U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-255 616

FINANCIAL ANALYSIS OF THE NORTHEAST CORRIDOR DEVELOPMENT PROJECT
VOLUME I: MAIN TEXT AND APPENDIXES A THROUGH D

PEAT, MARWICK, MITCHELL AND COMPANY

PREPARED FOR
FEDERAL RAILROAD ADMINISTRATION

JUNE 1976

217165

PB 255 616

REPORT NO. DOT-TSC-FRA-NCD-76-3,I

FINANCIAL ANALYSIS OF THE NORTHEAST CORRIDOR DEVELOPMENT PROJECT
Volume I: Main Text and Appendixes A Through D

H.S. Baker
M.O. Laughlin

Peat, Marwick, Mitchell & Co.
1025 Connecticut Avenue N.W.
Washington DC 20036

JUNE 1976
FINAL REPORT

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
The Administrator
Office of Northeast Corridor Development
Washington DC 20590

Technical Report Documentation Page

1. Report No. DOT-TSC-FRA-NCD-76-3,I	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FINANCIAL ANALYSIS OF THE NORTHEAST CORRIDOR DEVELOPMENT PROJECT Volume I: Main Text and Appendixes A Through D		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) H.S. Baker, M.O. Laughlin		8. Performing Organization Report No. DOT-TSC-FRA-76-3.I
9. Performing Organization Name and Address Peat, Marwick, Mitchell & Co* 1025 Connecticut Avenue N.W. Washington DC 20036		10. Work Unit No. (TRAIS) RR622/R6301
		11. Contract or Grant No. DOT-TSC-936
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Railroad Administration The Administrator Office of Northeast Corridor Development Washington DC 20036		13. Type of Report and Period Covered Final Report Oct. 1974 - Nov. 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge MA 02142

16. Abstract

A high speed passenger rail service between Washington, D.C., and Boston was called for in the Regional Rail Reorganization Act of 1973. Planning for the service has been conducted by the Office of Northeast Corridor Development in the Federal Railroad Administration. Engineering studies were undertaken to develop detailed plans and costs for the required facilities improvements.

This report described the development of financial projections for the service. Operating unit costs were estimated. The operating cost estimates were combined with capital costs based on the engineering studies, and with proposed organizational and funding arrangements to develop financial projections. A computer model was developed to produce pro forma cash flow statements, income statements, and balance sheets for future years. Several organization and funding arrangements were tested. The results were measured in net present value and return on investment. Sensitivity analysis was performed.

The report has been published in two volumes.

Volume I details the assumptions, analytical techniques, and results of the financial analysis. Volume II contains pro forma financial statements and a users' manual for the computer model.

17. Key Words Passenger Train, Northeast Corridor Cash Flow, High Speed Train, Operating Cost, Financial Model	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161 PRICES SUBJECT TO CHANGE

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 168	22. Price 6.75 2.25

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

PREFACE

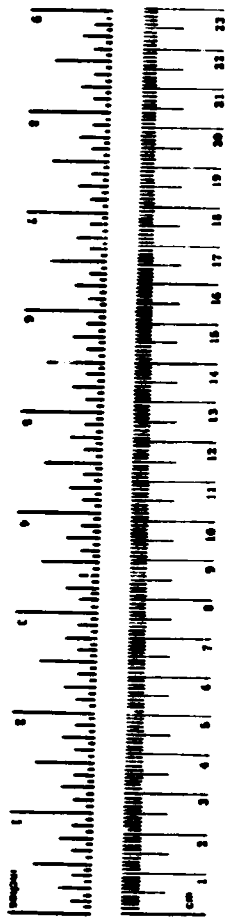
The Regional Rail Reorganization Act of 1973 directed the U.S. Secretary of Transportation to undertake engineering studies in preparation for implementation of the recommendations with respect to rail passenger service contained in the September 1971 Northeast Corridor Report. Included in the study requirements was the need for detailed financial projections for high speed rail service.

Planning for the service has been conducted by the Office of Northeast Corridor Development (ONECD) in the Federal Railroad Administration. The Transportation Systems Center (TSC) provided assistance to ONECD in the areas of demand forecasting and financial analysis. The work described in this document was done under contract to TSC.

METRIC CONVERSION FACTORS

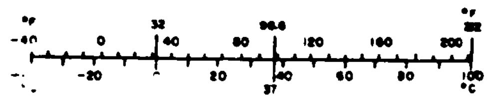
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



CONTENTS

CONTENTS (CONT.)

ILLUSTRATIONS

ILLUSTRATIONS (CONT.)

EXECUTIVE SUMMARY

This report represents the results of work accomplished by Peat, Marwick, Mitchell & Co. (PMM&Co.) under a contract to perform "Financial Analysis of the Northeast Corridor Improvement Project." That project is referred to in this report as the Northeast Corridor Development Project (NECDP). The service to be provided is referred to as CorridorRail. In addition, consideration is given to an organizational entity which would provide the service referred to in this report as the Operator. The work accomplished under this contract includes:

- development of a computer model for producing projected financial statements for the NECDP;
- preparation of pro forma financial statements for NECDP for various alternative organizational and financial scenarios;
- testing financial sensitivity to various operating, cost, and demand assumptions;
- estimation of CorridorRail operating costs; and
- projection of Northeast Corridor rail travel demand.

This report describes the preparation of the financial projections and their results, the sensitivity analysis, and the operating cost estimates. The results of the demand analysis are contained in a separate report.[1]

BACKGROUND

In September 1971, the Secretary of Transportation released the report on the Northeast Corridor Project which contained recommendations[2]

---

[1]Peat, Marwick, Mitchell & Co. Demand Projections for the Northeast Corridor, January 1976.

[2]U.S. Department of Transportation. Recommendations for Northeast Corridor Transportation. September 1971.

for a high-speed rail passenger service between Boston and Washington. In September 1973, the Secretary released a second report,[1] which contained updates of those recommendations. The Regional Rail Reorganization Act of 1973 directed the Secretary to begin engineering studies leading to implementation of recommendations in the 1971 report.

The mission of carrying out studies leading to the implementation of the high-speed passenger service (CorridorRail) was delegated to the Federal Railroad Administration which formed the Office of Northeast Corridor Development (ONECD) to meet this objective. Engineering studies sponsored by ONECD to formulate basic design parameters and construction cost estimates for CorridorRail were begun in fiscal year 1975. During the formative stage of ONECD, the Transportation Systems Center (TSC) provided financial analysis support which was then expanded upon by PMM&Co. under contract to TSC. Thus, the project reported on here, has been, in fact, to provide the financial analysis support required by ONECD in carrying out its mission.

OBJECTIVES

The major objective of this project was to develop pro forma financial statements to project the financial performance of NECDP and of the Operator of CorridorRail. The projections were to include balance sheets, income statements, cash flow statistics, and return on investment figures to be used as required by ONECD in analysis of the project.

Within the context of the overall objective, secondary objectives included: analysis of the sensitivity of project results to various cost assumptions; development of a computer program for use by ONECD for continuing financial analysis; accumulation of the most up-to-date available data for projecting the cost of CorridorRail operations; and continuing support to ONECD for interim financial and cost analyses as required.

---

[1] U.S. Department of Transportation. Improved High-Speed Rail for the Northeast Corridor. January 1973.

HOW THE STUDY WAS CONDUCTED

The conduct of the study included the following steps:

- development of financial statements and the computer program to produce them based on financial and organization assumptions of concern to ONECD;
- accumulation of input data for financial analysis including operating costs, project costs, and demand and revenue statistics; and
- calculation of financial projections for a baseline case, sensitivity analysis, and various special situations.

Development of Financial Statements

The financial statements which were developed comprised four components:

- operating revenues and expenses;
- sources and uses of funds;
- income statements; and
- balance sheets.

A computer program was developed to prepare these statements for each year during both a specified construction period (seven years for most cases) and any specified number of years thereafter (thirty years for most cases). The program was designed and used for projecting the results of numerous organization and financing alternatives. A discussion of organization and financing alternatives appears in Section II of this report. The financial statements and the logic of the program which produces them are described in Section III.

Organizational Alternatives

At the commencement of this project, several organizational alternatives were being considered for CorridorRail, and it was not known that the United States Railway Association's Final System Plan would designate Amtrak as owner and operator of the Northeast Corridor. Therefore, the program was designed to produce financial statements for three entities: owner; operator; and sum of owner, operator, and project manager. Since the designation of Amtrak as the entity to undertake corridor improvements, the program has been run in a single entity mode. Although Amtrak was not explicitly involved in this analysis, the resultant statements for the operator could, with some balance sheet account adjustments, be viewed as representing the portion of Amtrak's financial position which might result from Corridor-Rail.

Financial Alternatives

The analyses to be performed were to consider several combinations of financing. Each combination provided funding for the following functions:

- purchase of right-of-way;
- construction program;
- rolling stock development and acquisition;
- program management; and
- operations.

The methods of financing to be considered included:

- grants of federal funds;
- government guaranteed loans;
- state and local government participation; and
- cash surplus from operations.

The model included several alternatives for dealing with the cash flows associated with the financing alternatives (e.g., sinking funds, repayment of long-term debt, and financing of short-term debt). It also included accounting for transfers of cash between owner and operator entities with a portion of operator profits being transferred to the owner for payments on long-term debt.

Accumulation of Input Data

This project included the collection of cost data for input to the financial statements and development of passenger demand estimates. Demand estimates were used both as parameters for cost estimation and as a basis for revenue projections. A summary of the sources of input data is included as Exhibit A.

Cost Data

As a separate work task in this financial analysis project, PMM&Co. was charged with the responsibility for assembling all cost data necessary as input to the financial projections. This work included collecting both operating and construction costs, establishing a best estimate of each cost item, and determining reasonable ranges of uncertainty of costs. In performing this work, PMM&Co. was assisted by Thomas K. Dyer, Inc. in regard to fixed facility costs. The application of cost data is described in Section IV of this report, and the detailed derivation of cost data is described in Appendix B.

Operating cost estimates were based primarily on previous studies of high-speed rail passenger service. They were updated and adjusted to account for circumstances peculiar to CorridorRail. The cost data were further enhanced with the results of various special studies of corridor operations which took place during the course of this project.

Construction cost estimates were furnished by ONECD based upon the work of their engineering contractors. PMM&Co. reviewed those costs for general reasonableness and consistency with assumptions underlying operating costs and demand estimates.

Demand Data

An additional PMM&Co. work task was the projection of Northeast Corridor passenger demand under several different sets of hypotheses. This work is documented in Demand Projections for the Northeast Corridor.[1] PMM&Co.'s demand forecasts were used by ONECD in combination with other data available to it to develop its own best estimates. These estimates were used as input to the financial analysis.

The demand data were used in the financial analysis both for estimation of revenues and for cost analysis. The demand data provided a basis for estimating passenger trips and passenger miles by city pair. These estimates were then used as parameters for operating cost.

Calculation of Financial Projections

The computer program was used to process the cost and demand data to produce several types of financial analyses. First, a baseline financial projection was made, projecting the results of what were considered to be the most likely assumptions about the project. This analysis produced an estimate of project cash flow and return on investment. Then sensitivity tests were made to assess the impact of various contingencies on project financial results. In addition, numerous other special analyses were performed from time to time as requested by ONECD.

---

[1] Peat, Marwick, Mitchell & Co., op. cit.

The baseline financial projection assumptions and results are discussed in Section IV. The sensitivity analysis is described in Section V. Other financial analyses are described in Section VI.

SUMMARY OF RESULTS

The baseline financial analysis is predicated upon an investment program of $3.4 billion from 1976 through 1982. The right-of-way is purchased with an issue of seven-percent, 20-year term bonds. Improvements are financed by interest-free government loans to be repaid from earnings. Rolling stock is purchased with federal grants.

The baseline demand estimate begins at 17 million passenger trips in 1982 and increases to 30 million trips in 1990, and 54 million trips in 2011. Costs reflect a load factor assumption of 63 percent. The income from operations begins with a surplus of $47 million in 1982, increases to $137 million in 1990 and to $306 million in 2011, resulting in an overall project return on investment (ROI), on a discounted cash flow basis, of 3.4 percent. All debt obligations are retired by 2003.

Numerous individual sensitivity analyses with various contingencies produced ROIs in the range of 2.0 to 4.8 percent. In the worst-case sensitivity analysis, ROI was a negative 0.6 percent. This contrasts with a best-case ROI of 6.4 percent.

Using a conservative load factor estimate of 55 percent, the income from operations begins with $41 million in 1982 and increases to $126 million in 1990 and $287 million in 2011. This results in an ROI of 3.0 percent and retirement of all debt obligations by 2004.

* * * * *

The financial projections in this report have been prepared on the basis of information and assumptions set forth in the text and summarized in Appendix A. In some cases, PMM&Co. has relied on information from the sources indicated in that exhibit, without verifying such data. Although the Firm believes the information and assumptions used, with the exception of the right-of-way purchase price, constitute reasonable bases for preparation of the financial statements, the achievement of any financial projection is dependent upon the occurrence of future events, which cannot be assured. Therefore, the actual results achieved may vary from the projections.

In regard to the right-of-way purchase price, PMM&Co. has no sound basis for evaluating the reasonableness of the estimate. The amount used is subject to increase to an unpredictable extent due to future court rulings on the reasonableness of compensation to the estates of bankrupt railroads.

This report has been prepared solely for the internal use of the Federal Railroad Administration. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT A

SUMMARY OF PRINCIPAL ASSUMPTIONS AND SOURCES OF SIGNIFICANT DATA

This exhibit is intended to serve three purposes:

- to assemble in one place the most significant assumptions upon which the financial projections were based;
- to provide a summary of the sources from which the most significant assumptions were drawn; and
- to provide an index of assumptions which indicates where in the text and appendices each assumption is discussed.

The way in which data were used, the full citations of documents, and the detailed identification of sources is set out in the report and appendices.

In the following table, the assumptions are identified in the order in which they are discussed in the report. The columns identify the sources of information for the assumptions. Where an assumption consisted of a single figure, it is included in this table; where an assumption is lengthy, it is discussed in the text.

EXHIBIT A

SUMMARY OF PRINCIPAL ASSUMPTIONS AND SOURCES OF SIGNIFICANT DATA

PORTION OF REPORT IN WHICH ASSUMPTION IS DISCUSSED	SOURCES OF ASSUMPTIONS				
	ONECD	ENGINEERING CONTRACTORS*	RAILROAD ACCOUNTING RECORDS	PMM&CO. JUDGMENT	OTHER
Section I (NECDP)	Financial and legal scope of organizations (viz., Operator and Project Manager) Station list Project schedule Nature of improvements and of CorridorRail service				
Section II (Organization and Financing)	Types of funds, terms, priority of recourse to and repayment of debt				
Section III (CorridorRail Financial Model)	Straight-line depreciation of rolling stock			Cash management policies and timing	
Section IV (The Baseline Projection)	$600 million purchase price for ROW. (An estimate for planning purposes. Amount is subject to increase to an unpredictable extent due to future court rulings on the reasonableness of compensation to the estates of bankrupt railroads.) $2.36 billion to improve facilities (ONECD based the components of this figure and the timing of expenditures on the reports of engineering contractors) 14-year car service life 10% of price salvage value Patronage forecasts of passenger trips, passenger-miles and fare revenue 7% interest rate 20-year term for bonds	75-seat average car capacity (Task 9 report) $800 thousand car purchase price (Task 9 report) 203,000 car-miles per car per year utilization (Task 7 report)		Capitalization of construction period interest	10% discount rate for Net Present Value from OMB Circular No. A-94

* The engineering contractors and their tasks are listed in Exhibit I. 2.

EXHIBIT A (Continued)

SUMMARY OF PRINCIPAL ASSUMPTIONS AND SOURCES OF SIGNIFICANT DATA

PORTION OF REPORT IN WHICH ASSUMPTION IS DISCUSSED	SOURCES OF ASSUMPTIONS				
	ONECD	ENGINEERING CONTRACTORS*	RAILROAD ACCOUNTING RECORDS	PMM&CO. JUDGMENT	OTHER
Section V[@] (Sensitivity Analysis)	50% load factor [illegible] judgment			Except as otherwise noted in the text and appendices, the estimation of reasonable ranges of variation from the baseline estimates represent PMM&Co.'s judgment	
Section VI[@] (Owner/Operator Case)	Organizational structure and transfer payment bases				
Appendix B (Operating Costs and Working Capital)	Food and liquor cost equals food and liquor revenue The operating costs were estimated in light of assumptions about CorridorRail service including: all seats reserved; 3-1/2-hour Washington-Boston travel time; a closer resemblance, in general, to Metroliner service than to conventional passenger services.		Penn Central records for 1974 were used in estimating the following costs: train supplies and expense - $.132/car-mile; station masters - $4.7M per year; passenger services overhead - 3% of direct cost; maintenance of equipment overhead - 10% of direct cost 4-man crew - $1.54/train-mile; 5-man crew - $1.91/train-mile; switching - $1M per year; dispatching - $2M per year; transportation department overhead - 3% of direct cost transportation department liability - 10% of crew cost.	PMM&Co. made all estimates allowing for high speed, Northeastern location, and 1980-2010 timeframe.	

*The engineering contractors and their tasks are listed in Exhibit I.2.

@The assumptions made in Sections V and VI are for alternative cases; they are not part of the baseline set of assumptions used in the financial projections set out in Appendix F.

EXHIBIT A (Continued)

SUMMARY OF PRINCIPAL ASSUMPTIONS AND SOURCES OF SIGNIFICANT DATA

PORTION OF REPORT IN WHICH ASSUMPTION IS DISCUSSED	SOURCES OF ASSUMPTIONS				
	ONECD	ENGINEERING CONTRACTORS*	RAILROAD ACCOUNTING RECORDS	PMM&CO. JUDGMENT	OTHER
			Information from Amtrak operating, accounting, and financial planning functions contributed to the following estimates. snack-bar attendants - $.173/snack-car-mile; station personnel - $.406/on-line-passenger; ticket agency commission rate - 10% of sales; 80% of revenue from on-line sales; 20% of revenue from off-line sales; reservations - $.90/passenger; promotion - 5% of revenue accounts receivable - 3% of revenue		
		$.40/car-mile for car maintenance (Task 9 report) $.138/car-mile for energy (Tasks 4, 5, and 9 reports)			$42.04 million per year M of W&S (Thomas K Dyer, Inc., subcontractor)
			ICC statistics for passenger railroads were used to estimate: cash need - 3% of operating expenses; materials and supplies - 10% of maintenance expense*		
					20% and 50% of price for prepayments were suggested by TBC and compared to Washington Metro and BART contracts Commuter service agencies along NEC provided estimates of current commuter traffic. The National Transportation Study was used to project commuter traffic
Appendix C (Fleet-Sizing Exercise)		Freight traffic based on Task 1 report Schedule, turnaround time from Tasks 4, 5, and 9 reports Time-of-day demand distributions from Task 1 report Yard location (Task 4) 14 car maximum train length (Task 4 report)		Each shared cost was allocated among the users based on a causally related measure (s) of traffic O-D volumes based on <u>Demand for the Northeast Corridor</u> Time-of-day distributions based on studies of NEC travel demand	

*The engineering contractors and their tasks are listed in Exhibit I.2.

I. NORTHEAST CORRIDOR DEVELOPMENT PROJECT

The Northeast Corridor Development Project (NECDP) responds to the sections of the Regional Rail Reorganization Act[1] concerning rail passenger service in the Northeast Corridor (NEC). Its objective is to provide advanced high-speed service among the major cities from Washington, D.C., to Boston. It is being planned by the Office of Northeast Corridor Development (ONECD) in the Federal Railroad Administration (FRA).

NECDP consists of:

- a series of engineering studies for development of NEC;
- the purchase of fixed facilities including the right-of-way (ROW), terminals, and station facilities;
- a series of investments to improve the fixed facilities;
- the development and acquisition of high-speed rolling stock; and
- the operation of NEC intercity passenger service when the investment program is substantially completed.

There are three important entities to be considered in the analysis of NECDP:

- the organization(s) which would own and operate the high-speed passenger service, referred to in this report as "the Operator",
- the project to develop and operate the high-speed passenger service, referred to in this report as NECDP; and
- the service itself, referred to as CorridorRail.

The following paragraphs contain definitions and descriptions of these elements of NECDP. Exhibit I.1 contains a list of acronyms and abbreviations used in this report.

---

[1] Regional Rail Reoganization Act of 1973, Sections 206 (a)(3), 601 (d).

EXHIBIT I. 1

Acronyms and Abbreviations as Used in This Report

ARTS	-	Automated Reservations and Ticketing System (a proprietary name for Amtrak's reservations system)
CCS	-	Central Control System (a computerized train dispatching system)
FRA	-	Federal Railroad Administration (a part of the U.S. Department of Transportation)
ICC	-	Interstate Commerce Commission
M of W&S	-	Maintenance of Way and Structures
MU	-	Multiple Unit (self-propelled electric railroad cars)
NEC	-	Northeast Corridor
NECDP	-	Northeast Corridor Development Project
ONECD	-	Office of Northeast Corridor Development (an office within FRA)
PMM&Co.	-	Peat, Marwick, Mitchell and Co. (the contractor)
ROI	-	Return on Investment
ROW	-	Right of Way (the property composing a railroad roadbed, track structure, and associated facilities)
TKD	-	Thomas K. Dyer, Inc. (a subcontractor)
TOD	-	Time of Day
TSC	-	Transportation Systems Center (a part of the U.S. Department of Transportation)
USRA	-	United States Railway Association (an independent agency created by the Rail Reorganization Act of 1973)

THE OPERATOR

The Operator would perform all functions necessary to the operation of the contemplated service. Although it could consist of one or more financial entities, the Operator would be defined by the following characteristics:

- its principal assets;
- the functions it performs; and
- the timing of asset acquisition and of service inauguration.

A summary of these characteristics is presented here. The characteristics are described in more detail in the reports on the engineering contractor tasks listed in Exhibit I. 2.

Principal Assets

The Operator would own the rolling stock used for the service provided. The Operator would also own the stations, shops, and yards associated with the NEC. The stations would be at the following locations:

- Washington, D. C.,
- New Carrollton, Md. (Capital Beltway),
- Baltimore, Md.,
- Philadelphia, Pa.,
- Trenton, N. J.,
- Iselin, N. J. (Metropark),
- Newark, N. J.,
- Stamford, Ct.,
- New Haven, Ct.,
- New London, Ct.,
- Providence, R. I.,
- Dedham, Ma. (Route 128), and
- Boston, Ma.

Yards and shop facilities would be located in Boston, New York, Philadelphia, and Washington. Finally, the Operator would own the NEC right-of-way from Union Station in Washington, D. C., to South Station in Boston. This ROW, as improved, would have two to six tracks of which at least two would be for high-speed trains. Bridges, elevated structures, tunnels, and catenary are included.

EXHIBIT I. 2

CONTRACTOR ASSIGNMENTS FOR NEC ENGINEERING STUDIES

Task No.	Task Title	Contractor	Territory
1	Alternate Northeast Corridor Strategies; Demand Estimates	Bechtel	System
2	Determination of Immediate Track Upgrading Requirements	DeLeuw-Cather	System
3	Track and Structures Upgrading Standards Development	DeLeuw-Cather	System
4	Definition of System Design and Impacts	Bechtel	System
5	Electrification	Bechtel	System
6	Risk Analysis of Joint Passenger/Freight Operation	Bechtel	System
7	Terminals and Shops	DeLeuw-Cather	System
8	Local Coordination System Development	DeLeuw-Cather	System
9	Rolling Stock Performance and Cost	Bechtel	System
10	Grade Crossings and Fencing	Bechtel	Washington-New Haven
10	Grade Crossings and Fencing	DeLeuw-Cather	New Haven-Boston
11	Detailed Physical Plant Improvements and Costs	Bechtel	Washington-New Haven
11	Detailed Physical Plant Improvements and Costs	DeLeuw-Cather	New Haven-Boston

Functions

The primary function performed by the Operator would be the operation of the Northeast Corridor main line between Boston and Washington including all aspects of the CorridorRail service. Another function would be the provision of a right-of-way for those commuter and Amtrak inter-corridor services which require use of the corridor main line. An additional use would be for the Conrail local freight service to industries along the corridor and for limited through freigh service.

Timing

Immediately after acquiring the ROW in 1976, the Operator would begin to carry out the investment program, capitalizing improvements on its balance sheet. The first delivery of rolling stock, would be received when the ROW improvements were substantially complete, so that high-speed service could begin. At this time, assumed to be January 1982 for most cases, the Operator would assume full responsibility for the service.

THE NORTHEAST CORRIDOR DEVELOPMENT PROJECT

NECDP is the project which would meet the legislated objectives of the improved rail passenger service in the Northeast Corridor. It is defined by its financial scope which is somewhat broader than that of the Operator.

In addition to the functions performed by the Operator, the NECDP activities that have financial implications are principally project manager and planning functions. They might be undertaken by FRA. They are:

- project management,
- construction management for facilities improvements,
- rolling stock development,
- system testing,
- interim railroad support, and
- system engineering.

The following is a general description of the facilities improvement and rolling stock development program.

Facilities Improvement

The improvement program planned for the facilities consists of investment in the following categories:

- track and roadbed,
- bridges and tunnels,
- grade crossings,
- electric power system,
- communications and signals,
- stations,
- shops and yards, and
- freight service connections.

Track would be upgraded to permit speeds up to 150 miles per hour. All high-speed tracks would have continuous welded rails. Concrete ties would be used on track where speeds would be in excess of 125 miles per hour. In addition, curvature would be reduced in numerous locations to permit higher speeds.

Bridges and tunnels would be replaced or rehabilitated. All at-grade crossings would be eliminated.

The present power system for electric propulsion would be upgraded. Constant tension catenary would be installed on segments of the line to be operated at speeds in excess of 125 miles per hour. Electrification of NEC would be completed by electrifying the line between New Haven and Boston.

A computerized control system would be installed for high-speed operations. Signal systems would be upgraded. An automatic speed control system would be installed for CorridorRail trains.

Stations would be rebuilt or rehabilitated to a modern attractive standard of comfort and appearance. Maintenance and storage yard facilities for the new equipment would be constructed at Boston, New York, Philadelphia, and Washington.

Most inter-city freight will have been diverted from NEC to parallel routes, except in a few locations where alternative facilities are not available or would not have sufficient capacity. Local freight service would be provided as it is now. The system would be designed so that high-speed trains would not operate on tracks adjacent to freight trains.

Rolling Stock

New high-speed rolling stock would be in the design and development stages during the course of the project for improving the ROW. Prototypes would be thoroughly tested to achieve low maintenance costs and passenger comfort at speeds of 150 miles per hour.

Based on the work done by the engineering contractors, certain characteristics of the rolling stock were assumed to be the same for all financial projections. Self-propelled, electric, multiple-unit cars operating in married pairs were assumed. In addition to ordinary coaches, some of the cars would contain food service facilities and some would be designed for premium class service. These characteristics affect the fleet size necessary and the load factor attainable (Appendix C) .

CORRIDORRAIL

CorridorRail would serve the travel market defined by all possible pairings of the cities previously listed with certain exceptions. The exceptions are those city-pairs which would be served by commuter trains, viz.:

- Washington and New Carrollton,
- Philadelphia and Trenton,
- Trenton and Metropark,
- Metropark and New York City,
- New York City and Stamford,
- Stamford and New Haven, and
- Dedham and Boston.

This definition also excludes all trips beginning or ending outside NEC. A New York to Miami passenger, for instance, is not included in the demand projections and is assumed not to use a CorridorRail train.

CorridorRail would provide a travel time of five and one-half hours from Washington to Boston with ten intermediate stops. This travel time would be divided between three hours north of New York and two and one-half hours south of New York.

A basic schedule of half-hourly departures during weekdays was used for most financial projections. Each train would serve one or more sections,[1] stopping at all stations. During periods of concentrated demand, extra trains would be added at intermediate departure times, primarily on the New York-Philadelphia section.

All seats would be reserved. The increased control over and predictability of peaking patterns which this would allow are considered in the analysis, especially in equipment utilization calculations.

Two classes of service would be provided. The revenue and demand forecasts reflect this assumption, as does the seating capacity of cars.

---

[1]Throughout this report, the three route segments between terminals are referred to as "sections" (i.e., the Washington-Philadelphia section, the Philadelphia-New York section, and the New York-Boston section). The sections are sub-divided into links between adjacent stations (e.g., the Baltimore-Wilmington link).

II. ORGANIZATIONAL AND FINANCIAL ALTERNATIVES

When the financial analysis project was begun, the organizational identity and the methods of financing CorridorRail were under consideration. A large part of the work performed in connection with this study consisted of assisting ONECD in evaluating the alternatives by performing financial projections for various organizational and financial configurations. This work is discussed in Section VI. The organizational and financial alternatives which had to be provided for in the analytical model are the subject of this section.

ORGANIZATION

In order to provide complete flexibility for the analysis, the functions of the Operator were divided into five basic groups. Any combination of these groups could be combined and assigned an organizational identity for financial, operational, or legal purposes. The groups of functions are:

- ownership of the ROW,
- maintenance of the ROW,
- operation of the trains,
- maintenance of rolling stock, and
- passenger service and marketing.

Within any organization, these functions correspond to the departmental groupings of expenses.

For example, one plan considered was to create an NEC Authority with representation from each of the states through which the route passes. The Authority would own and maintain the ROW and would lease it to the several users, including the Operator. Each of the organizational configurations considered involved one or more transfer payments among the organizations. In the plan finally selected for the baseline projection, all functions were combined. Since the United States Railway Association's Final System Plan assigns all five functions to Amtrak, the unified Operator could be considered a part of Amtrak.

The four users of the ROW, as indicated in Section I, would be:

- the CorridorRail Operator,
- commuter service agencies,
- Conrail (local freight), and
- Amtrak (long distance passenger service).

The Operator would be responsible for the maintenance of the ROW. In all cases considered, the cost of maintaining the ROW and the cost of dispatching the trains would be allocated among the users. Because the projections are for the Operator, the only manifestations of the presence of other users are their payments to the Operator. Implicit in the payments received by the Operator from the other users and in the cost incurred by the Operator to maintain the facilities and control train movement is a residual cost of maintenance and dispatching which has been allocated to the Operator.

For the purposes of the financial projections, all of the expenditures which would not be made by the Operator, but which would be part of NECDP were collectively called project manager cash flows. Because these expenditures would not be made by the Operator and would appear neither on the income account as expenses nor on the balance sheet as assets, their only impact on the projections is on the cash flow for the total project and on the financial indicators for the total project.

In summary, the organizational structures considered for CorridorRail were made up from the following components:

- the project manager,
- one or more organizations comprising the Operator, and
- the non-CorridorRail users of the ROW.

FINANCING

Five sources of funds were specified by ONECD:

- interest-bearing debt,
- interest-free debt,
- federal grants,
- short-term debt, and
- funds generated by operations.

For each case considered, these sources of funds were combined in differing proportions to supply the cash needs of CorridorRail.

Interest-Bearing Debt

Interest-bearing debt was most often planned as a bond issue supported by a sinking fund. It could be thought of as a term bond issue drawing simple interest. The sinking fund would receive its first payment after the first year of high-speed operations, when the Operator had begun to generate a positive cash flow. The sinking fund would be invested at a rate such that the amount in the fund would be adequate to retire the issue at maturity. Although these are the terms in which the projections were made, no impact would be apparent on the net operating cash flow or the income statements if any of these conditions were not met--if it were not a public issue, if it were not a term issue, or if it were not guaranteed. As long as the interest rate is fixed and simple, and as long as the payments on principal are delayed until the beginning of the second year of operations, the net receipt and service of debt would be unchanged for each year.

During the years of CorridorRail construction, no revenue would be available against which to charge the interest on such a bond issue. The real cost of those assets which would be acquired with the debt receipts would include not only the purchase price but also the interest on any debt used to acquire them. For example, if an interest-bearing debt were used to purchase the ROW in 1976 for five hundred million dollars, the real cost to the Operator would be $500 million plus the interest until use of the ROW had generated revenue for the Operator. The appropriate valuation of the ROW on the balance sheet, therefore, includes the capitalization of interest through the construction period. Furthermore, if additional interest-bearing debt is necessary to pay the interest during the construction period, that interest would be capitalized at a compounded rate. This would result, for example, in the valuation of a $500 million purchase using a 7 percent bond at $803 million in 1983 when capitalization would end.

The source of funds for the capitalized interest is thus assumed to be fresh interest-bearing debt receipts in each year of the construction period. In fact, there is no impact on the net cash flow for those years if the original issue is large enough to cover the capitalized interest payments and if undisbursed receipts from the issue are invested at a rate equal to that of the debt received.

Interest-Free Debt

Interest-free debt is a source of funds with no interest cost, with no date fixed for repayment, but with an obligation on the part of the Operator to use any free cash generated after operating expenditures and mandatory debt service to repay the loan. It could, alternatively, be referred to as equity to be repaid. The repayment of this loan would be subordinated to the repayment of interest-bearing short-term debt and to scheduled repayment of the interest-bearing bond issue discussed above. In any period of operations, after expense had been paid, necessary investments had been made, obligatory debt service had been discharged, and short-term debt had been extinguished, any cash available would be used to retire the interest-free loan.[1]

Federal Grants

Federal grants were treated as equity receipts for the purpose of drawing up balance sheets. Unlike the various forms of debt, grants would never be repaid. Grants were used as a source of funds for rolling stock payments. In that case, grants would be a continuing source of funds for the Operator as its fleet of cars was expanded and replaced. Grants would be received as the payments on rolling stock were due, rather than as the rolling stock was delivered. This form of financing is consistent with that which is anticipated for future purchases of rolling stock by Amtrak.

Short-Term Debt

When operations, working capital requirements, or debt service requirements create a temporary need for cash, a line of credit would be available to the Operator. This line of credit would bear interest and would take priority over other obligations when free cash was available. A similar line of credit is currently available to Amtrak at a rate linked to that of treasury bills. The principal capital investments would, in any case considered, be funded from one of the sources of funds previously discussed. For this reason, short-term debt could not be used to finance long-term assets.

---

[1]For the details of this assumption and the one exception to the obligatory repayment, see Section III, which contains a description of the cash management assumptions made in the projections.

Cash from Operations

The final source of funds is cash generated by the Operator's operations. In years when surplus cash is generated and after debt obligations have been extinguished, the Operator would be able to invest its cash for use in future periods of cash need.

Priority of Fund Sources

The five sources of funds would always have the same order of priority, both with respect to calling upon the resources and with respect to order of annual debt service payments.

Order Called Upon

The first three sources, --debt, interest-free debt, and grants--would generally be received by the Operator on a schedule linked to expenditures. Grants, for example, might be received in the amount of rolling stock payments, regardless of other cash need or surplus.

When these three sources are not sufficient to supply the Operator's needs, excess cash from operations would be used. This might be in the form of excess cash from the current year's operations or from the liquidation of short-term investments which had been made with cash from previous years' operations.

Finally, as a last resort, short-term debt would be called upon.

Order for Debt Service

Net cash flow generated after operations (i.e., revenue less operating expenditures) would be used in the following order. The sinking fund payments and the retirement of the bond issue upon maturity would be legal requirements taking precedence over all else; they might even require drawing some short-term debt to avoid default. Any interest payments would have the same status.

After these mandatory payments had been made, cash would be used to retire short-term debt, retire interest-free debt, call long-term interest bearing debt, or make short-term investments, in that order.

III. CORRIDORRAIL FINANCIAL MODEL

In order to make financial projections for CorridorRail under many different sets of assumptions, a model was developed which formulated the relationships between a set of cost, demand, operations, organizational and financial assumptions and the items composing financial statements. This model was the basis for a computer program which can project annual financial statements for up to three component organizations comprising the Operator for a specified number of years. The statements include operating expenses, sources and uses of cash, income accounts, and balance sheet. The same program calculates net present value and ROI. This section presents a general description of:

- the projection format, and
- the computations.

For a detailed description of the computations, see Appendix D "CorridorRail Financial Model Line Items." For information about using the computer program see Appendix E, "CorridorRail Financial Model User's Manual." The model will be described here for projections for a single organization; the variations for a case involving more than one organization are discussed in Section VI.

PROJECTION FORMAT

The format used in the projections is illustrated by Exhibit III. 1. The format consists of:

- a cash flow summary for the projection period;
- annual pro forma financial statements (including operating and investment statistics, operating income acount, sources and uses of cash, income account, and balance sheet); and
- a cover sheet and list of input assumptions.

Cash Flow Summary

The Cash Flow Summary, illustrated on the first two pages of Exhibit III. 1, lists the net cash flow for each year for the Operator and for the program manager organization. The net cash flow for the total project combines the flows for the two organizations.

EXHIBIT III.1

ILLUSTRATIVE PRINTOUT (SHEET 1 OF 6)

This illustration has been [illegible] on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
C A S H F L O W S U M M A R Y

NAME OF ENTITY	YEAR 1976	YEAR 1977	YEAR 1978	YEAR 1979	YEAR 1980	YEAR 1981
COMBINED	-715.7	-327.9	-374.4	-534.5	-510.5	-457.3
PROJECT MGT.	-63.4	-66.1	-67.1	-37.[illegible]	-15.4	-16.4
TOTAL PROJECT	-779.1	-394.0	-441.5	-571.6	-526.0	-473.7
	YEAR 1982	YEAR 1983	YEAR 1984	YEAR 1985	YEAR 1986	YEAR 1987
COMBINED	-156.8	43.0	62.0	79.0	96.5	108.7
PROJECT MGT.	-1[illegible].4					
TOTAL PROJECT	-171.3	43.0	62.0	79.0	96.5	108.7
	YEAR 1988	YEAR 1989	YEAR 1990	YEAR 1991	YEAR 1992	YEAR 1993
COMBINED	116.7	122.1	126.6	131.8	137.3	143.9
PROJECT MGT.						
TOTAL PROJECT	116.7	122.1	126.6	131.8	137.3	143.9

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT III. 1

ILLUSTRATIVE PRINTOUT (SHEET 2 OF 6)

NEC IMPROVEMENT PROGRAM - - - FINANCIAL PROJECTIONS
C A S H F L O W S U M M A R Y

NAME OF ENTITY	YEAR 1994	YEAR 1995	YEAR 1996	YEAR 1997	YEAR 1998	YEAR 1999
COMBINED PROJECT MGT.	93.6	51.5	119.1	147.2	156.5	166.0
TOTAL PROJECT	93.6	51.5	119.1	147.2	156.5	166.0
	YEAR 2000	YEAR 2001	YEAR 2002	YEAR 2003	YEAR 2004	YEAR 2005
COMBINED PROJECT MGT.	177.5	188.0	197.0	205.2	212.7	220.8
TOTAL PROJECT	177.5	188.0	197.0	205.2	212.7	220.8
	YEAR 2006	YEAR 2007	YEAR 2008	YEAR 2009	YEAR 2010	YEAR 2011
COMBINED PROJECT MGT.	229.2	238.2	190.9	151.5	222.5	3,608.7
TOTAL PROJECT	229.2	238.2	190.9	151.5	222.5	3,608.7

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT III. 1

ILLUSTRATIVE PRINTOUT (SHEET 3 OF 6)

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
NEC [illegible] 05/09/75 FOR THE COMBINED ENTITY 09:26:32

OPERATING AND INVESTMENT STATISTICS	YEAR 1979 SOURCES USES	YEAR 1980 SOURCES USES	YEAR 1981 SOURCES USES	YEAR 1982 SOURCES USES	YEAR 1983 SOURCES USES	YEAR 1984 SOURCES USES
PASSENGER TRIPS				17.0	20.1	22.2
PASSENGER MILES				2,261.0	2,673.3	2,952.6
CAR MILES				47.8	56.5	62.4
TRAIN MILES				12.3	12.3	12.3
NUMBER OF CARS IN FLEET				236.0	279.C	306.0
NUMBER OF CARS DELIVERED				236.0	43.C	29.0
FACILITIES INVESTMENT						
SERVICE FACILITIES	27.2	30.4	41.0			
TRACK UPGRADING & STRUCTURAL DEV'T	108.6	82.7	55.0	6.0		
LONG LEAD MATERIALS	81.1					
FENCING	33.5	24.8	4.4			
LAND ACQUISITION FOR TRACK REALIGNMENT	1.4					
SYSTEM TEST						
BRIDGE AND TUNNEL UPGRADING	64.7	64.7	48.4			
ELECTRIFICATION	62.1	48.0	22.3			
SIGNALLING CONTROL	44.4	88.7	87.7	56.5		
STATIONS	68.5	68.7	44.7	7.5		
FREIGHT FACILITIES						
TOTAL FACILITIES INVESTMENT	491.6	408.0	303.5	72.1		

EXHIBIT III.1

ILLUSTRATIVE PRINTOUT (SHEET 4 OF 6)

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

NEC PRO FORMAS 09/09/75 NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS FOR THE COMBINED ENTITY 09:26:32

OPERATING INCOME ACCOUNTS	YEAR 1979 SOURCES	YEAR 1979 USES	YEAR 1980 SOURCES	YEAR 1980 USES	YEAR 1981 SOURCES	YEAR 1981 USES	YEAR 1982 SOURCES	YEAR 1982 USES	YEAR 1983 SOURCES	YEAR 1983 USES	YEAR 1984 SOURCES	YEAR 1984 USES
COMMUTER & LOCAL FREIGHT CONTRIBUTION							9.3		9.3		9.3	
INTER-CORRIDOR AMTRAK CONTRIBUTION							1.9		1.9		1.9	
PRIMARY REVENUE							194.9		230.4		254.7	
TOTAL REVENUE							206.1		241.6		265.9	
EXPENSES												
STATION PERSONNEL								6.7		8.0		8.8
STATION CLEANING AND UTILITIES								1.9		1.9		1.9
BAGGAGE CARTS								0.3		0.4		0.4
TRAIN SUPPLIES AND EXPENSES								6.5		7.7		8.5
SNACK BAR ATTENDANTS								2.8		3.3		3.6
TICKET AGENCY COMMISSIONS								3.9		4.6		5.1
RESERVATIONS								15.3		18.1		20.0
PROMOTION								9.7		10.1		10.7
PASSENGER SERVICE DEPARTMENT OVERHEAD								0.3		0.3		0.3
CAR MAINTENANCE								19.1		22.6		25.0
M. OF E. DEPARTMENT OVERHEAD								1.9		2.0		2.1
ENERGY								6.6		7.8		8.6
CREW								19.0		19.0		19.0
SWITCHING								1.0		1.0		1.0
DISPATCHING								2.0		2.0		2.0
STATION MASTERS								4.7		4.7		4.7
TRANSPORTATION DEPARTMENT OVERHEAD								0.8		0.8		0.8
MAINTENANCE OF WAY AND STRUCTURES								21.6		21.6		21.6
MAINTENANCE OF CATENARY								7.3		7.3		7.3
MAINTENANCE OF COMMUNICATION AND SIGNALS								5.6		5.6		5.6
MAINTENANCE OF STATIONS, SHOPS, & YARDS								4.2		4.2		4.2
M. OF W. DEPARTMENT SUPERVISION								3.3		3.3		3.3
TRANSPORTATION DEPT INSURANCE								1.9		1.9		1.9
GENERAL OVERHEAD								12.5		13.4		14.1
TOTAL OPERATING EXPENSES								159.0		171.6		180.6

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT III. 1
ILLUSTRATIVE PRINTOUT (SHEET 5 OF 6)

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
FOR THE COMBINED ENTITY

NEC [illegible] 09/09/75 09:26:32

SOURCES AND USES OF CASH	YEAR 1979 SOURCES	YEAR 1979 USES	YEAR 1980 SOURCES	YEAR 1980 USES	YEAR 1981 SOURCES	YEAR 1981 USES	YEAR 1982 SOURCES	YEAR 1982 USES	YEAR 1983 SOURCES	YEAR 1983 USES	YEAR 1984 SOURCES	YEAR 1984 USES
TOTAL REVENUE							206.1		241.6		265.9	
TOTAL OPERATING EXPENSES								159.0		171.6		180.6
OPERATING INCOME							47.1		70.0		85.3	
OTHER SOURCES AND USES OF CASH												
SALE OF ROLLING STOCK												
PREPAYMENTS ON ROLLING STOCK				56.6		104.7		24.2		18.3		17.4
FINAL PAYMENTS ON ROLLING STOCK								37.8		6.9		4.6
TOTAL FACILITIES INVESTMENT		491.6		408.0		303.5		72.1				
REAL ASSET ACQUISITION		42.9		45.9		49.1		52.5				
CASH NEED INCREASE								4.8		0.4		0.3
RECEIVABLES INCREASE								5.8		1.1		0.7
INVENTORY INCREASE								6.8		0.4		0.2
NET CASH FLOW	-534.5		-510.5		-457.3		-156.8		43.0		62.0	
NEW SHORT TERM DEBT												
NEW LONG TERM DEBT	491.6		408.0		303.5		72.1					
NEW LONG TERM DEBT WITH SINKING FUND	42.9		45.9		49.1		52.5					
ROW PURCHASE BOND RETIREMENT												
LONG-TERM DEBT RETIREMENT												1.1
LIQUIDATION OF RESERVE												
ROW PURCHASE BOND INTEREST										56.2		56.2
SINKING FUND PAYMENT										35.6		35.6
INCOME FROM SINKING FUND (REINVESTED)									2.5		5.2	
NET CASH AFTER DEBT TRANSACTIONS			-56.6		-104.7		-32.2		-48.8		-30.9	
NEW GRANTS			56.6		104.7		61.9		25.2		22.1	
LIQUIDATION OF INVESTMENTS									21.5		8.2	
INCOME FROM INVESTMENTS									2.1		0.6	
INVESTMENT OF SURPLUS								29.7				
TOTAL SOURCES OF CASH	534.5		510.5		457.3		233.7		121.3		121.4	
TOTAL USES OF CASH		534.5		510.5		457.3		233.7		121.3		121.4

EXHIBIT III.1

ILLUSTRATIVE PRINTOUT (SHEET 6 OF 6)

> This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
FOR THE COMBINED ENTITY

NEC PRC FURNAS 09/09/75 09:26:32

	YEAR 1979	YEAR 1980	YEAR 1981	YEAR 1982	YEAR 1983	YEAR 1984
INCOME ACCOUNT						
OPERATING INCOME				47.1	70.0	85.3
SALE OF ROLLING STOCK						
INCOME FORM INVESTMENTS					2.1	0.6
INCOME FROM SINKING FUND (REINVESTED)					2.5	5.2
INTEREST EXPENSE					56.2	56.2
ROLLING STOCK DEPRECIATION				13.5	15.9	17.6
NET INCOME				33.6	2.5	17.3
GENERAL BALANCE SHEETS						
ASSETS						
CASH				4.8	5.1	5.4
OTHER RECEIVABLES				5.8	6.9	7.6
PREPAYMENTS		56.6	161.4	34.5	25.3	24.2
MATERIAL AND SUPPLIES				6.8	7.1	7.4
INVESTMENTS				29.7	8.2	
SINKING FUND RESERVE					38.1	78.9
ROLLING STOCK AT COST				188.8	223.2	246.4
LESS ACCUMULATED DEPRECIATION				13.5	29.4	47.0
ROLLING STOCK BOOK VALUE	1,297.2	1,705.2	2,008.7	175.3	193.8	199.4
IMPROVEMENTS	655.4	701.3	750.4	2,080.8	2,080.8	2,080.8
REAL ASSETS				802.9	802.9	802.9
TOTAL ASSETS	1,952.6	2,463.1	2,920.4	3,140.6	3,168.3	3,206.5
LIABILITIES						
SHORT TERM DEBT						
LONG TERM DEBT	1,297.2	1,705.2	2,008.7	2,080.8	2,080.8	2,079.7
ROW PURCHASE BOND	655.4	701.3	750.4	802.9	802.9	802.9
EQUITY ACCOUNTS						
TOTAL GRANTS		56.6	161.4	223.3	248.5	270.6
RETAINED EARNINGS				33.6	36.1	53.3
TOTAL LIABILITIES	1,952.6	2,463.1	2,920.4	3,140.6	3,168.3	3,206.5
WORKING CAPITAL				47.1	27.4	20.4

Pro Forma Financial Statements

The pro forma financial statements, on the pages following the Cash Flow Summary, illustrate the cash flows, income accounts, and balance sheets. The pro forma financial statements are divided into four-page sets:

- Operating and Investment Statistics, including demand figures, car-miles, train-miles, fleet figures, and facilities investment are listed on the first of the four pages.

- Operating Income Accounts, including revenues and operating expenses grouped by department are presented on the second page. The last item for each department is the departmental overhead figure, and the last operating expense item is the general overhead figure.

- A statement of Sources and Uses of Cash comprises the third page. The operating income is summarized in the three lines listing total revenue, total operating expenses, and operating income. Other operating sources and uses, primarily investment items, are added to operating income, giving the "net cash flow." The net cash flow line reflects the cash needed (when negative) or generated (when positive) by the Operator before accounting for any funding arrangements. In other words, net cash flow is determined by operating items alone and is unaffected by interest rates,[1] debt service requirements, interest earned, etc. The cash flows related to debt are listed below the double line and conclude with the difference between non-equity sources and non-equity uses of cash. This difference is called "net cash after debt transactions." The net cash after debt transactions line reflects the return on equity just as the net cash flow line reflects the return on total investment; it is followed by the equity and surplus sources and uses of cash, such as grants for rolling stock and investment of surplus. The last two lines on the page are totals of all the sources and of all the uses of cash.

---

[1]An exception to this generalization is capitalized interest, discussed in Section II, under the heading Interest-Bearing Debt.

. The fourth page contains the Income Account and General Balance Sheets. The last line on this page states the working capital in use.

On the second line of each page, the pro forma financial statements carry the date of the computer run, the name of the entity for which the pro forma projection is being made, and the time of the computer run. The date and time provide a unique identification for each execution of the program. Each four-page set of the pro formas is wide enough to cover six years; for example, a 36-year projection requires 24 pages. If the book value of assets has been used as a terminal value, this terminal value will be included in the net cash flow for the last year of the projection.

Throughout the pro forma financial statements, the column for each year contains three sub-columns. The lefthand column (labeled "sources") is used for credit items (e.g., revenue, receipts from sale of assets, loan receipts) and for the asset side of the balance sheet. The right-hand column (labeled "uses") is used for debit items (e.g., expenses, interest payments) and for the liability side of the balance sheet. The center column is used for non-dollar statistics and for figures which do not add into the totals such as passenger trips, net cash flow, and rolling stock at cost.

Cover Page and List of Inputs

The cover page and list of inputs are omitted from Exhibit III. 1 for the sake of brevity. They are in Appendices F and G. The cover page of each printout summarizes the hypotheses which were used in the run and lists the ROI and net present value for the Operator and for the total project including the program manager expenditures. Because the program manager's cash flows are negative, no ROI can be calculated for this function separately.

A list headed "A Complete List of Model Inputs as Defined for This Execution" follows the pro forma financial statements. The figures used for each of the assumptions in the model are listed at the time of program execution. Each figure appears to the right of the variable name and unit of measurement. The inputs are individually discussed in the following paragraphs.

COMPUTATIONAL STEPS

The flow of information from input data to output items is diagramed in Figure III. 1. A detailed description of the steps in calculating each

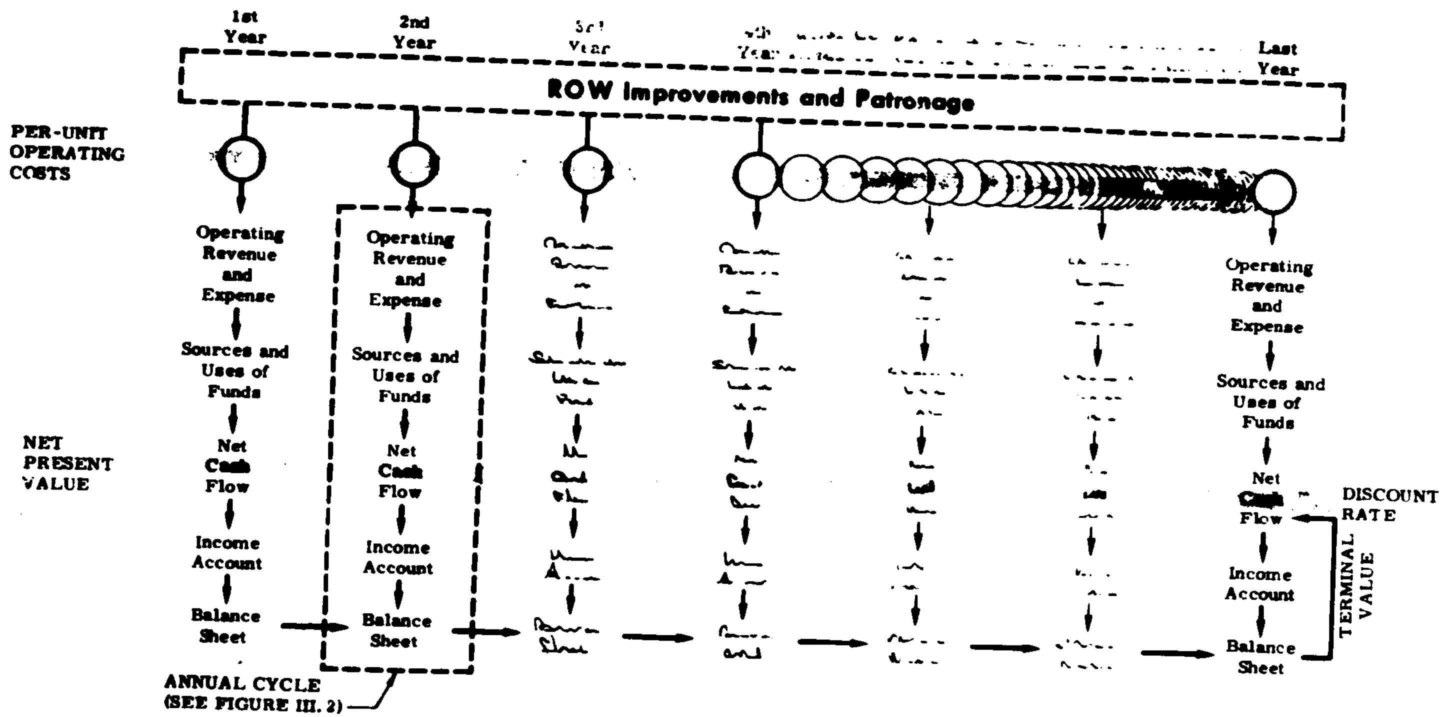


FIGURE III. 1: CORRIDORRAIL FINANCIAL MODEL line-item comprises Appendix D. This portion of the report summarizes:

- input requirements,
- fleet scheduling,
- investment scheduling,
- operating cost and revenue calculation,
- financial calculations,
- cash management routine,
- rolling stock accounts,
- income account and balance sheet projection, and
- financial indicator computation.

Input Requirements

A concise statement of the input data required may be found in the lists of model inputs at the end of Appendix F, Financial Projections for the Baseline Case. The first two pages of the list of inputs are presented as an example in Exhibit III. 2. The "Report" variable, the first in the list, defines the number of organizations and their names. Up to three organizations may be specified for any projection. The first year for projection, the year in which high-speed operations would begin, and the last year for projection determine the timing of all expenditures and revenue recognition.

The purchase price for the ROW is the next item and is followed by the load factor and rolling stock characteristics. These include provisions for car prepayments and rebuilding. Inter-organizational payments, including the share of costs allocated to non-CorridorRail users, are specified as a percentage of the appropriate accounts. Interest rates, the life of the term bond issue, and working capital ratios are followed by the discount rates to be used in calculating net present value.

Following the discount rates, the variables relating to operating expenses are specified. A unit cost or fixed annual cost must be specified

EXHIBIT III. 2

EXAMPLE OF MODEL INPUTS

A COMPLETE LIST OF MODEL INPUT VARIABLES
AS DEFINED FOR THIS EXECUTION

PAGE 1

VARIABLE	NAME		VALUE LIST		
REPORT	REPORT				COMBINED
START	FIRST YEAR OF PROJECTION	YEAR	1976	1976	1976
GO	HIGH-SPEED OPERATIONS BEGIN	YEAR	1982	1982	1982
STOP	LAST YEAR OF PROJECTION	YEAR	2011	2011	2011
ROW	R.O.W PURCHASE	$	0	0	500
LF	LOAD FACTOR	%	0	0	63.1
CRUT	CAR UTILIZATION	M/YR	0	0	0.203
STPC	SEATS PER CAR		0	0	83
SNACK	CARS PER SNACK BAR		0	0	3
RBLDY	YEAR IN WHICH CARS ARE REBUILT	YRS	0	0	0
CLF	CAR LIFE (IF NOT REBUILT)	YRS	0	0	14
RPLTL	TOTAL CAR LIFE IF REBUILT	YRS	0	0	14
CPRC	CAR PRICE	$	0	0	0.8
PRP1	PERCENT PAID 1 YEAR BEFORE DELIVERY	%	0	0	50
PRP2	PERCENT PAID 2 YEARS BEFORE DELIVERY	%	0	0	30
RBLDR	PERCENT OF COST TO REBUILD CAR	%	0	0	0
SLVG	PERCENT OF COST SALVAGED	%	0	0	10
EXPTFR	EXPENSES TRANSFER	1OR0	0	0	0
BOND	DEBT SERVICE TRANSFER	1OR0	0	0	0
INCS	INCOME SHARING PERCENTAGE	%	0	0	0
CRV	COMMUTER R OF WAY SHARE	%	0	0	19
CRD	COMMUTER DISPATCHING SHARE	%	0	0	29
FRV	NON-NEC AMTRAK R OF WAY SHARE	%	0	0	3.7
FRD	NON-NEC DISPATCHING SHARE	%	0	0	4.5
IRSD	SHORT DEBT INTEREST RATE	%	0	0	7
IRLD	LONG DEBT INTEREST RATE	%	0	0	0
IRSF	INTEREST RATE ON BOND (FOR BOND)	%	0	0	7
SFYR	TERM OF SINKING FUND	YRS	0	0	20
IRSECS	INTEREST RATE EARNABLE	%	0	0	7
LCAS	CASH-EXPENSE RATIO	%	0	0	3
RCBL	RECEIVABLE-REVENUE RATIO	%	0	0	3
INV	INVENTORY-MAINTENANCE RATIO	%	0	0	10
NPV	PRESENT VALUE DISCOUNT RATE	%	0	0	10
CNPV	TOTAL PROJECT DISCOUNT RATE	%	10	10	10
STNP	STATION PERSONNEL	$/P	0	0	0.3968
STCL	STATION CLEANING AND UTILITIES	$/YR	0	0	1.914
BGG	BAGGAGE CARTS	$/P	0	0	0.02
TNSP	TRAIN SUPPLIES AND EXPENSES	$/CM	0	0	0.136
FDCOM	FOOD AND LIQUOR REVENUE	$/PM	0	0	0
FOODC	FOOD AND LIQUOR COST	%	0	0	80
ATTS	SNACK BAR ATTENDANTS	$/CM	0	0	0.173
TISL	TICKET AGENCY COMMISSIONS	$REV	0	0	0.02
RSVN	RESERVATIONS	$/P	0	0	0.9
PROMO	PROMOTION	$REV	0	0	0.05
CRM	CAR MAINTENANCE	$/CM	0	0	0.4
ENGY	ENERGY	$/CM	0	0	0.138
CREW3	THREE-MAN CREW	$/TM	0	0	1.17
LENG3	PERCENT 3-MAN TRAIN MILES	%	0	0	0
CREW4	FOUR-MAN CREW	$/TM	0	0	1.54

EXHIBIT III. 2 (Continued)

EXAMPLE OF MODEL INPUTS

A COMPLETE LIST OF MODEL INPUT VARIABLES
AS DEFINED FOR THIS EXECUTION

PAGE 2

VARIABLE NAME			VALUE LIST		
LENG4	PERCENT 4-MAN TRAIN MILES	%	0	0	97.6
CREW5	FIVE-MAN CREW	$/TM	0	0	1.91
LENG5	PERCENT 5-MAN TRAIN MILES	%	0	0	2.4
CREW6	SIX-MAN CREW	$/TM	0	0	2.28
LENG6	PERCENT 6-MAN TRAIN MILES	%	C	0	0
TRMS82	1982 TRAIN MILES	TM	0	0	12.26
TRMS90	1990 TRAIN MILES	TM	0	0	12.26
TRMS11	2011 TRAIN MILES	TM	0	0	15.77
SWCH	SWITCHING	$/YR	0	0	1
DISP	DISPATCHING	$/YR	0	0	2
SHPM	STATION MASTERS	$/YR	0	0	4.7
TKM	M OF WAY AND STRUCTURES	$/YR	0	0	21.63
CTM	MAINTENANCE OF CATENARY	$/YR	0	0	7.32
SGM	MAINTENANCE OF CONTROLS AND SIGNALS	$/YR	0	0	5.59
STM	M OF STATIONS, SHOPS, & YARDS	$/YR	0	0	4.2
BURDS	PASSENGER SERVICES BURDEN	%	0	0	3
BURDF	FOOD SERVICE BURDEN	%	0	0	8
BURDT	TRANSPORTATION BURDEN	%	0	0	3
BURDE	MAINT. OF EQUIP. BURDEN	%	0	0	10
MOWOV	MAINTENANCE OF WAY DEPT. OVERHEAD	$/YR	0	0	3.3
INS	TRANSPORTATION DEPT INSURANCE BURDEN	%	0	0	10
GOV	GENERAL OVERHEAD BURDEN	%	0	0	8.5
PTPS	PASSENGER TRIPS	1976	0	0	0
		1977	0	0	0
		1978	0	0	0
		1979	0	0	0
		1980	0	0	0
		1981	0	0	0
		1982	0	0	17
		1983	0	0	20.1
		1984	0	0	22.2
		1985	0	0	24.2
		1986	0	0	26.1
		1987	0	0	27.4
		1988	0	0	28.4
		1989	0	0	29.2
		1990	0	0	30
		1991	0	0	30.9
		1992	0	0	31.8
		1993	0	0	32.8
		1994	0	0	33.8
		1995	0	0	34.8
		1996	0	0	35.8
		1997	0	0	36.9
		1998	0	0	38
		1999	0	0	39.1
		2000	0	0	40.3
		2001	0	0	41.5
		2002	0	0	42.7

for each operating expense. Included in the inputs required for crew costs are the three train-mile statistics (i.e., for 1982, 1990 and 2011). The percentages for overhead burdens and liability are grouped at the end of the list of operating expense inputs.

For each of the preceding inputs one figure is used for the entire projection period. For the remaining inputs, a separate figure is specified for each of the years to be projected.

Three of these inputs which require yearly figures are the patronage variables (passenger trips, passenger miles, and fare revenue). Following the patronage figures, the three variables for project manager expenditures are specified for each year. The last eleven variables in the list are the eleven improvement categories which comprise the ROW investment schedule.

Fleet Scheduling

The first use of the inputs is scheduling the fleet purchase payment for each year in the projection. This is necessary in order to have the prepayments calculated for the annual summation of cash flows. In order to schedule the fleet, the program uses the passenger-mile figures combined with load factor and car productivity to determine the necessary fleet size. The input for car life determines the replacements needed for each year. Last year's fleet size, the current year's fleet requirements, replacements necessary, and prepayment inputs determine the schedule of rolling stock investments.

Investment Scheduling

The improvement figures for the ROW are combined with the appropriate financial data (e.g., interest rate to be capitalized) to determine the investment in fixed facilities for each year. The interest is automatically capitalized through the first year of high-speed operations.

Operating Cost and Revenue Calculation

The program used to make financial projections then begins the annual cycle depicted in Figure III. 2. The portion of Figure III. 2 which relates to operations is presented in finer detail in Figure III. 3.

The following four forms of operating cost inputs are used in the model. A detailed explanation of how they were derived is presented in Appendix B:

- Direct costs (e.g., station cleaning, dispatching, and maintenance of way and structures which are fixed annual amounts are expressed in millions of 1974 dollars per year.

- Direct costs (e.g., station personnel and crew) which vary directly with the volume of patronage are generally expressed as unit costs (e.g., cost per passenger, per train-mile).

- Departmental overhead costs (e.g., maintenance of equipment and transportation department overhead) vary only in the long run with volume of patronage and are generally expressed as a burden rate. Each burden rate is assigned to specific direct and fixed annual costs. Each departmental overhead is calculated by multiplying the five-year running averages of the direct and fixed annual costs for that department by their respective burden rates and summing the products.

- General overhead cost is the product of a systemwide burden rate and the sum of all other operating expenses.

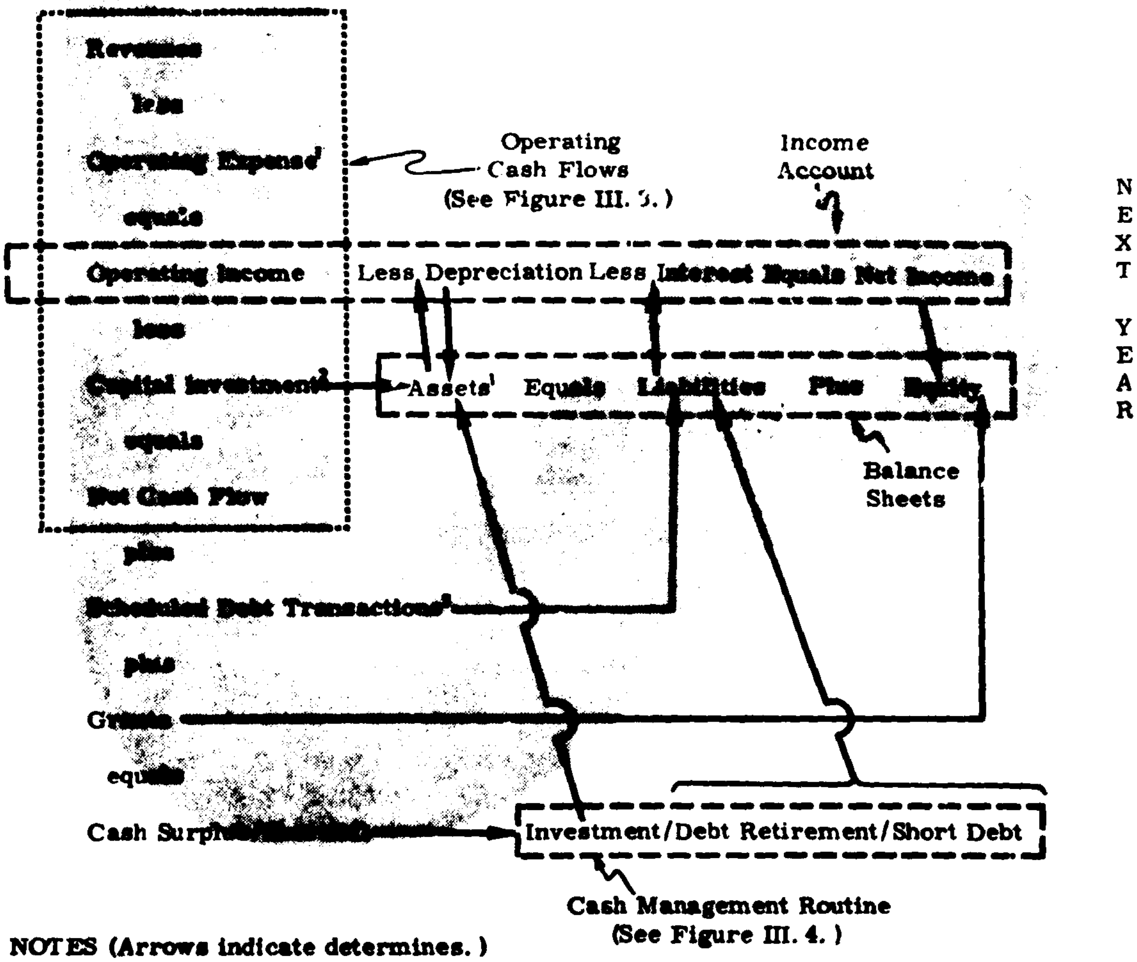
In each pass through the annual cycle, the program multiplies each unit cost by the appropriate statistic and applies the appropriate overhead rate.

The contribution charged to other users is calculated using the maintenance and dispatching costs. These contributions are combined with fare revenue to compute total revenue for the year. All operating expenses are summed and subtracted from total revenue to arrive at operating income.

Financial Calculations

The next step in the annual cycle (Figure III.2) is to calculate the remaining cash flows which are predetermined. These are principally:

- receipts from the sale of rolling stock, calculated using the cars-replaced figure from the rolling stock investment schedule;



NOTES (Arrows indicate determines.)

1. Some detail is omitted from this diagram; e.g., not all assets are depreciated.

2. Capital investment includes investment in ROW, in rolling stock, and in working capital. Strictly speaking, profits on sales of rolling stock must be included as an offset.

3. In investment years, scheduled receipts increase the cash stream. In later years, debt service requirements decrease the cash stream.

FIGURE III. 2: ANNUAL CYCLE CORRIDORRAIL FINANCIAL MODEL

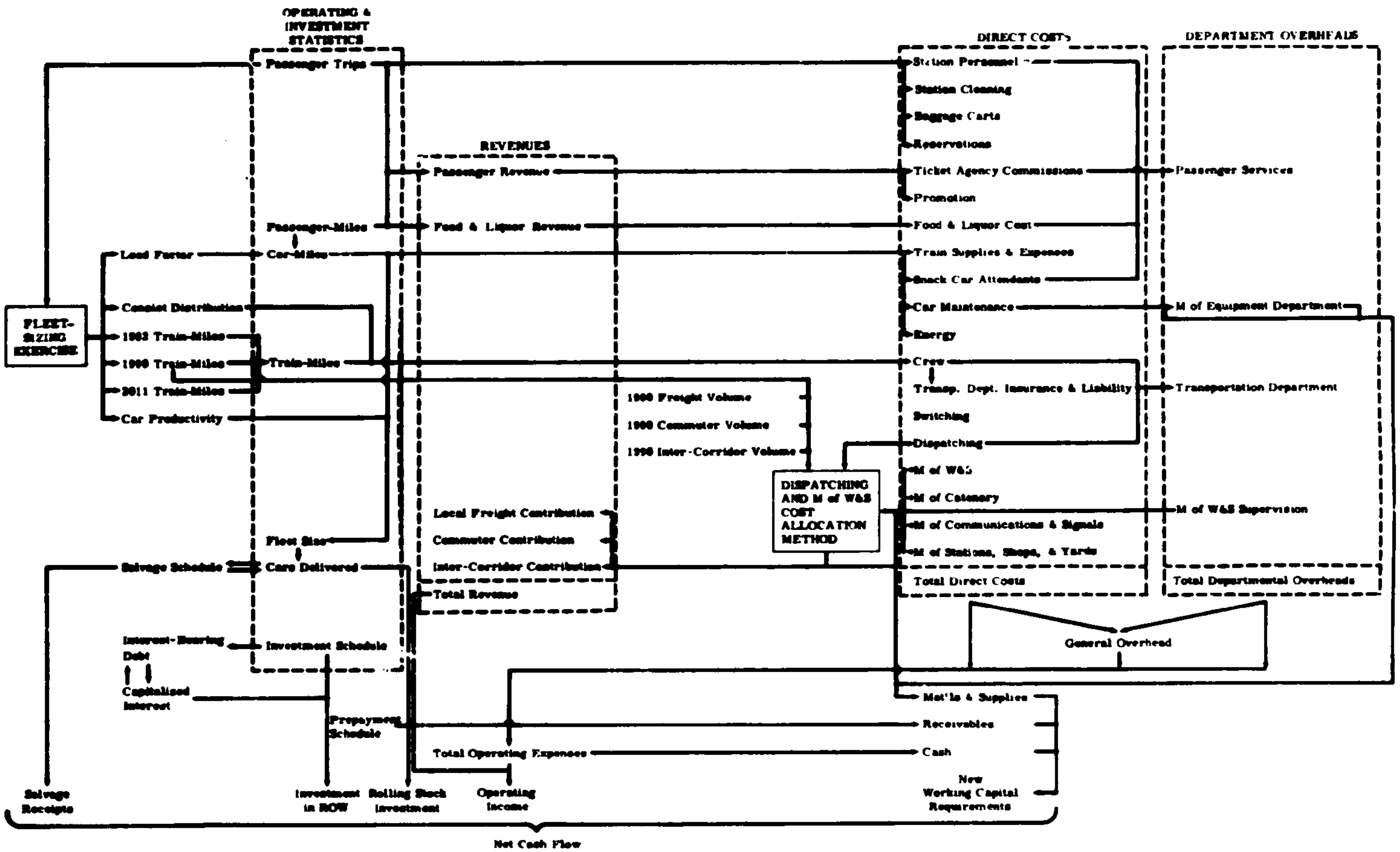


FIGURE III. 3: INFORMATION FLOW FOR OPERATING CASH FLOWS

- interest payments, calculated using the anticipated debt balances and the respective interest rates;

- the sinking fund payment calculated using the amount issued, the term of the issue, and the interest rate;

- and income from investments, calculated using last year's balance and the rate-earnable input figure.

These predetermined cash flows along with the investment figures and the operating income provide the information necessary to the cash management routine.

Cash Management Routine

The cash management routine (Figure III. 4) takes the cash needs and cash sources which have been calculated and goes through a series of steps which find the appropriate cash source or use for the cash shortfall or surplus. The following steps summarize the process:

1. Add: operating income,
new grants,
new long-term debt,
new bond issue receipts,
receipts from the sale of rolling stock,
liquidation of the sinking fund,
interest earned on investments, and
last year's investment balance, resulting in preliminary sources.

2. Then add: interest due,
scheduled debt repayment,
sinking fund payment,
rolling stock payments,
increases in working capital,
ROW improvement investments, and
ROW purchase payments, resulting in preliminary cash uses.

3. Subtract cash uses from cash sources to determine a preliminary cash shortfall or surplus.

4. If cash is needed, borrow short-term debt to meet the need, including enough to cover the interest on the new short-term debt. Then adjust the new short-term debt interest figure, the short-term debt balance, and reduce the investments account to zero (since it has been depleted).

5. If there is extra cash available, use it to reduce the short-term debt balance.

6. Check next year's cash flow. If a short-term debt would be needed next year, invest all cash available.

7. If there is still cash available, use it to reduce the long-term debt balance. If there is still cash available, use it to retire the ROW purchase bonds.

8. If there is still cash available, put it into the investment account.

The operating assumptions that can be inferred from these steps are:

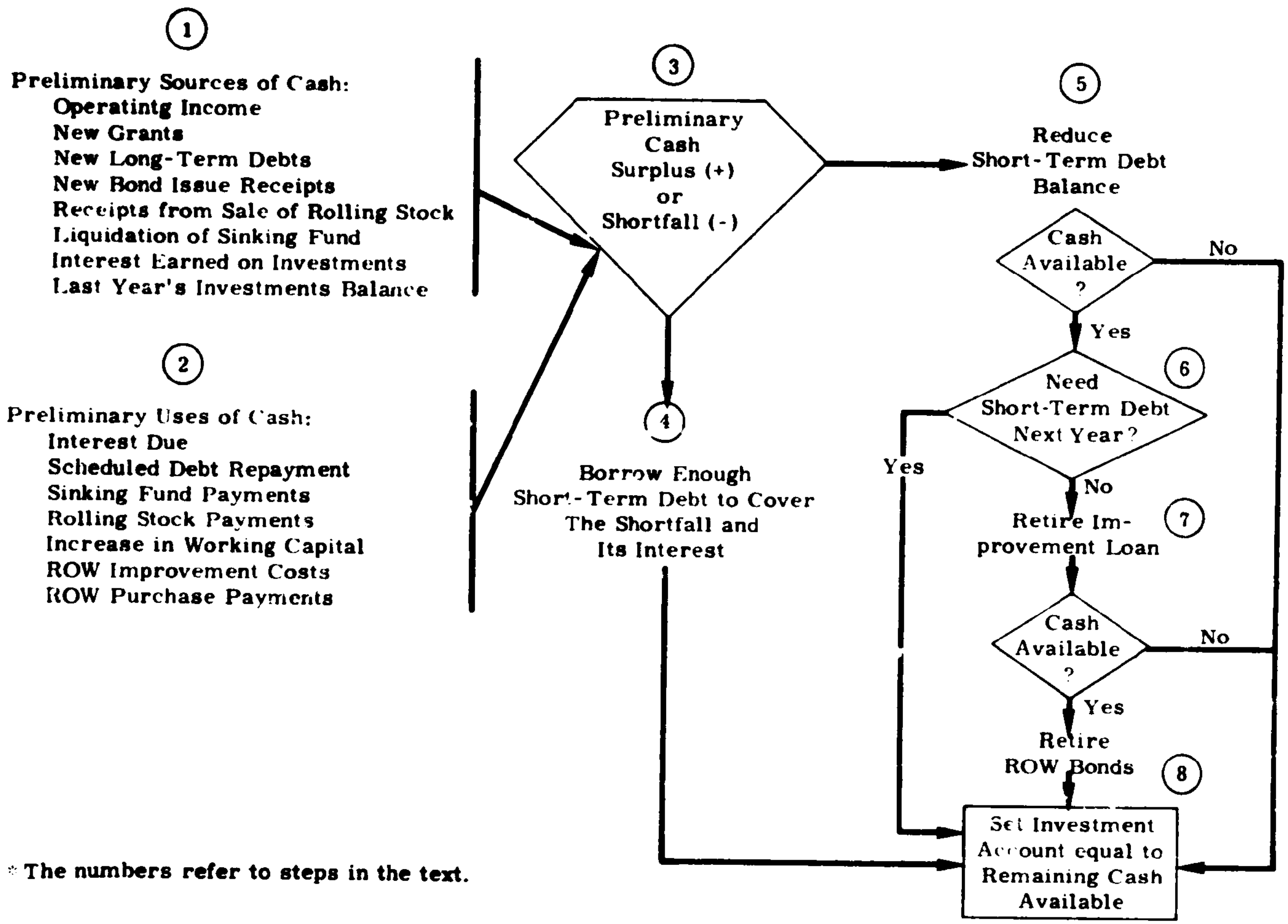
- Cash inventories, and receivables are maintained at a minimum operating balance.

- Short-term debt is drawn on the first day of a period of cash need and repaid on the last day of a period of cash surplus. This simulates a margin of safety in cash management.

- Long-term debt can be drawn or repaid on the first day of any period. Long-term debt repayment may be accelerated ahead of the scheduled repayments; however, accelerated repayments may not be made until the last day of the period of surplus. Thus, interest is charged for the period at the end of which the accelerated payment is made.

- Interest payments are made on the last day of each period.

- Investments are, made on the last day in a year of cash surplus.



* The numbers refer to steps in the text.

FIGURE III. 4: CORRIDORRAIL FINANCIAL MODEL CASH MANAGEMENT ROUTINE*

- Any surplus will be invested, and investments and their income are always available as a source of cash.
- New long-term debt and/or new grants are scheduled to insure that this cash management process will not cause short-term financing of capital improvements.
- The cash managers will be able to anticipate cash requirements one year in advance and will not retire interest-free debt if that would force them to borrow in the short-term market the next year.

Having performed the steps in the cash management routine, all of the sources and uses of cash have been determined. The operating uses are subtracted from the operating sources to determine net cash flow. The sum of all debt transactions is added to the net cash flow to determine net cash after debt transactions. Then all the sources and all the uses are summed to ensure that the totals balance each other.

Rolling Stock Accounts

In order to move from the cash flow items to the income account, rolling stock depreciation must be calculated. This is done by keeping running totals in the rolling stock accounts.

In order to make the calculation of rolling stock accounts clear, it will be useful to trace the entries associated with an individual car, rather than detailing the equations for the net financial effects of fleet transactions.

To begin with, the program requires inputs for car purchase price, percent paid one year before delivery, percent paid two years before delivery, total car life, and percent of purchase price received as salvage. The program uses the inputs at the following times:

- two years before delivery,
- one year before delivery,
- upon delivery,
- in each year after delivery, and
- upon retiring the car.

Two years before a car is purchased, its purchase price is multiplied by the percent paid two years before delivery. This amount is posted as a use of cash and is added to the asset account, "prepayments."

In the next year, the car's purchase price is multiplied by the percent paid one year before delivery. This amount is again posted as a use of cash and capitalized as an asset called "prepayments."

In the year of delivery, the percentage already paid for the car is subtracted from 100, and the residual percentage is multiplied by the purchase price. This amount is posted as a use of cash under the name "final payments on rolling stock." In the same year the prepayments for the car are subtracted from the asset account of prepayments and the entire purchase price of the car is added to the asset account called "rolling stock at cost."

The car is also depreciated during the first year at a straight-line rate based on the input "car life if not rebuilt." The depreciation on the car is an expense posted to the income account and is added to the account labeled "less accumulated depreciation," which is an offset to rolling stock at cost. The difference between the car's purchase price and its depreciation is included in the account "rolling stock book value."

In each successive year until the "car-life if not rebuilt" is expired, the depreciation is expensed and subtracted from the rolling stock book value through the accumulated depreciation account.

Finally, after the total car life is expired, the original purchase price of the car is multiplied by the percent of cost salvaged. This amount is posted as a source of cash, "sale of rolling stock." The appropriate depreciation expenses are posted in this last year; then the original purchase price of the car is subtracted from rolling stock at cost and from accumulated depreciation. Because the accumulated depreciation on the car exactly equals the purchase price, the car has no impact on the rolling stock book value account in this year or hereafter. However, it is assumed that a replacement car would have been ordered for delivery next year, and the prepayments would have been made on the replacement.

Income Account and Balance Sheet Projection

The income account, or profit and loss statement, begins on the page following Sources and Uses of Cash. Net income is computed by subtracting depreciation and interest expense from operating income, rolling stock sales, and interest earned.

The rest of the page contains the balance sheet. Each of the balance sheet items is calculated by accumulating the appropriate cash flows. Retained earnings, for example, is the accumulation of all net income figures including the current year. Similarly, cash is the accumulation of the cash increase figures, debt balances are the previous year's balances net of this year's transactions, and so on. The assets and liabilities are totaled to ensure that they balance.

Financial Indicator Computation

After the annual cycle has been completed for every year in the projection, two financial indicators are calculated:

- net present value, and
- return on investment.

Each of the indicators is calculated both with and without the project manager flows.

Net present value is calculated as the sum of the net cash flows in each year discounted by the rate specified in the input data.

In order to simulate the residual value at the end of the projected period, a terminal value is added to the net cash flow. The terminal value can be calculated in two ways. The book value of the assets other than investments can be added into the net cash flow for the last year projected, or the net cash flow for the last year can be assumed to continue (the present value of this infinite cash stream is added to the net present value of the individually calculated cash flows).

Return on investment is calculated as the discount rate which would reduce the net present value of the project to zero.

IV. THE BASELINE PROJECTION

This section discusses the "baseline" projection. The baseline projection was made using a set of assumptions and estimates from which variations could be tested. These assumptions, estimates, and their sources or justification are identified under the heading "Inputs." The second part of the section contains a discussion of the results produced by the projection using the baseline inputs.

INPUTS

The wide range of data which was used can be logically divided into the following categories:

- cost of improving the ROW,
- cost and design of rolling stock,
- costs of operation,
- patronage forecast, and
- financial arrangements.

The assumptions and estimates used in the baseline case are concisely stated in the lists of model inputs in Tables IV. 1A through IV. 1C. Table IV. 1A includes those quantities which are used in every year of the projection. Tables IV. 1B and IV. 1C include the investment and demand quantities which must be specified for each year. A survey of the sources of all data is presented in Appendix A.

Cost of Improving the ROW

The ROW purchase price of $500 million is a planning estimate made by ONECD. The investment figures for ROW improvement and the amounts listed as program manager expenditures were specified by ONECD in the form of a series of investment totals, which were subdivided by category, and a schedule, which determined the timing of the expenditures. They are based upon estimates by ONECD's engineering contractors. The total of $2. 08 billion, which appears on the balance sheets, is combined with the project manager expenditures of $280 million to yield a grand total of $2. 36 billion, as the amount

TABLE IV.1A
(Sheet 1 of 2)

BASELINE INPUTS - FIGURES HELD CONSTANT THROUGHOUT THE PROJECTION

Projection Scope	
Report	1 organization called Operator
First year of projection	1976
High-speed operations begin	1982
Last year of projection	2011
ROW purchase price	$500 million
Rolling Stock	
Load factor	63.1%
Car utilization	203 thousand miles/year
Seats per car	83 (average of 75
Cars per snack bar	3 seats/car)
Car service life	14 years
Car price	$0.8 million
Percent paid 1 year before delivery	50%
Percent paid 2 years before delivery	30%
Salvage value as % of price	10%
Transfer Payments	
Commuter & freight M of W&S share	19%
Commuter & freight dispatching share	29%
Inter-corridor M of W&S share	3.7%
Dispatching share	8.5%
Financial Factors	
Short-term debt interest rate	7%
Long-term debt interest rate	0%
Interest rate on bond (for ROW)	7%
Term of sinking fund	20 years
Interest rate earnable	7%
Cash-expense ratio	3:100
Receivable-revenue ratio	3:100
Inventory-maintenance expense ratio	1:10
Present value discount rate	10%

TABLE IV.1A (Sheet 2 of 2)

Direct Operating Costs	
Station personnel	$.3968/passenger
Station cleaning and utilities	$1.914 million/year
Baggage carts	$.02/passenger
Train supplies and expenses	$.136/car-mile
Snack bar attendants	$.173/snack-car-mile
Ticket agency commissions	2% of revenue
Reservations	$.90/passenger
Promotion	5% of revenue
Car Maintenance	$.40/car-mile
Energy	$.138/car-mile
Crew cost	$1.55/train-mile
1982 train miles	12.26 million
1990 train miles	12.26 million
2011 train miles	15.77 million
Switching	$1 million/year
Dispatching	$2 million/year
Station masters	$4.7 million/year
M of way and structures	$21.63 million/year
Maintenance of catenary	$7.32 million/year
Maintenance of controls and signals	$5.59 million/year
M of stations, shops, & yards	$4.2 million/year
Burden Rates	
Passenger service	3%
Transportation	3%
Maintenance of equipment	10%
Maintenance of way	$3.3 million/year
Transportation dept. liability	10% of crew costs
General overhead	8.5%

TABLE IV. 1B

BASELINE INPUTS - INVESTMENT FIGURES BY YEAR
(millions of 1974 dollars)

Investment Category	Year						
	1976	1977	1978	1979	1980	1981	1982
Project Manager Expenditures							
Program and construction management	11.429	11.429	11.429	11.429	11.429	11.429	11.429
Interim maintenance and railroad support	52	33	34	4	5	3	3
Rolling stock development and retrofit	0	21.667	21.666	21.666	0	0	0
Operator Expenditures							
Track upgrading and structural development	65.5	80.7	48.5	108.6	82.7	55.0	6.0
Fencing	0	0	4.4	33.5	24.8	4.4	0
Land acquisition for track realignment	9.8	21.7	16.1	1.4	0	0	0
Long lead materials	0	28.6	64.3	81.1	0	0	0
System test	0	0	6.0	0	0	0	0
Bridge and tunnel upgrading	53.8	64.7	64.7	64.7	64.7	48.4	0
Electrification	1.0	4.0	35.6	62.2	48.0	22.3	0
Signaling control	5.4	7.1	7.9	44.4	88.8	88.8	58.5
Service facilities	11.6	25.8	27.2	27.2	30.4	41.0	0
Stations	3.6	7.9	29.8	68.5	68.7	44.7	7.6
Freight facilities	30.0	50.0	30.0	0	0	0	0

TABLE IV. 1C

BASELINE INPUTS - PATRONAGE FIGURES BY YEAR

Year	Passenger Trips (millions)	Passenger-Miles (millions)	Fare Revenue (millions of 1974 dollars)
1982	17.0	2261.1	194.9
1983	20.1	2673.3	230.4
1984	22.2	2952.6	254.7
1985	24.2	3218.6	277.7
1986	26.1	3471.3	299.5
1987	27.4	3644.2	314.4
1988	28.4	3777.2	325.6
1989	29.2	3862.6	334.8
1990	30.0	3990.0	343.9
1991	30.9	4109.7	354.6
1992	31.8	4229.4	364.9
1993	32.8	4362.4	376.4
1994	33.8	4495.4	387.9
1995	34.8	4628.4	399.3
1996	35.8	4761.4	410.8
1997	36.9	4907.7	423.4
1998	38.0	5054.0	436.1
1999	39.1	5200.3	448.7
2000	40.3	5359.9	462.4
2001	41.5	5519.5	476.2
2002	42.7	5679.1	490.0
2003	44.0	5852.0	504.9
2004	45.3	6024.9	519.8
2005	46.7	6211.1	535.9
2006	48.1	6397.3	551.9
2007	49.5	6583.5	568.0
2008	51.0	6783.0	585.2
2009	52.5	6982.5	602.4
2010	54.1	7195.3	620.8
2011	55.7	7408.1	639.2

required for the improvements. The $500 million purchase of the ROW when combined with capitalized interest in the years 1976 through 1982 yields $803 million, as the amount required for the ownership. The total investment (without rolling stock purchases) by 1983 is the sum of these two figures or $3.16 billion.

Cost and Design of Rolling Stock

Several parameters related to rolling stock design affect the analysis:

- capacity,
- purchase price,
- maintenance cost,
- utilization,
- service life, and
- salvage value.

These items are closely dependent on each other. An accurate set of assumptions must use figures for these parameters which are consistent with each other. For example, if the purchase price for a particular car design is used, the maintenance cost for that design must also be used. Furthermore, in that the development of all new rolling stock is planned for CorridorRail, the maintenance cost may be one of the design specifications that determine purchase price.

The engineering contractors have made estimates for a car with an average capacity of 75 seats, after allowing for food service space and a mix of premium and coach seats in the seating density. The 83 "seats per car", which is used in the program, is a figure before allowing for food service space, in order to permit the frequency of snack-bars to be varied. In the baseline case, a snack-bar in every third car displaces 24 seats which lowers the average capacity from 83 to 75 seats. The estimated price was $800 thousand, and the cost of maintenance was 40 cents per car-mile.

An analysis of schedules (Appendix C) indicated that utilization of up to 260,000 car-miles per year would be obtained from a CorridorRail car. The design of maintenance facilities for rolling stock, however, was based on 203,000 car-miles per year. This more conservative estimate, which makes a reasonable allowance for technical problems that could be encountered with an advanced design, was used for the baseline case. In addition, a 14-year service life was used along with a salvage value of 10 percent of the purchase price.

Costs of Operation

The revision and refinement of estimates of operating costs were a major component of the financial analysis for CorridorRail. Estimates of the costs of operation require two types of inputs:

. the unit costs, and

. the system characteristics.

The unit costs and their derivation are discussed in Appendix B. The system characteristics determine the operating statistics to which the unit costs are applied. Some of the operating statistics (i.e., passenger trips, passenger miles, and revenue are directly available from the patronage forecasts. Others (e.g., car-miles, train-miles) require a study of system characteristics (e.g., demand distribution, track configuration, yard location, and station capacity). The derivation of these statistics is detailed in Appendix B.

Patronage

The projection of demand for the CorridorRail service was another major component of the financial analysis. The results of the demand projections are set out in the Demand Report. The patronage forecasts which appear in Table IV.1C as inputs to the baseline financial analysis are the results of consideration by ONECD of demand projections made for ONECD by several contractors.

Figures for passenger trips, passenger-miles, and fare revenue from 1982 to 1990 were specified. The passenger trip figures display the characteristics of a marked stimulation of demand in the early 1980s, as the advantages of high-speed service are realized, followed by a gradual return to a constant growth rate. This growth rate was specified as 3 percent per year from 1990 through 2011. The demand figures also incorporate constant average trip length of 133 miles per passenger and a fare structure of approximately $1.50 per passenger plus 7.5 cents per passenger-mile.

Financial Arrangements

For the baseline case, ONECD specified a source of funds for each of three investment categories:

- ROW purchase,
- ROW improvement, and
- rolling stock purchase.

The ROW would be purchased from the proceeds of a 7-percent, 20-year term bond issue. A sinking fund set up after the first year of operations would receive constant yearly payments and would be calculated to retire the entire issue in 1996. The Operator would continue to sell the bonds during the construction period in order to make the capitalized interest payments. In the year 1976, therefore, the Operator would purchase the ROW for $500 million by issuing $500 million in 7-percent bonds. On the last day of the year, he would pay $35 million interest by issuing an additional $35 million. Both the purchase price and the capitalized interest (a total of $535 million) would be posted to the account labeled "real assets." The same figure, $535 million, would be posted as real asset acquisition and ROW purchase bonds balance.

The ROW improvements would be made with interest-free debt. This debt would be received when needed and repaid when surplus cash generated from earnings is available. Even though the ROW purchase issue bond would carry a 7-percent interest rate, the interest-free improvement loan would be repaid before the accelerated repayment of the purchase bond issue. In 1996, when the bonds matured, repayment of the bonds would take precedence over repayment of the loan. The only case in which free cash might be invested rather than used to repay the loan would be when such an investment could avoid the need for short-term borrowing in the succeeding year.

Rolling stock payments would be made with federal grants. Grants to purchase rolling stock would be an ongoing source of funds for the Operator. They would be treated, for accounting purposes, in a similar manner to that accorded equity receipts.

These three sources of funds (the purchase bond, the improvement loan, and the federal grants) anticipate the major capital requirements of the Operator. The remaining components of cash flow would be operating income, investment in working capital, and costs of funds (i.e., debt service). Therefore, the repayment of the loan would proceed in the amounts by which operating income exceeded working capital increases and debt service requirements. The date by which the improvement loan is projected to be repaid thereby becomes a measure of the financial performance of the Operator.

Short-term debt would be available at 7-percent interest. The provision of the three principal sources of funds ensures that long-term investments would not be financed with short-term debts. This short-term line of credit is similar to an arrangement which Amtrak already enjoys with the Federal Financing Bank.

The final financial parameters required as inputs to the baseline case are calculations for interest rate earnable and discount rate for net present value. The assumption that the Operator could earn a 7-percent simple return on investments and on the sinking fund was made because it is reasonable to expect that interest could be earned at roughly the same rate as the cost of a federally guaranteed debt, such as the bond issue for the ROW purchase.

The discount rate for net present value calculations was set at 10 percent in accordance with the directives of the Office of Management and Budget[1] Note, however, that because the cash stream which is discounted is intended to represent only the investment program and the Operator's cash flows, the net present value and ROI are useful only to compare NECDP projections to each other: they cannot be used for comparison with other projects.

BASELINE RESULTS

The financial projection produced by the CorridorRail Financial Model using the baseline inputs is set out in Appendix F. A summary of significant items for selected years appears in Table IV.2. Opera-

---

[1]U.S. Office of Management and Budget. Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits. Circular No. A-94, March 1972

ting income, financial indicators, and cash flow patterns in this projection are noteworthy.

Operating Income

The operating income recognized in the first year of high-speed operations (1982) would be $47 million. As patronage increases and fixed costs become a smaller portion of operating expense, operating income increases to $137 million in 1990 and to $336 million in 2010. These operating income figures represent 23 percent, 38 percent, and and 47 percent of total revenue.

Operating income in 1983, the second year of high-speed operations, is not sufficient to cover the debt service requirements. Annual sinking fund payments and annual interest payments on the ROW purchase bond total $92 million, and operating income does not reach this level until 1985. However, the excess funds generated in 1982, before the incidence of debt service requirements, would be invested and would, with the interest earned, be sufficient to cover the cash shortfalls in 1983 and 1984. There would be, therefore, no need for short-term borrowing even in the initial years of high-speed operations.

Financial Indicators

The ROI for the operating entity is 4.6 percent assuming a level cash flow after 2011 and 3.4 assuming the book value of assets is received in 2011. The improvement loan would be repaid by the year 2003. No external financing beyond the ROW debt and the rolling stock grants is required.

Cash Flow Patterns

Net cash flow represents the cash generated or needed before accounting for funding arrangements. It shows the financial productivity of operations alone and is unaffected by interest expense or by interest income. After the heavy investment and corresponding negative net cash flows for the construction period, the net cash flow becomes positive in 1983. It increases from $43 million in 1983 to $127 million in 1990 and $223 million in 2010.

Certain years are critical ones for the cash flow stream. In the first year of operations, there is no sinking fund requirement, and the operation generates a cash surplus. Rather than immediately repaying

TABLE IV.2

SELECTED ITEMS FROM PROJECTED FINANCIAL STATEMENTS
FOR CORRIDORRAIL (BASELINE PROJECTION)*
(millions of 1974 dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Passenger Volume							17	20.1	22.2	24.2	26.1	27.4
Total Revenue							206.1	241.6	265.9	288.9	310.7	325.6
Operating Expense							159	171.6	180.6	189.5	198.3	205
Operating Income							47.1	70	85.3	99.4	112.4	120.6
Rolling Stock Investment					58.6	104.7	61.9	25.2	22.1	19.2	14.7	11.1
ROW Investment	715.7	327.9	374.4	534.5	453.9	352.6	124.6					
New Working Capital Required							17.4	1.9	1.2	1.2	1.2	.8
Project Manager	63.4	66.1	67.1	37.1	15.4	16.4	14.4					
Net Cash Flow	(779.1)	(394.0)	(441.5)	(571.6)	(526.0)	(473.7)	(171.3)	43	62	79	96.5	108.7
Mandatory Debt Service								91.8	91.9	91.8	91.8	91.8
Funds Provided in Advance	779.1	394.0	441.5	571.6	526.0	473.7	200.9	25.2	22.1	19.2	14.7	11.1
Additional Funds Needed ( )/ Generated	0	0	0	0	0	0	29.7	(21.5)	(7.7)	6.1	19.4	28

	1988	1989	1990	1992	1994	1996#	1998#	2000#	2005#	2010#
Passenger Volume	28.4	29.2	30.0	31.8	33.6	35.8	38.0	40.3	46.7	54.1
Total Revenue	336.8	346.0	355.1	376.1	399.1	422.0	447.3	473.6	547.1	632
Operating Expense	210.1	214.3	218.3	227.4	237.2	247.2	258	268.3	300.4	336.3
Operating Income	126.6	131.7	136.7	148.7	161.9	174.8	189.3	205.3	246.7	295.7
Rolling Stock Investment	9.3	9.0	9.7	10.8	67.7	74.0	34.5	28.2	25.9	92.2
ROW Investment										
New Working Capital Required	.6	.5	.5	.5	.5	.5	.7	.7	.9	1.0
Project Manager										
Net Cash Flow	116.7	127.1	126.6	137.3	93.6	119.1	156.5	177.5	220.8	222.5
Mandatory Debt Service	91.8	91.8	91.8	91.8	91.8	802.9@				
Funds Provided in Advance	9.3	9.0	9.7	10.8	67.7	841.3	34.5	28.2	25.9	92.2
Additional Funds Needed ( )/ Generated	34.2	39.3	44.4	56.3	69.4	157.5	191.0	235.7	246.7	314.7

*Rounding has caused arithmetic disparities within this table.

#Salvage receipts are implicit in cash flows.

@Includes 767.3 from a sinking fund.

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

part of the improvement loan, this surplus is invested in anticipation of a cash shortfall in 1983. The first sinking fund payment, in 1983, forces the liquidation of $21.5 million of the investments. The remain-maining investments are left untouched in anticipation of another cash shortfall in 1984. Again, in 1984, investments are liquidated to meet the debt service requirements. From here on, however, operating income is sufficient to meet all cash requirements; repayment of the improvement loan begins in 1985, with the payment of $1.1 million. The repayment of the loan continues at an increasing rate until it is completed in 2003. The replacement of the original fleet of cars causes discontinuity of the net cash flow in the years 1994 through 1996. Cash for the replacement is automatically provided for in the form of grants, so repayment of the improvement loan is unaffected. Similarly, the retirement of the term bond issue in 1996 has been provided for in the form of the sinking fund reserve. The risk inherent in the magnitude of the counter-balancing flows during the years 1994 to 1996 could strain the finances of the Operator severely. If, for example, the availability of grants were restricted, or if the sinking fund had been unprofitably managed, large requirements for short-term borrowing might be created.

Note that the excess cash generated (when defined as the repayment of the improvement loan plus investment of surplus) exceeds the annual receipt of rolling stock grants except in the start-up years (1976 to 1985) and in one fleet replacement year (1995). This suggests that if the initial purchase of rolling stock is provided for, the continuing purchase of rolling stock could be financed from operations. When a projection which eliminates grants after 1983 is executed, the maximum need for short-term debt is $43.1 million in 1995. Retirement of the improvement loan is delayed from 2003 to 2006.

V. SENSITIVITY ANALYSIS

The sensitivity analysis was directed toward determining the impact of using assumptions that varied from the baseline case. Studying the results of these projections permitted the sensitivity of ROI to be determined. The results also reflect the range of expectable deviation from the baseline projection. This section discusses the approach used and the results of the analyses.

APPROACH

The sensitivity analyses are designed to determine which are the most critical assumptions and to estimate the range of variation of the ROI given various possible differences between actual experience and the assumptions made for the baseline analysis. The analyses incorporated two types of tests:

- tests in which only one variable was changed from the baseline (simple sensitivity analysis), and
- tests in which several related variables were changed from the baseline (multiple sensitivity analysis).

Simple sensitivity analysis provides some insight into the relationships which are built into the financial model. It indicates which assumptions are most critical. For an input variable which is independent of other input variables, simple analysis also estimates the impact of changes in the baseline estimate for that variable.

Multiple sensitivity analysis, on the other hand, tests the impact of changes in groups of related input variables. It provides estimates of how the baseline projections could be affected by combinations of circumstances which might occur.

In short, simple analysis allows the inputs to change one at a time, independently of each other. Multiple analysis takes into account the interactivity among the input data.

SIMPLE SENSITIVITY ANALYSES

A list of the simple analyses that were performed is found in Table V.1. The list begins with the more general economic factors and

TABLE V.1

SIMPLE SENSITIVITY RESULTS

PARAMETER	BASELINE VALUE (ROI = 3.4%)	FAVORABLE EXCURSION VALUE	ROI	UNFAVORABLE EXCURSION VALUE	ROI
A. Macro-economic factors					
Economic growth rate	Exponential growth	--	--	Winestone (linear)	2.4%
Combustible fuel price	150% of 1974 level	Twice 1974 level	4.2%	1974 level	2.7%
B. Travel time (D.C.-N.Y./N.Y.-Boston)					
North of New York only	2.5 hours / 3 hours	--	--	2.5 hours / 4.5 hours	3.0%
North of New York only		--	--	2.5 hours / 3.5 hours	.3%
Entire route		--	--	2.8 hours / 3.5 hours	3.0%
C. Fixed and real asset investment					
ROW purchase price	$500 million	$350 million	3.6%	$2000 million $1000 million	2.1% 2.8%
Improvement program	$2081 million	--		$2,518 million	3.0%
Bridges & tunnels in 1976	$53.8 million	$13.8 million	3.4%	$113.8 million	3.3%
Bridges & tunnels in 1981	$48.36 million	$8.36 million	3.4%	$108.36 million	3.4%
D. Rolling Stock Characteristics					
Car price	$800 thousand	--	--	$1 million	3.2%
Prepayment schedule	30%-50%-20%	no prepayments	3.4%	45%-40%-1[illegible]	3.4%
Car productivity	203,000 miles per year	266,000 miles p.a.	3.6%	183,000 miles p.a.	3.3%
Car maintenance	$.40 per car-mile	$.30 per car-mile	3.7%	$.60 per car-mile	2.9%
Car service life	14 years	20 years	3.6%	10 years	3.1%
Salvage value	10% of cost	15% of cost	3.4%	no salvage value	3.4%
E. Operating costs					
Station master expense	$4.7 million p.a.	$2.5 million p.a.	3.5%	$7.5 million p.a.	3.3%
Energy	$.138 per car-mile	--		$.207 per car-mile	3.2%
Dispatching and switching	$3 million p.a.	--		$3.75 million p.a.	3.4%
Crew	$1.55 per train-mile	$1.10 per train-mile	3.9%	$1.62 per train mile	3.4%
Reservations	$.90 per passenger	no reservations	4.1%	$1.80 per passenger	2.6%
M of W&S	$42.04 million p.a.	$37.83 million p.a.	3.5%	$52.55 million p.a.	3.2%
Transp'n Dept. Liability	10% of crew costs	5% of crew costs	3.4%	15% of crew costs	3.4%
Passenger services	Stn. personnel - $.30/passenger Attendants - $.17/car-mile Stn. cleaning - $1.9 million p.a. Baggage - $.03/passenger Promotion 5 % of revenue Ticket ag'y comm. - 2% of rev. Train supplies - $.136/car-mile	10% below baseline values	3.6%	20% above baseline values	3.1%
Overhead	General overhead burden - 8.5% M of W&S supervision - $3.3 million p.a. M of equipment overhead - 10% Passenger Services Burden - 3% Transportation burden - 3%	6.375% $2.97 million p.a. 8% 2% 2%	3.5%	12% $4.13 million p.a. 12% 4.5% 4.5%	3.2%
F. Miscellaneous					
Current assets	Inventory/maintenance ratio - 10% Cash/expense ratio - 3% Receivables/revenue ratio - 3%	7% 2% 2%	3.4%	15% 4.5% 4.5%	3.4%
Frequency of service*	Half hourly departures	--	--	hourly departures	2.8%
Train miles	1982 - 12.3 million 1990 - 12.3 million 2011 - 15.8 million			1982 - 12.3 million 1990 - 13.5 million 2011 - 10.7 million	3.3%
Load factor	63.1%	70%	3.7%	50%	3.0%

* Demand change only.

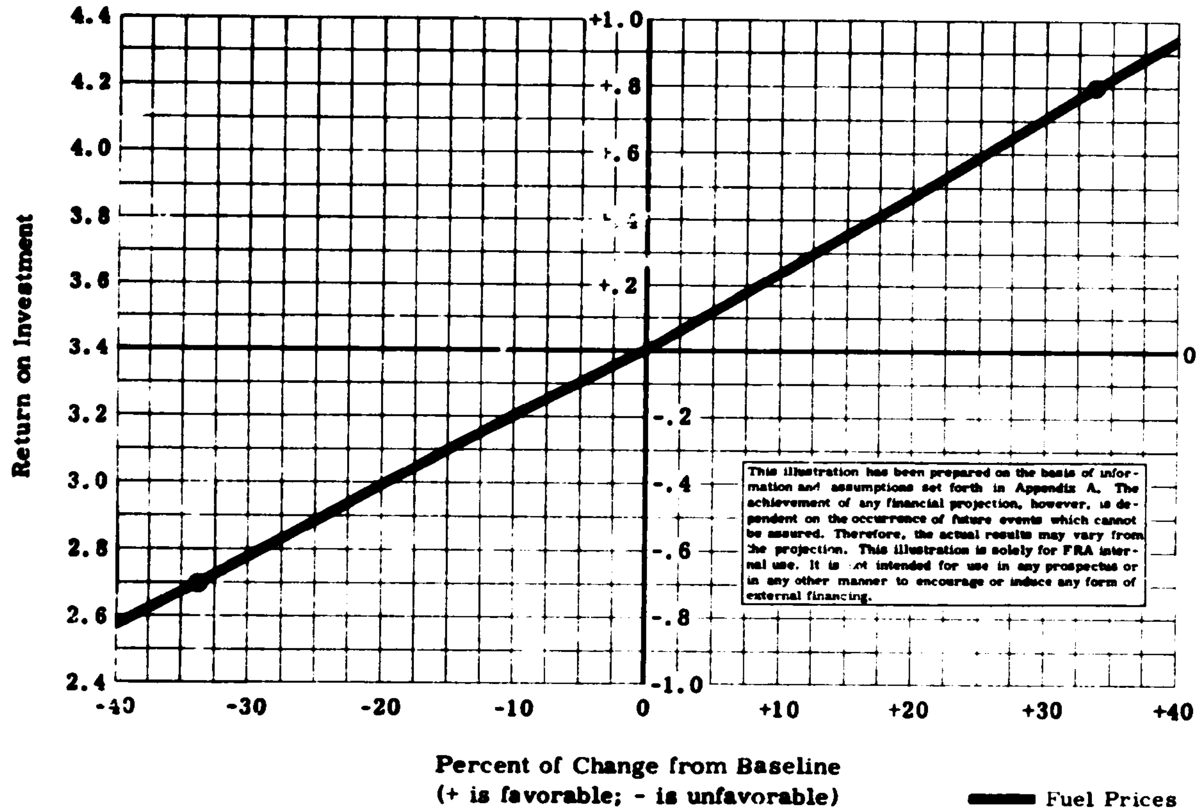
This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

progresses to the specific operating costs. Some of the variables would present such trivial tests by themselves that they are grouped together (e.g., overheads). For most parameters, there is a favorable and an unfavorable case. In each case, a reasonably expectable excursion from the base value for the parameter is listed. Next to the excursion value, the ROI that the model projects when the excursion value is substituted for the baseline value is listed. For example, when the cost of propulsion energy is raised from $.207 per car-mile to $.38, and all other inputs are unchanged, the ROI drops from 3.4 percent to 3.2 percent.

Figures V.1 through V.6 present in graphic form the same results as Table V.1. Each of the lines represents one variable. The slope of the line corresponds to the sensitivity of ROI to that variable. The horizontal axis provides a scale for the value of a variable as a percent of its baseline value; the vertical axis provides a scale for the ROI. Because the ROI for the complete set of baseline assumptions is 3.4 percent, and because only one variable is being changed at a time, all the lines pass through the point corresponding to 0-percent change in the parameter (i.e., equal to the baseline value) on the horizontal axis and 3.4 percent ROI on the vertical axis. In Figure V.2 for example, the ROI is about twice as sensitive to travel time overall as to travel time north of New York.

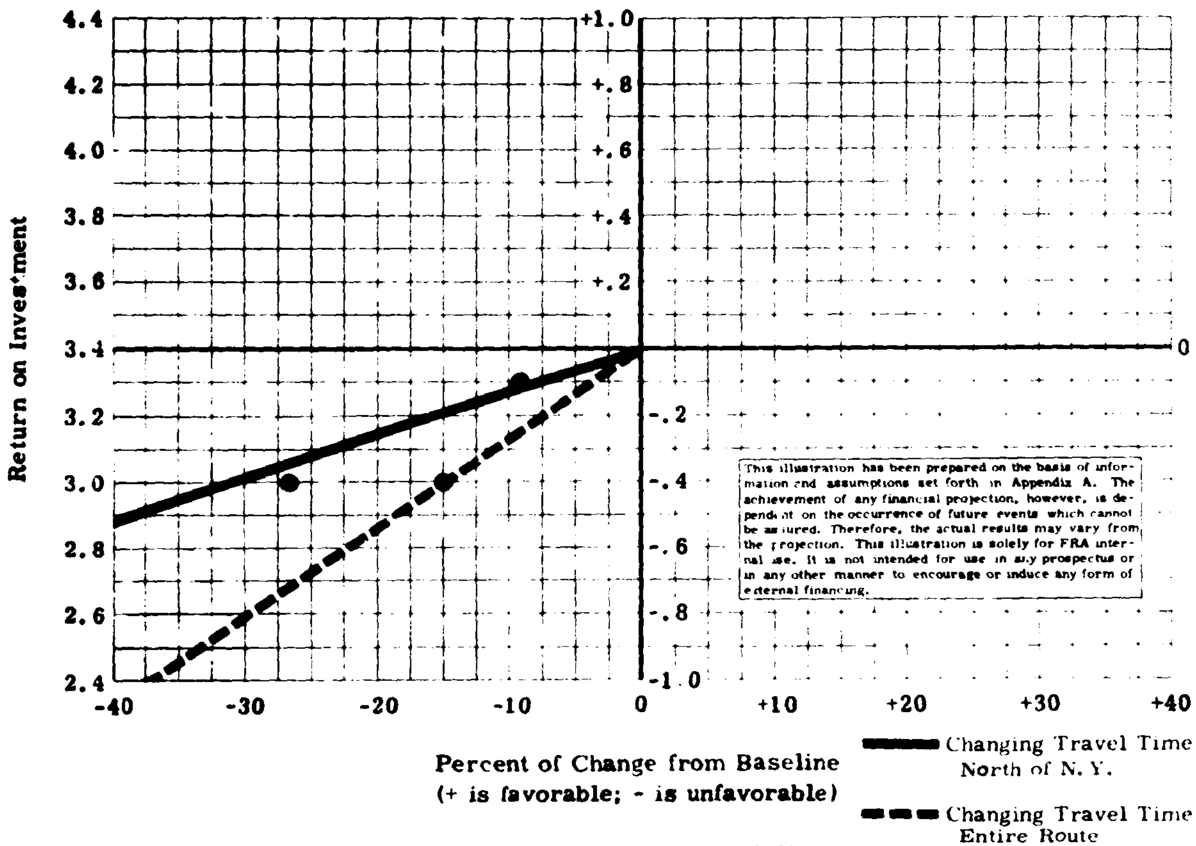
Similar information in a still different form is presented in Table V.2. This table suggests the tolerance of the investment program to changes in each of the input data. It shows how much of a change in a given variable will cause the ROI to change by 0.1 percent or 0.5 percent. For example, a decrease of 0.6 percent in the load factor will reduce the ROI by 0.5 percent, whereas a decrease of 50 percent in car-life is necessary to reduce the ROI by 0.5 percent. Where the input parameter could not be quantified by a single value (e.g., changes in patronage forecasts), or where an unreasonable excursion was required (e.g., the insurance burden to reduce ROI by .5 percent), the test was omitted from Table V.2.

One further word of caution in interpreting the results of the analyses is in order. When comparing the sensitivity of ROI to change in variables, it may be necessary to compare the variables in terms of percentages of their baseline values. One cannot otherwise compare variables which are expressed in different units. However, a given percentage change in a variable which determines one third of the annual operating expense will, a priori, have greater impact than the



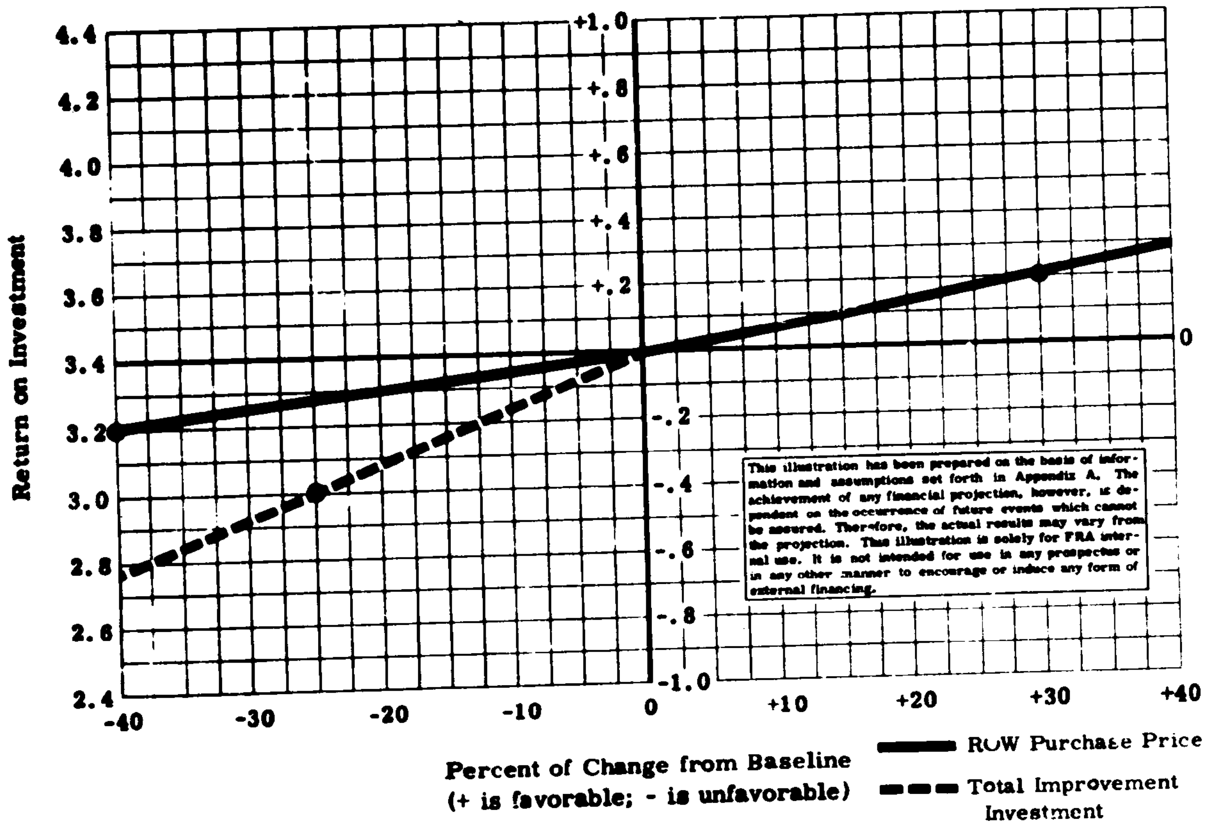
● Denotes simple sensitivity test result; remainder of each line is linearly interpolated to suggest a degree of sensitivity.

FIGURE V.1: MACROECONOMIC FACTORS



● Denotes simple sensitivity test result; remainder of each line is linearly interpolated to suggest a degree of sensitivity.

FIGURE V.2: TRAVEL TIME



● Denotes simple sensitivity test result; remainder of each line is linearly interpolated to suggest a degree of sensitivity.

FIGURE V.3: FIXED/REAL ASSET INVESTMENT

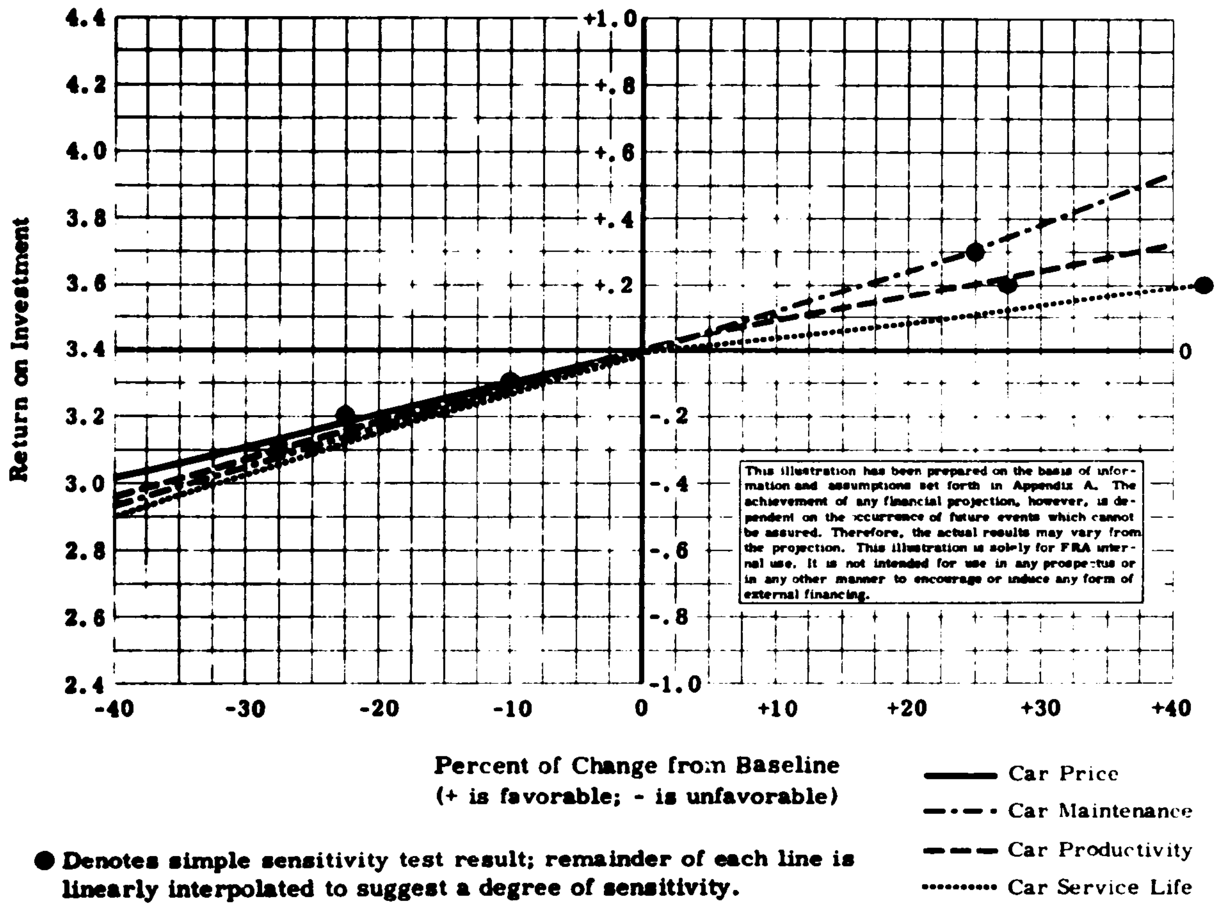
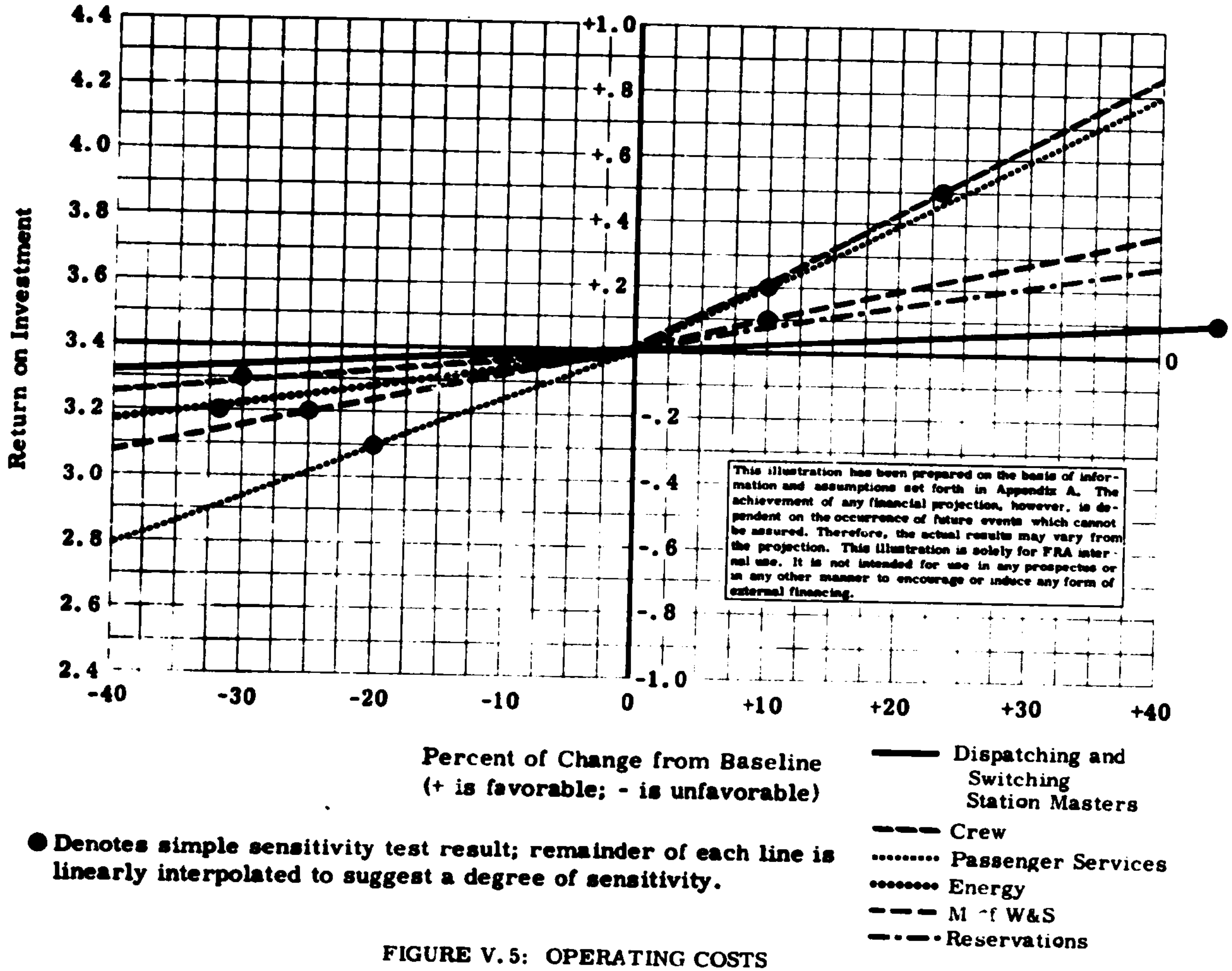
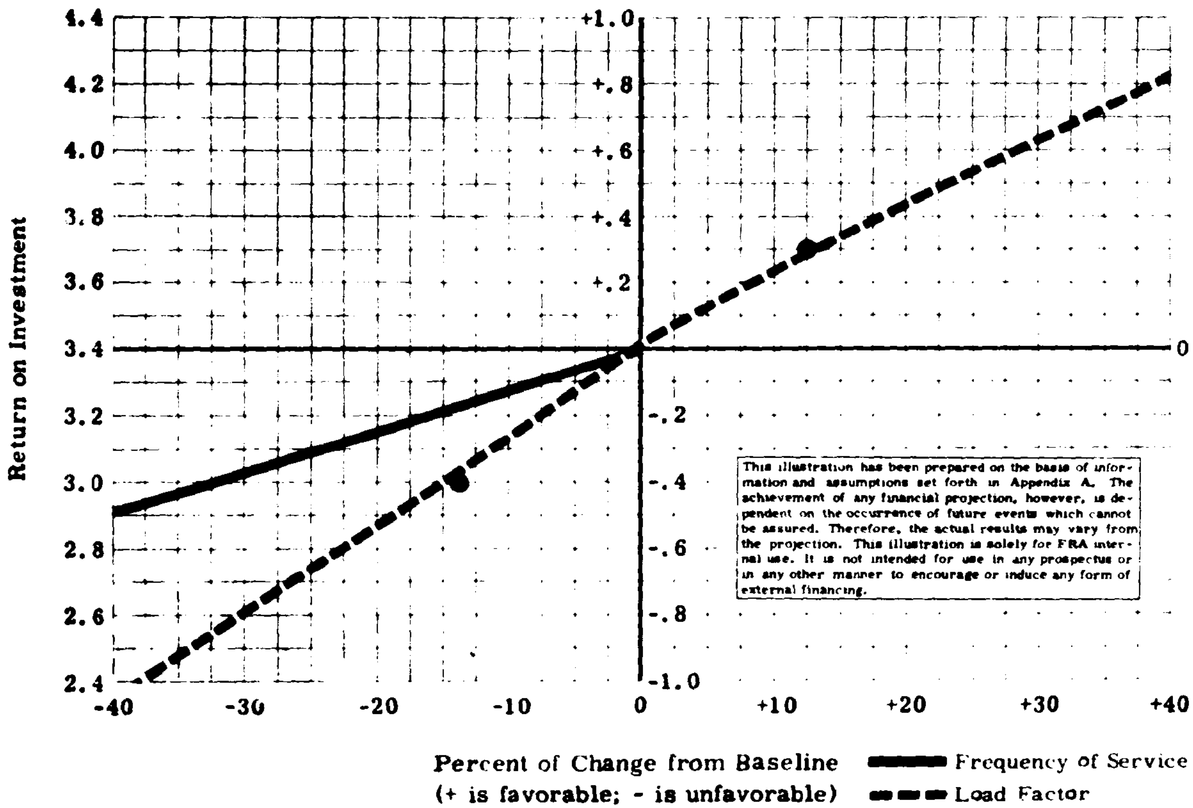


FIGURE V.4: ROLLING STOCK CHARACTERISTICS



● Denotes simple sensitivity test result; remainder of each line is linearly interpolated to suggest a degree of sensitivity.

FIGURE V.5: OPERATING COSTS



● **Denotes simple sensitivity test result; remainder of each line is linearly interpolated to suggest a degree of sensitivity.**

FIGURE V.6: MISCELLANEOUS

TABLE V.2

SIMPLE SENSITIVITY TESTS YIELDING ROIs OF:

3.3 % (0.1 BELOW BASELINE)
2.9 % (0.5 BELOW BASELINE)

PARAMETER	ROI = 3.4%	ROI IS 3.3 PERCENT		ROI IS 2.9 PERCENT	
	Baseline Value	Excursion value	Variation as a % of baseline	Excursion value	Variation as a % of baseline
A. Macro-economic factors					
Economic growth rate	Exponential growth				
Combustible fuel price	150% of 1974 level				
B. Travel time (D.C.-N.Y./N.Y.-Boston)					
North of New York only North of New York only Entire route	2.5 hours / 3 hours				
C. Fixed and real asset investment					
ROW purchase price	$500 million	$600 million	+20%	$900 million	+80%
Improvement program	$2081 million	$2,236 million	+7%	$2,781 million	+34%
Bridges & tunnels in 1976	$53.8 million	$113.8 million	+112%	$650 million	+1100%
Bridges & tunnels in 1981	$48.4 million	$208.4 million	331%	$908.4 million	+1778%
D. Rolling Stock Characteristics					
Car price	$800 thousand	$870 thousand	+9%	$1,400 thousand	+75%
Prepayment schedule	30%-50%-20%				
Car productivity	203,000 miles per year	183,000 miles per year	-10%	123,000 miles per year	-39%
Car maintenance	$.40 per car-mile	$0.44 per car-mile	+10%	$0.60 per car-mile	+50%
Car service life	14 years	11 years	-21%	7 years	-50%
Salvage value	[illegible]% of cost	(0.1 decrease)			
E. Operating costs					
Station masters	$4.7 million p.a.	$7.5 million p.a.	+60%	$25.5 million p.a.	+443%
Energy	$.138 per car-mile	$0.163 per car-mile	+18%	$0.326 per car-mile	+136%
Dispatching and switching	$3 million p.a.	$5.75 million p.a.	+92%	$27.75 million p.a.	+825%
Crew	$1.55 per train-mile	$2.00 per train-mile	+29%	$2.85 per train-mile	+84%
Reservations	$.90 per passenger	$1.01 per passenger	+12%	$1.45 per passenger	+61%
M of W&S	$42.04 million p.a.	$47.83 million p.a.	+14%	$67.55 million p.a.	+61%
Transp'n Dept. Liability	10% of crew costs	27% of crew costs	+172%		
Passenger services	Stn. personnel - $.39/passenger Attendants - $.17/car-mile Stn. cleaning - $1.9 million p.a. Baggage - $.02/passenger Promotion 5 % of revenue Ticket ag'y comm. - 2% of rev. Train supplies - $.138/car-mile	$0.41 per passenger $0.18 / car-mile $2.0 million p.a. $0.02/passenger 6% of revenue 2% of revenue $.146/car-mile	+6%	$0.51 per passenger $0.22 / car-mile $2.5 million p.a. $0.03/passenger 7% of revenue 3% of revenue $.178 per car-mile	+31%
Overhead	General overhead burden - 8.5% M of W&S supervision - $3.3 million p.a. M of equipment overhead - 10% Passenger Services Burden - 3% Transportation burden - 3%				
F. Miscellaneous					
Current assets	Inventory/maintenance ratio - 10% Cash/expense ratio - 3% Receivables/revenue ratio - 3%	30% 15% 15%	400%		
Frequency of service*	Half hourly departures				
Train miles	1982 - 12.3 million 1990 - 12.3 million 2011 - 15.8 million				
Load factor	63.1%	61%	-3%	53%	-16%

*Demand change only.

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

same percentage change in a variable which determines one-tenth of the annual operating expense. By arbitrarily combining or redefining cost categories, the sensitivity of ROI may appear to change. It is useful, therefore, to look at both the absolute change and the percentage change from the baseline value. A few of the individual tests which deserve special attention are discussed below.

Travel Time

The travel times are expressed in the form "Washington-N.Y./N.Y.-Boston." In two of the simple analyses, only the New York-Boston travel time was changed from the baseline; in a third simple analysis, the travel time for the entire route was changed. In order to compare the effect of spreading an additional half-hour over the entire route to the effect of concentrating an additional half-hour in the New York-Boston section, the changes are always expressed as a percent of the total Washington to Boston travel time. In Figure V.2, for example, an increase of 20 percent in the travel time spread over the entire route reduces the ROI to 2.8 percent, whereas the same increase in travel time concentrated north of New York reduces the ROI only to 3.1 percent.

Overhead

The parameter "overhead" is composed of several different overhead burden rates. It was determined that reasonably expectable excursions for these burden rates would vary in different proportions to the baseline values. For example, the maintenance of equipment burden is increased by 20 percent in the unfavorable overhead case, whereas transportation burden is increased by 50 percent in the same case. In order to present this case in the form of a graph, and in order to present the information in Table V.2 for this case, the excursion was described as a change in a single variable, viz., the combined overhead costs in 1990.

Load Factor

The case that uses a conservative load factor of 55 percent was of particular interest to ONECD. Load factor is a critical parameter which may be projected by simulating optimum equipment utilization (Appendix C) or may be estimated on an empirical basis. The complete set of projections using a load factor of 55 percent is reproduced in Appendix H.

ROLE OF THE DEMAND MODEL

In order to perform a series of sensitivity tests which involved changes in the patronage inputs to the financial model, it was necessary to develop a method for routinely projecting patronage data. The patronage data required were passenger trips, passenger-miles, and fare revenue for each of the 30 years in the projection period. Each set of patronage figures not only needed to be internally consistent, but also needed to represent a logical excursion from the baseline set of figures. The steps in developing the projections for sensitivity tests were to:

- forecast passenger trips for each case;
- recalibrate these projections for pivotal years in accordance with the baseline assumptions on market penetration;
- interpolate between and extrapolate beyond the pivotal years; and
- project passenger-miles and fare revenue from passenger trips in accordance with the baseline assumptions.

These steps are discussed below. A discussion of the passenger trip projection characteristics and assumptions is contained in the Demand Report.

Projected Passenger Trips

Each of the simple sensitivity cases involving patronage was formulated in terms of the inputs to the patronage projection. For example, in the case that tests the effects of a return to 1974 fuel prices, the relative cost advantage of CorridorRail was less than in the baseline. Using 1974 fuel prices with all other inputs at their baseline values, a patronage projection was made.

The baseline patronage estimate provides a projection of 22,704,000 CorridorRail passengers in 1982 and 30,067,000 CorridorRail passengers in 1990.[1] By setting the fuel prices back to 1974 levels, the demand

---

[1]The baseline patronage forecasts were made assuming cost attributes of a relative 38-percent increase for automobile travel and an 8-percent increase for air travel. The time attributes were a 10-percent increase in both automobile and bus travel time. Pages III.7 and III.8 of the Demand Report contain a discussion of these parameters.

model projects passenger volumes of 19,165,000 in 1982 and 25,373,000 in 1990. A Patronage estimate was made for each of the simple sensitivity analyses involving changes in demand.

Recalibrate

The passenger trip projections made during the course of the analyses are, however, for fully developed demand under static conditions. They do not reflect the rate at which a shift from one mode of transportation to another will occur. Therefore, whereas the demand model projects 1982 passenger volume of 22,704,000 trips, ONECD's evaluation of the several patronage forecasts made for them resulted in a 1982 estimate of 17,000,000 trips. ONECD then projected a gradual increase to the projected figure of 30,000,000 in 1990 reflecting a gradual realization of the benefits of CorridorRail.

As the first step in simulating this process of market development, the proportion of the fully developed patronage increase[1] which had been achieved in 1982 in the baseline case was assumed to apply to the sensitivity cases. For example, the proportion of the fully developed patronage increase which had been achieved in 1982 in the baseline case was estimated using the following equation:

$$\frac{\text{ONECD estimate of 1982 volume} - \text{1982 volume without CorridorRail}}{\text{model estimate of 1982 volume} - \text{1982 volume without CorridorRail}} = \text{1982 proportion}$$

Substituting the numbers described above:

$$\frac{17,000,000 - 12,426,000}{22,704,000 - 12,426,000} = \frac{4,754,000}{10,278,000} = 0.445$$

---

[1]The increase referred to here is the increase caused by the CorridorRail project; i.e., the increase over an unimproved Northeast Corridor service projection of 12,426,000 passengers in 1982. See page IV.8 in the Demand Report.

The next step is to estimate the 1982 volume for the simple sensitivity analysis case using the equation:

$$\begin{array}{c}1982\\ \text{estimate}\end{array} = \begin{array}{c}1982\\ \text{proportion}\end{array} \times \left(\begin{array}{c}\text{model}\\ \text{estimate of}\\ \text{1982 volume}\end{array} - \begin{array}{c}1982\\ \text{volume without}\\ \text{CorridorRail}\end{array} \right) + \begin{array}{c}1982\\ \text{volume without}\\ \text{CorridorRail}\end{array}$$

Substituting, for example, the 1982 demand estimate based on the case in which fuel prices return to 1974 levels:

$$0.445 \times (19,165,000 - 12,426,000) + 12,426,000 = 15,425,000$$

Then 15,425,000 trips was used as an estimate of the 1982 volume in the sensitivity test.

The figure 25,373,000 trips was the 1990 volume in the patronage forecast for the case involving 1974 fuel price levels. Because 1990 was selected as a year by which the shift from non-rail modes to CorridorRail would be fully developed, the 1990 estimate was used without recalibration.

Interpolate and Extrapolate

For the years between 1982 and 1990, it was assumed that the same proportion of the difference between the 1982 and 1990 volumes would be realized in each year as in the corresponding year of the baseline case. Thus, if the curves representing the level of demand for the baseline case and for the sensitivity cases were plotted on a time-volume graph, they would all have the same shape.

For the period beyond 1990, the similarity of shape was achieved by applying a 3 percent annual growth rate in the same manner as in the baseline case.

Project Passenger-Miles and Fare Revenue

To each of the sets of passenger trip figures thus calculated, the baseline assumptions for trip length and fare were applied. The average trip length of 133 miles was multiplied by each passenger trip figure to calculate passenger-miles. The fare formula of $1.50 per trip plus 7.5 cents per mile was applied to the passenger trip and passenger-mile figures to calculate fare revenue.

It should be noted that the sensitivity tests involving changes in patronage figures are "simple sensitivity tests" only if one considers the demand model and the financial model to be end-linked. That is, although only one input to the demand model was changed, many inputs to the financial model were changed for each of these tests.

MULTIPLE ANALYSES

Table V. 3 summarizes the results obtained from the multiple sensitivity tests. A case-by-case discussion of these tests follows. For each case, the actual values used for all inputs which were changed from the baseline case are listed in an accompanying table.

Unexpected Track Problems

This case combines the effects that might be felt if the track improvement program for high-speed service were to encounter difficulty. The cost of maintaining the track is increased by 25 percent, as is the cost of M of W&S supervision. To simulate the effect of delayed improvements, the New York-Boston travel time was held to 6 hours and 20 minutes for five years (through 1986), and the appropriate adjustment in patronage figures was made. These changes reduced the ROI to 3. 2 percent, a drop of 0. 2 percent from the baseline. This case is illustrated in Table V. 4.

Unexpected Problems with Rolling Stock

This case simulates the problems that might arise with the advanced rolling stock. Car maintenance was increased from 40 cents to 60 cents per car-mile. Car price was raised from $0. 8 million to $1 million, and cars were sold for salvage after 10 rather than 14 years of service. Annual car mileage was reduced from 203, 000 to 184, 000 miles. Increased maintenance time would lower the utilization of the cars. These changes resulted in a ROI of 2. 6 percent, a decrease of 0. 8 percent from the baseline. This case is illustrated in Table V. 5.

Decreased Frequency of Service

This case (Table V. 6) considered changing the basic schedule from half-hourly to hourly departures. An appropriate patronage forecast was incorporated, and train-miles and crew cost were recalculated ac-

TABLE V.3

SUMMARY OF MULTIPLE
SENSITIVITY ANALYSES

	Multiple Sensitivity Case	ROI
1.	Unexpected track problems	3.2 %
2.	Unexpected problems with rolling stock	2.6 %
3.	Decreased frequency of service	3.0 %
4.	Three-phased program	3.3 %
5.	Reduced investment program	3.5 %
6.	Upper limit (best case)	7.1 %
7.	Lower limit (worst case)	-0.8 %
	Baseline case	3.4 %

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

TABLE V.4

MULTIPLE SENSITIVITY ANALYSIS - UNEXPECTED TRACK PROBLEMS

INPUTS CHANGED FROM BASELINE CASE

Patronage

Year	Patronage Trips (millions)	Passenger-Miles (millions)	Fare Revenue (millions of 1974 dollars)
1982	16.[illegible]	2133.3	184.06
1983	18.[illegible]8	2486.9	211.56
1984	20.499	2726.4	235.22
1985	22.214	2954.4	254.9
1986	23.843	3171.1	273.6
1987	27.454	3651.3	315.03
1988	28.459	3785.0	326.56
1989	29.263	3892.0	335.79
1990	30.067	3998.9	345.02
1991	30.969	4118.9	355.37
1992	31.898	4242.4	366.03
1993	32.855	4369.7	377.01
1994	33.841	4500.8	388.32
1995	34.856	4635.8	399.97
1996	35.902	4774.9	411.97
1997	36.979	4918.2	424.33
1998	38.088	5065.7	437.06
1999	39.231	5217.7	450.17
2000	40.408	5374.2	463.68
2001	41.62	5535.4	477.59
2002	42.868	5701.5	491.91
2003	44.154	5872.5	506.67
2004	45.479	6048.7	521.87
2005	46.843	6230.2	537.53
2006	48.249	6417.1	553.65
2007	49.696	6609.6	570.26
2008	51.187	6807.9	587.37
2009	52.723	7012.1	604.99
2010	54.304	7222.5	723.14
2011	55.934	7439.2	641.84

	Value (millions of 1974 dollars)
M of W&S	27.04
M of communications signals	6.8
M of catenary	9.15
M of stations, shops, and yards	5.25
M of W&S department supervision	4.13

RESULTS

Resulting ROI	3.2[illegible]
Baseline ROI	3.1%

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

TABLE V. 5

MULTIPLE SENSITIVITY ANALYSIS -
UNEXPECTED PROBLEMS WITH ROLLING STOCK

INPUTS CHANGED FROM BASELINE CASE	VALUE
Car maintenance Car service life Car utilization	$.60/car-mile 10 years 184,000 miles/year
RESULTS	
Resulting RCI Baseline ROI	2.6% 3.4%

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

TABLE V.6

MULTIPLE SENSITIVITY ANALYSIS -
DECREASED FREQUENCY OF SERVICE

INPUTS CHANGED FROM BASELINE CASE

	Year	Patronage Trips (millions)	Passenger-Miles (millions)	Fare Revenue (millions of 1974 dollars)
Patronage	1982	15.68	2085.5	179.93
	1983	18.166	2416.0	208.45
	1984	19.849	2640.0	227.77
	1985	21.453	2853.2	246.17
	1986	22.976	3055.8	263.65
	1987	24.018	3194.4	275.61
	1988	24.82	3301.1	284.81
	1989	25.462	3386.4	292.17
	1990	26.103	3471.7	299.53
	1991	26.886	3575.9	308.52
	1992	27.693	3683.1	317.77
	1993	28.523	3793.6	327.31
	1994	29.379	3907.4	337.13
	1995	30.261	4024.7	347.24
	1996	31.168	4145.4	357.66
	1997	32.103	4269.8	368.39
	1998	33.067	4397.9	379.44
	1999	34.059	4529.8	390.82
	2000	35.08	4665.7	402.55
	2001	36.133	4805.7	414.62
	2002	37.217	4949.8	427.06
	2003	38.333	5098.3	439.87
	2004	39.483	5251.3	453.07
	2005	40.668	5408.8	466.66
	2006	41.888	5571.1	480.66
	2007	43.144	5738.2	495.08
	2008	44.439	5910.3	509.93
	2009	45.772	6087.7	525.23
	2010	47.145	6270.3	540.99
	2011	48.559	6458.4	557.22

	Value
Station personnel	$.43/passenger
Train-miles (1982)	6.1[illegible] millions
Train-miles (1990)	7.02 millions
Train-miles (2011)	10.87 millions
Crew cost	$1.565/train-mile

RESULTS

Resulting ROI	3.0%
Baseline ROI	3.4%

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

cordingly. The decreased train frequency would create a more marked peaking pattern in the flow of passengers through stations. Station personnel costs were raised from $.396 to $.43 per passenger, reflecting about a 10-percent increase in station manning to accommodate the peak volume of passengers. These changes reduced the ROI to 3.0 percent, a drop of 0.4 percent.

Three-Phased Program

A three-phased investment program, suggested by ONECD, was used for the capital investment. As shown in Table V.7, the first revenues and operating costs were recognized in 1984. The baseline demand input figures for the years 1984 through 2011 were used. These changes produced an ROI of 3.3 percent, an increase of 0.3 percent.

Reduced Investment Program

A reduced investment program, Metroliner II, was also considered during the analysis. Metroliner II would have a Boston-Washington travel time of 6 hours and 20 minutes. In order to properly evaluate this case, the analysis used a separate investment schedule. As shown in Table V.8, the electric power cost was reduced (in proportion to the square of the maximum speed) from 13.8 cents to 10.0 cents per car-mile. As a result of these changes, the ROI was increased from 3.4 percent to 3.5 percent.

Upper Limit

This case used all the favorable excursions listed as simple sensitivity analyses in Table V.1. Where there were two favorable excursion values for the same variable, the more favorable was used. This combination raised the ROI to 7.1 percent, an increase of 3.7 percent.

Lower Limit

This case used the unfavorable excursions listed as simple sensitivity analysis in Table V.1. Where one variable had been changed more than once in an unfavorable direction, the least favorable of the changes was used. For example, the patronage figures for the linear economic growth case were used, rather than the patronage figures for higher travel times or for lower fuel prices. This combination depressed the ROI to negative 0.8 percent, a drop of 4.2 percent.

TABLE V.7

MULTIPLE SENSITIVITY ANALYSIS -
THREE-PHASED PROGRAM
(millions of 1974 dollars)

INPUTS CHANGED FROM BASELINE	1976	1977	1978	1979	1980	1981	1982	1983	1984
Facilities Investment									
Se ice facilities	10.0	20.0	40.0	33.0	40.0	20.0			
Track upgrading and structural development	5.0	2.0		20.0	105.0	167.0	123.0	25.0	
Long lead materials			50.0	50.0	74.0				
Fencing	10.0	10.0	10.0	10.0	10.0	9.0	8.0		
Land acquisition for track realignment	9.0	10.0	15.0	15.0					
System test				6.0					
Bridge and tunnel upgrading	5.0	20.0	30.0	60.0	77.0	70.0	70.0	29.0	
Electrification	6.0	9.0	3.0	6.0	31.0	48.0	60.0	10.0	
Signalling control	5.0	10.0	10.0	5.0	25.0	110.0	90.0	35.0	10.0
Stations		12.0	57.0	105.0	57.0				
Freight facilities	30.0	50.0	30.0						
Total facilities investment (2,081M)	80.0	143.0	245.0	310.0	419.0	424.0	351.0	99.0	10.0
Project Manager Expenditures									
Program and construction management	7.0	10.0	12.0	12.0	11.0	11.0	7.0	5.0	5.0
Interim maintenance and railroad support	52.0	33.0	34.0	4.0	4.0	4.0	2.0	1.0	1.0
Rolling stock development and retrofit		10.0	10.0	5.0	10.0	20.0	10.0		
Total Manager Expenditures (280M)	59.0	53.0	56.0	21.0	25.0	35.0	19.0	6.0	6.0
First year of high-speed operations: 1984									

RESULTS

Resulting ROI	3.3%
Baseline ROI	3.4%

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

TABLE V.8

MULTIPLE SENSITIVITY ANALYSIS-
REDUCED INVESTMENT PROGRAM

INPUTS CHANGED FROM BASELINE CASE

Patronage	Year	Passenger Trips (millions)	Passenger-Miles (millions)	Fare Revenue (millions of 1974 dollars)
	1982	16.04	2133.3	184.06
	1983	18.698	2486.9	214.56
	1984	20.499	2726.4	235.2[illegible]
	1985	22.214	2954.4	254.9
	1986	23.843	3171.1	273.6
	1987	24.958	3319.4	286.39
	1988	25.815	3433.4	296.23
	1989	26.501	3524.6	304.1
	1990	27.187	3615.9	311.97
	1991	28.003	3724.3	321.33
	1992	28.843	3836.1	330.97
	1993	29.708	3951.[illegible]	340.9
	1994	30.599	406[illegible].7	351.13
	1995	31.517	4191.[illegible]	361.66
	1996	32.463	4317.5	372.51
	1997	33.437	4447.1	383.68
	1998	34.44	4580.5	395.2
	1999	35.473	4717.9	407.05
	2000	36.537	4859.4	419.26
	2001	37.633	5005.2	431.84
	2002	38.762	5155.4	444.8
	2003	39.925	5310.0	458.14
	2004	41.123	5469.3	471.89
	2005	42.357	5633.4	486.04
	2006	43.627	5802.4	500.62
	2007	44.936	5976.5	515.64
	2008	46.284	6155.8	531.11
	2009	47.673	6340.5	547.04
	2010	49.103	6530.7	563.46
	2011	50.576	6726.6	580.36

	Value (millions of 1974 dollars)						
	1976	1977	1978	1979	1980	1981	1982
Annual Facilities Investment	140.24	225.46	259.53	381.54	316.66	235.55	55.96

Total Investment in Facilities	$1,615 million
Energy	$ .10/car-mile

RESULTS

Resulting ROI	3.5%
Baseline ROI	3.4%

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

VI. SUPPLEMENTARY ANALYSES

In addition to the development of the baseline financial projections and sensitivity analyses, this project included continuing support to ONECD for supplementary analyses of various organization and financing alternatives. Alternatives which were analyzed included:

- purchase and improvement of the ROW with interest-free debt;
- purchase and improvement of the ROW with interest-bearing debt;
- removal of ownership of the rolling stock from the operator, thereby removing depreciation from his income account;
- purchase of the rolling stock with interest-bearing debt;
- lease rather than purchase of the ROW; and
- separate entities to own the ROW and to operate the service.

An alternative which was of particular interest was that of separate entities to own the ROW and to operate the service. By using the CorridorRail Financial Model to simulate the owner/operator case, the fiscal effects of a purely organizational change are illustrated. The owner/operator projections also reveal some of the underlying forces that control the financial performance of NECDP. The separate entity alternative will be referred to here as the owner/operator case. The method of analysis of the owner/operator case is described below. That is followed by a discussion of the results.

OWNER/OPERATOR CASE - METHOD OF ANALYSIS

The financial structure of the owner/operator case is illustrated in Figure VI.1. The resultant financial projections are shown in Appendix G. The following paragraphs describe the organizational arrangement and the manner in which the model accounts for variations from the baseline case.

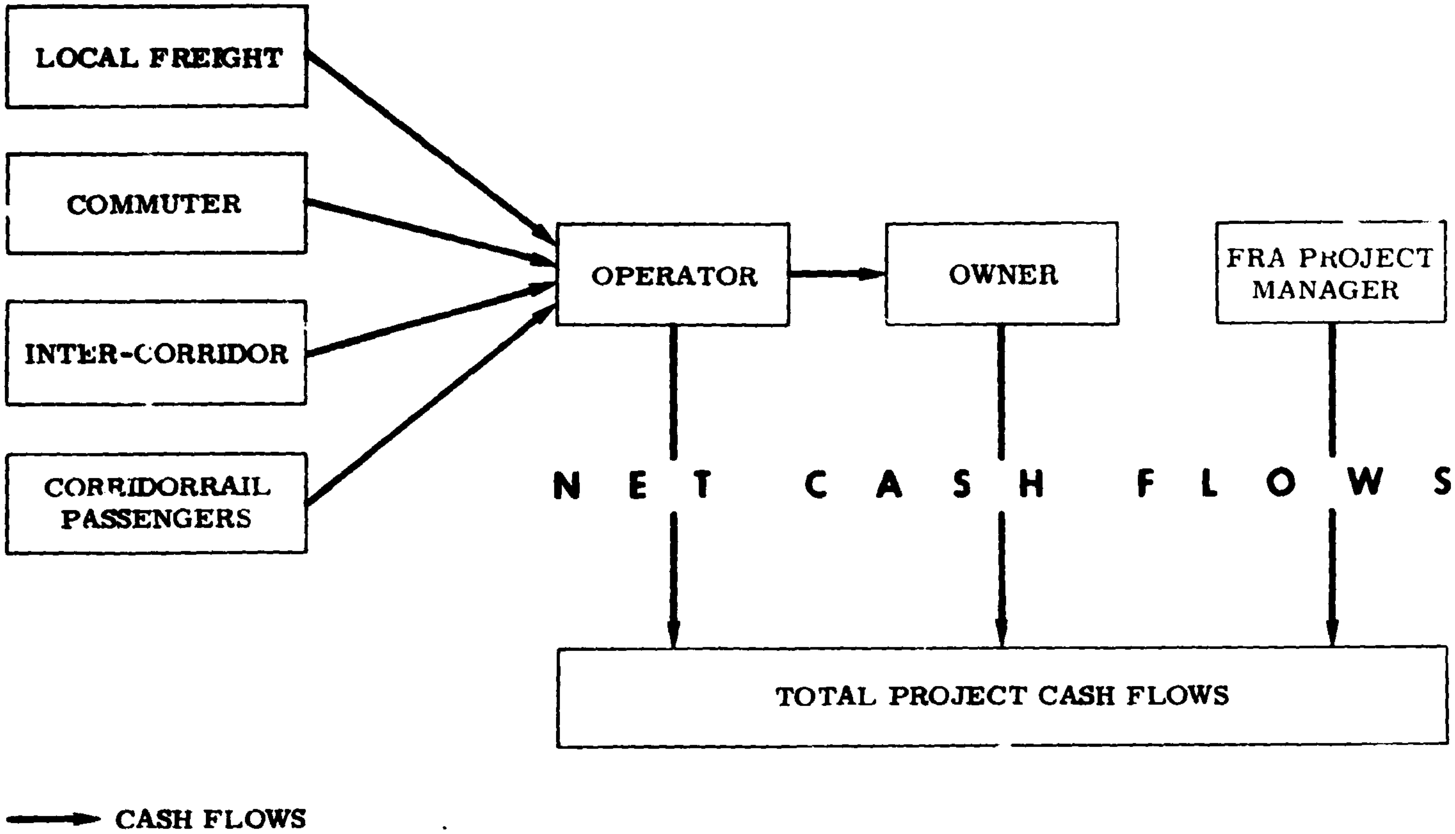


FIGURE VI. 1: NEC ORGANIZATION FOR THE OWNER/OPERATOR CASE

Description of the Organizational Arrangement

The owner would perform the following functions:

- purchase of the ROW,
- improvement of the ROW,
- maintenance of the ROW, and
- dispatching trains for the several users.

The operator would perform all of the other functions associated with CorridorRail including marketing, train and station operation, purchase and maintenance of rolling stock, and switching. Among the advantages of this arrangement are the impartial allocation of the ROW resources among the users, the opportunity for the various states and localities to participate in making decisions on the ROW characteristics without becoming involved in the railroad business, and the complementary opportunity of the railroad operator to avoid becoming entangled with the responsibilities of owning a ROW which affects the interests of seven states and hundreds of municipalities.

The owner would receive complete reimbursement for his operating expenses. The maintenance and dispatching costs would be allocated to the non-CorridorRail users in the same manner as in the baseline case. The commuter, local freight, and inter-corridor users would pay their contributions to the operator. By reimbursing all of the owner's expenses the operator would implicitly allocate a share of the maintenance of way and dispatching costs to itself. The operator would make two other payments to the owner:

- it would cover the owner's sinking fund payment; and
- it would pay the owner 75 percent of its net income.

All operating costs would be the same as for the baseline case, and the same funding would be available.

Accounting for the Separate Entities

The computer model produces two complete sets of pro forma financial statements for this case. The sequence of the line-items is the same as for the baseline case, but certain items have been omitted from each of the pro forma projections. The owner has no rolling stock accounts, the operator no ROW accounts.

The owner/operator case also requires that the transfer payments be accounted for. These are included in the complete listing of model accounts in Appendix D. The operating expense reimbursement appears in the pro forma financial statements as an operating expense for the operator and as the primary revenue for the owner. Because the reimbursement is based on its expense the owner has zero operating income in every year. The sinking fund payment transfer appears as a debt service requirement (debt service transfer) for the operator and as a debt receipt (debt service transferred) for the owner. The income sharing payment appears as return on equity, (income transfer) for the operator and as an equity receipt, (new grants) for the owner. In this way, there is no double counting for any item, and each transfer payment is confined to the cash flow subtotal which it properly affects (e.g., the debt service transfer is reflected in the net cash after debt transactions for both entities, but is not reflected in the net cash flow for either entity). A summary of the transfer payments is located below the operator's balance sheet in Appendix G.

OWNER/OPERATOR CASE - RESULTS

Using the assumptions listed above, the total project ROI was 3.3 percent or about 0.1 percent lower than the baseline case. Because the operator would have relatively small investment expenditures to account for, and because its income would be chronologically matched with its investments in rolling stock, it shows the relatively high ROI of 30.3 percent. Because the owner would have zero operating income in every year and because it would invest only in nondepreciable assets (ROW and working capital), the terminal net cash flow in 2011 is equal to the sum of all its investments when using the book value of assets as a terminal value. The computer calculates an ROI of zero for the owner. If the 2011 cash flow is extrapolated rather than the book value of assets added there is no ROI for the owner since it has only negative and zero cash flows. The operator's ROI, extrapolating the 2011 cash flow, is 30.3 percent but in this case the total project ROI is 4.3 percent. Repayment of the improvement loan is not accomplished until (2006) in the owner/operator case.

There are two causes for the decreased ROI and delayed repayment of the loan when compared with the baseline case. They are the higher combined operating costs of two separate entities and the use of operator income as the basis for transfer payments.

The combined operating costs of the separate entities are slightly greater than those of the single entity. The difference is reflected in the general overhead item. Whereas the owner and the operator have a combined general overhead in 1990 of \$3.7 million plus \$17.4 million or \$21.1 million, the 1990 general overhead for the single entity is only \$17.1 million. The arithmetic source of this difference is the multiplication of the general overhead burden by the operating expense transfer for the operator's general overhead. This accounts for the difference between total project ROI figures for the two cases.

Although the increased administrative cost contributes to the delay in the repayment of the improvement loan, the primary cause of the delay is the use of the operator's income as a basis for a transfer payment. Because the non-cash expense of rolling stock depreciation has been charged to the net income account, the operator builds up the cash for this expense rather than passing it on with the rest of its income to the owner. In addition to the operator's share of its income, this is a second stream of cash building up in the operator's investments account. These investments are not available to repay the improvement loan, and its complete retirement is thereby delayed. It is also true, however, that repayment of the loan under the owner/operator assumptions begins earlier. The operator is forced to incur short-term debt to meet the debt service transfer requirements in the first years of operation. Its income-sharing payment is more than enough to cover the remainder of the owner's financial needs, and the owner begins repaying the improvement loan in the first year of high-speed operation. This may be desirable if gradual, steady repayment of the loan is worth the cost of the short-term debt.

The respective ROIs of the owner, operator, and total project for the owner/operator case suggest some of the controlling financial forces in the project. In the combined as well as the separated structure, the magnitude of the investment program in the early years is the overriding factor in determining ROI. The railroad operation, as distinct from the capital investment program, and although quite profitable by itself, can do little to substantially increase the ROI. This also accounts for the relative insensitivity of ROI to differing operating assumptions.

APPENDIX A

SUMMARY OF PRINCIPAL ASSUMPTIONS AND SOURCES OF SIGNIFICANT DATA

This appendix brings together all of the principal assemptions and sources of data which were used for the financial projections made for this report. It is divided into two sections. The first relates to the inputs to the financial analysis program. The second relates to the processing of that data to prepare financial statements.

Numerous sensitivity tests were performed. The reasonably expected ranges of variation used in these sensitivity tests are often not amenable to precise calculation. They represent the professional judgment of PMM&Co., except as otherwise noted.

Many of the items of cost data used in this report are the result of the cost analysis reported on in Appendix B. The technical discussion of these items is not repeated in this exhibit but is referenced where it is important to a full understanding of the meaning of the financial projections.

INPUTS TO THE FINANCIAL ANALYSIS

The following description of inputs corresponds to the list of input variables shown in the last pages of Appendices F, G, and H. For a more detailed explanation of the application of the inputs see Section III of this report.

- Right-of-way purchase price
  $500 million - ONECD estimate for planning purposes. This amount is subject to increase to an unpredictable extent due to future court rulings on the reasonableness of compensation to the estates of bankrupt railroads.

- Load factor
  63.1 percent - fleet-sizing exercise (Appendix C)
  55 percent - financial projections (Appendix H), ONECD estimate

- Car utilization
  203,000 miles per car per year - ONECD Task 7B report

. Seats per car
75 seats - weighted average of coach, snack-bar-car, and first class cars as described in ONECD Task 9 report

. Cars per snack bar
3 cars - PMM&Co. estimate

. Car service life
14 years - ONECD estimate

. Car price
$800,000 - ONECD estimate; ONECD report on Task 9

. Car prepayment schedule
30 percent two years before delivery
50 percent one year before delivery
- PMM&Co. estimate

. Non-CorridorRail share of maintenance of way and dispatching costs

M of W - commuter and freight	19 percent
- other	3.7 percent
Dispatching - commuter and freight	29 percent
- other	8.5 percent

- PMM&Co. estimate (Appendix B)

. Short-term debt interest rate
7 percent - ONECD estimate

. Interest rate on ROW purchase bond
7 percent - ONECD estimate

. Term of ROW purchase bond
20 years - ONECD estimate

. Interest rate earnable
7percent - ONECD estimate

. Cash/expense ratio
3 percent - PMM&Co. estimate based on passenger railroad statistics

. Receivables/revenue ratio
  3 percent - PMM&Co. estimate based on analysis of Amtrak data

. Inventory/maintenance expense ratio
  10 percent - PMM&Co. estimate based on passenger railroad statistics

. Discount rates
  10 percent - ONECD, based on Office of Management and Budget circular on discount rates

. Station personnel
  $0.3968 per passenger - PMM&Co. analysis of Amtrak experience

. Station cleaning and utilities
  $1,914,000 per year - PMM&Co. estimate

. Baggage carts
  $0.02 per passenger - PMM&Co. estimate

. Train supplies and expenses
  $0.136 per car-mile - Penn Central 1974 billings to Amtrak for Metroliners

. Snack bar attendants
  $0.173 per snack-car-mile - PMM&Co. estimate based on Amtrak wage schedules

. Ticket agency commissions
  2 percent of revenue - PMM&Co. estimate

. Reservations
  $0.90 per passenger - PMM&Co. estimate based on Amtrak experience

. Promotion expense
  5 percent of revenue - PMM&Co. estimate based on budgeted Amtrak expense

. Car maintenance
$0.40 per car-mile - ONECD report on Task 9

. Energy
$0.138 per car-mile - ONECD Tasks 4, 5, 9 report

. Crew expense

4-man crew @ $1.54 per train-mile	97.6% of train-miles
5-man crew @ $1.91 per train-mile	2.4% of train-miles

- PMM&Co. estimate based on actual Metroliner expense and fleet-sizing exercise described in Appendix C.

. Train-miles

1982	12,260,000
1990	12,260,000
2011	15,770,000

- PMM&Co. estimates based on fleet-sizing exercise described in Appendix C.

. Switching
$1 million per year - PMM&Co. estimate

. Dispatching
$2 million per year - PMM&Co. estimate based on 1974 Penn Central experience

. Station masters
$4.7 million per year - PMM&Co. estimate based on 1974 Penn Central experience

. Maintenance of facilities

- Maintenance of way and structures	$21,630,000 per year
" " catenary	7,320,000 per year
" " control and signal systems	5,590,000 per year
" " stations, shops, and yards	4,200,000 per year

- engineering estimates by Thomas K. Dyer, Inc.

. Passenger services burden
3 percent - PMM&Co. estimate

. Transportation burden
    3 percent - PMM&Co. estimate

. Transportation Department Insurance and Liability
    10% of crew expense - PMM&Co. estimate based on 1974 Penn Central experience

. General Overhead
    8.5 percent - PMM&Co. estimate (in Appendix G applied twice, once for owner, once for operator)

. Passenger trips
  Passenger-miles
  Fare revenue
    - ONECD estimates based on demand analyses

. Investment, by year
    - ONECD estimates based on engineering reports

FINANCIAL STATMENT ITEMS

The following list of financial statement items indicates where in the report a description of the calculation of each item which is not self-explanatory can be found. The order of presentation corresponds to pages one through four of the pro forma financial statements.

. Passenger trip
  Passenger-mile
    see inputs

. Car-miles
    Passenger-miles / seats per car / load factor

. Train-miles
    see inputs

. Number of cars in fleet
    car-miles / miles per car per year (car utilization)

. Facilities investments
Commuter and freight contribution
Inter-corridor Amtrak contribution
Primary revenue (passenger)
Expenses
see inputs

. Payments on rolling stock
see Section III, the heading "Rolling Stock Accounts"

. Real asset acquisition
purchase of ROW and interest prior to beginning of operation
see Section II, the heading "Interest Bearing Debt"

. Cash need increase
Receivables increase
Inventory increase
increase in corresponding balance sheet items

. New short-term debt
see Section III, the heading "Cash Management Routine"

. New long-term debt (ROW improvement)
New long-term debt with sinking fund (ROW purchase)
ROW purchase bond retirement
Long-term debt retirement
Liquidation of sinking fund reserve
ROW purchase bond interest
Sinking fund payment
see Section IV, the heading "Financial Arrangements"

. Income from sinking fund
New grants
see Section IV, the heading "Financial Arrangements"

. Liquidation of investments
Income from investments
Investment of surplus
transactions related to investment of surplus cash - see Section III, the heading "Cash Management Routine"

. Sale of rolling stock
recovery of salvage value of rolling stock which is retired

. Rolling stock depreciation
see Section III, the heading "Rolling Stock Accounts"

. General Balance Sheets
see Section III, the heading "Income Account and Balance Sheet Projection"

. Owner/operator case (Appendix G)
see Section VI, the heading "Accounting for the Separate Entities" for discussion of transfer payments

APPENDIX B

DERIVATION OF OPERATING COSTS AND WORKING CAPITAL REQUIREMENTS

This appendix describes the development of estimates of operating costs and working capital requirements. It includes estimation of reasonably expectable ranges of variation where applicable. It also describes the methods for allocation of certain expenses to users other than CorridorRail.

DERIVATION OF OPERATING COSTS

The estimation of the annual cost of operating the CorridorRail service involved:

- identifying the sources of information available for estimating operating cost;
- designing the framework which would accurately reflect the total operating expense; and
- estimating each cost and its reasonable range of expectable variation.

The scope of this study did not include new research into cost elements for which detailed data were not available. Judgmental estimates were used for such cost elements.

Sources of Information

The following sources of cost information were used in this project.

- Previous railroad cost studies, including:
  - Peat, Marwick, Mitchell & Co. Survey to Determine the Potential for Improved Rail Advanced Vehicle Service, Work Unit II. U.S. Department of Transportation, Federal Railroad Administration, December 1972. In this report, the 1972 study is referred to as the High-Speed Passenger Study.

- Peat, Marwick, Mitchell & Co. Fully Allocated Cost of Rail Passenger Service Between New York and Washington, U.S. Department of Transportation, Federal Railroad Administration, July 1971. In this report, the 1971 report is referred tc as the "New York-Washington Study".

- Engineering studies prepared for the Office of Northeast Corridor Development and listed in Exhibit I. 1.

- A detailed study of the 1974 cost of Northeast Corridor passenger service performed by Peat, Marwick, Mitchell & Co. for ONECD in May 1975, using Penn Central expense records.

- Special studies of National Railroad Passenger Corporation and Penn Central Transportation Company costs.

- Statistics and expenses from annual reports of railroads to the Interstate Commerce Commission.

The Cost Framework

In order to present projections for operating costs, costs were classified by organization level and variability, as well as by operating function. The classification is illustrated in Figure B. 1.

Organizational Levels

Three organizational levels were considered in the analysis:

- direct costs, including labor and materials costs, incurred in the process of providing service to passengers, operating and maintaining the trains and maintaining the track and facilities;

- departmental costs, including principally supervision of labor, administrative support, and supplies not included in direct costs; and

- central costs, including general overhead expenses, such as accounting, planning, and higher level administrative support.

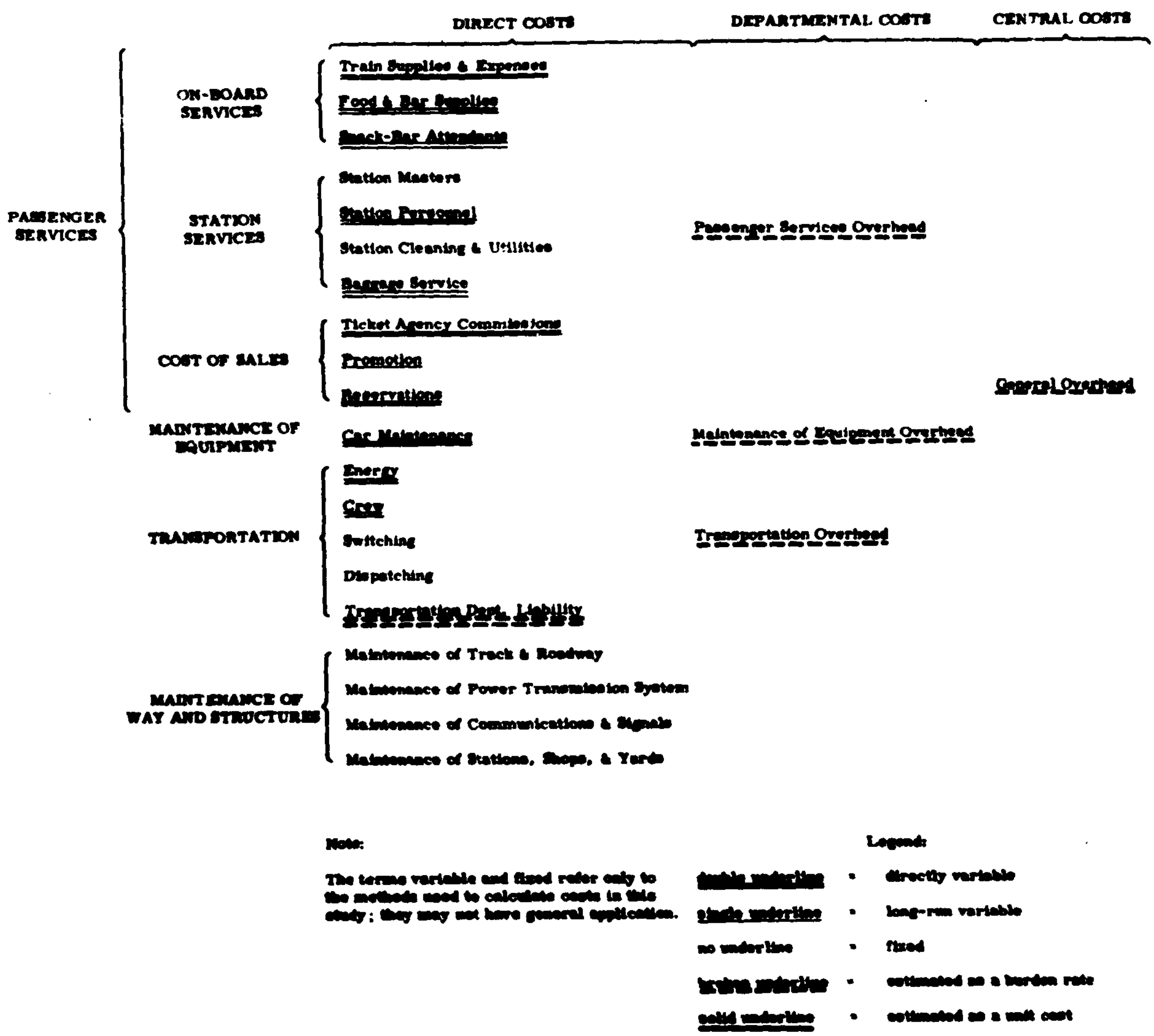


FIGURE B. 1: COST DEVELOPMENT FRAMEWORK

Variability

The costs were divided into three degrees of variability for computational purposes:

- costs which vary directly with the amount of service provided (primarily the direct costs discussed above);
- costs which vary in the long run with the amount of service provided, but which do not reflect short-term fluctuations (includes departmental costs discussed above); and
- costs which may be considered to remain constant for the scope and precision of the financial projections. (Some costs which might be variable in the long run are included in this category, but such variations are not material to this analysis.)

For the purpose of estimating variable costs for any particular year, the amount of service was expressed in one of the five operating statistics:[1]

- number of passenger trips;
- number of passenger-miles;
- amount of passenger fare revenue;
- number of car-miles; and
- number of train-miles.

For each variable cost item, either a "unit cost" (i.e., dollars per unit of an operating statistic) or a burden rate (i.e., percentage applied to previously calculated costs) was estimated. For each year, the appropriate projected operating statistics were multiplied by each of the unit costs for directly varying cost items. The burden rates were applied to appropriate, previously calculated costs. The five-year running averages of the appropriate operating statistics were multiplied by the unit costs for long-run varying cost items.

---

[1] The first three of these statistics were included in the patronage forecasts for each year. The calculation of the latter two, car-miles and train-miles, is explained in Appendix C, "Fleet-Sizing Exercise."

Functions

Of the many ways of grouping operating expenses for a railroad passenger service, the following hierarchy was used for this study:

- Passenger Services
- On board
  - Train supplies and expenses
  - Food and bar supplies
  - Snack bar attendants
- Stations
  - Station masters
  - Ticket sales
  - Cleaning and utilities
  - Baggage service
- Cost of sales
  - Agency commissions
  - Promotion
  - Reservations
- Passenger service overhead
- Maintenance of equipment
  - Car Maintenance
  - Overhead
- Train movement
  - Energy
  - Crew
  - Switching
  - Dispatching
  - Overhead
  - Insurance and liability
- Maintenance of way and structures
  - Track and roadway
  - Electric power transmission system
  - Communications and signals
  - Stations, shops, and yards
  - Supervision
- General Overhead

All of the costs of operating a passenger railroad are found within one or more of these categories. Although they are arranged somewhat differently from the ICC-prescribed Uniform System of Accounts, all expense accounts specified in that system are included within an expense category used in this study. The projections made in this study, therefore, do result in an estimate of total expenses which would be reconcilable with those expenses which would be recorded in a financial accounting system. Similarly, they could be reconciled with Amtrak's expense accounts. Three items--depreciation of fixed facilities, inflation, and taxes--were eliminated from the PMM&Co. cost framework and deserve some attention. A correlation of the ICC accounts with cost categories used in this report is shown in Figure B.2.

Depreciation of fixed facilities and rolling stock, which is treated like an expense in conventional railroad accounting, is not an operating cost in the context of this study. The ownership cost is dealt with as cash outflow at the appropriate times. Although not considered in the operating income account, which represents strictly cash flows, depreciation of rolling stock is included in the general income statement. Minor depreciation items, such as shop machinery and maintenance-of-way equipment are, however, included in the appropriate department overheads.

All costs are stated in 1974 dollars. Whenever historical costs, or costs from previous studies have been used, they have been indexed to 1974 levels, using AAR indices.[1]

Taxes have not been included in this study. It has been assumed by ONECD that CorridorRail facilities, as a quasi-governmental institution, would be exempt from real estate taxes. Any payment which might be made in lieu of such taxes cannot be reasonably predicted at this time.

The following discussion of the development of unit costs, burden rates, and annual amounts for the cost of the operating functions proceeds in the order listed above and in Figure B.1. The remainder of the operating costs portion of this appendix discusses each of the costs in detail.

---

[1] Association of American Railroads. Indexes of Railroad Material Prices and Wage Rates. Series Q-MPW-85.

ICC Uniform System of Accounts Number / CorridorRail Financial Analysis Account Name	M of Roadway & Structures								M of Equipment							Traffic			Transportation											
	201	202-221	227	229	235	247-249	257	269-277	301	302-304	311, 317, 326, 328	332-334, 339	351	352	353-360	371	372	373	376	377-380	392	396	401	402	404	409-411	414-420	441	450-460
Train supplies & expenses																							x						
Food & bar supplies																												x	
Snack-bar attendants																												x	
Station masters																		x											
Station personnel																		x											
Station cleaning & utilities																			x										
Baggage																			x										
Ticket agency commissions														x															
Promotion													x		x														
Reservations														x															
Passenger services overhead																x													
Car maintenance									x		x																		
M of equipment overhead									x	x		x																	
Energy																						x							
Crew																					x		x						
Switching																				x									
Dispatching																	x								x				
Transportation dept. liability																											x		
Transportation dept. overhead																x										x			
M of track & roadway		x		x																									
M of power transmission							x																						
M of communications & signals						x																							
M of stations, shops, & yards			x		x																								
M of W&S dept. supervision	x							x																					
General overhead																													x

Figure B. 2: Operating Cost - Cross Reference List

Passenger Services

These costs generally relate to activities directly affecting the passenger. They can be subdivided into expenses for:

- on board services;
- station operation; and
- marketing.

On Board Services

These are costs which are incurred on board the trains and relate directly to passenger comfort and service.

Train supplies and expenses. This expense category, which corresponds to ICC Account 402, includes costs for:

- cleaning cars;
- heating and lighting cars while in the station;
- lubricating cars;
- supplies and laundry for coaches and lounge cars; and
- other miscellaneous supplies and services incident to train operations.

The High-Speed Passenger Study, when indexed to 1974 price levels, indicates a cost of 7.0 cents per car-mile for these expenses. A sampling of 1974 Penn Central accounts for Northeast Corridor trains reveals a cost for all corridor passenger trains of 11.0 cents per car-mile. For Metroliner service the cost was 13.6 cents per car-mile. Since CorridorRail is planned for a service standard equal to, or higher than Metroliner service, 13.6 cents per car-mile is used in the baseline case. Although train supplies and expense would be considered a transportation department expense in conventional railroad accounting, here it is considered a passenger service expense.

Food and bar supplies. This category includes the cost of supplies delivered on board the trains and does not include service to passengers. A study of recent Metroliner costs shows the following costs as a percent of price:

Commissary	5.5 percent
Overhead	14.0
Food	60.0
Total	79.6 percent

This implies that receipts exceed costs by about 20%. These percentages are, however, based on Metroliner coach food and liquor service. The mix of liquor sales (which are more profitable) and premium class food sales (which are less profitable) subjects these percentages to great uncertainty. Assuming that, in the long run prices will be set to equal costs, zero has been entered for food and liquor revenues. This implies that the cost of purchasing, preparing, and loading the food will be approximately offset by the revenues from food sales.

Snack bar attendants. This category covers the cost of on-board food service personnel. Metroliner snack-cars were chosen as the closest analogue to the contemplated service. The current union agreements for snack-car attendants contain the following provisions:

- wages of $6.50 per hour;
- minimum pay of eight hours per trip;
- minimum of 180 hours per month;
- overtime is paid after 190 hours per month.

Another factor considered was the cost of training and clothing the crew members. This was estimated by Amtrak at $200 per new employee. This amount is inconsequential, and was not included in the analysis.

The cost of crew relief, however, is a significant factor. In order to provide for unexpected absences and a margin of safety in manpower, Amtrak's experience has shown that 14 percent must be added to the crew time calculated from train running times.

The basic wage cost must be increased for fringe benefits and vacation pay. These have been estimated for Penn Central employees and Amtrak employees, independently. The Penn Central figures showed:

Health and Welfare	4.83 percent
RR Unemployment	1.39
Supplemental Pension	1.40
RR Retirement	14.56
Vacation	9.27
Holiday	1.64
Total Fringe	33.09 percent

This amount is consistent with the estimate of 33 percent which was provided by Amtrak.

Using the current agreement as representative of the type of agreement which may be obtained and assuming that crews will be based in Boston and Washington and will make roundtrips to New York (thereby avoiding overnight costs), the cost of attendants per snack bar car-mile is derived as follows:

$$8 \text{ hrs./trip} \times \$6.50/\text{hr} \times \frac{2 \text{ trips}}{914 \text{ miles}} \times 1.33 \text{ fringe} \times 1.14 \text{ relief}$$

$$= 17.3 \text{ cents per snack bar car-mile}$$

One attendant for one snack-bar for every three cars is estimated for the baseline case.

Station Expenses

These are the expenses related to processing passengers and trains through the stations:

Station master expense. The station master expenses include station supervision, gatemen, and information service. They depend primarily on the specific stations selected and the degree of boarding control planned. Because it is largely for boarding control, the station master expense for any given station correlates closely with the number of train departures.

Using current Penn Central experience, an estimate of the average cost per train departure in NEC was made. This cost was applied to the proposed CorridorRail schedule, and the result was used as a fixed annual cost.

The best data on station master expenses was available for Baltimore, Philadelphia (30th Street), New York (Penn Station), New Haven, and Providence. The annual cost per daily train departure at these stations ranged from $1,400 to $3,900. The average annual cost was $2,300. It was estimated that the extra boarding control required for an all-reservation service could double this cost. Therefore, an annual cost of $5,000 per daily train departure was used as the baseline estimate.

The number of roundtrips per day in the proposed CorridorRail Schedule was determined for each pair of terminals. Each of these numbers was multiplied by the number of times a train would depart from a station during the respective round trip. The result was 938 daily station departures. At $5,000 per departure, the annual cost for station masters would be $4,690,000. This amount was rounded to $4.7 million for the baseline case.

Because the boarding control system has not been specified, this cost is subject to a large error of estimate. Sensitivity tests, therefore, were performed using excursions of 50 percent from the baseline value, or $2,500,000 and $7,500,000 per year.

Station personnel. This cost category comprises the wages and associated costs for the information, reservations, and ticketing functions. This includes CorridorRail city ticket offices, as well as the stations themselves.

Amtrak records which report the wages paid by category, the number of tickets sold, and the volume of revenue for each month for each station and ticket office in the corridor were analyzed. A multiple regression analysis of personnel costs for all stations in the months of January through November of 1974 yielded a fixed cost component plus 4.71 cents per ticket plus 4.73 percent of revenue. This result suggests that station personnel costs correlate more closely with the amount of revenue than with the number of passengers. This correlation may be largely explained by the time involved in checking schedules and explaining fares for long-haul passengers. When the cost of selling a ticket to a passenger traveling 133 miles (the average trip length forecast for a CorridorRail passenger) is estimated using this equation, a variable cost of $.496 per on-line passenger results. Both revenue records and the experience of operating personnel indicate that 80 percent of the sales in NEC are on-line and 20 percent are off-line. Therefore, the baseline cost of station personnel used is 80 % x $.496 = $.3968 per passenger.

This cost is lower than the constructed estimate of $.923 in the High-Speed Passenger Study. That estimate, however, was for low density operations and reflected low personnel utilization. It is also lower than the historical $.72 in the New York-Washington Study (which includes about 10 cents for station master expense). However, significant savings have been realized and will continue to be realized through the introduction of the Automatic Reservations and Ticketing System (ARTS) devices now used by Amtrak. The cost of this equipment is included in reservations costs described below. Other savings have resulted from simplification of procedures through elimination of interline ticketing with its attendant complexities.

Station cleaning and utilities. This cost includes the heating, lighting, air conditioning, and other utility costs of the stations, as well as cleaning which is not included in Station Maintenance. The cost reported in the New York-Washington Study, when indexed to 1974 levels and increased to include stations north of New York, provides the baseline estimate of $1.914 million annually.

Baggage service. The engineering studies do not address the nature of checked baggage service to be provided. The cost of providing baggage carts at stations was estimated at $.02 per passenger based on the High-Speed Passenger Study.

Cost of Sales

This cost category includes the cost of encouraging the use of the service as well as the expense of sales through travel agents. Reservation systems costs are also included in this category.

Ticket agency commissions. The current passenger service in the corridor does approximately 20 percent of its business off-line (i.e., through travel agents). The present 10 percent commission rate implies a total cost of 2 percent of fare revenue as a baseline cost for off-line ticket sales.

Reservations. A baseline assumption for CorridorRail is that all seats would be reserved. This assumption is inherent in the method of calculating load factor, train-miles, and crew costs (see Appendix C). The High-Speed Passenger Study reports a cost of $.82 per passenger, when indexed to 1974 dollars. This cost includes all central office costs, which are primarily the labor costs for telephone service, all communications cost incurred by the reservations system, and all software and hardware data processing costs of the system.

Amtrak's nationwide reservation cost for 1974 was about $23,000,000. A first approximation to the proportion of this cost related to NEC was made by using the number of Automated Reservation and Ticketing System (ARTS) terminals installed in the NEC as a proportion of the total ARTS terminals. This results in an allocation of 42 percent to the NEC. When the resultant amount is divided by the approximately 10.5 million passengers in the corridor, a baseline estimate of $.90 per passenger is derived.

The reservation systems estimate is subject to a multitude of uncertainties, which could move it substantially up or down. Lacking a major study of reservation systems for the NEC, it is possible to allow for variations only by a very wide range in the sensitivity tests. Plus or minus 100 percent was used as the range. (The minus 100 percent suggests a completely unreserved system but would require a higher station personnel cost for ticketing without ARTS terminals.)

Promotion. Promotion costs include issuance of schedules, advertising, and all traffic sales and service expenses other than ticket agency commissions. Promotional expense is a budgeted cost which leads to, rather than results from, the passenger trip. It varies in the long run and can be estimated as a percent of revenue. The High-Speed Passenger Study reports an expense of 5 percent of revenue for Amtrak. The 1974 percentage was 6.6 percent. When the large volume of traffic for the service was considered, the lower figure of 5 percent was selected as a baseline estimate for promotional expense. It was applied to the 5-year moving average of revenue.

Passenger Service Overhead

This cost category consists, principally, of administrative support and supervision. The following categories already include an allowance for this cost: Station Cleaning and Utilities, Baggage Carts, Train Supplies and Expense, Reservations, Ticket Agency Commissions, and Promotion.

Station Personnel and Snack-Car Attendants incur overhead costs which have not been accounted for so far. The Penn Central transportation department overhead rate was applied to these costs because it is representative of NEC overhead burden rates for labor intensive functions. The development of the 3 percent figure used for passenger services overhead in the baseline case is, therefore, discussed under "Transportation Department Overhead."

Maintenance of Equipment

These costs include only the cost of maintaining the cars and the overhead as defined below. Some costs associated with shops are included in Maintenance of Stations, Shops, and Yards.

Car Maintenance

The maintenance of equipment expense, since it was to be derived for operation of multiple unit (MU) cars at speeds of 150 mph, could not be reliably estimated on the basis of any existing operations. The only operation now reaching this speed is the Tokyo-Osaka line in Japan. It is questionable, however, whether the cost of this equipment is relevant, considering differences in wages, social structure, and material inputs between the U.S. and Japan. In addition, the Japanese cars represent a technology which is now 15 years old, whereas the CorridorRail cars will represent the latest available technology.

The present Metroliner operation uses equipment which was designed to reach speeds of 150 mph, but has never actually operated at such speed in regular service. Various estimates place Metroliner expenses in the range of $.75 to $1.00 per car-mile. The well publicized problems of the Metroliner indicate that this is not an appropriate number to use in estimating future costs of the CorridorRail Fleet.

Information received from ONECD indicates that the cost used in their systems analysis was $.40 per car-mile. This was based on an analysis of various railroad and rapid transit operations. This cost is being used in the present analysis. It should be understood, however, that realization of this cost is predicated on the design of cars for that level of maintenance; a practice common in the airline industry is to make the maintenance cost one of the design standards for the equipment. It is implicit in the capital costs for the equipment fleet that the equipment is initially constructed to result in the targeted maintenance cost level. The baseline value for car maintenance is, therefore, $.40 per car-mile. Because of the uncertainty inherent in such an estimate, a 50 percent increase to sixty cents per car-mile is used as an unfavorable excursion.

Maintenance of Equiment Department Overhead

The estimate of $.40 per car-mile includes shop supervision but does not include expense for shop facilities and machinery. It includes wage fringe benefits but does not include shop burden. The High-Speed Passenger Study arrived at a burden rate of 18.6 percent for maintenance of equipment. This included fringe benefits and some depreciation thereby double-counting some of the direct maintenance cost. A similar figure for the period 1971-72 is 16.7 percent. This number was used primarily because it represents the most recent experience.

The figure of 17.2 percent was recalculated to complement the scope of the $.40 per car-mile direct cost. The following ICC accounts were included as maintenance of equipment overhead:

- One half of 301 - Superintendence (as an estimate of shop burden without shop supervision);
- 302 - Shop Machinery;
- 304 - Power Plant Machinery;
- 334 - Maintenance of Equipment Expenses;
- 339 - Other Maintenance of Equipment Expenses;
- 332 - Injuries to Persons; and
- 333 - Insurance.

The following ICC accounts were used as the denominator in the overhead ratio:

- 331 - Locomotive Repairs;
- 317 - Passenger-Train Cars: Repairs;
- 326 - Work-Equipment: Repairs; and
- 328 - Miscellaneous Equipment: Repairs.

The resulting burden rate is 9.703 percent. Ten percent was used as a reasonable approximation for the baseline case.

Train Movement

The following costs relate to the actual movement of CorridorRail trains.

Energy

The engineering contractor's estimate of $.138 per car-mile was used for the baseline energy cost. He derived this figure from a consumption rate of 6 kilowatt-hours per car-mile (based on a Train Performance Calculator), and projection of future electric power cost of $.023 per kilowatt-hour. A 50-percent increase was used as a sensitivity test.

Crew

CorridorRail crew costs would be most closely analogous to those of the Metroliner service. A sampling of 1974 cost data indicated a Metroliner cost for four-man crews of $1.538 per train-mile. On the basis of wage and fringe rates, the following costs were developed:

- three-man crew - $1.17/train mile;
- four-man crew - $1.54/train mile;
- five-man crew - $1.91/train mile; and
- six-man crew - $2.28/train mile.

The basic crew requirement, with current labor agreements, is for an engineer, conductor, and two train men (brakemen or ticket collectors). This was assumed as the minimum for the baseline case. The number of crew members actually necessary is a function of the number of cars in which one crew member can collect tickets. All crew members except the engineer can collect tickets. For the baseline case, it was assumed that one man could collect tickets in four cars. The unfavorable sensitivity test assumes one man for each three cars. The favorable test assumes one man for five cars and a labor agreement allowing three-man crews.

Switching

The cost of switching is incurred primarily in paying the crews who assemble trains. This cost depends largely on the physical configuration of the system and on the operating characteristics. Additional switching in New Haven could escalate the costs; advanced coupling technology and yard facilities could cut the costs. As a rough cut, the following system configuration was considered:

- two-man MU car switching crews in Boston, Penn Station, Sunnyside Yard, Philadelphia, and Washington.

- three basic shifts in each yard (midnight - 8 a.m. - 4 p.m. - midnight) supplemented by two daytime shifts (6:30 a.m. - 2:30 p.m. - 10:30 p.m.);

- $40,000 in salary for each crew; and

- standard 33 percent fringe package.

This configuration results in an annual switching cost of $1,320,000. Because of the very generous allowance for the number of crews, this is rounded to $1,000,000 for the baseline case with favorable and unfavorable excursions of 50 percent in the sensitivity tests.

Dispatching

The cost of operating the central control system was estimated at $2,000,000 based on the analysis of 1974 Penn Central costs.

Transportation Department Overhead

This cost is composed primarily of crew dispatching and superintendence. The High-Speed Passenger Study reports a burden rate of 6.2 percent of direct costs for this item. A similar analysis of Amtrak accounts shows rates of 5.2 percent in 1972, and 10.9 percent in 1974. An analysis of the Eastern Region and New England Division of the Northeastern Region of Penn Central produced a 1973 transportation overhead rate of 5.5 percent. An analysis of 1974 Penn Central costs indicated a rate of 2.9 percent. To be consistent with the use of Penn Central data in other cost categories, this figure (rounded to 3 percent) was used for the baseline case.

Transportation Department Liability

Transportation department liability can be correlated most closely with train and engine crew wages. Using the 1974 Penn Central costs, the following ICC accounts comprise transportation department liability:

- 414 - Transportation Insurance;

- 415 - Clearing Wrecks;

- 416 - Transportation Damage to Property; and

- 420 - Transportation Injuries to Persons.

The following ICC accounts comprise crew wages:

- . 392 - Train Engineers; and
- . 401 - Lineman.

After adding the standard 33 percent for fringe benefits to the wages, the following insurance rate is calculated:

$$\frac{\text{Liability expense}}{\text{Crew expense}} = \frac{\$4,320,000}{\$41,592,000} = 10.4\%$$

Accordingly, a figure of 10 percent of crew expense is used in the baseline case. A sensitivity excursion to 5 percent was performed.

Maintenance of Way and Structures

The cost estimation for this category of costs was performed by Thomas K. Dyer, Inc. (TKD) under a subcontract to Peat, Marwick, Mitchell, and Co. TKD arrived at the following cost estimates:

Track and roadbed	$21.63 million per year
Signals and communication	7.32
Power transmission	5.59
Stations, shops, and yards	4.20
Supervision	3.30
Total M of W&S	$42.04 million per year

These figures were used in the baseline case. They were derived from standard engineering data as follows:

Track

The annual cost in 1974 dollars to maintain tracks in the corridor was estimated for accounts 202 - Roadway Maintenance, 220 - Track Laying and Surfacing, 212 - Ties, 214 - Rail, 216 - Other Track Material, and 218 - Ballast. The estimates were made on a normalized basis, i.e., the cost to perform the work function or material replacement divided by the frequency in years of performing the work function or of the life of the material being replaced.

Costs and work frequency estimates were based on studies made by TKD on several Class I railroads, including Penn Central. The life of track materials was based on published information on the subject, observations and estimates of responsible railroad maintenance personnel obtained in interviews, and extensive research by TKD over a period of years which included measurement of actual tie life for over 5,000 ties from tie replacement projects and hundreds of rail wear measurements under varying conditions.

Relationships have been developed for work frequency and life of materials for several factors which were measurable and had a significant effect on annual cost. The effect of these variables has been incorporated in computer programs for estimating track maintenance costs.

In estimating Northeast Corridor normalized track maintenance costs per track mile, the variables considered were: gross tons, number of trains operated and maximum allowable speed.

Signals and Communications

The annual cost for accounts 247 - Communications and 249 - Signals was estimated for the corridor on a normalized basis for the type of communications and signaling required in the corridor. The principal variables considered were the number of trains operated per day per track and the number of tracks.

Power

The annual cost for account 257 - Power Transmission Systems was estimated for the corridor on a normalized basis. The principal variables considered were maximum allowable speed, number of trains operated per track, and the number of tracks.

Bridge and Building Accounts

Bridge and building annual maintenance costs were developed from a recently completed statistical analysis of the relationship of maintenance costs to investment for 25 Class I railroads, including the Penn Central over a 20-year period, with maintenance costs converted to 1974 dollars by use of AAR cost indices. Where investment costs had not been estimated, Penn Central per-mile investment costs were used.

Other Costs

Expenses such as accounts 269 - Roadway Machines, 271 - Small Tools, 277 - Employees' Health and Welfare Benefits, and 532 Railroad Retirement are generally proportional to labor and were varied with gross tons, number of trains operated, and maximum allowable speed.

The annual cost of accounts 201 - Supervision, 221 - Fences, 229 - Roadway Buildings, 272 - Removing Snow and Ice, 273 - Public Improvements, and 274 - Injuries to Persons were also based on information developed from the statistical analysis of 20 years of actual expenses for 25 Class I railroads.

General Overhead

This category is the expense of corporate administration. It includes the expenses of the chief executive's office, and the financial, legal, real estate, valuation, and claim departments. Much of this cost results from the mere existence of an organization of a given size. The 1974 Penn Central rates for system overhead and Eastern Region overhead, were combined to develop the baseline figure of 8.5 percent.

WORKING CAPITAL RATIOS

Four working capital items, in addition to short-term investments, were used in the analysis:

- cash;
- prepayments;
- other receivables; and
- materials and supplies.

The derivation of the baseline input data for these accounts is described below.

Cash

The average cash balance necessary to conduct the day-to-day receipt and expenditure of cash is expressed as a percentage of total operating expenses using the 1971 and 1973 Penn Central and Amtrak Annual Reports. The following ICC accounts were divided by operating expenses:

- 701 - Cash;
- 702 - Temporary Cash Investments; and
- 703 - Special Deposits.

The quotients ranged from 1.74 to 4.53 percent and had an average of 2.89 percent. A baseline value of 3 percent was used with sensitivity tests at 2 percent and 4.5 percent.

Prepayments

The prepayment schedule for rolling stock will be a negotiated item. The preliminary financial analysis of CorridorRail[1] assumes that 30 percent must be paid two years before delivery, 50 percent one year before delivery, and 20 percent upon delivery.

In practice, prepayments are based upon stages of contract progress rather than upon specific time periods. Time schedules are useful, however, for projection purposes. Two contracts illustrative of advanced vehicle purchase orders are set out in Exhibits B-1 (Metro-Rohr Car Purchase), and B-2 (BART-Rohr Car Purchase). The majority of the payments (not of the dollar amounts) under each of these contracts was made in the year immediately preceding delivery. The percentages in the BART contract are quite severe, however. They translate roughly into a time schedule as 45 percent two years before delivery, 40 percent one year before delivery and 15 percent upon or after delivery. These figures were used for an unfavorable sensitivity test. The preliminary figures of 30 percent and 50 percent are preserved in the baseline case. A favorable excursion to zero prepayments was also performed.

The associated problem of lot-size (minimum order quantity) was also investigated. The effects of a minimum order quantity on financial flows are negligible when considering a 36-year period. Furthermore, any selected year is more representative if no minimum order quantity is imposed. In view of the uncertainty about possible elimination of and negligible impact from this item, it was omitted from the projections.

Other Receivables

Receivables for passenger railroad consist primarily of:

- credit card fares;
- commercial accounts; and

---

[1] Church, R.; Gertler, J.; and Spaeth, W. Projected Patronage and Financial Performance for Improved Rail Service in the NEC. U.S. Department of Transportation, Transportation Systems Center. Report No. WP-SP-U4-66, October 1974.

EXHIBIT B. 1

METRO-ROHR CAR PURCHASE PAYMENT SCHEDULE
(FOR 300 CARS)

5%	Of total contract paid upon completion of engineering
20%	Per unit after under-floor completion
20%	Per unit after shell completion
20%	Per unit after shipment
30%	Per unit after acceptance
4%	Of total contract after delivery of last car
1%	Per unit on warranty expiration

EXHIBIT B. 2

BART-ROHR CAR PURCHASE PAYMENT SCHEDULE
(450 CARS)

PROTOTYPE

5% of contract price upon submittal of critical path analysis, drawing list, program for design and engineering, progress schedule, etc.

10% of contract price when manufacture is commenced at Supplier's plant.

15% of contract price after testing of prototype truck and structural testing of one prototype car body.

40% of contract price upon receipt by Supplier of major subsystems as may be specified in contract.

10% of contract price after completion and successful testing of prototype cars.

Balance due after completion of successful demonstration and road testing of prototype cars.

(The Prototype portion of the Contract was a Lump Sum Item in the amount of $10,000,000.)

REVENUE CARS

Payment is to be made on the basis of each car.

45% of contract unit price after receipt by Supplier of all major subsystems as may be specified in the contract.

20% of contract unit price after completion and successful testing of each car.

20% of contract unit price after delivery of each car.

6% of contract unit price after provisional testing.

6% of contract unit price after final acceptance.

3% of balance due under contract to be paid after final acceptance of all cars.

. ticket agency accounts.

Examination of the monthly figures for 1974 Amtrak receivables indicated that receivables were approximately 3 percent of revenues. Conversations with Amtrak financial personnel corroborated this figure, and it was used in the baseline case. Sensitivity tests were performed at 4.5 percent and . ercent.

Materials and Supplies

The only significant inventories in a passenger rail operation are parts and supplies for the Maintenance of Equipment and Maintenance of Way and Structures Departments. Analysis of reports of several railroads for the years 1971 through 1974, indicates that the ratios of Materials and Supplies balance to Maintenance Expenses cluster near 10 percent, with a range from 9.0 percent to 11.9 percent. In the baseline case materials and supplies were estimated at 10 percent of maintenance of equipment and M of W&S costs.

ALLOCATIONS OF EXPENSE TO OTHER USERS

The NEC right-of-way is to be used not only for high-speed intercity passenger traffic, but also for commuter, freight, and intercorridor passenger traffic. The cost of dispatching the trains and the cost of maintaining the ROW will be allocated among these users. The following paragraphs describe the method for arriving at baseline estimates of the relative shares for each of the users.

Dispatching

For the central control system which is planned for the NEC, dispatching is largely a fixed cost. In the long run, however, it must vary with gross changes in the meets, overtakes, crossovers, and other activities requiring system logic and operator supervision. The variability will be greatest in the local control areas, which carry heavy commuter traffic. The dispatching activities are related to the number of trains and the distance each travels on the spine. The key causative variable in dispatching is the number of events in which trains interact. Although it is not precise, total train-miles is the most readily available measure of these interactions and is, therefore, used as the cost allocation factor.

Maintenance of W&S

For the purpose of allocating the cost of its maintenance, the ROW was broken down into 43 segments. The segment end points were chosen to correspond with changes in the level of traffic of any of the four user groups. Five cost categories which could be causally related to use were employed for allocating the costs of each segment. These categories and their bases of allocation are described in the following paragraphs.

Basic Track

Basic track maintenance for FRA Class 5 (80 mph) standards, which increases with either tonnage or number of trains, was allocated on the basis of tons multiplied by trains.

Signals

Signal maintenance is related to usage in terms of number of movements and, therefore, was allocated to users in proportion to number of trains.

Tunnels

Since tunnels are primarily related to provision of capability for train movement, tunnel maintenance was allocated in proportion to number of trains.

Power

Maintenance of catenary is basically a function of usage which can be expressed in terms of the number of pantographs. Therefore, this cost was allocated in proportion to the number of pantographs, which was estimated as:

- one for every two commuter cars;
- none for local freight;
- one for every intercorridor passenger train locomotive; and
- one for every four cars in a CorridorRail train.

Maintenance of power supply equipment was allocated on the same basis as catenary maintenance. A more rigorous analysis would allocate this cost in proportion to energy supplied, but those data were not available for other users and besides, the difference would not materially affect the results of the financial analysis.

High-Speed Track

Maintenance of track to standards in excess of FRA Class 5 standards, in order to allow high-speed operation, was allocated to CorridorRail.

Other M of W&S

The remaining costs, including:

- maintenance of stations,
- maintenance of shops,
- maintenance of yards, and
- maintenance of way department supervision.

were allocated in the same proportions as the total of the five categories above.

Total Cost Allocation to Other Users

When the dispatching and maintenance of way costs were allocated on the bases described above the results shown below were obtained. The commuter and local freight shares are combined for input to the financial model to give the following results:

commuter and local freight M of W&S share	19%
commuter and local freight dispatching share	29%
inter-corridor Amtrak M of W&S share	3.7%
inter-corridor Amtrak dispatching share	8.5%

These results leave 77 percent of the maintenance cost and 62.5 percent of the dispatching costs to CorridorRail.

APPENDIX C

FLEET SIZING EXERCISE

Several of the expenditures, which must be estimated in the course of the financial analysis, depend on the number of cars required, the number of train-miles operated, and size of trains. These reflect an uneven distribution of demand over time and its interaction with the chosen schedule of service. More specifically, crew costs depend on the number of train-miles and the length of each train. Investment in rolling stock depends on the number of seats which must be supplied in order to carry the projected number of passengers. Investment in rolling stock also depends on the number of cars necessary to be able to supply those seats at the right time in the right place. Cost of energy, car maintenance, and train supplies and expenses all depend on the number of car-miles necessary to supply the seats.

This appendix describes the fleet-sizing exercise carried out for CorridorRail which produced baseline estimates for:

. train-miles (including distribution of train consists),

. load factor, and

. car productivity as determined by logistical constraints.

The conceptual approach to each of these three objectives is explained in the following portion of the appendix. A description of the exercise itself and the results for each of the objectives make up the last two portions of the appendix. The role that these results played in the financial projections for NECDP is illustrated in Figure III. 3 and its accompanying text.

CONCEPTUAL APPROACHES

The conceptual basis for estimating each of these items is briefly discussed in the following paragraphs. Then, each step in the car-movement exercise is reported and the assumptions and sources of information are identified. Finally, the exercise's major uncertainties and their significance are indicated.

Train-Miles

The service is predicated upon half-hourly departures during business hours. Whenever demand for one of the half-hour intervals exceeds the 14-car capacity of the stations, an extra train is added. The number of extra trains on each section of the route determines the amount by which train-miles in any year will exceed the requirements of the minimum schedule. The mileages of these extra trains are the increments to the train-mile statistic. The relationship between the rate of increase in train-miles and in demand is (except in the very long run) irregular. If a number of trains are approaching the 14-car limit, several extra trains may be added in a very short time; train-miles may increase more rapidly than demand and average train consist may decrease. If most of the trains have just passed the 14-car limit and have split into eight-car trains, it might be some time before any more extra trains are added (i.e., train-miles would increase less rapidly than demand and average consist would increase). The number of trains which pass the 14-car limit in any period can be estimated if the demand and its distribution among the trains in that period are known.

The fleet-sizing exercise examined four periods of time: the design day for 1990, the average day for 1990, the design day for 2011, and the average day for 2011. When the small number of extra trains in 1990 was determined, it was evident that there could be little, if any, difference between 1990 train-miles and 1982 train-miles if the minimum schedule were adhered to in 1982. Linear interpolation between 1982, 1990, and 2011 figures for train-miles was the approximation used.

Load Factor

Load factor is a measure of utilization of capacity. It is calculated as passenger-miles divided by available seat-miles.

Determinants of Load Factor

There are three principal determinants of the amount by which the number of seat-miles supplied must exceed the number of passenger-miles required:

- car size;
- geographic demand distribution; and

. time-of-day (TOD) demand distribution.

If there were an infinite number of one-passenger cars available at every station, a 100 percent load factor could be achieved. Whenever a passenger boarded the train, a car would be added for him; whenever he left the train, a car would be dropped. The car size is the first significant determinant of load factor. For example, if every passenger were guaranteed a seat, and if cars were available only as 150-seat married pairs, then let us imagine that each successive pair of cars added to a train was filled by the passengers before adding the next pair. Over the course of time, the numbers of passengers who occupied an unfilled married pair, i.e., who occupied the last married pair added to the trains, would be randomly distributed from one to 149. The mean of these numbers would be approximately 75. Therefore, the trains in our system would need an average of 75 seats more than the trains with one-passenger cars to serve the same demand.

The second principal determinant of load factor is geographic demand distribution. Train consists are adjustable only in Philadelphia, New York, and at the end-points. Therefore, a train carrying 750 passengers from Philadelphia to Wilmington, 500 passengers from Wilmington to Baltimore, and 200 passengers from Baltimore to Washington, must take ten 75-passenger cars from Philadelphia to Washington. Seven of the cars would be unnecessary for the Baltimore-Washington trip by itself.

The third principal determinant of load factor is the practice of deadheading to minimize fleet size. If there is a net movement from Philadelphia to New York in the morning, then it will probably be possible for a few cars to make a run from Philadelphia into New York, return empty as part of a smaller train, and make another run from Philadelphia to New York.

Link Loadings

To quantify these determinants of load factor, it is necessary to consider the geographic and time-of-day (TOD) distribution of demand. If the schedule for a particular train is known, then a TOD distribution for each Origin-Destination (O-D) volume will permit calculation of the number of people getting on and getting off the train at each station. Accumulating these figures for the train will show the number of passengers on board the train as it leaves each station. These are referred to in this exercise as "link loadings." For each of the three sections (Washington to Philadelphia, Philadelphia to New York, and New York to Boston), a critical link will appear: this is the link for which the link loading is the highest. The critical link loading will determine the train consist. Performing this exercise for every train in the period being examined would permit load factor determination caused by car size and by geographic demand distribution. However, it does not permit determination of the deadheading determinant of load factor.

Time-Distance Chart

One way of calculating the total load factor, including the deadheading determinant, is to simulate the car movements and inventory changes for the period being examined. Figure C.1 is a simplified time-distance graph of CorridorRail operations. Time is on the horizontal axis, distance (or position) on the vertical axis. Each slanted line represents a train. The time-distance chart is a simulation device to allow the user to keep track of car inventories and movements. When link loadings and train consists are calculated for every train for the period under examination, it becomes apparent where and when car surpluses build up, and when there is time for a deadhead run.

When the car movements for an entire period have been simulated, the car-miles can be calculated. Multiplying the seats-per-car by the car-miles and dividing the product into the previously specified number of passenger-miles gives a load factor for the period under examination. Having calculated a load factor for the brief period under examination, the applicability of this load factor to other periods must be determined.

Car Productivity

There are two important constraints on the number of revenue earning miles the average car in a fleet can travel in a year. They are the down-time required to maintain the cars at the most cost-effective level, and the minimum number of cars needed to meet the peak demand served during the year. Clearly, the fleet must be sized to meet the more stringent of these constraints. This fleet-sizing exercise can deal with the latter constraint (viz., the minimum number of cars needed to meet the highest demand served). By choosing the design day and performing the simulation exercise with the time-distance chart in the manner just described, the minimum fleet size necessary to meet the design day is calculated. This fleet size is increased to allow for a certain number of unavoidable out-of-service cars at the time the peak hits. Determination of whether car maintenance can be scheduled for the off-peak days in such a manner as to permit such fleet optimization was outside the scope of this study.

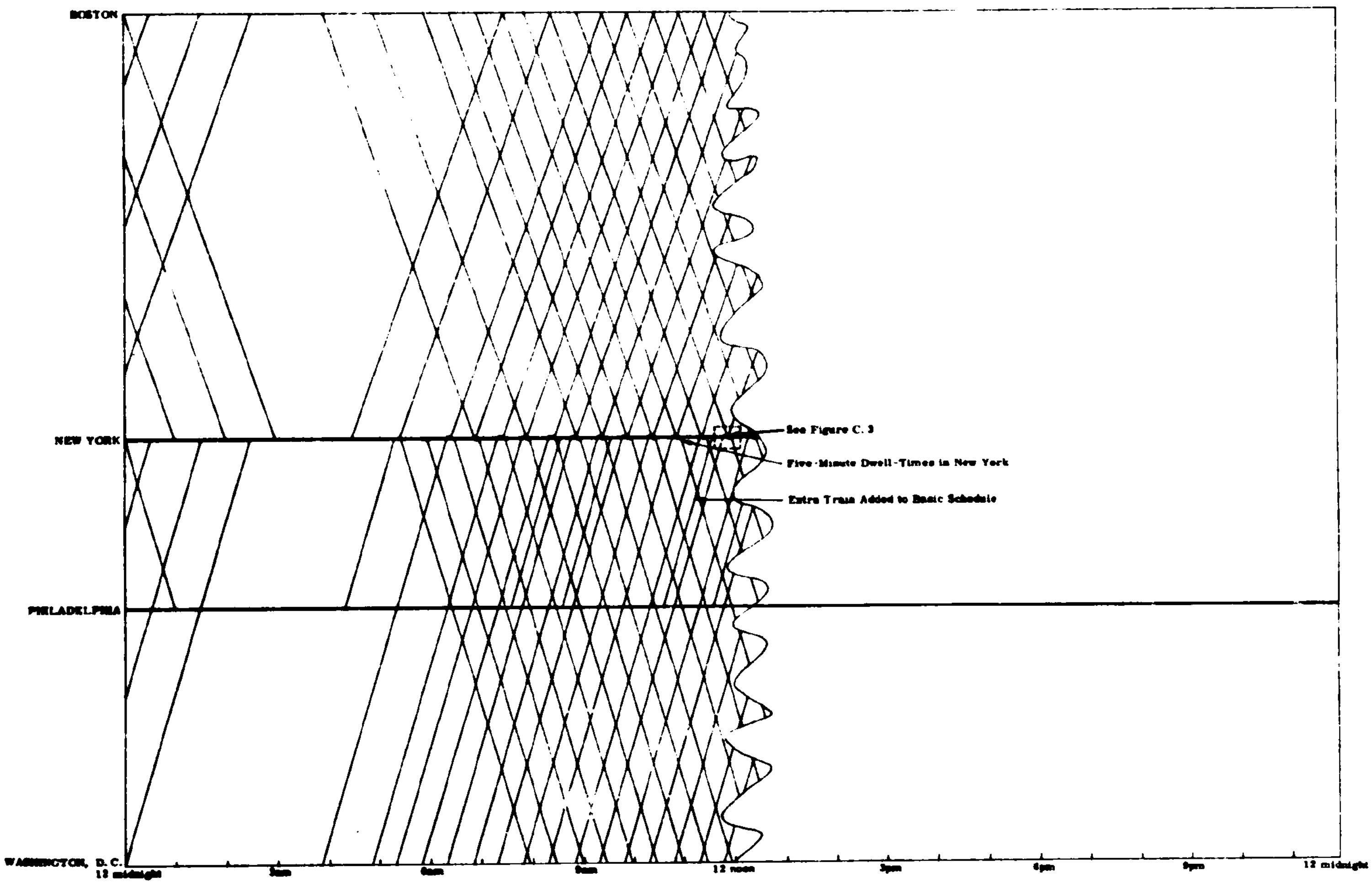


FIGURE C. 1: SIMPLIFIED TIME-DISTANCE CHART

DISCRIPTION OF THE EXERCISE

Outline

To complete the car movement exercise and obtain the estimates listed above the following steps were performed:

- Determine a method for plotting a time-of-day (TOD) demand distribution for each city-pair from the available data.
- Develop an entire train schedule for the basic half-hourly service, showing train times for each train for each station.
- Calculate the number of passengers boarding and leaving the train at each station for selected trains scattered across the day.
- Find the critical link loading for each train for each of the three route segments.
- Find the O-D volumes that span the critical link based on the pattern of critical links established in the last two steps.
- Calculate the critical link loadings for each train.
- Assign the appropriate number of cars to each train.
- Add extra sections where necessary.
- Calculate (for each of the four yards) the cumulative number of cars in and cars out for each departure and arrival time, allowing an appropriate turnaround time.
- Calculate the net number of cars outstanding or gained at each point during the day.
- Identify the situations in which a car could make an empty trip (deadhead) which decreases the peak car requirements in the destination yard without increasing the peak requirements in the origin yard. These situations occur when:
  - a car can make a complete round trip from the origin yard either before or after the time of the yard's peak car requirement (i.e., maximum number of cars outstanding), and

- the trip reaches the destination yard before the time of that yard's peak requirement.

- Alter the time-distance chart and car requirement figures in accordance with the deadheading opportunities just identified.

- Sum the maximum car requirements for the four yards to obtain the minimum fleet size necessary to serve the patronage forecast for the period under examination.

- Group the trains by consist length and route segment to determine the distribution of train-miles by consist.

- Multiply the route segment lengths, trains per consist, and cars per consist to obtain the number of car-miles.

- Calculate the load factor from the car-miles, seats per car, and passenger-miles.

Time of Day Distributions

Data Available

The first of these steps involves the greatest need for explanation. The latter steps will be briefly reported along with the few operating assumptions which were necessary.

Time-of-day (TOD) distribution data is available for only a few city-pairs in the corridor. The Task I Report[1] contains hourly variations of NEC rail departures for Friday, March 15, 1974, for the following city-pairs:

- Washington-New York;

- Philadelphia-New York;

- Washington-Philadelphia; and

---

[1]Bechtel, Inc. Northeast Corridor High-Speed Rail Service Improvement Project, Task 1, Demand Analysis. Report No. FRA-ONECD-75-1, April 1975, Appendix B. FRA's Economic Division use of the Amtrak Data Tag Program is cited.

. New York-Boston.

The Washington and Philadelphia distribution is reproduced in Figure C.2.

These four cities are distinguished enough by size alone to cast doubt upon the use of their TOD distributions for NEC in general. The principal categorization of NEC traffic is between business and nonbusiness travel. All four of the listed city-pairs reflect a disproportionate volume of business-related travel. All four of the cities show "commuter" TOD distributions (i.e., a net migration into the city in the morning and a net migration out of the city in the afternoon). Even among themselves, these cities display this pattern: there is a net migration from Washington and Philadelphia to New York in the morning and a net migration from New York to Philadelphia and Washington in the afternoon. Table C.1 shows the percentages of trips which were business related for the New York-Washington and Philadelphia-Washington city-pairs. Data from Boston were discarded for reasons noted later in this appendix. The trip purpose percentages suggest that current rail travel among these cities is business biased relative to rail travel in general and that the bias would probably be exaggerated by a shift from other modes to CorridorRail.

Furthermore, the TOD distributions are influenced by planned arrival time as well as by departure time.[1]

The influence of desired arrival time will change the TOD distribution from the distributions mentioned above both according to the distance between origin and destination and according to the speed of travel.

A more representative mix of business and nonbusiness travel for Friday TOD distributions in the NEC was found in the Delaware Memorial Bridge Survey of eastbound traffic on May 16, 1969.[2] The time of

---

[1]Peat, Marwick Mitchell & Co. Analysis of Intercity Travel Demand in the Northeast Corridor. Prepared for Strategic Planning Division, Office of the Assistant Secretary for Policy and International Affairs, U.S. Department of Transportation. December 1970, (unpublished), p. 68.

[2]Ibid., p 73. The proportion of business travel for this survey was 29 percent, (Ibid., p. 42), Table C.1.

TABLE C. 1

PROPORTIONS OF BUSINESS TRAVEL TO TOTAL TRAVEL

	RAIL (Percent)	ALL MODES (Percent)
Washington-New York [1]	40%	37%
Washington-Philadelphia [1]	44%	35%
Total NEC [2]	37%	27%

[1] Prokopy, J. C., and Ellis, R.H. Analysis of the Intercity Travel Market in the Northeast Corridor. Prepared by PMM&Co. for the U.S. Department of Transportation, Report No. DOT-OS-10051, pp. 36, 37.

[2] Peat, Marwick, Mitchell & Co. Analysis of Intercity Travel Demand in the Northeast Corridor. Prepared for U.S. Department of Transportation, Contract No. 8-35049-6 (Unpublished); December 1970, p. 20.

day distribution depicted by this survey was adjusted to reflect the characteristics of rail travel. It was used as a distribution of the desire to be "in transit" at the reported time of day. Where departure time is the predominant factor in the distribution for a city-pair, the data would be applied based on the time of departure. Where time of arrival is the predominant factor, the data would be applied to arrival times. Where there is a balance, the figures based on an arrival time and a departure time would be averaged.

Application of the Data

The Delaware Memorial Bridge data and three of the rail departure data sets listed above were applied in various combinations to each city-pair in the proposed CorridorRail system. The Boston-New York data were discarded because it is anticipated that CorridorRail traffic north of New York will be more similar to current traffic south of New York than to current traffic north of New York. Exhibit C.1 briefly identifies the way in which the data were used for each city-pair in each direction. The rationale used to develop Exhibit C.1 was:

- New York was considered a business city relative to Boston, Washington, and Philadelphia; all four were considered to be business cities relative to other cities in the corridor.

- Because distributions for CorridorRail north of New York are expected to resemble current distributions south of New York, Boston was given Washington's business characteristics relative to other cities.

- For any city-pair in which one member is considered a business city relative to the other member, the selected curve is applied, based on arrival time for trips to the business city, and based on departure time for trips from the business city.

- For city-pairs where a strong "commuter" TOD distribution was expected, the New York-Philadelphia data were applied.

- For city-pairs where a noticeable but weaker "commuter" TOD distribution was expected, the New York-Washington data were applied.

- For all of the longest trips, the Delaware Memorial Bridge data were used, based on arrival time, only.

EXHIBIT C.1

TIME OF DAY DEMAND DISTRIBUTIONS

Combinations of Source Distributions Assigned to City-Pair Projections

From \ To	Boston	Providence	New London	New Haven	Stamford	N.Y.C.	Metro-Park	Trenton	Philadelphia	Wilmington	Baltimore	D.C.
Boston		N to P Dep	N to P Dep	N to W Dep	N to W Dep	W to N Arr	N to W Dep	N to W Dep	W to P Arr & Dep	Standard Arr	Standard Arr	Standard Arr
Providence	P to N Arr		Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep	W to N Arr	Standard Arr & Dep	Standard Arr & Dep	W to N Arr	Standard Arr	Standard Arr	Standard Arr
New London	P to N Arr	Standard Arr & Dep		Standard Arr & Dep	Standard Arr & Dep	P to N Arr	Standard Arr & Dep	Standard Arr & Dep	W to N Arr	Standard Arr & Dep	Standard Arr	Standard Arr
New Haven	W to N Arr	Standard Arr & Dep	Standard Arr & Dep			P to N Arr		Standard Arr & Dep	W to N Arr	Standard Arr & Dep	Standard Arr	Standard Arr
Stamford	W to N Arr	Standard Arr & Dep	Standard Arr & Dep					Standard Arr & Dep	W to N Arr	Standard Arr & Dep	Standard Arr & Dep	Standard Arr
N.Y.C.	N to W Dep	N to W Dep	N to P Dep	N to P Dep				N to P Dep	N to P Dep	N to P Dep	N to W Dep	N to W Dep
Metro-Park	W to N Arr	Standard Arr & Dep	Standard Arr & Dep						P to N Arr	Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep
Trenton	W to N Arr	Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep	P to N Arr				Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep
Philadelphia	P to W Arr & Dep	N to W Dep	N to W Dep	N to W Dep	N to W Dep	P to N Arr	N to P Dep			N to P Dep	P to W Dep	P to W Arr & Dep
Wilmington	Standard Arr	Standard Arr	Standard Arr & Dep	Standard Arr & Dep	Standard Arr & Dep	P to N Arr	Standard Arr & Dep	Standard Arr & Dep	P to N Arr		Standard Arr & Dep	Standard Arr & Dep
Baltimore	Standard Arr	Standard Arr	Standard Arr	Standard Arr	Standard Arr & Dep	W to N Arr	Standard Arr & Dep	Standard Arr & Dep	W to P Arr	Standard Arr & Dep		P to N Arr
D.C.	Standard Arr	Standard Arr	Standard Arr	Standard Arr	Standard Arr	W to N Arr	Standard Arr & Dep	Standard Arr & Dep	N to P Arr & Dep	Standard Arr & Dep	N to P Dep	

KEY: Each cell of the matrix contains the source curve used and the trip characteristic which determines time of day distribution. For example,

W to P Arr&Dep = Washington to Philadelphia data were used averaging the arrival-time and departure-time influences.

Standard = Generalized TOD curve derived from Delaware Memorial Bridge Survey
N = New York
P = Philadelphia
W = Washington
Arr = Arrival-time-based
Dep = Departure-time-based

- For all other nonbusiness city-pairs, the average of the figures which would result from applying the Delaware Memorial Bridge data, based on time of arrival and time of departure, was applied.

- For the three city-pairs for which the city-pair's own data were applied, the data had to be modified for the CorridorRail travel times. Trips to New York were based on arrival times; trips from New York were based on departure times. Trips from Washington to Philadelphia were based on arrival times; trips from Philadelphia to Washington were based on departure times.

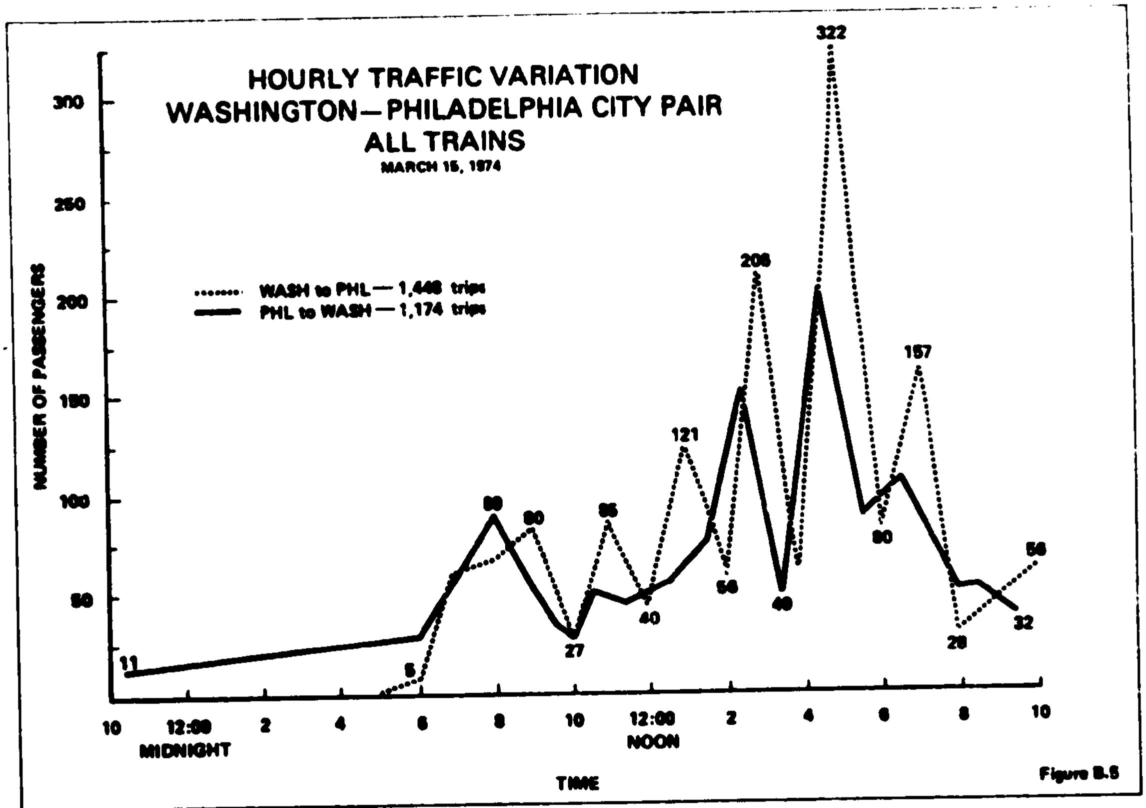
- Finally, for the Philadelphia-Boston trips, the average of the figures which would result from applying the Philadelphia-Washington data, based on time of arrival and on time of departures, was used.

The mechanics of converting the data into a number of passengers for a specific CorridorRail train was based on a continuous rate of demand concept. It was assumed that the points recorded in each of the surveys represented the passengers who had accumulated at a constant rate since the last data point recorded. The data could then be plotted on a cumulative graph. If the inverse assumption is made when reading numbers from these curves (i.e., if it is assumed that the people boarding any CorridorRail train will have accumulated at a constant rate since the last CorridorRail departure toward their destination), very little distortion results. In cases such as that of the Washington-Philadelphia city-pair (Figure C.2), where the figures are clearly influenced by the train schedule, rather than by demand[1] the cumulative line is smoothed. Using the cumulative graphs (exemplified in Figure C.3), it is possible to read for any specific interval of time on the horizontal axis, a corresponding increment of passengers from the vertical axis. All of the data was converted from numbers of passengers to percentages of the day's demand.

As an example of the way these curves were used, let us consider the volume of passengers traveling from Boston to Philadelphia on the

---

[1]The train schedule for the day on which these data were recorded shows a Metroliner departure coincident with roughly every other conventional departure. The alternative peaks and troughs in the data are explained by the high volume attracted by the double train departure.



Reproduced from C.W. Gillespie, S. Sultan, G. Fondak D. White. Northeast Corridor High-Speed Rail Passenger Improvement Project Task 1, Demand Analysis. Prepared by Bechtel, Inc. for ONECD; Report No. FRA-ONECD-75-1. April 1975; p. B-6.

FIGURE C. 2: BECHTEL ESTIMATE OF HOURLY VARIATION OF WASHINGTON-PHILADELPHIA TRAFFIC

CorridorRail train which departs Boston at 12:35 PM and arrives in Philadelphia at 4:30 PM. The preceding train left Boston at 11:55 AM and arrived in Philadelphia at 4:00 PM. Exhibit C.1 indicates that the Washington to Philadelphia data were applied based on average time of arrival and time of departure influences.

The curve (Figure C.3) was plotted in terms of departure times, so the departure component can be read directly: the percentage of people leaving Washington between 11:55 AM and 12:25 PM was two percent of the people traveling from Washington to Philadelphia on that day.

The number of people who arrived in Philadelphia between 4:00 PM and 4:30 PM from Washington was (based on average current travel time) the same as the number who departed Washington for Philadelphia between 1:55 PM and 2:25 PM. Figure C.3 shows this arrival component to be 4.5 percent of the number of people traveling from Washington to Philadelphia that day. The number of people who will board the 12:25 PM CorridorRail train, then, is (2 percent + 4.5 percent) / 2 or 3.25 percent of the people traveling from Boston to Philadelphia on the day for which the projection is being made.

In this manner, a percentage for each of the city-pairs which span a critical link was calculated for each train.

<u>Numbers of Passengers</u>

Then annual O-D volumes for each city-pair were obtained from the demand data used for the <u>Demand Report</u>. The demand model only calculates combined northbound and southbound volumes. These volumes were halved to obtain the total annual volume for each directional city-pair. The average day volume on each train was calculated by dividing the annual volume by 365 and multiplying the result by the percentage just derived for that train and city-pair. In order to calculate the design-day volumes, the design-day itself had to be defined. In the engineering design the tenth highest day of the year, or 0.37 percent of annual volume, was used as a design-day capacity.[1]

---

[1]Bechtel, Inc. pp. 3-35 ff.

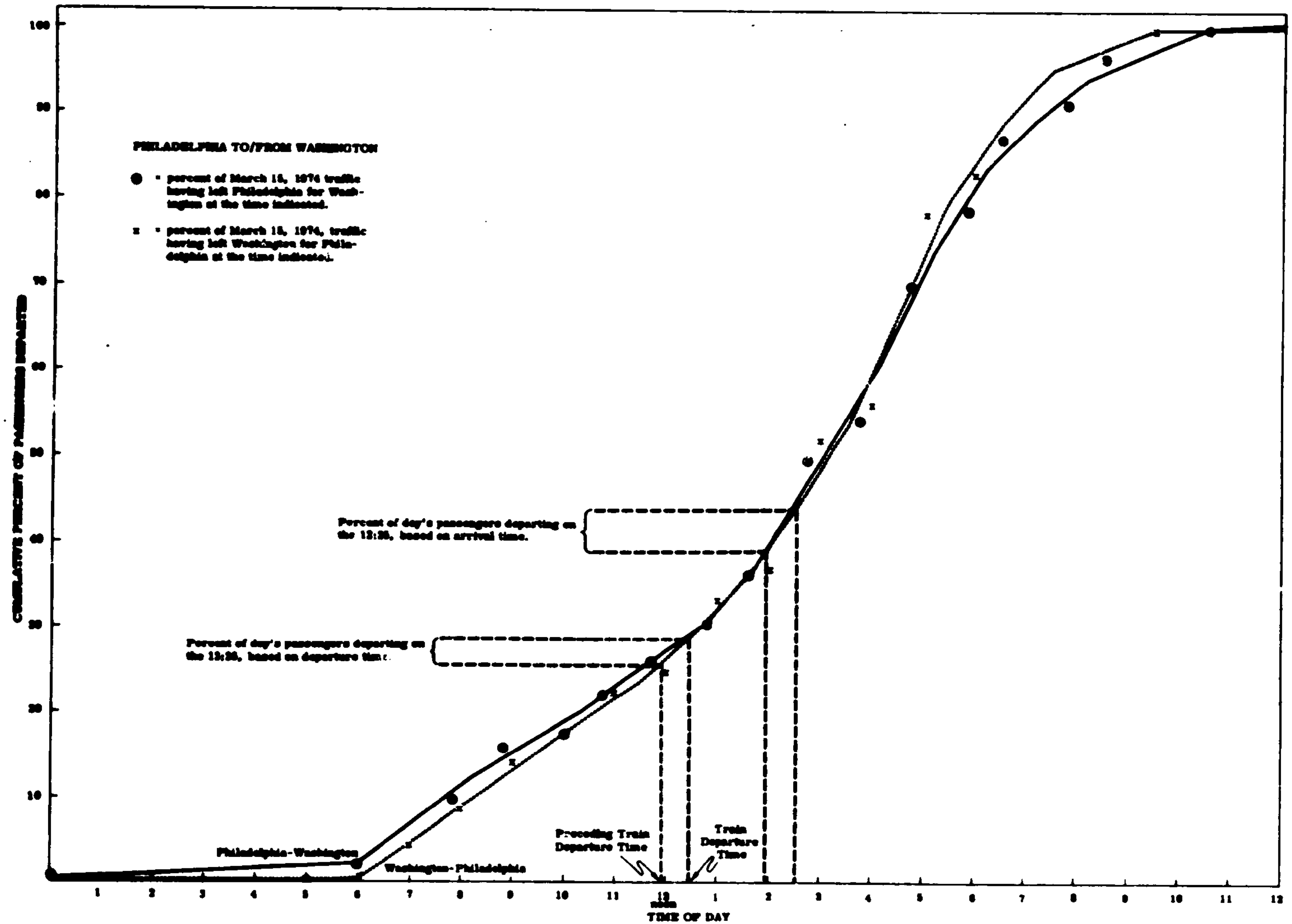


FIGURE C. 3: CUMULATIVE TIME-OF-DAY DISTRIBUTION

Car and Train Movements

Having calculated the number of passengers for each directional city-pair on each train, these had to be converted to car-movements and extra sections.

Critical Link Loading

By subtracting the sum of passengers traveling to a city on a train from the sum of passengers departing from the city on that train, the net change in passengers-on-board is calculated for each station. The cumulative sum of these net changes reveals the total passengers on board on the critical link.

Cars Per Section

Passengers per link for each train were converted into cars per link per train by dividing by 75 seats per car. The result was always rounded up to the nearest even number to be consistent with the MU married-pair assumption. Respective train lengths were applied directly to a time-distance chart. For example, on the Boston to New York section, the Providence to New London link may require 10 cars, whereas all preceding and succeeding links require only 8 or less. Therefore, the train would depart Boston with 10 cars to meet the Providence-New London critical link demand. Critical link demand always determined the train length departing a yard, unless deadheading was taking place.

Fleet Requirements

To determine the total fleet size, the maximum daily yard requirements for the four yards were summed. Each yard requirement was determined by adding the respective departing cars and subtracting the arriving cars from a running total. For example, assume that Figure C.4 represents the New York yard at a given point in time. The cumulative requirement at this point in time is 40 cars. The drawing represents the 11:55 AM arrival and departure node with a four-car through train arriving from the north and departing with six cars and an eight-car through train arriving from the south and departing with six cars. The cumulative total requirement is incremented by two cars (the two departing cars that were not a part of the incoming southbound train). The two excess cars from the northbound train do not affect the total until some point later in the day, which is a function of the time assumed to turn a car around. The results of the cumulative interactions produced maximum daily yard requirements.

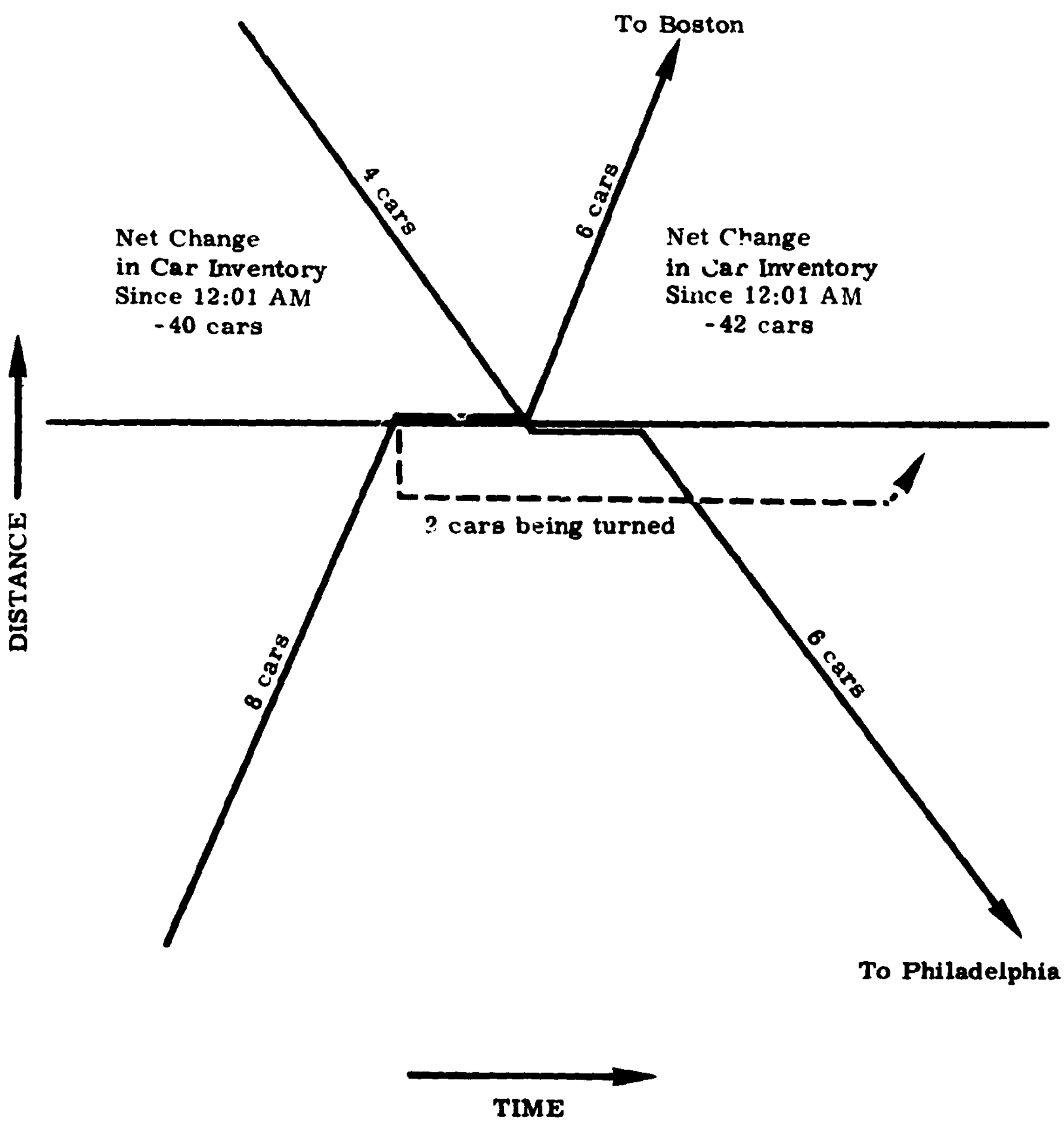


FIGURE C. 4: NEW YORK TERMINAL AT 11:55 AM
(DETAIL FROM FIGURE C. 1)

The maximum daily yard requirements were then reduced, if deadheading could be done. The cumulative totals were also plotted on the time-distance chart (Figure C.1) and maximum requirements noted. Because the distribution of peaks for each yard was at a different time of day, it was possible to move cars from one yard to another to increase the receiving yard's inventory before the sending yard's inventory reached its maximum need. Deadheading of this type reduced our total fleet requirements by about five percent.

RESULTS AND LIMITATIONS

The results tabulated from the fleet-sizing exercise are displayed in Exhibit C.2. All of these results depend, to some degree, on the accuracy of the TOD distributions. As a step-by-step consideration of the process has shown, the TOD distributions interact in a complicated pattern to produce load factors and maximum inventory requirements. The accuracy required, however, is only enough to estimate the way in which the peaking patterns for different city-pairs are likely to interact with each other. No claim to real accuracy in predicting the number of passengers on board a particular train, at a particular station on the tenth busiest day of 1990, is made. The data used produced reasonable peaking patterns and fleet-size requirements. Each of the results is briefly discussed below.

Train-Miles

Extra sections were needed almost exclusively in the Philadelphia-New York route segment. Fourteen extra trains were required on the average day in 1990. The distribution of consists was relevant only to crew costs. The baseline assumption was that four-man crews would be required on all trains up to ten cars in length, and that five-man crews would be required on twelve- and fourteen-car trains. A tabulation of the trains from the time-distance chart yielded 12.26 million train-miles in 1990, 2.4 percent of which were run with five-man crews. These were the figures used for the baseline case.

Load Factor

A load factor of 63.1 percent was projected by the exercise.

Car Productivity

The minimum fleet necessary to handle the design day in 1990, assuming that 5 percent of the fleet was out of service on that day, was

EXHIBIT C.2

RESULTS OF FLEET-SIZING EXERCISE

	Train-Miles	Extra Trains
1990 Average day	34,067	14
Design day	35,507	30
2011 Average day	43,819	113
Design day	53,801	150

Load factor	:	63.1 percent
Fleet required on design day, 1990	:	317 cars
Car productivity	:	266,000 miles per car per year
Annual train-miles for 1990	:	12.26 million
2011	:	15.77 million
Train-miles run with 5-man crew	:	2.4 percent of total
4-man crew	:	97.6 percent of total

317 cars. Since the total annual car-miles were estimated to be 84.3 million, the scheduling constraint on productivity was determined to be 266,000 miles per car per year.

APPENDIX D

CORRIDORRAIL FINANCIAL MODEL LINE ITEMS

This appendix supplements with greater detail the discussion in Section III of the computational steps in the CorridorRail Financial Model. The line items in the model's printout are discussed in the order in which they would appear in the projections (e.g., Appendices F, G, and H) although any particular projection would omit some of the items. The income-sharing payment, for example, is omitted from the baseline case (Section IV) but included in the owner/operator case (Section VI). For each line item discussed, the scope and the method of computation are defined. Exhibits D.1 through D.6 are extracts of the financial statements and may be helpful in using the following material.

Cover Page

Return on Investment (ROI) is the discount rate which will reduce the net present value of the stream of net cash flows to zero.

Net Present Value, sometimes called net present worth, is the sum of the stream of net cash flows after discounting them for the time value of money as specified by the input called "Present Value Discount Rate." The discounted cash flows include the terminal value of the project. The expression for net present value is:

$$\sum_{y=1}^{n} \left(f_y \ (1+r)^{-y} \right) + (\text{terminal value})\ (1+r)^{-n}$$

where:

y = year

n = number of years in projection

f_y = net cash flow in year y

r = discount rate

ROI and Net Present Value are calculated for each organization and for the total project. In the baseline case, for example, the difference between the indicators for the operator and for the total project result from the project manager expenditures.

EXHIBIT D.1

COVER PAGE

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

NEC IMPROVEMENT PROGRAM - - - FINANCIAL PROJECTIONS
BOSTON-WASHINGTON HIGH-SPEED RAILWAY

VEHICLES IN UNITS
ALL OTHER FIGURES IN MILLIONS

HYPOTHESES OF THIS RUN -- BASELINE CASE

1. FRA DEMAND (3% GROWTH AFTER 1990)
2. INTEREST-FREE DEBT FOR IMPROVEMENTS
3. GRANTS FOR ROLLING STOCK
4. 20-YEAR (1996) 7% BOND, WITH SINKING FUND IN 1983 FOR R.O.W. PURCHASE
5. PMM&CO OPERATIONAL COST ESTIMATES
6. FRA CAPITAL COST ESTIMATES
7. BOOK VALUE OF ASSETS ADDED INTO CASH STREAM IN 2011

ENTITY	RETURN ON INVESTMENT	NET PRESENT VALUE
COMBINED PROJECT MGT.	3.800%	-1,559.430
TOTAL PROJECT	3.407%	-1,773.722

EXHIBIT D. 2

CASH FLOW SUMMARY, PAGE 1

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
C A S H F L O W S U M M A R Y

NAME OF ENTITY	YEAR 1976	YEAR 1977	YEAR 1978	YEAR 1979	YEAR 1980	YEAR 1981
COMBINED	-715.7	-327.9	-374.4	-534.5	-510.5	-457.3
PROJECT MGT.	-63.4	-66.1	-67.1	-37.1	-15.4	-16.4
TOTAL PROJECT	-779.1	-394.0	-441.5	-571.6	-526.0	-473.7
	YEAR 1982	YEAR 1983	YEAR 1984	YEAR 1985	YEAR 1986	YEAR 1987
COMBINED	-156.8	43.0	62.0	79.0	96.5	108.7
PROJECT MGT.	-14.4					
TOTAL PROJECT	-171.3	43.0	62.0	79.0	96.5	108.7
	YEAR 1988	YEAR 1989	YEAR 1990	YEAR 1991	YEAR 1992	YEAR 1993
COMBINED	116.7	122.1	126.6	131.8	137.3	143.9
PROJECT MGT.						
TOTAL PROJECT	116.7	122.1	126.6	131.8	137.3	143.9

EXHIBIT D.2 (CONTINUED)
CASH FLOW SUMMARY, PAGE 2

[illegible] IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
C A S H F L O W S U M M A R Y

[illegible] ACTIVITY	YEAR 1994	YEAR 1995	YEAR 1996	YEAR 1997	YEAR 1998	YEAR 1999
COMBINED PROJECT AMT.	93.6	51.5	119.1	147.2	156.5	166.0
TOTAL PROJECT	93.6	51.5	119.1	147.2	156.5	166.0
	YEAR 2000	YEAR 2001	YEAR 2002	YEAR 2003	YEAR 2004	YEAR 2005
COMBINED PROJECT AMT.	177.5	189.0	197.0	205.2	212.7	220.8
TOTAL PROJECT	177.5	188.0	197.0	205.2	212.7	220.8
	YEAR 2006	YEAR 2007	YEAR 2008	YEAR 2009	YEAR 2010	YEAR 2011
COMBINED PROJECT AMT.	229.2	236.2	190.9	151.5	222.5	3,608.7
TOTAL PROJECT	229.2	238.2	190.9	151.5	222.5	3,608.7

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT D. 3

PRO FORMAS, PAGE 1

NEC IMPROVEMENT PROGRAM - - - FINANCIAL PROJECTIONS

NEC PRO FORMAS 05/09/75 FOR THE COMBINED ENTITY 09:26:32

OPERATING AND INVESTMENT STATISTICS	YEAR 1979 SOURCES USES	YEAR 1980 SOURCES USES	YEAR 1981 SOURCES USES	YEAR 1982 SOURCES USES	YEAR 1983 SOURCES USES	YEAR 1984 SOURCES USES
PASSENGER TRIPS				17.0	20.1	22.2
PASSENGER MILES				2,261.0	2,673.3	2,952.6
CAR MILES				47.8	56.5	62.4
TRAIN MILES				12.3	12.3	12.3
NUMBER OF CARS IN FLEET				236.0	279.C	308.0
NUMBER OF CARS DELIVERED				236.0	43.C	29.0
FACILITIES INVESTMENT						
SERVICE FACILITIES	27.2	30.4	41.0			
TRACK UPGRADING & STRUCTURAL DEVMT	108.6	82.7	55.0	6.0		
LONG LEAD MATERIALS	81.1					
FENCING	33.5	24.8	4.4			
LAND ACQUISITION FOR TRACK REALIGNMENT	1.4					
SYSTEM TEST						
BRIDGE AND TUNNEL UPGRADING	64.7	64.7	48.4			
ELECTRIFICATION	62.1	48.0	22.3			
SIGNALLING CONTROL	44.4	88.7	87.7	58.5		
STATIONS	68.5	68.7	44.7	7.5		
FREIGHT FACILITIES						
TOTAL FACILITIES INVESTMENT	491.6	408.0	303.5	72.1		

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT D.4
PRO FORMAS, PAGE 2

NEC PRO FORMAS 09/30/75 NEC IMPROVEMENT PROGRAM - - - FINANCIAL PROJECTIONS FOR THE COMBINED ENTITY 09:26:32

OPERATING INCOME ACCOUNTS	YEAR 1979 SOURCES	YEAR 1979 USES	YEAR 1980 SOURCES	YEAR 1980 USES	YEAR 1981 SOURCES	YEAR 1981 USES	YEAR 1982 SOURCES	YEAR 1982 USES	YEAR 1983 SOURCES	YEAR 1983 USES	YEAR 1984 SOURCES	YEAR 1984 USES
CORRIDOR & LOCAL FREIGHT CONTRIBUTION							9.3		9.3		9.3	
INTERCORRIDOR AMTRAK CONTRIBUTION							1.9		1.9		1.9	
FOOD AND LIQUOR REVENUE												
PRIMARY REVENUE							194.9		230.4		254.7	
TOTAL REVENUE							206.1		241.6		265.9	
EXPENSES												
STATION PERSONNEL								6.7		8.0		8.8
STATION CLEANING AND UTILITIES								1.9		1.9		1.9
BAGGAGE CARTS								0.3		0.4		0.4
TRAIN SUPPLIES AND EXPENSES								6.5		7.[illegible]		8.5
FOOD AND LIQUOR COST												
SNACK BAR ATTENDANTS								2.8		3.3		3.6
TICKET AGENCY COMMISSIONS								3.9		4.6		5.1
RESERVATIONS								15.3		18.1		20.0
PROMOTION								9.7		10.1		10.7
PASSENGER SERVICE DEPARTMENT OVERHEAD								0.3		C.3		0.3
CAR MAINTENANCE								19.1		22.6		25.0
M. OF E. DEPARTMENT OVERHEAD								1.9		2.0		2.1
ENERGY								6.6		7.8		8.6
CREW								19.0		19.0		19.0
SWITCHING								1.0		1.0		1.0
DISPATCHING								2.0		2.0		2.0
STATION MASTERS								4.7		4.7		4.7
TRANSPORTATION DEPARTMENT OVERHEAD								0.8		0.8		0.8
MAINTENANCE OF WAY AND STRUCTURES								21.6		21.6		21.6
MAINTENANCE OF CATENARY								7.3		7.3		7.3
MAINTENANCE OF COMMUNICATION AND SIGNALS								5.6		5.6		5.6
MAINTENANCE OF STATIONS, SHOPS, & YARDS								4.2		4.2		4.2
M. OF W. DEPARTMENT SUPERVISION								3.3		3.3		3.3
TRANSPORTATION DEPT INSURANCE								1.9		1.9		1.9
OPERATING EXPENSE TRANSFER												
GENERAL OVERHEAD								12.5		13.4		14.1
TOTAL OPERATING EXPENSES								159.0		171.6		180.6

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT D.5
PRO FORMAS, PAGE 3

NEC PRO FORMAS 09/09/75 NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS FOR THE COMBINED ENTITY 09:26:32

SOURCES AND USES OF CASH	YEAR 1979 SOURCES	YEAR 1979 USES	YEAR 1980 SOURCES	YEAR 1980 USES	YEAR 1981 SOURCES	YEAR 1981 USES	YEAR 1982 SOURCES	YEAR 1982 USES	YEAR 1983 SOURCES	YEAR 1983 USES	YEAR 1984 SOURCES	YEAR 1984 USES
TOTAL REVENUE							206.1		241.6		265.9	
TOTAL OPERATING EXPENSES								159.0		171.6		180.[illegible]
OPERATING INCOME							47.1		70.0		85.3	
OTHER SOURCES AND USES OF CASH												
SALE OF ROLLING STOCK												
PREPAYMENTS ON ROLLING STOCK				56.6		104.7		24.2		18.3		17.4
FINAL PAYMENTS ON ROLLING STOCK								37.8		6.9		4.6
ROLLING STOCK REBUILDING												
TOTAL FACILITIES INVESTMENT		491.6		408.0		303.5		72.1				
REAL ASSET ACQUISITION		42.9		45.9		49.1		52.5				
CASH NEED INCREASE								4.8		0.4		0.3
RECEIVABLES INCREASE								5.8		1.1		0.7
INVENTORY INCREASE								6.8		0.4		0.2
NET CASH FLOW	-534.5		-510.5		-457.3		-156.8		43.0		62.0	
NEW SHORT TERM DEBT												
NEW LONG TERM DEBT	491.6		408.0		303.5		72.1					
NEW LONG TERM DEBT WITH SINKING FUND	42.9		45.9		49.1		52.5					
ROW PURCHASE BOND RETIREMENT												
SHORT-TERM DEBT RETIREMENT												
LONG-TERM DEBT RETIREMENT												1.1
LIQUIDATION OF RESERVE												
DEBT SERVICE TRANSFER												
DEBT SERVICE TRANSFERRED												
SHORT-TERM DEBT INTEREST												
LONG-TERM DEBT INTEREST												
ROW PURCHASE BOND INTEREST										56.2		56.2
SINKING FUND PAYMENT										35.6		35.6
INCOME FROM SINKING FUND (REINVESTED)										2.5		5.2
NET CASH AFTER DEBT TRANSACTIONS			-56.6		-104.7		-32.2		-48.8		-30.9	
NEW GRANTS			56.6		104.7		61.9		25.2		22.1	
LIQUIDATION OF INVESTMENTS									21.5		8.2	
INCOME FROM INVESTMENTS									2.1		0.6	
INCOME TRANSFER												
INVESTMENT OF SURPLUS								29.7				
TOTAL SOURCES OF CASH	534.5		510.5		457.3		233.7		121.3		121.4	
TOTAL USES OF CASH		534.5		510.5		457.3		233.7		121.3		121.4

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

EXHIBIT D.6
PRO FORMAS, PAGE 4

NEC IMPROVEMENT PROGRAM --- FINANCIAL PROJECTIONS
FOR THE COMBINED ENTITY

NEC PRO FORMAS 07/09/75 09:26:32

	YEAR 1979	YEAR 1980	YEAR 1981	YEAR 1982	YEAR 1983	YEAR 1984
INCOME ACCOUNT						
OPERATING INCOME				47.1	70.0	85.3
SALE OF ROLLING STOCK						
INCOME FROM INVESTMENTS					2.1	0.6
INCOME FROM SINKING FUND (REINVESTED)					2.5	5.2
INTEREST EXPENSE					56.2	56.2
ROLLING STOCK DEPRECIATION				13.5	15.9	17.6
NET INCOME				33.6	2.5	17.3
GENERAL BALANCE SHEETS						
ASSETS						
CASH				4.8	5.1	5.4
OTHER RECEIVABLES				5.8	6.9	7.6
PREPAYMENTS		56.6	161.4	34.5	25.3	24.2
MATERIAL AND SUPPLIES				6.8	7.1	7.4
INVESTMENTS				29.7	8.2	
SINKING FUND RESERVE					38.1	78.9
ROLLING STOCK AT COST				188.8	223.2	246.4
LESS ACCUMULATED DEPRECIATION				13.5	29.4	47.0
ROLLING STOCK BOOK VALUE				175.3	193.8	199.4
IMPROVEMENTS	1,297.2	1,705.2	2,008.7	2,080.8	2,080.8	2,080.8
REAL ASSETS	655.4	701.3	750.4	802.9	802.9	802.9
TOTAL ASSETS	1,952.6	2,463.1	2,920.4	3,140.6	3,168.3	3,206.5
LIABILITIES						
SHORT TERM DEBT						
LONG TERM DEBT	1,297.2	1,705.2	2,008.7	2,080.8	2,080.8	2,079.7
ROW PURCHASE BOND	655.4	701.3	750.4	802.9	802.9	802.9
EQUITY ACCOUNTS						
TOTAL GRANTS		56.6	161.4	223.3	248.5	270.6
RETAINED EARNINGS				33.6	36.1	53.3
TOTAL LIABILITIES	1,952.6	2,463.1	2,920.4	3,140.6	3,168.3	3,206.5
WORKING CAPITAL				47.1	27.4	20.4
TRANSFER PAYMENTS						

This illustration has been prepared on the basis of information and assumptions set forth in Appendix A. The achievement of any financial projection, however, is dependent on the occurrence of future events which cannot be assured. Therefore, the actual results may vary from the projection. This illustration is solely for FRA internal use. It is not intended for use in any prospectus or in any other manner to encourage or induce any form of external financing.

Cash Flow Summary
Pages 1 and 2

Name of Entity appears above the column in which the name of each entity for which projections are made is listed. Net Cash Flows for each year are listed on the same line as the entity's name. A negative cash flow indicates that operations during that year required external financing, while a positive cash flow indicates that operations produced excess cash.

Project Manager Expenditures in each year are subtracted from the sum of the cash flows for the operating entity(ies) in that year to produce the "Total Project" cash flow.

Total Project cash flows are then discounted to produce the total project ROI and net present value figures on the preceding page of the projections.

The Terminal Value is a substitute for the value of the project remaining after the last year of the projection. Although it does not appear in the printout as such, the terminal value figure is implicit in certain figures, depending on which of the program options is selected. There are two ways to calculate terminal value:

- add the book value of assets less investments into the cash flow in the last year of the projection; or
- extrapolate an infinite stream of cash flows equal to that calculated for the last year of the projection.

In the former case, the net cash flow for the last year of the projection includes both the cash generated by the project and the book value of all assets except investments. In the latter case, the amount added to the net present value as a terminal value can be calculated from the formula for summing an infinite geometric series:

$$\text{net present value of terminal value} = \frac{\text{net cash flow in last year}}{\text{discount rate}} \times (1 + \text{discount rate})^{-(\text{years projected})}$$

Although the former is the more conservative measure of terminal value whenever the earning power of the railroad exceeds the book value of its assets, the latter case is better able to differentiate among assumptions that vary the income level rather than the investment level for the project.

Pro Formas,
Page 1,
Operating and Investment Statistics

Passenger Trips is the number of revenue passengers carried each year. A number must be specified for each year as an input to the program.

Passenger-Miles is the total number of miles traveled by revenue passengers on the railroad each year. This number must be specified for each year as an input to the program.

Car-Miles is the total number of miles traveled by passenger cars during the year and includes both revenue miles and deadheading. It is calculated by dividing passenger-miles by seats per car and then taking the result and dividing it by the load factor. The average number of seats per car allows for the seats displaced by a snack-bar:

$$\text{car-miles} = \frac{\text{passenger-miles}}{\text{seats per car} - \frac{\text{seats per snack bar}}{\text{cars per snack bar}}} \div \text{load factor}$$

Train-Miles is the sum of the number of miles traveled by each train (i.e., the number of car-miles divided by the average number of cars per train). The program accepts figures for train-miles in 1982, 1990, and 2011. It interpolates linearly between these figures. For the analysis which supports the figures used in the baseline run for train-miles, see Appendix C. The justification for the method of interpolation is to be found in Appendix C as well.

Facilities Investment items are specified as model inputs for each year. They consist of service facilities, track upgrading and structural development, long lead materials, fencing, land acquisition for track realignment, system test, bridge and tunnel upgrading, electrification, signaling control, stations, and freight facilities.

Total Facilities Investment is the sum of the accounts under facilities investment (service facilities through freight facilities).

Pro Formas,
Page 2,
Operating Income Accounts

Commuter and Local Freight Contribution is the amount transferred from suburban commuter and local freight services to CorridorRail as an allocation of maintenance of way and structures (M of W&S) and dispatching costs. The program requires a percentage to be allocated to commuter and local freight services for dispatching and for M of W&S. The dispatching percentage is multiplied by the dispatching cost and then by the departmental and general overhead rates. The M of W&S percentage is multiplied by the total M of W&S cost (including supervision) and then by the general overhead rate. These products are summed to calculate the total contribution of commuter and local freight services.

Where:

M = M of W&S cost
D = dispatching cost
m = M of W&S share
d = dispatching share
t = transportation overhead burden rate
g = general overhead burden rate

then

the contribution equals

$$[m \times M + d \times D \times (1 + t)] \times (1+g)$$

Inter-Corridor Amtrak Contribution is the portion of costs allocated to intercity passenger traffic which is not included in CorridorRail (e.g., trains from New York to Miami). It is calculated in a manner similar to the preceding account. See Appendix B for the details of the calculation of the four percentages used in these allocations in the baseline case.

Food and Liquor Revenue is the revenue from on-board food and liquor sales, calculated as a product of passenger-miles and a consumption rate.

Primary Revenue is the baseline case, passenger fare revenue as specified for each year in the program input data. It may be calculated differently in other cases; for example, in the separate owner/operator case (Appendix G) the owner's primary revenue is the operating cost subsidy it receives from the operator, commuter services, local freight services, and inter-corridor passenger services.

Total Revenue is the sum of the last four accounts.

Expenses

The cost methodology used in projecting operating costs for CorridorRail is fully described in Appendix B. The programming for the operating expenses is intended to accommodate the figures produced by this methodology.

Station Personnel is the cost of all personnel other than station masters, employed in the stations (e.g., ticket sellers). The cost figure is calculated by multiplyng the cost per passenger by the number of passenger trips.

Station Cleaning and Utilities is a fixed annual cost which covers heating, lighting, contracted cleaning, and supplies not included in overhead.

Baggage Carts is the cost of stocking, maintaining, and repositioning fleets of baggage carts used by passengers. It is estimated as a cost per passenger.

Train Supplies and Expenses consist of the cost of heating and lighting the cars in the station, cleaning the cars, and purchasing the miscellaneous supplies used on board. It is estimated as a cost per car-mile.

Food and Liquor Cost is the cost of purchasing food and liquor and the cost of getting it on board (i.e., the cost of a commissary). The figures are calculated as a percentage of Food and Liquor Revenue.

Snack Bar Attendants is the wages of the attendants who staff on-board snack bars. The figure is calculated as a cost per snack-car-mile. The number of snack-car-miles is calculated by dividing car-miles by cars per snack-bar.

Ticket Agency Commissions is the figure for commissions paid for off-line ticket sales and is calculated as a percentage of passenger revenue. This percentage is the product of the commission rate and the percentage of revenue from off-line sales.

Reservations is the figure for the wages of the employees in the central reservations bureaus, the communications costs, the cost of automated reservations and ticketing services, and a share of the amortization of central computing services (both hardware and software). It is calculated as a cost per passenger.

Promotion is the marketing and promotional expenses other than ticketing and travel agency commissions. It is calculated as a percentage of the five-year running average of passenger fare revenue.

Passenger Service Department Overhead is the passenger services burden rate applied to the running average of Station Personnel and Snack Bar Attendants.

Car Maintenance is wages, fringe benefits, and parts. It is calculated as a cost per car-mile.

Maintenance of Equipment Department Overhead is the figure obtained when the maintenance of equipment (M of E) burden rate is applied to car maintenance.

Energy is the expense of propulsive energy and is calculated as a cost per car-mile.

Crew contains the cost of train crews including engineers, trainmen, and conductors, but does not include snack-car attendants. It is calculated as the sum of the products of four pairs of input data: each pair consists of the crew cost per train-mile and the percentage of total train-miles run with three-man, four-man, five-man, or six-man crews.

Switching is the cost of moving cars within the yards to assemble trains and to adjust consists. Primarily, it is the cost of switching crews. It is a fixed annual cost.

Dispatching is the cost of operating the Central Control System (CCS), which dispatches trains for all users of the corridor. It is a fixed annual cost.

Station Masters is the cost of station masters, gatemen, and information services. It is expensed as a fixed annual cost.

Transportation Department Overhead is the five-year running averages of Energy, Crew, Switching, Dispatching, and Station Masters, multiplied by the transportation burden rate.

Maintenance of Way and Structures is the normalized maintenance of the roadbed, including bridges, tunnels, interlockings, and other structures not elsewhere included. It is a fixed annual cost.

Maintenance of Catenary is the cost of maintaining the power supply system and is a fixed annual cost for normalized maintenance.

Maintenance of Communication and Signals is the cost of maintaining CCS. It is a fixed annual cost.

Maintenance of Stations, Shops, and Yards is primarily the maintenance of buildings. It is a fixed annual cost.

Maintenance of Way Department Supervision is the cost of administering the maintenance of way and structures department. It is a fixed annual cost.

Transportation Department Liability represents insurance and liability expense normally found in the transportation accounts. It is calculated as a percentage of train crew costs. Certain other liability expenses are included in the overhead.

Operating Expense Transfer is the operating cost reimbursement transferred from the second organization (e.g., an operator) to the first organization (e.g., an owner). It is calculated as the sum of the first organization's maintenance of way, dispatching, and switching costs, plus the appropriate overheads (both departmental and general). If the first organization does not incur one or more of these costs, it is simply omitted from the calculation. In the separate owner/operator projections which are reproduced in Appendix G, the operator totally reimburses the owner's operating costs. The operator, who has received a percentage of these costs from the other users of the track, passes the receipts on to the owner. The remainder of the owner's cost reimbursement is the operator's own contribution.

General Overhead is the general overhead burden multiplied by the sum of all other operating expenses, including any transfers and departmental overheads.

Total Operating Expenses is the sum of all accounts under the heading "Expenses." (Station Personnel through General Overhead.)

Pro Formas,
Page 3,
Sources and Uses of Cash

Total Revenue is taken from page 2 of the pro formas.

Total Operating Expenses is taken from page 2 of the pro formas.

Operating Income is the difference between Total Revenue and Total Operating Expenses.

Other Sources and Uses of Cash

Sale of Rolling Stock is the receipts from the sale of salvageable rolling stock. It is calculated as the percent of cost salvaged times the total cost of cars delivered one total car-life before the current year. See the discussion of "Rolling Stock Accounts" in Section III for a fuller explanation of car lives, rehabilitation, and salvage.

Prepayments on Rolling Stock is the advance payments on car purchases and is calculated as:

(percent paid one year before delivery) x (cost of next year's delivery) + (percent paid two years before delivery) x (cost of deliveries two years hence)

Final Payments on Rolling Stock is the residual percentage of the cost of rolling stock delivered in the current year.

Rolling Stock Rebuilding is the cost of the one-time rehabilitation of rolling stock. It is calculated as the percent of cost to rebuild cars multiplied by the total cost of cars delivered in the year indicated by the input called "year in which cars are rebuilt".

Total Facilities Investment is taken from page 1 of the pro formas.

Real Asset Acquisition is the cost of acquiring the ROW. The calculation of this cost varies from year to year:

- The total purchase price is expended in the first year of the projection.

- The interest expense is added in the first year of the projection and in all years through the first year of high-speed operations. This capitalization of interest expense stops after the first year of operations, when cash from operations is available.

. There is no real asset acquisition after the first year of high-speed operations.

Cash Need Increase is the cash account maintained at a minimum level based on a percentage of total operating expenses. The cash need increase is the previous year's cash balance subtracted from the current year's cash balance.

Receivables Increase is the account that reflects the annual change in unpaid receivables (i.e., fares charged to credit cards or commercial accounts). As total revenue increases, funds must be supplied to increase the amount of this credit extended. The receivables are maintained at a percentage of passenger revenue, and the increase is obtained by subtracting the previous year's balance from the current year's receivables balance.

Inventory Increase is the account that reflects fluctuations in inventories. The only significant inventories are those of materials and supplies used in the maintenance functions. The current year's materials and supplies are calculated as a percentage of the maintenance costs (of equipment and of way). The increase is the previous year's balance subtracted from the current year's need.

Net Cash Flow is the operating income plus sale of rolling stock less the uses of cash above (rolling stock prepayments through inventory increases). The stream of net cash flows summarizes the net cash requirements (in investment years) and net cash generated (in return years) by the project. It is not affected by the method of financing, except through capitalized interest. As a surrogate for the cash flows after 2011, a terminal value may be added into the cash flow in the last year. (See the preceding discussion of Terminal Value.)

New Short-Term Debt is a line of credit drawn in periods of cash shortage. (See Cash Management Routine in Section III for the method of calculating short-term debt.)

New Long-Term Debt is set equal to Total Facilities Investment. If long-term debt were received in blocks not matched with expenditures, it is assumed that investment income would cancel the interest expense on undisbursed debt receipts.

New Long-Term Debt with Sinking Fund is set equal to real asset acquisition.

ROW Purchase Bonds Retirement is set equal to the sinking fund issue outstanding in the year of retirement only. The year of retirement is the term of sinking fund added to the first year of projection.

Short-Term Debt Retirement is described in Cash Management Routine (Section III).

Long-Term Debt Retirement is described as the repayment of im- ; ovement loans as cash is available. (See the Cash Management Routine.)

Liquidation of Reserve is the account from which funds are paid to retire the bonds. In the year in which the purchase bonds are retired, the sinking fund balance from the preceding year is liquidated and made available to retire the bonds. The remaining cash need to accomplish the retirement (approximately equal to one year's payment to the reserve) is made up through the Cash Management Routine. In other words, instead of making the regular fixed payment to the sinking fund in the year of maturity, the amount necessary to retire the issue is paid.

Debt Service Transfer is the amount paid by the second organization to the first organization in order to make the sinking fund payment. It is calculated from the amount of the bond issue, the interest rate charged, and the interest rate earned on the fund in order to make the constant annual payment which will retire the bond issue upon maturity. The expression is:

$$\frac{b \times B}{(1 + r)^n - 1}$$

Where:

- b = bond interest rate,
- B = total amount of bond outstanding,
- r = interest rate earnable, and
- n = number of payments.

The number of payments is one less than the difference between the year of maturity and the year in which high-speed operations begin.

Debt Service Transferred is the receipt of the Debt Service Transfer from the second organization by the first.

Short-Term Debt Interest is calculated by multiplying the short-term debt outstanding at the end of the previous year or the current year, whichever amount is greater, by short-term debt interest rate. This forces the borrower to refrain from making unscheduled debt repayments until December 31 and to maintain an operating margin of safety by extending borrowing beyond both ends of a period of cash need. (See Cash Management Routine.)

Long-Term Debt Interest is the long-term debt interest rate multiplied by the current year's long-term debt balance before unscheduled long-term debt retirement.

ROW Purchase Bond Interest is the interest expense (charged only after the first year of high-speed operation, when capitalization ceases) of the bond issue.

Sinking Fund Payment is the annual payment into the sinking fund. It is calculated in the same way as the Debt Service Transfer account.

Income from Sinking Fund is the interest earned on the sinking fund. Because debt transactions, including payment to the sinking fund, are made on January 1, interest is earned on the current year's payment. The interest is automatically reinvested by the fund and is, therefore, added into both sources and uses of cash.

Net Cash After Debt Transactions is the stream of flows which summarizes the total need for (or potential return to) equity financing. The calculation of an internal rate of return on this stream would provide a yield or return on equity figure.

New Grants reflects the equity receipts set equal to rolling stock purchase payments (both prepayments and final installments) plus income-sharing receipts.

Liquidation of Investments reflects the decrease in short-term investments (not including the sinking fund reserve). It is the first place turned to in a time of cash need. (See Cash Management Routine in Section III.)

Income from Investments is the interest rate earnable multiplied by the previous year's short-term investments balance.

Income Transfer is the income-sharing percentage multiplied by net income, if a positive income obtains.

Investment of Surplus is described under Cash Management Routine in Section III.

Total Sources of Cash is the sum of all cash sources including operating income.

Total Uses of Cash is the sum of uses. This account should balance the total sources.

Pro Formas,
Page 4,
Income Statement

Operating Income is copied from page 3 of the pro formas.

Sale of Rolling Stock is the amount of profit (receipts less book value) recognized when cars are sold for salvage. Because the cars are fully depreciated when sold, the profit equals the Rolling Stock Sales figure from page 3 of the pro formas.

Income from Investments is copied from page 3 of the pro formas.

Income from Sinking Fund is copied from page 3 of the pro formas.

Interest Expense is the sum of all debt interest expense.

Rolling Stock Depreciation is the depreciation of rolling stock when no rebuilding is to be done. (See Section III, under the heading "Rolling Stock Accounts".) Rebuilding is paid for with cash from operations (i.e., no grants are provided for rebuilding). The rebuilding expense is capitalized by adding it into the Rolling Stock at Cost account, and is depreciated using straight-line depreciation over a period equal to the difference between the inputs for Car Life if Not Rebuilt and the Total Car Life. This depreciation is added into the Rolling Stock Depreciation account and thereby also into the Accumulated Depreciation account. When the car is sold for salvage, the original cost of rebuilding is subtracted from the Rolling Stock at Cost account and from the Accumulated Depreciation account.

Net Income is the operations income plus sales of rolling stock plus investment income less interest less depreciation.

Pro Formas,
Page 4,
Balance Sheet

Cash is a percentage of the current year's operating expenses.

Other Receivables is the amount of credit extended to passengers. It is calculated as a percentage of passenger revenue.

Prepayments is the prepaid rolling stock account and is calculated as the previous year's prepayments balance plus this year's prepayments less this year's deliveries x (total percent prepaid).

Materials and Supplies is maintained at a percentage of the direct maintenance and maintenance department overhead costs.

Investments is used to absorb excess cash and as a source of cash when operations require cash. Although it generates income, this income is not produced by operations and therefore is not included in the cash stream used for ROI. The investment income is available as a future source of cash, thus somewhat reducing the total cost of capital.

Sinking Fund is the fund set up to ensure repayment of the ROW bond. The balance includes compound interest earned plus this year's payment less liquidation plus previous year's balance.

Rolling Stock at Cost is rolling stock after sales and purchase, plus rehabilitation, valued at cost.

Accumulated Depreciation is the accumulated depreciation of the rolling stock.

Rolling Stock Book Value is the rolling stock at cost less accumulated depreciation.

Improvements is the cumulative total of the investment of fixed facilities.

Real Assets is the cumulative total of the cost of purchasing the ROW, including interest capitalized.

Total Assets is the sum of the accounts (except Rolling Stock Book Value) listed under the heading "Assets" (Cash through Real Assets).

Short-Term Debt is the previous year's short-term debt plus new short-term debt less repayment of short-term debt.

Long-Term Debt is the previous year's long-term debt plus new long-term debt less repayment of long-term debt.

ROW Purchase Bond is the amount of the ROW purchase bond issue outstanding.

Total Grants is the cumulative sum of grants received from New Grants.

Retained Earnings is the cumulative sum of Net Income.

Total Liabilities is the sum of the accounts listed under the headings "Equity" and "Liabilities" (Short-Term Debt through Retained Earnings).

Working Capital is calculated as:

cash + receivables + prepayments + materials
and supplies + investments - short-term debt

Pro Formas,
Page 4,
Transfer Payments

Each of the transfer payments (debt service transfer, expenses transfer, and income-sharing payment) is repeated at this point if it is applicable.

Total Transfer Payments is the total amount transferred by the organization and is equal to:

expense transfer + debt service
transfer + income-sharing payment