Authority, Boston

Bill Mooney, Vice President of Bus Operations, Chicago Transit Authority, Illinois

Paul O'Brien, Rail Service General Manager, Utah Transit Authority, Midvale