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AMTRAK: AN EXPERIMENT IN RAIL SERVICE

NATIONAL TRANSPORTATION POLICY STUDY COMMISSION

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<u>Notice</u>

The attached paper was prepared for the National Transportation Policy Study Commission (Commission) by an outside consultant and solely represents the views and recommendations of that consultant. In no way should the paper be interpreted to represent the views of any Commissioner, any Commission staff member, or the Commission itself.

The views and recommendations contained herein may or may not appear in the Commission's final report. Such views and recommendations should not, under any circumstances, be interpreted as a preliminary or final report of the Commission.

Any questions, comments, or suggestions regarding this paper should be directed toward Edward R. Hamberger, General Counsel and Director of Public Participation for the Commission at 202-254-7453.

FOREWORD

The National Transportation Policy Study Commission (NTPSC) was created by Congress under the Federal-Aid Highway Act of 1976 to investigate U.S. transportation needs and institutions and to recommend new transport policies for the country. The NTPSC is composed of nineteen members, six serving from the U.S. Senate, six named from the House of Representatives, and seven members appointed by the President.

In the process of its research, working papers are prepared for the use of Commission members. From time to time, these papers will be distributed as "NTPSC Special Reports."

This paper was prepared for the Commission by Dr. Frank Mulvey, of Northeastern University. Professor Mulvey's dissertation dealt with Amtrak. He also conducted a rail passenger study for the State of Wisconsin and participated in a congressional study of domestic passenger transportation, including rail passenger service.

Mulvey's report provides a detailed legislative history of Amtrak, an analysis of current benefits and costs, and a presentation of expected future benefits and costs. Mulvey does express his interpretation of the meaning of data he presents, but carefully specifies the assumptions that are required to support his conclusions.

The background report about Amtrak is especially timely, as the U.S. Department of Transportation released in May 1978 a report which reexamines Amtrak's route structure. In addition, Congress is now considering various legislative proposals affecting Amtrak.

Although Professor Mulvey has obtained data from Amtrak and the ICC, and has received the benefit of editorial assistance and review by NTPSC staff and outside parties, his report should be understood to represent his own conclusions.

Amtrak: An Experiment in
Rail Service
NTPSC **Special Report No. 2**
Dr. Frank P. Mulvey

August 1978

ABSTRACT

This report analyzes the present and future contributions of the National Railroad Passenger Corporation (Amtrak) to the national transportation system. Chapter 1 reviews the major legislation affecting Amtrak since its creation by Congress in 1970 and discusses Amtrak's programs (labor, commissary, reservations, route expansion, etc.) with respect to the goals outlined in the legislation. The study finds that the original legislation provided Amtrak with conflicting goals and an unrealistically low level of initial funding and that subsequent amendments have not solved these problems. Chapter 2 analyzes Amtrak's performance in serving the national goals of safety, energy conservation, environmental protection, and provision of adequate service. The economic efficiency of the system is also analyzed. In general, Amtrak's contribution toward transportation goals is found to be negligible, although heavily travelled short-distance routes, such as in the Northeast Corridor, seem to offer potential net social benefits. Chapter 3 examines possible future contributions of Amtrak to the same national goals between now and the year 1990. Chapter 4 offers a summary of the findings and some recommendations for restructuring the Amtrak system to reduce the operating deficit and maximize its contribution to national goals. The recommendations include reducing or eliminating long-distance routes and rededicating rolling stock to short-distance markets.

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INTRODUCTION

A long decline in U.S. intercity rail passenger services culminated in the creation by Congress of the National Railroad Passenger Corporation, popularly called Amtrak, in 1971. 1/ This action relieved the private, primarily freight-carrying railroads from their responsibility to provide intercity passenger services. Relief was needed due to the deteriorating financial position of many rail common carriers owing, at least in part, to requirements by the Interstate Commerce Commission (ICC) and State regulatory authorities that they provide passenger train services even if the services did not break even. Rather than allow service to cease, Congress decided to continue passenger operations under the auspices of a quasi-public corporation, believing that intercity passenger train operations contribute to the general welfare and to the fulfillment of certain national transportation goals and objectives.

This study reviews the development of public goals and policy toward Amtrak and examines Amtrak's performance in terms of those goals. Chapter 1 shows that the initial Amtrak legislation proposed conflicting goals, gave no concrete objectives, allowed an unrealistically low level of initial funding, and set up an unwieldy administrative mechanism that provided conflicting priorities. Subsequent legislation has not resolved these problems.

The next two sections analyze Amtrak's contribution to national transport goals and objectives. In Chapter 2, we discuss Amtrak's current operations and examine how well the Corporation is succeeding in meeting the goals set for it by Congress. In Chapter 3, we examine the long-range potential of intercity rail passenger services. To accomplish this, it is necessary to estimate future levels of Amtrak operations, project rail passenger system performance in the goal areas outlined in Chapter 1, and forecast the national transportation environment.

Chapter 4 is a summary of findings of the report and offers some recommendations for improving Amtrak's contribution to national transportation goals.

AMTRAK'S LEGISLATIVE HISTORY

Although Amtrak is legally constituted as a "for profit" corporation, it has never earned a profit, nor is it likely to ever earn one. Amtrak does not rely on private capital and equity markets or operating surpluses to finance operation and capital needs. It depends on congressional appropriations. Therefore, Amtrak may be expected to behave differently from a private corporation. Amtrak's need to minimize deficits does not carry the same weight as the need for a private carrier to maximize profits. Amtrak will bend to the congressional will. It will internalize Congress' goals because Congress, not the customers, has the most control over the Corporation's existence.

Amtrak was originally conceived as an experiment designed to test the feasibility and desirability of revitalizing rail passenger service. Because of the growth of the alternative air and highway modes (and a public policy which promoted the growth of these newer modes), rail service had declined to practical insignificance in terms of numbers of passengers and passenger revenues. Regulatory policy of the ICC and the States, which required the railroads to continue unprofitable passenger services and restricted their ability to compete in the more profitable freight markets, had weakened the financial position of many U. S. railroads. This, in turn, resulted in a deteriorated physical infrastructure. Rights-of-way on many routes fell into a serious state of disintegration. Passenger cars and locomotives were not replaced. The amenities accorded the rail passenger were not improved from pre-war levels.

By the end of the 1960s, the ICC, concerned with the financial health of the railroads, had become increasingly lenient in allowing the railroads to abandon passenger service. 2/ If intercity rail passenger service was to be preserved, it was clear that either the passenger-carrying railroads would have to be subsidized, or the service would have to be offered directly by the public sector. A compromise between these two options was developed: public support for a quasi-public corporation.

The National Railroad Passenger Corporation assumed commercial operation of the nation's intercity passenger train service on May 1, 1971. The Corporation was to own the rolling stock and locomotive fleet, but it had to contract with the railroads for the actual operation of the trains and the right to use private railroad trackage. The railroads had the option to join Amtrak and be relieved of their common carrier responsibility to provide passenger service, or they could refuse to join and continue to provide their own service. Most railroads joined, but four decided it was in their best interest to remain outside the Amtrak system. 3/ The railroads paid a "buy-in" fee equal to $197,000,000 as the price for relief from the responsibility for offering passenger train service. At their option, they could receive common stock in return for this payment. 4/

Before the passage of the Transportation Act of 1958, governmental authority over private intercity passenger train operations was vested with State regulatory commissions. State commissions were not completely adverse to permitting passenger train discontinuances. Between 1920 and 1958 more than one-half of all miles of road in passenger service was discontinued. The number of daily trains declined from 20,000 to 11,000 during this period. The regulatory authorities had no choice but to allow discontinuance when the railroad was operating at a deficit overall. Requiring such a railroad to offer money-losing services is the same as taking private property without due process. However, if the railroad was making a profit on other parts of its operation, the commission could weigh the railroad's request to abandon passenger service against the public convenience and necessity. The term "public convenience and necessity" is not easily defined. Political pressure became an important element in the decisions.

Some States (Texas, Tennessee and Kentucky) attempted to standardize the abandonment procedure. For example, in Tennessee discontinuance was mandatory if, for a one year period, direct operating losses exceeded aggregate gross revenues by 30 percent or more.

As the number of trains declined, State commissions became more reluctant to allow further reduction in passenger train services. The railroads began to appeal their cases to the courts.

The Transportation Act of 1958 placed control over discontinuance proceedings with the Interstate Commerce Commission. Section 13(a)(1) allowed the Commission to rule on discontinuance of interstate trains. Section 13(a)(2) allowed a carrier to appeal to the ICC after a State commission had delayed a discontinuance for 120 days.

Still, the ICC also had to render judgments based partly on the notion of the public convenience and necessity. Certainly, the process of discontinuance was speeded up, but to avoid the discontinuance of all intercity passenger train service, another solution had to be found.

The solution was the National Railroad Passenger Corporation, created by the Rail Passenger Services Act of 1970. Figure 1.1 lists this and other major pieces of Amtrak legislation.

FIGURE 1.1

AMTRAK LEGISLATION, 1970-1976

Legislation	Date of Passage
Rail Passenger Service Act of 1970	October 30, 1970
Amendment of 1972	June 22, 1972
Amtrak Improvement Act of 1973	November 3, 1973
Amtrak Improvement Act of 1974	October 20, 1974
Amtrak Improvement Act of 1975	May 25, 1975
Railroad Revitalization and Regulatory Reform Act of 1976	February 5, 1976
Rail Transportation Improvement Act of 1976	October 14, 1976

In examining this legislation, several key words will be used. We define a goal to be a "desired end." Congress expresses its goals for Amtrak, through its legislation. Objectives are defined to be "specific statements of desired ends." That is, objectives are quantified goals. Examples are difficult to discover, but they do appear from time to time. For example, Congress, in the 1976 Railroad Revitalization and Regulatory Reform Act (4R Act), directed that Amtrak reduce travel times between Boston and New York to 3 hours 40 minutes within 5 years. A policy is defined as a "guide for choice." Congress directs certain policies through legislation, while Amtrak's Board of Directors and management also promulgate policies. Finally, a program is a "set of actions." Amtrak itself represents such a set of actions by Congress to reformulate the U. S. intercity rail passenger network.

The Rail Passenger Service Act of 1970, (P.L. 91-518)

The original 1970 act was composed of nine titles. Title I listed the congressional goals in creating Amtrak. Intercity rail passenger service was necessary to provide a "balanced transportation system"; to serve the public convenience and necessity by offering "fast and comfortable" train service; to end congestion of highways and airports; and to offer travelers maximum freedom of modal choice for intercity travel. Congress did not attempt to preserve the entire network, but cited the need to designate a basic system to provide "modern, efficient intercity rail passenger service." Congress recognized the need for combined Federal and private investment capital to undertake the experiment, and further, it provided interim emergency Federal financial assistance to railroads during the transition period (November 1970 to May 1971).

Title II directed the Secretary of Transportation to make recommendations for the basic system. 5/ The Secretary was to consider the population centers to be served, the availability of competing modes, potential route profitability, and other relevant criteria. These recommendations were subject to review by interested outside parties. 6/

The National Railroad Passenger Corporation was created under Title III. Section 301 required that Amtrak be a "for profit" corporation and not "an agency or establishment of the U. S. government." Congress did not intend to nationalize rail passenger service and did not specify that the corporation would be entitled to on-going subsidization. On the other hand, the public nature of the quasi-public corporation was manifested in the composition of the Board of Directors: a majority was to be appointed by the President of the United States.

Section 305 authorized the Corporation "to own, manage, operate . . . intercity trains . . . providing modern, efficient intercity transportation of passengers and to carry mail and express . . . and to acquire . . . physical facilities, equipment and all other devices necessary to rail passenger operations." However, Amtrak was directed to rely on the railroads for the provision of labor services for the actual operation and maintenance of trains.

To allow Amtrak maximum flexibility, Section 306 exempted the Corporation from ICC jurisdiction over its routes, fares, abandonments, and services. Amtrak was also granted immunity from State laws applying to passenger train operations. This freedom from regulation, and the attendent problems of regulatory lag, was felt to be of paramount importance if Amtrak was to have any meaningful opportunity to test the market potential of rail passenger service.

In Title IV, the ICC was granted authority to investigate disputes between Amtrak and the operating railroads and to impose settlements based on its findings. Amtrak was authorized to expand its services beyond its basic system "if consistent with prudent management." Under Section 403(b), Congress permitted State and local agencies to request Amtrak to provide service if those agencies were willing to cover a "reasonable portion" of the deficit (defined as not less than 66.6 percent). Amtrak could not discontinue any basic system service before July 1, 1973. After that time, if Amtrak felt it necessary to discontinue any part of the basic system, it could proceed under Section 13(a) of the Interstate Commerce Act. The remainder of Title IV dealt with employee protection agreements.

Titles V, VI and VII concerned the financing of the new organization. A financial advisory panel was established under Title V to advise Amtrak on increasing corporate capitalization. Title VI authorized the appropriation of $40 million in Federal grants to be used for corporate start up costs, an improved reservations system, advertising, maintenance of rolling stock, research and development, and improvement in fixed facilities. In addition to the grants, Congress approved loan guarantees. The amount of loans outstanding at any one time was not to exceed $100 million. Title VII entitled the railroads which joined Amtrak to guaranteed loans if the Secretary of Transportation found that the railroads needed them to carry out their responsibilities under the act. These loans were not to exceed $200 million outstanding.

Title VIII and IX contained provisions relating to auditing and reporting the Corporation's financial condition to the Comptroller General. Amendments to the Internal Revenue Code were included to allow tax deductions for railroad payments to Amtrak.

Public Role in Amtrak

Although it is always difficult to discern congressional intent, the legislation appears to initiate an experiment to determine the role of intercity rail passenger service in fulfilling national transportation goals. The act declares that Amtrak is neither an agency of the U. S. Government nor a vehicle for bringing about nationalization of rail passenger service. The act establishes Amtrak's monopoly position as the sole rail passenger carrying authority in the markets it serves, although the organization is without significant monopoly power because the relevant market is intercity passenger transport service in general. This grant of monopoly position traces not to industry cost characteristics or to market peculiarities, but rather to Amtrak's essentially experimental nature. It is for this reason, also, that the Corporation was rendered relatively free from detailed regulation. Finally, the provision that it be a "for profit" corporation and not a U. S. agency was included, at least in part, to free Amtrak from civil service requirements in meeting its staffing needs. 7/ Again, the need for flexibility on the part of the experimenter was stressed.

However, the governmental role in the affairs of Amtrak was large. Above and beyond providing the financing the Federal Government was involved in the following ways:

1) The President appoints a majority of the Board of Directors; in the absence of common stockholder representatives, the importance of this appointed majority is substantially magnified.
2) Amtrak is required to submit reports to both the executive and legislative branches.
3) The Federal government retains the right to investigate the financial affairs of the Corporation to ascertain whether or not the public's monies are being prudently managed.
4) The General Accounting Office conducts periodic audits of the Corporation.
5) The Department of Transportation (DOT) annually reviews Amtrak's activities and submits recommendations to the Congress
6) The ICC mediates disputes between Amtrak and the cooperating railroads and must approve any discontinuance of passenger trains.

Amtrak's Objectives

Although Congress specified several national transportation goals which Amtrak was expected to help fulfill, no specific objectives were set forth for the Corporation. The goals outlined were neither prioritized nor consistent. The goal that the Corporation operate on a "for profit" basis, for example, was seemingly inconsistent with the goal that Amtrak contribute to the fulfillment of social goals such as air pollution reduction and energy conservation. Even where goals were consistent, resource limitations precluded serious attempts at addressing all of them simultaneously. Congress also failed to provide Amtrak adequate direction in terms of establishing priorities and developing policies and programs designed to meet national transportation goals.

The Secretary of Transportation in his final system plan 8/ outlined the criteria for the inclusion of city-pairs in the initial basic system. The following is a brief summary of the criteria:

1) The nation's total transportation needs, including the availability of alternative modes and existing travel patterns, must be considered.

2) Anticipated demand for rail passenger service must be substantial.

3) The costs of offering the service must be competitive with those occuring in other modes.

4) The endpoint cities selected must form part of an integrated national rail passenger network.

5) The endpoint cities should be Standard Metropolitan Statistical Areas (SMSA's) of at least one million people.

6) The service along the route should not be so unprofitable that it imposes an undue burden on the Corporation.

7) The points selected should enable Amtrak to expand service, if desired.

8) The points selected should not have heavy capital cost requirements associated with them.

These criteria seem eminently reasonable and provide the necessary guidelines for establishing the basic system. However, it should be noted that they emphasize different considerations from those contained in the statute. The Secretary of Transportation was concerned that Amtrak be operated in an economically efficient manner. Several route criteria specifically preclude the Corporation from undertaking services that would produce large deficits. On the other hand, no mention is made of social or environmental objectives.

Amtrak itself was unsure of which goals to pursue. 9/ There was, however, no shortage of advisors to the fledgling Corporation. Some, like Anthony Haswell, of the National Association of Railroad Passengers, believed rail passenger service to be a public necessity that must be provided as part of a balanced transportation network. 10/ Haswell and his group pressed for more services than were provided for in the initial basic system. Others believed that Amtrak's role should be to preside over the orderly cessation of intercity railroad passenger services.

Amtrak commissioned a study to provide the Corporation with alternative objectives. That report submitted to Amtrak six possible categories of public interest goals that rail passenger service might fulfill. 11/ These were:

1) Provision of needed intercity passenger transportation service;

2) Provision of service with desirable attributes;

3) Operation of Amtrak as a self-sustaining, profit-making enterprise;

4) Optimal utilization of scarce economic resources;

5) Minimization of environmental impact;

6) Contribution to other desirable national goals (e.g. National Defense, interconnection of regions, etc.).

These goals were evaluated in terms of desirability to the public and Amtrak's potential for attaining them. The report concluded that Amtrak's potential for achieving the last two goals would be unclear or insignificant in all markets regardless of the time dimension involved. Except for "provision of service with desirable attributes," it appeared unlikely that long-distance trains would contribute greatly to the remaining goals. According to this report, Amtrak's goal should be to upgrade the quality of rail service in those short-haul corridor markets where the need for the service was already evident. 12/

Amtrak engaged Louis Harris and Associates to uncover the public's view. The Harris organization, after analyzing the results of a public opinion poll, suggested that Amtrak establish the objective of doubling its market share in the "greater than 100 mile" travel category. 13/ Harris, therefore, offered a specific objective for Amtrak.

Because of the abundance of sources offering advice and direction, Amtrak management was unclear as to which goals should take precedence, what reasonable objectives could be set, and what actions could be undertaken to fulfill its ill-defined purpose. The Corporation decided to move on several fronts simultaneously in an attempt to satisfy as many of the public transport goals as possible. Unfortunately, a combination of resource constraints and the underlying conflict among several of the goals made meaningful progress difficult on all fronts. The DOT's concern that the deficit be minimized and that the system operate efficiently within the guidelines set forth by the Secretary conflicted with the Congressional concern that Amtrak serve societal goals. Further, because the net social benefits that might flow from the provision of intercity rail passenger service had never been quantified, it was impossible to gauge Amtrak's success in contributing to the general welfare and overall efficiency in the transport sector.

It appeared that the legislation was deficient in several areas. These included:

1) An unrealistically low level of initial funding, considering the magnitude of the project to be undertaken;
2) A failure to adequately specify corporate objectives, either in short or long-run terms; and
3) A requirement for Amtrak to report to and be monitored by several agencies with widely varying priorities.

Subsequent legislation tried to clarify congressional intent, provide more realistic funding, and narrow the authority of non-congressional agencies over the activities of the Corporation.

Amendments of June 22, 1972 to the Rail Passenger Act of 1970 (P.L. 92-316)

Congressional dissatisfaction with the speed and direction of the Amtrak program was made evident in the June 1972 amendment to the original act. The amendment's first order of business was to cut the salary of Amtrak's President, Roger Lewis, from $125,000 to $60,000. Congress felt that Amtrak was acting too conservatively in its efforts to resuscitate passenger train services, required Amtrak to:

1) "Insofar as practicable . . . directly operate and control all aspects of its rail passenger service;"
2) Increase revenues by expanding mail and express services;
3) Expand the network where marketing analysis or other available information indicated that experimental service would be justified;

4) Begin developing international services to Mexico and Canada.

In this act, Congress clearly indicated that it desired an expansion in the Amtrak route network and that it wanted Amtrak to take over, as fully and completely as possible, the provision of intercity passenger train services. Because the original relationship between Amtrak and the operating railroads left Amtrak with too little control over service, Congress gave Amtrak more control over train operations. In addition, Section 403(a) was changed to remove the Secretary of Transportation as the final authority in determining route expansion. DOT's goals and considerations were subordinated to those of the Congress.

Besides providing Amtrak with more direction, the amendment of 1972 also:

1) Increased loan guarantees to the Corporation from $100 to $200 million;
2) Provided $2 million for international service;
3) Increased Federal grant authorization from $40 million to $225 million;
4) Amended Section 402 to direct the ICC to compel railroads to make tracks available to Amtrak in emergency situations;
5) Expanded Amtrak's freedom in staffing, and specified that the Corporation was not required to rehire all former railroad employees as it took over passenger operations.

Thus, the 1972 amendment increased Amtrak's freedom and ability to experiment and simultaneously provided Amtrak with a clearer understanding of congressional intent. However, ambiguities and conflicts between Amtrak's "for profit" status and its "public interest" goals persisted.

Amtrak Improvement Act of 1973 (P.L. 93-146)

In 1973, Congress again provided the Corporation with increased powers and flexibility. The 1973 amendment contained the following:

1) An implied proscription on auto-ferry operations was removed by amending Section 102(5). Along with the addition of Section 306(h), this permitted Amtrak to engage in auto-ferry operations. This was done in response to a refusal by the Southern Pacific to carry autos on its passenger trains, citing a California statute that forbade such carriage. The 1973 amendment overruled such restrictive state laws. However, Congress sanctioned the right of Auto-Train (a private firm offering passenger and auto service in very limited markets) to compete against Amtrak in this carriage. Amtrak's monopoly position was thereby compromised in the first challenge to it.
2) The size of Amtrak's Board of Directors was increased from 15 to 17 members. Congress specified that no more than five of the nine Presidential appointees may belong to the same political party, and that three of these must be consumer representatives. The amendment also precluded the Presidential appointment of any individual with "any direct or indirect financial or employment relationship with any railroad nor . . . with any person employed in the

transportation of passengers in competition with the Corporation." Amtrak's original Board of Directors contained a bus company executive.

3) Amtrak was vested with the power of eminent domain for acquiring rights-of-way, land, or other property, except properties of railroads.

4) The ICC was directed to place major emphasis on the service quality provided by railroads to Amtrak in determining any compensation to the carriers in excess of incremental costs.

5) The need for priority of passenger trains over freight trains traveling on the same track was re-emphasized.

6) The Secretary of Transportation was given the authority to invalidate railroad-proposed speed restrictions on Amtrak trains when accelerated speeds were safe and practical.

7) Amtrak was directed to "initiate not less than one experimental route each year," and to operate such routes at least two years.

8) The date after which Amtrak could discontinue any part of the basic system was extended to July 1, 1974.

9) Amtrak was directed to ensure that service would be available to the elderly and handicapped.

10) Federal grant authorizations were increased from $225 million to $334 million. The amount of guaranteed loans to be outstanding at any one time was also increased from $200 to $500 million.

11) Section 305(e) relating to the general powers of the Corporation was expanded and made more detailed. Amtrak was

authorized to:

a) Establish an improved reservations system and advertising;

b) Service, maintain, repair and rehabilitate railroad passenger equipment;

c) Conduct research and demonstration programs to develop new rail passenger services;

d) Develop and demonstrate improved rolling stock;

e) Establish and maintain essential fixed facilities;

f) Purchase or lease railroad rolling stock;

g) Develop and operate international, intercity rail passenger service between the U. S. and Mexico and Canada (such services were to be included in the basic system);

h) Carry out other corporate purposes.

With this act it became apparent that Amtrak was not experimental; its role was to develop, improve, and expand the intercity rail passenger network. The goals of increasing traveler choice and providing service for social needs began to take clear precedence over other transport goals. The goals of economic efficiency and financial stability appeared to be secondary.

It should be pointed out that the House and the Senate initially were not in complete agreement over the size of the financial commitment. The House version of the bill authorized only $250 million in guaranteed loans, while the Senate had allowed for a larger amount of Federal grants than finally appropriated. In general, the House has taken a more conservative and cautious stance on Amtrak than the Senate. Dissent over the size of Amtrak deficits has also been more vocal in the House.

Amtrak Improvement Act of 1974 (P.L. 93-496)

The 1974 amendment did not institute many significant changes, but its provisions buttress the contention that Amtrak had become a permanent fixture in the transportation environment. This can be seen by examining some of the provisions of the 1974 amendment.

1) Federal grants to Amtrak were increased by $200 million to total $534 million. The maximum amount of outstanding guaranteed loans was increased by $400 million to $900 million.

2) Section 305 was amended to direct Amtrak "to the maximum extent practicable, directly perform all maintenance, rehabilitation, repair and refurbishment of all rail passenger equipment." The railroads presently performing such tasks were admonished to perform such services in the meantime as expeditiously as possible. (The Senate version required railroads to place priority on passenger car refurbishment.)

3) Section 403(b) was amended to permit Amtrak to expand service at the request of State, regional, or local agencies provided that the agency "agrees to reimburse the Corporation for 66-2/3 per centum of solely related costs and associated capital costs of such service, including interest on passenger equipment, less revenues attributable to such service." The original legislation required that the agency involved pay at least two-thirds of all losses attributable to the service. Amtrak had indicated that future service expansion might require a 100 percent contribution. Congress found this unacceptable, especially in

light of the States' development of rail plans that provided for more intercity passenger train services. Congress felt that such State activity should be encouraged.

4) The Secretary of Transportation was directed to "give priority to experimental routes designed to extend intercity rail passenger service to the major population centers of each of the contiguous 48 States which do not have such service."

5) The date after which Amtrak may proceed to discontinue any part of the basic system was extended until July 2, 1975.

6) The High Speed Ground Transportation Act (49 U.S.C. 1631 et seq.) was amended to require the Secretary of Transportation to undertake a study of the feasibility of High Speed Ground Transportation between the cities of Tijuana, Mexico, and Vancouver, Canada over Amtrak's West Coast routes.

Especially noteworthy in the 1974 amendment was the first direct reference to Amtrak's potential contribution to solving energy and environmental problems. In reference to the feasibility study of High Speed Ground Transportation in the West, Congress directed the Sectetary to consider cost of implementation, availability of other modes, impact on population distribution, plus energy and environmental impacts. The energy and environmental directives are highly illuminating:

> The Secretary shall consider . . . the environmental impact of such a system, including the future environmental impact from air and other transportation modes if such a system is not established . . . the efficiency of energy utilization and impact on energy resources of such a system, including the future impact of existing transportation on energy resource if such a system is established. /Emphasis added./ 14/

This particular phrasing suggests the belief that intercity rail passenger service can alleviate environmental and energy problems. Congress had moved closer to the position that Amtrak's social contributions outweighed economic considerations. The developing policy emphasized service expansion and upgrading rather than experimentation. Although Amtrak ridership figures and revenues provided little evidence of overwhelming demand for intercity passenger train service, it appears Congress believed that substantially improved services would divert many travelers from more energy intensive and environmentally debilitating modes.

<u>Amtrak Improvement Act of 1975 (P.L. 94-25)</u>

Relatively little change was incorporated in the 1975 amendment. Its key provisions were:

1) The allowable salary for Amtrak's President was increased to $85,000 per annum. (This change had been proposed in the Senate version of the 1974 amendment, but was eliminated in the final conference report);
2) Federal grants through fiscal year 1975 were increased to $597.3 million and $1.118 billion was provided for operating and capital expenditures through October 1, 1977. Of this latter amount, not more than $62 million was to be used for 403(b) services, $245 million was reserved for capital expenses for the basic system, and the remainder was for basic system operating expenses;
3) The earliest date for discontinuance of basic system service was extended to October 1, 1976. Amtrak was charged to "study, develop and submit to the Secretary of the Department

of Transportation, to the Commission, and to the Congress an initial proposal setting forth criteria and procedures under which the Corporation would be authorized to add or discontinue routes and services." 15/ In establishing these criteria and procedures Amtrak was to consider the economic impacts on the Corporation and on the nation, the effects on revenues and costs, and the availability of alternative modes. Once such criteria and methods were adopted and approved by Congress, Amtrak was allowed to add and delete trains, notwithstanding the provisions of Section 13(a) of the Interstate Commerce Act.

The 1975 act served principally to increase the monetary commitment to the Corporation, and to establish procedures to evaluate the Amtrak route network. In the House version of the act, Congress acknowledged the wisdom of the original legislation. The House pointed to the energy efficiency of rail transport and noted that rail ranks only behind barges in fuel efficiency. Unfortunately, what may be true in the freight area may not necessarily be true of passenger transportation.

Railroad Revitalization and Regulatory Reform Act of 1976 (P.L. 94-210)

High-speed Metroliner service in the New York-Washington segment of the Northeast Corridor, originally sponsored by the Department of Transportation, came under Amtrak's authority in 1971. As with all other Amtrak routes, service was provided by the operating railroad--in this case, the Penn Central. The subsequent bankruptcy of that carrier, and the creation of Conrail as an all-freight railroad, required changes in passenger service in the Northeast Corridor.

The 4R Act of 1976, especially Title VII, made the necessary changes in the Passenger Service Act and other relevant legislation to effect these changes. The 4R Act authorized Amtrak to:

1) Acquire any real or personal property necessary for high-speed rail services in the Northeast Corridor;
2) Provide for operation and maintenance of freight, intercity passenger, and commuter service. Freight and commuter service were to be provided by compensatory contract with the responsible carriers;
3) Improve rights-of-way in the corridor;
4) Acquire, construct, improve, and install passenger stations, communications, electric power and other needed facilities and equipment; and
5) Secure trackage rights for freight and commuter services over the rights-of-way acquired under this Title. Cross-subsidization among intercity commuter and freight services was prohibited.

Amtrak, therefore, assumed control over the passenger-carrying trackage and properties in the Northeast Corridor, and the first time Amtrak was given complete control over service. The authorization for Amtrak to operate commutation and rail freight service, under contract, represents a major departure from previous policy.

The 4R Act set up a panel to resolve disputes between Amtrak, the railroads, and governmental agencies in all areas except those regulated by the ICC.

Section 703 of the act called for Amtrak to achieve the following in the Northeast Corridor Improvement Project:

1) Within 5 years, travel time between Boston and New York was to be reduced to 3 hours 40 minutes, and between New York and Washington to 2 hours 40 minutes. This represents a retreat from an earlier target of 3 hours and 2 1/2 hours, respectively. However, Congress required the Secretary to report in 2 years on the practicality of establishing the faster service.
2) Improvements were to be made to non-operational portions of stations and related facilities used in intercity passenger service. Fifty percent of the cost of such improvements are to be borne by State, local or regional agencies, but the Secretary of Transportation may fund entirely any safety-related improvement.
3) The facilities on all other main line routes were to be improved to insure compatibility with high-speed service.
4) Improvements undertaken were to be compatible with additional improvements in service levels and should produce the maximum benefit in terms of hiring persons presently unemployed.

Here Congress provided Amtrak with a set of goals and specific objectives, as opposed to the vague generalizations contained in earlier legislation. Congress had developed a clearer idea of what it expected Amtrak to accomplish in the Northeast Corridor than it had attained for the rest of the Amtrak route network.

The funding requirements were large. Congress authorized:

1) $1.6 billion to achieve the travel-time reductions (the Senate initially approved $2.4 billion);
2) $150 million to upgrade stations;
3) $10 million for non-recurring Amtrak start-up costs;
4) $85 million to acquire corridor properties;
5) $650,000 for mobile radio frequencies for high-speed train radio-telephone service;
6) $20 million for acquiring and improving non-corridor properties; and
7) $25 million for emergency maintenance.

Finally, the 4R Act amended the Rail Passenger Service Act to conform to the new requirements. Section 402(a) was altered to allow for the carriage of freight and the provision of commuter services. Section 403(b) was amended to allow Amtrak to provide requested services if the State, regional, or local agency reimbursed the Corporation for 50 percent of total operating losses and associated capital costs. This was a reduction from the two-thirds reimbursement required by the 1974 amendment. Further, Amtrak was released from the requirements of Section 361 of the Public Health Services Act (40 U.S.C. 264). (Amtrak had been in violation of FDA standards for food service and toilet facilities.)

The changes brought about by the 4R Act were borne of necessity due to the bankruptcy of the Penn Central. Many had argued that allowing Amtrak such complete control over service provision was the _sine qua non_ for success of the Amtrak experiment. Indeed, Congress had already been moving in this direction, as is evident from the preceding amendments. The policy of giving Amtrak control over its operations was now realized, at least in the Northeast Corridor.

Rail Transportation Improvement Act of 1976 (P.L. 94-555)

Title I comprises the Amtrak Improvement Act of 1976 and its provisions are of primary interest for this report. It contained the following:

1) Operating grants for the basic system and operating and capital grants for 403(b) service were not to exceed $350 million for fiscal year 1976; $105 million for the transition fiscal period to September 30, 1976; $430 million for fiscal year 1977; and $470 million for fiscal year 1978.
2) Grants for capital acquisition for the basic system were not to exceed $395 million over the same period.
3) Congress appropriated $143 million to cover operating expenses incurred through assuming Northeast Corridor service as mandated in the 4R Act.
4) Congress provided for gradual retirement of outstanding obligations.
5) Food and Drug Administration jurisdiction was re-established over food services, but the legislation continued to exclude Amtrak from meeting waste disposal requirements.
6) The Corporation was encouraged to establish through routes and joint fares with other common carriers, i.e., bus companies.

7) The basis for state contributions for 403(b) service was changed from "50 percent of operating losses" back to 66 2/3 percent of "solely related expenses." Congress had introduced the "50 percent" formula in the 4 R Act to encourage states to introduce more Amtrak service. However, that formulation resulted in an increase in state contributions because Amtrak's method of calculating operating losses nullified the reduced percentage. Returning to the solely related expense basis reduced the actual State share, and brought the Federal share for 403(b) expenses more in line with the Federal contribution for non-interstate highway costs (70 percent Federal and 30 percent non-Federal).

The congressional commitment to expanded Amtrak services is stressed both in the funding authorization and in the changes in 403(b). The directive to study the feasibility of through routes and joint fares with other common carriers of passengers is in line with the transport goal of increasing traveler choice. Yet, the most interesting aspect of the 1976 Amtrak Improvement Act may be a section that was in the Senate version but was dropped in conference. That section removed the clause that describes Amtrak as a "for profit" corporation and described Amtrak's role as one of providing service when public benefits exceed public costs. The Senate bill argued that DOT, the General Accounting Office and Amtrak all agreed that there was little likelihood the Corporation would ever turn a profit; railroad passenger service operates at a loss almost everywhere in the world. 16/ Although this change did not survive joint conference committee deliberations, it does present further evidence that the Congress views Amtrak as a vehicle for accomplishing social goals rather than narrowly defined economic ones. 17/

AMTRAK AND NATIONAL TRANSPORTATION POLICY

Analysis of the legislation allows us to draw several conclusions as to the key elements of public transportation policy regarding Amtrak. The legislation results in policies designed to accomplish national transportation goals and objectives. These policies mandate courses of action to be carried out by the Corporation to achieve the ultimate ends. The policies may be identified as follows:

1) Expand the Amtrak route network. This policy is articulated through the changes in Section 403(b) legislation and the admonition to provide service to at least one major population center in each of the 48 contiguous states.

2) Upgrade the quality of service. Much legislative action has directed Amtrak to improve service quality, or has attempted to coerce the railroads operating Amtrak trains to improve their performance. In addition, the ICC and DOT have played a role in monitoring Amtrak service quality. 18/ The congressional appropriation for the development of High Speed Rail Service in the Northeast, and to study the feasibility of such service on the West Coast, provides continuing evidence that improved intercity rail passenger service is public policy. If service experimentation remains a policy, the purpose of the

experiment has changed. It is not designed to test the market for the service, but rather to find alternate ways to provide service.

AMTRAK PROGRAMS

Although Amtrak is not legally an agency of the U. S. government, its dependence on the government for funding and the nature of its mission causes it to behave like one. Its policies and programs are the corporate manifestation of congressional policy, as interpreted by its administrators.

Labor Force

In Amtrak's early days it exercised little direct control over train or ancillary operations. The employees were railroad employees; all train servicing was undertaken in railroad shops; all ancillary operations were performed by the railroads and terminal companies under contract to Amtrak. Amtrak began to take over reservations and information functions in the fall of 1971 and to consolidate commissary operations in early 1972. 19/ Until these takeovers took place, Amtrak had little authority over the activities of its personnel. 20/ Because they did not work directly for Amtrak, there were no clear lines of authority and responsibility. Amtrak moved cautiously at first, because it did not wish to absorb all existing railroad passenger service employees. Some had developed unsuitable attitudes and work habits over the long period of private railroad neglect. In addition, railroad employee job functions were inflexible, governed by agreements between the operating railroads and rail labor union. Amtrak now employs over 10,000 workers directly and this number will increase to nearly 20,000 as the Corporation assumes direct control over the Northeast Corridor. 21/

Amtrak chose not to absorb certain operating employees into its labor force. Engineers and conductors work for the railroads rather than for Amtrak. If these employees worked for Amtrak, the Corporation would incur significant dead-heading expense. Instead, they can operate a passenger train from city A to city B and work back to A on a freight train. There are just not enough passenger trains to enable these workers to operate a passenger train in both directions. The rates of pay and work rules established for these workers are determined by negotiation between the railroads and the railway brotherhoods. Some have charged that labor costs are higher than they need be, and that restrictive work rules hinder productivity and raise operating costs. Freight traffic might be able to bear these inefficiencies, but they might constitute a real burden on passenger traffic. Obviously, because Amtrak foots the bill for passenger train work, the railroads have little incentive to bargain strongly over labor agreements. However, it is doubtful that these operating inefficiencies represent a significant drag on Amtrak operations.

Amtrak has consistently expressed the desire to upgrade rail passenger service job functions and improve employee morale. The Corporation's present Manpower Plan contains provisions for management development, employee development, management training, counseling and job enrichment. 22/ Amtrak labor policies are designed to improve service to the traveling public and to eradicate the negative image of passenger service employees that developed over the period of railroad neglect.

Rail passenger train work has long been an important area of minority employment. As the passenger train system contracted, minority employment was especially hard hit. Today, unemployment among minority groups runs twice the national average. Revitalization of passenger service, and upgrading the Northeast Corridor specifically, might positively impact minority group unemployment.

Commissary Operations

Amtrak inherited an antiquated, overlapping, and segmented system for the servicing of dining car operations. 23/ In pre-Amtrak days each railroad operated its own facilities, and quality varied widely. One of the Corporation's earliest policies was to consolidate these facilities in order to save money and standardize the on-board food product. Although Amtrak has now completed its commissary takeovers, the facilities are old and fail to meet current sanitation standards. Amtrak has had to rely on caterers. 24/ The Corporation is now embarking on a major program to upgrade its train provisioning centers so that such functions may be performed "in house" at substantial savings.

Mechanical and Maintenance Facilities

Maintenance and repair work on Amtrak's locomotive and car fleet was originally performed in railroad shops. Amtrak reimbursed the railroads for yard space, labor costs, and use of facilities on a cost-plus basis. Amtrak lacked control over the work performed, 25/ and there was no incentive for the railroads to hold down costs, or to give priority to Amtrak's needs. This arrangement proved unsatisfactory from the outset, and Amtrak, acting under congressional directive, began to take over and operate its own mechanical work facilities.

Currently, Amtrak has acquired or established facilities to handle 50 percent of its periodic car maintenance and 35 percent of car overhauls. The program will lead to Amtrak's eventually performing 100 percent of such tasks. Amtrak is now consolidating four car repair facilities in Chicago into a single year. This $30 million investment will generate annual savings of $7.5 million. Locomotive overhaul and maintenance continues to be performed on contract, but Amtrak's acquisition of Northeast Corridor facilities, and the building of other facilities, will give the Corporation control over this costly and important aspect of operations in a new years. 26/

Equipment Acquisition

In the fall of 1971 Amtrak purchased operating equipment from the railroads. Diesels and passenger cars averaged nearly 20 years of age, and some were as old as 34 years. None of the electric locomotives was less than 29 years old. If it is recognized that the average service life of locomotives and rolling stock is 15 to

20 years under the best conditions, 27/ and that the railroads had engaged in a policy of deferred maintenance, especially in passenger operations, it is obvious that the operating equipment did not meet the congressional goal to provide modern, efficient service. 28/ Notwithstanding these observations, early corporate policy was to rebuild and refurbish the aged fleet rather than purchase all new equipment. The initial funding levels were inadequate to embark on a major equipment acquisition program. The initial policy of refurbishment proved to be less than successful. 29/ The redone cars looked nice but were subject to repeated breakdowns and air climate control failures.

In 1973, Amtrak began to add new locomotives and cars to its fleet. By the end of 1977, Amtrak planned to have virtually all short- and intermediate-distance routes served by new Amfleet cars or Turboliner equipment. The Corporate Plan calls for the introduction of new bi-level cars during fiscal years 1977 and 1978 for long-distance routes operating west of the Mississippi River. Long-distance routes in the Northeast and Southeast will be without new equipment, but as the replacement program proceeds in other regions, the best available rolling stock will go to these areas. The Corporation will acquire long-distance, low level cars during the fiscal 1978-1981 period and three different kinds of self-contained train sets, including light rail cars which are better designed to take curves at high speeds. The equipment plan will allow Amtrak to increase available seat-miles by 17.9 percent, while reducing the number of cars in service by 14.6 percent. This will standardize the fleet, reduce non-revenue space, and reduce energy consumption. [30]

Currently, two-thirds of Amtrak's diesel fleet of 305 units is less than five years old. Twenty-five locomotives will be added in FY 1978, and the remaining aged power units will be phased out by FY 1981. Amtrak is committing $3 million to the construction of two prototype lightweight diesels specifically designed for high-speed passenger service.

In addition to conventional train sets, Amtrak inherited the Metroliner fleet operating in the Northeast Corridor. Service from these units has suffered in recent years, due to repeated breakdowns. Amtrak will begin overhauling them and will also develop a second generation of Metroliner equipment for high-speed service.

Stations and Terminal Facilities and Services

The passenger stations and terminals Amtrak inherited from the railroads were dilapidated and out-of-date. The quality of station services (ticketing, reservations, baggage handling, and information) varied, but nowhere was service modern or efficient. The stations generated high costs, and their deteriorated condition and poor service had cost rail passenger service much in terms of public support.

Amtrak began to take over and rehabilitate existing facilities, replace those beyond salvation, assume direct supervisory control over personnel who interact with the public (or whose work was primarily related to passenger train services), and create a new computerized reservation, information, and ticketing system. Although the Corporation has made great strides in improving station services, complaints are still common.

Amtrak currently operates more than 500 passenger stations and terminals. The average age of these facilities exceeds 40 years. An additional 30 stations are added each year as Amtrak expands the route system. To date, mostly minor repair and refurbishment of stations has been undertaken, but a few have undergone extensive renovation and ten new stations have been constructed. The Corporation plans to spend $500 million over the next five years to rehabilitate or replace all rail passenger stations.

Right-of-Way

While deterioration of the rolling stock and motive power that Amtrak inherited from the railroads may be related to a deliberate policy of deferred maintenance, degeneration in the quality of the roadbed was caused by widespread financial distress in the railroad industry. Amtrak uses the rights-of-way provided by the carriers, but it has little authority over the maintenance of the roadbed or other aspects of track conditions. The railroads are required to maintain the permanent way used by Amtrak at levels no worse than those which prevailed in 1971. Amtrak has had to appeal to the ICC to ensure that even these levels are maintained. 31/

The Corporation maintains that track upgrading and maintenance should be done by the freight railroads (perhaps with government aid) as they are the primary users of the infrastructure. However, Amtrak concedes that is is unlikely that the railroads will upgrade service beyond what is necessary for their own operations. The recent ICC decision in Ex Parte 277 on trackage confirms the limited role that railroads can be expected to play. 32/

The Corporation is undertaking a moderate rehabilitation and upgrading program. Spot improvements and emergency repair work will be done to prevent outright service failures and selected track upgrading will be undertaken on emerging corridors. A major program of track improvement will commence in the Northeast Corridor where Amtrak controls the tracks that were taken over from the Penn Central.

Route Expansion and Level of Operation

With the creation of Amtrak, the nationwide passenger train network was reduced overnight from 290 daily intercity trains operating over 49,500 route-miles to 180 trains serving a 21,000 mile network. Despite this drastic reduction in the amount of service offered, rail passenger transport still served 95 percent of the U.S. population residing in SMSAs.

The Corporation immediately began readjusting schedules and service frequencies to reflect needs of the new system. However, this is a long, tedious process, and Amtrak schedules have already gone through many editions. Service in most city-pair markets outside the Northeast Corridor is often only one train daily in each direction. Further, some cities, especially west of the Mississippi, are served only by trains operating over long-distance routes and receive only middle-of-the-night service. Infrequent service has made it impossible to match schedules with traveler preferences in most city-pair markets.

In spite of shortcomings, Amtrak has emphasized broadening the route network rather than deepening it. International services, new 403(b) routes, and the attempt to serve major population centers in each state comprise the basic components of the route-expansion program.

Amtrak plans to begin discontinuing highly unprofitable routes that are not required to meet the public convenience and necessity. It has developed guidelines 33/ for route evaluation and criteria for train deletion; however, discontinuing routes remains a troublesome issue. In 1977 Amtrak threatened to discontinue certain routes on an emergency basis, unless Congress passed a supplemental appropriation. (The appropriation was passed.)

Amtrak has identified several city-pairs as emerging corridors. The Corporation intends to study these to ascertain if high frequency service will be feasible in these corridors.

Fares

During the pre-Amtrak era, the fare structure was complex, with numerous nuisance charges and geographic differentials. One of Amtrak's first tasks was to remove fare differentials that were not based on operating costs, standardize the level and structure, and eliminate nuisance charges.

Amtrak's experimental nature has not been manifested in the fare area. The Corporation has adopted excursion fares, family plans and other programs designed to stimulate ridership, but it has not tried an aggressive pricing strategy to test demand elasticity, nor has it attempted to raise fares to cover even solely related costs. Selective price reductions in several particularly moribund markets were usually accompanied by heavy promotional campaigns, so it is hard to isolate the price effect.34/

In the main, fares have been adjusted to reflect increases in operating costs, but they generally have been raised by an amount less than the cost increase. Amtrak raised fares several times during the first few years of operation, 35/ largely due to rising operating costs and the need to ration available seats at peak travel periods. Amtrak now plans to adopt more peak and off-peak pricing mechanisms and to limit fare increases to those warranted by inflation. However, recent developments in the fare policies of competitive common carrier modes may force Amtrak to engage in a more aggressive pricing policy. The "super-saver" fares developed by the airlines and the bus companies' $50 unlimited travel (three days) programs drive their rates below Amtrak's.

The Corporation contends that its pricing strategy is geared to maximize revenues and ridership. It is difficult, however, to determine if either is being achieved. Fares are not just and reasonable, as these terms are usually defined. 36/ Fare practices produce income redistribution effects, as any heavily subsidized service involves redistribution from non-users to users. The subsidized fares also make rail passenger transportation more accessible to the poor and those who cannot drive cars. But, given the level of Amtrak fares vis-a-vis those of competitive modes, it is not clear that subsidizing Amtrak greatly increases travel by the disadvantaged.

The Corporation's five year financial plan for 1977-1981 indicates that Amtrak will continue to lose money. Table 1.1 shows the Corporation's projected operating grant needs through fiscal year 1981. Amtrak points out that in constant dollars, the subsidy will, in fact, decline.

TABLE 1.1

PROJECTED AMTRAK OPERATING GRANT REQUIREMENTS, 1977-81

Fiscal Year	Operating Grant Requirement (millions)
1977 (actual)	$482.6
1978	534.1
1979	549.1
1980	559.1
1981	566.1

The 1977-1981 financial plan is a far better document than its predecessor, which was riddled with assertions of enormous ridership increases. 37/ The new plan is more realistic, but it relies on two untestable hypotheses. First, it claims that costs can be kept down through the exercise of management will; second, cost escalation is said to abate as Amtrak completes the process of resurrecting the system from the ashes of long neglect.

Yet, the increased responsibilities imposed on it by the Act, the increased competitive pressure from the air and bus modes, and the continued commitment to route expansion and service upgrading lead one to conclude that Amtrak is far from the time when deficits will begin to recede or even stabilize.

When economic competition is present, efficiency considerations require prices equal to marginal costs. In the absence of competition, prices will diverge from marginal costs and may be based on the value-of-service rather than costs. In the case of Amtrak, it is difficult to identify either a cost-based or demand-based fare structure.

In the most general sense, fares are related to costs because as costs have escalated, Amtrak has increased fares. However, marginal costs of passenger train services are particularly difficult to identify because they are highly discontinuous. 38/ Some suggest that in the absence of traceable marginal costs, riders should pay at least the direct variable costs of the resources they consume. The route financial data supplied by the Corporation shows that Amtrak revenues fail to cover direct out-of-pocket costs, much less contribute to fixed overhead, administrative, and capital costs.

Nor can it be said that fares are demand-based. No one really knows the price elasticity of demand for intercity rail passenger services. Attempts to uncover the responsiveness of demand to fare changes have been inconclusive. 39/ 40/ The suspicion is that current Amtrak fares are below long-run marginal costs, and that if fares were raised to cover these, demand for the service would completely evaporate in nearly all markets. 41/ Therefore, just and reasonable fares that would require passengers to cover direct variable costs at present service levels would produce even greater deficits.

Research and Development

In order to modernize the system, Amtrak is investing moderate amounts in applied research and technological development in the following areas: car and locomotive suspension trucks; evaluation systems for truck performance and ride quality; traction motors; signals and communications; high-speed electric pantographs; and braking systems. 42/ During the long decline of rail passenger service, little effort was expended in the U.S. to develop appropriate technology. Amtrak will begin to revitalize research in these areas.

CONFLICT AMONG AMTRAK'S GOALS AND PROGRAMS

One general source of goal non-compatibility is between income redistribution and other social goals, such as environmental protection, energy conservation, and safety. Income redistribution represents an effort to reduce the level of income inequality in society. Low fares for the young or old, made up for by higher fares for the working age population, are believed to be socially justified. Yet, it is not clear that subsidies to Amtrak patrons have desirable social consequences. Although a disproportionate amount of Amtrak riders are in the older population cohorts, the majority is not. Demographic studies of Amtrak ridership do not support the contention that rail patrons have below average incomes. 43/ Therefore, expanding Amtrak service to capture other social benefits, such as energy conservation, may produce a negative impact on income redistribution and thereby generate an unintended social cost.

A major area of goal conflict is between social and economic goals. Nearly all social goals are thought to be advanced by expanding the Amtrak system. It is assumed that expansion will divert trafffic from modes which are less safe, more environmentally debilitating, and more energy intensive. System expansion will, almost by definition, improve interregional connectivity, offer more complete service, generate more employment opportunities for railway labor, and better meet national defense needs should these arise. On the other hand, system expansion means larger subsidies of rail passengers by non-users. In addition, carrier financial stability may be weakened as Amtrak deficits mount and traffic is diverted from competitive modes.

Individual Amtrak programs also directly conflict with national transport goals. Figure 1.2 shows the extent of conflict between programs and goals. As seen in this figure, Amtrak's programs most often conflict with the national transport goals of income distribution and just and reasonable fares. The Amtrak programs most often in conflict with national transport goals are route expansion plans and fare policy. In many cases, it is unclear what effect a particular Amtrak program will have. For example, expenditures for upgrading rights-of-way or purchasing operating equipment may reduce operating expenses, but the revenues generated may be insufficient to repay capital investment costs. Deficits from operations may mount less rapidly, but capital costs may never be recovered.

MEASURING AMTRAK'S COST EFFECTIVENESS

The issue of the efficacy of Amtrak's continued existence is now moot. The Corporation, for better or worse, is here to stay for the foreseeable future. Indeed, Amtrak has begun long-term planning programs which forecast large capital commitments. To an economist, it is specious to argue that a program must continue solely because so many resources have been dedicated to it. Nevertheless it is an appealing argument, especially to those who are convinced of the intrinsic goodness of train services. 44/ Yet, the question of how far the Amtrak program should be carried remains. We must ask if there are any limits to funding for this program and how are these limits to be set.

The benefits that are expected to flow from Amtrak are difficult to quantify. Positive externalities or public goods aspects emanating from a service do not have a market price. In the absence of a common measure of costs and benefits, public authorities often employ a cost-effectiveness approach to evaluating programs. 45/ The objective to be attained should be secured at the lowest possible cost. Therefore, the ultimate issue is whether Amtrak is cost-effective. There exists at least some evidence that it is not.

An objective evaluation of the Amtrak program is necessary to determine the cost-effectiveness of the service. The methodology proposed to accomplish such an evaluation will now be outlined.

Evaluative Methodology

Amtrak must be evaluated in light of the Congressional purpose revealed in the progress of the legislation. Although the transport goals left unstressed by the Congress cannot be totally ignored, the primary emphasis must lie in examining how well the Corporation fulfills its legislatively defined goals. In a sense, the Congress, by legislative action, has weighed the available goals and decided that social goals are more important than economic ones. We can accept this implicit hierarchy as given and gear our analysis toward estimating the present and potential cost effectiveness of the Amtrak program.

It is necessary to examine future rail potential as well as current Amtrak performance. While many intercity rail supporters admit that Amtrak does not presently generate benefits sufficient

FIGURE 1.2

AMTRAK PROGRAMS AND NATIONAL TRANSPORT GOALS

Goal \ Program	Labor Force Program	Commissary Operations	Mechanical & Maintenance Facilities	Equipment Acquisition	Status & Terminal Rehabilitation	Right-of-Way Upgrading	Route Development	Fares Program	Research & Development	Marketing & Financial
Economic Efficiency	B	B	B	B	B	B	A	A	B	B
Safety	D	D	B	B	D	B	C	D	B	D
Financial Stability	B	B	B	C	C	C	A	A	D	B
Environmental Protection	D	D	B	B	D	D	B	C	B	D
Energy Conservation	D	D	B	B	B	B	B	C	B	D
National Defense	D	D	D	D	D	B	B	D	D	D
Income Redistribution	C	D	D	A	A	A	A	A	D	A
Employment Protection	B	A	B	C	C	B	B	D	C	D
Economic Development	D	D	D	D	D	B	B	D	D	D
Equitable Dist. of Cost & Benefits	D	D	D	A	A	A	A	A	D	A
Reliability of Service	D	D	B	B	D	B	A	D	B	D
Adequacy and Completeness of Service	D	B	B	B	B	B	B	D	B	B
Just & Reasonable Fares	C	D	D	C	C	C	A	A	D	A

A = Conflict between goal and program.
B = Goals mutually supportive.
C = Goals may be in conflict or mutually supportive depending on the circumstances.
D = Goals unrelated.

FIGURE 1.3

CONFLICTS AMONG NATIONAL TRANSPORTATION GOALS

National Transportation Goals	Economic Efficiency	Safety	Financial Stability	Environmental Protection	Energy Conservation	National Defense	Income Redistribution	Employment Protection	Economic Development	Equitable Dist. of Cost & Benefits	Reliability of Service	Adequacy & Completeness of Service	Just & Reasonable Fares
Economic Efficiency		C C	C A	A A	C A	C A	A A	A A	C A	B B	B B	C A	B B
Safety			A A	C C	A B	D D	D D	B B	D D	A A	B B	B B	D D
Financial Stability				A A	A A	A A	A A	A A	A A	A A	C C	C A	C A
Environmental Protection					A B	C B	C B	A B	A B	B B	D B	A B	C A
Energy Conservation						A B	A B	A B	A B	B B	A B	A B	C B
National Defense							D D	B B	B B	A A	B B	B B	D D
Income Redistribution								B B	B B	A A	D D	C B	A A
Employment Protection									B B	D D	D D	B B	A A
Economic Development										A A	D D	B B	A A
Equitable Dist. of Cost & Benefits											D D	A A	B B
Reliability of Service												B B	C C
Adequacy and Completeness of Service													A A
Just & Reasonable Fares													

A = Conflict among goals.
B = Goals mutually supportive.
C = Goals may be in conflict or mutually supportive depending on the circumstances.
D = Goals unrelated.

to offset its deficits, they claim that demand will expand once Amtrak completes its restoration and revitalization programs. Further, it is often stated that energy and environmental problems will grow more severe in the years ahead, and that Amtrak may have an important effect on these problems. These points must be examined.

Whenever possible, performance measures are expressed by a common numeraire--such as the present value, in dollars, of benefits and costs. Two major types of analysis are attempted: (1) the cost of achieving a given level of performance through the rail mode is contrasted with the benefits produced; and (2) the costs and benefits of rail passenger services are compared with costs of alternative means to achieve the same level of benefits.

Amtrak's market potential will be estimated to determine both the maximum rail market potential and the most likely ridership level. We have tried to make explicit all assumptions underlying the forecasts presented here. Demand potential may be estimated by several techniques, including regression analysis or discriminant analysis. We have used several of the many available models to generate a range of demand forecasts.46/ The results generated through modeling must be interpreted in the light of experience in order to produce a final projection. Once potential rail usage has been forecasted, the impact on the national transport goals can be analyzed. If Amtrak's impacts are to be correctly gauged, the models should be constructed to distinguish between induced (new) travel demand, 47/ and that which results from modal shifts.

Key Performance Measures

There are a variety of performance measures available to gauge modal contribution toward each goal. Some are relatively easy to use and are widely accepted as the critical measures. In many cases, however, multiple measures are required, and some of these are difficult to use due to insufficiency of data, lack of agreement on proper interpretation, and difficulties in quantification. Notwithstanding these limitations, an analysis based on key performance measures is the most applicable approach. A brief discussion of performance measures by goal area is useful at this stage.

Environmental Protection

There are three major areas of environmental concern: air pollution, noise pollution and land-use patterns. The index of air pollution is usually kilograms of pollutants emitted into the atmosphere per period of time. However, the measure is a complex one because there are different types of pollutants (HC, NO_x, SO_x, etc.) and these often react synergistically to produce still others. Further, all air pollutants are not equally dangerous, and the importance differs depending on whether the area is already polluted or relatively clean. Noise pollution is usually measured by decibels per time period over a specified range. Land-use impacts relate to the problems of congestion. Construction of rights-of-way and terminals removes land from alternative uses. These opportunity costs must be considered in the modal evaluation process.

Energy

The performance measure most often employed is passenger-miles per gallon of fuel consumed. A complication arises when modes use different fuels or are powered by electricity. A standardized measure is British thermal units (Btu's) per passenger-mile, but this must be translated back into barrels of fuel-oil equivalents.

Adequacy of Service

Measures of service quality are difficult to quantify, much less reduce to a common measure. Comfort, cleanliness, ride smoothness, pleasantness of surroundings, levels of on-board amenities, and friendliness of personnel are some of the many variables. Perhaps the most efficient approach to this problem is to survey patrons of competitive modes and then rank the modes in terms of user satisfaction. 48/ It is difficult to reduce such a measure to dollars to benefits, but in some cases it might be possible to uncover the incremental cost of increasing user satisfaction.

Completeness of Service

In this case, accessibility is measured. Crude indicators are the number of places served and the percentage of the population that resides within a certain distance of a terminal. An improved measure would include the access and egress times to terminal sites. 49/ Accessibility or completeness of service should also take into account frequency of service.

Reliability

A measure of reliability is on-time performance. Here again, problems arise both in assigning the proper value to the measure and in comparing modal performances. Air travelers are more likely to be business travelers who value highly on-time performance. Intercity bus riders, on the other hand, may value this attribute less. Also, the importance of a delay is more or less dependent on total time in transit. A 45-minute delay on a 1-hour air flight may be a more serious departure from an acceptable standard than the same 45-minute delay on a 48-hour train trip.

Safety

The number of fatalities and injuries per passenger-mile is the most often used measure to evaluate modal safety, but it fails to account for exposure. Air travel is very safe on a per passenger-mile basis. It is less so if we examine fatalities per departure or if we compare hours spent in travel. The value placed on loss of human life must include the loss of non-market services to the victim's family and to the community.

Income Redistribution

Income redistribution is measured in terms of the subsidy per passenger-mile. To judge the desirability of such subsidization, it is necessary to examine modal riderships stratified by level of income.

Just and Reasonable Fares

These, along with the related question of the equitable distribution of benefits and costs, are covered under the redistribution of income measure.

Carrier Financial Stability

The normal measures--return on investment and return on equity--are not relevant for the evaluation of train services because the return is negative. However, the impact of Amtrak on the financial stability and viability of other modes may be estimated. Also, the value of alternative uses of resources devoted to Amtrak represents the real cost of providing rail passenger service.

Economic Efficiency

The best readily available measure of economic efficiency is operating cost per revenue passenger-mile. This presents some modal comparison difficulties because the importance of fixed costs varies widely from mode to mode. Further, some modal infrastructures are provided by government at less than full cost.

Employment Impacts

The number of jobs and the value of wages paid are two key measures of employment effects. However, some consideration should be paid to the lack of job skill transferability. If passenger train service was replaced by intercity bus, the engineers, brakemen, and other on-board service personnel could be displaced by bus drivers. The incidence of long-term unemployment among displaced passenger-rail employees should be analyzed in measuring the impact of achieving the cost-effective solution.

With these definitions and measures of performance it is now possible to turn to the analysis of the costs and benefits of intercity rail passenger train services.

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CHAPTER 1

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4 Only four railroads chose to take common stock; these were the Burlington Northern, the Penn Central, the Milwaukee Road, and the Grand Trunk Western. These railroads could select the members of the Board of Directors allocated to common shareholders.

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CHAPTER 2

CURRENT AMTRAK PERFORMANCE

Amtrak generates a relatively small percentage of total intercity passenger travel. Table 2.1 shows the market shares of the public modes in intercity travel. If private auto is included, then all public carrier market shares decline drastically. Private auto travel accounts for nearly 90 percent of intercity, non-commutation travel, as measured by passenger-miles. Private auto market share is related to trip distance, but several studies have shown that auto travel accounts for approximately one-half of intercity passenger-miles even including only trips in excess of 1,000 miles in one direction.[1/]

If total intercity travel is the basis for comparison, Amtrak's market share is insignificant. However, considering only those markets where Amtrak actually competes, the rail market share is more meaningful. Modal market shares are largely a function of trip distance. Amtrak's share is extremely small in both very long-haul (greater than 1000 miles) and very short-haul (less than 100 miles) markets. But, for trips of an intermediate length (e.g., 100-500 miles) rail travel is often an effective competitor. Users of Amtrak long-distance trains seldom traverse the entire route. On the Boston-Chicago route, for example, only three percent of the travelers ride endpoint to endpoint,[2/] despite the fact that Chicago is the connecting center for virtually all western service.[3/] Transcontinental train travel is practically non-existent. Amtrak has estimated that it has 16 percent of the intercity travel market carried by common carriers in those markets where it competes. In the Northeast Corridor it estimates that it has 16 percent of total interurban corridor travel.[4/]

TABLE 2.1

MARKET SHARE OF INTERCITY
COMMON CARRIER TRAVEL MODES
1971-1975

Mode	1971 Passenger-miles (Billions)	1971 % of Total	1972 Passenger-miles (Billions)	1972 % of Total	1973 Passenger-miles (Billions)	1973 % of Total	1974 Passenger-miles (Billions)	1974 % of Total	1975 Passenger-miles (Billions)	1975 % of Total
Domestic Air	110.6	76.3	123.0	78.2	134.4	78.7	135.5	78.1	136.9	79.5
Intercity Bus	25.5	17.6	25.6	16.3	26.4	15.7	27.6	15.9	25.5	14.8
Amtrak	2.1	1.4	3.0	1.9	3.8	2.3	4.3	2.5	3.6	2.1
Other RR	2.3	1.6	1.2	0.8	1.3	0.8	1.9	1.1	1.6	0.9
Commuter Rail	4.5	3.1	4.5	2.9	4.2	2.5	4.2	2.4	4.5	2.6

SOURCES: National Railroad Passenger Corporation;
National Association of Motor Bus Owners, Bus Facts, Washington, D.C.: 1975;
American Transportation Association, Transportation Facts and Trends, Washington, D.C.: 1976.

To measure Amtrak's impact, we must discover how rail users would have made their trips if Amtrak service were not available. The substitute chosen will be a function of modal availability, travel time (i.e., distance), alternative modal costs, and other determinants of modal preference. Ideally, a mode-choice model, which completely describes the decision-making process in all travel markets, should be used to estimate modal market shares in the absence of Amtrak. However, time and resource constraints preclude the construction and calibration of such a model for this report. An alternative approach is to ask Amtrak patrons how they would make their trip if the rail option did not exist. Variations of this question have been asked of Amtrak riders in several on-board passenger surveys.

Amtrak's president, Paul Reistrup, claimed in recent hearings before the House Appropriations Committee that surveys indicate most rail passengers have been diverted from automobiles.[5/] Depending on the type of train operation, the second most often selected alternative is air travel. The next choice Amtrak riders cited is, "I would not go," and the very last choice is bus. In an attempt to gain more precise information we asked Amtrak's Marketing Department for the percentage breakdown of passenger responses. The only train for which recent data (July 1977) were available was the Floridian (Chicago-Florida), which carries a relatively large proportion of true long-distance travelers. Passenger responses are given in Table 2.2

TABLE 2.2

RESPONSES TO THE QUESTION
"HOW WOULD YOU MAKE THIS TRIP IF TRAIN SERVICE WERE NOT AVAILABLE?"
FLORIDIAN--JULY 1977

Air	41%
Bus	26
Auto	19
Other train	5
Not go	7
Other means	2
	100%

SOURCE: National Railroad Passenger Corporation, Marketing Department.

If we limit possible choices to the three principle competitive modes, the alternative modal choice becomes:

Air	48%
Bus	30%
Auto	22%

The Wisconsin Department of Transportation asked rail riders in the Chicago-Milwaukee corridor their "normal mode" of transportation.[6/] Of those who did not answer "rail" the breakdown of alternative modes was:

Air	15%
Bus	11%
Auto	74%

Therefore, it appears that in short-distance travel markets, Amtrak captures riders primarily from the private auto, but as trip length increases, it claims more air and bus travelers.

In this report, we will use survey estimates of diversion effects, although more complete information would generate a more accurate measure. The analysis is complicated because many of those who ride long-distance trains are not necessarily long-distance travelers. Amtrak does have train on-off data, but these are too voluminous to be incorporated into this report. As will become apparent as we trace through Amtrak's impact on national transportation goals, even radical changes in the traffic diversion estimates may be inconsequential.

We shall assume that load factors would remain constant if rail travelers shifted to other modes so that measures of modal performance will be unaltered by the diversion. If load factors changed, suggesting all rail passengers in a certain market could be carried by existing bus and plane services, no increases in service levels would be required. With higher load factors, the air and bus modes would improve their output in economic, energy, and environmental areas. To keep these effects constant, it is assumed that load factors are unchanged by the diversion. To the extent this is untrue we overstate the positive impact of the rail mode.

SAFETY

It is widely accepted that rail is the safest mode of travel. Diversion of travelers from less safe modes will result in a reduction in the annual toll of travel-related deaths and injuries. However, as the data in Table 2.3 show, the problem of travel safety is largely confined to the private auto.[7/] The common carriers all have excellent safety records.

TABLE 2.3

ACCIDENT DEATH RATES IN PASSENGER TRANSPORTATION FATALITIES
PER 100 MILLION PASSENGER-MILES
(3-YEAR AVERAGES)

	Intercity Bus	Auto	Railroad	Airline
1956-58	.09	2.50	.18	.38
1959-61	.09	2.20	.10	.69
1962-64	.14	2.20	.09	.16
1965-68	.14	2.40	.10	.25
1969-71	.05	2.10	.12	.10
1971-73	.14	1.80	.28	.12

SOURCE: National Association of Motor Bus Owners, Bus Facts, 1974 Statistical Supplement, Washington, D.C.: June 1975, p. 5.

In fact, there are so few common carrier fatalities that a single serious accident affects the annual rate significantly. The high figure for rail in the 1971-73 period is due largely to one accident involving two Illinois Central commuter trains. If commuter trains are excluded from the data base, fatalities per passenger-mile for intercity rail travel decline to virtually zero.

We shall concentrate on the social savings that may be attributed to Amtrak from automobile traffic diversion because diversion from bus or air may have no net safety effects.

To measure Amtrak's impact in this area it is necessary to estimate how many passenger-miles of Amtrak services were diverted from auto. This is a function, in part, of trip distance. However, as noted earlier, many travelers on long-distance trains are auto-diverted, short-distance travelers. Alternatively, some estimates indicate that as many as 10 per cent of short-distance train users are connecting passengers for long-distance trains and are often diverted from air.[8/]

We shall assume that one-half of all long-distance train riders are making short-distance trips and that five per cent of all short-distance train riders (outside the Northeast Corridor) are making long-distance trips.[9/] We will apply the following diversion factors for the two kinds of travel:[10/]

Short-Distance	Air	15%
	Bus	10%
	Auto	75%
Long-Distance	Air	50%
	Bus	25%
	Auto	25%

The fatality rate given in Table 2.3 for the auto mode (1.8 deaths per 100 million passenger miles in 1971-73) relates to all travel, intercity as well as local. The fatality rate for Amtrak-diverted auto traffic may be different from that for auto traffic as a whole. Because Amtrak lines typically parallel Interstate Highways, which are safer than other roads, the rate for diverted traffic may be lower.[11/] Offsetting this is the tendency for intercity travel to require driving over less familiar terrain for longer distance at higher speeds than those to which the driver is accustomed. Further, intercity auto trips typically have higher occupancy rates than local or commutation trips. This would positively affect Amtrak's contribution. On the other hand, the cost of using Amtrak when more than one person is traveling raises the cost of Amtrak relative to auto. We might expect that train travelers are more likely to be traveling alone or in couples. Unfortunately, adequate data on auto fatalities by type of trip are not readily available.

Despite the above reservations, we will assume that the national rate applies to Amtrak-diverted auto traffic. However we will adjust this rate to include only deaths of drivers and passengers and to exclude accidents involving pedestrians and bicycles, as these are less likely to result from intercity travel. The adjusted rate is equal to 1.4 deaths per 100 million passenger miles.

To calculate the annual savings in lives due to auto travel diversion to Amtrak we apply the following formula.

FORMULA 2.1

ANNUAL SAVINGS IN LIVES DUE TO AUTO TRAVEL DIVERSION TO AMTRAK

$$S_L = \partial [.25(.5L_D + .05S_D) + .75(.95S_D + .5L_D)]$$

where

S_L = estimate of lives saved due to diversion

L_D = Amtrak's long-distance train ridership in passenger-miles

S_D = Amtrak's short-distance train ridership in passenger-miles

∂ = the adjusted auto fatality rate, equal to 1.4 per hundred million passenger miles

Relying on 1976 Amtrak ridership data, we estimate that 33 lives were saved due to intercity auto traffic diversion to Amtrak that year.

It is always difficult to place a dollar value on human life. The Department of Transportation's method[12/] involves calculating the expected life-time earnings of the victims--approximately $300,000 per fatality. It has been suggested that the loss of productivity to society is only a partial measure. Loss of services to family, friends, and the community for non-market activities may be even more important, raising the value of life lost to something like $1 million per victim.[13/] The annual contribution of Amtrak, therefore, is between $10 million and $33 million in terms of reduced, intercity-travel deaths.

In addition to the losses resulting from fatal accidents, there are real costs associated with non-fatal injuries. The National Safety Council's estimate of these costs is presented in Table 2.4.

TABLE 2.4

CERTAIN COSTS OF MOTOR VEHICLE ACCIDENTS, 1974

Cost Item and Explanation	Billions
Wage Loss - loss of wages (or value of service) due to temporary inability to work, lower wages when returned to work due to permanent partial disability and the present value of reduced anticipated future earnings due to permanent disability or death	$6.0
Medical Expenses - doctor and hospital fees	1.7
Insurance Administrative Costs - all administrative selling and claims settlement expenses for insurance companies and self-insurers	5.1
Property Damage - the value of damage to vehicles for moving vehicle accidents; the damage is valued at the cost of repair work or the fair market value of auto, if damage exceeds the auto's fair market value. It excludes damage for minor accidents.	6.5

SOURCE: National Safety Council, Accident Facts, 1975.

If we assume that one-half the value of lost wages is due to accident fatalities, and adjust all the 1974 costs in Table 2.4 by a 6 per cent inflation factor, then the 1976 estimate is approximately $18 billion. Given current auto travel levels and our assumed diversion estimates, Amtrak has reduced auto passenger-miles of travel by one-tenth of one percent. Applying this gross estimate, diversion results in a social savings of $18 million per annum due to reduced accident injuries and property damage. The total annual social benefit of Amtrak for improved travel safety ranges between $28 and $51 million. Any losses or costs due to death or injury on Amtrak trains must be deducted from these amounts to arrive at net social savings.

Amtrak makes a positive contribution in travel safety, but we must ask if providing Amtrak services is the best way to accomplish safety improvements. If auto traffic could be diverted to the equally safe air and bus modes, the same savings might be accomplished. Alternatively, monies devoted to Amtrak could be dedicated toward improving highway safety or the crash-worthiness of automobiles. These programs might generate a much greater return per dollar spent than results from supplying rail services. Amtrak's contribution is positive, but it is small relative to the scope of the safety problem. The cost-effectiveness of Amtrak as a vehicle for reducing deaths and injuries from auto travel is unclear.

ENERGY[14/]

It is widely believed that trains are efficient users of scarce petroleum resources. This intuitive feeling was buttressed by the early studies of Hirst and others on relative modal energy intensiveness.[15/] Table 2.5 provides Hirst's estimates of the energy efficiency of the competitive modes.

TABLE 2.5

ENERGY INTENSIVENESS OF TRANSPORT MODES 1950-1970

(BTU's PER PASSENGER-MILE)

	1950	1955	1960	1965	1970
Intercity auto	3,200*	3,300*	3,300*	3,300*	3,400*
Domestic air passenger	4,500*	4,800	6,900	8,200	8,400
Railroad passenger	7,400	3,700	2,900	2,700	2,900
Buses	640*	1,100*	1,500	1,600	1,600

*Estimates

SOURCE: Eric Hirst, Energy Intensiveness of Passenger and Freight Transport Modes 1950-1970, Oak Ridge, Tenn.: Oak Ridge National Laboratory, 1973, pp. 6-12.

These data, along with laboratory studies of rail tractive-effort requirements, convinced many that rail transport was an important conserver of energy. The steep decline in rail consumption of Btus per passenger-mile during the 1950s is due to the substitution of diesel engines for steam-powered locomotives. Unfortunately, this conversion required substituting relatively scarce petroleum derivatives for relatively abundant coal. Nevertheless, in terms of energy efficiency, rail appeared to be second only to bus for passenger transport, and second only to pipeline for freight carriage. Air is believed to be the most energy-intensive mode.

These early findings of comparative modal energy efficiencies have not gone unchallenged. Both air and highway carriers were quick to point out deficiencies in the modal energy performance measures and the techniques used in their calculation. Some of their arguments are not particularly germaine to the energy problem. For example, the argument that the type of service provided is heterogeneous and that unweighted modal energy comparisons are inappropriate begs the issue.[16/] While transporting one ton of electrical equipment is not strictly comparable to hauling one ton of coal, and transporting a passenger in two hours is not the same as taking 20 hours, we can ignore these differences in the value and quality of service and concentrate on the narrow issue of energy consumption to accomplish a given task (i.e., moving a passenger from point A to point B). Certain arguments concerning relative modal energy efficiency put forth by the air and highway interests do have merit, and these require further discussion.

First, intercity rail travel is more circuitous than either air or bus travel. The highway network is ubiquitous, while rail passenger lines are few and far between. Even if we constrain our analysis to train trips that require no interchanges, rail is still much more circuitous than air or bus for all but the shortest trips. Amtrak circuity ranges from 20 to 50 per cent of the Great Circle Mile Distance (GCD) for its most heavily traveled trains.[17/] In some city-pair markets, rail travels two and one-half times the GCD. Thus, although rail may be energy efficient on a per-mile basis, it loses much of its advantage because it must travel more miles to complete the trip.

Second, the measures of rail energy efficiency are often determined in an idealized laboratory setting. For example, the Empire Builder would be expected to burn 1,700 gallons between Seattle, Washington and Harve, Montana according to laboratory performance results. In fact, the train uses 3,975 gallons to make the journey due to the influence of grades.[18/] Morlok has shown that even rail freight carriage loses its energy advantage over motor trucks as grades approach 2 per cent.[19/]

A Boeing Corporation report found rail much less superior to air, bus and auto, as shown in Table 2.6.

TABLE 2.6

BOEING ESTIMATES OF RELATIVE MODAL ENERGY EFFICIENCY AND COMPARISON TO OTHER PUBLISHED RESULTS

Mode	Boeing Estimate (Great Circle Passenger-miles per gallon)	Other Estimates (Route Passenger-miles per gallon)
Airplane	18-28	14-21
Automobile	25-41	25-48
Intercity Bus	90-162	78-125
Cross Country Train	14-64	46-150
Load Factors:		
Public Modes	60%	b
Automobile	a	b
Distance (statute miles)	700	c

a - depends on trip distance
b - unknown or various
c - unknown

SOURCE: Boeing Commercial Aircraft Company, Intercity Passenger Transportation Data, Energy Comparison, Vol. 2, Seattle, Wash.: 1975, p. 71.

There is reason to suspect that Boeing overstates its case. The average rail distance between cities in the Boeing report was 1,135 miles Trips of this distance are extremely rare for Amtrak riders. If most trips are short-distance, then the overall circuity effect is much reduced. The most circuitous rail city-pairs likely have the least travel. Some city-pairs in the Boeing study are so circuitous that it is unlikely anyone would ever travel between them by rail.

Rail's failure to be as energy efficient as the physics indicate it should be is partly due to the deteriorated condition of plant and equipment. In the past, Amtrak has operated with a very poor car/locomotive ratio. The mean ratio in 1972 was only 3.3:1 implying an output of only 40 seat-miles per gallon.[20/] In addition, the average seating density of Amtrak cars was much lower than necessary for operating efficiency.

Amtrak's equipment replacement program should produce a more energy efficient system. The new 3,000 horse-power, turbo-charged, diesel locomotive can pull nine, 80-seat Amfleet coaches, generating 0.5 train-miles per gallon or 360 seat-miles per gallon.[21/] Amtrak presently intends to operate six-car Amfleet trains.

The figures in Table 2.7 are Amtrak's estimates of relative modal energy intensities.

TABLE 2.7

AMTRAK ESTIMATE OF COMPARATIVE MODAL FUEL EFFICIENCY

Mode	Seats	Vehicle Miles Per Gallon	Passenger Miles Per Gallon At Load Factor (per cent)			
			100%	85%	75%	55%
Bus	43	5.00	215	182	161	118
Amfleet (6 cars)	480	.59	285	242	214	157
Conventional Long Distance Train	464	.25	116	99	87	64
DC8	160	.25	40	34	30	22
747	385	.15	60	51	45	33
Private auto	4	15.00	60	51	45	33

SOURCE: National Railroad Passenger Corporation

There is considerable disagreement between the Amtrak data and those reported by Boeing and other researchers. The Amtrak data do not take into account route circuity, nor do they adequately reflect performance over non-level terrain. In addition, Amtrak compares rail passenger service to other modes using load factors which are totally out-of-line with Amtrak's own experience.[22/] Although air and intercity bus often operate with load factors over 50%, Amtrak has typically fallen short of this performance level, especially in short-distance trains, as indicated by the data in Table 2.8.

TABLE 2.8

AMTRAK PASSENGER LOAD FACTORS, SELECTED ROUTES
(COMPARISON OF FY 1975-1976)

Route	FY 1975 (Percent)	FY 1976 (Percent)	Percent Change
Long Haul			
Chicago-Los Angeles	53.2	60.5	13.7
Chicago-Oakland	50.9	56.8	11.6
Chicago-Seattle (North)	62.4	62.0	(0.6)
Chicago-Seattle (South)	60.7	58.7	(3.3)
Chicago-Houston	43.8	44.8	2.3
Chicago-New York/Washington	59.4	55.3	(6.9)
Chicago-Washington/Newport News	35.6	38.8	9.0
Chicago-Florida	41.5	46.3	11.6
Chicago-New Orleans	50.0	50.0	(1.4)
New Orleans-Los Angeles	51.7	47.4	(8.3)
Seattle-Los Angeles	53.4	51.0	(4.5)
New York-Florida	56.4	54.3	(3.7)
Kansas City-New York/Washington	40.0	36.1	(9.7)
Washington-Montreal	42.5	45.5	7.1
Short Haul			
Chicago-Quincy	32.8	27.0	(17.7)
Chicago-Detroit	46.8	37.8	(19.2)
Chicago-Dubuque	15.0	19.3	28.7
Chicago-Carbondale	36.7	29.3	(20.2)
Chicago-St. Louis	39.3	38.4	(2.3)
Los Angeles-San Diego	47.5	45.9	(3.4)
Seattle-Portland	46.7	41.5	(11.1)
Empire Service	38.2	41.3	8.1
Washington-Cumberland	23.6	22.8	(3.4)
San Francisco/Oakland-Bakersfield	38.2	32.5	(14.9)

TABLE 2.8 (CONT'D)

Route	FY 1975 (Percent)	FY 1976	Percent Change
New York-Boston	49.1	36.1	(26.5)
New York-Washington (Metroliner)	51.7	53.5	3.5

SOURCE: Statistics compiled from: Amtrak Market Research Passenger and Equipment Utilization Report for Selected Routes, Monthly, cited in Interstate Commerce Commission, Report to the President and The Congress: Effectiveness of the Act, Washington, D.C.: 1977.

NOTE: Lower load factors for short-haul routes may be attributed to the following factors:

1. Reservations on long-haul trains.
2. Numerous passengers taking short trips on long-haul trains.
3. Lower capacity cars on long-haul trains.
4. Lower ridership on state-supported 403(b) trains.
5. Greater frequencies of short-haul trains.

In order to analyze Amtrak's energy conservation impact, several assumptions about current modal operating performance must be made.

Equipment: For the bus and auto modes, assume that the 5 mpg and 15 mpg estimates are accurate (see Table 2.7). For the air mode, assume that DC 8s (0.25mpg) are commonly used in short-distance markets and 747s (0.15mpg) dominate long-haul travel. A problem arises in computing Amtrak's energy efficiency because the Corporation is presently replacing older equipment. Further, Amtrak's Metroliners in the Northeast Corridor are electrically powered and require separate analysis. For the sake of convenience, assume that all short-haul conventional trains use Amfleet equipment and that all long-distance trains use conventional equipment.

Load Factors: It is assumed that air and bus load factors are 50 per cent. The load factor for auto is positively related to trip distance. Assume that the typical short-distance intercity auto trip is characterized by 2 passengers per vehicle and that long-distance trips have 2.5. For Amtrak, assume that a

38 per cent load factor is a fair estimate for short-distance conventional trains, while a 50 per cent load factor is common for Metroliner and long-distance trains.

Diversion Factors: The same diversion factors employed in the safety analysis will be used in the evaluation of energy impacts, except that the estimate of Metroliner diversion is 50 per cent from air, 40 per cent from auto and 10 per cent from bus, reflecting business travel predominance on this higher priced service.

Circuity Adjustments: The rail performance factor must be reduced to reflect the rail route circuity. To account for this, we reduce the Amtrak energy performance estimate by 10 per cent for short-distance trips, and 25 per cent for long-distance trips. The more detailed route-by-route study needed to compensate for terrain effects is not feasible in this report.

Table 2.9 provides a summary of the fuel savings arising from travel diversion to intercity rail. The savings of 53 million gallons, at the current final user prices of diesel and air fuels, is equal to a savings of $29.2 million. However, there are several reasons for believing that this is an upper bound for Amtrak energy savings. First, Amtrak does not universally employ Amfleet equipment on its short-distance routes, and it is in these markets where projected savings are greatest. If all short-distance routes were serviced by conventional equipment, 45 per cent of the energy benefits would be lost. Second, the 15 mpg figure for the auto mode may be a conservative estimate, especially for intercity driving. Third, no account is taken of energy consumed by passengers in station access and egress.

It should be noted that bus outperforms rail in every market. If traffic currently diverted to Amtrak had been diverted to bus, the savings would be much larger. If all Amtrak traffic were carried by intercity buses, an additional

TABLE 2.9

ENERGY SAVINGS DUE TO INTERCITY RAIL PASSENGER SERVICES

Type of Service and Diversion	Passenger Miles (000)	Passenger Miles/ Gallon	Fuel Consumed (Gallons) Diverted and Net Savings
Metroliner	324,190	100	3,241,900
Diverted from:			
Air	162,095	20	8,104,750
Bus	32,419	120	270,075
Auto	129,675	30	4,322,500
		Net savings	9,453,258
Short-distance Travelers on:			
Short-distance trains	1,150,545	97	11,861,288
Long-distance trains	1,227,273	44	27,892,568
			39,753,856
Diverted from:			
Air	356,678	20	17,833,900
Bus	237,782	120	1,981,517
Auto	1,783,368	30	59,445,600
			79,261,017
		Net savings	39,507,161
Long-distance Travelers on:			
Short-distance trains	60,561	97	624,340
Long-distance trains	1,227,273	44	27,892,568
			28,516,908
Diverted from:			
Air	643,914	30	21,463,800
Bus	321,957	120	2,682,975
Auto	321,957	38	8,472,553
			32,619,328
		Net savings	4,102,420
		Total System Savings	53,062,839

38.3 million gallons would be saved. The value of Amtrak's contribution is heavily dependent on the assumption that intercity bus ridership is not as seriously affected as air and auto travel. Although rail passenger service may be conserving energy, there may be more cost-effective ways to accomplish this goal. For example, 100 per cent compliance with the 55 mph speed limit could save 2.508 billion gallons annually. 23/

As the results in Table 2.9 indicate, Amtrak's long-haul train services presently consume nearly as much fuel as would have been used by the riders' second-choice alternative. Amtrak's contribution to fuel conservation is effectively zero for long-distance travel. If appropriate short-distance rail passenger services could be provided to meet the needs of short-distance travelers on long-haul trains, the energy savings would be much larger, other things equal.

ENVIRONMENT

Along with energy conservation, preservation of the environment is often cited as a strong attribute of intercity rail passenger service.

There are three primary types of environmental degradation produced by transportation: air pollution, noise pollution and the loss of land to provide transport infrastructure. 24/ The last results from increased congestion which has brought about the need for expanding the highway network and building new airports. The aesthetic loss from these activities is, of course, impossible to quantify. We can examine, however, the extent to which Amtrak is contributing to the alleviation of airport and highway congestion.

In this report we will concentrate on alleviating pollution and congestion. Noise pollution will receive only brief treatment, as this problem involves technical considerations and measurement problems that remain unresolved.

Air Pollution [25]

Intercity passenger transportation produces external diseconomies through emitting several different types of pollutants into the atmosphere. The principal types of pollutants generated by the transport sector are the following.

Carbon monoxide (CO) is a clear, odorless gas resulting from the incomplete combustion of carbonaceous fuels. Although some CO is formed by natural processes, most of it is man-made. Because the affinity of hemoglobin for CO is approximately 200 times greater than for oxygen, excessive amounts of CO in the atmosphere inhibit the blood's ability to carry oxygen.[26]

Carbon dioxide (CO_2) also results from combustion. The creation of CO_2 may increase the reflectivity of the atmosphere, producing the so-called greenhouse effect.[27]

Nitrogen oxides (NO_x) also result from combustion. Initially NO is produced, but as it diffuses into the atmosphere and cools it is transformed into NO_2.[28] NO_2 creates the reddish brown haze often seen in urban areas. Background levels of NO_2 are typically .002 parts per million (ppm) and it presents a serious health threat in the range of 100 ppm, although this is an unlikely occurrence. Concentrations of only .12 ppm can be smelled, and continued exposure can increase the risk of upper respiratory disease and infection. The presence of NO_2 causes dyes to fade; mixed with water vapors it causes metals to corrode. [29]

Hydrocarbons (HC) are the result of incomplete combustion and evaporation of gasoline from storage areas. HC are more often emitted from natural sources than technological ones, but the latter may be important in areas that are already highly polluted. Real injury from HC requires concentrations of 25 ppm--a level that does not occur even in highly polluted air. However, eye irritation, irritation of the upper respiratory tract, and damage to plant life can result from typical concentrations in urban air.[30]

Photochemical oxidants (ozone and peroxyacetyl nitrates /PAN/) are produced when NO_x and HC are exposed to sunshine. These are usually present in very low concentrations, but traffic and weather conditions can combine to produce levels injurious to human health. During rush hour traffic, levels of PAN can reach .5 ppm. Ozone can be smelled when present in concentration of .02 ppm and it can impair respiratory functions at levels of .3 ppm.[31/] Plant life, fibers, and rubber products are especially susceptible to damage from photochemical smog.[32/]

Particulates are emitted from mobile sources in small amounts compared to those produced by natural and other technological sources. However, in heavily traveled areas the marginal contribution could be serious. High concentrations of particulate matter have been associated with chronic bronchitis and other upper respiratory infections. In addition, suspended particulate matter may affect weather conditions.[33/]

Sulphur oxides (SOx) are among the most serious of air pollutants. Diesel fuels are more sulfurous than gasoline, suggesting that trucks, locomotives, and diesel-powered buses are more harmful to the environment than autos with respect to this pollutant. Sulfur oxides can react synergistically with the atmosphere to produce phytotoxicants (substances poisonous to plants). They can damage the upper respiratory system as well as electronic equipment, fabrics, leather, and a variety of building materials.[34/]

There are innumerable difficulties with evaluating Amtrak's impact on the air pollution problem. First, it is necessary to reduce all modal emissions to a common measure. We have chosen pounds per passenger-mile as the relevant performance measure, and have converted the available data, under the assumptions outlined above, to arrive at the emission factors that appear in Table 2.10.

TABLE 2.10

EMISSION FACTORS FOR INTERCITY PASSENGER TRANSPORT MODES
(LBS. PER PASSENGER-MILE)

Mode	CO	HC	NO_x	SO_x	Particulates
			Pollutant		
Rail					
Long distance diesel	.00409	.00225	.01068	.00130	.00057
Short distance diesel	.00186	.00102	.00484	.00058	.00025
Metroliner a/	--	--	.00054	.00022	.00004
Air					
DC-9-30	.00146	.00112	.00060	.00026	.00010
Jumbo Jet	.00144	.00033	.00237	.00030	.00011
Medium Range Jet	.00052	.00013	.00077	.00017	.00013
Intercity Bus	.00134	.00022	.00224	.00016	.00008
Auto					
Short distance	.05500	.00704	.00539	.00022	.00064
Long distance	.04400	.00563	.00431	.00018	.00051

SOURCES FOR CALCULATIONS: U.S. Environmental Protection Agency, Supplement No. 5 for Compilation of Air Pollution Emission Factors, 2d ed., Research Triangle Park, N.C.: 1975; U.S. Department of Transportation, Environmental Impact Statement for High Speed Rail in the Northeast Corridor, Washington, D.C.: 1973; U.S. Environmental Protection Agency, Compilation of Air Pollution Emission Factors, Research Triangle Park, N.C.: 1973.

a/ Metroliner emissions are produced at the electric power generating plant.

Unfortunately, this measure has some drawbacks. Airplanes, for example, emit pollutants mostly during the landing-take-off (LTO) cycle.[35/] Therefore, nearly all emissions from aircraft impact on already polluted urban or suburban areas, whereas much of the pollution produced by the surface intercity transport modes is emitted in rural areas. Some pollutants, such as carbon monoxide, are primarily a localized, urban problem, while others, like nitrogen dioxide, result in more widespread damage.

Although research has shown that these emissions are harmful, there is no accepted method of valuing the damage from incremental pollution. The effects of changes in performance measures on the concentration of pollution in an environment should ideally be measured by a diffusion model. Such models do exist, but they work better for some emissions (e.g. CO) than for others.[36/]

Transport emissions are only part of the total pollution problem, and intercity passenger travel produces only a fraction of total emissions from mobile sources. Most transportation-created pollution comes from local and commutation passenger travel and from truck transport.

To evaluate Amtrak's impact on the air pollution problem, we measure the reduction in emissions due to traffic diversion, employing the same assumptions made for the energy analysis. All pollution is not equally deleterious to the nation's welfare, but it is not feasible to isolate those portions of intercity trips that impact on already polluted areas. Therefore, we shall examine gross emission differences due to Amtrak and recognize that the resulting measures provide an upper bound to Amtrak's contribution.

Diverted pollutants were estimated by multiplying the auto and bus passenger miles presented in Table 2.9 by the emission factors presented in Table 2.10. The description of each type of train service is the same as for the energy analysis. Emissions are calculated by multiplying emissions per passenger-mile for each service by number of passenger-miles.

For the air mode we estimated emissions based on the amount of pollutants produced during the LTO cycle, as shown in Table 2.11. We calculated the number of flights not flown due to traffic diversion to Amtrak (assuming 50 per cent load factors) and multiplied the number of flights by the LTO emission factors. We made the following assumptions to convert diverted air passenger-miles to number of flights:

Metroliner	= 75 passengers per plane, average distance 200 miles
Short-haul conventional Rail	= 60 passengers per plane, average distance 300 miles
Long-distance Rail	= 50% on jumbo jets-- 150 passengers, 1500 miles per passenger; 50% in other long-distance jets-- 75 passengers per plane and 1,000 miles per passenger

TABLE 2.11

EMISSION FACTORS PER AIRCRAFT LTO CYCLE
(IN POUNDS)

	Particulates	SO_x	CO	HC	NO_x
Jumbo Jet	1.3	1.82	46.8	12.2	31.4
Long-range Jet	1.21	1.56	47.4	41.2	7.9
Medium-range Jet	.41	1.01	17.0	4.9	10.2

SOURCE: U.S. Environmental Protection Agency, Compilation of Air Pollution Emission Factors, Washington, D.C.: 1973, pp. 3.21-3.24.

The results of these calculations are found in Table 2.12. They indicate that Amtrak's contribution to abating pollution is zero or negative in long-distance travel markets, although there is some reduction in carbon monoxide emissions due to the diversion of auto travelers. However, as pointed out above, CO pollution is primarily an urban phenomenon and long-distance trains spend relatively little time passing through urban areas. For NO_x and SO_x, which are nationwide problems, long-distance train service worsens, rather than abates the problem.

TABLE 2.12

AIR POLLUTION ABATEMENT EFFECTS DUE TO
INTERCITY RAIL PASSENGER SERVICE

METROLINER SERVICE DIVERSION:

Type of Pollutant	Annual Emissions in Pounds				Net Reduction
	Rail	Air	Bus	Auto	
CO	--	183,702	43,441	7,132,125	7,359,268
HC	--	52,949	7,132	912,912	972,993
NO_x	175,063	110,221	72,618	698,948	706,724
SO_x	71,322	10,914	5,187	28,529	(26,692)
Particulates	12,968	4,430	2,594	82,992	77,048

SHORT-DISTANCE TRAVELER DIVERSION:

Type of Pollutant	Annual Emissions in Pounds					Net Reduction
	Short-Distance Rail	Long-Distance Rail	Air	Bus	Auto	
CO	2,140,013	5,019,547	340,000	318,628	98,045,240	91,544,308
HC	1,173,556	2,761,364	98,000	52,312	12,554,910	8,770,302
NO_x	5,568,678	13,107,275	204,000	532,632	9,612,354	(8,326,967)
SO_x	667,316	1,595,455	20,200	38,045	285,339	(1,919,187)
Particulates	287,636	699,546	8,200	19,023	1,141,356	181,397

TABLE 2.12
(CCNT'D)

LONG-DISTANCE TRAVELER DIVERSION:

Type of Pollutant	Annual Emissions in Pounds					Net Reduction
	Short-Distance Rail	Long-Distance Rail	Air	Bus	Auto	
CO	112,643	5,019,547	270,412	431,422	14,166,108	9,735,752
HC	61,772	2,761,364	194,318	70,831	1,812,618	(745,369)
NO_x	293,115	13,107,275	78,817	721,184	1,355,439	(11,244,950)
SO_x	35,178	1,595,455	9,300	51,513	57,952	(1,511,868)
Particulates	15,162	699,546	7,058	25,757	164,198	(517,695)

TOTAL REDUCTIONS ALL SERVICES	Pounds Per Year	Tons Per Year
CO	108,639,328	54,319.5
HC	8,997,926	4,497.0
NO_x	(18,865,193)	(9,432.6)
SO_x	(3,457,747)	(1,723.9)
Particulates	(259,250)	(129.6)

Short-haul rail passenger service contributes to reduced emissions of four of the five types of pollutants examined. In this case, reduction of CO, especially in the megalopolitan Northeast Corridor, may have a real environmental impact. One-half of passengers on long-distance trains are making short-distance trips. They are traveling on trains that are less environmentally efficient than is necessary to meet their needs. This argues for restructuring the Amtrak route network to concentrate on short-distance markets where environmental effects of reducing auto travel may be meaningful.

It is easy to overstate Amtrak's contribution. In 1972 NO_x emission from stationary sources alone was 11,665,000 tons. In that same year hydrocarbon emission amounted to 27.1 million tons.[37/] The percentage of these totals that Amtrak diverts, is infinitesimally small. One estimate of the amount of pollutants emitted into the nation's atmosphere is presented in Table 2.13.

TABLE 2.13

ANNUAL VOLUME OF POLLUTANTS IN THE U.S.

Type of Pollutant	Millions of Tons per Year	
	Total	Transport Only
CO	100	78
HC	27	15
NO_x	22	11
SO_x	33	1
Particulates	27	1

SOURCE: U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C.: June 1975, p. 84.

We can examine the cost of reducing emission through alternative strategies and compare these to the cost of intercity rail passenger operations. A recent study[38/] estimated that the cost of reducing NO_x automobile emissions from 2.0 grams per mile (gpm), the current standard, to 1.0 gmp would be $450 per ton. Reductions beyond this to .4 gpm were predicted to cost $2,300 per ton. The same report estimated that lowering the national standard for HC emissions (1.5 gpm) to the California standard (.98 gpm in 1976 and .41 gpm in 1977) would cost $470 per ton removed.

Therefore, the same reduction in emissions that Amtrak produces on its short-distance and Metroliner services could be produced by imposing more stringent automobile emission standards at a cost of $2,924,058 for the HC reduction and $1,168,600 for NO_x reduction. This $4 million expenditure must be compared to Amtrak's half billion dollar deficit. In addition, there are other less costly alternatives. For example, improvements in utility boilers can reduce NO_x emissions for $100 per ton.[39/]

Clearly, Amtrak's contribution to pollution alleviation is small, even in areas where it might be expected to have an impact. The fault is not Amtrak's. The problem of pollution control is simply much larger than Amtrak's ability to contribute to its abatement. Although this rough analysis should be refined through more detailed investigation, the implications are apparent: pollution abatement cannot justify the Amtrak program.

Congestion

The Rail Passenger Act specifically cites congestion alleviation as a rationale for preserving and revitalizing intercity rail passenger transportation. Although congestion reduction can be viewed as an improvement in national transport service quality, it is included here under environmental effects because it is so often associated with pollution and the deterioration of the urban environment.

Airport Congestion

It is difficult to estimate congestion or the marginal impacts of diversion on the airport congestion problem. Congestion and the attendant aircraft and passenger delay are directly related to airport capacity which is neither easily defined nor solely dependent on runway and tower capabilities. In a simplistic sense, capacity can be considered the number of take-offs and landings that can be safely accommodated. However, since the type of aircraft using the airport can range from jumbo jets to private, single-person aircraft, it is not possible to translate operations capacity directly into passenger capacity. Further, the probability that an airline passenger will experience a delay from air space congestion is due largely to the time of day, day of the week, and time of the year he or she is traveling. Amtrak's impact on reducing congestion depends not only on how many flights are diverted, but also when these flights are diverted.

Amtrak's present scheduling policy minimizes its impact in all but a handful of city-pair markets. Airport congestion can only be alleviated if large numbers of air travelers are diverted. To accomplish this, Amtrak must offer substantial capacity in the markets where it competes with air. The overwhelming majority of Amtrak's routes are served by single, daily, round-trip service. Thus, a train from San Francisco to Chicago competes not only with San Francisco-Chicago air service, but also with San Francisco-Salt Lake City, San Francisco-Denver, San Francisco-Omaha and all other intraroute air services. Diversion of air passengers at any single airport, therefore, is small. Further, airports serve many other cities which Amtrak does not.

At present Amtrak's contribution to alleviating airport congestion is confined to those markets with frequent daily service, i.e., those in the Northeast Corridor. Air-competitive train service devoted solely to corridor traffic, along with New York-Florida service, generates 1.64 billion passenger-miles annually, or 41.1 per cent of Amtrak's total.

Not all of this traffic is diverted from air carriers. Some is short-distance, non-business travel diverted from the auto and bus modes. In order to simplify the analysis, assume the following diversion factors:

City-Pairs	% Diverted from Air
New York/Newark and south of New York to Washington	50
New York/Newark and north of New York to Boston	50
New York-Boston Corridor traffic	25
New York-Washington Corridor traffic	25
All other Corridor traffic (eg. Baltimore-Hartford)	25
New York-Florida	25
New York-Philadelphia	10

These diversion estimates are fairly high. The Amtrak congestion alleviation effect calculated below should be considered an upper bound.

In order to measure the impact on air traffic congestion at major Northeast Corridor airports, the diverted passenger-miles must be translated into flights. To accomplish this, assume an average load of 60 passengers per aircraft and that the average length of trip for air passengers is as follows:

- 200 miles for Metroliner travelers
- 150 miles for conventional Corridor travelers
- 300 miles for Boston-Washington travelers
- 750 miles for New York-Florida travelers

The reduction in the number of flights must be assigned to the relevant airport based on each airport's share of Corridor landings.[40/] These airports are Logan (Boston), La Guardia (New York City), Newark, Philadelphia, Baltimore-Washington International (Baltimore) and National (Washington). Smaller airports, such as Hartford, are omitted because these are not congested and account for relatively little Corridor air traffic. Dulles (Washington) and Kennedy (New York City) are also omitted, since the preponderance of traffic at these ports is non-Corridor.

In order to estimate the effect of Amtrak services, it is necessary to forecast aircraft delays due to the increased traffic if Amtrak's service did not exist. Thus one must define a relationship between the number of operations at an airport and the amount of aircraft delay. The Federal Aviation Administration has developed such a function based on a study of five major high density airports.[41/] The procedure was to regress delayed aircraft on total operations. The equations took the following form:

FORMULA 2.2

AIRCRAFT DELAY, NORTHEAST CORRIDOR AIRPORTS

$$D_{nny} = e^{-37.1867} (Q)^{3.51885}$$

$$D_{ny} = e^{-37.1867} (Q)^{3.51885} e^{1.59676}$$

$R^2 = .81$
df = 11

Where

D_{nny} = Delayed aircraft, if not a New York Airport;

D_{ny} = Delayed aircraft, if a New York airport;

$e^{-37.1867}$ = Constant in the regression equation;

Q = Number of operations - i.e., take-offs and landings;

$e^{1.59676}$ = A scalar for New York airports. This is included because interaction between N.Y. airports raises delays above what would be expected if a city were served by a single port.

TABLE 2.14

DIVERTED AIR OPERATIONS AT NORTHEAST CORRIDOR AIRPORTS
DUE TO AMTRAK SERVICE

Service	Annual Diverted # of Air Passenger Miles (000)	Annual Diverted # of Flights	Annual Diverted # of Operations	Affected Airports	Intra-Corridor Share of Flights of Affected Airports	Annual Diverted Operations	Daily Diverted Operations
METROLINER N.Y.-WASH.	162,095	13,508	27,010	LGA	20.6	5,564	15.2
				NWK	11.7	3,160	8.7
				PHIL	27.8	7,505	20.6
				BALT	12.0	3,240	8.9
				NAT	27.0	7,540	20.6
					100.0	27,009	56.0
CONVENTIONAL CORRIDOR N.Y.-WASH.	40,775	4,531	9,062	LGA	20.6	1,867	5.1
				NWK	11.7	1,060	2.9
				PHIL	27.8	2,519	6.9
				BALT	12.0	1,087	3.0
				NAT	27.0	2,529	6.9
					100.0	9,062	24.8
BOSTON-WASHINGTON	152,625	8,479	16,988	LOG	28.1	4,765	13.1
				LGA	14.9	2,527	6.9
				NWK	8.4	1,424	3.9
				PHIL	20.0	3,392	9.3
				BALT	8.6	1,458	4.0
				NAT	20.0	3,392	9.3
					100.0	16,958	46.5
N.Y.-PHILADELPHIA	16,488	2,748	5,496	LGA	40.5	2,228	6.1
				NWK	19.0	1,040	2.8
				PHIL	40.5	2,228	6.1
					100.0	5,496	15.0

TABLE 2.14
(CONT'D)

Service	Annual Diverted # of Air Passenger Miles (000)	Annual Diverted # of Flights	Annual Diverted # of Operations	Affected Airports	Intra-Corridor Share of Flights of Affected Airports	Annual Diverted Operations	Daily Diverted Operations
N.Y.-FLORIDA	145,025	3,233	6,466	LGA	21.5	1,332	3.6
				NWK	11.7	757	2.0
				PHIL	27.8	1,797	4.9
				BALT	12.0	776	2.1
				NAT	27.0	1,804	4.9
					100.0	6,466	17.5

LOG = Logan (Boston)
LGA = LaGuardia (New York City)
NWK = Newark
PHIL = Philadelphia
BALT = Baltimore
NAT = National (Washington, D.C.)

Table 2.14 summarizes the airport diversion estimates. The annual number of diverted operations (landings and takeoffs) at each airport is the relevant figure for computing expected delay. To calculate the change in delay at each terminal, compare delays in current operations with what they would be if Amtrak were not operating. Table 2.15 summarizes these results.

How long each aircraft would have been delayed is a function of when the delay occurs. The closer the delay is to the peak travel period, the longer it will be. For our purposes we will assume that each aircraft would have been delayed 30 minutes.[42/] If we assume that each passenger values his or her time at $10/hr., then annual value of Amtrak's congestion alleviation is $750,600. Further, the airlines achieve lower operating expenses as fewer aircraft are delayed. These have been estimated at $10 per operating minute. This yields an additional $750,600 in benefits. The total annual benefit from Amtrak air passenger diversion in the Northeast Corridor is slightly in excess of $1.5 million.

TABLE 2.15

DIFFERENCE IN AIRCRAFT DELAYED BY CONGESTION
AT MAJOR NORTHEAST CORRIDOR AIRPORTS
DUE TO OPERATION OF AMTRAK SERVICE

Airport	Actual # of Operations (Annual)	# of Operations if Amtrak Discontinued	Projected # of Aircraft Delayed w/Amtrak	Projected # of Aircraft Delayed w/o Amtrak	Diff. Due to Amtrak
Logan (Boston)	295,000	299,765	1,252	1,324	72
LaGuardia (NYC)	339,000	352,518	10,081	11,566	1,485
Newark	220,000	227,441	2,185	2,475	290
Philadelphia	316,000	333,443	1,594	1,926	332
Baltimore	125,000 a/	131,561	61	73	12
National (Washington)	326,000	341,265	1,779	2,090	311
			16,952	19,454	2,502

a/ Estimate

Highway Congestion

If Amtrak is to reduce highway congestion, it must divert significant numbers of auto users from heavily traveled roads. Most highway congestion is caused, not by intercity travel, but by commuter trips at peak periods. Only holiday congestion results primarily from intercity auto travel. The analysis will be concentrated on the heavily traveled and congested Northeast Corridor.

The benefit from reduced highway congestion accrues to those who continue to drive. If enough travelers forsake their autos and rely on Amtrak, those remaining on the highway have a reduced likelihood of delay. Further, if traffic diversion to rail offsets the normal gorwth in vehicular traffic on the nation's urban and near-urban arteries, the need to expand highway facilities might be eliminated. This future benefit will be treated in Chapter 3 of this report.

The task here is to estimate the time saved by highway users due to diversion of some intercity travelers to Amtrak. The average speed autos can travel is determined by the ratio of traffic volume to the capacity of the roadway (V/C ratio). Volume is usually expressed in terms of the Average Daily Traffic (ADT) over specific route segments. Capacity and ADT both vary over the length of the highway due to variation in terrain, road quality and number of lanes.

The current benefits from highway decongestion due to Amtrak can be estimated using a model previously employed in a study of High Speed Rail Passenger Service in the Northeast Corridor. [43/, 44/] Briefly, the model predicts changes in travel speeds through the folllwing linear equation:

FORMULA 2.3

CHANGES IN TRAVEL SPEED

$$S = S_b + a(r_1 - r_2)$$

where

S = the average auto operating speed, if Amtrak-diverted auto traffic were put back on the road;

S_b = the average auto operating speed at present;

a = speed coefficient representing the relationship between speed and the V/C ratio

r_1 = volume capacity ratio without Amtrak service;

r_2 = volume capacity ratio with Amtrak service.

Define

$$r_1 - r_2 = \frac{N+V}{C} - \frac{M+V}{C} = \frac{N-M}{C}$$

and

$$C = \frac{M+V}{r_2} + \frac{M}{Kr_2}$$

where

N = intercity auto traffic in ADT if Amtrak service did not exist,

M = intercity auto traffic with Amtrak,

C = design capacity of the highway route segment,

K = intercity portion of total traffic.

V = urban auto traffic in ADT.

The equations must be solved for each route segment along the Amtrak competitive highway corridor. Depending on the volume of diverted traffic and on each segment's capacity, the presence of Amtrak will affect average auto operating speeds. Obviously the effect will be nil in areas where there is no congestion and traffic can average the legal maximum even if all Amtrak-diverted traffic were put back on the highway. In congested urban areas, however, the effect could be substantial.

We can convert the change in average auto operating speed into auto travel time reductions through the formula:

FORMULA 2.4

AUTO TRAVEL TIME REDUCTIONS

$$T=\left(\frac{(1-U)D}{P_1S_1+(1-P_1)S_1}+\frac{UD}{P_2S_3+(1-P_2)S_4}\right)\left(\frac{(1-U)D}{P_1(S_1+S_d)+(1-P_1)(S_2+S_d)}+\frac{UD}{P_2(S_3+S_d)+(1-P_2)(S_4+S_d)}\right)$$

where:

T = trip time reduction in hours,

D = trip distance along highway segment,

P_1, P_2 = percent of intercity traffic at off peak and peak conditions respectively

S_1, S_2 = average speed on intercity (rural) expressways (off peak and peak),

S_3, S_4 = average speed on urban expressways (off peak and peak),

S_d = average speed change due to elimination of Amtrak service.

To arrive at the value of the benefit of Amtrak we calculate:

$$B = AT(N(L_nY_n)) + AT(V(L_vY_v))$$

where:

B = benefits of time saved in dollars per year,

Y_n = average value of time for intercity travelers,

Y_v = average value of time for urban travelers,

L_n, L_v = auto occupancy factors for inter- and intra-city tripmaking,[45]

A = annualization factor.

In order to adequately evaluate Amtrak's impact, auto travel volumes, highway design, and estimated rail diversion data should be collected for each segment of the affected highways. Such complete disaggregated data were not available in time for this report, but previous experience with the model allows us to approximate the value of the Amtrak diversion effect.

There are approximately 60 billion auto passenger-miles of travel (both intercity and non-intercity) along the spinal routes of the Northeast Corridor.[46/] The Corridor rail routes under consideration have diverted approximately 1 billion passenger-miles. Therefore, Corridor auto traffic is roughly 2 per cent less than it would be if Amtrak services were not available.[47/] Previous application of this model suggests that the value of time saved from this level of auto traffic reduction ranges between \$10 million and \$25 million annually.[48/] However, this model tends to overestimate the real value of savings. As long as traffic diversion volumes are large enough to affect the traffic flow, any diversion, no matter how small, will produce an improvement. But, the change may be imperceptable. For example, if 100,000,000 travelers each save 2 seconds over a ten-mile highway route segment, and if they value their time at \$3.00 per hour, the annual benefits are over \$150,000. Multiply this by the 40 segments that comprise the Corridor and we have more than \$6,000,000 per year in benefits. This is equivalent to saving 80 seconds over the entire Corridor length, a trip that normally takes 8 to 9 hours. Does a savings of 80 seconds have value if it is not perceived by the trip-maker?[49/]

Amtrak does have an impact on highway congestion, simply because it does remove some vehicles from the road. Whether that impact has measurable value is another question. Highway congestion is primarily an urban and commutation problem. Its alleviation may lie in increased reliance on train service, but that service must be geared to the needs of the predominant users of the highway, and these are not intercity travelers.

Although there may be positive benefits from Amtrak's decongestion of airports and highways, there may be costs as well. For example, landing fee revenue losses to airports and toll receipt losses to highway authorities must be considered in arriving at the net impact. Also, state and federal agencies lose gasoline tax revenues because of the traffic shifts. Given the level of diversion in the NEC, these revenue effects are as shown in Table 2.16.[50/]

TABLE 2.16

REVENUE LOSSES DUE TO AMTRAK TRAFFIC DIVERSION

	Millions of $
State and Local Fuel Taxes	$3.968
Toll Receipts	1.000
Airport Landings Fees	1.165
TOTAL	$6.133

Again, as in the case of energy and safety, there are benefits to society from Amtrak services, but the net benefits do not begin to approach the cost of service. One argument in rebuttal of this position is that it is improper to examine the benefits separately. The interrelationship, for example, between congestion and air pollution is such that the combined benefit may be greater than the sum of the individual benefits. However, we may note that the higher operating speeds which might result from decreased congestion have a mixed impact. An automobile traveling faster burns hotter and produces less carbon monoxide, but it produces more nitrogen oxides. The overall impact remains unclear. Analyzing the impacts separately has its drawbacks, but it avoids complications and incongruities that otherwise would render investigation hopeless. While it is difficult to estimate the cost effectiveness of Amtrak in reducing highway congestion, it seems that a more effective solution would be one that directly addressed the problem of commuter congestion. Commuter bus service, park-and-ride programs, reserved express bus lanes, and car pools are more efficient approaches.

Noise Pollution

Little is known about the long-term consequences of noise pollution, or about what ambient levels are tolerable without measurable damage. Noise pollution, though more serious in urban areas where ambient levels are already high, is a national problem and produces important diseconomies even in sparsely inhabited areas.[51/] Marginal changes in noise are hard to measure because different people are affected. For example, if one less flight takes off, the residents near the airport may perceive an improvement, but if the former air travelers take Amtrak, then the sound of the train might disturb those who live near the railroad tracks. The total number of people affected, both positively and negatively, depends on the population of the area, the distance they are from the source, the time of day the noise occurs, and the duration and loudness of the noise.

When people have been asked to specify which sounds they found most annoying, the overwhelming majority mentioned highway noises.[52/] Tables 2.17 and 2.18 present the tabulations of two studies which elicited such responses. Table 2.19 provides an estimate of the number of people in the United States who are subjected to various levels of highway noise.

Although rail is infrequently mentioned as a source of noise pollution, it is not justifiable to conclude that traffic shifts from air and highways to Amtrak would contribute to noise abatement. First, trucks, rather than automobiles, are the principle culprits in generating highway noise. At a distance of 50 feet, medium and heavy-duty trucks cruise at a noise level of 84 dBA, while passenger cars produce only 75 dBA.[53/] Introducing an additional automobile into a traffic flow with light truck traffic has a negligible impact on the noise level emanating from the highway.[54/] Second, noise levels do not increase arithmetically as more

TABLE 2.17

PERCENT CONTRIBUTION OF EACH SOURCE IDENTIFIED BY RESPONDENTS CLASSIFYING THEIR NEIGHBORHOOD AS NOISY (72% of 1,200 RESPONDENTS)

Source	Percentage
Motor Vehicles	55
Aircraft	15
Voices	12
Radio and TV Sets	2
Home Maintenance Equipment	2
Construction	1
Industrial	1
Other Noises	6
Not Ascertained	8

SOURCE: Bolt, Beranek and Newman, Inc., Survey of Annoyance from Motor Vehicle Noise, Automobile Manufacturer's Asso. Report No. 2112, June 1971 as quoted in U.S. Department of Transportation, Air Quality, Noise and Health: Report of a Panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980, Washington, D.C.: 1976, p. 6-7.

TABLE 2.18

THE ONE SOUND WHICH MOST BOTHERS PEOPLE AT HOME, OUTDOORS AND AT WORK

DESCRIPTION OF SOUND	THE ONE SOUND WHICH BOTHERS PEOPLE MOST		
	AT HOME %	OUTDOORS %	AT WORK %
Road traffic	22	6	2
Aircraft	5	1	0
Trains	2	0	-
Industrial/Constructional sounds	3	1	3
Domestic/Light appliances	1	-	1
Neighbors' impact noises	3	-	-
Children	4	0	0
Adults' voices	4	0	1
Wireless/T.V.	3	0	0
Bells/Alarms	1	0	0
Pets	1	0	-
Other sounds	0	-	-
Total sounds which bother most people	49	8	7
Individuals			
Those who are bothered by sounds	56	27	20
Those who notice but are not bothered by sound	41	64	70
Those who do not notice sounds	3	9	10
Base:	100	100	100
No. of individuals	1377	1377	832

SOURCE: A. C. McKennell and E.A. Hunt, Noise Annoyance in Central London, The Government Social Survey SS 332, March, 1966 as quoted in U.S. Department of Transportation, Air Quality, Noise and Health: Report of a Panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980, Washington, D.C.: 1976, p. 6.8.

TABLE 2.19

ESTIMATED NUMBER OF PEOPLE SUBJECTED TO TRAFFIC NOISE
(IN MILLIONS)

Noise Level (Outdoor Ldn [a/])	Urban Traffic Noise	Freeway Traffic Noise
55	93.4	4.9
60	59.0	3.1
65	24.3	2.5
70	6.9	1.9
75	1.3	0.9

SOURCE: U.S. Department of Transportation, Air Quality, Noise and Health, Report of a Panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980, Washington, D.C., March 1976, p. 6.18.

a/ Ldn = Day-Night Average Noise Level

vehicles are introduced into the highway. A tenfold increase in the flow of traffic (from 400 to 4000 vehicles per hour) only doubles highway noise (i.e., from 50 dBA to 60 dBA).[55/] Third, rail vehicles themselves are not quiet. A diesel electric locomotive generates 88-98 dBA at 50 feet, while an electric locomotive produces 76 to 85 dBA. Rail passenger cars produce 80-90 dBA. Metroliners and turbo-trains perform somewhat better, but at high speeds they approach the noise level of conventional, diesel-hauled, passenger trains. Figures 2.1 and 2.2 graph these noise levels. Rail vehicles are not as noisy as aircraft, but airplanes produce most of their negative impact during the LTO cycle. The fact that long-distance trains travel throughout the night suggests that train noise might be particularly annoying.

Measurement of the net effect from traffic shifts to Amtrak is not possible given the current state of the art. Any benefits that do accrue to Amtrak traffic diversion are probably confined to reduction of airplane LTO noises, but as noted, the net effect on noise abatement remains unclear.

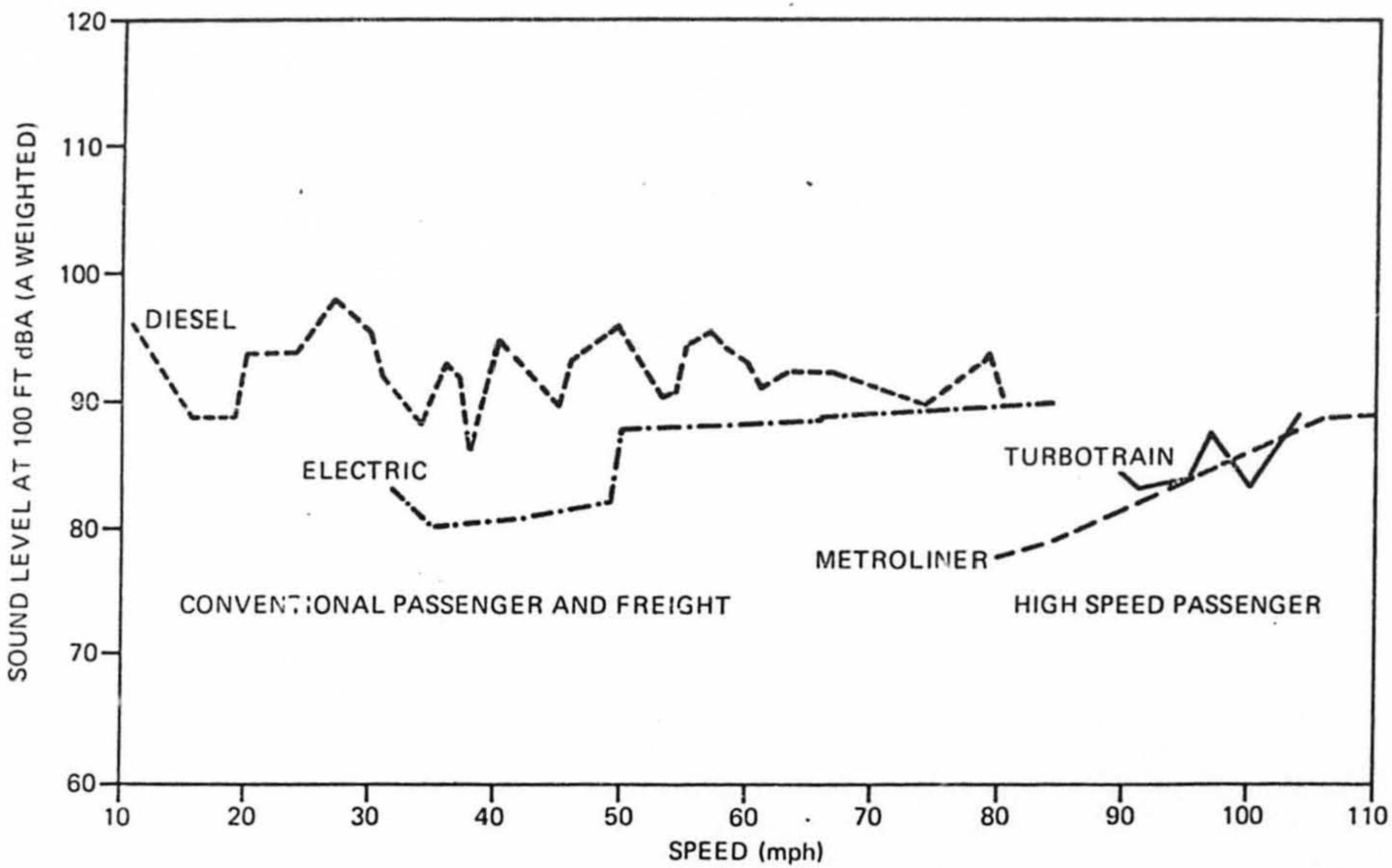


FIGURE 2.1 PEAK LOCOMOTIVE NOISE LEVEL VERSUS SPEED

SOURCE: Environometal Protection Agency, Office of Noise Abatement and Control <u>Background Document/Environmental Explanation for Proposed Interstate Rail Carrier Noise Emission Regulations</u>. Washington, D.C.: 1974.

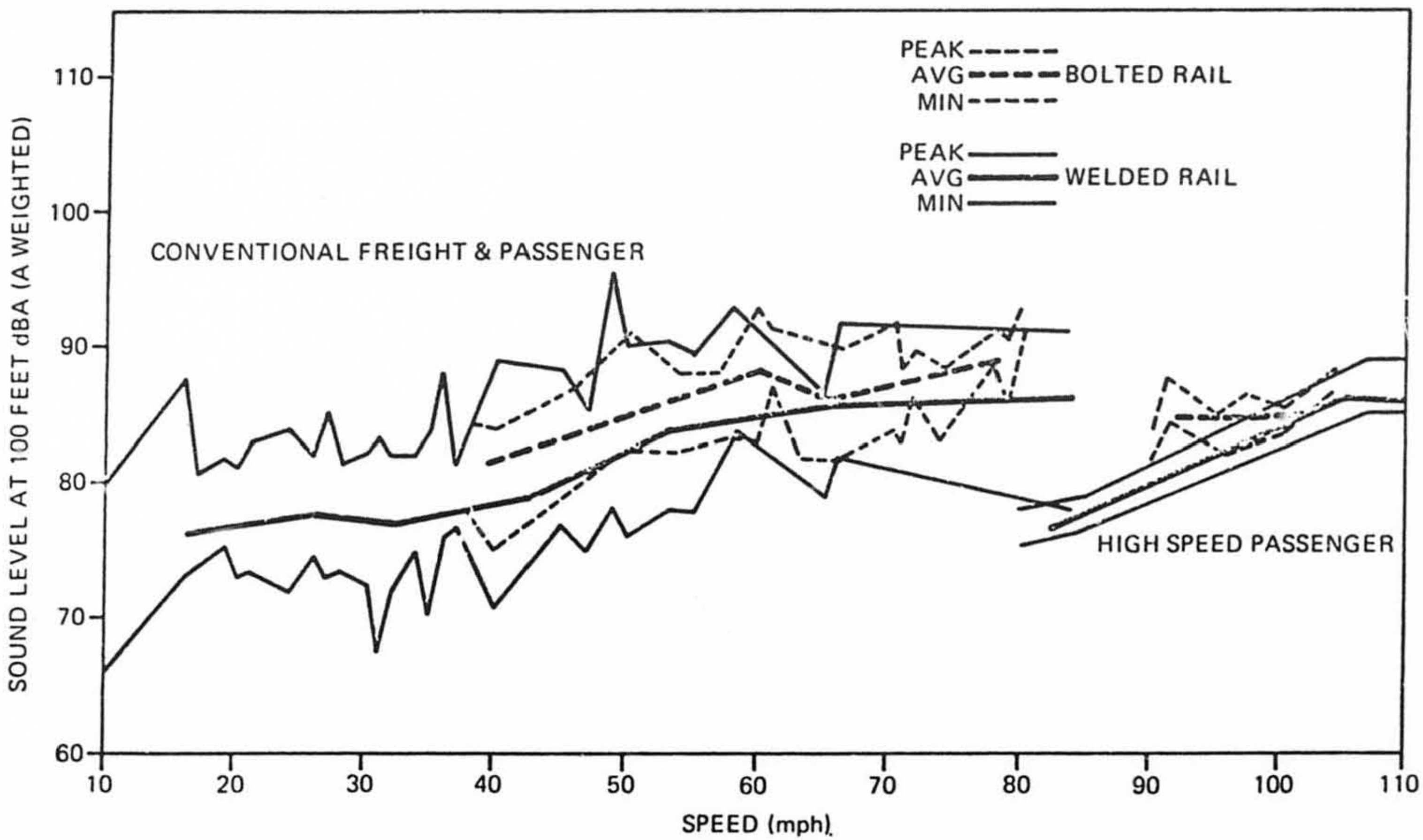


FIGURE 2.2 AVERAGE AND MINIMUM RAIL-WHEEL NOISE LEVEL VERSUS SPEED

SOURCE: Environmental Protection Agency, Office of Noise Abatement and Control <u>Background Document/Environmental Explanation for Proposed Interstate Rail Carrier Noise Emission Regulations</u>, Washington, D. C.: 1974

SERVICE

This section examines the characteristics of rail passenger service and its contribution to the overall passenger transportation network.

The components and measures of service are presented in Figure 2.3. While it is often impossible to place a dollar value on the benefits of rail passenger service, it is possible to compare Amtrak's services to those offered by the competing modes. We will again examine the question of what would occur if all Amtrak patrons relied on the alternative modes. Our concern is whether or not there would be a deterioration in the overall service quality of intercity travel if the Amtrak program were terminated.

FIGURE 2.3

COMPONENTS AND MEASURES OF SERVICE

Attributes	Measure	Comments
Reliability	On-time performance	Different definitions for OT performance among modes; lack of data for bus mode
Minimization of time in transit	Average trip speed	Terminal access and egress times complicate the measure
Accessibility	No. of cities served	Quality of service and city-pair connectivity not consistent--e.g. non-stop vs. multi-stop versus connecting service
Frequency of service	Number of daily departures	Not meaningful for auto mode
Subjective factors	Cleanliness, friendliness of on-board personnel, ease of making reservations, comfort	Typically impossible to measure objectively

Reliability

Reliability can be gauged by the likelihood that a traveler will reach a destination on schedule. A mode with good on-time performance is one that minimizes

TABLE 2.20

AMTRAK OPERATIONS DEPARTMENT CAUSES OF DELAY

(Shown as Percent of Total delay)

Categories	Average	May 1975	April 1975	March 1975	February 1975	January 1975	December 1974	November 1974	October 1974	September 1974	August 1974
A-Equipment malfunctions	7.34	5.8	5.9	6.9	7.4	8.0	8.4	7.7	7.6	7.6	8.1
B-Slow orders	39.21	43.4	46.9	44.1	44.4	38.3	30.8	35.5	38.7	37.4	32.6
C-Servicing in stations	5.74	2.6	4.2	5.6	5.9	6.8	8.3	5.7	5.0	6.4	6.9
D-Passenger train interference	5.33	4.9	3.7	5.0	5.9	5.4	5.8	5.4	5.2	5.6	6.4
E-Freight train interference	6.20	5.4	4.6	5.5	5.0	5.4	5.8	7.4	8.9	7.7	6.3
F-Waiting for connections	1.23	1.6	1.0	1.0	0.9	1.1	1.2	1.4	1.3	1.5	1.3
G-Miscellaneous	5.58	4.5	4.8	5.2	5.4	6.0	5.8	6.0	5.2	6.8	6.1
H-Passenger related delays	13.27	12.5	11.8	12.3	11.7	14.2	18.7	15.2	11.6	10.7	14.0
I-Signal failures	7.39	8.0	6.4	5.8	6.5	7.6	7.8	7.2	7.2	8.1	9.3
J-Maintenance of way work	4.62	8.1	6.7	3.3	2.4	2.6	3.7	3.8	5.5	4.9	5.2
K-Running time	3.40	2.4	3.3	4.1	3.2	3.5	3.5	4.2	3.5	3.0	3.3
L-Employee failure	.23	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.5
M-Weather related delays	.32	0.3	0.3	0.6	1.1	0.9	0	0	0	0	0
N-Freight derailments	.12	0.4	0.3	0.5	0	0	0	0	0	0	0

SOURCE: Interstate Commerce Commission, Ex Parte No. 277 (Sub No. 3) - Adequacy of Intercity Rail Passenger Service, Washington, D.C.: 1976, p. 977.

unexpected delays in transit. Amtrak has not achieved a noteworthy on-time performance record. The principle causes of delay are summarized in Table 2.20.

Delay problems should abate as Amtrak acquires new equipment, repairs rights-of-way, and gains more complete control over operations. However, the record of the past six years is not encouraging and unless Amtrak/railroad relations change drastically, the situation may improve only slightly. On a systemwide basis, Amtrak's on-time performance record has not improved since Amtrak assumed responsibility for service in May 1971. The continued failure to meet published schedules remains a leading cause of passenger complaints.[56/] In fact, in many instances improvements have resulted from lengthened schedules or redefinition of what constitutes on-time performance. Such cosmetic approaches may achieve better correspondence between schedules and performance, but they fail to get at the root of the problem.

To improve on-time performance, and encourage the railroads to give priority to operating passenger trains on schedule, Amtrak negotiated performance/incentive agreements with 10 of the railroads in 1974. These were designed to reward good performance and penalize the carriers for unnecessary delays.[57/] Amtrak also redefined "on-time" from "no less than five minutes late" to a step function of distance traveled (see Table 2.21).

TABLE 2.21

AMTRAK ON-TIME PERFORMANCE CRITERIA, 1974

Distance		On-Time Criteria			
Less than 100 miles		Up to 5 minutes late			
101-200	"	" " 10		"	"
201-300	"	" " 15		"	"
301-400	"	" " 20		"	"
401-500	"	" " 25		"	"
More than 500 miles		" " 30		"	"

SOURCE: U.S. Department of Transportation, The Rail Passenger Service Act of 1970: Report to Congress, Washington, D.C.: 1974, p. 25.

By June 30, 1976, Amtrak had paid $32.6 million in incentives, but there is little evidence that the payments improved on-time performance, although they did produce generous payments to the railroads. The improvements brought about were due largely to looser schedules, the redefinition of lateness, and the introduction of new locomotives.[58] Further, Amtrak only considered on-time performance at final destinations and ignored lateness at intermediate stops. If, as even Amtrak admits, its long-haul routes are really a series of short-distance routes, then an important segment of its ridership receives poor service. Nevertheless, no penalty is assessed on the offending railroads for lateness at intermediate points.[59] In addition, Amtrak has paid railroads for making up lost time whenever interline service was involved. Railroads like the Seaboard Coast Line, with much slack time scheduled in their segments, have benefited greatly from this provision.[60]

Amtrak decided on 65 per cent on-time performance as the baseline for payment of incentives, despite the fact that the systemwide average was far above this at the time incentive contracts were instituted.[61] All trains operated by an individual railroad were averaged together and long- and short-haul trains were weighted equally. Short-haul trains, because they are exposed to fewer miles of deteriorated track and are less likely to break down, are easier to operate on schedule. A carrier which operated one short-haul route 95 per cent on-time and two long-haul routes 60 per cent on-time would be considered eligible for incentive payments because it averaged 71.67 per cent.

Many individual trains, including trains with the newest equipment, have very poor on-time performance records. From March to August 1975, scheduled turbotrains averaged 36 minutes late 45 per cent of the time.[62] Amtrak attributes this to the fact that these trains operate over some of the worst track in the system.

Also, heavy demand for these trains has resulted in the deferral of maintenance and this has increased en route malfunctions. Why the Corporation places its most modern high-speed equipment on the worst rights-of-way and fails to properly maintain the train-sets are questions that have not been answered.

Amtrak is renegotiating the on-time performance contracts and is eliminating some of the more flagrant abuses. The new agreement will make it more difficult for the railroads to earn incentives because:

1. The method of determining on-time arrivals is stricter;
2. Schedules have been tightened;
3. The baseline has been increased to 80 per cent;
4. Incentives are paid for individual trains instead of for an average of all the carrier's trains; and
5. Incentives will now vary with each railroad's operating costs.[63/]

Although the new contracts are a substantial improvement, problems remain. With tighter schedules and a higher baseline, railroads may find it too difficult to earn incentives, and therefore, may reduce their efforts to operate Amtrak trains on time. Meaningful penalties for poor performance would be useful, but the railroads are opposed. Amtrak should monitor intermediate stations and endpoints, and Amtrak employees, not railroad personnel, should be responsible for reporting arrival and departure times.

Some argue that the entire incentive system is a waste of Amtrak's money. Most delays are not under the control of the operating railroads. The cure lies in large expenditures to rehabilitate roadbeds, modernize signalling, and incorporate new technology that would improve both rail passenger and freight operations.[64/] The railroads certainly will not, and cannot, undertake these expenditures merely to earn incentive payments from Amtrak

A traveler may experience two other kinds of delay in addition to a late arrival. He may be unable to secure his preferred departure time due to schedule limitations (frequency delays), or because his desired departure time is sold out (stochastic delay).[65] Given the infrequency of Amtrak departures, and its less than perfect reservation system, the likelihood of a traveler experiencing either a frequency or stochastic delay is greater for rail travel than for air or bus. By contrast, the weight of evidence suggests that a major problem with airline scheduling is the operation of too many flights at low load factors in an attempt to minimize frequency and stochastic delays.[66]

Although the bus companies do not report on-time performance to any public agency, there is some evidence to suggest that it is not a problem for intercity bus travel. In a survey by Louis Harris and Associates, 9 per cent of rail riders and 14 per cent of air travelers cited failure to meet published schedules as a disadvantage for bus travel.[67] Auto travel, on the other hand, is perceived by many travelers as unreliable because they fear breakdowns.

On balance, Amtrak does not appear to contribute to the reliability of the transport system. If anything, the addition of rail passenger services reduces the overall reliability of the system. Alternative common carrier modes perform at least as well as Amtrak. Air transport is between 75 and 85 per cent on time (defined as being within 15 minutes of scheduled arrival time).[68] Potential auto travelers who rely on Amtrak because they fear breakdowns en route would be at least as well off if they flew or took the bus.

Accessibility

Amtrak's creation signalled the termination of approximately one-half of all intercity passenger trains operating in the U.S. The basic system, however, still managed to provide service to 440 stations, 230 of which are in SMSAs accounting for 95 per cent of the total SMSA population. Through expansion of the network, more than 500 stations are now served by Amtrak. However, it is easy to overstate the accessibility of rail passenger service to the American public. Not all Americans reside in SMSAs and Amtrak fares less well compared to other public carriers in providing service to rural and smaller urban areas, as shown in Table 2.22.

A meaningful definition of accessibility must include more than the mere fact of service. Accessibility must take into account the number of places served directly from the origin point, the type of service available (e.g., direct, nonstop, connecting), the ease of access to terminal facilities, and the time and frequency of departures.

TABLE 2.22

PERCENTAGE OF CITIES HAVING DIRECT INTERCITY PASSENGER SERVICE, BY MODE

Population Category	Intercity Bus	Air Service[a/]	Rail Service
2,500 - 5,000	96	12	4
5,000 - 10,000	100	72	20
10,000 - 25,000	100	81	22
25,000 - 50,000	100	85	40
50,000 - 250,000	100	100	43
250,000 - 1,000,000	100	100	73
Over 1,000,000	100	100	93

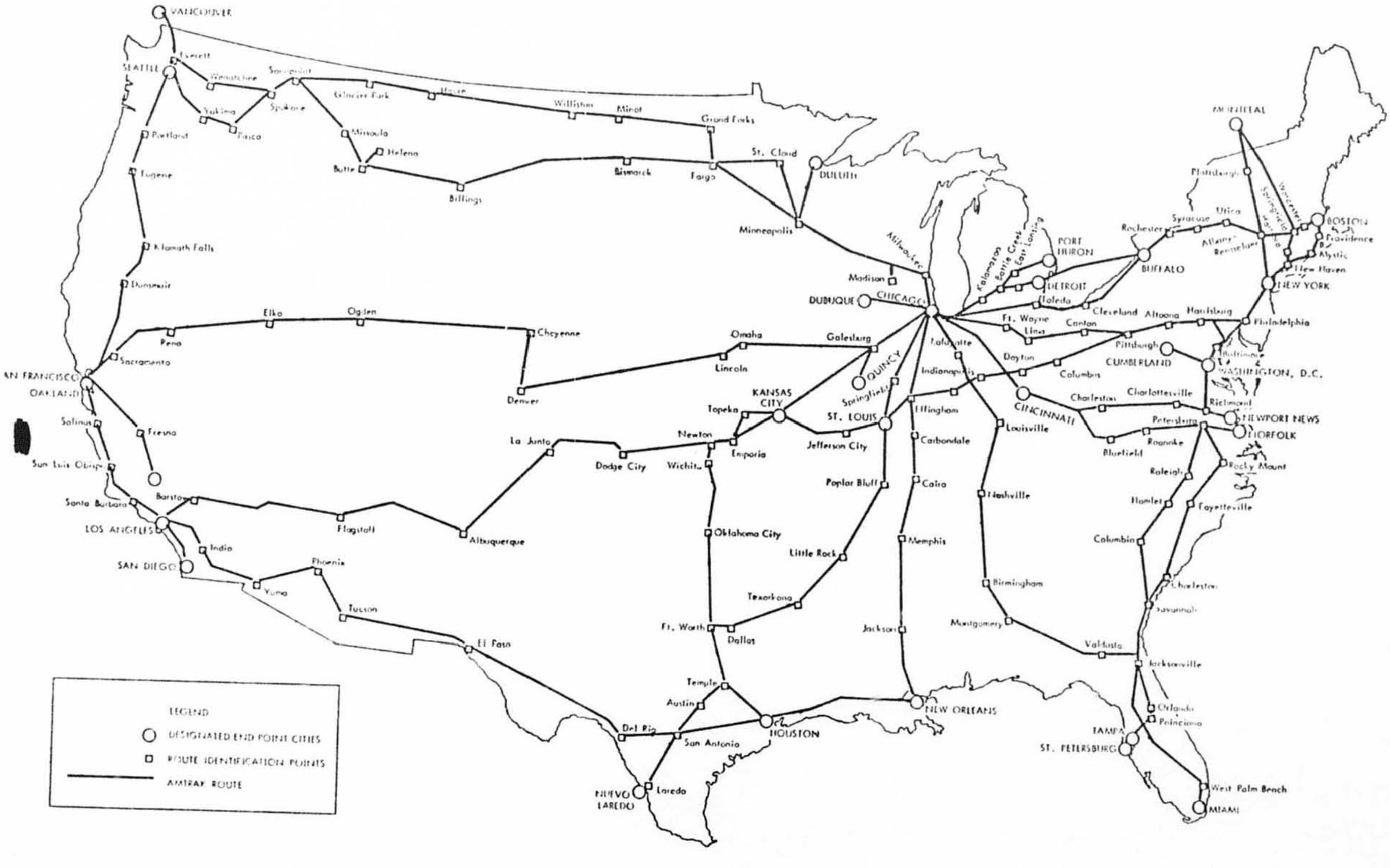
a/ Direct air service is defined as having an airport within 15 miles of the city which offered scheduled service by certificated airline or commuter air carriers, or unscheduled air taxi service.

SOURCE: U.S. Department of Transportation, 1974 National Transportation Report, Washington, D.C.: July 1976, p. 358.

A map of the Amtrak route network is provided in Figure 2.6. Two cities that receive Amtrak service are not necessarily connected by rail. North-South service in the western U.S. is practically non-existent. For example, both Phoenix and Flagstaff, Arizona, receive daily train service, but certainly it cannot be said

FIGURE 2.4

AMTRAK Intercity Rail Passenger Routes



SOURCE: Continental Trailways, Amtrak Yesterday, Today, and Tomorrow, [no place]: 1975[?], fig. 16.

that there exists Phoenix-Flagstaff rail passenger service. Unless a city is an important interchange (e.g., Chicago or New York), few places can be reached from a typical Amtrak station with direct, multi-stop service. Connections, particularly through Chicago, allow transcontinental travel from the major cities on the Pacific Coast to the Northeast. But, it is not really possible to travel from California to Florida, except through Chicago,which is unreasonably circuitous.

Most Amtrak terminals are located in the CBD. While this location may be convenient for business travelers, it also raises the problem of terminal access and egress. Moreover, as urban populations continue to decentralize into the suburban rings, the travel time required to reach downtown terminals becomes an increasingly important barrier to using the rail mode. Amtrak has inaugurated suburban stops in the Northeast Corridor, but this innovation has not been introduced systemwide. The assertion that Amtrak serves 95 per cent of the population residing in SMSAs is somewhat misleading. Accessibility to terminals should be expressed in terms of percent of population living within a certain number of minutes from the station. This is an especially serious problem in the West where Amtrak's stations are few and SMSAs are large. It is possible for someone to live more than 100 miles from the station, but still be included in the SMSA.

There are no points served by Amtrak that are not also served by intercity bus and the private automobile. The intercity bus route network serves over 15,000 cities and towns. (See Figure 2.5.) Unlike Amtrak, bus service is available in virtually every city with over 5,000 inhabitants and to 96 per cent of those with between 2,500 and 5,000 people. Also, unlike the railroads, the bus companies realized that air transportation would eventually dominate long-distance travel and shifted their emphasis from transcontinental to regional services in the 1950s.[69/] Although the main bus terminals are also

FIGURE 2.5

Major Bus Routes in Continental U.S.

SOURCE: Continental Trailways, Amtrak Yesterday, Today, and Tomorrow, [no place]: 1975[?], fig. 12.

located in the CBD, the flexibility of the mode has enabled it to follow the decentralization of the urban population.

Both bus and auto travel accessibility have improved with the development of the Interstate Highway System. While the absolute amount of rural highway mileage has not changed appreciably since the 1920s, the quality of the intercity highway route network has changed dramatically. There are very few places in the continental U.S. that are not accessible through the high-quality Interstate and primary federal-aid highway system.

Certificated and commuter air carriers' services are available to more than 700 communities. There are more than 1,800 airports serving the network, and 430 cities receive regularly scheduled, certificated carrier service.[70/] Although these figures do not appear significantly different from those of rail service, Figure 2.5 shows that the overall accessibility and connectivity provided by the air mode is far greater. Nearly two-thirds of the U.S. population resides within 30 minutes of an airport providing regular services, although only 41 per cent are within 30 minutes of certificated services. Smaller cities fare less well: many smaller cities are more than one hour's drive from the nearest airport.[71/]

The number of cities that can be reached with direct air service from a given airport is a function of city size. New technology (larger and faster planes) has allowed marked improvements in connectivity among the largest hub airports. For example, among the 21 largest airports there are 210 possible city-pair combinations. In 1940, only 27 of these were connected by non-stop service; in 111 of the markets connecting service was available. In 1950, 57 city-pairs received non-stop service, and this grew to 104 in 1960 and 185 by 1973. In 1973 every city-pair was connected by direct air service except one which required a connecting flight.[72/]

The technology that allowed these improvements also made it unprofitable for the large certificated carriers to serve smaller communities. However, commuter

FIGURE 2.6

Major Airline Routes in Continental U.S.

SOURCE: Continental Trailways, Amtrak Yesterday, Today, and Tomorrow, [no place]: 1975[?], fig. 13.

carriers and air taxi services have filled this gap. 73/ By operating equipment more suitable to the needs and demand characteristics of smaller communities and by offering more frequent departures, the commuter carriers have improved the accessibility of smaller cities to the nation's air transport network. In some markets where certificated service has been replaced by commuter carriage, air travel has expanded 1000 per cent. 74/

Finally, evidence suggests that access to air terminals, rather than deteriorating due to highway congestion is, in fact, improving. Surveys by the FHWA indicate a decrease in average travel time between CBDs and major airports between 1968 and 1972. 75/ However, these data cover only travel to the airport boundary. Traffic congestion on airport roads has probably increased. 76/

Amtrak does not contribute in a meaningful fashion to the national transport goals of increased accessibility or interregional connectivity. These goals are being better met by the air and highway modes. The rationale offered by Amtrak for operating a national system in light of the superior performances of non-rail competitors is not very convincing. The Corporation stresses that its legislation mandates a national network of intercity trains. 77/ This is true, but it fails to provide a justification that can be evaluated on cost/benefit or cost-effectiveness terms.

Travel Time

Before Amtrak, declining passenger demand and inadequate revenues led many railroads to defer maintenance of rights-of-way and equipment. As the roadbed fell into disrepair, average train speeds declined, and passenger train schedules lengthened. Table 2.23 compares 1972 Amtrak line-haul travel times with record times. The deterioration is significant over many routes. Only in the Northeast Corridor have travel times improved with the operation of federally-sponsored Metroliner

TABLE 2.23

DETERIORATION OF RAIL LINE-HAUL TRAVEL TIMES

Route	Amtrak Line-Haul Travel Time October 29, 1972 (Hours and Minutes)	Previous Time and Year Established (Hours and Minutes)	Increase in Travel Time with Amtrak (Hours and Minutes)
New York-Miami	26:12	23:45 (1971)	2:27
New York-St. Louis	21:30	19:10 (1958)	2:20
New York-Chicago	16:50	15:30 (1947)	1:20
Chicago-Los Angeles	40.05	39:30 (1954)	0:35
Chicago-Oakland	47:15	39:02 (1939)	8:13
Chicago-Seattle	46:50	42:45 (1962)	4:05
Chicago-St. Louis	5:20	4:55 (1936)	0:25
Chicago-Miami	36:25	29:10 (1940)	7:15
Chicago-New Orleans	17:20	15:55 (1947)	1:25
Chicago-Houston	26:55	24:50 (1954)	2:05
Chicago-Detroit	5:45	4:45 (1936)	1:00
Chicago-Minneapolis	7:40	6:45 (1940)	0:55
Chicago-Denver	17:15	15:35 (1940)	1:40
Portland-Seattle	3:45	3:30 (1971)	0:15
Portland-Oakland	16:10	14:55 (1958)	1:15
Los Angeles-San Diego	2:45	2:15 (1941)	0:30
Los Angeles-New Orleans	44:00	41:45 (1953)	2:15

SOURCES: U. S. Department of Transportation, Report to Congress, The Rail Passenger Service Act of 1970 (Washington, D. C.: Government Printing Office, March, 1973), p. 19; Trains Magazine, June 1972.

services. During 1974, in its effort to improve on-time performance, Amtrak's incentive contracts with the railroads added even more time, despite Amtrak's recognition that many schedules already had too much slack.

In 1976 Amtrak finally began to remove some of the padding that had crept into train schedules over the years. Table 2.24 summarizes these improvements. In most instances these changes are small, but they do represent a reversal of the long-term trend. These improvements notwithstanding, Amtrak trains averaged less than 47 mph in the summer of 1976. The problem is not equipment, but track. The SNCF turboliners introduced in the Chicago-St. Louis and Chicago-Detroit markets operate over schedules virtually identical to those which were offered with conventional equipment.[78/] Along with the NEC track upgrade program mandated by the 4R Act, Amtrak proposes to improve rights-of-way to allow higher operating speeds on other routes throughout the nation.[79/] The Amtrak plan in this area, its costs, and its potential will be treated more fully in Chapter 3.

Until the imposition of the 55-mph speed limit, the highway modes had achieved steady gains in average operating speeds. Between 1950 and 1973 average bus operating speeds increased by 20 per cent to 60.4 mph. In 1972, automobiles averaged 62 mph on main rural roads.[80/] Even though bus and auto travelers must stop and disembark to take meals, these modes were trip-time competitive with rail in all but the longest distance routes. The 55-mph limit, however, has reduced or eliminated the motor vehicle speed advantage. There is no doubt that slower highway speeds and the simultaneous reduction in the speed-band (the range of travel speeds of vehicles on the roadway) have aided in producing a significant decline in the annual number of fatalities and serious injuries on main rural roads.[81/] For this reason, regardless of future fuel availability, the 55-mph limit appears here to stay.

TABLE 2.24

AMTRAK'S REDUCED TRAVEL TIMES

Route and Direction	Time Savings: Hours	Time Savings: Minutes
Seattle to Chicago (Southern Route)	2	50
Chicago to Seattle (" ")	2	0
Seattle to Chicago (Northern Route)	1	45
Chicago to Seattle (" ")	1	45
Chicago to Laredo	1	10
Laredo to Chicago	1	10
San Francisco to Chicago	1	05
Chicago to San Francisco		50
Washington to Kansas City		35
New York to Kansas City		20
Kansas City to New York		10
Kansas City to Washington		10
Washington to Chicago via Pittsburgh		20
Chicago to Washington " "		03
New York to Montreal via Albany		15
Montreal to New York " "		15
Carbondale to Chicago		15
Chicago to Carbondale		05
Chicago to Boston		10
Washington to Chicago via Cincinnati		10
Chicago to Washington " "		10
Chicago to Champaign/Urbana		10
Champaign/Urbana to Chicago		10
Chicago to Quincy		05
Quincy to Chicago		05
Chicago to Dubuque		05
Dubuque to Chicago		05
Detroit to Jackson, Michigan		05

SOURCE: U.S. Interstate Commerce Commission, Report to The President and the Congress, Effectiveness of the Act: Amtrak, Washington, D.C.: 1977, p. 15.

Except for the shortest intercity trips (less than 100 miles) air holds a substantial travel time edge over the surface modes, even taking terminal access and egress times into consideration. Between 1963 and 1972 average air travel speeds increased from 304 to 415 mph largely due to the introduction of jet aircraft.82/

Amtrak's contribution to the national transportation policy goal of providing intercity travelers with modern, fast service must be deemed minimal when compared to the contributions made by its competitors. Even among surface transport modes, Amtrak does not hold a significant advantage over bus in very many markets. If we include factors for frequency, stochastic, and operating delays it is doubtful that rail travel times are superior to bus in any distance markets.

Frequency and Capacity

Outside the Northeast Corridor the vast majority of Amtrak routes are served by a single daily train in each direction. Only a few corridors receive as many as two to five daily departures in each direction. Many cities, especially intermediate points on long-distance routes, receive only middle-of-the-night service. Given the location of many of Amtrak's older stations, this service is particularly unattractive.

Amtrak has done little to change this situation. Route expansion has taken the form of increasing the number of routes, rather than providing more frequencies at more convenient departure times for cities already part of the basic system. Amtrak has often acknowledged this problem and has cited equipment shortages as the primary reason for not increasing frequencies. With more and newer equipment, Amtrak could expand the number of daily departures and increase seat mile capacity.

When Amtrak's services are added to those offered by the other modes, the overall improvement in passenger transport is negligible. Auto departure frequencies are, of course, as infinite as the division of time. Air and bus offer the traveler far more choice in departure times than Amtrak in every market outside the Northeast Corridor.

Several studies have shown that frequency is a key element in determining modal market shares.[83/] Indeed, the airlines, because they are precluded from engaging in price competition, have relied on offering numerous departures between cities as a major element of their marketing strategy. The wisdom of this approach is not at issue here and has been treated elsewhere.[84/] The point is simply that Federal subsidization of Amtrak has not effectively increased the availability of intercity passenger travel outside the Northeast Corridor.

The argument has often been put forth that it is in the public interest to maximize the number of travel options available. This argument is difficult to defend, especially in light of the regulatory environment in which the modes compete. More travel modes could result in increased intermodal competition and bring about lower fares. In some markets, bus and air carriers have had to reduce fares to meet competition from Amtrak.[85/] However, given the level of operating subsidy, it may be that rail competition is, in fact, predatory. The subsidy issue will be treated in more detail later.

Rail service is operationally different from its competitors, but this alone is not a sufficient condition for concluding that providing it makes a net addition to traveler welfare. Following this line of reasoning, we would be forced to conclude the nation requires the reestablishment of stagecoach services. There must be perceptible advantages over the services provided by the competition, to justify subsidizing a service. These advantages are not apparent in the case of intercity rail passenger service outside the Northeast Corridor.

Subjective Factors

Some aspects of travel are fundamentally non-quantifiable but, nevertheless, important. These subjective characteristics include comfort, friendliness of personnel, pleasantness of surroundings, cleanliness of on-board and station facilities, and other amenities and aspects of intercity passenger travel that enter into the determination of user satisfaction.

There have been and continue to be a large number of service complaints. In addition to their on-going Amtrak surveillance programs, both the GAO and the ICC have recently completed special studies of Amtrak service quality. The ICC held extensive hearings throughout the country on the adequacy of Amtrak service.[86/] The testimony offered was a litany of complaints ranging from inadequate climate control to rude and discourteous service from on-board and station personnel.

The volume of complaints about Amtrak service has remained virtually unchanged over the past few years, although complaints have shifted away from comfort and cleanliness areas to the failure to meet published schedules. Table 2.25 provides a summary of causes of complaints.

Both the GAO and the ICC in their own inspections found numerous instances of dirty cars, malfunctioning air-conditioning, inadequate food provision, and overall unsatisfactory conditions.[87/] Many of these problems go unreported to the Corporation. Amtrak has generally not penalized the railroads for failure to maintain Amtrak standards. As of June 30, 1976 Amtrak had penalized the railroads for only 439 dirty cars. Yet a GAO inspection of 343 cars, using standards much lower than the Corporation claims to use, found 130 cars that were dirty by any standards.[88/] One train with new Amfleet cars had clogged toilets. The conductor told the GAO investigators that this was a common problem.[89/] The GAO found that the maintenance incentive agreements have failed to produce a notable improvement in car cleanliness or attractiveness.[90/] Further, the GAO believes the introduction of new equipment, while a step in the right direction, will not solve the problem. The study holds that the equipment is improperly maintained and in time the new cars will be subject to the same problems as the older units.

Train travel should be the most comfortable form of intercity transportation because it provides the room to get up and walk about. But a rough ride over a

TABLE 2.25

PASSENGER COMPLAINTS ABOUT AMTRAK SERVICE, BY CATEGORY

	Passenger Responses		ICC Field Staff Reports	
		Total	Trains	Stations
Total Complaints	8,033	Reports	2,442	611
Regulation	Violations			
2 Information to be Provided	0		0	0
3 Reservations	1,219		1	38
4 Reservation-Making	62		0	56
5 Reservation-Confirming	22		0	12
6 On-Time Performance	1,280		307	2,218
7 Expeditious Service	22		22	0
8 Cancellation of Trains	13		0	49
9 Cancellation En Route	65		0	5
10 Thru Car Service	12		0	120
11 Station Hours	34		2	87
12 Consist of Stations	228		0	368
13 Checked Baggage	375		53	320
14 Consist of Trains	678		227	116
15 On-Board Services	1,319		171	0
16 Baggage Services	3		522	0
17 Food & Beverage	472		325	0
18 Temperature Control	1,986		617	0
19 Sleeping Cars	148		130	0
19 Functioning Equipment*	175		166	0
20 Coaches	480		304	0
20 Car Requirements*	304		154	0
21 Nonrevenue Space	38		67	0
21 Nonsmoking Space*	32		38	0
22 Nonsmoking Space	60		48	0
22 Complaint Procedure*	6		107	26
24 Complaint Procedure	9		155	53
26 Track Standards	0		0	0
TOTAL ALLEGED VIOLATIONS	9,042		3,416	3,468

*New regulations promulgated and effective 6/9/76.

SOURCE: Interstate Commerce Commission, Report to the President and the Congress, Effectiveness of the Act: Amtrak, Washington, D.C.: 1977, p. 8.

deteriorated roadbed, in dirty surroundings, makes train travel a less than pleasant experience. Yet, survey after survey indicates that in spite of these poor conditions, the riding public is basically satisfied with intercity rail travel.[91/] This incongruity is difficult to fathom. It has been suggested that rail travelers have a higher tolerance for these conditions.[92/] It may be that many rail patrons are loyal to the mode and fear that expressions of disapproval may cause passenger train discontinuances. Also, no matter how bad rail travel is today, there is no doubt that it is an improvement over the low level of the days immediately preceding the creation of Amtrak.[93/] Nevertheless, unless quantum improvements are made in those areas which directly affect the traveler's well-being, health, and comfort, Amtrak may find it increasingly difficult to hold, much less expand, its ridership. While those who currently ride the rails may indicate overall satisfaction, the public-at-large tends to view rail as an unattractive alternative.[94/]

Comparison of the alternative modes, in terms of the subjective elements, is hampered by the absence of complaint records for intercity bus and air travel. Surveys of attitudes toward the various intercity travel modes typically find that air is held in high esteem. Air travel is described as a cleaner, "friendlier," more pleasant way to travel than any of the other modes. Dissatisfaction with air travel centers around failure to meet schedules and fear of flying. Bus travel is generally considered to be uncomfortable and a relatively unpleasant mode of intercity transportation.[95/] No objective studies were uncovered in time for this report to confirm or reject this widely held view.[96/]

It is unlikely that Amtrak contributes to the overall quality of intercity travel. The record of passenger complaints and the results of GAO and ICC studies indicate that, on balance, it performs less well than its competitors. The one feature which gives rail travel an advantage--the amount of on-board space allowed the traveler--has begun to decline recently. New Amfleet coaches with their greater seating capacity reduce the amount of space per passenger by approximately one-third, thereby diminishing the one unique aspect of train travel.[97/]

The weight of evidence presented here and in the materials cited provide little justification for the Amtrak subsidy. The system does not contribute to the overall quality or quantity of intercity travel available to the American public. There is nothing truly unique about rail that warrants special consideration. In all the elements of service that we have examined Amtrak performs no better, and usually less well, than the other modes. Up to this point, it cannot be said that Amtrak is a vital element of the intercity transport network or that it contributes "balance" to the nation's passenger transport system.

ECONOMIC CONSIDERATIONS

This section examines Amtrak's economic efficiency. The term "economic efficiency" is used in a very narrow sense. The external and social effects of Amtrak which are important in considering relative modeal efficiencies have already been discussed in preceding sections.

Before beginning this presentation, we must first deal with a subsidy issue. In a recent report by the Department of Transportation, Secretary Coleman charged that the other modes were providing better service than Amtrak without the benefit of subsidy.[98/] Amtrak hotly disputed this contention, and argued that the alternative modes were, indeed, heavily subsidized and, in fact, received far more public monies than Amtrak.[99/] While we will treat the issue of current relative subsidies below, it is useful to point out some of the difficulties that plague research in this area.

Vast amounts of public funds, not fully repaid through user charges, have been spent on the air and highway modes. The Association of American Railroads annually totals up government expenditures on non-rail modes to highlight the inequality of public support.[100/] These expenditures on the airway and highway infrastructures, combined with indirect subsidies for vehicle research and development and some direct airline subsidization, are partly responsible for the traffic shifts that left railroads bereft of patronage. It is true that the railroads themselves received substantial public aid in the form of land grants. However, some claim that these have been repaid over the years through reduced rates for services provided to the government.[101/] Regardless, the land grants did not directly benefit the rail mode, although they made many railroad builders very wealthy.[102/]

It can be argued that more equitable treatment would have prevented rail passenger service from falling into the delibitated condition that Amtrak inherited. In order to evaluate this contention, it is necessary to construct a counterfactual hypothesis (i.e., what would be the relative position of each mode if the government had remained neutral?). While such an exercise is academically interesting, it provides little help in formulating current public policy or in determining the proper level of subsidy for each mode today. Although past public policy is largely responsible for the present situation, that past cannot be altered. It may have been a tremendous error to develop the highway and air modes to the extent we have, but they remain developed, and we must deal with the world as it is. One author has demonstrated rather convincingly that the development of the railroads was not an indispensable aspect of American economic growth. We could have accomplished much the same level of economic development if we had invested in canals instead.[103/] But the railroads were developed, and no one seriously suggests that parallel waterways now be built in the interest of modal fairness.

It is unfortunate that many otherwise astute observers have taken an anthropomorphic view of intercity train services. They speak of the death of trains, for example, as if they had a life of their own. We must analyze the service and its potential, in terms of its ability to perform a given task, i.e., transport people from place to place. The analysis must concentrate on effectiveness in performing the task in terms of the cost of the resources.

Economic Efficiency

The national interest requires that the output of intercity passenger transportation services be produced with minimum use of scarce resources. Efficiency in resource utilization is normally thought to be the natural result of economic competition among privately owned firms. The interaction of atomistic suppliers and demanders seeking to maximize profits and satisfaction will produce efficient markets. Inefficient producers will fail to survive the rigors of the market place. If excess profits materialize, new firms will enter the industry, and by their competition, eliminate them.

Rightly or wrongly, it has been decided that reliance on this market/price system is inappropriate for transportation. Over the years an extensive system of price and service regulation has developed. The rationale for substituting regulation for competition traces to the perceived unique characteristics of transportation. Because of the "natural monopoly" elements inherent in transportation, unrestrained competition was considered unworkable. The market mechanism would produce suboptimal levels of output at unjust and unreasonable rates, and would result in some firms earning monopoly rents.

In this context, Congress has stressed the need for economic efficiency, but has attached a different meaning to that term than is employed by economists. Transportation service should be cost-effective, that is, it should use no more resources than necessary to provide desired services.[104/] Regulatory practices have often concentrated on protecting the financial viability of firms in the industry, and stability of modal market shares, rather than on encouraging economic efficiency. This, combined with public subsidization and investment policies, yields an outcome which is radically different from what would have occurred if free markets were allowed to operate. This result, as many have observed, is far removed from the Paretian optimum. These broader issues are treated elsewhere and will not be covered in detail in this report.

Here, we will examine the economic efficiency of Amtrak in terms of the relative economic cost of intercity passenger service provision. Ideally, the appropriate measure of economic efficiency would be long-run marginal cost, but data limitations preclude the use of this measure. Instead, we will use average cost as the best measure of economic efficiency. We will exclude social costs, because they have already been discussed, but it is necessary to include more than just the direct costs incurred by the operators of passenger transport services. All scarce resources employed in service provision should be included, such as subsidies and costs of using unpaid factors (such as the imputed value of an auto driver's own time). Further, intercity travel costs for automobile users should include the cost of meals, lodging, and tolls where such charges are appropriate. These services are cost elements when provided by common carriers, and they must be included when they are incurred by users of modes that do not provide them as part of the transport service.

There is an important distinction between cost and price of a service. The price of undertaking an intercity trip is an important determinant of modal demand and the volume of interurban tripmaking. To some extent, the price is under the control of the trip-maker. If he drives, he may decide not to stop overnight and avoid lodging costs. If he takes the train, he may decide to pack his own meal. Costs, on the other hand, are the value of resources used up in providing the transportation service. The dining car operates whether or not the traveler chooses to use it. A national network of motels, hotels, and resturaunts operates solely to meet the needs of intercity travelers. In the case of rail, these ancillary services are provided by Amtrak. This tends to make intermodal comparisons very difficult. However, these operating differences may be considered natural or inherent modal advantages or disadvantages and, therefore, may be considered irrelevant to the narrow question of economic efficiency. With these caveats in mind, we will proceed to our analysis of comparative modal economic performances.

Amtrak Efficiency

The rapidly-growing deficits from passenger train operation in the pre-Amtrak period are well documented.[105/] Whether the deficits were measured on a full-cost or solely-related cost basis, they were unacceptably large and had become a burden on the railroads (see Table 2.26). The elimination of many of the more unprofitable trains in May 1971 was expected to enable Amtrak to provide service with a minimum of public financial support. Instead, during the past six years of Amtrak operations the long-term pattern of ever-mounting deficits proceeded apace, with ridership increases more than offset by spiraling operating costs.

During the first full year of Amtrak operations, operating expenses per revenue passenger-mile (RPM) averaged 10.2 cents systemwide.[106/] By late 1974 these had grown to 15.1 cents per RPM and by 1976 had risen to 18.0 cents per RPM.[107/] Amtrak's operating ratio, after improving from 1.91 in 1972 to 1.76 in 1973, began to deteriorate so that by 1976 operating expenses were 2.52 times greater than system revenues. Tables 2.27 and 2.28 provide current operating statistics on a route-by-route basis. Note that these performance figures seem to indicate that long-distance trains perform better than short-distance trains (outside the Northeast Corridor). Although revenue per RPM is somewhat higher on short-haul routes, expenses per RPM are much higher for short-haul trains than long-haul ones. The operating ratio is also worse for short distances,

TABLE 2.26

PASSENGER DEFICITS OF U.S. CLASS I RAILROADS
1941-1970

Year	Solely Related Passenger Deficit Millions of Dollars*	Full-Cost Passenger Deficit Millions of Dollars*
1941	(74)	226
1942	(499)	(89)
1943	(1021)	(280)
1944	(1036)	(234)
1945	(942)	(230)
1946	(405)	140
1947	(127)	427
1948	(34)	560
1949	44	650
1950	(73)	509
1951	50	681
1952	3	642
1953	37	705
1954	76	670
1955	85	637
1956	121	697
1957	114	724
1958	82	610
1959	38	544
1960	10	485
1961	(17)	408
1962	(12)	394
1963	9	399
1964	18	410
1965	44	421
1966	31	400
1967	138	485
1968	198	486
1969	225	464
1970	252	477

* Parantheses indicate surpluses rather than deficits.

SOURCES: The full cost deficit figures are from Association of American Railroads, Yearbook of Railroad Facts, Washington, D.C., Selected Years; figures for 1959-1962 are from Donald M. Steffee, "The Year Amtrak Abandoned Racetracks, the Conventional Failed to Top 80 MPH, Germany Scored on Comprehensiveness, Japan Experienced a Lull, and (sob) Milwaukee Road Bowed Out," Trains Magazine, June 1972, pp. 39-42. The solely related deficit figures are from James C. Nelson, Railroad Transportation and Public Policy, (Washington, D.C.: The Brookings Institution, 1959, p. 295; for 1958-68, ICC Report on Railroad Passenger Transportation; and for 1969-70, Yearbook of Railroad Facts.

TABLE 2.27

REVENUE AND COST PER REVENUE PASSENGER MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Revenue Passenger Miles[a]	Revenue Per Revenue Passenger Mile (Cents) (Col. 2÷Col.4)	Cost Per Revenue Passenger Mile (Cents) (Col. 3÷Col. 4	Profit (Loss) Per Revenue Passenger Mile (Cents) (Col. 5÷Col. 6)
Northeast Corridor						
New York City-Washington (Metroliner)	$40,357	$57,747	321,695	12.5¢	18.0¢	(5.5¢)
New York City-Washington (Conventional)	11,011	26,709	160,094	6.9	16.7	(9.8)
Boston-Washington	27,791	60,261	395,608	7.0	15.2	(8.2)
New Haven-Springfield	684	2,215	8,485	8.1	26.1	(18.0)
New York City-Philadelphia	8,129	29,124	162,199	5.0	18.0	(13.0)
Harrisburgh-Philadelphia	2,257	5,591	39,580	5.7	14.1	(8.4)
New York City-Harrisburgh	812	2,340	13,020	6.2	18.0	(11.8)
Northeast Corridor Totals	$91,041	$183,987	1,100,681	8.3¢	16.7¢	(8.4¢)
Traversing Northeast Corridor						
Washington-Montreal	$4,916	$17,202	64,711	7.6¢	26.6¢	(19.0¢)
New York City-Florida	34,684	75,615	548,250	6.3	13.8¢	(7.5)
Chicago-NYC-Washington	10,107	25,393	130,164	7.8	19.5¢	(11.7)
Kansas City-NYC-Washington	5,475	18,203	74,953	7.3	24.3¢	(17.0)
Boston-Newport News	149	234	1,618	9.2	14.5¢	(5.3)
New York City-Savannah	182	285	3,509	5.9	9.3¢	(3.4)
Traversing Northeast Corridor Totals	$55,513	$136,932	822,755	6.7¢	16.6¢	(9.9¢)

TABLE 2.27
(Continued)
REVENUE AND COST PER REVENUE PASSENGER MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Revenue Passenger Miles[a/]	Revenue Per Revenue Passenger Mile (Cents) (Col. 2÷Col.4)	Cost Per Revenue Passenger Mile (Cents) (Col. 3÷Col. 4	Profit (Loss) Per Revenue Passenger Mile (Cents) (Col. 5÷Col. 6)
Short Haul						
New York City-Buffalo-Detroit	$7,492	$19,647	109,640	6.8¢	17.9¢	(11.1¢)
Chicago-St. Louis	3,836	11,106	53,868	7.1	20.6	(13.5)
Chicago-Milwaukee	1,272	5,847	19,648	6.5	29.8	(23.3)
Chicago-Detroit	4,089	14,323	62,889	6.5	22.8	(16.3)
Chicago-Carbondale	1,951	5,162	23,167	8.4	22.3	(13.9)
Chicago-Quincy	1,750	2,372	13,820	12.7	17.2	(4.5)
Los Angeles-San Diego	1,853	6,770	31,698	5.8	21.4	(15.6)
Seattle-Portland	858	6,392	15,334	5.6	41.7	(36.1)
Vancouver-Seattle[b/]	239	2,799	3,530	6.8	79.3	(72.5)
Washington-Cumberland	388	2,658	5,475	7.1	48.5	(41.4)
San Francisco-Bakersfield	553	6,042	9,172	6.0	65.9	(59.9)
New York City-Montreal	2,608	5,054	17,901	14.6	28.2	(13.6)
Chicago-Port Huron	2,138	4,344	14,198	15.1	30.6	(15.5)
Chicago-Dubuque	893	1,517	4,146	21.5	36.6	(15.1)
Minneapolis-Superior	762	1,510	4,744	16.1	31.8	(15.7)
Los Angeles-Las Vegas[c/]	53	97	560	10.1	17.3	(7.3)
Special Trains	388	388	---	---	---	---
Short Haul Totals	$31,126	$96,028	389,790	8.0¢	24.6¢	(16.6¢)

TABLE 2.27
(Continued)
REVENUE AND COST PER REVENUE PASSENGER MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Revenue Passenger Miles a/	Revenue Per Revenue Passenger Mile (Cents) (Col. 2÷Col.4)	Cost Per Revenue Passenger Mile (Cents) (Col. 3÷Col. 4	Profit (Loss) Per Revenue Passenger Mile (Cents) (Col. 5÷Col. 6)
Long Haul						
Chicago-Washington-Norfolk	$3,454	$18,415	59,330	5.8¢	31.0¢	(25.2¢)
Chicago-Seattle (North)	11,970	35,658	175,163	6.8	20.4	(13.6)
Chicago-Seattle (South)	5,752	25,017	90,329	6.4	27.7	(21.3)
Chicago-San Francisco	12,539	36,190	188,177	6.7	19.2	(12.5)
Chicago-Los Angeles	16,622	39,317	265,011	6.3	14.8	(8.5)
Chicago-Houston	6,767	17,680	115,648	5.9	15.3	(9.4)
Chicago-New Orleans	5,160	11,130	88,470	5.8	12.6	(6.8)
Chicago-Florida	6,246	26,896	87,634	7.1	30.7	(23.6)
St. Louis-Laredo	1,156	6,532	17,758	6.5	36.8	(30.3)
New Orleans-Los Angeles	4,939	10,841	82,734	6.0	13.1	(7.1)
Seattle-Los Angeles	10,864	22,190	171,739	6.3	12.9	(6.6)
Chicago-New York City-Boston	4,331	7,494	62,416	6.9	12.0	(5.1)
Long Haul Totals	$89,800	$257,360	1,404,409	6.4¢	18.3¢	(11.9¢)
AMTRAK TOTAL (Excluding Northeast Corridor)	$120,926	$353,388	1,794,199	6.7¢	19.7¢	(13.0¢)
NORTHEAST CORRIDOR TOTALS	$146,551	$320,919	1,923,436	7.6¢	16.7¢	(9.1¢)
AMTRAK SYSTEM TOTALS	$267,481	$674,307	3,717,635	7.2¢	18.1¢	(10.9¢)

NOTES: a/ Revenue passenger mile means the carriage of a revenue passenger one mile. It does not include miles generated by the carriage of non-revenue passengers such as railroad employees traveling on passes.

b/ The International Bridge between the U.S. and Canada was out from January-April 1976; therefore the data shown for the Vancouver-Seattle routes represent 8 months of data only.

c/ Los Angeles-Las Vegas are experimental (seasonal) routes. Only two months of data are shown--May-June 1976.

TABLE 2.28

REVENUE AND COST PER TRAIN MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Train Miles	Revenue Per Train Mile (Col.2÷Col.4)	Cost Per Train Mile (Col.3÷Col.4)	Profit (Loss) Per Train Mile (Col. 5÷Col. 6)
Northeast Corridor						
New York City-Washington (Metroliner)	$40,357	$57,747	2,262	$17.84	$25.53	($ 7.69)
New York City-Washington (Conventional)	11,011	26,709	1,229	9.01	21.86	(12.85)
Boston-Washington	27,791	60,094	2,172	12.80	27.76	(14.96)
New Haven-Springfield	684	2,215	255	2.68	8.69	(6.01)
New York City-Philadelphia	8,129	29,124	687	11.83	42.39	(30.56)
Harrisburgh-Philadelphia	2,257	5,591	677	3.33	8.26	(4.93)
New York City-Harrisburgh	812	2,340	111	7.32	21.08	(13.76)
Northeast Corridor Totals	$91,041	$183,987	7,393	$12.33	$24.91	($12.58)
Traversing Northeast Corridor						
Washington-Montreal	$4,916	$17,202	490	$10.03	$35.11	($25.08)
New York City-Florida	34,684	75,615	3,887	8.92	19.45	(10.53)
Chicago-NYC-Washington	10,107	25,393	1,340	7.54	18.95	(11.41)
Kansas City-NYC-Washington	5,475	18,203	1,428	3.83	12.75	(8.92)
Boston-Newport News	149	234	21	7.10	11.14	(4.04)
New York City-Savannah	182	285	26	7.00	10.96	(3.96)
Traversing Northeast Corridor Totals	$55,513	$136,932	7,192	$7.72	$19.04	($11.32)

TABLE 2.28
(Continued)
REVENUE AND COST PER TRAIN MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Train Miles	Revenue Per Train Mile (Col.2÷Col.4)	Cost Per Train Mile (Col.3÷Col.4)	Profit (Loss) Per Train Mile (Col. 5÷Col. 6)
Short Haul						
New York City-Buffalo-Detroit	$7,492	$19,647	1,231	$6.09	$15.96	($10.30)
Chicago-St-Louis	3,836	11,106	595	6.45	18.67	(12.22)
Chicago-Milwaukee	1,272	5,847	255	4.99	22.93	(17.84)
Chicago-Detroit	4,089	14,323	641	6.38	22.34	(15.96)
Chicago-Carbondale	1,951	5,162	322	6.06	16.03	(9.97)
Chicago-Quincy	1,750	2,372	191	9.16	12.42	(3.26)
Los Angeles-San Diego	1,853	6,770	281	6.59	24.09	(17.50)
Seattle-Portland	858	6,392	272	3.15	23.50	(20.35)
Vancouver-Seattle[a/]	239	2,799	76	3.14	36.83	(33.69)
Washington-Cumberland	388	2,658	124	3.13	21.44	(18.31)
San Francisco-Bakersfield	553	6,042	319	1.73	18.94	(17.21)
New York City-Montreal	2,608	5,054	278	9.38	18.18	(8.80)
Chicago-Port Huron	2,138	4,344	233	9.18	18.64	(9.46)
Chicago-Dubuque	893	1,517	133	6.71	11.41	(4.70)
Minneapolis-Superior	762	1,510	107	7.12	14.11	(6.99)
Los Angeles-Las Vegas[b/]	56	97	3	18.66	32.33	(13.67)
Special Trains	388	388	N/A	----	----	----
Short Haul Totals	$31,126	$96,028	5,061	$6.15	$18.97	($12.82)

NOTES:

a/ The International Bridge between the U.S. and Canada was out from Jan.-April '76; therefore, the data shown for the Vancouver-Seattle routes represent 8 months of data only.

b/ L.A.-Las Vegas are experimental (seasonal) routes. Only 2 months of data are shown--May-June 1976.

TABLE 2.28
(Continued)
REVENUE AND COST PER TRAIN MILE
FISCAL YEAR 1976
(In Thousands)

Amtrak Route	Revenue	Expenses	Train Miles	Revenue Per Train Mile (Col.2÷Col.4)	Cost Per Train Mile (Col.3÷Col.4)	Profit (Loss) Per Train Mile (Col. 5÷Col. 6)
Long Haul						
Chicago-Washington-Norfolk	$3,454	$18,415	2,044	$1.69	$9.01	($7.32)
Chicago-Seattle (North)	11,970	35,658	1,673	7.15	21.31	(14.16)
Chicago-Seattle (South)	5,752	25,017	1,325	4.34	18.88	(14.54)
Chicago-San Francisco	12,539	36,190	1,777	7.06	20.37	(13.31)
Chicago-Los Angeles	16,622	39,317	1,627	10.22	24.17	(13.95)
Chicago-Houston	6,767	17,680	1,792	3.78	9.87	(6.09)
Chicago-New Orleans	5,160	11,130	676	7.63	16.46	(8.83)
Chicago-Florida	6,246	26,896	2,243	2.78	11.99	(9.21)
St. Louis-Laredo	1,156	6,532	379	3.05	17.23	(14.18)
New Orleans-Los Angeles	4,939	10,841	640	7.72	16.94	(9.22)
Seattle-Los Angeles	10,864	22,190	996	10.91	22.28	(11.37)
Chicago-New York City-Boston	4,331	7,494	994	4.36	7.54	(3.18)
Long Haul Totals	$89,800	$257,360	16,166	$5.55	$15.92	($10.37)
AMTRAK TOTAL (Excluding Northeast Corridor)	$120,926	$353,388	21,227	$5.70	$16.65	($10.95)
NORTHEAST CORRIDOR TOTALS	$146,551	$320,919	14,585	$10.05	$22.00	($11.95)
AMTRAK SYSTEM TOTALS	$267,481	$674,307	35,812	$7.47	$18.83	($11.36)

SOURCE: ICC, Report to the President and the Congress, Effectiveness of the Act, Washington, D.C., 1977, table 3-11.

but th's is more indicative of the very low load-factors Amtrak has on its short-distance trains, than of any inherent operating superiority of long-distance train services. The results for the heavily traveled Northeast Corridor are much better than for the system as a whole, but expenses still exceed revenues by a ratio of more than two to one.[108/] Deficits have continued to mount, despite the ridership increase by 1976 to nearly one-third above 1972 levels, and despite Amtrak's replacement of deteriorated operating equipment.

Not a single Amtrak route covers operating expenses. Although improved load factors would help to reduce the deficit, it is hard to imagine load factors much above 60 percent (given the operating characteristics of intercity rail). Furthermore, even if trains were run at 100 percent of percent Amtrak would still fail to cover operating costs. (It is estimated that with 100 percent load factors, Amtrak would still lose between $75 and $100 million annually.)[109/]

Amtrak has made some progress in improving the operating performance of some routes through new equipment and more attractive fares. Figure 2.29 shows how these innovations have affected route operating performances. However, note that although the loss per RPM has declined, the total deficit on these routes continues to increase. The ridership and revenue increases engendered by these improvements have not been great enough to offset the costs of their achievement.

Part of Amtrak's problem has been caused by adding new routes which are unable to generate ridership and revenues sufficient to even begin to match associated expenses. Table 2.30 ranks 20 Amtrak routes by decreasing avoidable loss per revenue dollar. (Avoidable loss is the amount that would be saved if the train did not run.) Most of these routes were added after

TABLE 2.29

RESULTS OF SERVICE IMPROVEMENTS
SELECTED AMTRAK ROUTES

Chicago-Detroit

Actions:

1. An additional round-trip (3 instead of 2 daily round trips) was added consonant with change from conventional to turboliner equipment, May 15, 1975. Service is now maintained with a combination of turboliner and new Amfleet equipment.

2. A major advertising campaign and promotional activity in Michigan cities.

3. Subsequent schedule adjustments have been made to more closely fit market requirements.

Results:

For comparative periods October-April 1974/75

	Passengers	Passenger-Miles	Revenue
1974	140,000	22,074,000	$1,190,000
1975	240,000	34,782,000	$1,794,000
Change	72%	57.6%	51.6%

	Revenue	Riders	Full Cost	RPM's	Loss/RPM
Before (Jan-Apr '75)	$744	84,000	$2,529	11,842	$0.151
After (Jan-Apr '76)	$1199	138,000	$3,918	20,133	$0.135

Los Angeles-San Diego

Actions:

1. Amfleet equipment introduced on May 16, 1976, replacing all conventional equipment with new Amfleet equipment.

2. Added one round trip daily increasing frequency from 3 to 4 round trips daily; 403(b) operation supported by CalTrans.

3. Network television advertising keyed to Amfleet introduction.

Results:

For comparative period May-November 1975/76

	Passengers	Passenger-Miles	Revenue
1975	224,000	19,909,000	$988,000
1976	303,000	26,865,000	$1,370,000
Change	35.3%	34.9%	38.7%

Amfleet Equipment	Revenue	Riders	Full Cost	RPM's	Loss/RPM
Before (Jun-Dec '75)	$1,009	213,000	$3,528	19,071	$0.132
After (Jun-Dec '76)	$1,516	307,000	$5,019	27,561	$0.127

TABLE 2.29
(Continued)
RESULTS OF SERVICE IMPROVEMENTS
SELECTED AMTRAK ROUTES

Seattle-Portland

Actions:

1. Introduced Amfleet equipment on July 19, 1976.
2. Instituted 25% round-trip excursion discount on August 8, 1976.
3. Network television advertising keyed to Amfleet equipment introduction.

Results:

For comparative periods July-November 1975/76

	Passengers	Passenger-Miles	Revenue
1975	49,000	7,200,000	$295,000
1976	68,000	10,131,000	$424,000
Change	38.8%	40.7%	43.7%

	Revenue	Riders	Full Cost	RPM's	Loss/RPM
Before (Aug-Dec '75)	$305	46,000	$2,446	6,886	$0.311
After (Aug-Dec '76)	$474	71,000	$2,576	10,581	$0.199

Seattle-Vancouver

Actions:

1. Amfleet equipment introduced on July 19, 1976.
2. Instituted 25% round-trip excursion discount on August 8, 1976.
3. Network television advertising keyed to Amfleet equipment introduction.

Results:

For comparative periods July-November 1975/76

	Passengers	Passenger-Miles	Revenue
1975	21,000	2,495,000	$124,000
1976	34,000	3,754,000	$188,000
Change	61.9%	50.5%	51.6%

	Revenue	Riders	Full Cost	RPM's	Loss/RPM
Before (Aug-Dec '75)	$128	20,000	$1,149	2,364	$0.432
After (Aug-Dec '76)	$221	35,000	$1,379	4,084	$0.284

SOURCE: U.S. Congress, House, Committee on Appropriations, Hearings Before the House Appropriations Committee on Federal Grants to the National Railroad Passenger Corporation,/Testimony of National Railroad Passenger Corporation/, March 7, 1977, 95th Cong., 1st Sess., Washington, D.C.: GPO, 1977.

TABLE 2.30

TWENTY AMTRAK ROUTES
RANKED BY DECREASING AVOIDABLE LOSS PER REVENUE DOLLAR
FISCAL YEAR 1976

Route	Avoidable Loss Per Revenue Dollar
1. San Francisco-Bakersfield	5.99
2. Seattle-Vancouver	5.88
3. Seattle-Portland	3.93
4. Washington-Cumberland	3.25
5. St. Louis-Laredo	3.19
6. Chicago-Washington/Norfolk	3.16
7. Chicago-Dubuque	2.97
8. Minneapolis-Superior	2.54
9. Chicago-Seattle (South)	2.25
10. Chicago-Port Huron	2.23
11. Chicago-Florida	2.18
12. New York-Montreal	1.75
13. Chicago-Milwaukee	1.56
14. Washington-Montreal	1.40
15. Kansas City-New York/Washington	1.37
16. Chicago-Detroit	1.36
17. Chicago-Carbondale	1.34
18. Empire service	1.32
19. New York-Philadelphia	1.30
20. Chicago-Quincy	1.29

SOURCE: U.S. Congress, House, Committee on Appropriations, Hearings Before the House Appropriations Committee on Federal Grants to the National Rail-Road Passenger Corporation, March 7, 1977, 95th Cong., 1st Sess., Washington, D.C.: GPO, 1977, p. 670.

TABLE 2.31

TWENTY AMTRAK ROUTES
RANKED BY DECREASING AVOIDABLE LOSS
FISCAL YEAR 1976

Route	Avoidable Loss
1. New York-Florida	20,874,000
2. Chicago-San Francisco	15,315,000
3. Chicago-Seattle (North)	14,891,000
4. Chicago-Los Angeles	14,097,000
5. Chicago-Florida	13,514,000
6. Chicago-Seattle (South)	12,857,000
7. Chicago-Washington/Norfolk	10,859,000
8. New York-Philadelphia	10,477,000
9. Boston-Washington	10,348,000
10. Chicago-New York/Washington	9,118,000
11. Empire service	8,431,000
12. Kansas City-New York/Washington	7,423,000
13. Washington-Montreal	6,820,000
14. Seattle-Los Angeles	6,769,000
15. Chicago-Houston	5,850,000
16. Chicago-Detroit	5,163,000
17. Conventional Corridor	5,115,000
18. Chicago-St. Louis	4,164,000
19. Chicago-Laredo	3,630,000
20. New Orleans-Los Angeles	3,409,000

SOURCE: U.S. Congress, House, Committee on Appropriations, Hearings Before the House Appropriations Committee on Federal Grants to the National Railroad Passenger Corporation, March 7, 1977, 95th Cong., 1st Sess., Washington, D.C.: GPO, 1977, p. 671.

May 1971. However, the data in Table 2.31 showing the 20 routes responsible for the largest avoidable losses demonstrate that most of the avoidable deficit is produced by basic system services.

Clearly, the long-distance routes are responsible for the bulk of Amtrak deficits while the non-basic-system, short-haul trains are among the Corporation's more inefficient operations. Unfortunately, there is not much positive that can be said about the economics of any component of the Amtrak system.

Efficiency of Other Modes

If we compare Amtrak's economic performance to those of the alternative modes, we find that rail has become the most expensive mode of intercity passenger transportation. The subsidies received by other modes are large, far larger than those granted intercity rail passenger travel. As Amtrak points out, the DOT recently allocated over $1 billion for 4.3 miles of urban highway in New York.[110/] But when these outlays are considered on a performance basis, it is rail travel that is more heavily subsidized.

Intercity bus transportation, although its ridership has not changed much over the past decade, has managed to retain operating superiority over passenger rail. Bus operating expenses per passenger-mile have increased--but only from 5.1 cents to slightly over 6 cents per RPM since 1972. Further, over the years bus companies have adjusted their operations in response to changes in the competitive environment. In 1939, for example, fares from passengers traveling over regular intercity routes accounted for 92.1 percent of bus revenues. Today, they account for less than 70 percent. Charter, special, and package express services now generate approximately 27 percent of Class I motor bus revenues.[111/] Such adjustment to changing market conditions has not been a hallmark of rail passenger operations.

Automobile operating costs have been estimated by several investigators. Perhaps the most widely used auto cost estimates are those computed by the Federal Highway Administration.[112/] That agency estimated that in 1976 the total cost per vehicle-mile ranged from 12.6 cents per vehicle-mile for a sub-compact to 17.9 cents for a standard-sized car. If we assume an average occupancy of 2.19 passengers, the per passenger-mile cost is between 5.75 cents and 8.17 cents. The FHWA figures include depreciation, maintenance, parts, accessories, tires, tolls, parking, gas and oil (exclusive of taxes), insurance, Federal and State taxes, and assume a 10 year, 100,000 mile vehicle life.

The cost of resources employed in making an intercity auto trip should include some amount for the effort expended by the driver. One study employed a variable payment to the driver depending on trip purpose. It assumed that pleasure driving should be valued at 25 percent of the average wage rate, while business travel equalled 100 percent.[113/] This adds between one and four cents per passenger-mile to the average cost figures.

Additional costs are governmental expenditures on the highway and road network that are not covered by user fees. These include capital expenditures for road construction, maintenance, and surface upgrading, property taxes foregone, and the cost of highway patrol services, administration, and similar expenses. Unfortunately, assignment of these uncovered subsidies among the various users of the highway network is virtually impossible. Because trucks require a higher cost roadway, and because they carry heavier loads and increase the need for maintenance, some have argued that trucks have failed to pay their full share of highway costs. In addition, expenditures for urban and suburban roads primarily benefit commuter travel and should not be charged to the intercity tripmaker. There is extensive cross-subsidization involved, and it is quite possible that the intercity traveler more than bears the full cost of his tripmaking.[114/] Yet, even if the entire $20 billion spent annually on highways could be charged to the intercity traveler, the net effect would be to add only one to two cents per passenger-mile to the average auto operating costs. This still leaves intercity passenger auto travel far less costly than rail.

The economic efficiency of air passenger transportation has recently been the subject of congressional investigation. There is considerable evidence that operating expenses per passenger-mile are far higher than is consistent with the goal of economic efficiency. Because the Civil Aeronautics Board had long precluded the airlines from engaging in price competition, the certificated carriers competed on the basis of service.[115/] Sources of airline operating inefficiencies include operating a large number of flights to gain market identification; providing on-board amenities in excess of what passengers would ask or pay for given the choice; operating the newest equipment in anticipation of demand that often fails to materialize; and designing seating densities to improve passenger comfort rather than to maximize revenues.[116/] Despite these inefficiencies, the expense per RPM in 1974 was 8 cents, which is lower than the deficit per RPM for Amtrak services. The public monies expended on Amtrak could be used to pay for air trips for all Amtrak patrons.

The amount of subsidy to air travelers is difficult to estimate. Although airlines pay landing fees, airport rentals, and some terminal construction costs,[117/] it is unlikely that they pay the full cost of providing the terminal. This cost is often borne by local taxpayers with some assistance from the State and Federal Government.[118/] Navigation and control systems are likewise a major public contribution which is largely uncovered by user fees, although the evidence suggests it is general aviation, not commercial aviation, that is not paying its fair share.[119/] Further, much of the cost of research into new technology has been undertaken by the Federal Government. Jets were developed as military planes and later adapted to commercial use. Whether this type of government expenditure should be considered a "subsidy" is unclear, but it places rail at a disadvantage in terms of technological development. However, even if airline costs were recalculated to include these subsidies, operating costs would rise by less than 25 percent, and would remain substantially below intercity rail costs.

Conclusion

The presence of subsidy in any mode indicates that fares are not just and reasonable. If we added together all direct and indirect subsidies and a charge for the social costs of intercity travel, costs for all modes would be higher. Given the evidence presented in the enviromental section of this report, it is unlikely that including these social costs greatly improves the relative position of rail, at least not at current modal performance levels.

Amtrak's fare policy from the outset has been to remove regional differences and to reduce fares that are not cost-based. There still remain (as in the case of the other modes) rail fare differentials that are not reflective of relative costs. However, perhaps the major difficulty with Amtrak's fare structure is the distance taper, which Amtrak introduced in emulation of air and bus modes. Long-distance train riders, whose subsidized use of Amtrak generates the least social savings, pay a lower rate per passenger-mile than short-distance travelers. The economics of tapered fares may be justified for those modes which largely pay their own way, but a service whose rationale is predicated on the existence of external benefits should price its services so that those travelers generating the most social savings pay the lowest fare. Although constructing and implementing an inverted fare taper would be difficult, it is necessary to produce just and reasonable fares--fares which require travelers who produce the least (perhaps negative) social savings be charged, as nearly as possible, the full cost of the resources they consume.

Intercity rail passenger service is not a viable industry as viability is typically defined. There is no positive return on invested capital or shareholder equity. The operating ratio is greater than 200 percent. Congress and other governmental agencies have often admonished the Corporation to attempt to reduce costs, increase revenues, and reduce the deficit, but Amtrak is no longer seriously expected to make a profit.

Amtrak contends that its performance, thus far, must be evaluated taking full account of the enormity of the task of restoring rail passenger service. It must make up for years of railroad neglect, and its special relationship with operating railroads limits how far and how fast it can accomplish improvements. In fact, Amtrak can point to many areas of success. It has replaced much of the deteriorated operating equipment, refurbished and rebuilt stations, improved maintenance procedures, improved employee morale, modernized the reservations and information system, and turned around the long-term decline in train usage.

On the other hand, Amtrak recently announced that it might have to cut back service in the Northeast Corridor if Congress denied supplemental appropriations. Because the NEC is the only area of the nation where frequent train services are provided, it is a logical candidate for service cut-backs. Thus, the Corporation was obliged to consider reducing service levels in the only markets where trains may be contributing to the public welfare and where subsidized rail service may be justified. Unfortunately, Amtrak had little ch ice. Service reductions on many other routes would be impossible without eliminating the service altogether. The restrictions on train discontinuance, established in the legislation, render this option impossible. The appropriations were granted and the service cuts were not made.

The question remains: Are the accomplishments worth the price? The evidence presented in this section indicates that they are not. Given Amtrak's performance thusfar, the experiment must be deemed a failure. Passenger rail has not accomplished the tasks or alleviated the problems that the Congress specified as its mission. Yet, it is not possible to conclude that the experiment should be terminated. Most defenders of Amtrak will readily admit that the system does not now contribute much to the nation's transportation network, but they reason that as Amtrak continues to make improvements, and as the energy and environmental crises worsen, intercity rail passenger services will become an increasingly important component of the national transport environment. We now turn to an examination of Amtrak's longer term potential.

REFERENCES

CHAPTER 2

1. U.S. Federal Energy Administration, Project Independence Blueprint - Final Task Force Report, Vol. 2, Washington, D.C.: 1974, p. 19.

2. U.S. Congress, House, Committee on Appropriations, Hearing Before House Appropriation Committee on Federal Grants to the National Railroad Passenger Corporation -- [Testimony of Amtrak President, Paul Reistrup] -- March 7, 1977, 95th Cong., 1st sess., Washington, D.C.: Government Printing Office, 1977, p. 445.

3. Connectivity is an important element of Amtrak intercity train services. See William Anderson, Amtrak Connectivity, unpublished working paper, Washington, D.C.: U.S. Department of Transportation, 1973.

4. House Committee on Appropriations, Hearing, p. 442.

5. Ibid., pp. 435-436.

6. Wisconsin State Department of Transportation, Wisconsin State Rail Plan: The Future of Wisconsin Rail Passenger Service, Madison, Wis.: 1975, Ch. 2.

7. Private air travel also has a very poor safety record.

8. See Anderson, Amtrak Connectivity, for specific route data.

9. The NEC is excluded because connectivity is less important in this market.

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11. U.S. Congress, Senate, Committee on Commerce, Science, and Transportation, Intercity Domestic Transportation System for Passengers and Freight, 95th Cong., 1st sess., Washington, D.C.: Government Printing Office, 1977, pp. 378-380.

12. U.S. Department of Transportation, National Highway Traffic Safety Administration, Societal Costs of Motor Vehicle Accidents, Washington, D.C.: 1972. The NHTSA estimate has been updated by an annual inflation factor for use in this report.

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14. For a discussion of the importance of transportation in energy consumption see John Pollard, Daniel Hiatt, and David Rubin, Summary of Opportunities to Conserve Transport Energy, Washington, D.C.: U.S. Department of Transportation, 1975.

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19. Edmund V. Morlok, "Comparison of Railroad and Truck Line Haul Work (Energy) Requirements Under Various Shipment Weight, Speed and Topographic Conditions," paper presented at annual meeting of Transportation Research Board, Washington, D.C., January 20, 1976.

20. U.S. Department of Transportation, Federal Railroad Administration, The Rail Passenger Service Act of 1970, Washington, D.C.: 1973.

21. House Committee on Appropriations, Hearings, p. 684.

22. See, for example, the Amtrak load factor estimate in U.S. Department of Transportation, National Transportation Trends and Choices (to the Year 2000), Washington, D.C.: Government Printing Office, 1977, p. 192.

23. Pollard, Hiatt, and Rubin, Summary of Opportunities, pp. 2-18.

24. This section on air pollution is adopted from William Hyman, "The Social Cost of the Automobile" (unpublished), Madison, Wis.: 1976, Ch. 6; See also U.S. Department of Transportation, Air Quality, Noise and Health: Report of a Panel of the Interagency Task Force on Motor Vehicle Goals beyond 1980, Washington, D.C.: 1976, Ch. 2.

25. L. B. Barrett and T. E. Waddell, Cost of Air Pollution Damage: A Status Report, Research Triangle Park, N.C.: U.S. Environmental Protection Agency, National Environmental Research Center, 1973, p. viii.

26. Research and Education Association, Pollution Control Technology, New York: 1973, p. 136.

27. Wilfred Bach, Atmosphere Pollution, New York: McGraw-Hill, 1972, p. 16.

28. Research and Education Association, Pollution Control, p. 97.

29. Ibid., pp. 97-99.

30. Ibid., p. 102.

31. Ibid., pp. 121-129.

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36. John W. Fuller and William Hyman, Energy and Environmental Effects of Railroad Abandonment, paper presented before the annual meeting of the Transportation Research Board, January 1976, pp. 13-15.

37. DOT, Air Quality, Noise and Health, pp. 4.4 and 5.33.

38. Ibid., pp. 5.1-5.51.

39. Ibid., pp. 5.12-5.17.

40. Civil Aeronautics Board, Airport Activity Statistics for Certificated Air Carriers (Tables 3 and 7), Washington, D.C.: monthly; Official Airline Guide, North American Edition, Oak Brook, Ill.: Reuben H. Donnelley, 1976.

41. The congestion parameters used in this study were provided by the Federal Aviation Administration and were from an in-house study done by the agency in 1972. The airports used in the regression analysis were O'Hare (Chicago), JFK and LaGuardia (NYC), Newark, and Washington National.

42. It should be noted that we are only considering delays due to air traffic congestion. Delays due to bad weather and other factors that cannot be offset by Amtrak diversion are not included.

43. This model was developed by Paul F. Deenemann and Armando M. Laga, External Costs and Benefits Analysis, NECTP, Bethesda, Md.: Resource Management Corporation, 1969.

44. F. Mulvey, The Northeast Corridor High-Speed Rail System Selected Impacts on Alternative Modes, Boston: Harbridge House, 1975.

45. The rate for NEC intercity auto travelers is 2.1 based on results of a study by Alan M. Voorhees and Associates, The Northeast Corridor Intercity Travel Survey: Air, Auto and Bus Modes, Washington, D.C.: 1971.

46. Intercity auto travel estimates are based on Peat, Marwick, Mitchell, and Co., "Demand Forecast for the Northeast Corridor," unpublished computer printout, March 1975. Intercity and commutation Corridor travel is estimated at 90 per cent of the total.

47. Note this is in approximate agreement with Amtrak's claim of its Corridor market share.

48. Mulvey, The Northeast Corridor, pp. II 20-22.

49. Ibid., pp. II 22-25.

50. Calculated from data on State and Federal motor vehicle gasoline tax rates, toll charges of bridges, tunnels and highways in the Corridor, and information provided by Air Transport Association of America.

51. Hyman, The Social Cost of the Automobile, Ch. 7.

52. DOT, Air Quality, Noise and Health, pp. 6.4-7.12.

53. Ibid., p. 6.21.

54. Hyman, The Social Cost of the Automobile, pp. 7.7-7.11.

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58. CAO, Amtrak's Incentive Contracts, pp. 9-22.

59. Ibid., pp. 15-16.

60. Ibid., pp. 19-20.

61. Ibid., pp. 16-17.

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63. GAO, Amtrak's Incentive Contracts, p. 22.

64. Ibid., p. 7.

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66. Ibid., pp. 80-94. See also U.S. Congress, Senate, Committee on the Judiciary, Subcommittee on Administrative Practice and Procedure, Oversight of Civil Aeronautics Board Practices and Procedures, Hearings, 94th Congress, 1st Session, Washington, D.C.: Government Printing Office, 1975.

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71. Ibid., pp. 394-396.

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74. U.S. Department of Transportation, Federal Aviation Administration, Commuter Air Carriers, An Overview, Washington, D.C.: 1975, pp. 10-11.

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78. Senate Committee on Commerce, Science, and Transportation, Intercity Domestic Transportation, p. 320.

79. National Railroad Passenger Corporation (Amtrak), Five Year Corporate Plan: Fiscal Years 1977-1981, Washington, D.C.: 1976, pp. 103-108.

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86. Interstate Commerce Commission, Ex Parte 277 (sub. No. 2): Adequacy of Intercity Rail Passenger Service, Washington, D.C.: 1976.

87. GAO, Quality of Amtrak Service, pp. 13-14.

88. GAO, Amtrak Incentive Contracts, pp. 24-26.

89. GAO, Quality of Amtrak Service, p. 12.

90. GAO, Quality of Amtrak Service, Ch. 3; also see Interstate Commerce Commission, Amtrak Maintenance Study and Facility Review, Washington, D.C.: 1976.

91. See for example, Wisconsin State DOT, *Wisconsin State Rail Plan*, Ch. 2.

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CHAPTER 3

AMTRAK'S LONGER TERM POTENTIAL

Before assessing Amtrak's future contribution to national transportation goals, we must describe the future transportation environment. Many different scenarios are possible, in light of the recent energy crisis. In the extreme, we could postulate a situation in which petroleum resources were completely exhausted. As rail is currently the only passenger transport mode capable of providing intercity service with non-petroleum based fuels, the future importance of Amtrak would be assured. This case is unlikely; although petroleum reserves are finite, estimated world reserves are thought to be sufficient to meet demands in the foreseeable future.

The forecast period chosen must be long enough so that Amtrak will have had ample opportunity to correct past problems and develop the best possible service for the riding public. Conversely, the period must not be so long that a great many major technological developments will have occurred. In such a case prognostication would be little more than crystal ball gazing.

For this report we will employ 1990 as the forecast year. This date is appropriate for the following reasons:

1. By 1990 Amtrak will have had nearly twenty years to bring about the revitalization of intercity rail passenger service;

2. Most forecasts of modal activity, energy availability, and environmental impacts do not go much beyond 1990. Therefore, this is the latest year for which projections of the operating environment are readily available;

3. No major technological breakthroughs, such as battery-powered automobiles capable of intercity trips, are expected by 1990.

INTERCITY PASSENGER TRANSPORT IN 1990

Several forecasts of intercity passenger travel in 1990 are available. These forecasts, while not in perfect agreement, usually project little change in modal market shares. A forecast based on an econometric model whose parameters are determined from historical relationships cannot be expected to project truly dramatic traffic shifts, unless a large change in a variable is hypothesized (e.g. the real price of auto gasoline quadruples), or the parameters themselves are arbitrarily adjusted based on the forecaster's own judgment. The former requires a priori documentation for such a break with historical trend, and the latter removes the rationale for employing models. Yet, given the discussion in Chapter 2, it is clear that projections which extrapolate from current trends, although they may be accurate, will forecast an insignificant role for Amtrak. Further, because most forecasts focus primarily on the dominant air and auto modes, Amtrak and intercity bus are usually afforded inadequate treatment. As the defense of Amtrak depends so heavily on its future role, we will examine its potential contribution in a highly favorable light. We will rely on Amtrak's optimistic ridership forecasts;[1/] adjust some of the performance measures for other modes;[2/] and assume that Amtrak will attain all possible improvements in service characteristics by 1990.

This gives a "best case" forecast of Amtrak's potential. If we err, we err in favor of the Corporation. The stream of benefits that can be expected from Amtrak over the forecast period will be compared to their cost of achievement.

Transportation projections made by Jack Faucett Associates are widely used in many analyses, and these will form the bases of our own evaluation of alternative market potential.[3/] However, we will make some critical adjustments in the Faucett estimates. In Faucett projections, the growth in demand for rail travel depends on the level of real per capita income. This takes inadequate account of the rather substantial improvements Amtrak plans to introduce during the forecast period.[4/] Even with Faucett's highest growth estimate, Amtrak's output is expected to increase only to 5 billion passenger-miles or approximately 22 million passengers in 1990. On the other hand, Amtrak forecasts that it will carry almost 23 million passengers by 1981.[5/]

The Corporation also cites a recent Federal Railroad Administration estimate of 30 million passengers in 1990 in the Northeast Corridor alone.[6/] If we employ Amtrak's projected growth rates and FRA's corridor ridership estimate, Amtrak will carry about 56 million riders in 1990 and generate nearly 12 billion passenger-miles. We will use these figures for rail in our analysis, rather than the more conservative Faucett projections.

For the other modes of intercity travel we will rely on the Faucett "most likely" projections. These are summarized in Table 3.1.

TABLE 3.1

PROJECTIONS OF 1990 INTERCITY TRAVEL LEVEL
NON-RAIL MODES

Mode	1990 Intercity Passenger-Miles (Billions)
Domestic Air Passenger	347.8
Intercity Bus	25.6
Private Automobile	3,519.1

SOURCE: Jack Faucett Associates, Inc., Transportation Projections 1985, 1995, 2000, Chevy Chase, Md.: 1977.

Even with our optimistic projections of Amtrak ridership growth, Amtrak will only capture 1.4% of the intercity travel market.[7] However, its impact may be important in those markets where it is an effective competitor. Our analysis will concentrate on those markets.

We will assume that new rail riders will continue to be attracted from other modes in the same proportion as hypothesized in Chapter II. However, Amtrak forecasts that short-distance train ridership will grow faster than long-distance travel (7% versus 4% annually).[8] Applying these differential rates growth, yields the ridership and diversion figures than appear in Table 3.2.

TABLE 3.2
1990 AMTRAK RIDERSHIP AND DIVERSION ESTIMATES

Type of Route	Amtrak Ridership (Millions of Passenger-Miles)	Diverted From: (Millions of Passenger-Miles)		
		Auto	Air	Bus
Northeast Corridor (All Metroliner)	4,500	1,800.0	2,250.0	450.0
Short-Distance Trains (5% of ridership in long-distance)	3,128	2,267.8	523.9	336.3
Long-Distance Trains (50% of ridership in short-distance)	4,250	2,125.0	1,381.25	743.75
TOTALS	11,878	6,192.8	4,155.15	1,530.05

Underlying our prediction of traffic growth are several assumptions concerning the operating characteristics of Amtrak services in 1990:

1. All locomotives and rolling stock inherited from the railroads will be replaced. New bi-level cars, long-distance, low-level cars, and Amfleet cars with their higher seating density and smoother ride quality will be in service. All

service in the NEC will be provided by second-generation Metroliner equipment.

2. The quality of Amtrak service in 1990 will have been improved as outlined in Amtrak's Corporate and marketing plans. Station facilities will have been modernized, and Amtrak employee development programs will have brought about the desired changes in employee attitudes.

3. The rights-of-way will have been improved so that Amtrak trains can average at least 60 mph on all routes. Travel delays due to bad track will be largely eliminated.

In effect, we are assuming that Amtrak will have greatly upgraded its service. We will not examine Amtrak's 1990 comparative performance in service and subjective areas because good service is the sine qua non of forecasted ridership growth. We assume that rail service will be reliable and attractive and competitive in the subjective areas that influence user satisfaction. We assume that Amtrak's triptimes will compare favorably with the other surface modes. Although no changes in relative modal accessibility are projected, we may witness some changes in modal frequencies. However, the question of service frequency will be postponed to the concluding section of this report.

SAFETY

There are no reasons to suspect that passenger rail will improve its relative position with respect to safety. As mentioned in Part II, all common carrier modes have enjoyed excellent safety records in the past, and these performances should continue. Automobile travel, although responsible for a large number of annual fatalities, has had a record of continual improvement in safety performance over the past 50 years (for example see Table 2.3). If for no other reason, demographic changes should guarantee a lower highway fatality rate in the 1990s: the number of younger drivers will decline due to current low birthrates.

With improvements in highway design, development of more crashworthy vehicles, and increased use of passive and active restraint systems, the auto mode could continue this trend of reduced fatalities,[10/] producing an auto fatality rate of 1.35 deaths per 100 million passenger-miles in 1990. On the other hand, the 1974 National Transportation Report suggests that if we do no more than maintain the present highway system, only a seven percent improvement can be expected by 1990.[11/] This lower bound auto safety estimate implies a passenger-mile fatality rate of 1.67 in 1990.

If the value of lives saved increases at the long-term rate of growth of real GNP per capita, then the benefit in 1990 from reduced fatalities due to auto traffic diversion to Amtrak is between $38.5 and $132.2 million. (See Table 3.3.)

TABLE 3.3

VALUE OF LIVES SAVED DUE TO AUTO TRAFFIC DIVERSION TO AMTRAK: 1990

	(Millions of Dollars)
Lower Bound of Auto Safety Improvement:	
Loss to society from lost worker production	38.5
Loss to society including loss to family and community	132.2
Upper Bound of Auto Safety Improvement:	
Loss to society from lost worker production	31.3
Loss to society including loss to family and community	107.3

If the associated motor vehicle accident costs discussed in Chapter 2 increase proportionately, this would add approximately $50 million in 1990 to the Amtrak diversion benefit. However, if the current rapid increases in medical and motor vehicle accident repair costs continue throughout the forecast period, this saving could be considerably higher. Notwithstanding these results, rail will probably not achieve safety superiority over the air and bus modes in 1990. Auto traffic diversion to air and bus will be at least as effective as diversion to rail. Finally, we must note the importance of train operating assumptions to our projection. We have presupposed major improvements in rail rights-of-way. If roadbeds continue to deteriorate, Amtrak's contribution to improved travel safety will be greatly diminished.[12/]

ENERGY

At the time of this report, Federal energy policy direction remained unresolved. Congress had not approved Carter Administration proposals to increase gasoline taxes and to levy a surcharge on gas-guzzling new automobiles. However, there seems to be Congressional sympathy for stiffening the energy efficiency standards for cars. Given the degree of uncertainty that surrounds future energy policy, our forecasts will rely largely on projections made before the Administration submitted its proposals to the Congress.

Rail passenger equipment has a long life. In fact, one of the problems which plagues this mode is that the equipment becomes obsolete, in terms of on-board amenities, long before it has physically exhausted its productive life.[13/]

We will posit, therefore, that Amtrak routes in 1990 will be served by the new equipment that has either recently been placed in service, or is planned for introduction in the near future.

Outside the NEC, Amtrak trains will be hauled by new diesels (P30CH and F40PH) and diesel electrics (E60CP) which are expected to be more fuel efficient than current motive power. Amtrak is also developing a lightweight diesel capable of high speeds and expects to begin using these units in 1978.[14/] Amtrak has supplied us with its estimate of the energy performance of its new locomotives. (See Table 3.4) We will incorporate the following additional assumptions in developing our estimate of rail energy intensity:

1. The new lightweight diesels generate sufficient fuel savings to offset the circuity problem;

2. The new, more powerful locomotives will not suffer the fuel efficiency loss of older locomotives when they encounter hilly or mountainous terrain;

3. The increasing concern with energy will cause Amtrak to undertake operating changes, and (if feasible) make modifications in its locomotives to improve energy efficiency. We will take this into account by eliminating the fuel consumed during station stops and locomotive idle time. Therefore, we will use only the gallon per seat-mile estimates provided in Table 3.5;

4. We will assume that Metroliner II equipment is 20 percent more fuel efficient than the Metroliners now in use;

5. Amtrak will be able to operate with 70% load factors on all routes.

These assumptions, combined with the Amtrak data, generate the rail energy performance estimates for 1990 that appear in Table 3.5.

TABLE 3.5
1990 RAIL ENERGY EFFICIENCY

	Type of Route	Fuel Efficiency at 70% Load Factors
1	Long-distance trains, P30CH locomotives--half all coach and half with sleepers, diners, and lounge cars	.00429 gal./passenger mile or 233 passenger-miles/gal.
2	Short-distance trains.[a/] All services with Amfleet trains.	.00343 gal./passenger-mile or 292 passenger-miles/gal.
3	Northeast Corridor--Metroliner II	.00309 gal./passenger-mile or 324 passenger-miles/gal.

a/ Note if turboliner trains are widely employed, and do not improve their fuel efficiency, this performance measure will be markedly lower. E.g., if half the short-distance routes are served by 12-car RTGs, then the measure is 166.7 passenger-miles/gal.

TABLE 3.4

FUEL EFFICIENCY - AMFLEET

DIESEL LOCOMOTIVE	CARS (1)	REVENUE SEATS	GALLONS PER SEAT-MILE	GALLONS PER (2) SEAT-HOUR	BTU PER SEAT-MILE	BTU PER (2) SEAT-HOUR	LOCOMOTIVE IDLE GALLONS/HOUR (Summer Only)
E-8 (Steam Gen.)	12	960	.0026	.068	351	9180	5.0
SDP40F (Steam Gen.)	17	1356	.0021	.048	284	6480	5.5
P30CH	15	1188	.0024	.051	324	6885	5.0
F40PH	11	876	.0024	.063	324	8505	4.3
LRC (5-car train) (3)	5	385	.0030	.053	405	7155	5.0
LRC (Maximum number (4) of cars)	12	938	.0021	.061	284	8235	5.0
TURBINE LOCOMOTIVE							
RTG (5-car train) (3)	5	263	.0083	.112	1121	15120	-0-
RTG (Maximum number (4) of cars)	12	727	.0060	.081	810	10935	-0-
ELECTRIC LOCOMOTIVE (5)			EQUIVALENT GALLONS PER SEAT-MILE	EQUIVALENT GALLONS PER SEAT-HOUR			
GG-1 (Steam Gen.)	18	1440	.0021	.032	279	4320	-0-
E60CP	18	1440	.0024	.048	326	6480	-0-
Metroliner	6	440	.0027 (NEC estimate)	.055	365	7425	-0-

NOTES: on page 2

TABLE 3.4

FUEL EFFICIENCY - BI-LEVEL

DIESEL LOCOMOTIVE	CARS	REVENUE SEATS	GALLONS PER SEAT-MILE	GALLONS PER (2) SEAT-HOUR	BTU-PER SEAT-MILE	BTU PER (2) SEAT-HOUR	LOCOMOTIVE IDLE GALLONS/HOUR (SUMMER ONLY)
P30CH	12 (6)	705	.0034	.068	460	9207	5.0
F40PH	10 (7)	550	.0039	.098	522	13214	4.3
P30CH	12 (8) coaches	930	.0026	.052	351	7020	5.0
F40PH	10 (9) coaches	775	.0027	.069	365	9315	4.3

NOTES:

(1) Mix of cars - 1 Amcafe : 4 Amcoach
(2) Fuel used during station stops
(3) LRC and RTG were designed as 5-car trains to meet maximum speed specifications.
(4) Number of cars determined by locomotive or head end power capacity
(5) Energy from catenary adjusted for thermal efficiency and electric transmission losses (29% efficiency).
Source: International Railway Gazette, G. Mitchell, "Design to Achieve Conservation of Resources," 12/1976.
(6) 3 high density coach : 5 low density coach : 2 sleeper : 1 diner : 1 lounge car
(7) 2 high density coach ; 4 low density coach : 2 sleeper : 1 diner : 1 lounge car

On long distance trains, travelling overnight, ICC regulations require the provision of a dining car, lounge space, sleeping accommodations, and checked baggage space, all of which reduce the Revenue Seating Capacity of these trains and adversely affect the fuel efficiency per revenue seat.

(8) 6 high density coaches; 6 low density coaches
(9) 5 high density coaches; 5 low density coaches

Source: National Railroad Passenger Corporation

Although we project major improvements in Amtrak's energy efficiency, the other modes will not remain static. Interpolating from the 1985 and 1995 energy efficiency projections of the Faucett model, airplane energy intensity will be only 74 percent of current levels. Auto energy usage is expected to decline to 67.7 percent of current levels. [15/] The Faucett report does not forecast any changes for intercity bus (or intercity passenger rail), but rather claims that any improvements in these modes will be due to higher load factors. This seems unduly conservative for bus, and incorrect for rail. We will assume that intercity bus is 25 percent more energy efficient in 1990, due to both improved load factors and newer, more efficient equipment. Also, Faucett's projected auto fuel economy improvement seems unreasonably low. At present, autos average approximately 15 mpg, but recent legislation (P.L. 94-173) sets the fuel economy standard at 27.5 mpg in 1985. The Secretary of Transportation has the option of selecting a performance level as low as 26.0 mpg. Using this lower figure as the average for all autos in 1990, the estimate of auto energy intensity is 54 percent of current levels.

With these assumptions and projections we can examine 1990 energy savings due to Amtrak diversion. Table 3.6 summarizes the results. If the price of all fuels appreciates at 6 percent per annum, then the 1990 value of these savings is $244 million.

As was the case for current Amtrak energy performance, future fuel savings will be greatest for the diversion of short-haul and Corridor passengers. Long-distance trains make a positive contribution, but half of the travel on these trains is assumed to be short-haul and the savings are credited to short-haul diversion. True long-distance travel diversion is not large and neither are the resultant fuel savings.

TABLE 3.6

Forecast Of 1990 Energy Savings From Amtrak Diversion

Rail Service Type and Diversion	Passenger Miles (000)	Passenger Miles Per Gallon	Fuel Consumed, Diverted & Net Savings (Gallons)
Metroliner	4,500,000	324	13,888,888
Diverted from:			
Air	2,250,000	27	83,333,333
Bus	450,000	160	2,812,500
Auto	1,800,000	56	32,142,857
		Net savings	104,399,802
Short Distance Diversion Travellers Carried By:			
Short Distance Rail	2,971,600	292	10,176,712
Long Distance Rail	2,125,000	233	9,120,172
Diverted from:			
Air	1,508,240	27	55,860,740
Bus	828,410	160	5,177,563
Auto	2,759,950	56	49,284,821
		Net savings	91,026,240
Long Distance Diversion Travellers Carried By:			
Short Distance Rail	156,400	292	535,616
Long Distance Rail	2,125,000	233	9,120,172
Diverted From:			
Air	1,085,960	41	26,486,829
Bus	546,890	160	3,418,063
Auto	648,550	70	9,265,000
		Net savings	29,514,104
		Total Savings	224,936,146

Our assumptions about Amtrak's energy efficiency in 1990 have been generous. The savings forecasted are small in light of the projected 1990 Amtrak deficit (see Table 3.16) and the capital expenditures which must be made to bring about the projected diversion. Note that an intercity rail passenger system designed to meet the specific needs of relatively short-distance trip-makers would generate more fuel savings than the projected system. Short-distance trains of Amfleet coaches with high seating density are more efficient than long-distance trains with non-revenue cars, sleepers, and other first-class cars.

ENVIRONMENT

Air Pollution

Emission standards for rail vehicles have not yet been established. However, some estimates exist for high-speed rail passenger service in the Northeast Corridor, and we can project rail diesel emissions based on improved energy efficiency.

If 50 percent of the electricity required to run high speed Metroliners is generated by nuclear power and fifty percent is produced through burning highly controlled fossil fuels,[16] Metroliner emissions will be as shown in Table 3.7. Allowing the energy improvement factors for short- and long-distance trains to serve as a proxy for the reduction in emissions per passenger-mile, conventionally powered equipment will also emit pollutants at a much reduced rate in 1990, as shown in Table [illegible]. Long-distance trains will produce only 20 percent of current emissions per passenger-mile and short-distance trains will emit one-third as many. These improvements are not due to cleaner burning locomotives but to higher load factors, more dense seating, and more efficient energy consumption.

TABLE 3.7

1990 EMISSION FACTORS FOR INTERCITY RAIL PASSENGER SERVICE
(LBS. PER PASSENGER MILE)

	CO	HC	NO_x	SO_x	Particulates
Metroliner	---	---	.00024	.00009	.00001
Short-Distance Trains	.00063	.00035	.00165	.00020	.00009
Long-Distance Trains	.00082	.00045	.00214	.00026	.00012

The air, bus, and auto modes will also improve their environmental performances by 1990. The data presented in Chapter 2 for the auto mode were based on extrapolations of EPA test data. We had estimated that auto currently produces 50 grams per mile of CO, 6 gpm of HC, 4.8 gpm of NO_x, 2 gpm of SO_x, and .58 gpm of particulates. Automobile emission standards for automobiles beginning with model year 1979, are 3.4 gpm for CO, 0.4 gpm for HC, and 0.4 gpm for NO_x.[17/] This represents a significant improvement over present levels and it is probable that even stricter standards will be in effect by the 1980s. For SO_x and particulates, for which standards have not been set, we will assume that by 1990 a 25 percent reduction has been achieved.

Diesel-powered, heavy duty vehicles are not expected to improve their performance as dramatically as auto. From the available data, it appears that bus emissions will be approximately one-half of current levels.[18/] We will reduce bus emission factors for CO, HC, and NO_x by that amount. A 25 percent reduction will be assumed for SO_x and particulates. Although there are no firm plans for increasing airplane emissions standards, one projection held that new "ultralow emissions technology" could reduce aircraft emissions of NO_x and other pollutants five to ten fold.[19/] However, because we were unable to verify this estimate we will assume that an overall reduction of 50 percent (reflecting more efficient operations) is more accurate. The emissions factors for the non-rail modes in 1990 are presented in Table 3.8 and the projected emissions reduction due to Amtrak diversion in 1990 appears in Table 3.9.

TABLE 3.8

1990 EMISSION FACTORS FOR
AUTO, AIR, AND INTERCITY BUS MODES

Modes	Pollutant (Lbs. Per Passenger Miles)				
	CO	HC	NO_x	SO_x	Particulates
Auto					
Short Distance	.00374	.00047	.00044	.00017	.00048
Long Distance	.00299	.00038	.00035	.00014	.00038
Intercity Bus	.00067	.00011	.00112	.00012	.00006
Air					
DC-9-30	.00073	.00056	.00030	.00013	.00005
Jumbo Jet	.00072	.00017	.00119	.00015	.00006
Medium Range Jet	.00026	.00007	.00040	.00009	.00007

Only electrified Metroliner services in the NEC are expected to make an unambiguous contribution to air pollution abatement in 1990. Even in the case of Metroliner diversion, the impact is not large. Comparing these results to those in Table 2.12, it appears that passenger rail will have even less of an impact on air pollution in 1990 than it does now. This result is largely due to the anticipated reduction in carbon monoxide emissions for autos. The major improvement in 1990 rail passenger services comes in the area of nitrogen oxides emissions, but here we forecast only that rail's overall negative impact will be less than it is today. Again, provision of appropriate service to long-distance train riders making short-distance trips would improve rail's performance.

Congestion

Airport Congestion

Faucett's medium growth rate projection for domestic air carrier activity through 1990 is 5.7 percent.[20/] This implies 3.13 billion passenger-miles of Northeast Corridor air traffic in 1990 as opposed to 1.29 billion today.[21/] This "normal" growth of 1.84 billion passenger-miles is just offset by our estimate of a net increase of 2 billion passenger-miles diverted from air by Amtrak through

TABLE 3.9

1990 AIR POLLUTION ABATEMENT EFFECTS
DUE TO
INTERCITY RAIL PASSENGER SERVICE

Northeast Corridor--Metroliner Service
Annual Emissions in Pounds

Type of Pollutant	Rail	Air	Bus	Auto	Net Reduction
CO	--	585,000	301,500	6,732,000	7,618,500
HC	--	157,500	49,500	846,000	1,053,000
NO_x	1,080,000	900,000	504,000	792,000	1,116,000
SO_x	405,000	202,500	54,000	306,000	157,500
Particulates	45,000	157,500	27,000	864,000	1,003,500

Short Distance Travel Diversion
Annual Emissions in Pounds

Type of Pollutant	Rail: Short Distance	Rail: Long Distance	Air	Bus	Auto	Net Reduction
CO	1,872,108	1,742,500	392,142	555,035	10,322,213	7,654,782
HC	1,040,060	956,250	105,577	91,126	1,297,177	(502,430)
NO_x	4,903,140	4,547,500	603,296	927,819	1,214,378	(6,705,147)
SO_x	594,320	552,500	135,742	99,409	469,192	(442,477)
Particulates	267,444	255,000	105,577	49,705	1,324,776	957,611

TABLE 3.9
(Continued)
1990 AIR POLLUTION ABATEMENT EFFECTS
DUE TO
INTERCITY RAIL PASSENGER SERVICE

Long Distance Travel Diversion
Annual Emissions in Pounds

Type of Pollutant	Rail Short Distance	Rail Long Distance	Air	Bus	Auto	Net Reduction
CO	98,532	1,742,500	787,321	366,416	1,934,165	1,251,870
HC	54,740	956,250	396,375	60,168	246,449	(308,008)
NO_x	258,060	4,547,500	809,040	612,517	226,993	(3,157,010)
SO_x	31,280	552,500	152,034	65,629	90,797	(275,320)
Particulates	14,076	255,000	59,724	32,813	246,449	69,910

TOTAL POLLUTION REDUCTION--ALL SERVICES

Type of Pollutant	Lbs. per Year	Tons per Year
CO	16,525,152	8,262.2
HC	242,562	121.3
NO_x	(8,746,157)	(4,373.1)
SO_x	(560,297)	(280.1)
Particulates	2,031,021	1,015.5

the introduction of improved high-speed rail service in the Corridor. If anything, our diversion estimate may be somewhat conservative. Intra-Corridor air traffic has declined at a rate of 6.4 percent in recent years, while Metroliner traffic has grown.[22/]

Evaluation of Amtrak's impact on NEC airport congestion in 1990 requires the following steps:

1. Convert diverted air passenger-miles to diverted flights and operations (landings and takeoffs);

2. Assign these diverted flights and operations to affected Corridor airports;

3. Estimate total operations at Corridor airports in 1990;

4. Adjust Corridor airport capacities to 1990 levels;

5. Calculate and estimate the benefit of reduced delays, as was done in Chapter 2.

We employ the following assumptions for this analysis:

1. Average load per aircraft will be 70 passengers, representing a 16 percent improvement over our 1976 assumption;

2. Average trip length of diverted passengers in 1990 will be 250 miles;

3. The proportion of air operations handled at each NEC airport will be the same as today;

4. Because the economy of the Northeast is not expected to grow as fast as the U.S. as a whole during the forecast period, we will assume that air traffic at Corridor airports increases 6 percent per annum, and that the number of operations increases 5 percent per annum due to improved load factors;

5. The relationship between number of operations and expected delays will change as airport operations change. Airport capacity will be increased through

the introduction of new air control (microwave) systems, new runways, and other developments. One estimate of capacity improvements for NEC airports is presented in Table 3.10.

TABLE 3.10

CAPACITY IMPROVEMENTS AT NEC AIRPORTS BY 1985

Airport	Percentage Increase in Capacity
Logan (Boston)	71
LaGuardia (New York)	72
Newark	120
Philadelphia	128
Baltimore	67
National (Washington)	70

SOURCE: U.S. Department of Transportation, Recommendations for Northeast Corridor Transportation, Washington, D.C.: 1971, p. A1-3.

It is not possible to estimate a function showing the future relationships between airport operations and delays at NEC airports. Instead, we will calculate the 1990 V/C ratio, that is, the ratio of 1990 operations to 1990 Practical Annual Capacity (PANCAP). As the operations/delay parameters are only valid for current airport capacities, we reduce the 1990 level of operations with expanded airport capacities to the comparable level in 1976 at the same V/C ratios. For example, if 1975 volume of operations at a particular airport equalled 100,000 and 1976 PANCAP was 180,000, the 1976 V/C would be 55.6. If traffic increased to 200,000 in 1990 and capacity increased to 500,000, the 1990 V/C ratio would be .40. Comparable 1976 operations at the new 1990 V/C ratio would be 72,000. Because capacity grew faster than operations, in this example, we would expect fewer delays in 1990.

6. We will adjust the value of time saved by passengers and airlines by an annual inflation factor of 6 percent.

The results presented in Table 3.11 indicate that Amtrak's contribution to air traffic congestion in 1990 will be much greater than today. In Chapter 2 we estimated that Amtrak diverts enough potential air travelers to reduce the annual number of delayed aircraft by 2,500. We now estimate that high-speed Metroliner service will reduce the number of delayed aircraft by 64,808 annually, if no change in airport capacity takes place, and by 13,838, if proposed airport capacity expansion occurs. Given our assumptions about the value of time, number of passengers per plane, and further assuming that 1990 air congestion delays average one hour, the value of Amtrak's diversion is as shown in Table 3.12.

TABLE 3.11

AMTRAK 1990 IMPACT ON NEC AIRPORT CONGESTION ALLEVIATION

Airport	Without AMTRAK Total 1990 AM Operation (000)	AMTRAK Diversion 1990 (000)	1990 NEC Air Operation w/AMTRAK (000)	1990 Aircraft Delayed No Change in Capacity w/o AMTRAK	1990 Aircraft Delayed No Change in Capacity w/AMTRAK	Net Change Due to AMTRAK	1990 Aircraft Delayed Assuming Change in Capacity w/o AMTRAK	1990 Aircraft Delayed Assuming Change in Capacity w/AMTRAK	1990 Difference Due to AMTRAK
Logan	527,000	30,000	497,000	9,626	7,846	1,780	1,457	1,016	441
LaGuardia	790,000	52,000	738,000	198,134	155,702	42,432	29,279	19,178	10,101
Newark	514,000	24,000	485,000	43,604	35,543	8,061	2,735	1,717	1,018
Philadelphia	606,000	69,000	537,000	15,764	10,302	5,462	881	308	573
BWI	254,000	28,000	226,000	739	490	249	121	59	62
National	679,000	63,000	616,000	23,523	16,699	6,824	3,622	1,979	1,643
						64,808			13,838

TABLE 3.12

VALUE OF AMTRAK CONTRIBUTION TO AIR TRAFFIC CONGESTION ALLEVIATION (IN DOLLARS)

	With No Capacity Change	With Capacity Change
Passenger Time	$102,526,250	$21,891,716
Aircraft Time	87,879,648	18,764,328
TOTAL	$190,405,898	$40,6[illegible]6,044

There are, of course, some limitations to this approach. Air traffic levels in 1990 are really predicated on airport expansion. If airport capacities are not enlarged to meet projected travel demand, greatly increased air travel cannot take place. The airports will be operating well above their PANCAP's, and Amtrak diversion, although very important at the margin, will not be sufficient to solve the problem. The second set of figures, which includes proposed capacity adjustments, is more realistic. Amtrak does have an effect, and it is reasonably large (over $40 million per year). Yet, these savings are not great enough to cover projected Amtrak deficits in the Corridor. Also, it is highly unlikely that there are very many airports outside the NEC where Amtrak can be expected to make a contribution to airport congestion alleviation by 1990. Yet, airport expansion is itself very costly. A program designed to shift more Corridor air passengers on to high speed rail could prove cost-effective. The evaluation of such alternative strategies is not the task of this report, but it does appear that airport congestion alleviation in the densely populated NEC is an area where Amtrak has at least some potential for achieving a purpose underlying its creation.

Highway Congestion

In an earlier study, we employed the auto congestion model, outlined in Chapter 2, to evaluate how well high-speed rail services (HSRS) alleviated auto congestion.[23/] The total estimate for diversion of auto traffic used in that study (incremental diversion due to high-speed service plus normal growth of rail passenger traffic) was approximately equal to the Amtrak auto diversion estimate used in the present report (1.789 versus 1.8 billion auto passenger-miles). We will use only the figure for incremental diversion (1.029 billion passenger-miles in 1990). The figure for Amtrak benefits in 1990 with the diversion estimates of the earlier report is approximately 50 percent greater than this earlier contribution.

To measure the value of rail's impact in reducing highway congestion we must identify the affected highways. For our purpose, we will assume all diverted auto travelers in the NEC would have used I-95. Other routes are, of course, available. To the extent that travelers use other, less congested routes, the impact of Amtrak is overstated. We will investigate the Amtrak effect in the following situations:

Case I : Intercity auto travel in 1990 is double current levels and intra-urban traffic is 50 percent higher than today.

Case II : Same as Case I, but assume that highway capacity is expanded by 50 percent.

Case III: Same as Case I, but assume that highway capacity is doubled.

Table 3.14 summarizes the amount and value of time savings due to the introduction of HSRS. We assume that 1990 intercity auto travelers value their time at $9.60 per hour and that intracity drivers value time at $4.56 per hour.[24/] Auto occupancy for intercity trips is estimated at 2.1 persons per vehicle and 1.5 persons per vehicle for intracity trips.

TABLE 3.13

BENEFITS ACCRUING TO NEC AUTO TRAVELERS
DUE TO HIGH SPEED RAIL SERVICE

	Reduction In Travel Time Over Entire Corridor	Value of Time Saved
Case I	17.082 mins./vehicle	$140,650,000
Case II	11.532 mins./vehicle	$ 82,485,000
Case III	8.694 mins./vehicle	$ 71,427,000

SOURCE: F. Mulvey, The Northeast Corridor High Speed Rail System: Selected Impacts on Alternative Modes, Boston, Mass.: Harbridge House, 1975, p. II-22.

The total benefit from the provision of the Amtrak alternative in 1990 is approximately 50 percent greater than the savings shown in Table 3.13.[25/] If no expansion in highway capacity occurs between now and 1990, the value of Amtrak's congestion reduction in the Corridor would be more than $200 million annually. This is an impressive contribution.

Unfortunately, there are several reasons for exercising caution in evaluating this benefit:

1. The savings are based on the estimated value of time in 1990. In constant 1976 dollars, they are only half as great;

2. We have assumed that all intercity auto traffic uses the spinal I-95 network. If we assume that half use other roads, the estimate falls by nearly two-thirds;

3. As we pointed out in Chapter 2, the amount of time saved per vehicle over some highway segments is very small, although the value of time saved for the total number of vehicles is large. We do not know at what point the time savings become so small as to be imperceptible to the traveler.

Nevertheless, there do appear to be important savings from NEC auto traffic congestion relief by Amtrak in 1990. The benefit appears to be greatest at the approaches to urban areas. Nearly nine percent of the total dollar benefit in Case I is due to alleviating congestion on one mile of the Harlem River Drive.

It should be asked whether Amtrak is the best way to achieve these benefits. Rail diversion potential is often expressed in terms of land saved from fulfilling highway expansion needs. Yet, the 1.8 billion auto passenger-miles diverted in 1990 will be less than one year's auto traffic growth if present growth rates continue. Although Amtrak's diversion has a positive impact, it must be stressed that the principle problem is, and will remain, congestion due to commutation and other local traffic, which Amtrak will not affect. New highway construction may be postponed for a year due to Amtrak diversion, but eventually highway capacity must be expanded, or meaningful diversion must take place through the provision of commutation rail and/or bus services.

Noise Pollution

At present, very little can be said about Amtrak's long-term impact on reducing noise pollution. As pointed out in Chapter 2, if any benefits exist they appear to come from diverting air, rather than automobile passengers. Truck traffic is primarily responsible for highway noise. But, trucks are expected to register a significant improvement by 1990. One study predicts the changes that are shown in Table 3.14. Recalling that the dBA is measured on a logarithmic scale, heavy-duty trucks will be less than half as noisy as they are today.

TABLE 3.14

MEDIAN HIGHWAY NOISE BEFORE AND AFTER REGULATION

Vehicle	Present	After Regulation
Heavy Duty Trucks	85 dBA	71 dBA
Medium Duty Trucks	77	71
Buses	79	75
Motorcycles	82	78

SOURCE: U.S. Department of Transportation, Air Quality Noise and Health: Report of a Panel of The Interagency Task Force on Motor Vehicle Goals Beyond 1980, Washington, D.C.: 1976, p. 6.28.

According to the DOT, the implementation of an engine retrofit program will further reduce aircraft noise.[26/] The noisy aircraft now in service will have been retrofitted or phased out over the next four to six years. Further, the noise alleviation benefits from Amtrak are confined to the NEC and perhaps a few other heavily traveled short-haul markets. According to our forecast of air traffic diversion, Amtrak will be responsible for reducing the number of long-distance flights in the U.S. by only 33 per day in 1990. There will be 200 fewer short-distance air flights daily outside the NEC. In the NEC we project a reduction of 430 flights daily. Amtrak's impact, if any, will be largely confined to the NEC.

ECONOMIC CONSIDERATIONS

We have projected a very significant increase in Amtrak ridership largely due to the introduction of high speed Metroliner II service in the NEC and generally improved service on Amtrak routes in the rest of the United States. Amtrak will be able to increase fares, but if it is to keep its prices competitive, it will not be able to raise fares to cover operating cost increases.[27/] Based on

Amtrak's own projections, we calculated the 1990 rail fares per passenger-mile (Table 3.15).

TABLE 3.15

AMTRAK REVENUES IN 1990

Rail Route Type	Passenger-Miles Revenue (RPM)	Fare/RPM ($)	Total Revenue ($)
Northeast Corridor	4,500,000,000	0.22	990,000,000
Short-Distance Routes	3,128,000,000	0.16	500,480,000
Long-Distance Routes	4,250,000,000	0.128	544,000,000

Expenses for Amtrak services in 1990 are more difficult to estimate. There will certainly be some areas where improved Amtrak operations will effectuate major savings. The replacement of aged rolling stock and locomotives should reduce equipment maintenance expense. In addition, new Amtrak cars have a greater seating density, enabling Amtrak to produce more passenger-miles of service without proportionate increases in train-miles. Further, we have assumed that Amtrak will improve load factors to 70 percent so that the increase in ridership will not cause a proportional increase in operating expense per passenger-mile.

Amtrak has provided forecasts of its expenses through Fiscal Year 1981.[28/] Systemwide, costs are expected to rise 19 percent in 1977, 11 percent in 1978, and slightly over 6 percent thereafter; the rates of increase are expected to be slightly lower in the NEC. Our approach will be to use Amtrak's operating expense increases and to extrapolate an annual 6-percent rate of increase from 1981 to 1990. To account for the higher load factors and increased seating densities of new equipment, we will reduce the projected increase in expenses per passenger-mile in 1990 by 40 percent. Table 3.16 summarizes Amtrak's 1990 economic picture under these assumptions.

TABLE 3.16

AMTRAK'S FINANCIAL ENVIRONMENT IN 1990

Type of Service	Revenue Passenger-Miles (Millions)	Expenses Per RPM	Expenses (Millions)	Revenues (Millions)	Deficit (Millions)	Deficit Per RPM
Metroliner	4,500	$0.287	$1,291.5	$ 990	$ 301.5	$0.067
Short-Haul	3,128	0.392	1,226.2	500	726.2	0.232
Long-Haul	4,250	0.291	1,236.8	544	692.8	0.163
TOTALS			$3,754.5	$2,034	$1,720.5	

The projected 1990 operating deficit is large. This deficit does not include the capital grants and guaranteed loans needed to develop the Amtrak system to meet 1990 demand. The benefits, where they exist, do not begin to cover operating costs, much less contribute to the recovery of capital costs.

One important area of capital cost is the expense associated with track upgrading and rehabilitation. Such improvements are necessary if the forecasted ridership growth is to materialize. The improvements needed to produce faster, more attractive, and more reliable service will be costly. Many track-miles need repair and upgrading if Amtrak trains are to average 60 mph and operate on time in 1990.

A recent ICC investigation[29/] into the quality of track for passenger train services provides evidence that substantial investment in rights-of-way will be needed if Amtrak is to offer faster service. Even on the rights-of-way of railroads with relatively excellent track maintenance records there are barriers to faster operations. In the Santa Fe's Los Angeles-San Diego route, for example, there are 82 curves between Fullerton and San Diego; 10 have a 25 mph speed restriction and 25 require passenger trains to slow down to 50 mph. Further, many communities have local ordinances prohibiting train speeds of more than 30 or 40 mph within city limits.[30/] It would be necessary to completely fence in rights-of-way and construct separated grade crossings if faster service is to be provided. Table 3.17 presents railroad's estimate of rights-of-way upgrading costs to meet higher Federal Railroad Administration standards for faster passenger train operations. Given the wide variance in labor productivity of the different railroads it would be wise to take these estimates as an upper boundary for repair costs. These costs include expenses for realignment, laying and straightening of track; elimination of grade and crossings; modifying super-elevation; and changing ballast and replacing ties. For the most part, these estimates do not include the costs of new cab signalling equipment for locomotives or other expenses related to traffic control. Further, the annual maintenance cost for Class 5 track is estimated to be $1,800 per mile more than for Class 4 track.31/

The railroads see little benefit to their freight operations from the track upgrade program. The problem of poor rail freight services is not one of inadequate line-haul operating speeds. Rather, railroad freight operations suffer from excess capacity and inefficient utilization of rolling stock. Faster passenger trains, they argue, would hinder the efficient and safe operation of freight trains.

Our forecasts of 1990 Amtrak operations and the attendant benefits from provision of intercity rail passenger service make it difficult to justify these outlays. It is hard to imagine a set of circumstances where the benefits from Amtrak could even begin to approach the operating and capital costs needed to provide them.

TABLE 3.17

RAILROAD COST ESTIMATES OF TRACK REPAIR AND UPGRADE WORK

Railroad & Route	Project	Estimated Cost (Millions)
Burlington-Northern: Seattle-Portland	Upgrade track from FRA Class 4 to Class 5	$492.0
Chicago Quincy	Upgrade track from Class 4 to Class 5	$500.0
Milwaukee Road: Chicago-St. Paul	Upgrade track from Class 4 to Class 5	$205.0
Chicago Rock Island & Pacific RR: Chicago-Peoria	Upgrade track to FRA Class 3	$ 13.2
Chicago Rock Island & Pacific RR: Chicago-Rock Island	Upgrade to FRA Class 5	$ 57.0
Illinois Central: Chicago-St. Louis & Chicago-Carbondale	Upgrade from Class 4 to Class 5	$ 47.9
Missouri Pacific: St. Louis-Kansas City	Upgrade from Class 4 to Class 5	$ 87.3
Missouri Pacific: St. Louis-Texarkana	Upgrade from Class 4 to Class 5	$ 59.0
Missouri Pacific: Milano-Laredo	Upgrade from Class 3 to Class 5	$137.6
Texas Pacific: Texarkana-Ft. Worth	Upgrade from Class 4 to Class 5	$ 82.4
Texas Pacific: Atlee-Laredo	Upgrade from Class 3 to Class 5	$400.0
Penn Central (Conrail): NY-Washington	Eliminate slow orders only	$ 7.8
Penn Central (Conrail): NY-Boston (Providence)	Eliminate slow orders only	$ 6.8
Penn Central (Conrail): NY-Boston (Springfield)	Eliminate slow orders only	$ 7.0
Penn Central (Conrail): NY-Buffalo	Eliminate slow orders only	$ 12.7

TABLE 3.17
(CONTINUED)

RAILROAD COST ESTIMATES OF TRACK REPAIR AND UPGRADE WORK

Railroad & Route	Project	Estimated Cost (Millions)
Penn Central (Conrail): Philadelphia-Harrisburg	Eliminate slow orders only	$ 2.9
Penn Central (Conrail): Chicago-Detroit	Eliminate slow orders only	$ 7.7
Penn Central (Conrail): Chicago-Cincinnati	Eliminate slow orders only	$ 17.1
Richmond, Fredericksburg, Potomac: Washington-Richmond	Upgrade to Class 5	$ 26.5
Seaboard Coast Line	Upgrade to allow 100 mph Turbos	$ 70.3-93.5
Southern Pacific:	Upgrade to allow speeds of:	
-Oakland-Ogden	60 mph	$ 84.1
	80 mph	$ 143.9
	90 mph	$ 414.4
-Oakland-Portland	60 mph	$ 123.0
	80 mph	$ 254.1
	90 mph	$ 610.1
-Oakland-Los Angeles	60 mph	$ 45.3
	90 mph	$5,903.0
-Los Angeles-New Orleans	60 mph	$ 122.8
	80 mph	$ 415.3
	90 mph	$1,773.9

SOURCE: Interstate Commerce Commission, Ex Parte 277, Sub No. 2: Adequacy of Intercity Rail Passenger Service, Washington, D.C., 1976, pp. 520-551.

Subsidization of other modes of transportation will continue through 1990. The amount of subsidy is difficult to forecast. Some fear that Highway Trust Fund receipts will not be adequate to cover highway maintenance costs. If maintenance has to be financed from the General Fund, subsidies to highway users could rise by $25 billion annually.[32/] On the other hand, the highway infrastructure is mostly complete. The enormous costs of land acquisition and highway construction are largely behind us. There may be a tendency for subsidies to highway modes to diminish in the years ahead.

Regardless of the general direction of subsidies to air and highway passenger transport, the subsidy per passenger-mile for these modes will not approach that received by rail. The absolute amount of subsidy is not the relevant figure for determining modal performance. The Amtrak subsidy per passenger-mile is, and will continue to be, the highest of any mode of intercity travel. We have been unable to identify benefits sufficient, even under highly favorable assumptions, to warrant these expenditures.

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2 Where such adjustments are made, the reason for them will be specified.

3 Jack Faucett Associates, Inc., Transportation Projections 1985, 1995, 2000: Draft Final Report Chevy Chase. Md.: 1977.

4 Amtrak, Five Year Corporate Plan, 1977-81.

5 Ibid., p. 45.

6 U.S. Congress, House, Committee on Appropriations, Federal Grants to the National Railroad Passenger Corporation, Hearings; [Statement of Paul Reistrap, Amtrak President], March 1977, 95th Congress, 1st Sess., Washington, D.C.: Government Printing Office, 1977, p. 441.

7 Caution must be exercised in defining intercity auto travel. While such travel is more clearly defined for the air, rail, and bus modes, its definition varies for auto travel. Some studies employ 100 miles as the cut-off point, while others include any trips over 30 miles. This study uses 30 miles.

8 Amtrak, Five Year Corporate Plan, 1977-81, pp. 44-45.

9 Here we differ from Amtrak's current plans. However, if Amtrak is to capture 30,000,000 riders annually in the Corridor, it seems that the majority of trains will be attractive, high-speed Metroliners.

10 U.S. Congress, Senate, Committee on Commerce, Science and Transportation, Intercity Domestic Transportation for Passengers and Freight, 95th Cong., 1st Sess., Washington, D.C.: Government Printing Office, 1977, pp. 377-383.

11 U.S. Department of Transportation, 1974 National Transportation Report, Washington, D.C.: 1975, p. 387.

12 Amtrak has had several derailments in recent years. While these have not been particularly serious, continued deterioration of rights-of-way will cause rail derailments to increase. Eventually, a serious derailment could occur.

13 At the time of Amtrak's creation, users of the air, bus, and auto modes enjoyed amenities associated with equipment typically less than five years old. Amtrak passenger cars averaged over 20 years.

14 Amtrak, Five Year Corporate Plan, 1977-81, p. 73.

15 Faucett, Transportation Projections, p. 102.

16 U.S. Department of Transportation, *Environmental Impact Statement, Northeast Corridor Rail Improvement Project*, Washington, D.C.: 1973, p. II-4.

17 Faucett, *Transportation Projections*, p. 50.

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21 Peat, Marwick, Mitchell & Co.,"Demand Forecasts for Northeast Corridor Travel by City-Pair" (unpublished computer print-out), March 1975.

22 Faucett, *Transportation Projections*, p. 56.

23 F. Mulvey, *The Northeast Corridor High Speed Rail System: Selected Impacts on Alternative Modes*, Boston, Mass.: Harbridge House, 1975, pp. II 13-25.

24 This is a six percent inflation factor applied to the auto value of time estimates in Chapter 2.

25 The additional 800,000 diverted auto travelers will not reduce congestion as much as the first one million diverted.

26 DOT, *Trends and Choices*, p. 250.

27 Amtrak does not forecast fare increases equal to operating costs, and we accept their conclusion. See Amtrak, *Five Year Corporate Plan, 1977-81*, pp. 49-58.

28 *Ibid.*, pp. 145-150.

29 Interstate Commerce Commission, *Ex Parte 277 (Sub. No. 2) Adequacy of Intercity Rail Passenger Service, Track*, Washington, D.C.: 1976.

30 *Ibid.*, pp. 521-527.

31 Ibid., p. 538. FRA Track Class Standards are:

Track Class	Max. Speed/Freight Trains	Max. Speed/Passenger Train
1	10	15
2	25	30
3	40	60
4	60	80
5	80	90
6	100	110

32 House, Committee on Appropriations, *Hearings*, p. 439.

CHAPTER 4

SUMMARY, CONCLUSIONS, AND IMPLICATIONS OF THIS REPORT

This report has examined the Amtrak experiment in light of the transportation objectives that it was designed to fulfill. The evolution of the Amtrak legislation indicates that Congress views the Corporation primarily as a vehicle for alleviating external diseconomies induced by transportation. Thus, in Chapter 2 we evaluated current rail passenger operations to determine Amtrak's success in contributing to the fulfillment of national transport goals, paying special attention to the social goals stressed in the legislation. In Chapter 3 we offered an optimistic projection of Amtrak's 1990 operations, and evaluated its future ability to fulfill national transport goals. In both analyses we were unable to identify benefits large enough to justify the size of current and projected subsidies.

It is, of course, possible to argue that we did not paint a bleak enough picture of the future transportation environment. If we were to completely exhaust our supply of oil, the future availability of other modes might vanish. We might claim that an all-electric train system is the only possible mode of intercity passenger transportation in 1990. Such an approach, however, was ill-suited to the task before us. We attempted to evaluate Amtrak's role in the foreseeable future, expecting that known and undiscovered petroleum reserves are sufficient to postpone the "day we run out of oil" for some time. Although it is fashionable to criticize technological solutions to impending crises, we must first demonstrate that there are no technological solutions to the energy needs of the non-rail modes before constructing a scenario in which rail is the only possible form of intercity passenger transport. This we cannot do. Time may be running out, but there is still sufficient time for technological innovations to be developed and implemented. Therefore, it is much too soon to forecast with confidence a world without cars or planes. We have examined existing transport modes operating with current technology. Major technological changes, such as magnetic propulsion vehicles, represent entirely new modes of intercity transport. Although some of these futuristic designs share characteristics with current rail passenger service, they require their own infrastructure and vehicles. These may eventually replace trains, but it is not necessary to preserve the current system for the day when these new modes become available.

In spite of the unimpressive findings described by Chapters 2 and 3, we do not argue that the Amtrak experiment should be terminated. Certainly, the Northeast Corridor represents an area where Amtrak can provide socially useful service with a relatively low subsidy per passenger-mile. In fact, Metroliner services have covered direct operating expenses in the past. Complete abandonment of intercity passenger rail is not the issue. The questions to address are:

(1) Can this system be restructured in order to make a meaningful contribution to national transport goals and objectives?

(2) How much of the existing system should be preserved?

(3) How large and how long a commitment is the country willing to make to the Amtrak experiment?

INAPPROPRIATE COMPARISONS TO FOREIGN EXPERIENCE

A major difficulty with the current Amtrak system is that it was constructed to preserve a national rail passenger system. The supporters of this approach often cite the relatively successful intercity rail passenger systems of Europe and Japan. Although most foreign passenger train networks now operate at a defifit, the deficit per passenger-mile for their services is much smaller than Amtrak's, and the social benefits seem much larger. Major portions of European and Japanese systems are electrified, and, as we have shown, energy and environmental benefits are greater for electrified service. However, comparisons with European and Japanese experiences are inappropriate because their transport environments differ so significantly from our own as to render comparisons meaningless. Major differences include the following:

1. On-line population densities in Europe and Japan are much greater than in the U.S. Long-distance trains in Europe connect a series of short-distance corridors, but unlike the U.S. network, the corridors are adjacent.[1/] Amtrak trains must travel long distances through sparsely populated territory, whereas most European trains do not. Only the Northeast Corridor has on-line population densities comparable to major West European and Japanese routes.

2. Travel habits are different for Europeans and Japanese. For several decades, the overwhelming majority of Americans have relied on private transportation. Only when a public mode, such as air, offers benefits great enough to offset the American preference for the privacy of the auto, will there be a large demand for common carrier transportation. Most Americans do not use public transit for local and commutation trips even when it is available. The auto has largely determined our residential living patterns. Decentralization of the urban population has not only caused people to move further out into the suburban rings, but has also allowed them to disperse from the transportation spokes that radiate out from the Central Business Districts.

3. The phenomenon that we have witnessed in the U.S. is now happening in Western Europe and Japan. Rising real incomes have allowed people to desert mass transit and intercity public transport modes. This is occurring in Europe and Japan despite gasoline prices three to four times higher than in the U.S. It seems clear that the "habit" of reliance on public transportation is one that many travelers find easy to break.

4. Public promotional and subsidization policies overseas have not favored the air and highway modes at the expense of their nationalized rail systems. This is beginning to change as governments respond to their publics' demand for improved intercity highway systems.

5. In summary, the European and Japanese transport environments are characterized by: shorter travel distances between major urban centers, higher per-passenger-mile air fares, much higher gasoline prices, a less developed highway network, and a rail system which is dedicated more to passenger than to freight services. In such an environment, passenger rail should flourish. What is surprising is that foreign rail passenger systems are also losing riders and experiencing rising deficits.

Foreign experience, therefore, is not greatly relevant to the evaluation of Amtrak.

RESPONSE TO DEFENDERS OF THE EXISTING AMTRAK SYSTEM

The analyses in Chapters 2 and 3 suggest that external benefits of Amtrak are not important enough to justify large subsidies. A basic re-thinking of the Amtrak experiment is in order. The system, as currently designed and operated, is structured so as to almost guarantee major losses and minimal social benefits. It is the present route system that needs to be changed. This requires that Amtrak abandon the position that it fulfill the national transport goal of maximizing accessibility on a nationwide basis.

Before presenting guidelines for route restructuring, we will first address the arguments of those who support the present Amtrak route system or an expanded version of Amtrak.

1. Amtrak is legally mandated to be a national system. This is true. Major changes in the Amtrak law would be required to bring about a more effective system. However, Congress has not been opposed to changing the Amtrak

legislation. Citing current law is an inadequate defense for offering long-distance train services. The legally constituted system has failed to meet the major goals set for it by the Congress. The conflicts in the legislation must be resolved. The Corporation should be provided with a more consistent set of objectives.

2. Rural and less populated areas will lose all train services. Again, this is true. It is also true that small towns are without subways, international airports, or for that matter, hospitals that can perform heart transplant operations. If sufficient demand for a service does not exist, then the service should not be offered, unless the social benefits are large enough to justify subsidization. As we have seen, social benefits from Amtrak are virtually non-existent in rural areas. Further, few small communities will be cut off from the outside world if the one daily Amtrak train no longer stops there. These places are all served by bus and highways. Most are near major airports. Amtrak long-distance trains do not connect small, on-line cities with most of the places that travelers wish to reach.

The loss of Amtrak service might result in improved overall accessibility. As the large air carriers abandoned smaller cities, commuter and air taxi services replaced them, offering services more appropriate to the needs of smaller communities. Bus operators, who currently do not wish to compete with heavily subsidized rail, might improve their market offerings if sufficient demand exists.

3. Although long-distance trains do not presently generate social savings, we should continue to operate them because they may be needed in the future. We should preserve the existing rail passenger infrastructure. It may be true that rail may become the "mode of last resort" for intercity trips. However, the succession of calamities required for this to come to pass does not appear imminent. There is little need to preserve the service today because it may be needed in the distant future. The rights-of-way used by Amtrak will not disappear. They are in continuous use by freight trains. Railway stations might be preserved as museums

(as has been done in several cities) or converted to other uses. The passenger trains themselves could be mothballed or (as will be suggested below) employed where they might be more efficiently utilized.

4. People should have maximum choice among the alternative modes to meet their legitimate travel needs. This argument fails to recognize that choices are subject to resource constraints. Our wants always exceed the resources available to meet them. The transport services that travelers support will be provided; those not chosen will be eliminated. This is fundamental to economic efficiency.

PROPOSALS FOR RESTRUCTURING THE AMTRAK ROUTE NETWORK

Even under the most favorable assumptions, it appears difficult to defend Amtrak as a good public investment. If Congress remains committed to intercity rail passenger service, efforts are needed to make that service more cost-effective than it is today. The proposals outlined below are offered as a means of reducing the deficit and making Amtrak more efficient.

1. Reduce or eliminate long-distance passenger train service; price remaining services at cost. The number of Amtrak routes could be reduced and train services on remaining routes could be provided at less frequent intervals, lowering the expense of operating Amtrak. For the services that remain, absent compelling social reasons for offering long-distance service at less than full costs, those who choose to use passenger trains should pay the cost of the resources they consume. Of course, the argument that users should pay the costs of the resources expended in providing services holds for all transport modes. After all, it is the users who benefit most directly from the services they consume.

In the vacation or recreation market which long-haul Amtrak trains now serve, it is possible that a reduction in service frequency, perhaps to a tri-weekly basis, would not reduce ridership significantly. Service could be offered to travelers whose primary concern is not travel time and cost, but who wish to "ride the rails" to see the scenery or indulge in nostalgia. One option would be to provide such service on a "cruise-type" basis in conjunction with travel agencies. A train could "sail" weekly or twice a month to meet this demand. Cruise-type service could include first-class accomodations, with lounge, dome, and full dining cars. If there is great demand for rail cruises, more sections could be added. However, the full cost of resources used in providing cruise service should be covered through the fare box.

2. Re-examine short-distance markets. The Northeast Corridor is the area where Amtrak service is most logically justified. Due to a particular set of circumstances--including high population density and the relative saturation of the airways and highways--rail passenger service provides a reasonably competitive alternative to air and highway travel. In addition, Amtrak has the advantage of superior access to downtown areas. The Northeast Corridor has dedicated high-quality track for Amtrak services, allowing high-speed passenger transportation without affecting rail freight service.

It may be that this set of circumstances exists in other corridors and that Amtrak could shift equipment to such markets to provide more frequent service. Many relatively proximate city-pairs now receive inadequate and unattractive service. These include not only city-pairs on short distance routes, but also many city-pairs within Amtrak long-distance routes that receive infrequent and poorly scheduled service. Frequent service between these cities could make the rail option substantially more attractive. Eight or more daily round trips between cities 100-300 miles apart could be operated on schedules that match travelers' preferred departure and arrival times. Too often, potential riders cannot choose rail because the infrequent service does not match these temporal needs. Frequent, short-distance train service could enable Amtrak to gain market identification, as has been achieved in the Northeast Corridor. This would privide a valid experiment of the viability of intercity passenger rail. Rail would be competing in those markets where it is not at a severe competitive disadvantage with air travel.

Decisions about rail passenger service should be made considering international relationships with competitive modes of travel. Recent changes in airline regulation, permitting greater competition, appears to have led to major increases in air passenger demand and to higher company profits. Despite rising vehicle and operating costs, auto usage continues to increase, and the flexibility this mode provides likely will permit it to maintain its major share of the short-distance, intercity passenger market. Intercity buses have cost advantages in less dense markets, plus flexibility and scheduling advantages. In each instance where short-haul Amtrak service is an option, careful marketing studies should be made that take other modes into account before choosing the particular cities for service. It may well be that intercity bus services or short-haul air services provide a superior option.

The appropriate fare for short-distance trains will vary from market to market depending on the cost of providing service and the existence of measurable social benefits. When such benefits can be identified and appropriately valued, subsidies might be justified. However, the same rule should apply to those services as to long-distance trains--"use or lose it." If a combination of fares and services cannot be found to attract enough riders, the trains should not be operated.

Equipment designed for long-haul passenger service may not be suitable for short-haul trains. Sleepers and dining cars might not be usable at all, and other cars might have to be reconfigured to allow higher seating densities. In addition, increased frequency of passenger trains might cause capacity problems on existing track facilities in some markets. The problems of joint use of track by passenger and freight trains must be overcome if short-haul services are to expand.

3. Improve passenger collection and distribution. Because rail lacks the flexibility of the highway modes, terminal facilities are quite distant for many potential users. Frequent rail service may allow the operation of minibuses, which for an appropriate charge could pick up and discharge travelers residing outside the CBD. Such service could be included in the rail fare and the minibuses could operate on a regular schedule. Frequent train departures and arrivals would minimize minibus idle time.

It can be argued that the restructuring proposals suggested will result in the balkanization of Amtrak. This is true. Many short-distance, city-pair trains would be isolated from the rest of the network. However, there is no reason why all Amtrak services should be interconnected. The changes suggested would test the viability of intercity, rail-passenger service in the last quarter of the twentieth century. If the experiment is to be a fair test of rail potential, it must be carried out in markets where Amtrak can compete effectively.

CONCLUSION

Amtrak as originally designed seems to have been doomed to fail from the outset. It has simply been too expensive in its original configuration for the service provided. In particular, long-haul trains make little sense except for limited amounts of recreational travel, and recreational users should pay the costs they entail. The only major difference between past and present rail operations since the coming of Amtrak is that subsidies are now covered by the government, rather than by the privately-owned railroads. Government has learned what the railroads have known for many years: a complete network of intercity rail passenger services cannot be operated in the U.S. on a for-profit basis. Northeast Corridor services are another matter. Given mounting Amtrak deficits, it appears about time that route elimination and restructuring changes take place.

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CHAPTER 4

1/ For example, Stuttgart-Frankfurt; Frankfurt-Koln; Koln-Dusseldorf, etc. Only in the NEC where Boston-N.Y. and N.Y.-Washington are connected do we have a situation truly comparable to most European routes.

2/ The DRG&W chose not to join Amtrak because it feared that passenger trains might interfere with its scheduled freight services. The DRG&W right-of-way runs through spectacular Rocky Mountain scenery in Colorado and Utah. Many Amtrak riders disembark in Denver and take the DRG&W's own passenger train to see the sights.

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