

TRANSPORTATION RESEARCH
CIRCULAR

Number 490

January 1999

**Research Problem Statements on
Intercity Passenger Rail**

RESEARCH PROBLEM STATEMENTS ON INTERCITY PASSENGER RAIL

PREPARED BY A JOINT SUBCOMMITTEE OF TRB COMMITTEES A1E13, A2M05, and A2M02

A1E13

Daniel Roth, Chairman

Harriet Parcels
Rohit T. Aggarwala
Christine F. Andersen
Brenda Donly
Thomas E. Frawley

Nazih K. Haddad
George Haikalis
Emmanuel S. Horowitz
Arrigo P. Mongini
Thomas E. Parody
Anthony D. Perl

Aad Ruhl
Ronald C. Sheck
Mark B. Sullivan
John C. Tone
Warren D. Weber

A2M02

Paul K. Stangas, Chairman

Jeffrey E. Gordon
Kenneth W. Addison
John G. Bell
Richard U. Cogswell
Allan C. Fisher
Robert B. Fisher

Manuel Galdo
Robert E. Heggstad
David F. Jones
Robert H. Leilich
Arne Magnusson
Howard G. Moody
Per-Erik Olson

William A. Petit
Paul H. Reistrup
John A. Reoch
Louis F. Sanders
Peter L. Shaw
Richard C. Tansill

A2M05

John A. Harrison, Chairman

Brenda Myers Bohlke
Alan J. Bing
William W. Dickhart, III
Robert M. Dorer
Marilyn Duffey
Mohammed A. El-Shrafi
Nazih K. Haddad
Carl E. Hanson

Larry R. Jacobson
Larry D. Kelterborn
Robert L. Kuehne
Kenneth L. Lawson
Daniel S. Leavitt
Myles B. Mitchell
Thomas V. Peacock

R. Scott Phelan
Jerome R. Pier
Bruce R. Smith
David E. Staplin
Sun Duck Suh
Mark C. Walbrun
Robert B. Watson
Mark E. Yachmetz

Elaine King, TRB Representative

Subscriber category
VII Rail

Transportation Research Board
National Research Council
2101 Constitution Avenue, NW
Washington, DC 20418

The **Transportation Research Board** is a unit of the National Research Council, which is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering. The Research Council provides independent advice on scientific and technical matters under a congressional charter granted to the National Academy of Sciences, a private, nonprofit institution dedicated to the advancement of science and technology and to their use for the general welfare.

PREFACE

This document describes critical research needs for the short- and long-term future development of intercity passenger rail as a viable mode and component of the national transportation system. These needs were identified in response to the call for research that was articulated during the National Conference on Critical Issues for the Future of Passenger Rail in June 1997. TRB Committees A1E13, A2M02, and A2M05 developed these recommendations subsequent to this conference.

It is clear that there are profound gaps in research of the intercity passenger rail system. We contend that it is necessary to develop better documentation of lessons learned at Amtrak, as well as in international intercity passenger rail systems. This information is critical for the future of passenger rail in the United States.

It is important that documentation be based on factual information and sound analysis. We find that too often the debate is laden with emotions and biased perceptions. Research also should be far-reaching and forward-thinking. While this research may not address Amtrak's short-term crises, it should lay the foundation for long-term decision making regarding intercity passenger rail service and infrastructure whether provided by Amtrak or otherwise.

The research and evaluation of the intercity passenger rail system seeks to answer two central, fundamental questions:

- **Is intercity passenger rail a necessary component of an effective and efficient multimodal transportation system?**
- **If so, what form(s) should it take?**

These are, of course, as much policy questions as research questions. However, the research community must provide the data and analysis needed to support and guide the policy-making process.

Thus, the *Research Track* of problem statements includes the establishment and collection of intercity passenger rail metrics and the collection on an international scale of data and research results. There is also a parallel *Analysis Track*, which would explore the above question in detail from economic, social, and environmental perspectives; would further investigate the various institutional, financing, and infrastructure options available to take intercity passenger rail forward.

ACKNOWLEDGEMENTS

The preparation of this Circular resulted from the valuable contributions of a number of members and friends of three TRB committees: Intercity Rail Passenger Systems (A1E13), Electrification and Train Control Systems for Guided Ground Transportation Systems (A2M02), and Guided Intercity Passenger Transportation (A2M05). These individuals include the following: Rohit Aggarwala, Christine Andersen, Alan Bing, Emmanuel (Bruce) Horowitz, Daniel Roth, John Harrison, Paul Stangas, Brenda Donly, Daniel Leavitt, Raul Bravo, Arrigo, Mongini, John Dawson, and Harry Gow.

**RESEARCH PROBLEM STATEMENTS ON
INTERCITY PASSENGER RAIL**

TABLE OF CONTENTS

1. SUMMARY OF RESEARCH STATEMENTS.....	6
2. INTRODUCTION.....	9
2.1 Background.....	9
2.2 Implementation Considerations.....	10
2.3 Dissemination of Research Outputs.....	11
3. RESEARCH TRACK.....	14
3.1 Research Problem Statement 1: Rail Metrics.....	14
3.2 Research Problem Statement 2: International Research.....	19
4. ANALYSIS TRACK.....	30
4.1 Research Problem Statement 3: The Value of Intercity Passenger Rail.....	30
4.2 Research Problem Statement 4: Management and Financing.....	40
4.3 Research Problem Statement 5: Infrastructure.....	48
ACRONYMS	59

1. SUMMARY OF RESEARCH PROBLEM STATEMENTS

The key elements of each research problem statement are summarized in this section. The sections in which these elements are discussed in more detail are listed in parentheses.

Research Track: **Identify and collect information on intercity passenger rail systems.**

Statement 1 *Intercity Passenger Rail Metrics*

(Section 3.1) Develop a set of cost and benefit metrics that allow comparison of intercity rail passenger system performance with other modes and under different conditions.

- Develop an appropriate framework of information (metrics) on which to determine the optimal investment in intercity rail in a “multimodal context.” Framework development should include a full range of costs and benefits across all modes and regarding the overall economy.
- Where possible, align each of the benefits and costs identified in the framework with available data sources. Develop a database of information that can be used to quantify and, where possible, monetize benefits and costs for use in the analysis of intercity passenger transportation systems and in the NEPA and MIS review processes.

Statement 2 *International Research*

(Section 3.2) Conduct an international literature review to assemble comparative information on economic, institutional and other factors that drive results internationally, in an effort to inform the debate on intercity passenger rail in the United States.

- Identify metrics for international comparisons of intercity passenger rail services, to include business performance, the external policy and regulatory environment, and external impacts.
- Survey passenger rail performance and environment in countries of interest, selected to illustrate the effects of a range of different policies and institutional structures.
- Identify or conduct in-depth studies of intercity passenger rail in selected countries in comparison with the situation in the United States.

Analysis Track: **Use available information to analyze key issues in the debate on the feasibility of intercity passenger rail systems.**

Statement 3
(Section 4.1)

The Value of Intercity Passenger Rail

Evaluate the economic, social, and environmental worth of maintaining intercity rail passenger as a mode and as a vital part of a multimodal network.

- Address the direct and secondary externality benefits of each type of intercity rail passenger service, as well as the short- and long-term risks if the mode ceases to exist. Also explore the proposition that a multimodal transportation system that includes conventional intercity or high-speed passenger rail is more efficient than one that does not; i.e., move away from the studies of “passenger rail versus other modes.”
- Explore the following topics for detailed analysis: mobility and economic benefits for geographic regions served, mobility improvements across socioeconomic groups, fossil fuel consumption reduction, passenger safety, pollution reduction, and highway/airport congestion reduction. Research is also proposed on the potential value of a passenger rail market to government (state and regional/local) and private industry.

Statement 4
(Section 4.2)

Management and Financing Systems

Evaluate the range of possible institutional delivery systems for intercity passenger rail, including related external and self-funding mechanisms.

- Examine closely the financial sustainability of Amtrak and the current national system. Could a more sustainable system be based on corridors and regions, driven by market demand and state-based initiatives? Consider alternative institutional arrangements, including alternative operators.
- Understand the service implications of a continuation of the current approach to funding Amtrak, and contrast with the funding and service consequences under a privatized structure.
- Contrast the emerging roles of states, which are taking on a more active role in planning and funding intercity passenger rail, contrast with that of the federal government. Explore ways of overcoming institutional and administrative barriers and of improving coordination between states.
- Identify the key institutional, managerial, financial, and other success factors for intercity passenger rail systems around the world, and consider how these conditions might be created in the United States. Clarify commercial, political, and funding risks to new services and systems, and explore how to overcome them.

Statement 5
(Section 4.3)

Infrastructure Options

Explore current and alternative approaches to providing for passenger rail infrastructure, including related institutional issues and impacts.

- Identify the costs and benefits of passenger rail's use of freight railroad right-of-way, in order to judge the allocation of costs and to assess the impacts of expanded or reduced service, or of altered access conditions, on both the freight and passenger railroads.
- Investigate the opportunities and costs of a policy of developing passenger-only rights-of-way, based on Northeast Corridor and international experience. The compatibility of high-value, high-speed freight service should also be investigated.
- Address issues specific to the Northeast Corridor, including its ownership and management (particularly in view of its heavy use by commuter operators) and the latent possibilities for its expansion.
- Develop a fact base regarding possible infrastructure improvements, such as airport connections, electrification, speed increases, and at-grade crossing improvements or elimination.

2. INTRODUCTION

2.1 Background

Rail travel was once the primary mode of transportation. Passenger trains ran between New York and Chicago at over 100 miles per hour and traveled across the nation carrying passengers safely, comfortably, and on time.

Passenger and freight services were provided as an integral part of the rail transportation mode by railroads that also owned the infrastructure. Through the unlimited interchange system, all major railroads in the country were also able to operate trains on each other's tracks.

Today, most passenger trains cannot exceed 79 miles per hour. With few exceptions rail travel is extremely unreliable and can not provide the level of services expected by travelers and offered by the competition. U.S. intercity passenger rail services are provided by a nationwide organization created and controlled by government, namely, Amtrak. According to the Worldwatch Institute in their recent paper, "Back on Track: The Global Revival," Amtrak carries less than 1 percent of the total traveling public in the United States. The U.S. Department of Transportation (DOT) publication 1995 American Travel Survey shows that the actual share for trains is 0.5 percent, with fully half of passenger traffic concentrated in the Northeast Corridor.

The relative success of intercity rail in the Northeast Corridor—the only place where rail is truly competitive with other modes—is due to the fact that it has received over \$3 billion in federal infrastructure investment since Amtrak's creation. This has allowed Amtrak to compete effectively with other modes, which have themselves benefited considerably over the years from government investment.

Today only a portion of Amtrak's business can be considered commercially viable, such as many of the services in the Northeast Corridor plus possibly Los Angeles–San Diego. With further developments, a few other corridors might be commercially viable: the Chicago hub routes and New York–Albany, among others. But even their financial viability is in question because of disagreements about accounting systems or costing methodologies. At the end of the day, most of today's Amtrak routes survive thanks to federal and state financial assistance driven by political and popular support. Key questions then arise, such as: What should intercity passenger rail's role outside the Northeast Corridor be in the longer term? How will it be paid for, and who would best be responsible for its development?

Services of any type can be sustained only in response to well-defined needs. Central to the intercity rail "problem" is the determination of market demand, particularly in environments of relatively poor service. Economic and social justifications also help support the public investments. Once a market-based justification exists, other issues may be evaluated, including project financing, availability of rights-of-way, facilities, management issues, and other supporting conditions for success. This statement takes the position that demand studies are already frequent

and fairly sophisticated, such that the research needs in this area are not as pressing and have therefore not been included. It is in the other areas that much more work needs to be done.

Because of the extensive systems in European countries and Japan, many look to these as models for resolving our intercity passenger rail problems. However, we often fail to recognize the vast differences of the underlying issues: demographics, access to passenger origin and destination points, the integration and comprehensiveness of transportation networks, ownership and management of transportation infrastructure and facilities, strength of competitive modes, political commitments, social and institutional issues, among others. Nevertheless, there are many insights to be gained and lessons to be learned.

The current wave of privatization or concessioning of transportation services to the private sector around the world is viewed by many as a potential model to be applied in the United States. While these approaches can indeed be successful under certain conditions, it is prudent to analyze their applicability on a case-by-case basis, in the context of our specific intercity passenger transportation needs, the legal and institutional conditions encountered here, and the ultimate social and economic benefits. The role of the private sector in partnership with the public sector, the complex legal aspects affecting such efforts, and the conditions to attract private developers and operators must be carefully evaluated to ensure long-lasting relationships.

It is critical that in-depth, objective research be undertaken in all these areas to determine and to support the viability of intercity rail passenger transportation. If it is determined that intercity rail passenger transportation is a needed component of a national, regional, or local total transportation network, then an examination should be undertaken of the institutional, management, and funding structure under which it can flourish. With environmental concerns and traffic congestion affecting all modes of transportation, and presenting a serious challenge to the public's well being and to the broader U.S. economy, this research should prove timely and central to identifying intercity passenger rail's most beneficial, effective, and sustainable role.

After years of "band-aid" solutions to the national intercity passenger rail system, it is now essential that long-term, viable solutions are found and adopted. If not, the relatively little service that exists today may not last long. If sound and objective, the research described herein will prove its usefulness through a transportation network that will improve the quality of life for all Americans.

2.2 Implementation Considerations

The implementation of a research program such as the one suggested in this set of problem statements depends partly on the interests of the sponsoring organizations. These could include, primarily, the federal government, state sponsors of rail passenger service, Amtrak, and possibly railroad suppliers. Each of these organizations has different viewpoints, interests, and budgets. The purpose of this section is not to recommend which organizations should conduct specific types of research or to dictate research priorities, but rather to provide a descriptive summary of the research interests of the various relevant organizations.

The federal government's interest is the broadest. It includes helping answer questions such as whether, where, and what type of rail passenger service is economically justified; the amount of public funds needed to provide different levels of service; and how the provision of rail passenger service should be organized and managed. Some of this type of research may be done through internal staff papers, and some through separately commissioned studies. In addition, the federal government has an interest in facilitating the success of rail passenger service by helping state governments and Amtrak to conduct research of their own through grants. The availability of funds for any of these activities has been scarce over the last few years. Funding has been directed more at research and demonstration of hardware rather than "soft" studies.

State sponsors are interested in many of the same issues as the federal government but also in issues more specific to planning, constructing, and promoting their own projects. States are also interested in particular issues such as the legal question of whether, under the original Amtrak franchise, organizations other than Amtrak can be allowed to operate intercity service in the absence of Amtrak. State budgets for such research are just as constrained as the Federal budget, though a number of states with common interest might find it advantageous to pool their resources under arrangements analogous to the NCHRP or the TCRP, in which matching federal funds could be involved.

Amtrak itself has typically not undertaken research of the type discussed here; rather, its interests tend to be those of a customer-driven business enterprise, that is, promoting rail passenger service, tailoring and marketing its service to respond to demand and customer needs, and improving its cost-efficiency.

Finally, while railroad suppliers may be interested in a number of the research projects suggested in this report—because they could promote their interests and provide information on their markets—these organizations are less likely to become major sponsors.

It is difficult to say exactly which topics might be given priority by each organization. In fact, it would be useful to ask key representatives of these organizations to rank the topics in priority order as the next step toward implementation. In terms of the broad groupings of the Research Problem Statements in Section 3, the federal government would probably be very interested in several of the metrics topics and, as support for planning at the state level, in the demand topics. Some comparative international studies and infrastructure topics would also be of interest. States would probably give higher priority to management and financing. Amtrak would probably rank demand studies very high, along with the value of passenger rail.

2.3 Dissemination of Research Outputs

The future shape of intercity passenger rail is changing rapidly. Numerous states are now actively planning and funding improvements in infrastructure, passenger equipment, and service. Amtrak has significantly transformed its approach to service delivery over the past several years and also

currently faces a serious financial crisis, combined with new opportunities and threats, created by its legislative reauthorization. The federal government and Congress continue to seek the appropriate policies and funding mechanisms for conventional and high-speed passenger rail.

This Research Problem Statement grew out of a collection of issues and research needs that were identified as critical for intercity passenger rail *today*. It is therefore imperative that the outputs of the research outlined in this document respond to this urgency. The parties interested in this research include federal, state, and local policy-makers and planners and private sector industry participants (including Amtrak, other potential operators, and suppliers). Readers might include elected officials and their staff, managers, and other professionals and practitioners. For these parties to take an interest in this research, and to tangibly benefit from the research findings, the outputs should be generated in formats that can be readily used.

The output should have three basic characteristics:

1. *Practicality*: The research findings should provide information, insights, and solutions that are of direct use and current and that are presented with a view towards implementation;
2. *Accessibility*: While the research should be of the highest quality, and appropriate sophisticated methodologies may be used, the results should be summarized at a level of complexity that makes them accessible to decision makers and planners;
3. *Clarity and objectiveness*: The analyses should be clear and based on empirical evidence; hypotheses should be tested; and opposing viewpoints should be thoughtfully considered.

The format of the output of specific research efforts will naturally depend on the nature and the goals of the research sponsor (e.g., federal research program, state-sponsored studies, academic research programs, industry groups). A common avenue for reporting research results will likely continue to be papers published in peer-reviewed journals. Students may write dissertations and theses. Presentations may be prepared for various conferences. Regardless of the medium, the researcher's output should ideally include a summary of results, perhaps best described as a *Resource Paper*. Facts, lessons learned, methodologies, information sources (including relevant past work)—all should be summarized in a format that is conducive to being readily used by individuals engaged in planning and improving intercity passenger rail service.

Taking these notions one step further, it may be desirable to design a program of research with goals similar to that of the TRCP (sponsored by the Federal Transit Administration, and guided jointly by the FTA, the TRB, and an educational and research arm of the American Public Transit Association). As with the TCRP, the desire in this Problem Statement is to focus on issues significant to the intercity passenger rail mode, and to emphasize the development of near-term research findings in a number of problem areas. Like the TCRP, the research results should indicate the applicability of the findings to practical issues and problems. Many TCRP projects culminate with the publication of *Handbooks*, case studies, digests or guides—documents that would be designed to have practical value in implementing improvements to intercity passenger rail service. Handbooks already exist for other modes of transportation. A comprehensive intercity passenger rail handbook—covering economic, financial and planning issues, and

including methodologies, results, and implementation guides—could be particularly helpful to state DOTs and others.

Finally, the urgency of the research areas outlined in this document means that the research outputs must be disseminated widely, and as rapidly as possible. In addition to possibly sponsoring research, existing governmental entities as well as industry groups (e.g. AASHTO's SCORT, HSGTA) will be recipients, and preferably distributors themselves. Of course, dissemination should also take advantage of electronic media. In short, this Research Problem Statement suggests an active and dynamic process for the prosecution of the research, and equally importantly, for the distribution of the results.

3. RESEARCH TRACK

The following two research problem statements propose to collect literature and data on intercity passenger rail in the United States and internationally. This collection of information is intended to lay the foundation for objective analyses of the value, funding, management, and infrastructure of the intercity passenger rail system in the United States.

3.1 Research Problem Statement 1: Rail Metrics

Develop a set of cost and benefit metrics that allow comparison of the performance of the intercity rail passenger system with that of other modes, and under different conditions.

3.1.1 Abstract/Statement of Need

There is a need for research to develop a framework for benefit/cost analysis of intercity passenger transportation investments, to identify the categories of benefits and costs to be considered, and to quantify the physical quantities (metrics) and value per physical unit to be used in these analyses. This research would become the foundation for sound analysis of intercity rail as a viable mode of transportation. These measures would provide the basis for on-going assessments of the value, systems, and infrastructure of intercity passenger rail service. They should capture the total life-cycle costs and benefits attributable to different modes (highway, rail, and air), including direct and indirect socioeconomic benefits, for use in planning for expansion and/or development of new intercity passenger transportation systems. Environmental impacts, net plus or minus, need to be quantified in economic terms and included in the framework. A similar research problem statement was included in *TRB Circular No. 464*, October 1996, as "Problem 163: Intercity Passenger Transportation Life Cycle Cost/Benefit Analysis." To date, this research need has not been adequately addressed.

3.1.2 Purpose of Research

Context

Some attempts to justify public expenditures on intercity rail transportation have taken the approach of first projecting the purely financial results and then estimating the magnitude of public benefits. Often there is a financial shortfall. Since the public sector must usually cover the shortfall, the question then becomes what this expenditure on the shortfall "buys" in terms of public benefits. As opposed to most U.S. studies to date, French and German studies have made a distinction between "commercial rate of return," which takes into account only revenues and costs accruing to the provider of service, and "social rate of return," which includes benefits and costs to the public at large. Highway investment analysis (i.e., for other than toll roads) must be done purely from a public benefits standpoint because no new revenues, except for gas taxes, will typically accrue to the provider of the service.

A great variety of benefits are often considered in the analysis and are quantified in various degrees. Some of the benefits, such as employment impacts or increased real estate values, are arguably offset by changes in the opposite direction in locations not served by the new facility. It can also be argued that such benefits simply reflect the capitalization of transportation benefits, which may already have been counted elsewhere in the analysis. Others have argued that a new transportation facility, particularly one that represents a dramatic decrease in the time or cost of travel, can lead to unforeseen impacts in productivity of business sectors that use transportation, as well as in non-business related travel, resulting in repercussions to the entire economy. Transportation/economic models currently in use do not capture some of these effects.

There is a mistaken impression that all highway and aviation infrastructure improvements are paid for by the user. In the recently completed "Commercial Feasibility Study" the Federal Railroad Administration identified a conceptual framework, labeled "partnership potential," which recognized that each travel mode (air, highway, and rail) shows distinctly split responsibilities for such essential functions as the provision, maintenance and operation of rights-of-way, terminals and vehicles (U.S. DOT, FRA: *High Speed Ground Transportation for America*, September 1997, page O-5. Thus, every means of intercity passenger transport in this country represents an implicit or explicit private/public partnership that while incorporating user financing in large measure, also demonstrates governmental support and involvement. Comparisons of costs and benefits to the public at large, including all publicly-borne costs, would allow policy makers to determine the degree to which the public at large (not just users) would obtain a return on its investment in any particular mode.

Usefulness

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 required Metropolitan Planning Organizations (MPOs), in cooperation with states, to develop transportation plans and programs for state urbanized areas. What ISTEA did not address was how states plan for *inter-city* transportation. Also, since ISTEA does not address the air travel mode, there is no commonly accepted methodology or planning approach used for intercity transportation, either mandated by law or in common use, that encourages true multimodal evaluation and tradeoffs of modes and technologies at a statewide or multistate level. Some states are at the forefront in considering intercity passenger rail in their evaluation of statewide transportation investments. Others have virtually no programs and are unprepared to take a role in supporting passenger rail. Models used for other modes, such as highway, do not necessarily apply well to passenger rail.

Development of commonly accepted metrics should augment the evaluation of different modes in intercity travel corridors, allowing planners to evaluate more comprehensively all public transportation investment options in a more objective way. Just as ISTEA formalized the urban transportation planning process, so would development and implementation of new multimodal planning and analysis tools perform in the intercity travel market.

The proposed research could help identify possible mechanisms for introducing a new mode or upgrading an existing underutilized mode, based on savings achieved by reducing the need for future capacity expansion in other modes or by extending another mode's economic life.

Alternatively, it could identify mechanisms for introducing a new mode by reducing congestion through diversion from another mode, including an analysis of assumptions to be used regarding future capacity of the other mode.

Objective

The objectives of this research are to do the following:

1. Develop an appropriate framework of information (metrics) on which to determine the optimal investment in intercity rail in a "multimodal context." Framework development should include the following operations:
 - Identify categories of benefits and costs.
 - Identify specific benefits and costs within each category, as well as consumer surplus, i.e., benefits to users that exceed amounts paid.
 - Identify potential overlaps or double counts.
 - Specify methods for integrating and presenting this information to facilitate implementation decisions.
 - Include consideration of impacts of all modes and effects on the overall economy and on land-use patterns.
2. Where possible, align each of the benefits and costs identified in the framework with measures and viable data sources. In other words, each benefit area identified would be accompanied by a corresponding list of measures (metrics), as well as references to where additional related information can be obtained.
3. Develop a database of information that can be used to quantify and, where possible, monetize benefits and costs for use in the analysis of intercity passenger transportation systems and in the NEPA and MIS review processes.

3.1.3 Research Topics

Topic 1. Develop a framework or methodology and a comprehensive set of metrics for life-cycle cost/benefit analysis of intercity passenger transportation investments, identification of categories of benefits and costs to be considered (with care not to double count), and quantification of the physical quantities and value per physical unit. The set of metrics should capture the essential performance, benefit-cost effectiveness, market demand and capacity, socioeconomic externalities, and other dimensions determined to be most important in transportation policy-making and investment decisions. The metrics (or performance measures) must be selected carefully so as to capture key concerns while avoiding bias caused by underlying institutional issues. For example, measuring the performance of Amtrak on a dollar of subsidy per passenger would be dangerous, because this would not adjust for Amtrak's underlying cost structure (which is institutionally imposed), and may not be applicable to a future delivery system or agency.

At least two categories of metrics should be identified: those measuring economic performance (including socioeconomic and environmental effects); and those measuring transportation (supply) performance of alternative intercity modes. The metrics will have to be sensitive to scale, scope, and (dis)economies, in the sense that while certain performance measures would be calculated on a per-unit basis, the measure (whether an average or marginal cost) could change significantly at other levels of output.

The analysis of mode performance using metrics should be done by market, where a market is defined along several dimensions, including geography, trip length, trip purpose, and demography. The lack of intercity rail in a given market should not preclude its being considered a potentially desirable option. Commonly recognized metrics would facilitate the evaluation of cost compliance with environmental requirements, especially where new infrastructure is required.

In discussing benefits and costs, "consumer surplus" should be explicitly addressed. In fact, it may be a good idea to require a discussion of the propriety of including consumer surplus as a benefit and how it should be measured. In accordance with OMB Circular A-94 (revised October 29, 1992), *Guidelines and Discount Rates*, Section G, "user benefits" have long been recognized and measured (e.g., time savings) in highway analyses. But in performing the Commercial Feasibility Study, FRA discovered that OMB did not want to count rail user benefits beyond the extent to which they were paid for by users, and yet they allow the use of highway user benefits because "they are recovered through user charges." Clearly, the latter may be true only in a very general sense, not with regard to particular stretches of highway.

It is important to explore the relative usefulness of developing metrics that consider operating cost and capital costs separately, versus those considering all costs in a cost curve. Even if certain investments are already made (and thus could be considered "sunk"), in fact recapitalization is necessary on an ongoing basis, and efficient pricing (marginal costing) requires a look at the total (long-run) cost allocation of resources to, and possible underpricing of, the air and highway modes.

Suggested Methodology and Sources

The Coalition of Northeastern Governors High-Speed Rail Task Force issued report in October 1990 entitled, *CONEG High-Speed Rail Regional Benefits Study, A Report on the Benefits to the Region of Improved Passenger Rail Service Between Boston and New York*. This was an early attempt to identify and quantify categories of benefits and costs specifically for the intercity rail mode. While not multimodal in approach, this study might provide a starting point for further research in this area.

In August 1993, the FRA's Office of Policy prepared an annotated bibliography of papers and reports on the measurement, mitigation, and costing of the environmental externalities and social costs of transportation systems that lists current research under way in areas related to this need. This comprehensive list, while somewhat dated, should be referred to in carrying out the proposed research.

The recently completed FRA Commercial Feasibility Study, referred to earlier, developed a framework for the passenger rail mode that could be incorporated in the overall framework.

Swedish R&D in this field, discussed by Lars Hansson (*The Swedish Approach to Multimodal Transportation Planning*), is a worthwhile reference source.

The American Public Transit Association recently published a report entitled *Commuter Rail, Serving America's Emerging Suburban/Urban Economy*, September 1997, which focuses specifically on commuter rail (as opposed to intercity rail). It lists benefits and costs common to all rail modes, which may be useful in carrying out the proposed research. This study also lists three pages of references that may be of use in the proposed further research.

The Federal Transit Administration's major investment study methodology probably comes the closest to meeting the objectives of this research. Yet a suitable framework specifically addressing intercity passenger transportation investments does not exist.

Topic 2. Develop a set of measures for the metric set. The comprehensive set of metrics will include all potential metrics, even if they are difficult or impossible to measure. Therefore, it is critical to examine the feasibility of each metric by identifying existing data sources and examining other tools, which might be devised to collect information. The existence of data will limit the size of the set of measurable metrics.

Suggested Methodology and Sources

Potential sources for existing data and collection instruments include the U.S. DOT, the FRA, and the Office of Railroad Development, which have conducted some limited research recently in the course of preparing the Commercial Feasibility Study and may have other sources of data that should be investigated. Also several state DOTs, particularly those sponsoring high-speed rail studies, (e.g., Florida DOT, CalTrans, and NYS DOT) may provide some useful data. The Coalition of Northeastern Governors (CONEG) Policy Office may also be of some assistance. Several prominent transportation research institutes, such as the Center for Transportation Studies at MIT, the Texas Transportation Institute, the Center for Transportation Research (CUTR) in Florida, and the Institute for Transportation Studies at Cal Berkeley, have all no doubt conducted related research in this field. Finally, overseas research sources should also be investigated to the extent possible.

Topic 3. Develop a database of information that can be used to quantify, and where possible monetize, benefits and costs for use in the analysis of intercity passenger transportation systems and in the NEPA and MIS review process.

Suggested Methodology and Sources

The previously cited sources would apply to the conduct of this task as well.

3.2 Research Problem Statement 2: International Research

Conduct an international literature review to assemble comparative information on economic, institutional, and other factors that can inform the debate on intercity passenger rail.

3.2.1 Abstract/Statement of Need

International experience in the provision of intercity passenger rail services may hold valuable lessons for the United States regarding policy alternatives and likely outcomes. A wide variety of restructuring and policy initiatives are being initiated, especially in Europe, to improve service quality and the financial performance of rail systems. Substantial investment in high-speed rail continues in parallel with enhancements on existing lines. The technology and service characteristics associated with these developments have been widely reported in the United States. However, less information is available about the actual results achieved in terms of market share, and financial performance, and the political, economic, and geographical environment in which these results are being obtained.

The proposed research will fill this gap. A series of case studies of different groups of intercity rail services will provide the actual results being achieved, and the conditions under which these results are being obtained. Candidates for this study include domestic intercity rail services in the United Kingdom, France, Germany, Sweden, and Japan and international high-speed services in northwestern Europe. The metrics used to characterize and evaluate the different groups of services will be coordinated with those used in other proposed intercity rail research efforts to facilitate comparisons between U.S. and international experience. Finally, the case studies will be reviewed to yield general lessons of relevance to the situation in the U.S.

3.2.2 Purpose of Research

Context

The recent battle to ensure continued financial and political support for Amtrak is only the latest round in the continuing debate regarding the role of intercity rail in the United States. The debate has been going on ever since the decline in passenger rail services in the 1960s. Unresolved issues include the following:

- The rationale for and amount of government financial support of intercity rail, both at the federal and state levels.
- The best methods to ensure that an operator offers safe, attractive, and efficient services.
- The social obligations that intercity rail operators should be expected to assume with regard to such matters as labor agreements, railroad worker pensions, services to small or remote communities, accident liability, and how the operator should be compensated for the resulting costs.

- The best way to provide equitable sharing of scarce railroad track capacity on both publicly- and privately-owned rights of way, particularly the rights of access of a train service operator to track owned by another party.
- The best way to serve the U.S. populace—whether by a number of separate intercity rail operators on different routes and in different regions, possibly competing with each other, or by a single national system.

Strongly held opinions and partisan views (for example, from the private freight railroads or rail labor interests) have characterized the debate, rather than objective information on the likely results of different policies. Without such information, far-reaching decisions on intercity passenger rail may be made that are not in the interests of the traveling public or the nation as a whole, or that have unforeseen consequences.

The issues facing government and industry decision-makers regarding intercity rail are not unique to the United States. Almost all developed countries are struggling with the questions of the role of intercity rail versus competing modes; whether and how to support intercity rail services with government funds; how to encourage high-quality and efficient service; and how to manage the competing claims from intercity, freight and commuter services on the limited rail capacity. A wide variety of restructuring and privatization initiatives have been undertaken or are planned to resolve these issues. These include different approaches toward making major passenger rail investments, such as high-speed rail lines.

Specific examples of these developments include the following:

- The gradual progress toward a common transport policy in the European Union (EU), generally aimed at enhancing competition, reducing government subsidies, and improving financial visibility. Specific EU railway policies are to separate infrastructure from rail operations and to give potential operators rights of access to the railway infrastructure. The objectives are to break up national railway monopolies and to increase service performance and innovation.
- The development of international services in Europe, such as the Eurocity network of conventional intercity services; the Channel Tunnel services between London, Paris, and Brussels; and “Thalys” service connecting France, Belgium, Netherlands, and Germany.

Total privatization of the railway industry in the United Kingdom, with passenger services being split between 25 passenger service franchises and awarded to Train Operating Companies (TOCs). The TOCs are given a franchise for 7 to 15 years, plus a subsidy in most cases, in return for a commitment to operate a specified minimum service and to underwrite specific improvements. About six of the franchises provide mostly intercity service; the rest operate commuter and local services. Creating a single regulated monopoly, Railtrack PLC, has privatized the infrastructure in the United Kingdom.

- The restructuring and partial privatization of the former Japanese National Railways. Six regional passenger companies and a freight company were created. The companies were relieved of some historic debt, pension, and employment obligations with the aim of creating commercially viable enterprises. Three of the regional companies—East, West, and Central Japan Railways—inherited the bulk of the Shinkansen high-speed network and have been pursuing lower-cost ways of enhancing service.
- The experience in Sweden, which pioneered the separation of railway infrastructure and operations, and where a common approach to evaluating and financing transport infrastructure developments is used for all modes.
- Restructuring of the German Federal Railways, combined with the rail system in the former East Germany, into separate passenger, freight, and infrastructure businesses. Criteria for open access to the infrastructure and an infrastructure pricing scheme are being worked out, initially for freight services. Local and commuter services are being transferred to local and regional authorities. The overall goal is to improve service quality and efficiency, while achieving greater financial visibility.
- Continued development of the high-speed services in France, with extensions of high-speed lines and new generations of the TGV trains, but with more limited changes in transportation policies and financing approaches.
- Progress with projects to develop new high-speed rail links along the primary intercity corridors in both Taiwan and Korea.

Usefulness

This problem statement starts from a hypothesis that the United States has something to learn from the experience of other countries, and that intercity travelers everywhere respond in a similar way to travel cost and service opportunities. In the past, foreign experience, typically in Japan or Europe, has either been held up as a model of what is needed in the U.S., or has been rejected as irrelevant because of different demographics, consumer attitudes, and availability of generous financial support. The truth probably lies between the two: that there are important lessons to be learned, both positive and negative, from a thorough and objective examination of this foreign experience. The lessons could include the effects of different intercity transportation policies, the limitations to the market share available in even highly rail-friendly environments, and how to promote attractive and efficient services.

The point about consumer attitudes and response to travel alternatives being similar everywhere needs elaboration. Some believe that travelers from the United States are less likely to use intercity rail services because an inflexible cultural attitude that is something separate from a rational response to price, service, the accessibility of rail and its alternatives, and familiarity with rail service. The hypothesis to be tested in this research is that there is no such cultural attitude, and that Americans will respond the same way as Europeans and Japanese, if given the same alternatives, once they are familiar with the service being offered. Indeed, Americans travel as

much by a common carrier mode (usually air) as Europeans, and Europeans are as car-oriented as Americans for both business and leisure trips—and most likely for the same reasons of convenience and privacy.

Objective

The overall objective of this research is to assemble comparative information on the relative success of intercity rail versus other modes of intercity transportation in the countries and regions of interest, combined with the policy, financial, geographic, and service characteristics that led to the observed result. This information will then be reviewed to identify common factors that may result in successful intercity rail services. Success may be defined as having a robust market share in comparison with intercity rail services elsewhere and delivering a combination of good financial performance plus measurable environmental and social benefits. Technology per se will not be a focus of this effort, except where technology appears to be a significant factor in achieving good results. Foreign passenger rail technology has already been widely described and demonstrated in the United States.

The result of this research effort will be a series of case studies and reviews to yield lessons of relevance to intercity passenger rail in the United States.

3.2.3 Research Topics

The specific topics to be covered in this research effort are concerned with quantifying and comparing the performance of intercity rail passenger services in different countries, and the policy, economic, geographic, and other factors that underlie results achieved by the services.

The recommended research subject areas, in order of priority are these:

1. Identify metrics for international comparisons of intercity passenger rail services, to include business performance, the external policy and regulatory environment, and external impacts.
2. Survey passenger rail performance and environment in countries of interest, selected to illustrate the effects of a range of different policies and institutional structures.
3. Identify or conduct in-depth studies of intercity passenger rail in selected countries in comparison with the situation in the United States.

Subject 1: Metrics for International Comparisons of Intercity Rail Services

Choice of metrics to measure the performance of intercity rail services is an essential first step in carrying out meaningful international comparisons. As far as possible, work on this subject will be coordinated with that on *Research Problem Statement 1: Rail Metrics*. However, valid international comparisons will need a broader range of metrics than those needed for domestic

U.S. analysis, especially to characterize geographical, demographic, and economic differences between countries. Individual topics within this subject are as described below.

Topic 1.1 Business Performance of Intercity Rail Services

In coordination with the work being conducted under *Research Problem Statement 1: Rail Metrics* international rail metrics will be developed for evaluating the performance of intercity rail services as a business. To the extent feasible, these metrics should cover the following:

- Market share achieved by the services in their service area. This could be quantified, for example, as the share of passenger-miles of journeys over 100 miles captured by rail, air, bus, and private car. The exact metric may depend on how the available data are structured.
- Characteristics of the services that produced this result—speed, frequency, accessibility, and general quality. Accessibility will include physical access to stations and terminals by car or public transportation, and access to service information and reservation systems. General quality will include (as available) service reliability, age and type of rolling stock, and similar factors.
- Financial performance achieved by the services—the extent to which actual revenue (exclusive of any subsidies) covers operating and capital costs. It is hoped that the restructuring initiatives in many countries will result in greater availability of service-specific financial information.
- Productivity achieved in the use of labor, rolling stock, and infrastructure. High productivity and high utilization of capital assets obviously help keep costs low and improve financial performance.
- Type of organization offering the service, such as a division of a national rail system, an international alliance, a private company operating under a franchise agreement, and so on. Arrangements for access to infrastructure and methods of charging for usage should also be included. This information will help indicate whether there is any difference in the performance measures that appear to be attributable to the type of organization involved and the degree of commercial freedom enjoyed by the operator, rather than to other internal or external factors.

Suggested Methodology and Sources

A suggested methodology for International Rail Metrics follows Topic 1.3.

Topic 1.2 External Environment for Intercity Rail Services

A wide range of factors outside the direct control of an intercity rail service operator will affect the results achieved by the service, especially the ability to attract sufficient patronage at a fare level that enables the operator to cover capital and operating costs. Specific factors that will affect results, and should be quantified or evaluated include the following:

- Cost and availability to the customer of competing modes of transportation (air, bus, and private car), and the policies that underlie the costs. For example, the cost of auto travel in Europe is typically much higher than in the U.S., primarily because of higher taxes and higher car prices. Also, transportation regulation may restrict competing bus and air services, or keep prices of these modes relatively high.
- Quality and convenience of alternative modes, particularly the level of highway congestion, accessibility of airports, and congestion problems affecting commercial aviation.
- Cost of passenger transportation by all modes relative to the cost of living in a country or a region, which affects the overall volume of intercity travel.
- Amount of capital or operating subsidy provided for intercity rail services and competing modes, and how the subsidy is justified. Subsidies reduce cost the of rail travel to the customer and increase patronage but may also encourage inefficient operating practices. The justification of subsidy is a policy issue of great interest. Is the government trying to deliberately encourage one mode over another for social, environmental, or safety reasons; 'leveling the playing field' between modes; or yielding to 'modal lobbies'?
- Geographical factors affecting the attractiveness of rail travel. High population densities locally around major metropolitan areas and in the regions served by the intercity rail service as a whole may make rail more attractive (relative to road, in particular).
- Environmental, health, and safety regulations that affect the relative cost and attractiveness of different transportation modes.

Overall this information will indicate whether a rail service is operating in a rail-friendly or a rail-unfriendly external environment, and to what extent the external environment faced by the foreign service differs from that in the United States.

Suggested Methodology and Sources

A suggested methodology for International Rail Metrics follows Topic 1.3.

Topic 1.3 External Costs and Benefits of Intercity Rail and Competing Modes

A number of transportation costs and benefits are typically not captured in fares, user charges or operating costs. Quantification of such costs and benefits is an important part of a fair international comparison. Typical external impacts are as follows:

- Air pollution and carbon dioxide emissions from fossil fuels, whether burnt at a power plant or by a prime-mover on the train.
- Noise impacts on communities adjacent to rail lines, highways, and airports.
- Mobility provided, including to otherwise disadvantaged communities or population groups.

Suggested Methodology and Sources (Subject 1)

Sources for choice of metrics will be similar to those mentioned in *Research Problem Statement 1: Rail Metrics*. In addition, metrics will be needed to reflect the differences between countries. However, these are likely to be the same as or similar to those used, for example, to characterize the potential for rail intercity service in different regions of the United States and probably include economic prosperity indicators, car ownership, the total size of the travel market, and population size and density.

Subject 2: Initial Survey of Candidate Foreign Rail Services

The services of potential interest are those where intercity rail services are operated on a scale comparable to present or potential future services in the United States and have been restructured to improve performance, service quality, or financial results. Preferably, sufficient time will have passed since restructuring for results to be available regarding the success or otherwise of the changes. Specific suggestions for study are these:

- Services provided by the intercity TOCs in the United Kingdom, using the performance of British Rail's intercity sector prior to privatization for comparison. Public company annual reports and requirements for reporting to the newly established regulatory authorities will provide some financial and operating information. There also are likely to be many other investigations of privatization costs and benefits to provide a further source of research material.
- International services in Europe that have a separate identity, and for which separate cost and operating information may be available. The best examples are

the Eurostar services between London, Paris, and Brussels and the Thalys service connecting Paris, Brussels, Amsterdam, and Cologne.

- Intercity rail services in Sweden, which have the longest history of separation between track and infrastructure and operations and utilize an approach that treats infrastructure financing for all modes in the same way. Sweden also has a low population density, making it more comparable with North America than elsewhere in Europe.
- Intercity and high-speed services in France, which are not only those most often cited by rail advocates as a model but also the most extensive high-speed network in Europe. France should be a good example of what can be achieved in a thoroughly “rail-friendly” environment, but also one in which there has perhaps been less attention to managing costs.
- Intercity and high-speed services in Germany, which also are often cited as exemplary by rail advocates. While data on German experience should be assembled, and the German restructuring approach deserves to be assessed, the data may have limited value in the short term. As well as restructuring to improve financial performance and to respond to EU policies and directives, the German rail system is continuing to deal with the aftermath of absorbing the run-down East German system and the consequent changes in travel patterns.
- Shinkansen high-speed services in Japan. Following a 1988 restructuring, the three regional rail systems responsible for Shinkansen have acted to enhance service and seek ways of lowering costs. There is clearly great interest in the ongoing financial benefits from the restructuring and in the performance of the regional firms after several years of experience.

In addition, comparable information will be assembled for intercity rail service in the United States, taken from data generated during analysis of other intercity passenger rail research problems.

Suggested Methodology and Sources

This research will rely exclusively on readily available published sources, to enable initial comparisons to be developed quickly. The research will involve developing a concise overview of intercity passenger rail services in each of the countries and regions of potential interest plus comparable information for the United States. As many as possible of the performance and external environment measures identified in Subject 1 will be quantified. Readily available sources may include the following:

- *Railway Statistics*, published by the International Union of Railways (UIC)
- Annual reports of individual railway systems

- National transportation statistics for individual countries
- Publications of *The Economist* newspaper, such as *Economist Intelligence Unit Reports* on individual countries, and the pocket *World in Figures*.
- World Tourist Organization, *Yearbook of Tourism Statistics*
- International Civil Aviation Organization, *Digest of Statistics*
- OECD Environmental Data
- International Road Federation, *World Road Statistics*
- UN *Energy Statistics Yearbook*
- Publications of the EU, especially on railway regulation and legal frameworks
- Publications of the European Council of Ministers of Transport (ECMT)
- Research studies, such as those by Chris Nash and his colleagues at Leeds University in England

The most likely difficulty in making these initial comparisons will be in separating data for intercity rail services (costs, revenue, and market share) from all passenger rail data, which usually include local and regional services. To the extent feasible estimates should be made of intercity data for comparison purposes, recognizing that the data will necessarily be approximate.

On conclusion of this research, an international seminar or workshop would be a good way of publicizing the results and of obtaining input from intercity rail researchers and service providers in different countries.

Subject 3: In-Depth Studies of Intercity Passenger Rail Service

This subject is concerned with probing to understand why intercity services of different types and in different countries and regions may be more or less successful. This effort would likely involve a direct approach to individual operators to request cooperation in the studies, and offering to share results. Typical issues that may be studied in this subject include these:

- Approaches to selection of optimal (higher) speeds, and where to implement these speeds.
- Benefits of being part of a network of rail services. For example, Switzerland has a high rail share of travel in spite of modest speeds. This may be the result of excellent connections between local regional and intercity services, as well as geographical factors and lack of competition from other modes.
- Influence of population density in major metropolitan areas.
- Influence of the availability, price and convenience of other modes.
- Quality and price of service offered by the rail operator.
- Extent to which the intercity rail operator has capacity limitations. For example, the intercity sector of the former British Rail followed a high-fare strategy to maximize revenue from limited capacity, in contrast to other major European railways, which had more capacity, followed lower fare strategies, and obtained a greater market share.
- Real operating and maintenance costs, after removing cross-subsidies to or from other rail services. This is likely to be the most difficult issue: Most intercity services share

infrastructure (lines and terminals) with other rail services (local and regional passenger and freight), thus creating a need to estimate the share of cost applied to each service type.

- Capital and operating subsidies.
- Interaction of passenger and freight services, and resolution of associated operational and financial issues.

Suggested Methodology and Sources (Subject 3)

The sources for this information will be similar to those cited for Subject 2, plus information obtained directly from service providers. To protect proprietary information, it may be necessary to keep some of the underlying data confidential and publish only the results of statistical or engineering analysis.

Candidate rail systems for this detailed analysis include French TGV and conventional intercity services, selected intercity franchises in the United Kingdom, the Channel Tunnel (Eurostar) service, the Thalys international high-speed service connecting Paris, Brussels, Amsterdam, and Koln; and the three Shinkansen services in Japan.

A three-phase effort is recommended, as follows:

1. In coordination with initial work on *Research Problem Statement 1: Rail Metrics*, define a set of measures of passenger rail service market position and financial performance, and describe the external environment in which the service is operated.
2. Relying exclusively on readily available published sources, develop a concise overview of intercity passenger rail services in each of the countries and regions of potential interest plus comparable information for the United States, covering as many of the performance measures of and external environment as possible.
3. From the results of the first two steps, prepare in-depth studies of each country or group of services in turn, starting with those likely to yield the most useful information. This phase should involve making a direct approach to relevant intercity rail service operators and government agencies, requesting their cooperation in the research and offering to share results.

A wide range of data sources is available to support this research, many of which can now be accessed through the Internet, as well as obtained in hard copy form. Specific sources include the following:

North America

- Transportation Research Information Service (TRIS)
- Academic institutes (e.g., MIT, Northwestern)
- Census data
- Transportation statistics (U.S. DOT)
- State and regional transportation agencies
- Transport Canada

Europe

- Transport ministries in individual countries
- Annual reports of rail service operators
- Reports to transportation regulators (especially in the U.K.)
- European Union transport and competition commissions
- National economic and transportation statistics in individual countries
- European Conference of Ministries of Transport (ECMT)
- International Transport Associations, such as UIC and UITP
- Academic and government research institutes

Asia

- Japanese, Taiwanese, and Korean Ministries of Transport
- Reports of individual rail service operators
- National economic and transportation statistics
- Academic and government research institutes

A final note: An international cooperative research effort might be both more feasible and more desirable. The subject of intercity passenger rail is clearly of broad international interest, and considerable research and analysis are continuing in many countries. Also, international cooperation will help advance development of appropriate methodologies for evaluating intercity passenger rail policies and performance. However, such an international effort may be difficult or impossible to arrange and may be overly cumbersome to manage effectively. A less far-reaching alternative might be to sponsor an international seminar, after some initial work is completed.

4. ANALYSIS TRACK

The following research problem statements outline the types of analyses that are needed to support an objective critique of the intercity passenger rail system in the United States. These statements propose that the value, management, financing, and infrastructure of the intercity passenger rail system should be assessed by using the data and information that would be collected in the research track.

4.1 Research Problem Statement 3: The Value of Intercity Passenger Rail

Evaluate the (economic, social, and environmental) worth of maintaining intercity rail passenger as a mode. Evaluate the worth of maintaining intercity rail passenger service as a vital part of a multimodal network.

4.1.1 Abstract/Statement of Need

This statement addresses the potential socioeconomic value of Intercity Passenger Rail systems. This research should include the direct social, economic, and environmental impacts as well as secondary externality benefits of each type of intercity rail passenger service. It also should estimate the short- and long-term social, economic, environmental, and externality risks if the mode ceases to exist.

Research should explore the proposition that a multimodal transportation system that includes conventional intercity or high-speed passenger rail is more efficient than unimodal passenger transport. Stated differently, the proposed research should move away from more traditional studies of passenger rail versus other modes in specific markets, and move towards the concept of intercity rail as an integral component of a multimodal transportation system.

Research topics for detailed analysis include these: mobility and economic productivity improvements for geographic regions (Topic 1), mobility improvements in a diverse socioeconomic spectrum (Topic 2), fossil fuel consumption reduction (Topic 3), passenger safety (Topic 4), pollution reduction (Topic 5), and highway/airport congestion reduction (Topic 6). Research is also identified on the potential value of a passenger rail market to state and regional/local governments (Topic 7) and to private industry (Topic 8).

In each topic area, proposed research should quantify and measure total societal impacts in carefully defined scenarios that include and exclude a viable conventional intercity or high-speed rail component. These analyses shall include secondary (offsetting) impacts such as added fossil-fuel train emissions, which partially offset reduced automobile emissions. There are likely to be multiple branches in each major subject area, to include such variations as electric or fossil-fueled trains; conventional, incremental, or full high-speed operations; and others.

4.1.2 Purpose of Research

Context

Frequently, in the investment debate on public or public/private joint development in passenger rail transportation systems, unsubstantiated favorable and opposing arguments are made on the socioeconomic value of such systems. Despite the availability of detailed, corridor-specific studies, prepared either in conjunction with individual corridor projects or FRA-sponsored multi-corridor studies, most of the prior research looks at rail vs. other modes, as opposed to rail as a component among modes. There is also a need to more rigorously explore potential future system scenarios in which the competitive environment may be quite different and thereby result in more significant potential contributions of the rail component.

Usefulness

Accurate assessment of the socioeconomic contribution of intercity rail to the total transportation system should be a critical factor in improving public and joint development investment decision making. Public policy makers and interested private developers could greatly benefit from the availability of better tools and the better resulting data on the full socioeconomic costs and benefits of passenger rail.

There has been significant interest in improving the depth and quality of arguments used in the political funding debate on conventional intercity and high-speed rail systems. Currently, several high-population density states are considering supporting wholly state-funding or joint public-private partnerships to stimulate investment in high-speed rail corridors. All of the public sector support is grounded on the presumption that there will be a significant net social welfare benefit. Improved analysis and demonstration of anticipated benefit contributions should help clarify the debate and improve the quality of decisions.

Objective

In each of the proposed research topic areas, it is suggested to develop tools and perform quantitative analysis to determine the net socioeconomic contribution of intercity and high-speed passenger rail systems. In all cases, one must ensure that the rail component is evaluated as one integral element of a coordinated, multimodal system, with each modal element contributing its optimum economic component. We propose to research eight topic areas:

1. Mobility and economic productivity improvements for geographic regions
2. Mobility improvements in a diverse socioeconomic spectrum
3. Reduction of fossil fuel consumption
4. Passenger safety
5. Reduction of pollution

6. Highway/airport congestion reduction
7. Rail system value to state and regional/local governments
8. The value to private industry

4.1.3 Research Topics

The following are primary research topics on the value of intercity passenger rail, listed in rough order of priority:

Topic 1. Improvements to Mobility for Regions Served

Evaluate the impacts of improved movement of people between the regions served by intercity passenger rail. Such improvements, and their consequent impact on economic development, are one of the most common justifications for new transportation investments and capacity. New or enhanced intercity rail service can introduce or improve high-performance common carrier transportation options for areas not well served by air, typically secondary or regional urban centers. Even for major metropolitan areas, arguments are put forth regarding the benefits of increased transportation capacity.

The types of benefits generally cited include greater access for residents to jobs and commerce; attraction of new commerce and corporate business investments; and reinvestment and invigoration of station areas. While these kinds of benefits are put forth for all types of transportation investments, not just rail, it would be useful to focus on the mobility-related economic effects of rail service investments, to be able (among other things) to contrast them to often-competing road and airport investments.

This research would also help clarify an issue that is often ambiguous in transportation investment debates: To what extent are transportation investments generators of economic activity in and of themselves, versus being catalyzers or energizers of latent, untapped economic potential? In short, Is a new or enhanced service enough to kick-start beneficial economic development on its own, or must there be concurrent investment and improvement efforts on the part of the locality served? This research would help inform the debates surrounding intercity passenger rail investments.

Suggested Methodology and Sources

This analysis might make use of econometric approaches to estimating equations relating independent measures of transportation effectiveness to economic development. Dependent variables would include various measures of economic activity (e.g., per capita income, jobs growth, regional product). Independent (explanatory) variables would include accessibility measures, generalized costs of travel (out of pocket, travel time, and so forth), and transportation capacity measures. Other relevant factors might include the geographic position and economic

status of an urban area within its regional network of cities. Care would need to be taken to isolate the transportation changes related to intercity passenger rail, for example by measuring the incremental changes in explanatory variables.

Using such variables, the analysis could compare cities before and after intercity rail investment. Where data could be obtained, North American or European examples of secondary cities would be most relevant. Indeed, it is likely that institutes in certain European countries will have already examined these issues; although their results might not be directly applicable to the North American context, we could learn from their studies' methodologies.

Topic 2. Impacts on Mobility for Socioeconomic Groups

Evaluate the impacts on mobility of diverse socioeconomic groups of an intercity system including conventional passenger or high-speed rail. Traditional political arguments for Amtrak (and some state-sponsored intercity services) have included claims that intercity rail provides a unique addition to overall mobility and it fills a potential void. Such arguments are broadened for proposed advanced incremental and new high-speed services. It would be a valuable addition to the knowledge base of practitioners and theoreticians to understand more precisely the incidence of intercity rail use among various socioeconomic strata.

There is considerable interest in maintaining transportation access to the elderly, partially mobility impaired, and the poor. Transportation access limitation (primarily local commuting, though) is increasingly recognized as a major obstacle to ending chronic un- and under-employment. The proposed research in this section should provide new quantitative insights and help in future questions of equity distribution allocation.

Suggested Methodology and Sources

A large variety of strata must be considered. On the user side, there are economic-based (e.g., poverty) and physical limitation-based (e.g., mobility impaired/age) bases for inability to use automobile. In each case, these must be measured against the (unique) offerings of intercity rail. There will not always be a fit. For instance, many conventional services are not fully accessible or even present along other problems of access; conversely, new high-speed rail systems may be well-accessible, but priced so as to prohibit lower- (or even middle-) income users.

Probably a parametric or matrix approach will produce the most valuable information, resulting in a series of needs-versus-availability overlays for various types of intercity passenger service. Such findings are likely to prove invaluable to public-sector policy makers in their decision making on future transportation investment alternatives.

Topic 3. Fossil Fuel Consumption Reduction

Assess the potential reduction in fossil fuel consumption that might result from increased intercity passenger rail use by evaluating the difference in total fossil fuel consumption within defined high-

density corridors in a transportation system. The analysis should consider attractive, world-class high-speed rail or incrementally improved rail measured against the existing combined base of highway, bus, air, and Amtrak (if relevant).

An effective argument in justifying public passenger rail investment could be the contribution to energy conservation. It is essential to gain an objective, quantitative assessment of the incremental fossil fuel consumption of high-speed (or incrementally improved) rail versus highway, bus, and air modes in conjunction with realistic forecasts of an achievable rail modal split.

An equally meaningful related topic would evaluate the disbenefit of (presumed) increased fuel consumption that would result from the removal of existing passenger rail corridor service from those routes in which rail now plays a meaningful role.

Suggested Methodology and Sources

There are equally complex issues here: unit energy consumption of each mode; actual attainable load factors; reasonable forecasts of demand, as a function of such factors as service level, price, and competitiveness; likely improvements in fuel consumption rates of the traditional "fuel-intensive" modes; and others.

One research area will include reassessment of fuel consumption levels for conventional rail (diesel and electric); incrementally improved rail (diesel and electric); world-class, high-speed rail (presumably only electric); individual automobiles; intercity bus; air; and Maglev. A related topic is the anticipated achievement of lower consumption rates in conventional vehicles and potential use of alternative fuels.

The second research area can be drawn directly from Topic 1, namely, achievable demand levels, including newly induced demand, for improved rail or world-class, high-speed rail in the context of the existing (or predicted future) competitive highway and air environment.

The net social welfare results should forecast the likely levels of energy consumption, by mode, in a total transportation system that includes improved or full high-speed rail in comparison with a system having only the current mix of choices. A more complex analysis might attempt to quantify the international economic value and balance of trade implications of specifically avoiding the use of imported fossil fuel.

The final research area would be the "downside" analysis, namely increased fossil fuel consumption that would likely result from the removal of existing passenger service from those corridors in which rail now plays a significant role. Many of the same analysis techniques would be applied, but reassigning demand no longer accommodated by rail to the more fuel-consumptive modes. If well documented, these results could be instrumental in future defense of maintaining existing rail service.

As in the previous topic, it is highly desirable to avoid “reinventing the wheel.” Available prior research performed by states and by the FRA in its Commercial Feasibility Study should be considered before defining new research.

Topic 4. Passenger Safety

Evaluate potential passenger fatality, injury, and accident reductions from increased intercity passenger rail use. Assess the difference in total passenger fatalities, injuries and accidents along corridors in a transportation system that includes attractive, world-class, high-speed rail or incrementally improved rail, measured against the existing combined base of highway, bus, air, and Amtrak (if relevant).

One of the potentially most significant political arguments in justifying public passenger rail investment is the extraordinary safety record of high-speed rail contrasted with the acknowledged poor safety of highways. Demonstrated safety of dedicated rights-of-way high-speed rail lines overseas is excellent, with no rail-failure-based passenger fatalities in 25 years of operation in Japan and France. It will be essential to gain an objective, quantitative assessment of anticipated safety, through risk-assessment techniques, of each level of high-speed or incrementally improved rail investment. The analysis will also explore anticipated future highway, bus, and air safety rates.

A related topic would evaluate the disbenefit of anticipated increased fatalities and accidents resulting from the removal of existing passenger rail service from those routes in which rail now plays a meaningful role.

Suggested Methodology and Sources

There are several complex issues here: specific fatality, injury-accident, and property-accident rates for each of the modes; actual attainable load factors; reasonable forecasts of demand, as a function of such factors as service level, price and competitiveness; and possible future improvements in safety of the highway and air modes.

One research area will involve use of risk assessment to determine accurate relative statistical safety rates for conventional rail (diesel and electric); incrementally improved rail (diesel and electric); world-class high-speed (presumably only electric and on dedicated rights of way—a key safety determinant); individual automobiles; intercity bus; and air. A related topic will be any anticipated achievement of safety improvements in the competing modes.

The second research area can again be drawn directly from Topic 1, namely, achievable demand levels, including newly induced demand, for improved rail or world-class, high-speed rail in the context of the existing (or predicted future) competitive highway and air environment.

The net social welfare results should forecast the likely total annual fatalities, injury accidents, and property accidents by mode, in a total transportation system with improved or full high-speed rail,

compared with a system having only the current mix of choices. There should be discussion on the potential "quantification" issues, with the most intellectually problematic involving assignment of a single dollar value to death by whatever mode.

The final research area would be the "downside" analysis, namely likely increased fatalities, injuries, and accidents that would likely result from the removal of existing passenger service from those corridors in which rail now plays a significant role. If sufficiently documented, these results could be instrumental in future defense of maintaining existing rail service.

As in other topics, it is highly desirable to avoid "reinventing the wheel." Available prior research performed by several states (Florida, California, New York, Oregon-Washington, etc.) and by the FRA in its *High-Speed Ground Transportation for America* should be considered.

Topic 5. Pollution Reduction

Evaluate the potential reduction of pollution that can be achievable from increased passenger rail use by assessing the difference in total pollution generated within defined high-density corridors in a transportation system. The analysis should consider viable, attractive, world-class, high-speed rail or incrementally improved rail, measured against the existing combined base of highway, bus, air, and Amtrak (if relevant).

One of the perennial political arguments in justifying the public component of (high-speed) passenger rail investment is contribution to the national goal of reducing emissions. It is essential to gain an objective, quantitative assessment of the emissions differential between high-speed (or incrementally improved) rail and the highway, bus and air modes, as well as realistic forecasts of an achievable modal split to rail.

A meaningful outcome exercise would also evaluate the net social welfare disbenefit of (presumed) increased pollution that would result from the removal of existing passenger rail corridor service from those routes in which rail now plays a non-negligible role

Suggested Methodology and Sources

There are several complex issues here: unit emission production of each of the modes, with special emphasis on the problem of "shifted-source" emissions for fossil-generated electric-powered trains; reasonable forecasts of demand, as a function of such factors as service level, price, and competitiveness; the emissions "offset" of induced demand as the new mode is introduced, likely improvements in reduction of unit emission of the traditional "pollution intensive" modes; and others.

One research bundle will have to include re-assessment of emission levels for conventional rail (diesel and electric); improved rail (diesel and electric); world-class, high-speed (presumably only electric); individual automobiles; intercity bus; and air. A related package should examine unique pollution/emission problems in certain likely rail corridors, such as current unacceptable levels,

frequent meteorological inversion conditions, growth, and so forth.

A second essential research area (with results that can equally serve other topics) addresses achievable demand levels, including newly induced demand, for improved rail or world class high-speed rail in the context of the existing (or known future) competitive highway and air environment.

The net social welfare benefit results should demonstrate the likely levels of potential net emission reduction, by major populated corridor, in a total transportation system with improved or full high-speed rail only the current mix of choices. A more complex analysis might attempt to quantify the dollar value of pollution avoided to allow a true social benefit-cost comparison, weighing the value against the (public and private) investment requirements of the suggested rail improvements.

The final research area would be the “downside” analysis, namely, increased pollution that would result from the removal of existing passenger service from those corridors in which rail now plays a significant role. Many of the same analysis techniques would be applied, but reassigning the demand no longer accommodated by rail to the more pollution-intensive modes. If well documented, these results could be instrumental in future defense of maintaining existing rail service.

Some of the excellent prior research performed by various states and by the FRA in its *High Speed Ground Transportation for America* should be considered before defining new research. It is hoped that some of the techniques and resulting data findings may provide a valuable foundation. New work should begin only where previous findings leave off.

Topic 6. Congestion Reduction

Assess the potential highway and airport congestion reduction that may be achievable from increased use of intercity passenger rail. This should be done by evaluating the difference in urban highway and major airport congestion at key cities along high-density corridors in a transportation system that includes attractive, world-class, high-speed rail or incrementally improved rail, measured against the existing base of highway, bus, air, and Amtrak service (if relevant).

This is another area of potentially significant justification for public support and investment. High-density corridors typically already have significant peak (or greater) period roadway and airport congestion. The costs of highway and airport capacity expansion may be greater than costs of equivalent capacity in high-speed intercity rail. This topic will require solid analysis of a specific region’s highway and airport capacity and utilization, as well as precisely how much relief might be anticipated from diversion of eligible trips to rail.

In those corridors where rail already plays a significant role (e.g. the Northeast Corridor), an equally meaningful related analysis would evaluate the disbenefit of increased highway and airport congestion that would result from removal of existing passenger rail service.

Suggested Methodology and Sources

There are several complex issues here: time-of-day highway point-to-point accessibility and airport capacity and utilization; incremental components of those highway and air trips divertible to rail; and reasonable forecasts of rail demand, as a function of such factors as service level, price, and competitiveness.

Some of the (presumed) extensive research results already available on highway and airport congestion may be used as-is or with minimal recasting. The rail-demand portion of the equation may be related to research results in *Research Problem Statements 1 and 2 (Sections 3.1 and 3.2)*.

The net social welfare results should forecast the likely improvements in highway and airport/airway flows in a transportation system that includes improved or full high-speed rail versus a system having only the current mix of choices.

A related but equally compelling research area would be the "downside" analysis, namely the increased highway and airport congestion likely to result from removal of existing passenger service from those corridors in which rail plays a significant role.

Topic 7. Value to State and Regional/Local Governments

Evaluate the potential value of intercity passenger rail to state and regional/local governments that would support and maintain conventional or high-speed intercity passenger rail corridors. Many states and regional governments have identified the likely importance of conventional intercity passenger or high-speed rail services in their transportation plans and policies. Nearly a dozen states participate with Amtrak in the shared funding 403(b) program, which has relied on increasing state contributions to offset federal funding constraints. A few states have purchased rights of way (e.g. North Carolina, Michigan, and Vermont) or dedicated equipment (California, Washington, North Carolina) to share the financial burden of providing conventional passenger

service. Other states are in advanced planning stages towards defining public/private partnerships to develop dramatic new high-speed rail systems (Florida and California).

In each case, there is a presumed value to the state in excess of direct outlays. Frequently, the most obvious perceived benefit is relief from investment in equivalent capacity of highways, a program in which state DOTs have significant financial stake. This research topic will explore the range of direct financial and socioeconomic factors underlying state and regional government involvement in passenger rail programs. We anticipate that findings from one state may have meaningful application to others, such that this research may result in exchange of information exchange between states.

Suggested Methodology and Sources

This analysis should examine all states that have made significant capital or operating investments in existing service and attempt to evaluate the underlying motivation and justification. It should review state-funded development and investment plans to ascertain the specific anticipated regional benefits. Additional research may focus on elements of FRA corridor studies in which state-specific benefits have been identified. After review of findings from existing studies and programs, a quantitative benefit “gap” may be identified, leading to a target area or group of topics on state benefits worthy of additional exploration.

Topic 8. Value to Private Industry

Evaluate the impact of intercity passenger rail on the domestic car and aircraft-building industries. It has been argued that the viability and competitiveness of the U.S. railway car and locomotive construction industry have been hindered by the lack of a known, solid, domestic market for equipment. Many of the foreign manufacturers count on, as a minimum, the “captive” demand for a least a portion of their products by their own country’s systems. Similarly, although certainly of a secondary order, one should consider any impacts that an increase or decline in intercity passenger rail use would have on industries reliant on other modes.

Suggested Methodology and Sources

This analysis should examine the domestic supplier marketplace for rolling stock and related equipment. It should compare the prospectus today, with limited existing or committed future domestic customers, with that for a marketplace with likely ongoing large equipment orders. Research may interact with the international issues and infrastructure components of the overall passenger rail research agenda.

4.2 Research Problem Statement 4: Management and Financing

Evaluate the range of possible institutional delivery systems for intercity passenger rail, including their related external and self-funding mechanisms.

4.2.1 Abstract/Statement of Need

The deterioration and possible loss of a national passenger rail system in the United States demonstrates the need to better understand the choices that are facing federal, state, and local elected officials and DOTs now and in the immediate future. Some states are aggressively in the forefront of passenger rail. Others have virtually no programs and are unprepared to take on a role in passenger rail. Local communities and city pairs have become important champions and partners in preserving and expanding intercity passenger rail service in several areas across the country. Traditional models of public funding and management that have been most frequently used for other modes of transportation do not necessarily apply well to passenger rail.

This research would examine what the sustainable role of intercity passenger rail could be, from management and financing perspectives. Intercity passenger rail serves numerous markets, of various trip lengths, trip purposes, and demographic characteristics, and in different geographic configurations. There are cases to be made for and against having a single national system managed by a single national entity. Alternatives include regional solutions and solutions involving the private sector. A source of research information that can be accessed by decision makers, planners, and the private sector is needed to help establish management structures and stable financing arrangements for public, private, and joint-venture intercity passenger rail. It is necessary to make the most efficient use of limited resources while assuring sustainability of passenger rail systems.

4.2.2 Purpose of Research

Context

Intercity passenger rail in the United States has had a very unstable funding base and management structure for several decades. Prior to the creation of the National Railroad Passenger Corporation (Amtrak), private intercity passenger rail service had been in decline. Since 1970, Amtrak has been struggling to establish a firm foundation and stable funding under a legislatively ordained management structure. Critical choices will need to be made by federal, state, and local agencies in the next few years if there is to continue to be a national passenger rail system in the United States. Making appropriate choices and developing strategies for both the management and the financing of intercity passenger rail will be aided by an evaluation of the wide range of options currently in place, both nationally and internationally, to enable those experiences to inform current and future decisions.

The basic elements of intercity passenger rail include infrastructure (right-of-way, track, and stations), equipment (train sets), operations (scheduling, operations, and maintenance), and management (marketing, administration, planning, and financial and asset management). All four

elements can be the responsibility of one agency, whether public or private, or there can be an array of partnerships and interagency agreements, public and private. In the majority of national transportation systems, the infrastructure is publicly owned and operated, while the equipment is privately owned and operated (e.g., roads: autos and trucks; airports: aircraft; waterways: ships and barges). Intercity passenger rail does not fit this basic model.

When the Rail Passenger Services Act (RPSA) was passed in 1970, the infrastructure (except in of the Northeast Corridor) remained in private ownership and the equipment became publicly owned and operated. The Northeast Corridor has long been the most successful passenger rail corridor in the United States. How critical to that success is the public ownership and management of the infrastructure in this corridor? Can other corridors in the country compete successfully for market share of passenger travel without public ownership and management of infrastructure? If passenger rail is to succeed in establishing a transportation market share, the management conflicts with freight movements on this same system, including dispatch and priority routing will become more critical. In addition, capital investment in the maintenance and improvement of this infrastructure continues to be a critical consideration.

Effective management of Amtrak has been limited by constraints contained in the originating legislation (e.g., labor, wages and work rules). Understanding how significant these management constraints are in affecting the cost-effectiveness and efficiency of Amtrak is helpful in assessing the need to change. Without these constraints, how would the most effective management structure for a national passenger rail system look? Would it, for example, consist of new regional entities?

To be an effective choice of transportation, intercity passenger rail must be cost-effective and reliable and offer fares and travel times that are competitive with those of other modes. This requires integrated scheduling with the modes that link to passenger rail, simplified ticketing, and seamless interface of all components of a passenger trip from beginning to end. Examining existing private, public, and joint-venture systems to assess their strengths and weaknesses; determining those that are most successful at meeting these goals; and considering those that point toward different approaches that might be more successful are critical research needs.

The financing of intercity passenger rail has been a major stumbling block in developing a national intercity passenger rail system, partly because it is far from clear that a fully national network is sustainable from a market demand perspective without public funding support. Beyond this issue, an assessment of the impediments to a more financially sustainable passenger rail system (e.g., labor laws and work rules and restricted use of transportation funding traditionally used for highways) is needed to get at the most critical obstacles to success (whether nationally or in specific corridors). Establishment of a dedicated on-going funding stream (e.g., trust fund approach established for modes such as highway and aviation) should be evaluated along with an assessment of the most appropriate role for state funding of a national system. Amtrak has, for example, proposed that a portion of federal gas tax revenues be used as a funding base. This should be evaluated along with comparisons to funding mechanisms that are successfully in place in other countries.

The role of private-sector financing in the United States needs to be evaluated in those corridors where it currently exists or where plans have been developed for possible applicability elsewhere. Recently enacted federal surface transportation legislation contained provisions for innovative public-private financing partnerships, offering a new menu of options for sharing development risks along with rewards. Full privatization can have popular appeal without a clear understanding of the implications for cost, availability of service, and sustainability. Recent experiences in the United Kingdom can be used as the basis for a research study to better understand the true implications of privatization—with its intended and unintended consequences.

Usefulness

This research would inform the Congress in determining appropriate next steps for Amtrak funding and legislative changes. Indeed, it would explore potentially very different institutional alternatives to the current Amtrak structure. It also would be useful to states involved in developing intercity rail within their state borders and across state and national borders. States' roles in various intercity passenger rail programs are evolving rapidly and in many instances without a strong framework of structure and experience to draw upon. Other areas of applicability include the evaluation of private sector proposals and joint ventures to provide passenger rail service. Guidance on the most effective and workable relationships for the various partnerships that may be developed to support passenger rail would be invaluable.

Objective

The primary objective of research into management and financing of intercity passenger rail systems is to explore what mechanisms and institutional structures can be put in place to foster long-term growth across the U.S. The research will lead to greater clarity with respect to the roles and responsibilities of all levels of government and private sector parties. The research will also shed light on the relative merit of a national, top-down approach versus a ground-up, regional approach.

4.2.3 Research Topics

These research topics are presented in descending order of priority.

Topic 1. Sustainability of Amtrak and the Current National System

In any national transportation system there will likely be segments of the network that require higher funding subsidy than others. Many communities in the United States that historically had access to intercity rail lost that service decades ago. Currently, there is a debate over how many additional low revenue-producing routes will need to be eliminated from the system. This leads to the more fundamental questions of whether intercity rail passenger service should become corridor-driven rather than based on the premise of a nationally connected network. While national interconnectedness and service to areas between major population concentrations may be desirable from a policy perspective, it is worth asking whether a more sustainable passenger rail system could be based around financially sound corridor and regional systems, in effect being

driven by concentrated market demand and by state-based initiatives.

A related concern has to do with the current institutional design for the national network, namely, Amtrak. Amtrak has been burdened with costs and constraints due to the way it was conceived in the RPSA and as a result of its separation from, but continued reliance on, private freight railroads. How might these costs differ if intercity rail were provided by other entities? How does the answer differ based on the type of market served (e.g., long-distance routes versus short, dense corridors)? Alternative operators could be explored but may not be feasible in all instances (at least for conventional rail services) because of the loss of incremental cost access to the infrastructure-owning freight railroads, and their potential opposition. Currently only Amtrak has operating rights conferred to it through the RPSA; other operators would have to negotiate access.

Other impediments to alternative or innovative institutions include the funding bottleneck at many state DOTs. Either intercity rail is still not promoted strongly, or if it is, federal matching programs are still limited. In regions where new intercity infrastructure is being planned with state support (e.g., California, Florida), independent private operators will be at the fore. These limited systems and operators may provide the nucleus for a rebirth of intercity rail at a subnational level. Once operational, their economics will provide useful performance benchmarks for intercity rail planners.

Suggested Methodology and Sources

At present, there are few empirical data available to easily examine the issues raised here. For example, there are obviously no alternative intercity passenger rail operators or institutions for comparison. This research will be exploratory, perhaps even speculative. But it may be possible to infer conclusions by looking at other public services, including some outside of transportation, and examining different institutional structures. It would also be more practical to disaggregate "intercity passenger rail" into its constituent geographic markets, ranging from local and regional to long-distance and trans-continental.

Special attention should be paid to the issue of national interconnectedness. A national system does serve certain markets, but these have probably been the least well studied to date. Some evidence suggests there are two basic market types: long-distance land cruise and tourism; and basic surface transportation to rural and small towns, possibly for lower-income populations. These markets should be more carefully examined and used in forming conclusions as to what institutional form (e.g., low-fare public carrier, or private tour operator) the national system should take to serve them.

Even as this research topic is undertaken, new institutional forms may be taking shape. Florida and California are planning all-new systems with private operators, supported in part with public funds. The Midwestern states have formed a compact to manage and invest in an upgraded regional system and at one point considered an alternative to Amtrak. Amtrak itself is very strong in the Northeast and has seen the strongest recent growth in its conventional speed West Coast

business unit. Thus for the foreseeable future, intercity passenger rail will be developed in a number of different institutional forms. These all should be studied, and creative thinking should be applied to search for additional approaches.

Topic 2. Privatization and Required Level of Funding

Amtrak has repeatedly made the case to Congress that the level of funding for the intercity rail passenger system is not sufficient to sustain the current level of service. In particular, to become operationally self-sufficient (i.e., no operating support), Amtrak first needs an ongoing, dedicated source of capital funding, much like federal-aid highways and public transit. The capital funding is needed to catch up on a backlog of railroad investment in the Northeast Corridor's South End, as well as to ensure adequate future capital expenditure.

For some, an answer to these ongoing requirements is some form of privatization, in which Amtrak and its assets would be transferred to a private-sector group, the notion being that once free from its quasi-public responsibilities and strings, it will be able to improve its financial health and service quality. Privatization has seen increased interest and application in other spheres of public services, and has been given a boost by the apparent success of privatization of the entire United Kingdom rail system. In light of this interest, it would be useful to understand the service implications of holding funding at current levels—or of decreasing funding—under the current institutional structure, and then under a privatized structure.

Suggested Methodology and Sources

Without additional funding Amtrak is unable to sustain its current level of service for the long term. Presumably Amtrak has analyzed this current system and has the data to describe the network of passenger rail that could be supported in a sustainable manner with the current level of funding. This would identify the service elimination necessary to achieve stability and is the companion piece of information to the assessment of needed funding to achieve stability of the current system. Appropriate levels of subsidy for transportation modes provide for ongoing debate. Understanding consequences of underfunding and establishing a comparison of passenger rail subsidy in other countries would be helpful, in addition to attempting to establish comparisons of subsidy across various transportation modes in the United States. This would likely be a data-gathering project of existing information.

Another research effort that would be useful in informing the debate regarding privatization is evaluation of the before and after conditions of privatized intercity rail passenger service in the United Kingdom. Impacts of the loss of service to lower revenue-producing segments of the rail system would be evaluated for shifts in cost to other modes of transportation as well as for other social and environmental impacts. Public financial incentives necessary to stimulate privatization would also be evaluated. Such a research effort would lend itself to collaboration with other countries interested in evaluating privatization efforts.

Topic 3. Federal and State Agency Roles

The majority of intercity rail passenger corridors in the United States cross one or more state lines. Consistency in level of service, reliability of performance, and sustainable funding are necessary for the successful management and operation of these corridors. As states are stepping up to a more active role in planning and funding for intercity rail, it is useful to evaluate the federal role in management and oversight of intercity passenger rail necessary to support and encourage local initiatives. Institutional barriers (e.g., structural, legal, and financial) may need to be addressed between agencies and when forming public-private partnerships. Regional identification of intercity rail corridors can help to stimulate local political and financial support for continuing and enhanced passenger service. However, it is important to have constructive ways to empower local communities and states so that expectations can be successfully realized.

Suggested Methodology and Sources

It would be useful to contrast and compare the planning and management coordination of other interstate transportation modes with interstate passenger rail. For example, planning and implementation of the Interstate Highway System were spearheaded by the Federal Highway Administration. Although there is still an oversight role, the management and operation of the Interstate Highway System is now primarily a state function. Cooperation between states and neighboring jurisdictions is fostered by the perception of mutual benefit and the willingness of all parties to participate. States have mechanisms in place to work through coordination of highways that cross state boundaries. New mechanisms may be necessary to foster coordination of interstate rail planning and implementation.

Preparing and initiating a survey of the neighboring states that have established agreements supporting planning and implementation of intercity passenger rail would provide an understanding of the effectiveness and limitations of these alliances. There are several examples of multistate planning efforts to consider (e.g., nine states involved in the Midwest Rail Initiative and four states in the Deep South High-Speed Rail Corridor). While planning is a necessary first step, the establishment of implementation strategies and funding is a critical challenge. Examples, including the Northwest High-Speed Rail Corridor coordination between two states and Canada, can point to some of the obstacles (e.g., transportation funding limitations of neighboring states, coordination of different budget cycles) as well as some of the accomplishments. The roles of the Federal Railroad Administration and Amtrak in these partnerships are also important to understand and assess.

Topic 4. Elements of Successful Intercity Passenger Rail Systems

Establishing an understanding of the critical elements of successful intercity passenger rail systems through the identification of key factors of well-managed and financially stable systems would help ensure the success of new ventures and the ability to troubleshoot existing efforts that are struggling. Although funding is the obvious hurdle for most rail programs, there can also be institutional barriers and structural strengths and weaknesses that contribute to the success or

failure of rail programs. For nearly three decades Amtrak has struggled not only because of inadequate funding but also the inflexible constraints of the original Rail Passenger Service Act. Some relief has opened up for Amtrak from labor and liability statutes that have been a major handicap in achieving operating efficiencies. Consideration needs to be given to other barriers that may still remain.

Suggested Methodology and Sources

This research should involve selecting existing national (e.g., Northeast Corridor) and international passenger rail corridors or entire systems that are highly functioning, have established stable funding, and are viewed as successful by the communities they serve. Identified key characteristics can serve as indicators in evaluating and troubleshooting intercity passenger rail systems. Possible characteristics to consider include the following:

- a. institutional structure and decision-making authority;
- b. infrastructure ownership and management;
- c. revenue and funding sources;
- d. level of non-revenue subsidy;
- e. freight-passenger conflict resolution;
- f. level of long range planning and ability to implement plans;
- g. role of private sector; and
- h. identification of obstacles that require effort to overcome and of the strategies used to overcome them.

Topic 5. Issues of Financial Risk

It can be argued that the greatest stumbling block to a more developed, effective intercity rail passenger system is a widespread notion that the risks are fairly high. From the government's perspective, it is a political and funding risk: the risk that money invested in the system will be for naught and that returns to the economy and to the public at large will be too small. For potential private sector participants, there is the commercial risk associated with relatively untested markets. Outside of the Northeast, intercity rail is almost nonexistent, and it is hard to gauge potential future demand (although statistical methodologies to do this exist). Other partners to intercity rail development perceive risks as well. This research topic seeks to clarify these risks, put them into perspective, and understand how they may be overcome.

Suggested Methodology and Sources

The key to a successful development project or new service is an efficient allocation of financial risks and responsibilities. To this allocation is matched the potential financial or economic rewards. A starting point would be to thoroughly catalogue risks involved in new start-up projects (including infrastructure) and in new services that use the existing infrastructure. At the highest level, typical areas include commercial/market risks, political risks, technology risks, and development-phase risks. The appropriate allocation of risk follows by assigning responsibilities

and risks to the party or parties best able to manage them, or able to finance them at least cost. These risks and responsibilities are typically enforced through the legal or contractual framework.

This research would clarify the appropriate financial and risk-taking roles of federal, state, and regional/local levels of government and the various private-sector entities involved in future intercity passenger rail development. It would also consider how private-sector participation can be encouraged, while ensuring that returns to private parties are reasonable and do not result in transfers of public funds.

One specific area that recurs as a stumbling block is the risk to railroads that would host passenger service. Their frequent opposition to passenger services stems in part from perceived and actual financial risks, including tort liability and impacts on their freight service. There have been fitful attempts to address this over the years, some with Amtrak and some with commuter railroads, but none has produced fully satisfactory results. This area needs to be explored more fully.

4.3 Research Problem Statement 5: Infrastructure

Explore current and alternative approaches to providing for passenger rail infrastructure, including related institutional issues and impacts.

4.3.1 Abstract/Statement of Need

Infrastructure issues are an important research interest; they have a direct relationship with the quality (in speed, frequency, and service) and costs of passenger rail service. Although much research has been done on small-scale, specific infrastructure improvements to Amtrak, as well as corridor-specific plans (many related to the provision of high-speed rail [HSR]), little of this work has been assessed and made easily available to the non-specialist public to serve as a basis for policy. That which has been done has generally focused mainly on HSR or has been produced by groups supporting particular policies from the outset. Thus, a need exists for unbiased, scholarly research that will be accessible to the layman and will include policy recommendations or options.

Research needs fall into four main categories:

1. A fuller understanding of the costs and benefits of passenger rail's use of freight railroad right-of-way, to judge the allocation of costs and to assess the impacts of expanded or reduced service, or altered access conditions, on both the freight and passenger railroads.
2. Investigation into the opportunities and costs of a policy of developing passenger-only rights-of-way, following the model of the Northeast Corridor and many European railroads, and the recommendations of the June 1997 report of the Congressional Working Group on Intercity Passenger Rail on Amtrak. The compatibility of high-value, high-speed freight service should also be investigated.
3. Specific investigation into the Northeast Corridor, including issues of ownership and management specific to the Corridor (particularly in view of its heavy use by commuter operators) and the potential for expansion of the Corridor itself.
4. Specific investigation into possible infrastructure improvements, such as airport connections, electrification, speed increases, and at-grade crossing improvements or elimination.

4.3.2 Purpose of Research

Context

Infrastructure governs the success of the delivery of passenger rail service in terms of speed, frequency, safety, and on-time performance. It also affects the financial success of the service, both because revenues are dependent on the quality of the service and because maintenance is one of a railroad's largest expenditures. Nonetheless, little analytical work has been done to objectively assess the current paradigms of passenger rail operation (over freight rail lines and in

the Amtrak-owned Northeast Corridor) or to consider alternatives in any systematic, non-case-specific way.

Work to date on infrastructure and other passenger rail issues falls into three categories: special interest-supported research, scholarly research, and research that is targeted toward specific issues. The first are studies, proposals, and claims undertaken by interested parties, such as Amtrak, freight railroads, and their supporters. Although these may be of high quality, their objectivity may nevertheless be called into question, given their source; their conclusions should be assessed by more-objective researchers. The second group includes scholarly writings such as dissertations and other unpublished works, and articles published in journals with limited circulation beyond academia; these need to be consulted and utilized. An additional concern about this research is that it has not been summarized in forms that are useful to the policy-making and service-operating community, or that include clear discussions of relevance and concrete recommendations. Finally, a third type of research in this area targets specific corridors, lines or proposals; these should be consolidated so that general conclusions can be made that will help guide policy in other situations. Some of this research overlaps with the first two categories, in that these studies may be sponsored by interest groups or conducted within the academic community.

Infrastructure issues are important in the analysis of passenger rail because they will shape both Amtrak's current operating pattern with the freight railroads and any incremental high-speed corridors that may be upgraded in the future. The potential for a drastic restructuring of the provision of passenger rail service in this country, including the extreme possibility of an Amtrak bankruptcy or replacement, makes it imperative that the research community provide policymakers and others with scholarly, objective assessments of both the current situation and any and all alternatives. For example, the June 1997 report of the Congressional Working Group on Intercity Passenger Rail on Amtrak has recommended splitting Amtrak into infrastructure-owning and service-operating institutions; this has implications not only for general management of passenger rail (as dealt with in *Research Problem Statement 4: Management and Financing*) but also with the future of infrastructure improvements. Should an infrastructure-owning body be created, its enabling legislation must be informed by complete, unbiased, and imaginative research of all possible passenger rail infrastructure improvements.

Usefulness

Research into these areas will have direct relevance to any discussion of national and corridor-specific passenger rail service. Its primary audience will be policymakers, railroad and passenger service-operating companies, and the passenger rail community. Thus, research should be written in such a way as to be generally accessible for those without academic training in economics, management, or transportation. It should also include direct policy recommendations drawn from the research, or at least a range of policy options.

Infrastructure research will be most useful if it includes a complete investigation and assessment of the impacts on, and interests of, not only passenger rail but also other concerned parties, such as freight railroads, commuter operators, and airlines.

Research on these subjects could lead to federal or state legislation governing the operation of passenger trains, such as the implementation of the June 1997 report of the Congressional Working Group on Intercity Passenger Rail on Amtrak; the acquisition of passenger-only lines a requirement for future freight rail mergers; or changing ownership of the Northeast Corridor. It will also assist those planning improvements in passenger service and thus shape both initial conceptual proposals and final studies. An important reason to undertake much of this research as an academic venture is to ensure that the information and policy recommendations are available at short notice; a crisis in Amtrak, for example, calling into question the ownership of the Northeast Corridor or a new merger proposal providing an opportunity for a new passenger-only line, may require reactions in too short a time to allow for new research to be conducted; thus, any available research will help to shape the debate and the outcome.

Objective

The objective of this research is to understand current and possible alternative solutions for the provision of passenger rail infrastructure, including both infrastructure needs themselves as well as arrangements for infrastructure use, and to influence decision making in the political, transportation policy, and service provision spheres.

4.3.3 Research Topics

Subject 1. The Use of Conventional Freight Railroad Lines for Passenger Service

Topic 1.1 Assessing Passenger Impact on Freight Lines (highest priority)

What are the real impacts on a freight railroad of accommodating a passenger service, including such factors as operating costs, maintenance costs (including the availability of maintenance windows), capacity concerns, exposure to liability, and possible forgone revenue? How does this change with traffic mix and density? Are there any intangible benefits, such as scheduling discipline, that a scheduled passenger train brings? Is there a difference in the impact of intercity passenger service on major railroads and smaller railroads? How do these impacts relate to what Amtrak currently pays the freight railroads for access? How does it compare with methodologies used elsewhere, such as in Britain with Railtrack?

Topic 1.2 Expanding Amtrak's Right of Access to Other Operators (highest priority)

What are the legal and economic ramifications, for both freight and passenger operators, of allowing Amtrak's right of access to freight lines to be granted to states and other operators? Are there any similar situations in other industries with high barriers to entry? What about the former historical argument that Amtrak was a one-time compact between the freight lines and the government, and that former no longer have any obligation to accommodate passenger service? Freight railroads argue that any other operator should have to make agreements that are financially attractive to the freight railroad host, in other words, that the freight railroad should

make as much profit from hosting the passenger train as it would by running one of its own freights. Is there merit in this argument? What would the impact be on passenger service? How much profit is made per freight train, anyway?

Topic 1.3 Allocating Benefits of Public Investment in Freight Lines (high priority)

If public entities make capital investments that improve both freight and passenger capacity and service quality, can we quantify the benefits to the passengers, the freight railroads, and the economy? Should the freight railroads contribute towards these improvements to the extent to which they benefit from them? Should this be done by agreement only, or should they be legally required to do so? Or do such benefits constitute a invisible payment to the railroad in return for access? (Commuter operation investments provide many opportunities for case studies.)

Topic 1.4 Non-Amtrak Access Agreements (medium priority)

What difficulties are faced by states and other entities in negotiating access to freight lines? What powers would state governments have to bring railroads to the table? Are legislative changes needed to ensure that freight railroads cooperate with reasonable proposals?

Topic 1.5 Ensuring Capacity for Freight and Passenger Growth (medium priority)

As both freight and passenger traffic increases on many lines, how can the costs of capacity expansion be divided equitably, and how can it be ensured that freight traffic increases do not harm passenger service? Can and should provisions be made to provide alternate routes, for either freight or passengers, or both? (see section 2.2)

Suggested Methodology and Sources

The costing of passenger use of freight traffic is itself one of the significant issues, and a first step in any serious research into this issue will be a survey of the various methodologies in current or past use in the United States and other countries. The increasing capacity constraints on freight lines seem to cast doubt on engineering-based methodologies such as that of short-term avoidable cost because of the possibility that a train may “cost” not only its impact on the right-of-way but also its use of potentially limited capacity that could otherwise have been used for one of the freight company’s own trains (which are presumably profitable).

Regarding non-Amtrak access, issues include not only methodologies but also legal issues regarding the power of the government over rail lines. Sources for these issues will include current and planned commuter operators and the European and Japanese experiences with different types of open-access policies for rail line use such as the following:

European Conference of Ministers of Transport, Economics Research Centre. *The Separation of Operations from Infrastructure in the Provision of Railway Services*. Round Table on Transportation Economics no. 103, (Paris: ECMT, 1997).

Larson, J.L. Amtrak's Contractual Relationship with the Railroad Industry and Costing Methodology. (Washington, DC: National Railroad Passenger Corporation (Amtrak), September 1992).

Office of the Rail Regulator. Railtrack's Charges for Passenger Rail Services: The Future Level of Charges. A Policy Statement. (London: Her Majesty's Printing Office, 1995).

Roth, D.L. Incremental High Speed Rail in the U.S.: Economic and Institutional Issues. (M.S. thesis, Massachusetts Institute of Technology, 1994).

Tilley, J.W. "Determining the Incremental Cost of Passenger Train Operations—A Freight Railroad's Perspective." Presentation at Maintaining Railway Track conference, Railway Track and Structures/Zeta-Tech Associates, October 18-19, 1993, Arlington, VA.

Subject 2. The Northeast Corridor

The Northeast Corridor (NEC), North America's premier passenger rail line, is the only corridor owned entirely by Amtrak. This ownership has allowed the Corridor to be shaped to suit intercity rail, but problems remain. The burden of maintaining and recapitalizing the NEC is Amtrak's largest expense, clouding the public's perception of Amtrak's financial performance; moreover, commuter services, in fact the NEC's main users, pay less than some have argued they should, thus burdening Amtrak further. With its constrained budget, Amtrak has been unable to develop the NEC's potential for expansion north, west, and south, and Amtrak ownership has made the states of the Northeast less willing to contribute towards NEC improvements than in non-NEC corridors—a practice that may have to change if the federal government reorganizes support for Amtrak.

Topic 2.1 Ownership of the Corridor (highest priority)

Who should own the NEC? Would its adoption by a public, multistate agency that would charge "rents" to operators be a better system? Or its incorporation as a private company, as in Britain's Railtrack? Or a federal "Amrail"? What would be the impact on intercity and commuter service? Can the states undertake the ownership and improvement of the Corridor, ending its special status as a ward of the federal government?

Topic 2.2 Expanding the Corridor (highest priority)

Why has Amtrak failed to propose suggestions for expanding the NEC to include similar operations and improvements on its extensions (such as to Albany, Springfield, Harrisburg, and Richmond)? Is it just a timid strategy, or are there reasons that investments outside the Boston-

Washington corridor are less attractive? If Amtrak should not undertake these extensions, who should? Because improvements to these extensions will greatly benefit the Corridor itself, how can that increased revenue be included in the funding of these improvements? (For example, if a state funds an improvement that increases NEC ridership via connections or run-throughs, how can that state capture Amtrak's increased profits to pay for those improvements?)

Topic 2.3 Allocation of Operating Costs (high priority)

Is the division of costs among the intercity and commuter operators currently using the Corridor fair? What would be the impacts of readjustment? If Amtrak were to negotiate a different set of agreements with the freight railroads, would this affect the commuter operators' use of the Corridor? If, in effect, Amtrak is currently subsidizing the commuter railroads, is this fair? Is it good policy? Or should the subsidy be recognized as such and allocated separately, via the Federal Transit Administration? What are the effects (with respect to speed, frequency, cost, and so forth) of the different goals of commuter and intercity operations?

Topic 2.4 Operating Competition (high priority)

If the right to run passenger trains on freight lines were opened up to non-Amtrak operators, would Amtrak be required to open up the Corridor the same way? What would be the impacts, costs, and benefits of this? What would be the best way to introduce competition into NEC operations: open competition, franchises (as Great Britain has used), or other methods?

Topic 2.5 Encouraging Non-Federal Investment in the Corridor (high priority)

Barring changes in ownership, how can non-federal sources of funding be incorporated into Corridor improvements? The focus of federal investment on the Northeast has raised criticism of Amtrak from other parts of the region; given the Corridor's continuing investment needs, it is unlikely that the federal government will be able to play as major a role as it does now once the current NEC improvement project is complete. What is needed to achieve a "state of good repair" and to realize foreseeable improvements in the future?

Suggested Methodology and Sources

Issues under this topic include economics, management, politics, and planning, and methodologies will vary depending on the type of research. In general, economic issues will involve, as in 3.1.3, assessing various cost models. Issues of management, especially those of dealing with competition, will require comparison with foreign rail experience as well as with the U.S. experience with airline deregulation, and will need to take into account both market segmentation (especially with regard to "skimming") and commercial and social benefits (i.e., does competition reduce profits but provide better overall transportation?). Issues of ownership and expansion will need to consider the economics and political realities of alternative ownership structures and incentives for states to participate in multi-state investment plans. Research should also include the impacts on those incentives of changes in Federal law, especially as regards flexibility for the

use of transportation funds and the creation of Federally sanctioned multi-state compacts. For guidance, consult the following references:

Federal Railroad Administration. Two-Year Report on the Northeast Corridor, (Washington, DC: U.S. Department of Transportation, February 1978).

General Accounting Office. Congresssional Action Is Needed To Resolve the Northeast Corridor Cost-Sharing Dispute: Report (Washington, DC: General Accounting Office, 1981).

Nice, D.C. The States and Amtrak, *Transportation Quarterly* 40 (1986), 559–570.

Subject 3. Assessing Infrastructure Improvements

Topic 3.1 Grade Crossings (highest priority)

While the issue of safety at highway-rail grade crossings is important for all railroading, it takes on greater importance at higher speeds, both as a safety issue and as an issue of infrastructure cost and speed limitation. Grade crossings also affect a potential source of public anxiety and distrust of high-speed rail, should a statistically unlikely but devastating grade crossing derailment occur at high speed. FRA's proposed Passenger Rail Safety Standards are likely to require that between 110 and 125 mph, grade crossings need to be protected by physical barriers that prevent trespass by road vehicles, and that above 125 mph, all grade crossings must be eliminated.

Is this the right strategy from a cost/benefit point of view, including the potential loss of public confidence resulting from an accident? What technologies are best for providing a physical barrier? Are there systems approaches that can be applied to other corridors? Are there low-cost technologies for grade separations? What has been the operating and safety benefit of eliminating grade crossings on the entire New York-Washington portion of the NEC? Was it worth the cost? Should it be duplicated?

Topic 3.2 Airport Connections (high priority)

How can we measure and allocate the benefits of airport connections? Should the airport Passenger Facility Charge be made flexible for use for air-rail stations and extensions/diversion of passenger rail lines to serve airports? What types of airport connections are currently in operation, what kinds of designs have been successful, and what kinds have not been? Where are there significant opportunities for the integration of rail and air travel, such as the Alitalia and Lufthansa rail services?

Although intermodal connections, in this case the linkage of intercity rail with air service, provide great opportunities to improve transportation options, few airports have direct air-rail connections. Not only do the commercial aspects of these connections need to be explored (both on a simple utility basis and with commercial interests of existing airlines in mind), but infrastructure designs also need to be explored, with attention to both American and European

examples of air-rail connections. For example, is a shuttle bus sufficient, or do trains need to run into air terminals? If an airport has multiple terminals, can a train station off-site be tied into the airport with the same means that tie the terminals together (e.g., walkways and people movers)? What can the use of buses on certain routes by some airlines suggest about one-carrier intermodal services? How would baggage be dealt with?

Topic 3.3 Electrification (high priority)

What are the costs and benefits of electrification? Can general guidelines be developed for when a corridor, especially that for which an incremental HSR upgrade is being considered or that shared with frequent commuter service, should be a candidate for electrification? Can a sound, quantitative methodology be developed that can be applied to various cases, that would take into account the various technical and financial issues? What broader issues about financing passenger rail are raised by the extent to which electrification increases capital costs but reduces operating costs?

Suggested Methodology and Sources

Grade Crossings. Research into this topic should consider both traditional cost/benefit analysis, the statistical likelihood of accidents of various types at various types of crossings (including private crossings), and the adverse public reaction to an accident, no matter how rare, which may be difficult to estimate. Further, the varied benefits of speed through better-protected or eliminated grade crossings, depending on their location along a route, following the approach used by Amtrak and FRA in the current improvement of the New Haven-Boston portion of the NEC and the “sealed corridor” concept being developed and implemented in North Carolina, will need to be considered. Finally, we it will need to assess the various technologies that have been proposed for the physical barrier protection at crossings in the 110 to 125 mph range, both as to their cost and as to their continued maintenance and other issues, such as suitability in this climate.

Airport Connections. Research into this topic will need to consider economic impacts on both service and infrastructure providers in both modes, and passenger acceptance of different types of connections. Site-specific research should also consider diversion from other airports, the impact on this diversion of improvements in rail service, and opportunities related due to particular airline or rail route and price structures. Policy issues related to the PFC should include its impact on ridership, both air and rail; the opposition of airlines to various uses of the PFC; and the imposition of the PFC on rail tickets to airport stations funded by the PFC. FAA regulations regarding the PFC, check-in and security procedures, and other issues must also be considered. Sources for this would include public discussion and official records relating to the FAA approval of the use of the PFC for the rail access line to John F. Kennedy International Airport in New York, and to the proposal to use PFC funds to extend BART to San Francisco International Airport (SFO), as well as any discussion of the use of the PFC for commuter rail stations at San Francisco, Chicago’s O’Hare, and the commuter rail line to Philadelphia International.

Electrification. Given that electrification in corridor-specific proposals and studies is often considered or not on the basis of not hard data but preconceived notions (either in favor or against), it seems that a set of guidelines for when this process should be considered could be developed. These would include general assessments of speed, frequency, other traffic, and similar inputs that would make electrification worthwhile or inadvisable; financial concerns, such as financing mechanisms and the cost of capital; and other concerns, such as public resistance to electrification for aesthetic and safety reasons. A starting point would be documents produced regarding the current New Haven-Boston electrification and the Commercial Feasibility Study. Studies done in corridors where electrification is under consideration should also be examined, including the following:

Federal Railroad Administration. Final Environmental Impact Statement/Report and 4(f) Statement, Northeast Corridor Improvement Project: Electrification-New Haven, CT, to Boston, MA. (Washington, D.C.: FRA, 1994).

McHenry, J. *Getting to the Airport: The Rail Alternative*. (M.S. thesis, Columbia University, 1992).

North Carolina Department of Transportation, Rail Division. Sealed Corridor Web Pages. Available at <http://www.bytrain.org/sealed.htm>. (Includes quarterly reports to Federal Railroad Administration.)

Transportation Research Record 1023. *Six Papers on Aspects of Rail Electrification* (Washington, DC: Transportation Research Board, 1985).

U.S. Transportation Systems Center, *A Model for Evaluating the Costs and Benefits of Railroad Electrification*. 2 vols. (Washington, DC: U.S. Department of Transportation, 1983) SS-742-U-12-12).

U.S. Department of Transportation. Accidents that Shouldn't Happen: A Report of the Grade Crossing Safety Task Force to Secretary Federico Peña. (Washington: USDOT, 1996).

Subject 4. The Creation and Operation of Passenger-Only Rights of Way

The NEC provides the only example in the United States of a full corridor converted from mixed use to a clear focus on intercity passenger service, allowing for investments, traffic organizations, and liability issues to be directed explicitly at providing better passenger service, especially with regard to speed and electrification. In much of Europe, however, this type of traffic segregation is common, and the June 1997 report of the Congressional Working Group on Intercity Passenger Rail on Amtrak supports further similar conversions. Changes in traffic flows and freight railroad mergers open the possibility that existing freight rights-of-way may be available for conversion to such dedicated use. Furthermore, freight traffic itself could be segregated in the future: high-speed, high-value freight services could be provided over existing or new "passenger-only" lines with fewer operational difficulties than over conventional freight lines.

Is this a practice the United States should follow? If so, how should it be accomplished? As the Northeast Corridor provides America's main example of this situation, research topics in subject 3 (above) will also be relevant, and can provide a model for other potential segregated corridors.

Topic 4.1 Assessing the Creation of Passenger-Only Lines (highest priority)

What are the costs and benefits of creating passenger-only conventional lines by purchasing or otherwise using secondary or underutilized freight lines? Is this a viable way to eliminate passenger-freight interference in corridors? Can limited, high-speed freight service be accommodated in an economically beneficial manner? What costs and barriers currently exist to Amtrak, states, or other entities purchasing such lines? Is legislative remedy necessary? Should federal legislation be enacted to ensure that, in any further mergers, lines be set aside for passenger use? Are there liability benefits by ownership of non-freight railroads? Who should own these new routes? And what are the benefits—and costs—of instituting commuter service on them as well? How can communities be reimbursed when a new line passes through but does not stop in the community (i.e., cost with no benefit)?

Topic 4.2 Identification of Possible Corridors (high priority)

In what corridors are there available or potentially available lines for the creation of passenger-only service? (Given changes in population, this should include city-pairs not included in Amtrak since its 1971 inception.) Are there major bottlenecks of passenger or freight-passenger interference that could be ameliorated by the separation of trains over short stretches of track? What types of investments would this require to provide capacity for both freight and passenger service? Are there other benefits that such separations might produce (opportunities to serve downtowns, airports, and other currently off-line destinations)?

Topic 4.3 Benefits to Freight Lines of Parallel Passenger Routes (medium priority)

Can Amtrak relinquish its right to use freight track? That is, if Amtrak has the opportunity to shift to a passenger-only route, can it seek to get the existing freight host to contribute to cost of purchase/upgrade in return for giving up right to use the freight route?

Suggested Methodology and Sources

As these issues are particularly highlighted by the report of the Congressional Working Group, that report and the testimony on which it is based will likely be the first source for any research on this topic.

Research on these topics will primarily fall into three distinct types: legal issues, economic issues, and research into opportunities currently available. Economic analysis will most likely need to use engineering cost analyses, preferably creating realistic cost models based on traffic and equipment

factors that will be different from current operations (including that NEC), although some commuter operations may provide viable existing models. They will also need to take into account issues such as land value and taxation. The identification of corridor possibilities will need to consider current and future freight traffic flows, issues such as routing through cities (for stations), and the costs of upgrading lines to passenger-level speeds.

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
HSGTA	High-Speed Ground Transportation Association
MIS	major investment study
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Protection Act
PFC	passenger facility charge
SCORT	Standing Committee on Rail Transportation of AASHTO
TCRP	Transit Cooperative Research Program
TGV	Train à Grand Vitesse
UIC	International Union of Railways
UITP	International Union of Public Transport