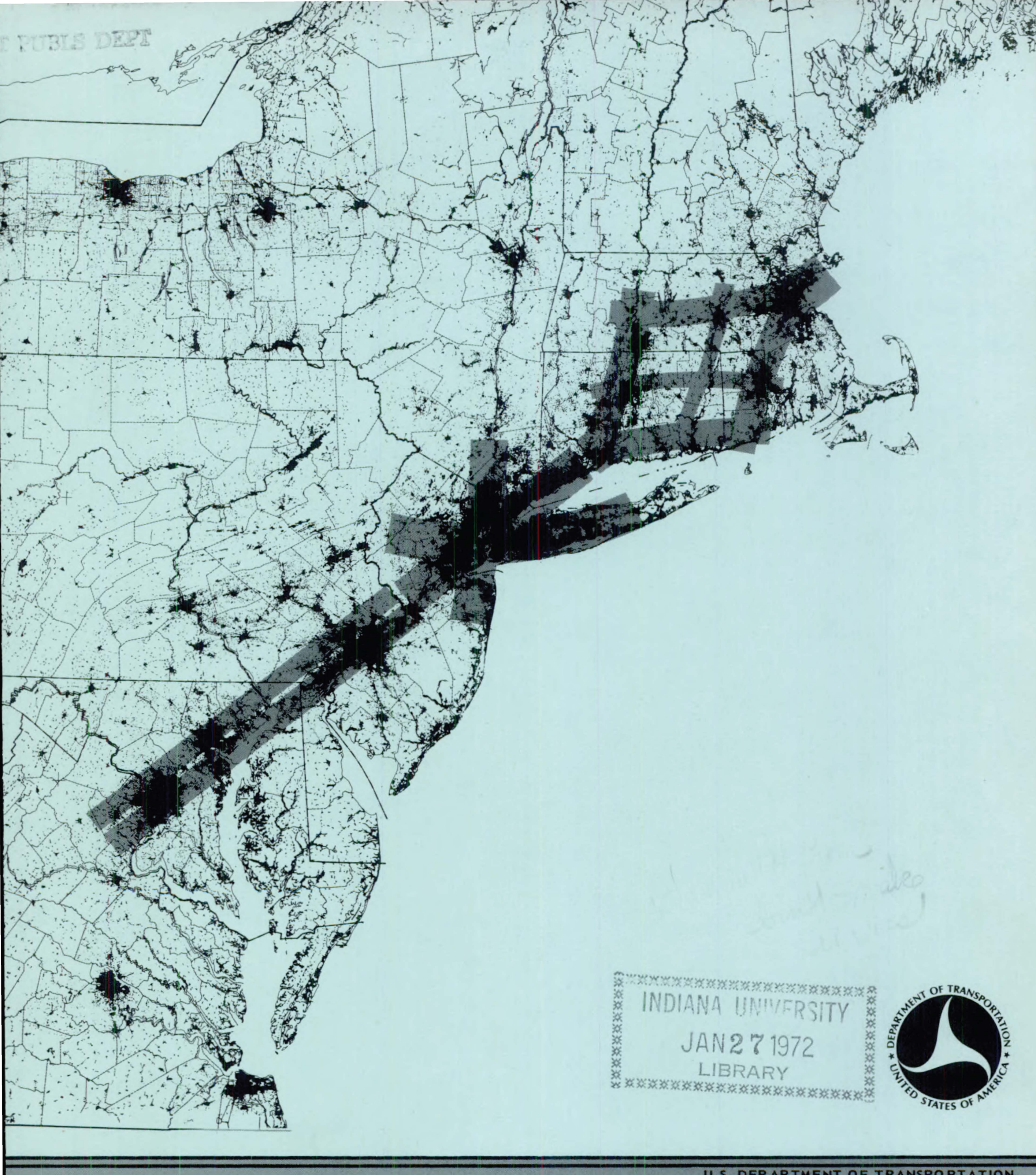

U.S. DEPARTMENT OF TRANSPORTATION

ASSISTANT SECRETARY FOR POLICY AND INTERNATIONAL AFFAIRS – OFFICE OF SYSTEMS ANALYSIS & INFORMATION

VOLUME 1

SUMMARY REPORT

RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION

FINAL REPORT

RELEASED SEPTEMBER 1971

RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION

SUMMARY REPORT

VOLUME 1

U. S. Department of Transportation
Assistant Secretary for Policy & International Affairs
Office of Systems Analysis and Information
Strategic Planning Division

Final Report

Released

September 1971

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

September 15, 1971

Honorable Carl Albert
Speaker of the House
of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

I take great pride in sending you today the final report and recommendations of the Department's Northeast Corridor Transportation Project. You will recall that I submitted a status report on the Project on May 4, 1970 which contained much valuable information, but no definite recommendations. Now the Project is complete and I commend its results to your attention.

This study is certainly one of the most comprehensive analytical efforts ever undertaken in the field of transportation. The Department of Transportation was created by the Congress to attack the types of multi-modal and inter-modal problems found in the Northeast Corridor and to encourage the application of the most advanced analytical techniques available in doing so. I believe that this report does just this.

The Report and its recommendations represent five years of careful, thoughtful study. Various modes of air and ground transportation were examined. The analysis concludes that improving the rail system in the Boston-Washington corridor is necessary to meet the needs of inter-city public transportation in the 1970's. Important recommendations for improved use of present highway capacity are also put forward and could be implemented early in this decade.

The Report leaves open the alternatives for the 1980's and calls for a diversified and vigorous program of technological research and development to explore the possibilities. Decisions on the "next generation" systems must be made by 1976.

A theme in the recommendations for the 1970's is the need to make more effective use of existing transportation systems capacity rather than introducing new technology systems that will require large and costly new facilities in densely populated areas. Avoiding the construction of such facilities is not only economical, but spares us the heavy environmental and social costs often associated with the disruption of densely settled regions.

Although the Report's recommendations are moderate when viewed in the context of the alternatives considered, substantial resources are involved, particularly for the improvement of the rail system. For this reason, the Report's recommendations require very careful consideration on the part of all concerned, especially the States and localities affected. Accordingly, the recommendations are not to be construed as legislative proposals on the part of the Administration for Federal action. Rather, the Report represents a study of problems and alternatives, proposing solutions for the several levels of government and the private sector to consider. For our part, the Northeast Corridor Report will assist the Department in the formulation and execution of transportation programs for this area.

I look forward eagerly to a constructive public discussion which will enable the nation to take on an exciting challenge for the improvement of our transportation system in this critical region. Furthermore, it is my hope that as this century progresses and population densities increase, the projects we undertake in the Northeast Corridor will serve as the prologue to similar projects elsewhere in the country, albeit with appropriate regional variations.

The Northeast Corridor Report contains the essentials needed for development of public policy and program decisions which are both innovative and prudent. Transportation progress is no longer a subject to be discussed in abstract terms, but rather lies within our reach. We anticipate with enthusiasm the participation of the Congress, the States and municipalities, the private sector, and the public, joining with us to grasp this opportunity.

Sincerely,

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle
Recommendations for Northeast Corridor Transportation

5. Report Date
Released--September 1971

6. Performing Organization Code
TPI-13

7. Author(s) Myron Miller, NECTP Director, Melvyn Cheslow, Nancy T. Ebersole, John Gerba, Donald J. Igo, Walter Velona and Robert L. Winestone *

8. Performing Organization Report No.

9. Performing Organization Name and Address
Strategic Planning Division
Office of Systems Analysis and Information
Assistant Secretary for Policy & Internation Affairs
United States Department of Transportation

10. Work Unit No.

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
United States Department of Transportation
400-7th Street, S. W.
Washington, D. C. 20590

13. Type of Report and Period Covered
Final Report April 1970 to September 1971

14. Sponsoring Agency Code
DOT/TPI

15. Supplementary Notes *The systems analyses contained in this report are the products of a government-industry team effort. Industry contractors included the MITRE Corp., Peat, Marwick, Mitchell and Co., and the Resource Management Corp. Significant contributions were also made by the National Bureau of Standards.

16. Abstract The report recommends a series of policy actions necessary to resolve future short-haul intercity passenger transportation problems in the region. Emphasis has been placed on common carrier and highway improvements which are needed to insure relief of the most pressing problems during the "interim" 1970's time period, and actions necessary now to insure adequate lead time for "long term" solutions during the 1980's. The final report consists of the following documents:

Volume 1, Summary Report - Contains recommendations and supplementary conclusions, and discusses in highly summarized form the background to the Corridor's transportation problems, the general study approach and the evaluation of alternatives.

Volume 2, Main Report - Includes discussions of the Corridor's population growth patterns and the region's transportation system, the evaluation methodology, descriptions of the "interim" and "long term" alternative systems, and a comparative analysis of the alternatives as to their technological feasibility, economic costs and benefits and environmental impacts for the years 1975 and 1985.

Volume 3, Technical Appendices - Contains descriptions of methodology and detailed results of the Corridor's air and highway systems analysis and general environmental forecasts through 1985.

17. Key Words: Northeast Corridor, transportation planning, systems analysis and evaluation, system alternatives, net present value analysis, facility requirements, environmental impact, simulation, congestion, capacity constraints, fares, patronage, transportation coordination, regional transportation, NECTP, high speed ground transportation, high speed rail, STOL, VTOL, TACV, automated highway

18. Distribution Statement: Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TABLE OF CONTENTS

	Pages
PREFACE	ix
CONCLUSIONS AND RECOMMENDATIONS	1
POPULATION GROWTH AND DISTRIBUTION	14
TRANSPORTATION PROBLEMS - THE NEED FOR ACTION	15
GENERAL ANALYTIC APPROACH	22
ANALYSIS AND EVALUATION FOR THE INTERIM PERIOD (1970's)	24
ANALYSIS AND EVALUATION FOR THE LONG-TERM PERIOD (1980's)	44

LIST OF TABLES

TABLE	TITLE	PAGE
1	Attributes Considered in Evaluation of Alternatives	23
2	Terminal Locations for Alternatives for the 70's	29
3	Door-to-Door Times Between Representative City Pairs	30
4	Net Present Value, Fares, Patronage, Investment and Salvage Value, Northeast Corridor Transportation Alternatives	35
5	Comparative Costs for IHSR and IHSR--STOL Systems (1975)	36
6	Driver Information System and Network Improvements	43
7	Patronage and Cost Estimates	53
8	Comparative Costs of 60 Million Annual Trips Using TACV vs. TACV and STOL (1985)	54

LIST OF FIGURES

FIGURE	TITLE	PAGE
1	Average Access Times to Terminals in Washington, D.C., Metropolitan Area	28
2	Percent Diversion of New York CTOL Traffic	31
3	Travel Time Improvement from Right-of-Way Improvement in IHSR	38
4	Net Present Value versus Reduction in Block Time for Investment in IHSR	39
5	Annualized Cost for 1985 Alternative High Speed Modes	52

PREFACE

The Northeast Corridor Transportation Project is recommending actions necessary to resolve the future short-haul intercity passenger transportation problems in the region. Conclusions, recommendations and supporting analyses are presented for two time periods: (1) an "interim" period covering the 1970's; and (2) a "long-term" period covering the 1980's. Emphasis has been placed on actions which must be taken immediately to insure relief of the most pressing problems and actions necessary now to insure adequate lead time for "long term" solutions.*

The report is divided into three volumes: Volume 1, the Summary Report, Volume 2, the Main Report, and Volume 3, the Technical Appendices. The systems analyses contained in this report are the product of a government-industry team effort. The MITRE Corporation made very important contributions to the air and multi-modal analyses. Significant contributions were also made by the National Bureau of Standards on high speed ground transportation; by Peat, Marwick, Mitchell and Co., on highway systems; and the Resource Management Corporation on environmental quality and impacts. Tracked Hovercraft Limited supplied input data for the tracked air cushion vehicle system cost estimates. The cover map was provided by the New York Regional Planning Association.

---

*This report supersedes the Northeast Corridor Transportation Project Report, NECTP-209, April 1970. NECTP-209 was a preliminary status report, contained no policy recommendations, and has been replaced by the new analyses described in this report.

CONCLUSIONS AND RECOMMENDATIONS

SUMMARY OF ACTION PROGRAMS

The actions recommended for the Northeast Corridor are designed to meet the growing demand for short-haul transportation in the region, while minimizing the costs and adverse environmental impacts of moving large numbers of people.

To provide transportation service for the interim (1970's) period, actions beyond existing plans are called for to maximize the utilization of the Corridor's unique transportation assets, i.e., the large investments in existing facilities. The (1970's) action program consists of:

1. Improvement of high speed rail service by reducing line haul time, improving passenger amenities, and increasing departure frequencies and schedules;

2. Development and implementation of a real-time highway information system to assist intercity drivers in making route choice decisions; and improvement of highway connectivity to provide additional alternative routes during peak travel periods.

To provide high speed common carrier service for the longer term (1980's) period, additional actions are recommended that must be performed now, so that the required information will be on hand for the investment decisions concerning the 1980's.

1. Immediate planning of a new high speed ground right-of-way along the spine of the Corridor;

2. Expansion and acceleration of research and development of tracked air cushion vehicles (TACV), with emphasis on developing an environmentally acceptable system;

3. Orientation of short and vertical take-off and landing aircraft (STOL and VTOL) R&D toward requirements for the 80's emphasizing airport and air traffic control system capacity, safety, noise and air pollution abatement, and ride quality;

4. Establishment of 1976 1/ as a definite decision year for a Northeast Corridor (NEC) intercity transportation investment program in the 1980's based on the evaluation of the results of R&D and Improved High Speed Rail operations.

To provide sufficient highway capacity for the long term, the following actions are required now to provide alternatives to continued proliferation of conventional highways:

1. Expansion of the automated highway research and development program to define and evaluate possible concepts;

2. Preparation of proposed legislation for the Post Interstate Highway Program which will permit highways to be planned and built in such a way that accommodation to automated capability will be possible.

DETAILS OF ACTION PROGRAM

Recommendations for the Interim Period (1970's)

The Northeast Corridor Transportation Project concludes that, in the near term, increasing congestion at urban Conventional Take-off and Landing (CTOL) air terminals will preclude sufficient growth of both long and short-haul traffic to meet the air travel demands. It further concludes that the provision of improved, expanded high-speed ground service for short-haul travel along the NEC spine can help to alleviate increasing CTOL congestion while meeting the rising demands for travel. Major factors influencing these conclusions are (1) the increasing public sensitivity to adverse environmental impacts of the current air system, which militates against expansion of the air system (acquiring new land for airports, increasing operations), and (2) the increasing demand for long-haul domestic and overseas air service. Alternate air transportation concepts (such as STOL and VTOL) which could potentially provide improved service for short-haul travel are not considered practical for application in this time frame for reasons discussed in the next paragraph. The only system capable of increasing the speed of travel and which can be rapidly implemented is improved high-speed rail which expands and improves the demonstration service 2/ on the existing right-of-way between Washington and Boston.

.STOL and VTOL

In the Northeast Corridor Transportation Project's study of short and vertical take-off and landing (STOL and VTOL) aircraft for the '70's the early analyses 3/ were encouraging. However, the inclusion of more complete cost and environmental considerations raises serious doubts whether an effective and community acceptable city center system could be made operational during the '70's. Strong Federal fiscal support would be necessary to finance the urban STOL and VTOL terminals and air traffic control which are considered essential to fully exploiting the flexibility of these air systems.

Air terminal facilities are traditionally heavily supported by municipal agencies. Community opposition to VTOLport and STOLport sites currently exists because of noise, air pollution and safety concerns to a degree that early acceptance and/or municipal financial support are unlikely to materialize. The New York area is critical to transportation in the Northeast Corridor not only because it contains more than half of the population and it has a central position astride the Corridor spine, but also because more than 60 percent of all common carrier trips either begin or end in the New York metropolitan area. In this dominating part of the Corridor major opposition to new airports or expansion of existing airports has materialized. In addition, interference of STOL or VTOL flights with the already congested CTOL (both commercial and general aviation) ir traffic may not be preventable in the '70's.

A final difficulty arises because of the expected disparity in ride quality and comfort between present CTOL jets and the turboprop STOL or helicopter VTOL postulated for the '70's. If passengers regard STOL or VTOL as a serious step backward, then significant passenger diversion by these CTOL competitors is not likely.

The NECTP recognizes that STOL and VTOL aircraft are presently providing limited feeder service to some Corridor CTOL airports. This is viewed as an adjunct to the conventional air system rather than a completely new alternative. The demonstration of improved technology on service of this kind could be the first step in testing user acceptance.

. Improved High-Speed Rail (IHSR)

IHSR is a mode that could be developed out of the present Metroliner demonstrations, taking advantage of the resource savings resulting from using existing facilities with unused capacity. Metroliner results plus analytical projections indicate that (a) more high-speed Metroliner-type cars, (b) better passenger amenities, (c) stepped up frequency of schedules and (d) availability of non-reservation and some non-stop service would attract significant additional rail patronage in the New York-Washington, New York-Boston, and (their) intermediate markets, thereby providing some relief to CTOL airport congestion.

Further improvements in speed 4/ should be achieved by upgrading the right-of-way. Expenditures of $100 million should be made for right-of-way improvements south of New York to permit approximately 2-hour nonstop New York-Washington service; and an additional expenditure of $190 million should be made north of New York to permit approximately 2 3/4-hour nonstop New York-Boston service. Approximately $70 million for terminal improvements and $100 million for additional vehicles would complete the investment required for this level of service. Approximately three years after the decision to proceed, full operation of the Improved High Speed Rail (IHSR) service could be available to the Boston-Washington traveler.

Capital will probably not be available for IHSR financing as a purely private enterprise. The existence of the quasi-public NRPC 5/ is the result of the inability and disinclination of private railroads to pursue the rail passenger market. The NRPC, however, is unlikely to have resources to invest in the Northeast Corridor, even if that corporation were to decide its most pressing problem lay there. The impetus must come from the Federal Government. Because the project is expected to be profitable, an outright grant is unnecessary. Federal support could take the form of a direct loan, guaranteed bonds or some similar arrangement.

Following such investment and as the IHSR system begins to operate (and its ridership levels increase), further investments could be made which would boost the capability of the IHSR to the level of 1 1/2 hours nonstop city center service New York to Washington, and 2 hours nonstop city center service New York to Boston. 6/ Of major significance is the distinct possibility that such "second stage" investments could be financed from the earnings of IHSR system once the first stage is completed. A decision regarding such additional investments should be made after obtaining the patronage response to the earlier improvements. In addition, the decision should be part of the broader long term decisions to be made in 1976.

On the basis of the foregoing, the Northeast Corridor Transportation Project recommends that:

. THE ADMINISTRATION SUPPORT IMPLEMENTATION OF IMPROVED HIGH-SPEED, NON-RESERVATION, HIGH FREQUENCY RAIL SERVICE ALONG THE WASHINGTON TO BOSTON SPINE. THE DEPARTMENT OF TRANSPORTATION SHOULD SEEK LEGISLATION TO INSURE THAT NECESSARY FUNDING FOR THIS EFFORT IS MADE AVAILABLE (LOANS, LOAN GUARANTEES, ETC.) DOT POLICY SHOULD BE TO STIMULATE IMPROVED HIGH SPEED RAIL SERVICE TO ATTRACT MORE SHORT-HAUL PASSENGERS BETWEEN NEW YORK - BOSTON, WASHINGTON - NEW YORK, AND INTERMEDIATE DISTANCES ALONG THE SPINE OF THE CORRIDOR. TOTAL ESTIMATED COST IS $460 MILLION.

. Highway

With regard to highway travel in the 1970's, the Northeast Corridor Transportation Project concludes that congestion problems will increase drastically over the next decade due to bottlenecks at the metropolitan areas where intercity traffic interfaces with urban commuter and week-end traffic. The existing and presently planned highway network, however, offers broad capabilities for alternative routing of intercity traffic around urban congestion points. Interim period network and connectivity improvements have been identified that will partially relieve intercity highway travel congestion.

But, full exploitation of the future capacity and flexibility of the Corridor highway network will require a capability for intercity drivers to make intelligent decisions concerning alternate routes based on actual traffic conditions. The analyses show that a real-time highway information system would provide the motorist with substantial benefits in delay avoidance -- even if no further highway network connectivity improvements were made. On the other hand, with further network connectivity improvements the existence of a real-time information system gives the motorist the opportunity to take advantage of a wider variety of uncongested route alternatives. Similarly, an alternate spinal route, which avoids the major metropolitan areas and which could be achieved by minor improvements to an existing route, would be beneficial, especially at peak periods. In view of the large advantages to be gained from more intensive use of the existing highway network, the Northeast Corridor Transportation Project recommends both a real-time information system and network connectivity improvements as follows:

- THE EARLY IMPLEMENTATION OF A REAL-TIME HIGHWAY INFORMATION SYSTEM FOR THE MAJOR HIGHWAYS OF THE CORRIDOR SHOULD BE A HIGH-PRIORITY DEPARTMENTAL GOAL. FREEWAY-SURVEILLANCE AND RAMP-METERING CONTROL SYSTEMS SHOULD BE COORDINATED WITH THE HIGHWAY INFORMATION SYSTEM. TOTAL ESTIMATED INVESTMENT COST IS $80 MILLION.

- IN ORDER TO FACILITATE INTERCITY HIGHWAY MOVEMENTS ALONG THE CONGESTED BOSTON-TO-WASHINGTON SPINAL NETWORK, THE CONNECTIVITY OF THE EXISTING AND PLANNED NETWORK SHOULD BE IMPROVED, PARTICULARLY AROUND THE CONGESTED METROPOLITAN AREAS, BY CONSTRUCTING ADDITIONAL SHORT SECTIONS OF FREEWAY BYPASSES AND INTERCHANGES. THE INFORMATION SYSTEM WILL ENABLE DRIVERS TO GET MAXIMUM BENEFITS FROM THESE CONNECTIVITY IMPROVEMENTS WHICH WOULD COST AN ESTIMATED $50 MILLION.

- THE FEDERAL HIGHWAY ADMINISTRATION SHOULD STUDY ALTERNATIVE LOW COST MEANS OF ACHIEVING, IN THE 1970's, THE CONSOLIDATION OF EXISTING HIGHWAYS INTO A NEW NORTH-SOUTH ROUTE WHICH WILL PASS OUTSIDE OF THE CONGESTED METROPOLITAN AREAS. ONE LOW-COST EXAMPLE COULD BE IMPLEMENTED BY JUST ONE 15-MILE NEW SECTION AND FURTHER UPGRADING OF EXISTING AND PLANNED FACILITIES AT AN ESTIMATED INCREMENTAL COST OF $60 MILLION.

Recommendations for the Long Term Period (1980's)

The Northeast Corridor Transportation Project has performed a detailed examination of alternatives to meet the short-haul passenger transportation needs of the long-term period (1980's) and concludes that additional R&D is required to develop the necessary information to make investment decisions for the 1980's. The long-term action program, therefore, is designed to identify what must be done between now and a decision date (1976) to insure the availability of the information needed for rational decisions on long lead-time investments.

The Project has examined the use of both new air and high-speed ground transportation systems along the Corridor spine and concludes that there are significant R&D risks associated with each. If the recommended R&D programs are successful, however, the transportation requirements can be met. The Project also concludes that the IHSR, which would be operating in the 1970's, may be able to meet a significant portion of the 1980's requirements as well. Therefore, IHSR must be considered in the investment decisions to be made in 1976.

The prime alternatives considered for the long-term period include the tracked air cushion vehicle system (TACV), Improved High Speed Rail (IHSR), short take-off and landing aircraft (STOL), and vertical take-off and landing aircraft (VTOL). In addition, the potential of automated highways complementary to the above alternatives has been addressed.

. Tracked Air Cushion Vehicles (TACV)

TACV offers the potential for very good reliability, comfort and safety; high capacity; and decreasing passenger-mile costs at high volume. Because the acquisition of a sufficiently straight, continuous right-of-way will be a difficult and long-lead item for any high-speed ground system, the Northeast Corridor Transportation Project recommends:

. THE DEPARTMENT OF TRANSPORTATION SHOULD BEGIN AT ONCE TO EXPLORE POSSIBLE ROUTES FOR A RIGHT-OF-WAY SUITABLE FOR A TRACKED AIR CUSHION VEHICLE SYSTEM AND TO INVESTIGATE POSSIBLE INSTITUTIONAL ARRANGEMENTS FOR AN OPERATING SYSTEM.

Research and development currently in progress on Tracked Air Cushion Vehicles is primarily aimed at problems of propulsion and cushion performance. In terms of environmental compatibility, the TACV powered by a linear induction motor has the potential for minimizing noise and air pollution (assuming the movement to nuclear generation of electric power continues at currently projected rate for the NEC).

Because of the great importance of alleviating noise and other environmental impacts, it is necessary that these factors be given added emphasis in the R&D program. A critical element in securing a TACV right-of-way will be its environmental acceptability. Accordingly, the Northeast Corridor Transportation Project recommends:

. RESEARCH AND DEVELOPMENT EFFORTS FOR TACV SHOULD BE EXPANDED AND ACCELERATED AND SHOULD INCLUDE HEAVY EMPHASIS ON THE ENVIRONMENTAL IMPACT OF THE SYSTEM (INCLUDING ELECTRIC POWER SOURCES).

The Northeast Corridor Transportation Project recognizes that technological risks exist in the research and development for the TACV system and that socio-political risks are involved in securing new rights-of-way and in achieving proper institutional arrangements. One of the risks is that the fixed investments in right-of-way preparation and guideway construction are large and not easily recoverable. In terms of capacity and passenger-mile costs for high volume spinal traffic, the TACV appears to have an advantage over air systems. Actual decisions regarding ride comfort, safety, reliability, and environmental compatibility must await the results of research and development.

. STOL and VTOL

The Project recognizes the value of the greater flexibility, speed and network connectivity of STOL and VTOL air systems under consideration for the 1980's. The appropriate investment decision, however, hinges on the relative success of curbing environmental impacts through research and development efforts, as well as on the success of alternative measures.

The Northeast Corridor Transportation Project, therefore recommends that:

. STOL AND VTOL R&D, ORIENTED TOWARD MEETING REQUIREMENTS FOR THE 1980's, SHOULD CONTINUE EMPHASIZING NOISE AND AIR POLLUTION ABATEMENT, RIDE QUALITY, AIRPORT AND AIR TRAFFIC CONTROL CONSIDERATIONS, AND COMMUNITY AND PASSENGER SAFETY.

. ALTERNATE STOL AND VTOL SYSTEM PLANS SHOULD BE EXAMINED AND EVALUATED TO FACILITATE DECISIONS ON POSSIBLE FUTURE (1980's) IMPLEMENTATION.

. MAJOR INVESTMENT DECISIONS SHOULD BE DEFERRED UNTIL THE REQUIREMENT IS ESTABLISHED TO GO BEYOND THE INTERIM RECOMMENDATIONS AND UNTIL THE OUTCOMES OF THE TACV, STOL AND VTOL RESEARCH AND DEVELOPMENT PROGRAMS ARE EVALUATED. A DEFINITE DATE SHOULD BE SET FOR SUCH EVALUATION AND THE R&D PROGRAMS ORIENTED TOWARD MEETING SUCH A DATE (RECOMMEND THE YEAR 1976).

. TO AID IN THE EVALUATION OF THE TACV, STOL AND VTOL RESEARCH AND DEVELOPMENT PROGRAMS, THE FEDERAL GOVERNMENT SHOULD MAKE A DETERMINED EFFORT TO ESTABLISH REALISTIC ENVIRONMENTAL ACCEPTABILITY CRITERIA AND STANDARDS FOR COMMON CARRIER SYSTEMS.

. Automated Highway

The Northeast Corridor Transportation Project concludes that automation of highways and the resulting benefits could reach fruition within the operable life of highways built in the next decade. Because of the huge investment represented by the highway system, it will be a serious mistake if Post-Interstate highway planning and construction preclude later installation of advanced technologies. Therefore, in recognition of the potential for high-speed, high-density operation through automatic control and guidance of individual vehicles, (and for operation both on and off controlled highways) the Northeast Corridor Transportation Project recommends:

. EFFORT SHOULD BE EXPANDED AND ACCELERATED TO DEFINE AND ESTABLISH THE DESIRABILITY OF MOVING TOWARD AUTOMATED HIGHWAYS. AFTER COMPLETION OF THE REQUIREMENTS PHASE, AND IF AFFIRMATIVE, A RESEARCH, DEVELOPMENT AND IMPLEMENTATION PROGRAM SHOULD BE ESTABLISHED FOR AN AUTOMATED HIGHWAY SYSTEM IN THE CORRIDOR. THE RESULTS OF AUTOMATED HIGHWAY RESEARCH WILL DETERMINE APPROPRIATE FEDERAL DESIGN SPECIFICATIONS TO DIRECT THE POST INTERSTATE HIGHWAY PROGRAM SO THAT NEW CONVENTIONAL HIGHWAYS MAY BE ADAPTED TO AUTOMATION WITH MINIMUM EXPENDITURE.

Supplementary Conclusions

Additional conclusions are presented which resulted from the analyses and the experience and insights developed during the Northeast Corridor Transportation Project study. Although important to the overall improvement of intercity transportation, they represent tentative findings and identification of possible areas for further study.

New York Hub Air Congestion

The necessity to provide additional or expanded facilities for increasing long-haul domestic and international air travel demand will continue to impact on the airport capacity of the Northeast Corridor. Despite favorable assumptions regarding major improvements in air traffic control, the widespread use of high-capacity jets, better rationalization of airline operations, constraints on general aviation operations, and the diversion of Corridor short-haul air travelers to high speed ground modes, the Northeast Corridor Transportation Project concludes that, unless additional actions to divert CTOL passengers are undertaken, the New York Hub area will, in all likelihood, face severe and unmanageable air congestion problems in the 1980's.

Northeast Corridor analyses indicate that one useful action would be to operate the three New York airports -- JFK, LaGuardia, and Newark--in a manner that equaliz the delays at all three. This action would require scheduling operations into each airport proportional to its capacity and would result in some transfer of traffic from LaGuardia and Kennedy to Newark. But this action alone will not solve the New York hub problem. There could be substantial improvements in the efficiency of processing travelers from these three airports by including in the spinal rail or TACV system a connection to Philadelphia International Airport and Bradley

Airport in Hartford, Connecticut, thus permitting operation as a regional air hub. Another approach to alleviate congestion is the diversion of some of the international travel, particularly that which is not specifically destined to the New York area.

The Northeast Corridor Transportation Project, while not having made an exhaustive study of all possible means of adding to New York airport capacity, calls attention to the following tentative conclusions which require further study.

- -Service proportional to supply instead of demand at the hub airports can be accomplished and used to increase hub capacity.
- -A proportion of the benefits of a fourth New York jetport could be achieved by the alternative method of connecting existing airports (New York Three-Airport Hub, Philadelphia and Hartford) to a spinal high-speed ground system, thus forming a regional air hub.
- -Some international and long-haul flights should be diverted to other Corridor airports to avoid congesting New York hub airports.

Institutional Considerations

The NECTP multi-modal approach to transportation analysis and planning has served to highlight serious inequities among the modes in regulatory and taxation policies, and in providing command and control, terminals and rights-of-way. A high degree of cooperation among metropolitan, state, regional, and Federal governments (as well as cooperation within and coordination among modes) is needed to achieve efficient resource allocation in transportation. The attainment of the necessary cooperation and coordination is hampered by jurisdictional, legal, regulatory and other problems.

-The Department of Transportation should press for and participate in reexamination of institutional, regulatory, tax and support status policies of transportation to facilitate the multi-mode approach necessary for efficient resource allocation in Corridor transportation.

Short-Haul Feeder and Off-Spine Service

While the Project did not engage in an intensive study of feeder and off-spine transportation supplementary to spinal service, recognition is given to the flexibility a: network connectivity characteristics of the air system in general and the STOL and VTOL modes in particular.

Consideration was given to a role for VTOL, STOL, CTOL short-range, and CTOL small-capacity air, as well as rail systems, for feeder and off-spine service.

All have potential for serving the feeder market. The VTOL and STOL appear to serve more economically those dispersed cities where land costs are high; small CTOL where land is not valued at premium prices; and rail, where track exists.

The Northeast Corridor Transportation Project, therefore concludes:

-A follow-on study should be made to determine the best modes for short-haul feeder and off-spine type service as a supplement to the spinal Improved High-Speed Rail service in order to establish appropriate modal requirements for the interim and long-term periods. In this regard, early identification is needed of existing rail feeder lines to prevent possible premature disposal of these rights-of-way. Such facilities cannot now and should not be disposed of without prior consideration by the Interstate Commerce Commission.

High-Speed Ground Transportation Research and Development

Two high-speed ground modes requiring advanced technology are worthy of special mention, although they do not represent alternatives for the time period of the 1980's. The underground tube vehicle system has been eliminated as a feasible 1980's alternative because of the prohibitive cost of tunneling. If it becomes impossible to secure ground-level right-of-way, or a major breakthrough is made in reducing the cost of tunneling, underground high speed (tube) systems could prove a practical alternative in some spinal intercity as well as urban applications. In addition, tunneling into some cities will be required for the TACV alternative, and it may be even more necessary in the future as land use constraints and environmental pressures increase. Therefore, a major effort should be undertaken in tunneling technology to achieve a significant improvement in cost.

The technological development of magnetically levitated vehicles has not been considered sufficient to warrant their inclusion as 1980's alternatives. In a broad sense, magnetic levitation could be very nearly interchangeable with air cushions for vehicle suspension, and the technology could possibly form a natural follow-on to TACV. Magnetic suspension also has great potential for evacuated tube-vehicle-type systems that preclude use of air-cushion suspension.

The Northeast Corridor Transportation Project thus concludes:

-The ongoing research in tunneling and in magnetic levitation technology, as well as in tube-vehicle systems, is necessary to the development of a broad based future capability for high-speed ground transportation.

Continuing DOT Program for Implementation

A continuing and concentrated evaluation effort will be required to insure that the foregoing recommendations are carried out in an effective manner:

- The relative progress of the TACV and STOL/VTOL R&D efforts must be monitored and evaluated;
- Study and analysis must continue on air-ground trade-offs;
- Data collection and evaluation are needed to examine investments incrementally and to determine if expectations are being achieved;
- Relationship of the transportation system to community acceptance needs to be continually assessed.

POPULATION GROWTH AND DISTRIBUTION

The Northeast Corridor megalopolis is the most extensively urbanized region in the nation, housing 44 million people (more than one-fifth of the nation's population) on less than two percent of the nation's land. The region's population has been projected by Census and DOT to increase to 47 million by 1975 and 52 million in 1985.

The most significant feature to be derived from the Corridor's growth pattern is the large differences in population increases between urban and non-urban areas. Presently, metropolitan centers contain almost 38 of the Corridor's 44 million residents. Between 1960-70, the region's metropolitan areas attracted four million people -- almost six times as many as its non-metropolitan portion. Projections based on a continuation of this trend indicate that 6.5 million new residents will be added to these metropolitan centers over the next 15 years, in contrast to an additional 1.5 million in non-metropolitan areas.

Of particular importance for transportation improvements is the fact that about two-thirds of the metropolitan areas (including the major cities of Washington, Baltimore, Philadelphia, New York and Boston) are located on -- or in close proximity to -- the linear spinal networks of the Corridor's major rail and highway facilities. These metropolitan centers account for a major share of the Corridor's intercity travel demand, and their central business districts represent the largest single points of geographical concentration for common carrier travelers' trip ends.

Continuation of population growth and distribution trends of the Northeast Corridor megalopolis with adjustments for anticipated changes in the birthrate have been postulated in the absence of a national population concentration or distribution policy. The emphasis has been placed upon <u>organizing</u> the growth where it is likely to occur (in the major urban areas) and <u>identifying</u> intercity transportation service and environmental problems through-out the region at the point where they presently occur or are expected to occur. Not surprisingly, the areas in which opposition to environmental impairment is strongest and where travel demands are exceeding supply (measured by travel delay times) are precisely where population and development is the most dense and where growth is continuing to occur in greatest numbers -- along the Washington to Boston spine.

TRANSPORTATION PROBLEMS - THE NEED FOR ACTION

The principal intercity traffic flows in the Corridor -in volumes unmatched anywhere in the world -- move between the region's metropolitan areas lying along the narrow Boston to Washington spine. Many intercity trips not only overlap and interfere with one another, but often become mired in urban traffic as well. The disruption to the smooth flow of intercity highway travel is at its worst in the vast New York metropolitan area. Intercity highway traffic and air, rail and bus terminal access travelers in the New York area must compete with almost a million daily local trips to reach destinations within or beyond the metropolitan area; 75 percent of Corridor air travelers are destined for New York where they share limited air and terminal space with over three times as many extra-Corridor and international air travelers; and even some through-rail passengers must contend with an inter-terminal transfer made all the more onerous by local street congestion. Given that approximately 60 percent of all intercity trips within the Corridor either begin or end in New York, traffic congestion in this city exerts a dominant influence on intercity travel throughout the region.

The Corridor will be facing increasing demands for transportation services as a result of an expanding, ever more interdependent economy and an increasingly mobile and affluent society. Median family income, in constant dollars, is projected to increase at approximately the national rate reaching $15,000 by 1985, compared with $10,000 today. Unless additional steps are taken (over and above what is currently planned) to meet the future mobility needs, the ability of the Corridor's transportation networks to accommodate expected demands will be severely constrained. Our existing systems will operate with gradually reduced effectiveness. Actual physical limits on expanding highways and airports are already appearing. Problems are systems capacity constraints and many limitations imposed by the heightened societal concern with air and noise pollution; public protests over land acquisition threatening forests, parklands and residential tranquility; the need to compete for land with an increasing number of non-transportation uses; concern for user and community safety; and, finally, the scarcity of undeveloped urban land convenient to central business districts and other established employment centers. To this list must be added the increasing user, operator and government costs for transportation (expenditures by transportation users are expected to double between now and 1985); and the non-centralized nature of the political organization in the region, characterized by the loose and largely uncoordinated decision-making structure for transportation. The problem is not simply one of knowing that transportation facilities in the region need to be expanded and improved, but in deciding what improvements should be recommended; where they should be located; when they should be introduced; who will suffer; and who will benefit; and what actions are required to finance and manage the improvements. Each of these issues will be elaborated upon in the discussion which follows:

Air Congestion

Airport investment and development in the 1960's have not kept pace with aviation demands. Flight operations in the Corridor are restricted and disrupted by technological limitations of the air system and environmental constraints. The most critical limiting elements are the inadequacy of present air traffic control capability to track all aircraft in congested metropolitan airspace (where most near midair collisions occur) the number and location of airport facilities constrained by noise restrictions and the inability of these facilities to accommodate peak hour flight demands.

Aircraft and terminal delay increased nationally 20 percent in 1969. Five major Corridor airports accounted for almost 30 percent of the national delay figure. Air delays have declined somewhat in 1970 because the continuing imposition of airport quotas and adverse business conditions. The long term trend indicates that demand and delays for air transportation will increase. The introduction of wide-bodied jets and the subsequent scheduled improvements in air traffic control will improve the situation somewhat. The Corridor airports -- especially those in the New York metropolitan area -- are operating at or near peak-hour saturation, not only in terms of the number of aircraft they can accept in the airways and on the runways, but also in terms of the overloads on the terminal building facilities, automobile parking areas and airport access. Unless relief can be found in the form of new or expanded airports or in diversion of some of the demand pressure, passenger delays in the long-term period are likely to increase to very severe levels. In particular, the portion of the passengers processed during periods when the airports operate at or near saturation is likely to grow from 20 percent to 50 percent or more by 1985.

Highway Congestion

Between 1950 and the mid-1960's, substantial improvements to the Corridor's highway network led to a more than 30 percent reduction in travel time between Boston and New York and 40 percent reduction between New York and Washington. More recently, intercity travel times have begun to increase again due to traffic congestion along the Boston-New York-Washington spine, accentuated by critical gaps in the urban sections of I-95. It must be emphasized that congestion on these facilities generally does not result from intercity travel *per se*, but from local commuter and weekend traffic in and around the major metropolitan areas.

Corridor forecasts indicate a 65 percent increase in demand for intercity highway travel between 1970 and 1985. Most of this additional demand will occur along the Washington-Boston spine. The most significant portion of a planned $17 billion investment in Corridor highway construction between now and 1978 will be spent on radial urban freeways and for rural and semi-rural freeways perpendicular to the spine. Relatively little of this new funding will be used to improve facilities along the I-95 spinal route. Therefore, it is expected that there will be a general deterioration between 1970-85 in the average-day travel speed and reliability along this spinal route, and severe deterioration of service for significant numbers of intercity travelers who must pass through one or more congested metropolitan areas. Furthermore, during peak days, travelers will tend to encounter congestion on the rural and semi-rural portions of the spinal route as well. By 1985 congestion will have reached such severity that the Corridor's highway travel patterns, especially the routes, starting time of trips, and the decisions to make trips, will be significantly affected.

Underutilization of Rail Capacity

In contrast to the steady increase in travel on the air and highway modes, rail patronage in the Corridor has declined sharply since the early 1950's. Between 1955 and 1968, the number of non-commuter passengers carried on Corridor rail dropped 47 percent. The rate of decrease in rail patronage slowed down, however, between 1966 and 1969 averaging only 2 percent, compared with 17 percent nationally.

A steady decrease in the number of communities served and in the level of service provided has accompanied the decline in rail patronage. Since 1955, passenger service has been discontinued on 40 percent of the Corridor's roadbed. The longer trips have declined most sharply resulting in a 70-percent drop in passenger miles and a 60-percent reduction in gross revenues (in constant dollars). Consequently, there now exists considerable excess capacity in almost every section of the passenger rail system in the Corridor. Significantly greater numbers of passengers could be transported by rail without expansion of the fixed plant. The problem, however, is in the ability of conventional rail (excluding the high speed demonstration service) to attract patronage.

The introduction of the Government-sponsored Metroliner demonstration has reduced the travel time between New York and Washington by an average of one hour and has rekindled interest in passenger train service. Load factors averaged 67 percent over the last six months of 1970. The insufficient reliability of equipment, however, resulted in a low utilization rate -- an unexpectedly large proportion of the cars have required extraordinary maintenance. The Metroliners appear to be more than covering their direct operating costs with preliminary first quarter 1971 revenues totaling $3.1 million and direct operating costs of $2.1 million. Still the "Metroliner" service has not achieved its true operating potential because of speed restrictions on approximately 20 percent of the New York to Washington route. There are sharp curves, bad track alignment and several dangerous grade crossings in Maryland and Delaware.

Air Terminal and Access Problems

Forecasts of 1985 peak-hour air demand indicate critical problems for most Corridor airports, involving terminal-access trip times, parking capacity and passenger and baggage handling. The implications for terminal access are particularly severe since trip times to and from terminals currently exceed the line-haul times for many short-haul air trips. This situation appears to have as its underlying causes the predominant use of highway vehicles for terminal trips and the high correspondence between air traffic peak hours and urban commuter peak hours.

Urban freeways and city streets are already congested during morning and evening peak periods and these peaks are forecasted to get significantly longer and progressively more severe by 1985. Over 50 percent of airport-access travel is estimated to occur by 1985 during these periods of urban highway congestion, resulting in even longer access times and poor reliability of judging the arrival times for the majority of airport-access travelers. This projected deterioration in the level of service provided by the urban highway system for air travelers' terminal trips will compromise the level of air service which might otherwise by provided.

The air terminal access problem is one of many facing urban transportation planners. Solutions are not separate unto themselves, but are part of the total urban transportation problem currently receiving high priority.

Air Pollution

Recent agency ratings from the Department of Health, Education and Welfare place eight NEC metropolitan areas among the top twenty nationally with the severest air pollution problems. Widespread episodes in Corridor cities during the last two summers involving photochemical smog are indications of a trend toward dangerous levels of nitrogen oxide and hydro-carbon emissions (two necessary components of smog) whose prime source is the gasoline powered vehicle.

While transportation is cited as a major source of air pollution, highway vehicles used for urban trip purposes generate a much larger share of total metropolitan area emissions than those on intercity trips. Nevertheless, because today there is a pronounced concern over contamination from any source, greater emphasis must be given to the assessment of air pollution characteristics of alternative intercity transport technologies in comparing their suitability for application in densely settled regions such as the Northeast Corridor.

Noise

In the decade of the 1960's, the measured levels and extent of urban noise rose significantly, as did the social awareness of noise and its discomforts.

Noise is a problem with most modes of transportation, particularly in heavily settled areas such as the Northeast Corridor. Air transportation has received the sharpest criticisms and the greatest degree of control. Noise abatement regulations are enforced at almost all major Corridor airports, restricting runway utilization and operating capacities. Furthermore, aircraft noise currently acts as a constraint to expansion of the air system because public objection to noise severely limits the selection of new airport sites or curtails air operations in certain communities.
Concerning the future, the Interagency Aircraft Noise Abatement Committee concludes ... "assuming continued growth in air demands, noise in the vicinity of many metropolitan CTOL airports will probably become worse in the next few years, and noise abatement operating procedures will do little more than chip away the rough edges of the problem." 7/

The problems of noise pollution and community acceptance of alternative 1975 and 1985 air technologies and the ground system alternatives as well, had to receive particular emphasis in the Corridor evaluation to satisfy the provisions of the National Environmental Policy Act of 1969, which states that plans for major Federal actions must be cognizant of the impact on the quality of the human environment.

Land Requirements for Transportation

Land values in the Corridor vary from about $1,000 to $10,000 per acre in rural areas depending on density and reach $500,000 per acre for densely populated urban land. Modern air and highway facilities require extensive amounts of land for safe and efficient operation. Current suggested standards for new jetports specify 14,000 to 20,000 acres, against which Dulles' 10,000 acres shrinks to an almost modest scale. A search for a fourth jetport in New York was initiated some twelve years ago, and yet uncertainties still prevail today. 8/

New Corridor highway facilities would have to be accommodated into what is already the most intensively developed region in the country -- 14 percent of the nation's total network is concentrated within the Corridor on 2 percent of the nation's land area. It is debatable how many more lanes of highway can or should be added to the Jersey Turnpike; the newly widened section of that road already consumes 36 acres of land per mile in its 300 foot wide swath. Under present design standards, a 4-lane interstate highway in a rural area consumes 40 acres of land per mile excluding interchanges.

Nationally, major interstate highway (urban) route controversies rage in 11 urban areas -- seven of the problem areas and four-fifths of the disputed route miles are located in the Corridor. Strong opposition has developed primarily because of the threatened displacement of residences and businesses, as well as environmental and aesthetic impairment of neighborhoods.

It is in the highly developed urban areas, that the most intense pressures of growth and development are being felt. Little vacant urban land is available for future development and open space is frequently inadequate. Communities will be hard pressed to make forceful decisions regarding future land use conversion, redevelopment, which may require relocation and disruption of existing urban facilities.

Safety

National transportation fatality rates published by the National Safety Council are presented below. Both general aviation and automobile travel have rates which are orders-of-magnitude greater than those for the common carrier modes.

In non-fatal injury rates (not shown in the table), the auto and bus modes are markedly higher than scheduled air or rail.

National Safety Council
Transportation Accident Death Rates, 1969

Passenger Deaths in:	Death Rate (per 100 million Pass. Miles)
Passenger Automobiles and taxis (Drivers are considered passengers)	2.30
Passenger Automobiles on turnpikes*	1.20
Buses	0.22
Railroad Passenger Trains	0.07
Scheduled Air (Domestic)	0.13
General Aviation (Includes pilots and crew)	18.00

*The turnpike death rate is considered a useful surrogate for fatality rates for intercity Corridor automobile trips.

While efficiency, speed, comfort and dependability are desirable qualities for any transportation mode, safety must rank foremost in the ordering of priorities for expanding and improving the Corridor's transportation system.

Aircraft not under control mixed with aircraft under control may pose a problem to the efficient and safe operation of commercial air service in the Northeast Corridor region, as suggested by the high rate of involvement of such aircraft in midair near misses in the U.S. in 1968.

AVIATION INVOLVEMENT IN COLLISIONS (TOTAL 1965-68) AND NEAR MISSES (1968 ONLY)

		Total All Aviation	Gen. Avn. vs. Gen. Avn.	Gen. Avn. vs. Com. Avn.	Gen. Avn. vs. Mil.	Gen. Avn. Involvement
'65-'68	Collisions					
	In Terminal Areas	78	70	7	1	78
	Enroute	41	34	--	6	40
1968	Hazardous Near Miss					
	In Terminal Areas	719	190	271	174	635
	Enroute	409	93	65	129	287
	Critical*					
	In Terminal Areas	189	45	71	54	170
	Enroute	128	28	16	38	82
	Potential**					
	In Terminal Area	530	145	200	120	465
	Enroute	281	65	49	91	205

*Critical Near Miss - Collision avoidance was due to chance rather than an act on the part of the pilot.

**Potential Near Miss- Collision might have occurred if no action had been taken by either pilot.

Source: Federal Aviation Administration, Near Mid Air Collision Report of 1968, Air Traffic and Flight Standards Technical Report; July 1969, pp. 119-163.

General aviation is expected to become ever more dominant in the sky over the U.S.; growing 89 percent from 1969 to 1981, while the commercial aircraft fleet is growing 40 percent for the same years. The percentages do not indicate the real magnitude of the change shown in the following table:

FLEET SIZE CHANGES 1969-1981

		General Aviation	Commercial Aviation
1969	Number	124,237	2,700
	Percent	97.87	2.13
1981	Number	235,000	3,800
	Percent	98.46	1.54

GENERAL ANALYTIC APPROACH

The study of Northeast Corridor passenger transportation has required a high level of analytical activity. The scope has varied from calculating the magnitude of the growing problems (e.g. congestion) to determining the relative effectiveness of alternative solutions (e.g. TACV).

The analyses in this report include (1) air and highway capacity and congestion projections; (2) comprehensive environmental impact analyses; (3) demand projections for both 1975 and 1985; and (4) computations of operator and government costs and revenues for air and high speed ground modes, 1970-1999. Computer analyses have been performed to simulate the supply and demand interaction in the market place for various competing modal mixes. By this means, the commercial viability of various transportation alternatives for the 1970's and 1980's could be analytically tested. In addition, the analyses in this report have attempted to reflect the projected impacts of the substantial body of new legislation relating to transportation, e.g., the Airport and Airway Development and Revenue Act of 1970; the Rail Passenger Service Act of 1970; the Urban Mass Transportation Assistance Act of 1970; the National Air Quality Standards Act of 1970; the Federal-Aid Highway Act of 1970; and the National Environmental Quality Act of 1969.

The impacts of the transportation system alternatives on five interest groups have been evaluated. These groups include the particular system users; other modal travelers; government agencies; private operators; and the community. The alternatives are compared with respect to the attributes shown in Table 1. Valuation of costs and benefits for users and operators is in dollar terms. Quantitative measurement in physical units is used for attributes such as speed, noise levels, air pollution, and land requirements. For some items, such as passenger comfort and degree of institutional disruption, descriptions of projected impacts are included although no quantification was attempted. After each alternative mode is rated for each attribute and for each affected group, dominant advantages and disadvantages for these modes are identified and used to derive conclusions concerning the relative desirability of each alternative.

Results are presented separately for the two-time periods considered, i.e., the 1970's and the 1980's. In both cases, highway alternatives are considered separately from high-speed common-carrier modes, since NEC projections indicate that even the introduction of a major new high speed common carrier will not alter significantly the highway's share of the intercity travel market.

Table 1

ATTRIBUTES CONSIDERED IN
EVALUATION OF ALTERNATIVES

User

1. Comfort
2. Convenience; Personal Control
3. Cost: Business Trips
4. Cost: Non-Business Trips
5. Line Haul Speed
6. Door-to-Door Travel Time
7. Travel Time Reliability
8. Safety
9. Connectivity of Network

Other Travelers

1. Impact on Airport and Airways Congestion
2. Impact on Highway Congestion: Interurban
3. Impact on Highway Congestion: Intraurban

Community

1. Noise
2. Air Pollution
3. Land Use
4. Energy Requirements
5. Community Safety
6. Local service benefit

Government Agencies

1. Number of Local Government Agencies Involved
2. Institutional Rearrangements Required
3. Federal support Required
4. Local Government Support Required (e.g., for Terminals)
5. Time Streams of Costs and Revenues (Net Present Value)
6. Competitive Effect on Other Modes
7. Potential for Serving Projected Future Population Distribution

Private Operator

1. Private Capital Requirements
2. Profitability
3. Degree of Risk in Patronage Projections
4. Degree of Risk in R&D Program
5. Labor Intensiveness
6. Adaptability to Market Changes

ANALYSIS AND EVALUATION FOR THE INTERIM PERIOD (1970's)

ALTERNATIVES

The modal alternatives analyzed for possible application in the '70's are classified into three broad categories: Air, including CTOL, STOL and VTOL; Rail, including conventional and improved high speed rail; and Highway, including auto and bus. Each alternative is described briefly in the following paragraphs.

Air

CTOL (Conventional Take-Off and Landing) aircraft presently provide almost all commercial intercity air service. The CTOL airports of the Northeast Corridor serve international and domestic long, medium and short-haul markets to points outside the Corridor in addition to short-haul service within the corridor. The general trend has been toward increasing air congestion and traffic delays at major Corridor airports, and this trend is expected to continue in the '70's. It was assumed that the approaches which will be taken for alleviating CTOL congestion include major improvement to a third generation air traffic control system plus added runways and facilities at existing airports. The former is going forward under the FAA but the latter - new runways and runway extension - is meeting heavy opposition, particularly in New York. Another approach involves building wholly new airports; however, proposed new airport construction has been meeting strong opposition in New York and Boston.

Long-haul CTOL facility improvements have not been fully studied for this report, which focuses on travel within the Northeast Corridor. The full benefits and costs of alternatives for overall CTOL facility improvement cannot be analyzed without extending the study beyond the geographical limits of the Corridor to include long-haul domestic and international operations. However, the interactions between the complete CTOL services and Corridor short-haul traffic have been analyzed.

The introduction of Short and Vertical Take-Off-and-Landing aircraft (STOL and VTOL) have been studied for the 1970's in several aircraft types and terminal location combinations. STOL and VTOL have been viewed as "cooperative" traffic diverters of CTOL flights in the sense that present CTOL carriers would accede to the diversion by cutting back short-haul CTOL schedules. Modal designations for the '70's in STOL and VTOL were:

STOL 75 — Turboprop aircraft using extensive flaps and low wing-loading to reduce take-off and landing distance. Two state-of-the-art aircraft were considered -- a 48-passenger type designed for a nominal 2000-foot runway and a 120 passenger type designed for a 1500-foot runway. The sets of terminal include a total of nine or ten sites in seven metropolitan areas. Five were located at existing airports and the remainder involve new construction.

VTOL 75 Compound helicopter aircraft using turbine engines and propellers for forward propulsion in the cruise condition at 265 mph with an unloaded rotor. Capacity is 86 passengers with a nominal 318 mile range. The terminal set covered the same cities as the STOL 75 but all sites were considered as new VTOLport construction in favorable access locations.

The use of STOL strips at existing metropolitan airports was considered feasible for the 70's provided air traffic control advances allowed operation on an independent and non-interfering basis with CTOL traffic. Location of STOL strips at major general aviation airports such as Teterboro was not considered because of the very large increases in traffic expected for general aviation. Most of the analysis for STOL and VTOL involved service among the major metropolitan areas of the corridor. A limited evaluation was made of service extended to additional short-haul points within and outside the Corridor.

Rail

The possible rail options for the '70's fall into two broad classes -- conventional rail and improved rail. Conventional rail is typified by all the rail service currently being offered other than the demonstration Metroliners and Turbotrains. Conventional rail cannot be considered as a new alternative and it appears highly unlikely that the conventional service along the spine would be viable if the Metroliners and Turbotrains were removed.

IHSR (Improved High Speed Rail) as the rail alternative covers a range of possible configurations featuring improvements and higher speeds over the present service. The minimum level, called DEMO in previous reports, assumes use of equipment of the present Metroliner and Turbotrain quality operating on expanded schedules over the present trackage between Washington and Boston. The maximum service level, called HSRA in previous reports, involves extensive track, roadbed and right-of-way improvements plus full electrification to allow realization of the 150-mph cruise-speed potential of the equipment. A number of intermediate improvement levels have been analyzed. Nonstop trip times for DEMO, one intermediate improvement level designated IHSR-1, and HSRA, are shown in the following table:

	Trip Times (Non-Stop)	
	New York-Washington	New York-Boston
DEMO	2 1/2 hrs.	3 1/2 hrs.
IHSR-1	2 hrs.	2 3/4 hrs.
HSRA	1 1/2 hrs.	2 hrs.

Route alternatives for IHSR north of New York include both the present Turbotrain route from New York through Providence, R.I. to Boston, and a variation which goes north from New Haven through Hartford, Conn. and Springfield, Massachusetts to Boston.

Highway

The highway alternatives focus on the use of conventional vehicles -- private auto and common carrier bus -- and emphasize improvements to the existing highway network. It is assumed that current program plans for new construction and upgrading of conventional highways will be implemented. New options considered for the 1970's include:

(1) Expansion of the system to include major new primary or secondary highways, in addition to those presently planned.

(2) Improvement of the utilization and efficiency of the existing and planned highway system including:

 (a) A surveillance and information system to provide intercity drivers with the realtime knowledge to select the fastest route based on actual travel conditions.

 (b) Limited new key highway sections to provide improved highway connectivity and effective alternate routes to avoid the existing Washington-to-Boston main spinal network.

RESULTS

The development of recommendations for the '70's encompasses two objectives: 1) provide continuing capacity and services for the common carrier travelers who have been encountering increasing air terminal congestion and increasing travel time over the past few years; and 2) provide relief for the intercity highway travelers from increasingly severe congestion near the major metropolitan areas.

For both objectives major consideration was given to the question of what can be done now. For this reason the selection of candidate alternatives for the '70's was restricted to the technologies now in hand -- trains, aircraft, and electronics systems that are within the present state-of-the-art. The more advanced technologies -- those still in the laboratory, on the drawing board or at the proving ground make up the alternatives for the next decade and beyond. Ideally, of course, a single set of recommendations could solve the problem for now and the future. Recognizing that the ideal is not likely to be found, the NECTP attempted to ensure that the recommendations for the '70's are compatible with the recommendations for the long-term period.

The High Speed Traveler

Roughly 35 percent of the intercity trips in the Corridor are those in which the primary factor influencing selection of travel mode is time. The market is dominated by the one-day round trip for business but also includes all those trips whose purpose makes speed desirable for persons with high income levels. The market has expanded rapidly over the past two decades, principally under the impetus of improving air service which made the one-day round trip anywhere in the Corridor a practical reality. The traveler is not per se, an air traveler. He has a remarkable similarity of profile, riding the airline to Boston, the Metroliner to New York, and driving to Baltimore from Washington. He makes his decision on the basis of the services offered and he is divertible.

A major problem affecting these travelers, however, is increasing travel times due to air service congestion. If new airport construction or major expansion cannot take place, particularly in New York, air travelers face increasing delays despite major improvement in air traffic control. (The short-haul trip is in particular trouble since the delays affect its trip time most on a percentage basis; it forms the lowest-profit market for airlines with present jet aircraft; and its smaller aircraft sizes contribute disproportionately to the traffic congestion.)

Thus it can be concluded that, precluding the expansion of overall CTOL capacity, diversion of short-haul demand from conventional air service is the best way to benefit both the diverted short-haul passengers and the remaining CTOL travelers making longer trips.

Door-to-Door Trip Time

The traveler's perception of trip time is not based only on vehicle speed or on the advertised schedule. He must add his access time to and from the terminal (or freeway interchange) and modify the result with consideration of the probable delay, the reliability of the service and the convenience of schedule. Access time depends on the location of the terminal relative to (1) the actual end points of the trip and (2) the urban transportation (primarily highway) network. Figure 1 is based on Washington, D. C. but is generally representative of any city. A city with one terminal located near the central business district (CBD) will achieve a minimum average access time for the entire metropolitan area. If it has several suburban terminals in addition to the CBD terminal, the average access time can be further reduced.

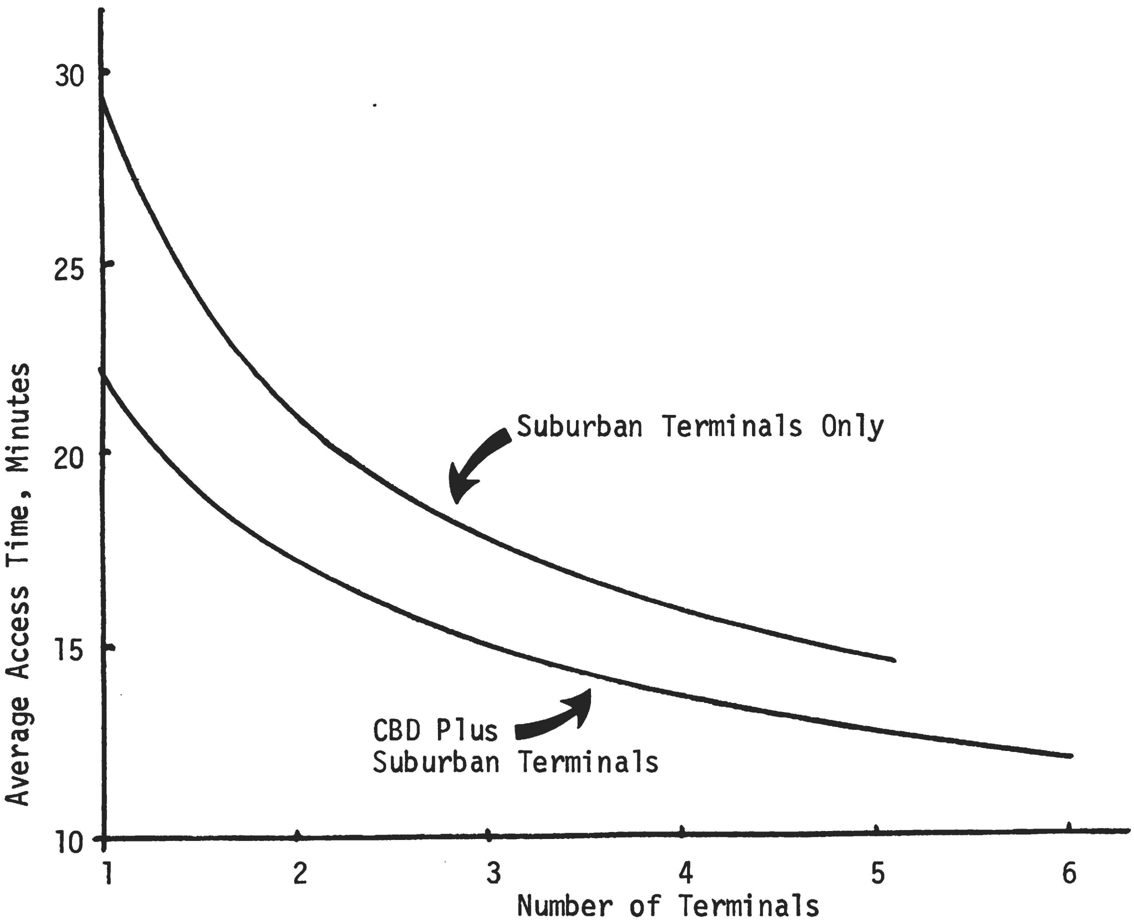

Figure 1. Average Access Time to Terminals in Washington, D.C. Metropolitan Area

Early research by the NECTP indicated the importance of decreasing access time in order to get full benefits from high-speed line-haul common carriers. Therefore, CBD terminals coupled with additional suburban terminals were used in the alternatives whenever the travel volumes justified them.

Six metropolitan areas would be served by all the alternatives - IHSR, STOL, VTOL, and CTOL. These areas are Washington, Baltimore, Philadelphia, New York, Providence, and Boston. In addition all the air modes serve Hartford, while IHSR has terminals at Wilmington, Trenton, and New Haven. 9/ The number and location of terminals is shown in Table 2. Variations in terminal number and sites were made. In particular STOL was examined using the CBD-oriented VTOL terminal locations.

TABLE 2
Terminal Locations for Alternatives For the 70's

	IHSR	VTOL	STOL 10/	CTOL
Washington	1 CBD; 1 Suburban	1 CBD; 1 Suburban	1 CTOL Strip	Existing
Baltimore	1 CBD	1 CBD	1 CTOL Strip	Existing
Philadelphia	1 CBD; 2 Suburban 11/	1 CBD	1 CTOL Strip	Existing
New York	1 CBD; 2 Suburban	1 CBD; 3 Suburban	1 CBD; 3 Suburban	Existing
Hew Haven	1 CBD	----------	----------	--------
Hartford	----------	1 CBD	1 Suburban	Existing
Providence	1 CBD	1 CBD	1 CTOL Strip	Existing
Boston	1 CBD; 1 Suburban	1 CBD; 1 Suburban	1 CTOL Strip	Existing

The air modes terminal sites were selected with the advice of the FAA and subsequent analysis indicates that the number of terminals is approximately as many as the 1975 (analysis year) demand will support.

The average access times, estimated in detail for all the terminals, confirm the indication of Figure 1 above:

All the new modes have better access times than CTOL; and IHSR has access times generally better than the STOL system (with landing strips at CTOL airports) and similar to VTOL for areas they both serve.

By combining line-haul and average access times with the expected delays, door-to-door times between representative city pairs have been constructed and are shown in Table 3.

TABLE 3

AVERAGE DOOR-TO-DOOR TRAVEL TIMES

Using Average Metropolitan Area Access Times

	Highway Distance (Miles)	1975 CTOL	STOL75	(Minutes) VTOL75	IHSR-1*
Washington-Baltimore	40	155	150	95	90
New York-Philadelphia	91	180	143	130	160
Philadelphia-Washington	136	180	165	130	165
New York-Baltimore	187	195	160	140	185
New York-Washington	227	195	155	150	200
New York-Boston	230	185	145	140	235
Philadelphia-Boston	304	190	185	165	310
Washington-Boston	456	205	205	180	350

*IHSR-1 times assume non-stop line haul service, New York to Washington and New York to Boston; and one stop in New York for Washington to Boston. All other times include all station stops.

The influence of access and delay are apparent:

> Auto dominates the very short trips (roughly under 50 miles); IHSR has shorter or virtually equal expected travel time compared with CTOL up to about 255 miles, which includes the key Washington-New York market; and STOL 75 and VTOL 75, using CBD terminals, have shortest times in the 150-350 mile range.

<u>Diversion from CTOL</u>

The major purpose of the NEC recommendations is to improve the capability to move large numbers of passengers along the spine of the Corridor. There may be, in addition, decreased congestion at CTOL airports, and those time savings become extra benefits resulting from the transportation improvements.

If the new modes can provide improved services over CTOL, what are the potential diversions possible? The New York hub is the critical traffic point and provides the best measure for assessing the improvements in delays. The hub serves all air markets: long and short-haul, domestic and international, Coridor spinal and non-spinal. Delay varies from day to day and hour to hour. The measure used in Figure 2 is the average passenger delay on the worst 36 days (decile) of the year. Currently, the delay on these days averages roughly 24 minutes and by 1975 (with a 20% increase in capacity offset by a 63% increase in patronage) delay could rise to 32 minutes. Figure 2 shows the effect on delays according to the percentages diverted from CTOL.

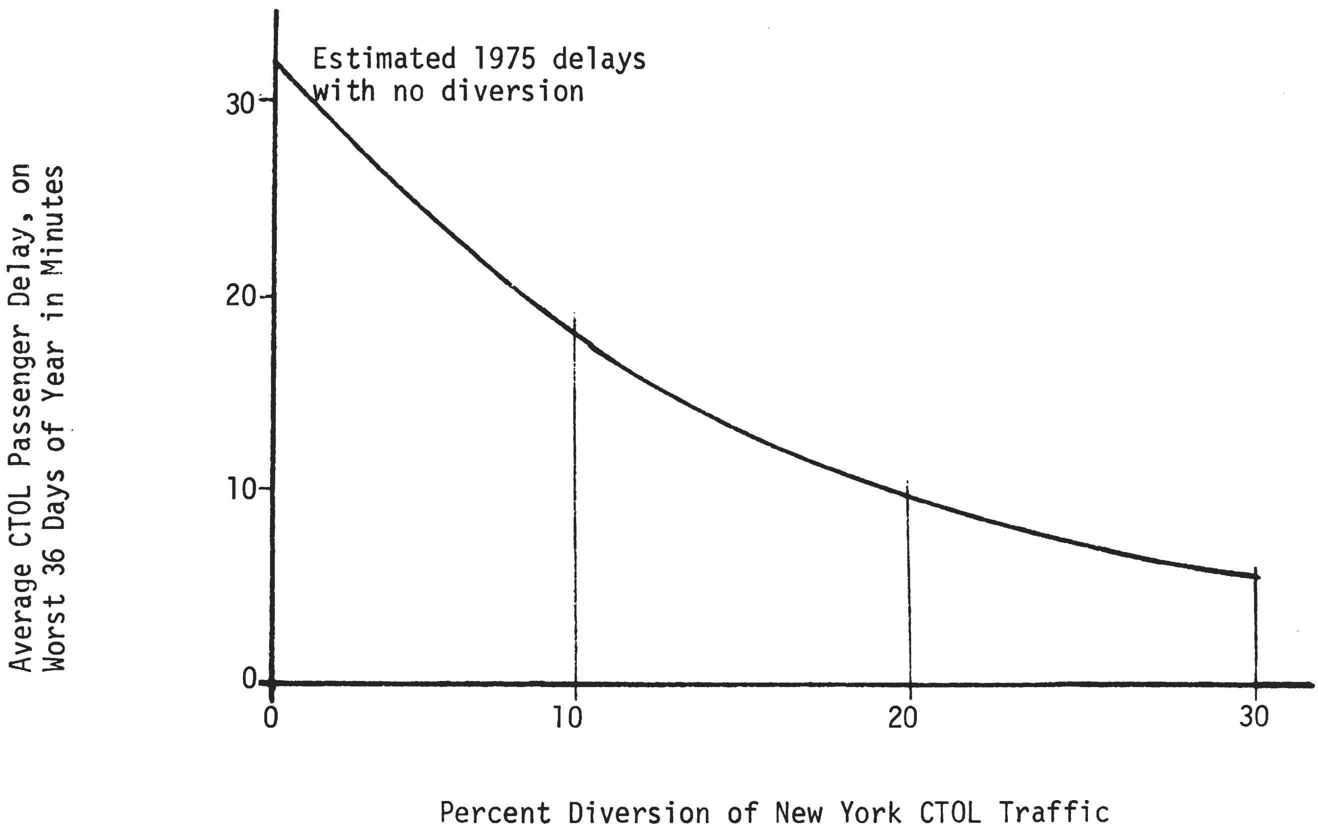

Figure 2 Passenger Inconvenience in New York Metropolitan Area as Affected by Diversion of Traffic from CTOL

Passenger Acceptance

Will the traffic divert? Clearly, air passengers may ride the Metroliners--20 percent of the passengers surveyed in 1970 had taken their most recent previous trip by air. Will they also ride STOL 75 or VTOL 75?

The STOL 75 is a high-wing turbo-prop aircraft; a technological step backward to the previous Electras, Viscounts and F-27's in terms of power plant, and perhaps back to the earlier reciprocating engine aircraft (even to the DC-3) in low wing loading. Compared to the DC-9's, 727's and 737's, the STOL will be noisier internally, have a higher vibration level and at least twice the sensitivity to gusts. Almost all of the STOL flight paths will be at altitudes subject to atmospheric turbulence.

The degree to which the disparity in comfort would deter CTOL passengers from diverting to STOL 75 in unknown. Certainly, if the airlines simply stopped flying CTOL on the Corridor routes and switched to STOL, many passengers would still fly. However, airline experience throughout the country has proved that turboprop equipment cannot successfully compete with jets flying the same routes. Therefore, the study concludes that, for diversion from CTOL to STOL 75 to occur, a marked improvement in level of service will be needed to overcome the decrease in ride comfort.

VTOL 75, a compound helicopter, may ride somewhat more comfortably than STOL 75 but will not compare with the ride quality of jet aircraft. Added difficulties in achieving passenger acceptance may result from passengers' unfamiliarity with the rotor configuration and uncertainty concerning the vehicles' safety. No comparable competitive situation presently exists in airline experience and it can only be concluded that VTOL 75 will encounter much the same problems in passenger acceptance as STOL 75.

Community Acceptance

The improved rail alternative operates on the existing Boston-to-Washington right-of-way and uses existing terminals for the most part. No affirmative community action is required to permit increased schedules of Metroliner-like trains or to upgrade track and roadbed. Elimination of grade crossings, long a community safety complaint, is scheduled as one of the early IHSR investments. Compared to diesels and freight, the new electric powered passenger equipment will be quiet and non-polluting.

Community acceptance of STOL and VTOL in the near future appears negative. Land acquisition for STOL and VTOL terminal ports poses a serious future constraint to these systems. Almost every attempt at new construction or expansion of conventional airports in the Corridor over the past decade has met with strong community opposition. All attempts to establish a STOLport in Manhattan have failed.

The most frequent objections to airports are due to noise. STOL 75 and VTOL 75 will be quieter than present jets, but they are still relatively noisy compared to the ground mode alternatives. The noise emitted from VTOL 75 is estimated at 113 PNdB at 500 feet and for STOL 75 at 95 PNdB to 100 PNdB or greater. The estimates of land area affected, based on the NEF 30 12/ criterion is much smaller than for CTOL. We note that the region between NEF 30 and NEF 25 is one in which "...some noise complaints are possible and noise may interfere with some activities." 13/ A low level of complaints concerning additional noise at existing facilities cannot be equated to community acceptance of a new installation.

Air pollution complaints are also levied against airports and airplanes. The new STOL and VTOL aircraft will avoid the visible particulate trials which have aroused opposition to jet pollution, but will produce invisible hydrocarbons, carbon monoxide, and oxides of nitrogen and sulfur.

Safety is also a difficult point for aviation. The public tends to ignore the safety record of scheduled air service (which is 10 times better than auto) and perceives instead the disastrous crash potential of aircraft overflights. With the possible use of rooftop STOLports or VTOLports on center cities, a new hazard is created due to the large volume of aircraft operations and the quantities of aviation fuel present in confined areas. What would be a minor field emergency at a conventional airport could become a serious situation at a downtown STOLport.

Terminal Financing

The NECTP analyses have underscored the problems of financing STOLports and VTOLports. Under the provisions of the Airport and Airways Development Act of 1960, 14/ a public authority (municipal) is required to provide more than half of the land and terminal construction costs. For a STOL system, investments could run in excess of $300 million for land and new terminal structures in only a few metropolitan areas. New STOLports in all major metropolitan areas would run well over $600 million. VTOLports are smaller and cheaper to build, but the VTOL 75 system involves new construction for all terminals, hence a possible $270 million municipal investment.

The forecasted patronage levels indicate that the STOL 75 and VTOL 75 revenues from terminal rentals and fees could pay off the high municipal investment and avoid any long run municipal net loss. 15/ However, a decision to invest municipal funds or to authorize a bond issue usually requires an affirmative community action -- not likely to occur -- in view of opposition to noise, pollution, land acquisition, and safety hazards.

The study concludes that the likelihood of affirmative community action to approve and support STOLports or VTOLports is low, given the present attitudes toward aviation.

The initial investment levels for land and fixed facilities are nearly equivalent for STOL 75, VTOL 75 and IHSR-1, i.e. roughly $400 million depending on the particular situation. IHSR-1, however, requires roughly $100 million for vehicles, STOL 75 about $300 million and VTOL 75 nearly $500 million. Thus, the total investment for the high-speed rail is in the neighborhood of half a billion dollars, while the air systems could cost three quarters of a billion or more. To keep up with demand, additional expenditures would be continually needed for STOL or VTOL systems since the terminal capacities are limited. IHSR has, except for possible freight train interference, a large enough capacity to meet the needs of the '70's.

Decisions on making transportation investments are frequently based on net present-value considerations. For each alternative, the stream of costs and investments over time is balanced against the expected revenues, and the amounts for each year discounted back to the present. Discounting emphasizes small near-term expenditures and rapid acquisition of revenues. It makes future net revenues less important than close-in net revenues.

IHSR can start on the existing right-of-way -- with little lead time -- and accrue revenue while track upgrading, to attain higher speeds, proceeds. Operating costs are low and the various service levels of this alternative have positive net present values for even short periods of operation.

In contrast, STOL 75 and VTOL 75 require larger investments with a longer lead time to build the needed terminals. Table 4 indicates that STOL 75 would have just paid itself off by 1985, and VTOL 75 would have a low positive present value, and IHSR would produce a very high present value.

TABLE 4

Net Present Value, Fares, Patronage, Investment and Salvage Value of Interim Northeast Corridor Transportation Alternatives

	VTOL 75	STOL 75	DEMO	IHSR-1	HSRA
Fare NY-Wash	23.25	24.50	18.49	20.00	21.70
Millions of Passengers 1975	19	14	15	19	23
Millions of Dollars Net Present Value 1985	67	1	418	432	-30
Salvage Value at cut-off 1985	56	27	0	60	248
Initial Investment in $Millions (not discounted)	890	670	110	450	1630

Federal Investment

Under the provisions of the Airport and Airways Development and Revenue Acts of 1970, the Federal investment in STOL 75 and VTOL 75 would be roughtly $100 million. The 8% ticket tax might be considered as paying for air traffic control operating and investment costs, although no provisions of the acts require such repayment.

No provisions now exist for Federal support of IHSR other than possibly through the NRPC. Presumably, arrangements could be made to finance the IHSR investment and to retire the debt, especially in view of the favorable cost-revenue projections for IHSR. The lack of a specific institutional arrangements could pose a source of delay in providing improved rail service. The large magnitude of funding required -- all of the fixed and vehicle investments -- may also delay action.

What Would it Cost Society for a Competitive Spinal Short-Haul Transportation System?

If the alternative decision were between implementing (1) an IHRS system alone or (2) IHSR plus a STOL-75 system, there would be costs to society associated with each. The data presented in Table 5 are based on the following assumptions:

(1) There is no induced demand whether operating IHSR alone or together with STOL 75; there is an annual total of 20 million passengers in either case.

(2) The air mode cannot handle the entire movement of 20 million passengers along the spine, whereas the IHSR can.

The results shown in Table 5 indicate that society would be paying $162 million for moving 20 million passengers using IHSR alone. However, it would cost society $218 million to move 10 million passengers by STOL 75 (each saving 3/4 hour in door-to-door time), and the movement of the remaining 10 million passengers by IHSR would cost $86 million. The annual additional cost to society for 7.5 million hours of the saving is $142 million or about $19 per hour saved. Any firm insisting on higher speed for its employees on the basis of $19 per hour value of time is in effect valuing employees at approximately $40,000 per year.

Table 5

IHSR and STOL 75

Comparative Costs for IHSR and IHSR--STOL Systems

	STOL	IHSR	IHSR(alone)
Millions of Passengers	10	10	20
Cost Per Passenger Mile	$.14	$.075	$.06
Door-to-Door Time New York-Wash (Minutes)	155	200	200
Average Trip Length (Miles)	156	115	135
Total Cost (Millions)	$218	$86	$162

A Recommendation for the 1970's

Clearly, in terms of service and CTOL traffic diversion, the travel time and flexibility of STOL and VTOL offer the greatest potential benefits. However, the uncertainty of passenger acceptance and the major problem of achieving community acceptance create serious doubt that these potential benefits can be realized in the '70's. The investment levels required are high and net present value is marginal compared to improved rail. If the expected patronage does not materialize, the financial problems could be serious.

The improved rail alternative involves fewer uncertainties than STOL or VTOL in either passenger or community acceptance. By upgrading the existing demonstration service, IHSR can start in the near future and move ahead as the demand grows. Problems in implementing IHSR involve the institutional arrangements -- the lack of a private operator and the still formative nature of the NRPC. The major impetus for financing appears to fall to the Federal government. The risk of default on debt retirement appears low.

The NECTP recommends on balance, the implementation of the improved rail alternative as the new Corridor spinal system for the '70's. Subsequent sections will discuss the recommended level of investment and some of the implementation strategies.

The negative conclusions regarding STOL and VTOL implementation along the spine of the Corridor in the '70's should not be construed as indicating that work on these technologies should be abandoned. On the contrary, vigorous efforts should continue to try and solve the critical problems of community acceptance, to find ways of insuring passenger acceptance, and to work out details of air traffic and operating procedures. The recommended STOL/VTOL R&D program will be discussed under alternatives for the '80's.

Small aircraft with STOL and VTOL capabilities are now operating along Corridor air routes into many existing airports. At present these operations are in the air taxi category, are few in number, and are incapable of providing the mass transportation postulated for the Corridor's 1970's alternatives. The existing service is considered an adjunct to conventional air, rather than a wholly new mode capable of exploiting the full potential of the technology. Over the '70's, however, these early STOL/VTOL services could, in a process of controlled evolution, grow into a demonstration of their potential.

IHSR Investment Level

The Improved High Speed Rail represents a range of possible investments from DEMO (costing roughly a hundred million dollars for rolling stock and no right-of-way improvements) to HSRA, with extensive right-of-way upgrading and total investment of over a billion and a half dollars. As the recommended alternative for the '70's, what level of investment in IHSR should be selected and what should be the strategy in applying it? The primary service effect of investment is improvement in trip time. For analysis purposes, various IHSR investment possibilities were compared with the amount of time saved as shown in Figure 3. The Northern (New York-Boston) and Southern (New York-Washington) routes are shown separately. In each case, the end points are DEMO (D) and HSRA (A).

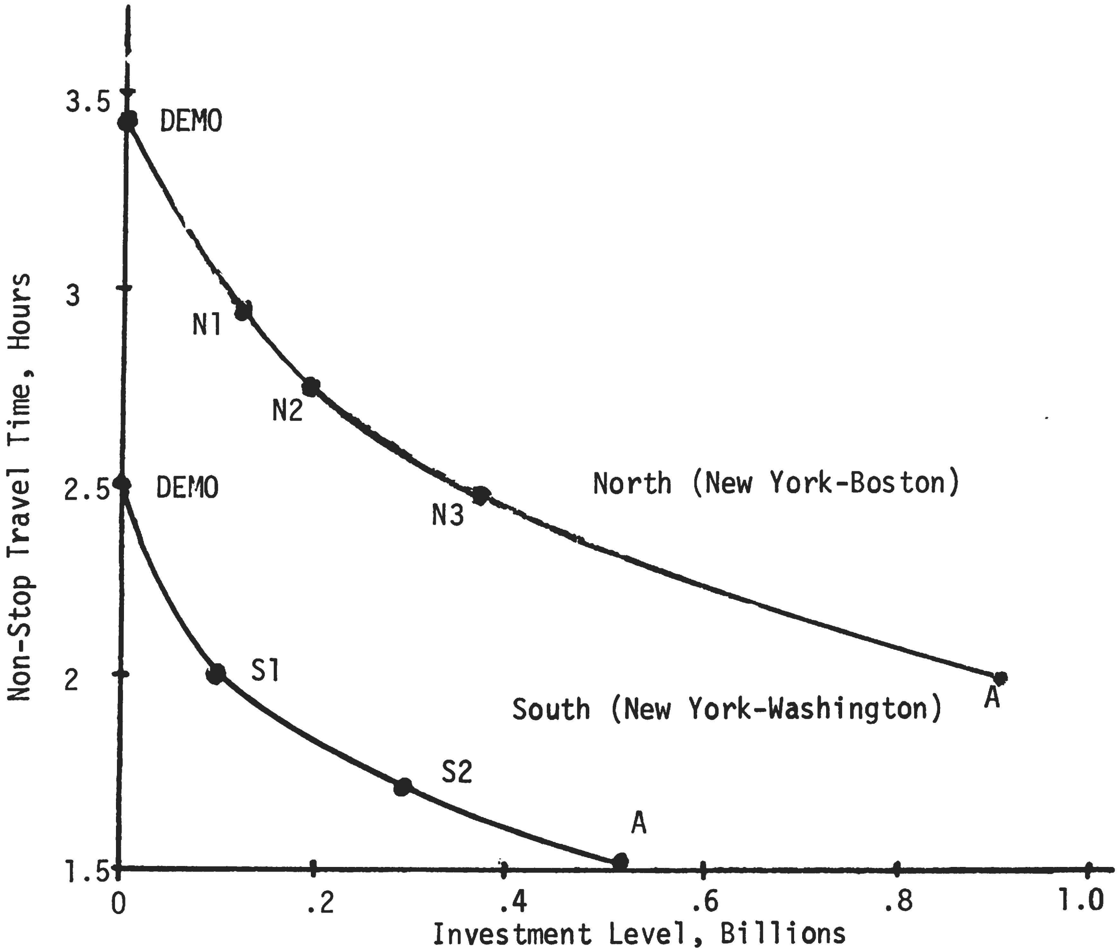

Figure 3 Travel Time Improvement From Right-of-Way Improvement in IHSR

Travel time, alone, presents only part of the picture. The largest population centers lie along the route south of New York and a vast majority of the traffic (70%) exists on the southern section of the line. Travel time improvements in the south produce the largest increases in patronage and revenue. The net present values (NPV) were computed for different combinations of north and south investments indicated on Figure 3. Plotted on Figure 4 is NPV versus time reduction. In effect, this figure plots a profit measure against a service measure. An ordering of the investments is shown by the curve with higher investments, lower NPV, and faster times proceeding to the right. The optimal point on the curve depends on the relative weighting of the two measures -- pure profit orientation would stop at the peak of the curve and service orientation might opt for a lower NPV.

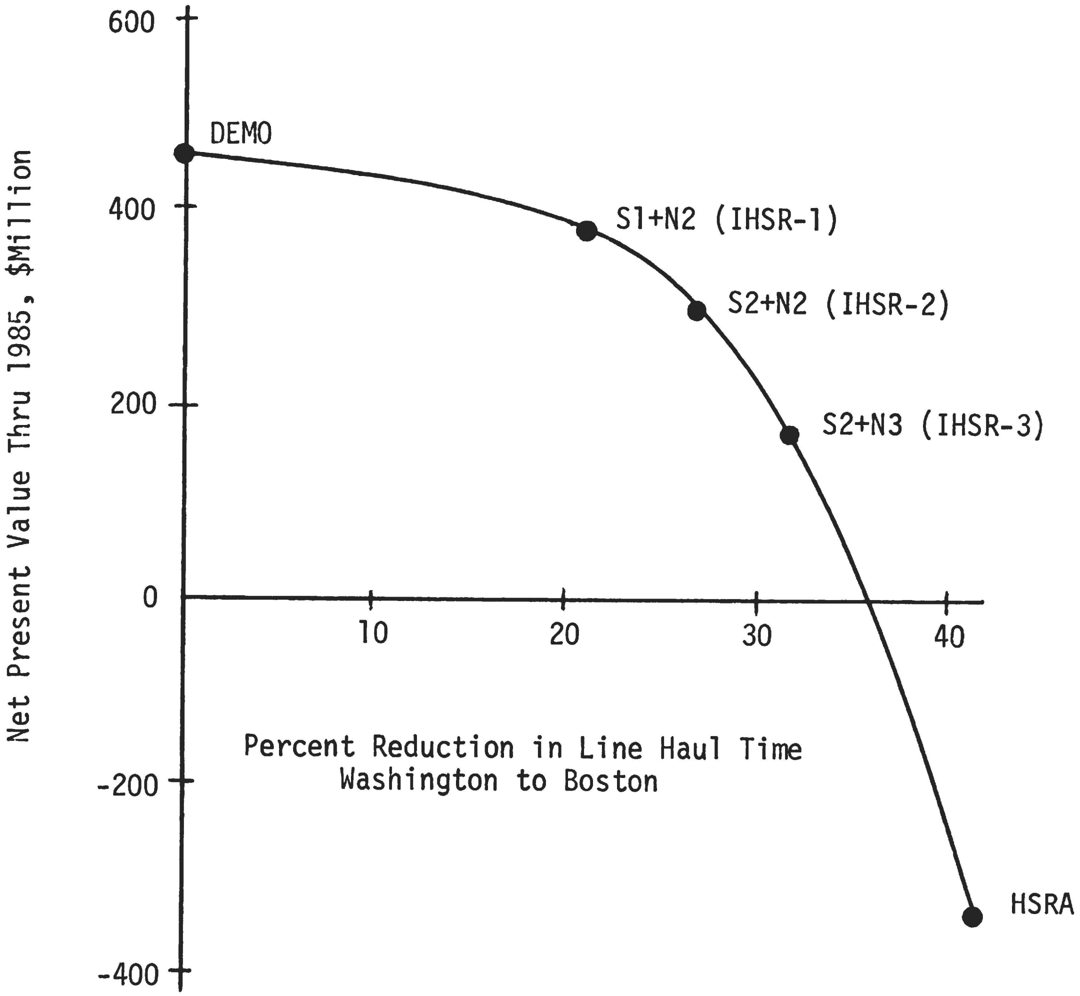

Figure 4 Net Present Value vs Reduction in Block Time for Investment in IHSR

Since the Federal government will probably take the initiative in financing, service orientation is implied. However, a positive NPV is also desirable to allow for patronage and cost uncertainties, support of the NRPC or plow-back to better IHSR. For these reasons, the NECTP recommends an investment of approximately $460 million to reach the IHSR-1 point on the curve by 1975. The next steps - adding either S2 or N3 - would require additional investments and would be beyond the "knee" of the time - investment curves of Figure 3 for both the Northern and Southern routes.

Strategy for IHSR

The recommended investment in IHSR will permit the New York-Boston non-stop time to be reduced to 2 3/4 hours and will cut the New York-Washington time to approximately two hours.

Early consideration must be given to the solution of problems of commuter and freight interference as the schedule frequency builds up under IHSR. The problem exists at two levels: institutional -- since the intercity passenger, local commuter and freight services will not be operated by the same corporate entity -- and physical. Preliminary analysis has indicated that the system can accept large increases in passenger traffic if adjustments can be made in the schedules and operating procedures of all three services. There will, however, be no substitute for examination and negotiation of the problems in detail as operations proceed.

IHSR Financing

There is no present indication that capital will be available for IHSR financing as a purely private enterprise. The existence of the quasi-public NRPC is in part the result of the inability and disinclination of Corridor railroads to pursue the rail passenger market. The NRPC, however, is unlikely to have resources to invest in the Northeast Corridor even if that corporation were to decide its most pressing problem lay there. The impetus must come from the Federal government. Because the project is expected to be profitable, an outright grant is unnecessary. Federal support could take the form of a direct loan, guaranteed bonds or some similar arrangement.

Further Investment in IHSR

Regardless of the precise form of the Federal support mechanism, it may be desirable that improvement of service in the Corridor continue beyond the level of this initial investment. The IHSR system could be set up as a profit center by the NRPC with part of the proceeds earmarked to be plowed back into the system and part to nationwide rail service. The arrangement with the NRPC should insure continued Federal and regional participation in decisions affecting IHSR service. A decision will be required in the future concerning whether or not to add incremental investments to the IHSR system; these additions could be paid for from operating surplus.

The Highway Initiatives Through the '70's and '80's

Highways represent the principal means of intercity travel in the Northeast Corridor. Automobiles and buses currently attract about 74 percent and 5 percent, respectively, of all trips. In addition, nearly all air travelers, and a preponderance of rail and bus travelers, rely on the highways for the terminal access and egress segments of the intercity trips. The extensive demand and modal preference analyses undertaken by the NECTP strongly suggest that the highway's dominance of the intercity travel market will continue in the future, even if a major new high-speed common carrier mode were introduced into the Corridor. The highway market is composed of travelers who, by reason of large group size, low income or special convenience, select auto or bus for travel. Aside from the special sub-group, who need the auto to make multiple stops or to reach out-of-the way places, much of the highway demand group is price oriented. These travelers value time but make the final decision to drive on the basis of cost. The price of the high speed common carrier modes is substantially higher than the perceived 16/ cost of auto. When cost considerations are combined with the convenience of auto, substantial diversion of highway traffic appears unlikely.

The driver in the '70's will have available the excellent interstate network, newly completed. He will find, however, that his intercity trip will encounter increasing congestion in all the metropolitan areas where segments of the interstate system are part of the urban network. His speed on nominally 60 mph-plus highways will slow to a crawl as he is caught in local rush hour traffic or the inevitable jam about an accident or stalled car. There is every indication that the urban commuter crush will continue to worsen before any relief from mass transit can arrive.

The intercity driver caught in commuter traffic differs from the commuters in two important ways:

- He is basically unfamiliar with the road, the interchanges and local conditions. He may tend to add to congestion by slowing to read signs, lane switching for turn-off or general indecision.

- He really does not have to be there. Unless the congestion happens to be directly at his origin or destination, the highway network is extensive enough to permit his use of a route to avoid the problem <u>if he knew of it in advance</u>. Even for his end points, his timing may be flexible enough to let him avoid the rush hour <u>if he knew of it</u>.

In both cases, the difference is information. The intercity driver has essentially a good highway network system available, but does not have the information to use it properly. The initiatives the NECTP proposes for the highway aim at improving the effectiveness of the existing highway system by implementation of a real-time driver information system for intercity travelers. Such a system will:

- Continuously acquire data on traffic flow and other conditions for all major intercity highways in the Northeast Corridor.
- Analyze these data to determine for drivers the optimal route between major decision points and important final destinations.
- Communicate the information on the optimal route to the driver in time to make the route choice (message displays, radio broadcasts, electronic route guidance, etc.).
- Include driver education and route planning service (updated maps, expected conditions, etc.) to prepare the driver to use the real-time system.

The capital cost of an intercity information system would be approximately $50 million.

Network Additions

In concert with the implementation of the information system, the NECTP also recommends a modest number of specific connectivity improvements in key decision areas. Typically these are short by-passes around obvious congestion points or connectors between major systems not essential for "normal" flows, but highly desirable to provide alternate routes during peak flows. The links are described in detail in Volume 2 and are estimated to cost $50 million.

An Alternate Spinal Route

A useful network addition is the upgrading of existing or planned routes to form an alternate spinal route parallel to I-95. A possible route is one passing west of the major metropolitan areas. The only new construction required is approximately 15 miles in New Jersey; the remainder of the proposed route already exists but would require upgrading. Estimated cost of these improvements is $60 million over planned expenditures.

Surveillance and Control

The final recommended action is for freeway surveillance and ramp metering control systems for congested facilities. Implementation would afford the greatest benefits to urban traffic, but the reduction of congestion would affect both urban and intercity travelers. The NECTP includes the initiative for urban surveillance and control in its recommendations because close coordination with the regional information system is essential. Data acquisition equipment would be common to both urban and intercity systems and integrated communication facilities will supplement ramp metering by providing a warning of the expected wait to urban drivers approaching metered ramps. Estimated capital costs are about $30 million.

Benefits From Highway Initiatives

Table 6 shows a measure of the effectiveness of the information system and network improvements for 1985 traffic levels. Assuming predicted levels of local congestion, the basic intercity highway network is expected to account for roughly 492 million annual person-hours of travel. If this congestion could be totally removed, person-hours would drop to 400 million for the same number of trips, a potential saving of 92 million person-hours.

TABLE 6
DRIVER INFORMATION SYSTEM AND NETWORK IMPROVEMENTS

	Annual Total Vehicle Hours of Travel in 1985 (Millions)	Annual Total Person Hours of Travel in 1985 (Millions)
Basic Network	246	492
Basic Network with Information System	222	445
Improved Network with Information System	220	440
Basic Network (Under perfect conditions of no congestion)	200	400

Applying the driver information system alone to the basic network achieves 49% of the potential for time saving. The driver information system plus the network improvements achieve 55% of the potential savings in person hours lost to congestion.

ANALYSIS AND EVALUATION FOR THE LONG-TERM PERIOD (1980's)

ALTERNATIVES

A large number of technologies were examined as potential alternatives for the 1980's. In the discussion which follows, those which were selected for further analysis will be mentioned only briefly and covered more completely under the later discussion of concepts.

Automated Highway represents the general class of systems in which a specially equipped automobile can be automatically guided along a modified highway under central control. The vehicle may be operated under driver control on normal roads. The principal advantage of automation lies in the closer spacing between cars possible under the system and the consequent higher capacity from a given number of lanes. Depending on the system reaction time and safety requirement, maximum capacity may occur at higher speed than on conventional highways.

The NECTP was unable to obtain a sufficiently precise definition of automated highway system characteristics to permit a complete evaluation. Full realization of automated highway as an intercity mode appears unlikely in time to qualify as an initiative for the '80's. Nevertheless, the NECTP has concluded that some form of highway automation may be necessary before the end of the century to avoid the continued proliferation of highway lanes under pressure of rising demand. Because of the very large portion of that demand which is unlikely to divert to other common carrier modes, it is essential that means be found to provide the expanded capacity. The very large and continuing investment in highways makes it mandatory that planning for new facilities include automation if the technology will permit.

High Speed Rail. Continued improvement of IHSR to its 150 mph limit (HSRA) and a possibly more advanced 200 mph system on a new right-of-way (HSRC) are considered as possible alternatives through the '80's.

Tracked Air Cushion Vehicle (TACV) operating on a new rightof-way at speeds up to 300 mph is considered as an alternative for the '80's.

STOL 85 and VTOL 85, vehicle types resulting from continued research and development over the '70's are considered as alternatives for the '80's.

Conventional Air. It was projected that CTOL will continue to suffer from inability to expand airport facilities through the '80's. Under this restriction, the best course is to try to attract the Northeast Corridor traffic to an alternative and conserve the CTOL facilities for longer haul domestic and overseas traffic which has no alternative. CTOL was not actively considered as a Corridor alternative. However, multimode combinations of CTOL with ground technologies were considered as possibilities to ease the airport expansion restrictions.

Underground Tube Vehicle systems which use partially evacuated tubes and gravity assist to attain very high speeds were considered as a possible technology. Despite the attractiveness of the high speed and the freedom from community noise impacts which the system offers, the cost of tunnels makes it impractical over intercity distances. Unless operation on or above the surface is completely impossible or major breakthroughs are made in tunneling techniques, underground tube vehicles will not be an alternative for the '80's.

Magnetically Levitated Systems which use magnetic repulsive forces for vehicle support were judged to be further in the future as operating equipments than the '80's. However, magnetic levitation lends itself particularly well to very high-speed ground systems, in evacuated tubes and on the surface, and must be considered as a longer range technology. Conceptually, magnetically levitated vehicles could provide a higher-speed, next-generation follow-on to TACV on essentially the same guideway.

System Concepts That Were Analyzed for the 1980's

Continued IHSR. The improved high speed rail system recommended as the alternative in the '70's could be continued into the '80's. The basic route would remain the same but continued upgrading of the right-of-way would move the system toward its limit point (HSRA) with non-stop trip times of two hours, New York-to-Boston, and 1 1/2 hours, New York-to-Washington. The additional investment would be about $1.1 billion. 17/ Further additions might include two routes north from New Haven to Boston, one via Hartford, Springfield and Worcester and the other via Providence.

Advanced High Speed Rail (HSRC). The HSRC concept envisions a new right-of-way with greatly increased radii of curvature to permit rail vehicle speeds up to 200 mph. the route analyzed serves the same metropolitan areas as IHSR (12 stops) with minor changes in station location. The vehicles require additional R&D for stability, ride quality and safety at the higher speeds plus propulsion performance. Trip time expected (with station stops) would be roughly 1 1/2 hours from New York to either Washington or Boston. Initial investment cost would be approximately $2.4 billion.

Tracked Air Cushion Vehicle (TACV). The TACV system concept envisions air cushion vehicles capable of speeds up to 300 mph operating along a new right-of-way between Washington and Boston. For analysis, the same right-of-way as HSRC was used, but trip times would be approximately one hour non-stop from New York to either Washington or Boston. The primary system analyzed used 100-passenger vehicles capable of being operated as trains running on an elevated box beam guideway. Initial investment cost is estimated at approximately $2.6 billion.

Short Take Off and Landing (STOL-85). The STOL concept for the '80's makes use of aircraft resulting from R&D performed in the '70's. Aircraft characteristics include fanjet propulsion for cruise speeds of 500 mph or better, advanced structural techniques for improved payload-to-gross weight ratios, and advanced aerodynamic concepts for high lift coefficient for take-off and landing. The system concept envisions terminals located with very good access to population and business centers. The system analyzed used a basic rooftop STOLport design for urban locations with a single runway, costing between 40 and 200 million dollars depending on runway length, number of gates and land prices at the particular location. Aircraft cost varies from $2.5 to $5.2 million per vehicle, depending on capacity and take-off distance (capacities of 40, 80 and 120 were considered with take-off distances of 1500 and 2500 feet).

The system operating concept stresses multiple terminals with frequent service on a highly connective network. System investment for a broadly dispersed 1985 network (24 terminals) using small aircraft for high service frequency was estimated at $3.3 billion of which nearly $900 million was for aircraft. Because STOLport capacity is limited by operation on a single runway, the system requires continuing investment in new terminals as demand grows.

Vertical Take-Off and Landing (VTOL-85). The VTOL concept for the '80's, like that for STOL, makes use of advanced aircraft design and performance resulting for R&D performed in the 1970's. The design postulated for analysis is a turboprop-powered tilt-wing with a cruise speed of 465 mph. Cost per aircraft ranges from $3.6 million to $8.2 million, depending on capacity (40, 80 and 120 passenger versions were considered). The system operating concept, like STOL 85, stresses multiple terminals, locations with good access to population and business centers, and connective network and schedules. The estimated terminal cost ranges from $6 million to $60 million depending on number of gates and land cost. System investment for a broadly dispersed 1985 network was $1.8 billion, including $1.1 billion for aircraft. Because the concept envisions small vertiports limited by operations rate at a single pad, the system requires continuing investment in new terminals as the demand grows.

CTOL - Multimode. This concept is not advanced as a shorthaul alternative but rather as an aid in overcoming airport capacity problems at the New York Hub. Under the concept, outlying existing airports are tied into New York by high speed ground links. Using TACV, airfields as far away as Philadelphia or Bradley at Hartford can be linked to Manhattan with access times of about one half hour.

RESULTS

The analysis and evaluation for the '80's involved (1) examination of the technological risks inherent in each concept; (2) estimation of the demand for each of the concepts or combination of concepts; and finally, (3) on the assumption that the technological risks would be resolved, performance of investment analyses. The results of these analyses are described in the following pages.

Technological and Operational Risks

IHSR involves no technological risks as such. The guideway and vehicles are representative of present ('70's) state-of-the-art.

A major operational risk however lies in the possibility of physical interference with freight and commuter traffic and eventual saturation of the right-of-way. As noted in the analysis for the '70's, the initial interference problem will be institutional, requiring the negotiation of schedule accommodations among the operators. At some point in the '80's however, the combined growth of demand on all three services could result in traffic levels too high to be handled by any degree of schedule rearrangement. Because the date for saturation depends on growth projection for three separate demands, (and the degree to which schedule accommodation can be accomplished) no reliable estimates can be made now. Observation of operations during the '70's should permit reasonable projections for the '80's.

One possible solution for IHSR saturation will be to shift freight operations to a parallel line such as the Baltimore and Ohio Railroad. Here, however, institutional and plant access difficulties may occur.

A second risk occurs through the development of competing technologies in other regions. If newer technologies provide faster short-haul service in other regions, a comparative economic disadvantage may result for the Northeast Corridor. Over the long run, pressures will develop to implement the newer service in the corridor. Thus, even if IHSR capacity is not saturated and the system is operating profitably, it may suffer from its '70's technology, if more advanced systems exist elsewhere.

HSRC involves a technological risk in pushing the steel rail flanged wheel technology to higher speeds. Problems of truck "hunting", gyroscopic and centrifugal forces, cross-wind loads, track alignment, etc., all increase with speed. Ride quality and safety are both involved in the speed increase.

The need for a new, straightened right-of-way poses a major land acquisition problem. The inability to detour easily may lead to extensive and expensive use of tunnels in urban areas. Railroads, although as a "fait accompli," are not opposed, may be considered as a blight on the landscape. Railroad embankments form barriers in neighborhoods with possible "wrong side of the tracks" connotations. Therefore, institutional risk lies in obtaining community approval and land availability in contiguous parcels over the length of the corridor.

TACV involves technological risk in obtaining the desired performance for the suspension and propulsion systems. Wayside power pickup at 300 mph will pose special difficulties as will the technique for switching the TACV guideways. These problems will be addressed during the R&D phase and appear capable of solution although the effect on cost is uncertain.

TACV will encounter much the same problem in obtaining a straight right-of-way as would HSRC. The use of an elevated guideway reduces the right-of-way width needed to 100 feet and eliminates difficulties in creating a physical barrier through communities. In so doing, however, the elevated guideway may encounter aesthetic opposition. Community safety is not a problem with an elevated guidway which avoids grade crossings, children on the tracks, etc. The elevated guideway does tend to increase noise effects from the vehicle. However, the noise emission projections developed for the NECTP by the DOT Office of Noise Abatement indicate that TACV noise impacts, in terms of land area and population affected, could be reduced to very low levels by 1985. 18/ It should be stressed that these projections represent goals, which might be achieved by 1985, given agressive systems development and design efforts. Office of Noise Abatement estimates also indicate that, if substantial technological improvements can be achieved, STOL-85 and VTOL-85 noise impacts could be reduced to relatively low levels. 19/ Assessments of the noise impacts of 1985 TACV, VTOL and STOL systems should be an important part of the decision process concerning a transportation investment program for the 1980's. As indicated earlier, it is recommended that these decisions be made in 1976, when the progress of research and development efforts can be evaluated.

While projected TACV noise levels are low compared to CTOL aircraft, TACV right-of-way will run through non-urban areas where the ambient noise level is very low. As a result TACV may encounter community opposition from rural areas at a much lower absolute noise level than would be considered acceptable in urban areas. The R&D problem will be, first to determine acceptable noise levels and, then, to develop the vehicle/guidway/shielding combinations to meet the requirements. As with the previous technological problems, the uncertainty may lie in the cost associated with meeting the low noise criteria. TACV using U-shaped guideway at or below grade could require an investment in excess of $3.3 billion.

TACV will use electric power for propulsion and suspension with little likelihood of objection to the vehicle on pollution grounds. The generating plant producing the power, as a new addition to the corridor grid, can take advantage of new technology.

STOL 85 will be the result of up to 10 years R&D and most of the uncertainties should have been resolved concerning the '75 aircraft. The use of turbofan engines should overcome passenger acceptance of internal noise and vibration associated with propellers. Advanced, high lift technology should avoid the need for very low wing loading to achieve short field operation and some form of gust alleviating device may be perfected to reduce effects of atmospheric turbulence. Since neither the high lift nor gust alleviation devices are certainties, ride quality must remain a risk item.

Turbofan propulsion will increase the difficulty of reducing external noise for community acceptance. Intensive efforts will be expended in quiet jet engine R&D for all aircraft but the high power to weight ratio needed for STOL could make it proportionately more noisy than conventional aircraft. If the design must be altered to turboprop to achieve noise acceptance, then passenger acceptance problems will increase.

Community acceptance for noise will remain a STOL risk; in part because of uncertainties as to just what noise levels communities will accept. To some extent the toleration of noise annoyance might be tempered by the level of benefits the service can bring to the community. The STOL 85 concept of many small STOLports with frequent schedules to short-haul points is based on the principle of sizing the terminal to the needs of the local community rather than creating a regional terminal which forces disproportionate disbenefits on the community.

A small size terminal served by small aircraft tends to be inefficient in terms of cost and air pollution. The smaller aircraft require more take-offs and landings for a given demand level and emit somewhat more pollutants. It should be pointed out that STOL air pollution emissions are of significance, primarily because of local concentrations, even though NEC projections indicate that STOL emissions would represent an insignificant percentage of total regional emissions from all transportation and non-transportation sources, in 1985.

A major problem in the operational concept is whether a satisfactory balance can be found among community benefits and disbenefits which will win overall approval.

An additional risk is that STOL 85 has the distinct possibility of adding to the already severe loads for air traffic control. If STOL 85 were successful in diverting the Northeast Corridor short-haul CTOL traffic and induced the expected new demand, as many as 3500 STOL operations a day might replace 1000 diverted CTOL operations in the New York Hub. With the remaining CTOL, New York hub air traffic could peak above 400 operations an hour. Clearly stacking space is inadequate and the load on the metering, scheduling and terminal control facilities would be severe in maintaining a smooth flow. An added problem will be the much greater use by STOL of altitudes now used primarily by general aviation, creating an additional safety hazard.

Whether sufficient air traffic control capacity in the hub area can be developed to handle the very large loads STOL may create will remain a risk item.

VTOL 85 as a system concept is similar to STOL 85 and will carry much the same risks. The aircraft analyzed is a tilt wing turboprop which entails a somewhat higher level of risk in passenger acceptance plus additional aircraft transitional control problems not encountered with STOL.

On the credit side, VTOL will use a smaller terminal, involving a lower investment commitment from communities and hence a better chance of overall acceptance. VTOL, by being less sensitive to wind direction has greater flexibility in arranging takeoff and approach patterns to minimize noise impacts and safety hazards.

In general, the air traffic control problems, and therefore the risks, for VTOL 85 will be the same as for STOL 85.

CTOL - Multimode as a system concept envisions a TACV line connecting outlying airports to New York City. The principal risks are those associated with implementing a tracked air cushion vehicle as an intercity mode. The investment required for a TACV system will be too large to justify implementation exclusively for long-distance airport access and must also move large numbers of Corridor travelers. The marginal cost of a slightly expanded TACV route adding interconnecting spurs would be much less than the cost of new airport construction.

The effect of the concept is to create a larger New York regional hub. If Philadelphia and Hartford were tied into New York, the average CTOL delay time for New York would drop from 14 minutes to 4 minutes (as compared to 3 minutes for the addition of a 4th jet port). An institutional risk would be whether Philadelphia and Hartford would want the extra traffic which would raise their delay from about 1 minute to 4 minutes. An additional risk will be whether the institutional problems in arranging connecting schedules between long-haul CTOL flights and short-haul TACV can be surmounted.

Demand Estimates and Investment Analysis

The benefits from any of the alternatives of the '80's will vary directly -- although not necessarily linearly -- with the level of demand served by the alternative. The discussion for CTOL stressed the need to provide relief from congestion by attracting Corridor short-haul passengers to an alternative mode. In addition, the special connectivity provided by each of the new systems will produce a new level of demand beyond that which CTOL would have attracted.

The level of patronage for each 1985 alternative will depend strongly on the trip times it offers and the locations it serves. STOL 85 and VTOL 85 have an advantage in speed and in number of terminals served. TACV has a speed competitive with that of the air modes, and a special advantage in that service frequency is high for all stations it serves. The air modes, on the other hand, serve the terminals having smaller patronage rather infrequently. The rail modes, IHSR, HSRA and HSRC have lower speeds than TACV and can consequently expect lower demand.

The decisions for the '80's will include the following alternatives.

- Retain IHSR
- Upgrade IHSR to HSRA
- Shift to new right-of-way and HSRC
- Shift to new right-of-way and TACV
- Retain IHSR and add STOL 85
- Retain IHSR and add VTOL 85
- Shift to TACV and add STOL 85 (or VTOL 85)

Decisions to retain and/or upgrade IHSR depend on the absence of serious interference difficulties with freight or commuter service. The decision to retain IHSR and add an air mode would provide the added benefit of new fast service. The air mode would also tend to suppress further growth in demand for rail, thus reducing the probability of freight-passenger interference. If IHSR were in danger of being crowded off the rails, then a shift to a new right-of-way would be indicated, resulting in either TACV or HSRC. Finally if the desire were to maximize the benefit as represented by patronage, a new high speed ground mode <u>and</u> a new air mode might both be selected.

The decision in favor of any long-term alternative cannot be made separately from the resource expenditures. The monetary cost of moving people is not independent of the volumes carried. In fact, as Figure 5 shows, the cost per mile varies quite markedly with the demand level. The curves of Figure 5 reflect the different basic expense characteristics of air and high speed ground modes:

- The ground modes, especially HSRC and TACV, require very large fixed investments before any passengers are carried. The cost of this investment -- amortization and annual return required by the investor -- is independent of the volume carried. Operating expense for the ground mode is relatively low and very nearly constant per passenger mile. The <u>annualized total</u> is the sum of the investment costs and the operating expenses spread over the volume of passengers carried -- expressed as cents per passenger mile, it approaches operating expense at high volumes.

. The air modes have smaller fixed expenditures than TACV or HSRC, but in the STOL 85 concepts, terminals and aircraft must be added as volume increases. Thus, for air, the investment total rises as volume increases. Operating expenses for the aircraft are relatively high because of the special performance and short range involved. The annualized cost per passenger mile of each additional passenger reflects the operating expenses plus the added investment in aircraft and terminals to carry him.

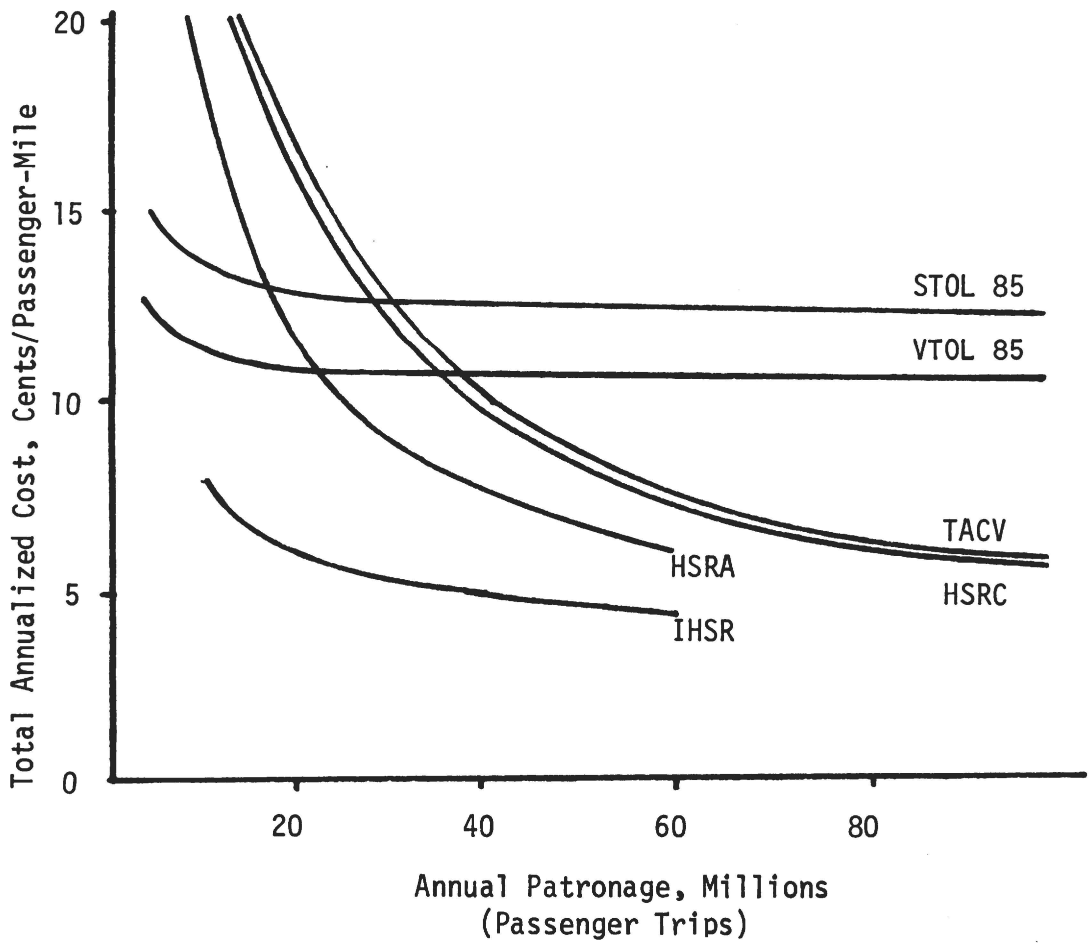

Figure 5: Annualized Cost for 1985 Alternative High Speed Modes

Figure 5 above is based on a 10% rate of return as recommended by the Office f Management and Budget on all costs including government expenditures (Federal r local). (Private investors without such intervention would require a higher ate of return before taxes.) Air is the lowest cost mode at low volumes and TOL 85 is cheaper than STOL 85 because of the smaller terminals. Ground modes ave lower costs than air at high volumes. The crossover point depends on the ate of return, the number of passengers, and on the final vehicle and system esign.

Table 7 combines demand and annualized cost extimates for the seven decision lternatives. The range in demand reflects uncertainty in population and conomic projections as well as in estimated levels of induced demand.

TABLE 7

PATRONAGE AND COST ESTIMATES

ong Term lternatives	Nominal Block Time NY-Wash (minutes)	1985 Patronage Range (million/year) (Passenger Trips)	1985 Annualized * Cost at Patronage Level (cents/ pass-miles)	Investment Required for 1985 Patronage $ Billions
HSR	125	19-25**	6-5.6	0.5
SRA	105	22-30**	11-9	1.6
SRC	75	33-50	11-8	2.5
ACV	55	40-60	10-7.5	2.7
TOL 85 & IHSR	40	40-60	11-8.5	1.5-2.3
TOL 85 & IHSR	35	40-60	13-9.5	2.7-3.7
TOL 85	35	44-70	14-12	4.3-5.3

*Includes both investment and operating costs.

**CTOL carries additional patronage for these alternatives. Since CTOL costs are not calculated, this patronage has not been included.

Table 7 is presented only to indicate the range of patronage and costs ossible with the various decisions. It does not imply conclusions regarding ne optimum decision. On the contrary, the NECTP concluded that it would be an xtremely precarious decision if reached now from estimates of the type resented in the table. The critical decision variables are so strongly dependent on the outcome of the technological and operational risk items that an "optimum" decision could turn out very badly in the years to come.

It is significant to note from Table 7 that if the TACV system can carry 60 million passengers when operating alone, the cost is $.075 per passenger mile but when TACV and STOL compete with each other and divide the 70 million passenger market evenly between them, the marginal cost of carrying the 10 million additional passengers (1,600 million passenger miles) is $.37 per passenger mile. The average trip distance for TACV alone is 150 miles; when STOL competes with TACV, average length of trip is 180 miles for STOL and 130 miles for TACV.

Table 8 assumes 60 million total riders whether TACV is operated alone or in competition with STOL 85. Each mode splits the market in 1985. Society would be paying $488 million for the 1/3 hour of average time saving obtained by the 30 million STOL 85 passengers, i.e., value of time is almost $49 per hour. The premium firms would be paying for speedier service implies that each employee (who travels) is worth $101,000 per year to the company.

Table 8

TACV and STOL 85

Comparative Costs of 60 million Annual Trips
Using TACV vs. TACV and STOL

	STOL	TACV	TACV (alone)
Millions of Passengers	30	30	60
Cost Per Passenger Mile	$.125	$.125	$.075
Door-to-Door Time Washington-New York (Minutes)	107	127	127
Average Trip Length (Miles)	180	130	150
Total Cost (Millions)	$675	$488	$675

Recommendations for the 1980's

The NECTP recommends that R&D continue with special emphasis on those items -- particularly environmental, community and passenger acceptance -- noted as technological and operational risks. All the alternatives should be included in the R&D program for the following reasons:

- Air -- STOL and VTOL -- because it promises a high level of benefits combined with flexibility for Corridor use.
- High speed rail because of its role in the '70's and as a backup in case of failure in the TACV, STOL, or VTOL R&D.
- TACV because if offers the potential of very attractive service and low unit cost at the high volume levels likely in the Corridor.

The NECTP recommends that a definite date be set for reaching a decision for the '80's. The timing should be soon enough to allow implementation of any of the alternatives and late enough to complete the R&D programs. The NECTP suggests 1976 as meeting both these criteria.

One very long lead-time item should receive early priority: selection of a route and acquisition of a new high speed ground (TACV or HSRC) right-of-way are so critical to those modes and so time consuming that preliminary actions should begin immediately. Major commitment of funds may be delayed until after the decision date but sufficient explorations should be completed by then to ascertain whether any route will be feasible and what its cost will be.

FOOTNOTES

1/ The decision year represents a compromise between the time required for R&D and the lead time for 1980's operational system.

2/ "Metroliner" and "Turbo Train."

3/ See Preliminary Report, NECTP-209, April 1970. In that report, STOL was treated as an adjunct of conventional air service with incomplete accounting for indirect operating costs and for construction and operation of STOLports. Rate of return for STOL and VTOL did not make allowance for adequate before-taxes profits.

4/ Average speeds of 110 mph -- maximum speeds of 135 mph (with improvements).

5/ National Rail Passenger Corporation (AMTRAK).

6/ Defined as "high Speed Rail A".

7/ First Federal Aircraft Noise Abatement Plan, FY 1969-70 U.S. GPO, pg.7

8/ Active consideration of Stewart Field Military Reservation for use as fourth jetport is now underway.

9/ IHSR could have terminals at Hartford, Springfield, Mass., and Worchester, Mass., instead of Providence.

10/ STOL strips are used at existing CTOL airports.

11/ Wilmington and Trenton terminals are considered suburban terminals for the Philadelphia area since they are on commuter rail lines. In addition they serve their own metropolitan areas.

12/ The concept of Noise Exposure Forecasts (NEF) was developed for evaluation of excessive noise from conventional airports. The NEF criterion combines estimates of subjective response to noise in EPNdb with penalty factors for numerical frequencies of day-time and night-time operations.

13/ Noise Exposure Forecasts as Indicators of Community Response, Paper by Dr. Wm. J. Galloway (of Bolt, Beranek, & Newman) presented at the SAE/DOT Conference on Aircraft and the Environment, February, 1971.

14/ The analyses assume that the provisions of the Airport and Airways Development and Revenue Acts of 1970 apply to VTOL and STOL facilities and operations, as well as to conventional air.

15/ There is an assumption implicit in the analysis that the STOL and VTOL port building -- the top of which becomes the landing strip -- will be built and paid for at no cost to the municipal agency or the air carrier; instead being paid for by parking fees.

16/ Most auto owners consider the purchase price as charged off against day-to-day convenience and the local urban trips. Depreciation of autos is primarily by year rather than by mileage. Therefore, the driver tends to consider only out-of-pocket fuel, tools and on-the-road maintenance costs as applicable to the infrequent intercity trip. He may, in fact, think of the long trip mileage as increasing his utilization per year and decreasing his overall cost per mile.

17/ All investments have been estimated in constant 1970 dollars.

18/ The 1985 projections by the Office of Noise Abatement indicate that TACV noise levels will be as follows: at-grade U-shaped guideway, 96 PNdB at 50 feet from the vehicle; elevated box-beam guideway, 111 PNdB at 50 feet from the vehicle.

19/ Based on Office of Noise Abatement data, a noise level of 88 PNdB at 500 feet for small (40-80 passenger) STOL and VTOL aircraft was projected.

GPO 917-375