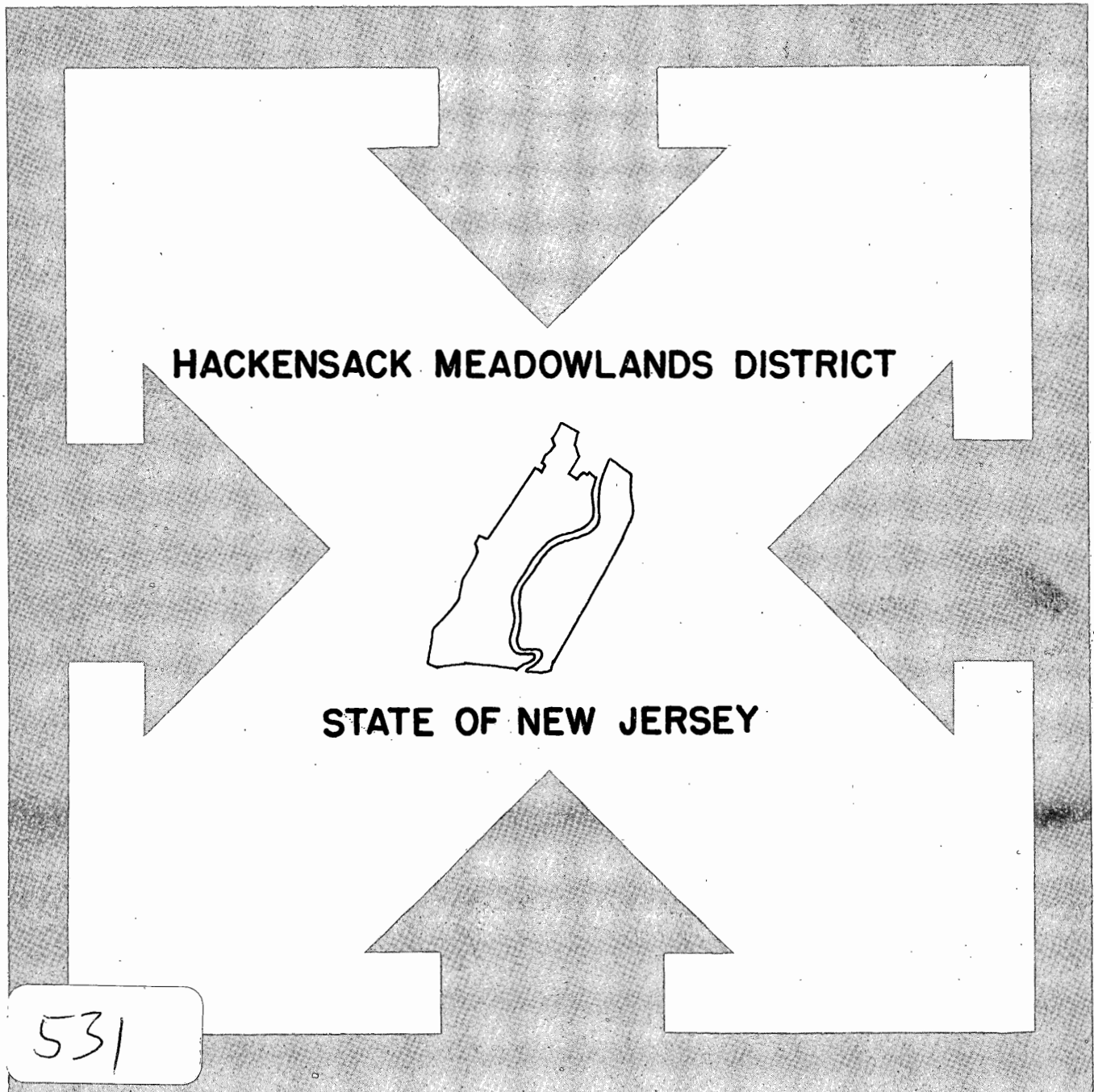


The Hackensack Meadowlands Transportation Study



Prepared by: THE HACKENSACK MEADOWLANDS DEVELOPMENT COMMISSION and
THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

HACKENSACK MEADOWLANDS
TRANSPORTATION STUDY

PROJECT Nos, IT-09-0037

IT-09-0014/34/PL-1

PREPARED BY: THE HACKENSACK MEADOWLANDS DEVELOPMENT COMMISSION AND
THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

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DECEMBER 1978

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>	<u>Chapter</u>	<u>Title</u>	<u>Page</u>
	Introduction		V	Travel Characteristics of Meadowlands Workers	
I	Executive Summary			Need for Survey	V-1
II	Study Objectives			Description of Study Zones	V-4
	The Review Process	II-1		Employee Survey Results	V-5
	Ranking of Objectives	II-2		Origin of Journey to Work Trips	V-5
III	Background and History			Modal Choice	V-6
	History of Transportation in the Meadowlands	III-1		Travel Times	V-7
	Early Development			Work Start Times	V-7
	Planning Efforts	III-6		Travel Costs	V-8
	Meadowlands Regional Planning Board	III-8		Labor Force Composition	V-9
	Meadowlands Regional Development Agency	III-11		Satisfaction with Trips	V-9
	Hackensack Meadowlands Development Commission	III-13		Implications of Survey Results	V-10
IV	Existing Transportation System			Employer Survey Results	V-11
	Highway Facilities	IV-1	VI	Existing and Future Demand	
	Regional Routes	IV-1		Forecast Years	VI-1
	Feeder Routes	IV-2		The Estimating Process	VI-2
	Internal Routes	IV-2		Types of Trips	VI-3
	Existing Traffic Volume	IV-3		Projected Land Use	VI-3
	Determination of Roadway Capacity	IV-4		Converting Land Use to Peak Hour Trips	VI-4
	Open Highways	IV-6		Work Trips by Meadowlands Residents	VI-5
	Signalized Intersections	IV-6		The Meadowlands Resident Labor Force	VI-5
	Capacity and Volumes at Key Locations	IV-7		Residents Who Work in District	VI-5
	Bus Service	IV-8		Residents Who Work in Manhattan	VI-6
	Port Authority Bus Terminal and Exclusive Bus Lane	IV-10		Residents Who Work at Other Locations	VI-7
	New Jersey Bus Studies	IV-10		Work Trips by Non-Residents	VI-7
	Park-Ride Lots	IV-11		Journey-to-Work Summary Tables	VI-9
	Rail Passenger Service	IV-12		Shopping and Recreational Trips	VI-9
	Erie Lackawanna	IV-12		Truck Traffic	VI-10
	Other Commuter Rail Systems	IV-14		Travel Through the District	VI-10
	Port Authority Trans-Hudson (PATH)	IV-15			
	Rail Freight	IV-16			

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>	<u>Chapter</u>	<u>Title</u>	<u>Page</u>
VII	Current Transportation Plans		VIII	The Proposed Networks (cont.)	
	1972 Commission Plan	VII-1		Findings From Preliminary Networks	VIII-5
	Transportation Centers - Berrys Creek Center, Secaucus, Moonachie/Teterboro, Kearny, The Sports Complex and Hartz Mountain Station	VII-2		Selected Transit Networks	VIII-6
	Direct Rail Access Project	VII-5		Bus Network	VIII-6
	Rail Equipment	VII-6		Rail Network	VIII-8
	Bus Service	VII-7		PRT Network	VIII-9
	Intra-Meadows Transportation	VII-7		Busway-Van Pool Network	VIII-14
	Highway Improvements	VII-7		Other Transit Modes and Networks Considered	VIII-16
	Major Feeder Routes - I-280, N.J. Route 17, U.S. Route 1&9 and N.J. Turnpike	VII-7		Travel Times	VIII-18
	Local Routes - Moonachie Ave., Red Neck Avenue Extension, County Road, Washington Avenue, New County Road, Schuyler Avenue - Orient Way (Bergen Co.), Schuyler Avenue (Hudson Co.), Meadowland Parkway and Westside Avenue	VII-9		Low Capital Proposals	VIII-18
	Major Bypass Routes - N.J. Route 4 and N.J. Route 21 Freeway	VII-11	IX	Evaluation of Networks	
	Local Service Streets	VII-11		Modal Split	IX-2
	Truck Movements	VII-12		Historical Method	IX-2
	Bike & Moped Routes	VII-12		Regional Plan Association Method	IX-3
	Low Capital Intensive Programs	VII-12		Residual Method	IX-4
				Selected Method	IX-5
				Traffic Assignment	IX-5
				The Highway Needs	IX-7
				All-Highway Network	IX-7
				All-Highway Evaluation	IX-9
				Highway Needs with Transit	IX-10
				Highway Needs with Transit Evaluation	IX-11
				Bus Network	IX-12
				Modal Split and Assignment	IX-12
				Capital Needs	IX-13
				Operating Costs and Revenues	IX-14
				Implementation and Financing	IX-15
				Evaluation	IX-16
				Rail Network	IX-16
				Modal Split and Assignment	IX-17
				Capital Needs	IX-17
				Operating Costs and Revenues	IX-20
				Implementation and Financing	IX-21
				Evaluation	IX-22
VIII	The Proposed Networks				
	Background	VIII-1			
	Highway Alternatives	VIII-2			
	Initial Transit Networks	VIII-3			
	Preliminary Bus Network	VIII-4			
	Preliminary Rail Network	VIII-4			
	Preliminary Automated Guideway Network	VIII-4			

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>	<u>Chapter</u>	<u>Title</u>	<u>Page</u>
IX	Evaluation of Networks (cont.)		X	Environmental Analysis, Parks and Recreation, and Bikeways (cont.)	
	PRT Network	IX-24		Regional Analysis of Air Quality in the Hackensack Meadowlands District	X-31
	Modal Split and Ass- ignment	IX-24		Budget Analysis of Existing Conditions and Transit Alter- natives	X-34
	Capital Needs	IX-24		Existing Conditions	X-36
	Operating Costs and Revenues	IX-26		All Highway Network	X-37
	Implementation and Evaluations	IX-26		Bus Network	X-38
	Busway/VanPool Network	IX-27		Rail Network	X-39
	Modal Split and Ass- ignment	IX-28		PRT Network	X-41
	Capital Needs	IX-28		Busway/Van Pool Network	X-41
	Operating Costs and Revenues	IX-29		Microscale Analy- sis of Existing Conditions and Proposed Networks	X-42
	Implementation and Financing	IX-30		Air Quality Sum- mary	X-45
	Evaluation	IX-31		Parks and Recreation: Transportation Needs	X-47
	Internal Highway and Road Network	IX-31		Transportation Im- pacts on Parks	X-47
	N.J. Route 3	IX-31		General Description of Major Parks and Recreation Areas	X-49
	Other Internal Roads	IX-33		Berrys Creek Tidal Marsh and Environ- mental Education Center	X-50
X	Environmental Analysis, Parks and Recreation, and Bikeways			Losen Slote State Park	X-51
	Environmental Analysis: Reciprocal Relationships Between Land Use Planning and Transportation/Transit Planning	X-1		R. W. DeKorte State Park	X-51
	Perspective	X-1		Transportation Demand	X-53
	Land Use, Transportation and Environmental Exper- ience in the Hackensack Meadowlands - 1972-1978	X-1		Transportation Plan- ning for Parks, High- ways and Roads	X-55
	Similarities to Transporta- tion Components in the 1972 Master Plan	X-3		Public Transit	X-56
	Regional Carrying Capa- city	X-10		Bikeways	X-59
	Primary Impacts	X-14		The Bicycle as an Alternative Means of Transportation	X-59
	The Region	X-17			
	Air Quality Assessment	X-24			
	Environmental Setting	X-25			
	Previous Land Use/Air Quality Planning in the Hackensack Meadowlands	X-26			
	Air Quality Monitoring Data	X-27			

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>	<u>Chapter</u>	<u>Title</u>	<u>Page</u>
X	Environmental Analysis, Parks and Recreation, and Bikeways (cont.)		XI	Financing (cont.)	
	Bikeway Definitions	X-60		Major Private Land Developers	XI-11
	Bikeway Demand	X-61		Private/Government Funding	XI-11
	Demand Projections for the Hackensack Meadowlands	X-63		Monitoring, Management and Timing	XI-13
	Geography and Land Use	X-66		Monitoring	XI-13
	Climate and Environmental Conditions	X-67		Managing the Demand	XI-14
	Obstacles and Corridors	X-67		Timing	XI-14
	Intermodal Integration and Ancillary Facilities	X-69		Capital Cost Calculations	XI-15
	Legal and Institutional Costs	X-70		Loans Vs. Grants	XI-15
	Conclusions and Recommendations	X-70	XII	Meeting 1985 Needs - A Recommended Action Program	
	Summary and Recommendations	X-73		Meeting 1985 Needs	XII-1
XI	Financing			Highway Needs	XII-2
	Current Capital Funding Process	XI-3		Route 3	XII-2
	The Transportation Improvement Program	XI-3		Route 1 & 9	XII-3
	UMTA and FHWA	XI-4		Lincoln Tunnel	XII-4
	New Jersey Department of Transportation	XI-5		Other Locations	XII-4
	Local Government	XI-6		1985 Transit Facilities	XII-4
	Tri-State Regional Planning Commission	XI-6		Bikeway Needs	XII-5
	The Planning Process and Funding	XI-6		An Action Program	XII-6
	Future Sources of Capital Funds	XI-7		Planning for Capital Construction	XII-6
	UMTA, FHWA and NJDOT	XI-7		Operational Planning	XII-9
	Bergen and Hudson Counties and the Municipalities	XI-8		a) Bus Route Planning	XII-10
	The Port Authority of New York and New Jersey	XI-9		b) Priority Lanes	XII-11
	Hackensack Meadowlands Development Commission	XI-9		c) Staggered Work Hours	XII-12
				d) Car and Van Pools	XII-16
				e) Other Para-Transit Options	XII-19
				f) Peripheral Parking Lots	XII-20
				g) Differential Pricing and Limiting Parking Space	XII-21
				h) Recreational Planning	XII-21
				A Transportation Planning Group	XII-23

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
XII	Meeting 1985 Needs - A Recommended Action Program (cont.)	
	Institutional and Financial Considerations	XII-23
	Staff Requirements	XII-25
	Monitoring Development and Transportation Needs	XII-30

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

List of Tables

<u>Table Number</u>	<u>Title</u>	<u>Follows Page</u>
I-1	Economic Summary of Transit Alternatives	On Page I-12
II-1	Ranking of Objectives	II-2
IV-1	Capacity and Volume at Key Locations (1976)	IV-7
IV-2	Bus Routes Serving District	IV-9
IV-3	Existing ConRail Commuter Operations	IV-12
IV-4	Existing E-L Passenger Demand By Line	IV-14
V-1	Mode Used for Journey To Work	V-6
V-2	Average Daily Travel Costs	V-8
V-3	Labor Force Composition	V-9
V-4	Satisfaction With Trip	V-9
VI-1	Land Uses By Sub Areas of Meadowlands	VI-4
VI-2	Work Trip Generation Rates	VI-4
VI-3	Peak Hour Journey To Work Trips By Meadowlands Employees	VI-4
VI-4	Workers Per Household	VI-4
VI-5	Work Trips to The Same and Adjacent Towns	VI-6
VI-6	Work Trips to The Same County	VI-6
VI-7	Work Trips to Manhattan	VI-6
VI-8	Estimated Peak Hour Work Trips in 1975	VI-9
VI-9	Estimated Peak Hour Work Trips in 1985	VI-9
VI-10	Estimated Peak Hour Work Trips in 2000	VI-9
IX-1	Economic Summary of Alternatives	IX-1
IX-2	Travel Time Summary	IX-1
IX-3	Methods of Estimating Transit Use	IX-2
IX-4	Non-Residential Density - Full Development	IX-3
IX-5	Estimated Peak Hour Transit Ridership	IX-5
IX-6	Vehicles in Excess of Roadway Capacity	IX-7
IX-7	Capital Costs - Highway Network	IX-9
IX-8	Peak Hour Demand - Bus Network	IX-13
IX-9	Capital Costs - Bus Network	IX-13
IX-10	Economics - Bus Network	IX-14
IX-11	Peak Hour Demand - Rail Network	IX-17
IX-12	Capital Costs - Rail Network	IX-17
IX-13	Economics - Rail Network	IX-20
IX-14	Peak Hour Demand - PRT Network	IX-24
IX-15	Capital Costs - PRT Network	IX-24
IX-16	Economics - PRT Network	IX-26
IX-17	Peak Hour Demand - Busway/Van Pool Network	IX-28
IX-18	Capital Costs - Busway/Van Pool Network	IX-28
IX-19	Economics - Busway/Van Pool Network	IX-29
X-1	Site #1 Air Monitoring Data (PPM)	X-30
X-2	Site #2 Air Monitoring Data (PPM)	X-30
X-3	Site #3 Air Monitoring Data (PPM)	X-30
X-4	Site #4 Air Monitoring Data (PPM)	X-30
X-5	Site #5 Air Monitoring Data (PPM)	X-30

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

List of Tables

<u>Table Number</u>	<u>Title</u>	<u>Follows Page</u>
X-6	Wind Rose Data For Site #3	X-31
X-7	1976 Regional CO and HC Budget	X-36
X-8	All Highway Network CO and HC Budget Breakdown by Roadway	X-37
X-9	Proposed Networks and 1976 HC and CO Budgets	X-40
X-10	Microscale Carbon Monoxide Analyses	X-44
X-11	Total CO and HC Budgets (Tons/Year)	X-45
X-12	Vehicle Trips Generated by the Losen State and R.W. DeKorte State Parks and the Environmental Education Center	X-53
XI-1	Hudson and Bergen Counties' Transportation Improve- ment Programs for the Hackensack Meadowlands District	XI-8
XII-1	Vehicles in Excess of Roadway Capacity (1985)	XII-2
XII-2	Peak Hour Demand Transit (1985)	XII-5
XII-3	Employment Density (Full Development)	XII-7

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

List of Figures

<u>Figure Number</u>	<u>Title</u>	<u>Follows Page</u>
I-1	Location in Region	a
I-2	Projected Land Uses	I-6
IV-1	Regional Highways	IV-1
IV-2	Vehicle Counting Locations on Key Feeder Routes	IV-4
IV-3	Vehicle Counting Locations on Key Routes Within District	IV-4
IV-4	Bus Routes	IV-9
IV-5	Existing Commuter Rail Routes	IV-12
V-1	Locations of Participating Firms	V-4
V-2	Job Classifications	V-4
V-3	Study Zones Within Meadowlands	V-4
V-4	Study Zones Outside Meadowlands	V-4
V-5	Origins of Journey to Work Trips	V-5
V-6	Average Travel Times	V-7
V-7	Work Start Times	V-7
VI-1	Originating Zones, 71,909 Non-Resident Work Trips (Year 2000)	VI-9
VII-1	Transportation Centers and Other Current Rail Proposals	VII-1
VII-2	Current Highway Proposals	VII-7
VIII-1	Preliminary Bus Network	VIII-4
VIII-2	Preliminary Rail Network	VIII-4
VIII-3	Preliminary Automated Guideway Network	VIII-5
VIII-4	Bus Network	VIII-6
VIII-5	Rail Network	VIII-8
VIII-6	PRT Network	VIII-10
VIII-7	Busway - Van Pool Network	VIII-14
IX-1	Critical Locations on Feeder Highways	IX-7
IX-2	Highway Network Volumes	IX-10
IX-3	Bus Network Link Volumes	IX-13
IX-4	Rail Network Link Volumes	IX-19
IX-5	PRT Network Link Volumes	IX-24
IX-6	Busway - Van Pool Network Link Volumes	IX-28
IX-7	Internal Roads	IX-34
X-1	Existing Developed Areas and Preserved Open Space (1972-1978)	X-7
X-2	Impact of Place of Residence on Journey-To-Work Trips	X-19
X-3	Air Quality Monitoring Sites	X-27
X-4	Hourly Averages of Air Monitoring	X-30
X-5	Typical AQUIP Plot	X-33
X-6	Major Parks and Recreation Areas	X-49
X-7	Approximate Prime Feeder Area	X-51

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

List of Figures

<u>Figure Number</u>	<u>Title</u>	<u>Follows Page</u>
X-8	Existing Developed Area	X-63
X-9	Origins of Journey-To-Work Trips	X-63
X-10	Existing Journey-To-Work Trips (1,000-4,500 Trips/Day)	X-64
X-11	Existing Journey-To-Work Trips (300-1,000 Trips/Day)	X-64
X-12	Full Development Journey-To-Work Trips - External (4,500-10,000 Trips/Day)	X-64
X-13	Full Development Journey-To-Work Trips - External (1,000-4,500 Trips/Day)	X-64
X-14	Full Development Journey-To-Work Trips - External (300-1,000 Trips/Day)	X-64
X-15	Full Development Journey-To-Work Trips- Internal (1,000-4,500 Trips/Day)	X-64
X-16	Full Development Journey-To-Work Trips- Internal (300-1,000 Trips/Day)	X-64
X-17	Potential Bikeway Corridors	X-68

INTRODUCTION

In 1968, the New Jersey Legislature created the Hackensack Meadowlands Development Commission. The Commission is concerned with zoning regulations and land use in the 19,730 acre district. In 1972, the Commission adopted zoning regulations and an official zoning map. The District includes 14 municipalities in Bergen and Hudson Counties, and is slightly larger than Manhattan Island (See Figure I-1). No other urban area has as large a tract of open land within its inner ring. The District now acts as a major regional gateway to New Jersey and serves as a transportation **corridor** for interurban travel in northeastern New Jersey, as well as for auto, bus and rail commuters destined for New York City. The importance of transportation in the master plan is emphasized by the following table:

	<u>Existing Uses</u>	<u>Proposed Future Uses</u>	<u>Total Acres</u>
Transportation Center	20	130	150
Teterboro Airport	650	100	750
Rail	975	25	1,000
Local Roads	70	130	200
Turnpike & Limited Access Roads	<u>950</u>	<u>1,050</u>	<u>2,000</u>
Total Transportation	2,665	1,435	4,100
All Acreage	7,140	12,460	19,600
Transportation as Percent of Total	37%	12%	21%

Under the Hackensack Meadowlands Development Act, the master plan for the Meadowlands may include provisions for "transportation, streets, parking, public transit lines and stations both above and below ground level, freight facilities, airports, harbors, channels, docks and wharves, and all other like matters."

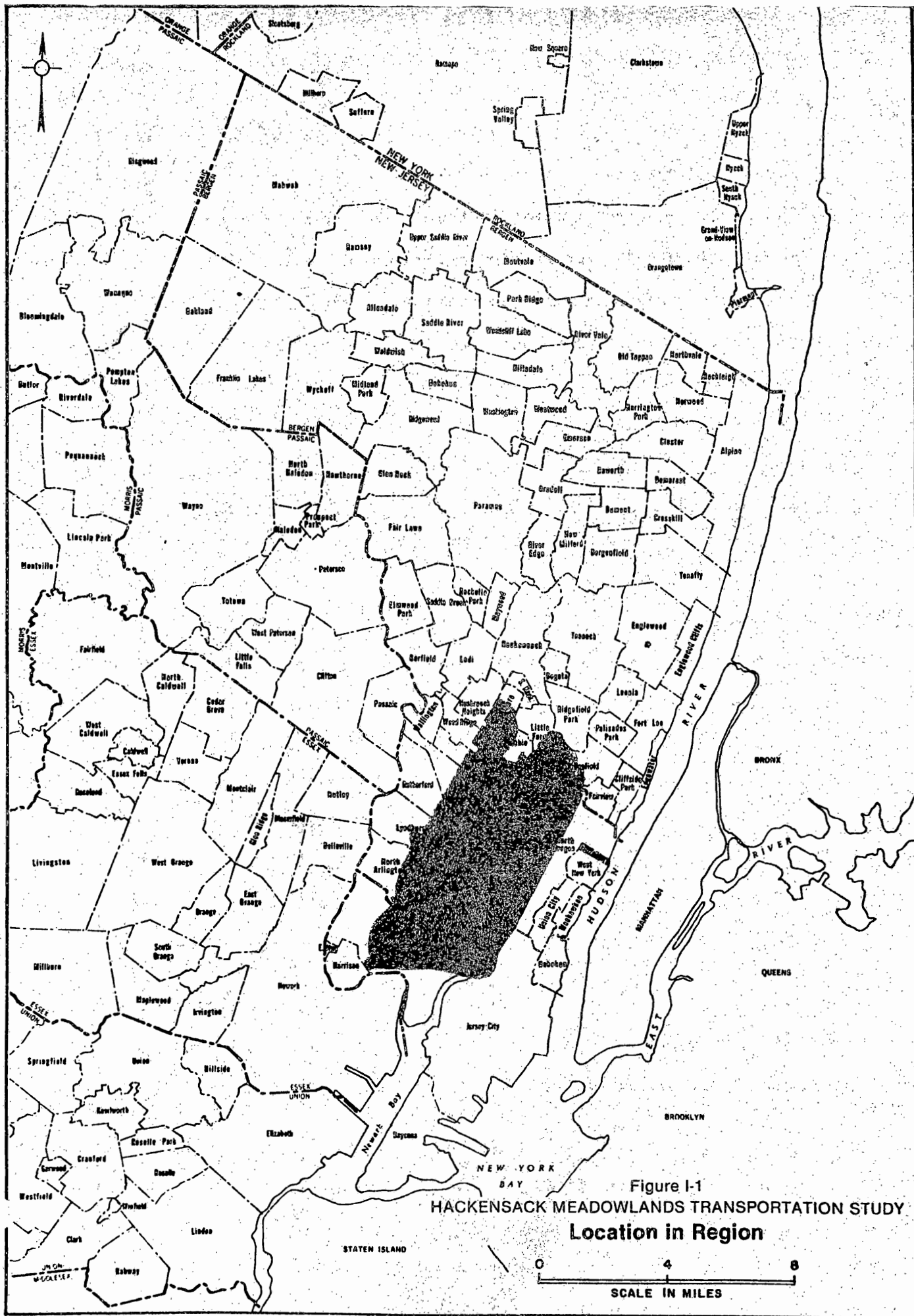


Figure I-1
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Location in Region

b.

In its 1972 master plan, the Commission, as an interim step, called for the retention of certain existing rail lines, provisions for local mass transportation in "specially planned areas" and for transportation centers. The transportation centers were to be located at Moonachie on a 35 acre site adjacent to Teterboro Airport and ConRail's Pascack Valley Line, at Kearny on a 92 acre site adjacent to ConRail, PATH, and New Jersey Turnpike and I-280, at Secaucus on a 77 acre site where ConRail's mainline, E-L Bergen County Line and P-C mainline intersect, and at Berry's Creek in East Rutherford at ConRail's Bergen County Line and a proposed major commercial, retail and residential development.

The purpose of this study is to conduct a detailed examination of the future transportation needs of the Meadowlands and recommend a comprehensive, long-term transportation program for the District. This represents a unique opportunity for integrating transportation and development. The number of employees in the district will increase from just under 50,000 in 1975 to almost 200,000 at full development. The master plan for the District represents an unparalleled opportunity to correct existing land use imbalances and to benefit the region in the process. Built well, it could afford a higher quality of life than previously possible.

It is expected that the transportation plan for the Hackensack Meadowlands will produce benefits for the rest of the region as well. For example, a direct rail connection or a transfer station at Secaucus will not only permit residents in the Meadowlands to reach Midtown Manhattan quickly by rail, but will also allow all residents of Bergen County the

c.

same excellent rail access. The construction of transportation facilities at the proposed shopping, employment and residential complexes will enable persons from District's surrounding communities who lack an automobile to reach these activity centers. The commuter transportation system designed for weekday use will be available for weekend travel to the sports complex or the park area. Finally the improvement of traffic conditions on highways feeding the Meadowlands will speed up highway travel for workers who pass through the Meadowlands by car to reach jobs elsewhere.

The forecast of ultimate development for the Meadowlands predicts that 9,400 employees will live east of the Hudson River. Another 9,000 will live in Jersey City and Bayonne. It appears that the Meadowlands offers significant employment opportunities for inner city blue collar workers. These employees represent a small portion of the work force of New York and Hudson County, but the opportunities for unskilled employment in the Meadowlands is becoming very important to them as industry leaves Manhattan and Jersey City.

Development of the Hackensack Meadowlands is consistent with the concept of centrality in this Region. In the recently released Regional Development Guide prepared by the Tri-State Regional Planning Commission, the Hackensack Meadowlands District is identified as one of six areas close to Manhattan where development should take place. To quote from this report by Tri-State in reference to the six areas where development should occur, "In an environmentally conscious time when energy is scarce, the bulk of the Region's future economic development should be directed to these central areas, and many of the Region's new jobs should be located there."

d.

PROJECT DESCRIPTION

- Task 1 - Determine what new travel data is needed for the study.
- Task 2 - Measure existing traffic volumes, travel conditions, public transportation use, and origin and destination information.
- Task 3 - Measure existing environmental conditions, including vegetation, water quality, hydrology, wildlife and air quality.
- Task 4 - Analyze and project existing travel and estimate for full development (circa 2,000 A.D.) and for 1985.
- Task 5 - Forecast HMDC master plan travel for full development and 1985.
- Task 6 - Integrate forecasts of existing and master plan travel for all modes.
- Task 7 - Inventory transportation facilities for all highway and transit modes including both existing and planned.
- Task 8 - Determine transportation capacities for major routes and services.
- Task 9 - Relate travel forecast to capacities and identify excess capacities and deficiencies.
- Task 10 - Identify transportation opportunities including both introduction of new services and use of demand reduction techniques.
- Task 11 - Consider means of funding of new services as well as policy, legal and institutional considerations.
- Task 12 - Develop potential transportation programs based on previously completed tasks.

e.

Task 13 - Evaluate potential programs by comparing ability to provide needed transportation, cost of program and environmental and energy effects.

Task 14 - Develop recommended programs based on evaluations.

Task 15 - Prepare final report.

METHODOLOGY

The direction of the study and the selection of alternatives is influenced by the objectives of those conducting the study. For this reason, the Study Coordinating and Advisory Committees were asked in December, 1976 to list and rank study objectives. This process is described in Chapter II, Study Objectives.

A second input to the direction of the study is the history of the Meadowlands and its impact on existing transportation and development. Chapter III, Background and History, discusses the role of transportation in the growth of the Meadowlands. Included are the early planning efforts and the manner in which these influence current facilities and plans.

Chapter IV, Existing Transportation System, details the existing complex as required under Tasks 2,4 (analyze existing travel) and 7 (inventory transportation facilities). It also sets forth the capacities of the existing network (Task 8).

Chapter V, Travel Characteristics of Meadowlands Workers, determines the data requirements (Task 1), provides additional analysis of existing travel (Task 4), and begins to identify possible transportation programs (Task 10).

f.

Chapter VI, Existing and Future Demand, projects existing travel (Task 4), forecasts HMDc master plan travel (Task 5) and integrates the two travel forecasts (Task 6).

Chapter VII, Current Transportation Plans, is the inventory of existing transportation programs (second part of Task 7) and identifies other possible transportation programs (Task 10).

Chapter VIII, The Proposed Networks, identifies additional transportation programs (Task 10) and develops a number of these programs (Task 12).

Chapter IX, Evaluation of Networks, relates the forecast of demand for each proposed network to the existing capacity (Task 9), thereby determining the extent of the needed improvements. The investment, operating cost and ease of implementation is examined (Task 13).

In Chapter X, Meeting 1985 Needs - A Recommended Action Program, policy, legal, institutional and financing questions are discussed (Task 11) and a program recommended (Task 14).

Chapter I summarizes the entire study. Task 3, the measurement of existing environmental conditions, is contained in a separate document prepared by the Commission.

ACKNOWLEDGEMENTS

The cooperation and assistance of the following participating agencies and members of the Project Coordinating Committee is gratefully acknowledged:

POLICY COORDINATOR - George Cascino, Hackensack Meadowlands Development Commission

PROJECT COORDINATOR - Andrew Sparberg, Tri-State Regional Planning Commission

TRI-STATE REGIONAL PLANNING COMMISSION - George Haikalis

U.S. DEPARTMENT OF TRANSPORTATION, URBAN MASS TRANSPORTATION ADMINISTRATION - Kenneth Vought

U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION - John Kessler

NEW JERSEY DEPARTMENT OF TRANSPORTATION - John Gutberlet, Richard Anderson

HACKENSACK MEADOWLANDS DEVELOPMENT COMMISSION - George Cascino

PORT AUTHORITY OF NEW YORK AND NEW JERSEY - Clayton Peavey

BERGEN COUNTY BOARD OF TRANSPORTATION - Frank Tilley

HUDSON COUNTY PLANNING BOARD - Fred Suljic, Al Rinaldi, John Lane

Also acknowledged are the contributions of the following additional agencies and members of the Project Advisory Committee:

NEW JERSEY SPORTS AND EXPOSITION AUTHORITY - Martin Holleran, Anthony Rosamilia

NEW JERSEY TURNPIKE AUTHORITY - Richard Zipp

Project Principals for the Port Authority of New York and New Jersey and the Hackensack Meadowlands Development Commission included: Project Manager Leon Goodman (PA), Assistant Project Managers Richard Roberts (HMDC) and Hermann Botzow (PA), and Messrs. Juhan Simonson (HMDC), John Bolan (HMDC), Warren Quimby (PA), Gene Lessieu (PA), William Gerstle (PA), Steve Carlson (PA), Ray Louriero (PA), Tom Kelly (PA), and Douglas Karpiloff (PA).

CHAPTER I

EXECUTIVE SUMMARY

A special survey of Meadowlands employees and examination of forecast land use leads to the conclusion that ultimately almost 100,000 peak hour trips will be generated by Meadowlands employees and residents. This chapter summarizes the process that led to the development of four transit networks and the associated highway improvements to handle this demand. It is recommended that the Commission adopt one or a combination of these networks as its master plan for transportation. It should expand its staff for this effort and follow up with short-term operational concepts such as staggered work hours and van pooling, until the long-term concepts can be implemented.

Study Objectives

At the outset, study objectives were needed to determine what information would be needed and to guide the eventual development of alternative solutions. In December, 1976, the members of the study Coordinating and Advisory Committees were asked to review and rank the **importance** of a list of objectives. The two highest ranked objectives were:

1. The improvement of transportation between the District and nearby cities and towns, and
2. The use of existing transportation corridors.

The networks analyzed in this report rely primarily on improvements to existing highway and transit corridors to the Meadowlands to handle peak hour employee trips. The development of public transit networks to

satisfy this demand reflects the third and fourth most important objectives, minimizing environmental impacts and reducing reliance on the auto.

Background

The glacial scouring of the Meadowlands and the subsequent invasion by seawater created a salt water marshland that discouraged both agricultural and industrial development. Hence, the concentration of transportation corridors and facilities in the District. Beginning with canoe routes and Indian trails, these corridors included plank roads and, eventually, concrete highways. By 1868, all but four major highway routes were built. The Morris Canal had opened through the Meadows in 1836.

The early 1800's also saw intense interest in uniting the east and west with rails. By 1838, rails linked Paterson and Newark to the Hudson River. By the late 1800's, passenger trolley lines girded the Meadows. These have subsequently been replaced with buses just as piggy-back yards have replaced most of the rail freight lighterage.

By 1900, attempts had begun to plan the development of the large remaining areas of open land. Industrial, commercial and residential uses were suggested, often in conjunction with an expanded transportation function such as belt lines for freight or new passenger terminals. However, development did not actually begin until the 1950's when suitable engineering techniques were found for building on the District's marshy areas.

Finally, in 1968, the New Jersey Legislature authorized the Hackensack Meadowlands Development Commission to regulate the District

in the public interest. In 1972, the Commission adopted a zoning plan that included office buildings, housing, medical institutions, cultural facilities, regional shopping facilities and recreation areas, as well as industrial and commercial uses. The plan included proposed transportation centers. However, its most important distinction was its reaffirmation of the need to connect the Meadows to surrounding cities and towns. In the 150 years since the first transportation facilities, the scope of transportation in the Meadows has grown from use as a corridor to that of a large community.

Existing Transportation System

Virtually all of today's transportation to jobs in the Meadows is by auto or bus. It is its excellent highway access that had propelled the Meadows into the largest trucking and warehousing area in the New York-Northern New Jersey area. These routes include the two spurs of the New Jersey Turnpike, Interstate Routes I-80 and I-280, and Routes, 1, 3, 4, 9, 17, 20, 21 and 46. Included are connections to Manhattan by the Holland and Lincoln Tunnels and the George Washington Bridge.

In 1976 and 1977, traffic counts were conducted on major routes leading to the District as well as on important roads within the area. At the same time, roadways were measured and the peak hour capacity computed. These studies indicate that major feeder routes to the Meadowlands such as the Holland Tunnel, Lincoln Tunnel, Routes 1&9, 3, 17, and 46 are at or near capacity. Selected locations and their capacity and demand in terms of autos in the peak hour are:

<u>Description</u>	<u>Capacity</u>	<u>Demand</u>	<u>Unused Capacity</u>
Route 17 SB-South of Williams Avenue	3,000	2,920	80
Route 3 EB @ Passaic River	5,300	5,280	20
Route 46 WB @ Little Ferry Circle	2,080	2,080	0
Routes 1&9 NB-North of Skyway	1,800	1,800	0
Lincoln Tunnel WB	2,400	2,400	0
Holland Tunnel WB	2,200	2,200	0

The existing Meadows employees that use transit arrive on 14 franchised bus routes to and through the Meadows plus "industrial trippers" that are operated by employers for their workers. Buses operate primarily between the Hartz and Lyndhurst industrial centers and the Port Authority Bus Terminal (Manhattan) or Journal Square.

Until very recently, no rail passenger stations existed in the Meadows. However, the Wood Ridge station is just across the District boundary. Also, PATH, five commuter routes of ConRail's Erie Lackawanna service and ConRail's Newark to New York passenger trains all pass through the Meadows. In the rush hour, the 62 trains on these services carry 38,000 eastbound commuters through the Meadows. All lines operate modern equipment or have it on order. Most of the previous transit proposals for the Meadowlands involve stopping and interconnecting these services.

Travel Characteristics Of Meadowlands Workers

The residences of existing employees is a key indicator of future demand on highway and transit routes leading to the Meadows. This and other employee and employer information was obtained from 116 companies and 7,573 employees in 1976. The survey indicated that:

1. Forty percent of the labor force lives in communities in or adjacent to the District.
2. Seventeen percent of the employees live east of the Hudson River.
3. Auto is the predominant access mode, and is used by 90 percent of all employees.
4. Bus is the primary mode of public transit, accounting for nine percent of all trips.
5. Fifteen percent of all commuters participate in car pools.
6. Today's typical travel time to work is 30 minutes.
7. The morning rush hour is the busiest. Over one-half of all workers arrive between 8:00 and 9:00 A.M.
8. Forty percent of the labor force is female.

With such great reliance on the auto, the survey results suggest that car and van pooling programs might be used to reduce congestion. With peak demand concentrated in a single hour, it would appear that spreading work schedules would reduce congestion. The large female labor force, particularly from adjoining towns, is supportive of additional public transit.

Existing And Future Demand

The existing work force as determined by land use surveys by the Commission, is the starting point for estimating future rush hour demand. Starting from a 1975 base year, 1985 is selected as an intermediate design year for projects that could be enacted immediately. The year 2000 is selected as a convenient year, in which the entire Meadowlands could be developed in accordance with the present master plan. The year 2000

is a judgemental estimate. The exact year depends on a whole host of factors and could occur earlier or later. (See Figure I-2)

The first step in the planning process, the generation of future journey-to-work trips, is based on the following land use development in the area:

Type of Use	Year		
	1975	1985	2000
Commercial (million sq. ft.)	1.3	3.0	9.2
Office (million sq. ft.)	1.0	4.0	19.0
Light Industrial (million sq. ft.)	9.2	19.1	81.6
Heavy Industrial (1,000 acres)	1.4	1.4	1.2
Residential (1,000 dwelling units)	0	2.0	47.5

Floor space is converted to peak hour employment demand using the 1976 employer survey data. From this data, it is forecast that the 28,000 peak hour trips in 1975 will grow to 34,500 by 1985 and 84,400 by 2000.

Between 1975 and 2000, the number of Meadowlands employees travelling in the rush hour who live in the District will increase from virtually none to 12,513. This forecast is, of course, dependent upon the mix of the available housing and the manner in which the housing matches the type of available jobs. In this study, it is assumed that housing and job mixes complement each other. The resultant self containment is an important element in the transportation planning process since it greatly reduces the traffic on roads leading to the area.

As the existing Harmon Cove development demonstrates, not all residents will work in the District. By 2000 it is estimated that in

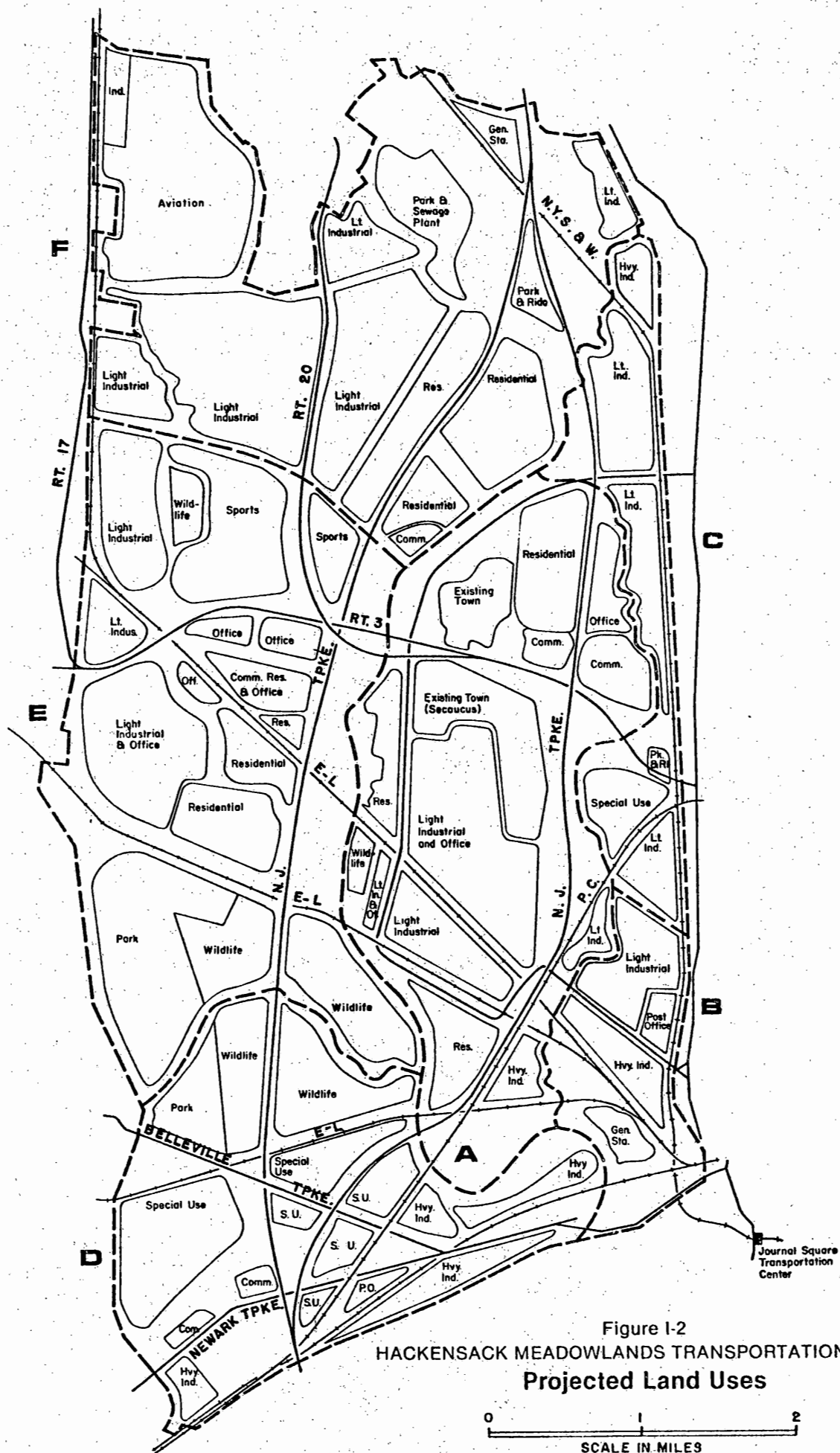
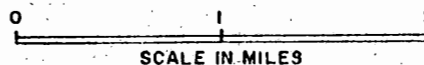


Figure I-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Projected Land Uses



the rush hour 5,006 residents will journey to jobs east of the Hudson River and another 10,289 will work outside the District in New Jersey.

The addition of resident trips raises total peak hour demand to 35,500 trips in 1985 and 99,700 trips in 2000. These trips are distributed by zone of origin in Tables VI-9 and VI-10.

Current Plans

The 1970 Land Use Plan of the Meadowlands Commission represents the first step in planning transit improvements to accomodate the demand anticipated by the year 2000. This plan included transportation centers at Berrys Creek, Secaucus, Teterboro and Kearny. More recently, Hartz Mountain Industries (Hartz) has completed construction of a rail station on ConRail's Bergen County Line just west of Meadowland Parkway. These would provide train stops and train-bus transfer possibilities for employees and residents.

In 1972 a joint task force comprised of the State of New Jersey, the MTA and the Port Authority proposed direct rail connections between the former Penn Central high line and former Erie Lackawanna at two locations, Kearny and Secaucus, the latter as a successor to the Secaucus Transfer proposal. These, in conjunction with the Berrys Creek and Teterboro proposals would provide direct rail service to Manhattan. Proposals for improvements on highways feeding the District include:

1. Expanding the Route 17 interchange with Routes 4 and 46 and widening Route 17 between the two interchanges.
2. Building a new Route 1&9 freeway from the Pulaski Skyway to I-80-95.

In addition, the Turnpike is considering widening its westerly

spur north of Route 3. NJDOT and Bergen County are involved in widening several local streets in the District. Unfortunately, the proposed improvements to the critical feeder routes are currently unfunded. Also missing from current plans are short-term, low-capital programs for car or van pools, priority lanes or staggered work hours.

The Proposed Networks

Earlier transportation planning for the Meadows viewed the area as primarily an assembly point for Manhattan trips. Today's development plans visualize the District as a place where people live and work. Thus, previous transportation plans are inappropriate.

Despite current energy problems, it is obvious that the majority of the peak hour trips will arrive in the District by highway in the year 2000. However, the highways feeding traffic to the area already are at or near capacity. Therefore substantial highway improvements are needed under any alternative that is proposed. Failure to address the need for an improved transportation network could jeopardize future development proposals and prevent the further development of the District. Currently, inflation, a lack of funding and environmental concerns have drastically curtailed New Jersey's highway program. As a result, the only major highway plans expected to be completed in the year 2000 would be I-280, the widening of the Turnpike, the extension of Route 17 south to Route 4, and extension of the Meadowland Parkway north.

Using the above highway improvements as a base, there are five proposed networks. These include:

1. An All Highway Network in which it is assumed that no additional transit is provided. This network of additional highways is

used as a basis for comparison only. Such a network could not be constructed because of its environmental implications.

2. A Bus Network which achieves the minimum capital investment by utilizing the available highway system for transit. For local distribution, bus facilities are provided at Meadows East, Meadows West, Kearny and Wood Ridge. For this and other transit networks, modern, air-conditioned buses would be equipped with 40 seats to provide more comfortable services.
3. A Rail Network that takes advantage of existing rail lines. This proposal includes the transportation centers shown in the Master Plan plus a Hartz Station and a light rail line running from Journal Square to Secaucus, and then north along the easterly border of the District. Both the bus and rail networks employ a system of internal bus routes for distribution.
4. A Personal Rapid Transit (PRT) Network comprised of a main loop around the Meadows West plus spurs and secondary loops to individual developments. Six seat automated rubber-tired vehicles operate at up to 30 mph on a protected, two-way roadway. The 33-mile system is designed to speed up travel in the District, and to reduce the inconvenience of transfer at the mass transit delivery points. Included is a spur to Journal Square and major stations at Meadows West, Berrys Creek, Meadows East, Wood Ridge and the Vince Lombardi Park and Ride Lot.
5. A Busway/Van Pool Network that is designed to give all Meadowlands employees a no-transfer ride from their residence, a feature not available in the three other transit networks. This is achieved

by constructing a two-lane bus-only highway along the same alignment as the PRT. Access to the roadway would be by magnetic card. Buses would provide doorstep delivery by leaving the roadway and circulating on local streets. A spur would connect to Journal Square, but transfer stations would not be needed. Van pools could also be authorized to use the special right-of-way.

Evaluation of Networks

The All Highway Network requires the following:

<u>Route</u>	<u>Improvement</u>	<u>Cost (millions)</u>
Route 17	Widening from Rte. 3 to Parkway plus new interchanges	\$ 291M
Route 3	New Passaic River bridge plus widening from Rte. 21 to Pkwy.	94
Routes 1&9	New four-lane freeway	328
Holland Tunnel	New two-lane tube and approach highways	589
Route 46	Widening to six lanes, Turnpike to Route 17	94
Total		<u>\$ 1,396M</u>

The new trans-Hudson facility needed under this alternate is completely unrealistic given today's environmental problems and the disastrous effect new trans-Hudson highway capacity would have on parallel transit routes such as ConRail, PATH and suburban bus operations.

For determining the size of the alternate transit networks it was first necessary to determine how many of the 99,700 peak hour users in the year 2000 would be divertible to public transportation. A model split

process was developed for this step using density of employment at the work site and auto ownership at the point of origin. For this analysis, each network was assumed to provide all potential users with maximum headways of 15 minutes and a distribution system that brings employees within at least 1,000 feet of their place of employment. The average travel times offered under each network and the predicted peak hour transit patronage is as follows:

<u>Network</u>	<u>Average Travel Time</u>	<u>Peak Hour Transit Demand</u>
Existing Highways	30 min.	
Transit Network - Year 2000		
Bus	48	12,810 pass.
Rail	43	9,875
PRT	31	17,967
Busway/Van Pool	36	20,988

Subsequently, the peak hour demand was used to determine the extent of construction, number of vehicles, the amount of land and other items of investment as of 1985, when the networks could first be available.

With each increase in transit ridership, less highway improvements were needed. Of particular interest, the bus and busway/vanpool networks attracted enough trans-Hudson patrons to eliminate the need for additional Hudson River auto capacity. The busway attracted sufficient additional auto patronage from Hudson and Bergen Counties to permit a widening program to be substituted for a new US 1&9 freeway, and also reduced needed improvements on Route 46. However, the areas to the west are less densely populated and can not be served well by transit. Thus, none of the networks attracted enough patronage to reduce the improvements needed on Routes 3 and 17.

Next, individual services were developed for each network based upon the predicted demand between each pair of origins and destinations. Income for each network was predicted using existing fare levels. Standard operating costs were escalated to 1985 and applied to each service to obtain an overall operating and maintenance cost. The capital and operating costs and deficits per passenger are shown on Table I-1.

Table I-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Economic Summary of Transit Alternatives

	Transit Network			
	Bus	Rail	PRT	Busway
Annual Passengers (millions)	12.8Million	9.9	18.0	21.0
Capital Cost (millions)				
Transit	\$ 60Million	\$ 401	\$1,743	\$ 864
Highway	<u>582</u>	<u>1,183</u>	<u>1,109</u>	<u>461</u>
Total	\$ 642	\$1,584	\$2,852	\$1,325
Annual Operations (millions)				
Revenues	\$ 8.2Million	\$ 6.3	\$ 11.0	\$ 13.6
Less: O&M	<u>-10.7</u>	<u>-7.3</u>	<u>-19.8</u>	<u>-18.4</u>
Deficit	(2.5)	(1.0)	(8.8)	(4.8)
Deficit Per Trip	20¢	10¢	49¢	23¢

Bus Network

The Bus Network is the least expensive transit network. It also is the most capital efficient, requiring an investment of only \$2,326 per daily passenger for transit facilities. It has the second smallest deficit, 20¢ per passenger. Unfortunately, it also is the slowest with the average peak hour travel time of 48 minutes, or 18 minutes above the existing travel time. This feature, coupled with the transfers and local delays in this system and the poor image it presents (even with new buses) suggests that the feasibility of more sophisticated transit plans be explored.

Rail Network

The Rail Network is the second least expensive transit network, costing \$401 million, and has the lowest operating deficit. However it carries 4.3 million less annual passengers than the bus network which results in an investment of \$20,300 per passenger for transit. It does offer a five-minute improvement in travel time as compared with the bus network but the 43 minute average is still 13 minutes longer than the existing average. Also it requires additional trans-Hudson capacity unless improved transit connections with other Meadowlands-oriented employment centers in New York City are provided.

From this it would seem that a modified version of the rail network might be considered which would further reduce capital investment without seriously impacting service. For example, consideration might be given to eliminating the Kearny station from the network on the basis that its \$11 million cost is not justified by its small patronage. Further, the light rail service included in this alternative represents an invest-

ment of \$209 million to serve 3,392 daily passengers. An alternate bus service, while perhaps not as fast or convenient would only cost \$7 million. Other reductions in the scope of the network might also be found. On the other hand some additions to the network could result in service improvement such as substituting a direct rail connection at Secaucus for the transfer station now included (additional cost: \$22 million).

PRT Network

The PRT Network is probably the most difficult to implement and finance. There is no state program available for supplying capital and the federal program is totally committed. The PRT network is by far the most expensive in both capital and operating dollars. It is also the least capital efficient, requiring an investment of \$48,400 per daily passenger for the transit element alone. On the other hand, these additional costs reduce average travel time to 31 minutes, or only one minute over today's average. This improvement in speed is remarkable when compared to the bus and rail networks. However, the cost to achieve this is extremely high and suggest that the PRT network not be given further consideration.

Busway/Van Pool Network

While the Busway Network is the second most expensive transit network, it is only half as expensive as the PRT. It appears that sections of the network would be relatively easy to finance and implement with local support. It minimizes the amount of improvements needed on feeder highways and is the only network that can also carry buses and vans that otherwise

must use routes within the District. It has a low operating deficit, 23¢ per passenger, and its average travel time of 33 minutes exceeds existing conditions by only three minutes. Nevertheless, construction of a complete Busway would be difficult due to its high capital cost.

Environmental Analysis

Environmental analysis of this transportation study's findings began at the same point that the study itself began - - with existing transportation/land use conditions in the Hackensack Meadowlands and their existing, measured environmental and land use impacts and imprints. The environmental benefits and costs of expanding and improving that transportation network by alternative means were then analyzed.

The all highway network was found environmentally unacceptable, with preference extended instead, to the transit networks and their possible combinations. The primary impacts of new transportation facilities on land and water based ecosystems, and on anticipated land use patterns are directly related to the "clustered" land uses these transportation facilities would serve within the regulatory context of the Master Plan Zoning Regulations. In essence, clustered development simultaneously reduces dramatically the more traditional massive impacts on wetlands and terrestrial ecosystems that invariably come with urban sprawl and its repetitive grid patterns of streets, utility corridors, and individual site plans. New disturbances to wetland ecosystems are substantially minimized because the proposed transit corridors have been chosen to correspond with existing transit corridors. All such corridors, however, will continue to be subjected to the rigorous environmental controls, which, as part of the Zoning Regulations mentioned above, are

already in place and well tested in their environmental protection capabilities. These, along with the following results concerning air quality, parks and recreation areas and bikeways, as the central findings of the environmental analysis.

Air Quality

An extensive air quality analysis was performed as part of this study. The ambient air quality was monitored in five locations around the District and the results from this monitoring effort were used in a computer model to predict the air quality in 1976. Further analysis was performed to predict the air quality assuming full development of the District according to the Master Plan for each of the five transportation networks.

It was concluded that, when the District is fully developed, 97-99% of the pollutants which would collect in the Hackensack Meadowlands would be blown in from the surrounding Region; and that 1-3% would be generated by the District's development. Within the 1-3% range of room to make environmental quality decisions for the Hackensack Meadowlands District, the air quality analysis finds little air quality differences among the four transit networks, but a significant difference between these four and the all-highway network. Thus choosing any one of the mass transit networks produces a much better air quality result than choosing the all highway network. This conclusion is this study's major environmental finding.

Parks and Recreation Areas

There are three major parks and recreation areas in the District which are large enough to have a measurable impact on the transportation network. They are: the 130 acre Berrys Creek Tidal Marsh and Environmental Education Center, which is located in the New Jersey Sports Complex in East Rutherford; the 100 acre Losen Slote State Park, which is located in Little Ferry; and, the 2,000 acre Richard W. DeKorte State Park, which is located partly in Lyndhurst, North Arlington and Kearny.

The analysis of the transportation needs of these three parks and recreation areas indicates that the Berrys Creek Tidal Marsh and Environmental Education Center and Losen Slote State Park will not require any new highways or roads to accommodate the predicted demand. While the R. W. DeKorte State Park does not require any new highways or roads, beyond those needed for internal access, it would benefit substantially from the proposed extension of Route 17 south of its interchange with Route 3 to a feasible connection with I-280 and the New Jersey Turnpike in Kearny. The demand for transportation facilities and services by these parks does not pose a real problem because the peak park visitation hours occur on weekends and do not coincide with the journey-to-work peak hours.

Each of these three parks and recreation areas can be ably served by any of the four transit networks. No major additions to these networks or additional equipment purchases are necessary. The HMDC should try to encourage the use of public transit by providing frequent and convenient mass transit services to these parks. The HMDC should also limit the number of parking spaces provided adjacent to these parks in an effort to reduce the use of the auto as the primary access mode to these parks.

Bikeways

Based on the analysis contained in this study, it has been concluded that the bicycle is an alternative means of transportation and should be part of an overall transportation plan. Specifically, if adequate bikeway facilities were available 2-5% of the journey-to-work trips in the District of less than 5 miles could be expected to be made by bicycle. It was also concluded, that because of the unique planning and regulatory powers of the HMDC, combined with the vast amount of vacant land in the District, and the number of road, rail and utility right-of-ways crossing the District, an unprecedented opportunity for development of a comprehensive bikeway network exists. It is recommended that the HMDC continue the planning efforts begun as part of this study and that an interim bikeway implementation plan be developed and acted upon as soon as possible.

Financing

At this time, there is nothing to indicate that the HMDC will ever be able to fund transportation improvements. The HMDC's present transportation planning program is heavily dependent on the receipt of special Federal planning grants. The HMDC will have to rely on the established funding sources and programs. The HMDC will also have to study further other possible sources of funding which can be generated directly through the Commission, such as floating bond issues or establishing a special tax assessment district. There are legal and monetary problems associated with both of these approaches.

Private/Government Funding

One approach to the funding problem which the HMDC should pursue is the efficient use of private capital from major land developers to improve the transportation network. The HMDC should further examine ways to utilize the funds which these developers can contribute to transportation improvements as the local matching share needed to obtain Federal funds. There are strong indications that the Federal, State and local agencies are now reevaluating this approach to funding transportation improvements.

No absolute assurances can be obtained from any of the government agencies presently responsible for funding transportation improvements regarding their ability to fund the major transportation improvements which this District will need in the future. The HMDC will have to approach the transportation funding process on a project-by-project basis and determine which sources of funding are available at that time for a particular project. The HMDC should also do everything possible to monitor and manage the demand for transportation facilities and services so that it has sufficient time to seek funds and implement the necessary transportation improvements before anticipated transportation problems reach the crisis stage.

Meeting 1985 Needs - A Recommended Action Program

By 1985, the total peak hour will grow from 28,000 work trips to 35,500. During this period no comprehensive transit system can be

developed. However, a train station exists at Wood Ridge, a second has opened at Harmon Cove in Secaucus, the initial stages of Meadows East and Meadows West terminals, and a rail station at Berrys Creek should be available. With 4,130 peak hour trips by transit, it will be necessary to purchase at least four rail coaches and 35-40 buses.

Approximately 25 percent of the 1985 demand will not be handled unless highway improvements also are begun. These include a new Route 3 bridge at the Passaic River, a widening of Route 3 between Routes 17 and 21, additional lanes on US 1&9 from the Pulaski Skyway to 69th Street, and widening Route 17 between Routes 4 and 46.

Today much of the Meadowlands District is not developed and the major growth is in the future. This offers the HMDC an unprecedented opportunity to plan and stage the highway and transit system required to support the proposed development. To accomplish this it is recommended that the Commission form a special, four-man transportation group consisting of a Supervising Engineer, Highway Engineer, Transportation Systems Engineer and a Transportation Planner. This group could then supply the staff expertise that would permit the Commission to undertake the following programs or actions:

1. Within 12 months adopt an official long-term transit plan.

The plan should designate needed right-of-ways and include a mechanism for coordinating the construction of transportation facilities with proposed land developments.

2. Mount a program of planning bus routes to be introduced as new development is completed.

3. Investigate the use of priority lanes for transit vehicles probably as part of a long-term transit plan.
4. Adopt and implement a staggered work hours program in which 25 percent of the District work force would begin work 15 to 30 minutes earlier.
5. Organize a formal, Meadowlands-wide van pooling program with a goal of attracting five percent of the District's employees.
6. Investigate the feasibility of para-transit between Meadows employment centers and adjoining communities.
7. Consider joint use of existing commuter park-ride lots in conjunction with new transit services to the District.
8. Plan recreational services to new park areas using commuter transit equipment.
9. Prepare a complete bikeway plan for implementation.

CHAPTER II

STUDY OBJECTIVES

As a first step in this Hackensack Meadowlands Transportation Study the project Coordinating and Advisory Committees rated a number of study objectives or guidelines to establish a priority for applying the objectives in the development of Meadowlands transportation proposals. This chapter outlines the review process and briefly discusses the implications of the final ranking.

The Review Process

To begin the rating process, the staff of the Meadowlands Commission and the Port Authority prepared a list of twelve objectives for discussion at a combined meeting of the study Coordinating and Advisory Committees on December 8, 1976. Following this meeting those present were asked to review the objectives, add objectives they felt necessary for consideration, and then rank each item by one of four classifications - critical, very important, important, and not important. (See Appendix II-1.)

Of the nine agencies represented on the two committees, six responded. Several agencies sent in more than one completed ranking sheet. In total, four additional objectives were submitted. An overall ranking was then made by assigning a score of three to those items marked "critical", two to those items marked "very important", one to the "important" items, and no score to those items that were checked as "not important". In instances where there was more than one submission from an agency, the submissions were averaged, and the average score included with the scores

for the other agencies. Based on the inputs of the six agencies, it is possible to establish an overall ranking for the 12 listed objectives and for four additional objectives that were submitted by the respondents. The rankings by agency and the overall ranking is shown on Table II-1, while the following section lists the objectives in the same rank order with a brief comment on the implication of the ranking.

The Objectives - Ranking and Implication

1. Improve transportation between centers within the Meadowlands District and cities and towns outside the District.

This involves the bulk of journey-to-work travel and the manner in which it is handled on routes and at centers within the Meadowlands.

2. Utilize existing transportation corridors within District when possible.

This objective, which received nearly equal rating, applies to both highway routes and railroad right-of-ways. Obviously, new major corridors within the District are to be avoided if possible, due to the associated expense.

3. Minimize adverse impacts on environment, particularly air quality.

There were six objectives that received intermediate scores. The first of these deals with the environment, and particularly air quality, and obviously suggests that future automobile traffic within the District be kept at the lowest possible levels.

4. Reduce reliance on auto within District, increase reliance on public transportation.

Table II-1
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Ranking of Objectives

Objective	Score							Avg	% Max Score
	Tri-State	NJDOT	HMDC	PANYNJ	Bergen County	Turnpike	Total		
1	2.0	2.5	1.7	2.5	2.0	3.0	13.7	2.3	100
2	3.0	2.5	2.0	2.0	1.0	3.0	13.5	2.3	99
3	2.0	3.0	2.7	1.7	1.0	1.0	11.4	1.9	83
4	1.0	2.5	2.3	1.3	3.0	1.0	11.1	1.9	81
5	1.0	2.5	2.0	2.5	1.0	2.0	11.0	1.8	80
6	2.0	2.0	1.3	1.5	2.0	2.0	10.8	1.8	79
7	1.0	2.5	2.0	1.3	1.0	3.0	10.8	1.8	79
8	3.0	2.5	1.0	1.0	1.0	2.0	10.5	1.8	77
9	1.0	1.5	1.3	2.5	1.0	3.0	9.3	1.6	68
10	1.0	1.0	1.3	2.0	2.0	2.0	9.3	1.6	68
11	2.0	2.0	1.3	2.0	0.0	1.0	8.3	1.4	61
12	1.0	2.5	1.3	0.7	0.0	1.0	6.5	1.1	47
13	3.0	-	-	-	-	-	3.0	0.5	22
14	-	1.5	-	0.5	-	-	2.0	0.3	15
15	-	1.0	-	-	-	-	1.0	0.2	7
16	-	0.5	-	-	-	-	0.5	0.1	4

Notes: Tri-State - Tri-State Regional Planning Commission
 NJDOT - New Jersey Department of Transportation
 HMDC - Hackensack Meadowlands Development Commission
 PANYNJ - The Port Authority of New York and New Jersey
 Turnpike - New Jersey Turnpike Authority
 Bergen County - Bergen County Board of Transportation
 No Response - Hudson County Planning Department
 Federal Urban Mass Transportation Administration
 Federal Highway Administration

Scoring: If objective is considered critical, 3 points. Very important, 2 points. Important, 1 point. Not important, 0 points. If agency returned more than one questionnaire, results for agency were averaged.

Hyphen (-) denotes no mention, pertains to write-in objectives.

This is closely akin to Objective #3 and implies that to the extent possible, the study should focus on public transit, and particularly on those forms of public transit that do not cause pollution.

5. Connect centers within District with external modes of public transportation.

This applies principally to the railroads that pass through the District, but which do not have stations readily accessible to the District.

6. Improve utilization of existing transportation systems within Meadowlands.

This is much like the objective that ranked second, the utilization of existing corridors. Again, there is an emphasis on using the systems presently available.

7. Maximize both private and public financing of additional transportation within District.
8. Develop programs that minimize the capital investment that is required.

The seventh and eighth ranking objectives, maximization of financing and minimization of capital requirements, point out the importance of developing transportation proposals that do not require huge sums from already scant capital resources of UMTA and the State of New Jersey. Furthermore, they reflect the recognition that there is little transportation within the District that is designed primarily to serve trips that

terminate in the District and that, therefore, there is a need for a large number of these facilities in the future. Obviously, each of the new facilities must have low cost if an entire program is to be financed. Inasmuch that this is a new area and development does not exist, there may be means of financing the needed transportation as part of the individual developments that are built in the future.

9. Improve transportation between various centers within the Meadowlands District.

This objective received a surprisingly low score in view of its importance as the Meadowlands develops as a community, with its own internal trips for personal business, shopping, meals, and entertainment. Literally, the availability of internal transportation will determine the extent to which the Meadowlands functions as a community.

10. Develop transportation proposals that are easy to implement.

This reflects a recognition that long-term plans must first be developed, and only when they are developed should thought be given to implementation. This does not mean that aspects of implementation should be avoided, but rather that the magnitude of the overall transportation needed must be established before one can talk about how a particular plan might be put into effect.

11. Minimize impacts of additional transportation demand on existing transportation systems within Meadowlands.

This appears to be a realistic recognition that the shift

in emphasis in Meadowlands transportation should change from that of an area that trips pass through to that of an area in which trips terminate.

12. Encourage participation of the private sector in implementation of transportation proposals.

This objective is important but comes into consideration only after a basic transportation plan has been established.

13. Adopt proposals that reinforce older urban centers near District.
14. Adopt proposals that conserve energy.
15. Minimize travel time for internal trips.
16. Meet transit dependent needs.

The last four objectives received low scores primarily because they were write-in items and were mentioned only by one or two people. Objective 13, reinforcing older urban centers, reflects a regional approach in considering the transportation needs of the District. Numbers 14 and 16 appear to be akin to higher ranking objectives particularly 3, air quality considerations, and number 4, reduced reliance on the auto. Finally, Objective 15, internal travel time, emphasizes the importance of internal Meadowlands transportation improvements as expressed in Objective number 9.

CHAPTER III

BACKGROUND AND HISTORY

This chapter briefly traces the history of the Meadows and outlines its role in the region's transportation and development. Planning efforts related to Meadows development are traced from 1896 to today, culminating in the Hackensack Meadowlands Development Commission's Master Plan.

History of Transportation in the Meadowlands

The history of the Meadowlands has been determined by its physical geography. During the Ice Ages the area was scoured by the advancing glaciers and then covered by glacial drift as the ice melted. A terminal moraine extending from Long Island across Staten Island to Perth Amboy held the melt water and formed glacial Lake Hackensack. Later the lake breached the terminal moraine which drained the lake and allowed the encroachment of the ocean to create an estuary.

From the beginning the early settlers sought to turn the area to their benefit through various attempts to reclaim the land for agriculture. None were successful.

As the surrounding areas gradually developed, the Meadowlands, whose physical characteristics - generally poor soil and wetlands - precluded any significant development, became the locale for transportation and terminal facilities. Thus the history of the Meadows is really the story of the development of the region's transportation, and transportation has been one of the most dominant land uses in the Meadowlands.

The earliest recorded form of transportation for the inhabitants of the Meadowlands area was water-oriented, accounting for the importance of the Hackensack River, but the colonists were also concerned with land

transportation. Old Indian trails soon became roads. For example, in 1718, a road was constructed from Ridgefield to "Whehocken Ferry" following the old Indian trail to Pavonia. Others followed such as the Cedar Plank Road built by Philip Schuyler in 1759 to reach his Arlington Cooper Mines. This eventually became the Belleville Turnpike. In the early 1800's roads were improved by turnpike companies, but in the second half of the century the turnpikes gradually fell into a state of disrepair and were converted into public highways. However, their names have been retained - Bergen Turnpike, Newark Turnpike, Belleville Turnpike and Paterson Plank Road.

By 1868, the road network of the Meadows was well established. Only four primary roads have been added since - the Pulaski Skyway (1932), New Jersey Route 3 (1945), the New Jersey Turnpike (1951), and the Western Spur of the Turnpike (1970).

In 1824, the Morris Canal and Banking Company was chartered by the New Jersey Legislature for the purpose of constructing a canal to transport heavy, bulk merchandise, such as coal, from the interior of the country to the rapidly growing urban area centered around New York. In 1831, the canal was opened from Phillipsburg on the Delaware River to Newark. Traffic between Newark and Jersey City was carried on an eleven mile extension opened in 1836. This canal crossed the Hackensack Meadows at Kearny Point.

As New York City became established as the chief seaport on the East coast, it increasingly required rail outlets to the West. Agitation for a railroad across the Meadows became particularly fervent in Newark and Paterson, the major cities of Northern New Jersey. Both the Newark and Paterson groups wanted their lines to terminate in Jersey City. In

1833, the Paterson and Hudson's first locomotive reached this goal. Today the main line of the Erie follows the early Paterson and Hudson route through the Meadows. In 1834, the New Jersey Railroad and Transportation Company built from Jersey City to Newark crossing the Meadows in the vicinity of the present Meadows Yards. Until 1838, both of the railroads had to terminate to the west of Bergen Hill. In that year a tunnel was cut through Bergen Hill to the shores of the Hudson River and was shared by the two competing railroads.

By 1870, the Morris and Essex Railroad operated along a route through the Meadows adjacent to the New Jersey Railroad on its northern side. Also in existence was the Delaware, Lackawanna, and Western right-of-way past Laurel Hill, the Newark and New York Railroad crossing near the tip of Kearny Point which later became part of the Central Railroad of New Jersey, the Northern Railroad of New Jersey, and the Hackensack and New York Railroad. The Northern Railroad had a route along the eastern margin of the Meadows and Overpeck Marshes and later became a branch of the Erie Railroad.

The Delaware, Lackawanna and Western tracks along the base of the upland in Kearny and North Arlington were added after 1870, as were trans-Meadows tracks of the Erie in Kearny, and the main passenger line of the Pennsylvania Railroad past Laurel Hill, through the Palisades and under the Hudson River to Pennsylvania Station in New York City. In addition to several new tunnels through the Palisades and interconnections of the existing major networks, the West Shore (New York Central System) route was developed across the northern part of the Meadows in the latter part of the nineteenth century. All the aforementioned rail lines have

now become part of the Amtrak and ConRail Systems. Another railroad which runs through the Meadowlands is the New York, Susquehanna and Western. This railroad is in bankruptcy proceedings but is not a part of ConRail.

As the Meadows became a transportation network, other development took place which took advantage of this network. One such development was the establishment of vast sprawling freight yards to handle a traffic volume that could not be handled on the crowded shores of the Hudson River where expansion was no longer possible. These freight yards were designed primarily to allow for the assembly and disassembly of freight trains and support extensive lighterage and carfloat operations in New York Harbor. Since the early 1900's, the lighterage has declined considerably as trucks and truck access routes have improved. The floating of railroad cars across New York Bay was further reduced in 1967, when the New Haven was included in the Penn-Central merger, providing a direct overland rail route to Long Island from the west via Selkirk, New York and the Hell Gate Bridge.

In more recent years, many of these yards have expanded their piggyback operations, with the ConRail Meadows yard in Kearny now being the largest in the country. The other two piggyback yards in the Meadows are Croxton and North Bergen. These operations produce an impact on the highway network.

The Meadows have also been a popular locale for truck facilities because of the excellent highway access to all parts of the region, the availability of large parcels of flat land and the proximity to the large metropolitan market area.

Another form of rail transportation, the street railway or trolley, got its start in the 1860's as horse cars. Steam power was attempted as early as 1863, but it was not until electric power was available that the trolleys were permanently established in 1890. Traction companies were quickly established and trolley lines proliferated. The lines spread throughout Northeast New Jersey with Newark as the primary hub. Jersey City, Hackensack, and Paterson were also important junctions linked through networks along the ridges on either side of the Meadows and also connected by lines following existing road crossings of the Meadows.

In 1935, Public Service, then the chief operator of trolley routes, began substituting gas-electric trolley buses for streetcars. By 1940, most streetcars were replaced. Subsequent to the war, the trolley buses were replaced with diesel buses that are now on all routes.

Another recent addition to the Meadowlands transportation system is Teterboro Airport. The airport is own by the Port Authority and operated under lease by Pan American Airways. This facility, founded in 1917, has served as an important airport for general aviation purposes. Business, training, and personal flying are carried on extensively with more than 204,000 plane movements recorded in 1975. Numerous technological improvements and expansions to the facilities have been undertaken at the airport over the years to meet increased demands. Major facilities to handle sales and storage functions have been added in recent years.

Newark International Airport, just 2 1/2 miles south of the Meadowlands, also has played an important part in development of the area because of its passenger flights and air freight connections to most major

U.S. cities. The airport serves scheduled airlines, charter flights, and general aviation. A major redevelopment program including new passenger terminal, an expansion of the cargo area, and a new roadway system has recently been completed. In 1975, Newark handled 166,000 plane movements and over 6 million passengers.

Transportation remains the most dominant land use in the Meadowlands, even though its relative percentage of the totally developed area has somewhat declined due to the large surge of construction activity in the industrial, office and residential uses. Each of these, however, has required the laying out of new roads and local streets, adding to the transportation land-use category. In addition, the recently completed Sports Complex has been responsible for substantial new road construction. Thus as additional development occurs in the Meadowlands transportation will continue to occupy a prominent place in the overall land-use structure.

Early Development Planning Efforts

The earliest known plan dealing with the physical improvement and development of the Hackensack Meadowlands was promulgated by the New Jersey State Geologist, C.C. Vermuele, before the turn of the century. In his reports of 1896 and 1897 to the State Legislature, he referred to the Meadowland as "a blot upon an otherwise fair landscape" and proposed the reclamation of the area through known methods into a series of land areas interspersed with an extensive network of navigable waterways. Initially the new land would have been available for agricultural purposes but ultimately he envisioned that the land would be occupied by the houses and industries of over one million people.

In 1926, the New Jersey Waterways and Highways Improvement Association attempted to plan for the Meadowlands area. The basic thrust of the plan was directed toward the creation of a transportation framework to serve future development. Of the 15,000 acres under consideration in the Association's plan, more than one-third would have been devoted to transportation including a navy yard to handle overflow from the then inadequate Brooklyn Navy Yard, an airport, waterways connecting with New York port areas, highways and railway terminals.

The next major planning effort was in 1929 when the Russell Sage Foundation published a study prepared by the Regional Plan Association entitled The Regional Plan of New York and Its Environs which included a specific plan for the reclamation and land use of the Hackensack Meadowlands. The plan called for a balanced allocation among the industrial, open space and residential uses in the Meadowlands. Waterways, parkways, an airport, and possible new rail classification yards were also slated to take up a considerable portion of the proposed land use.

In the following year, another plan appeared. The Meadows Reclamation Commission, which had been appointed under a joint resolution of the New Jersey Legislative, issued their report which came to be known as the "Jadwin Plan", named for the consulting engineer to the Commission, Lt. General Edgar Jadwin, former Chief, United States Army Corps of Engineers. The "Jadwin Plan" favored intense industrial development in the Meadowlands with an extensive rail system including a belt rail loop along the periphery of the area. A port zone was an important part of the "Jadwin Plan" concept.

In addition to these generalized, conceptual land use proposals for the development of the Meadowlands, a number of plans have been offered over the last half century to alleviate the perennial transportation problems existing in the Northeastern New Jersey and New York City corridor. Three basic solutions have been discussed namely, 1) rapid transit plans with an intercepting artery across the Meadows and links to Mid-Manhattan, 2) railroad terminal plans with the terminal located in the Meadows linked to New York City by a rapid transit line, 3) railroad terminal plans with the terminal located in Manhattan. In addition, there are variations and combinations of the above. Each proposal involved the Meadowlands, and, if effectuated, would have left a marked imprint on the Meadowlands. Today these proposals cannot be considered feasible because they do not address the newest aspect of the Meadowlands - its prominence as a large and rapidly growing employment center. These various proposals are listed in Appendix III-1.

Meadowlands Regional Planning Board

In the 1950's new efforts began for the reclamation and development of the Meadowlands. Interest in the needs of the area by businessmen and civic leaders of five Bergen County communities in the northern part of the Meadowlands led to the formation in 1956 of the Meadowlands Regional Planning Board (MRPB), the first regional planning board in the State of New Jersey. The area covered by MRPB consisted of 7000 acres lying in the communities of East Rutherford, Lyndhurst, Carlstadt, Rutherford and North Arlington.

Transportation related proposals were of great importance in the MRPB's five-community plan. Among their major recommendations were the following:

1.) North-South (Hackensack River) Expressway

The basic proposal for a north-south highway through the Meadowlands area originated with the New Jersey State Highway Department in the 1930's and became known as Route 100. In the 1950's the Bergen County Planning Board proposed a similar north-south route through the Meadowlands area which was adopted by them and included in their Land Use and Transportation Plan. The proposed highway, to be built to expressway standards, would have run parallel to the Hackensack River and Route 20 to Route 3. South of Route 3 the expressway would have adjoined the Transcontinental Gas pipeline and its service road to an interchange with the New Jersey Turnpike in Kearny. Such a north-south expressway became a reality some twelve years later in the form of the Western Spur of the New Jersey Turnpike.

2.) Route 3 Improvements

The MRPB Plan endorsed the State Highway Department's recommendation to upgrade Route 3 to a limited access highway by the construction of marginal roads on either side of the highway. A major interchange with the proposed north-south expressway was included in the plan, together with the endorsement of the State Highway Department's proposal for a parallel Route 3 bridge over the Hackensack River. Many features of this package are operational today.

3.) Route 17 Extension

The MRPB proposed the extension of Route 17 southward from Route 3 to an interchange with the proposed Hackensack River Expressway in Kearny. This extension was to be a minimum of four lanes with partially controlled access. This proposal is still under active consideration.

4.) Moonachie Avenue

The plan also called for the realignment and widening of Moonachie Avenue and establishing an interchange with the Hackensack River Expressway. The realignment and widening proposals are presently in the active planning phase.

5.) River Crossings

The MRPB also indicated the need for two additional Hackensack River crossings. The one in the northern section of the Meadowlands would have been an extension of Moonachie Avenue across the River. The other would have been an extension of the southerly portion of Route 17 across the Hackensack to tie in with Route 1 and 9 in Jersey City.

6.) Transit

The possibility of a future transit system was also considered in the MRPB plan. Possible stations were considered along the Erie mainline, the Boonton branch of the

Lackawanna and the Pascack Valley Line in hopes there would eventually be a tie-in with the New York subway system and Erie commuter service between Jersey City and the Meadowlands.

The MRPB was unable to obtain Federal or State funds for its project and so it fell into inactivity.

The Meadowlands Regional Development Agency

In 1959, the State of New Jersey, through the Department of Conservation and Economic Development, proposed to the thirteen municipalities sharing the Meadowlands that a regional development agency be established. In September, 1960, these municipalities joined together and formed the Meadowlands Regional Development Agency (MRDA). This agency was comprised of the five municipalities plus Moonachie, Teterboro, and Little Ferry in Bergen County and Kearny, Secaucus, North Bergen, and Jersey City in Hudson County.

Unlike its predecessor board, MRDA was designed to be an action agency legally empowered to perform reclamation and development under the provisions of the New Jersey Redevelopment Agencies Act.

In June, 1964, the Federal Government approved a major planning grant enabling the New Jersey Division of State and Regional Planning to prepare comprehensive planning studies for the Meadowlands Region. This agency drew up five alternative land development proposals for the Hackensack Meadowlands. These concept plans and their transportation requirements were:

1) The Meadowlands - As Part of a Region Dominated by a Strong Central Core

High intensity development and highly concentrated population nodes called for a higher level of transit service. A basic feature of the plan was a rapid transit loop through the Meadowlands, served by several transfer stations at strategic locations along the route. It also called for the upgrading of other rail facilities in the Meadowlands and an intense network of intrameadows streets and roads.

2) The Meadowlands - As Part of a Region Decentralized With No Significant Centers

This concept envisioned a rather low-density, evenly spread development across the Meadowlands District. Under this concept no mass transit facilities were called for since this kind of development would not economically justify this type of transportation. The need for a local road system would have been high to provide access to scattered home and work sites.

3) The Meadowlands - As Part of a Region Decentralized Into Centers

Under this concept there would be minimal additional development as the District would primarily serve as a corridor for trips between the surrounding major urban centers. Several major highways were called for to provide for east-west as well as north-south movements and two additional crossings of the Hackensack River would have been required under this plan. The existing rail network would have been retained

to provide for inter-center travel movements.

4) The Meadowlands - As a Distinct Center in the Region

Under this concept a new community, accommodating all types of land uses and urban functions to be as self-containing as possible, would be developed in the geographic center of the Meadowlands. Major by-pass routes were called for to divert inter-regional traffic from the new community. A rapid transit system was proposed to connect this center with the nearby urban centers of Newark, Paterson, and New York City.

5) The Meadowlands - As Part of Surrounding Sub-centers In The Region

Under this concept the Meadowlands would accommodate the expansion of the surrounding centers and their respective fringe development. In order to serve these patterns, the transportation network would be oriented towards the existing communities on the periphery of the Meadowlands. No mass transit would be required under this concept.

In 1967, responsibility for supervising efforts to develop a solution to the Meadowlands problem was assigned to the newly created Department of Community Affairs. One year later the New Jersey Legislation approved formation of the Hackensack Meadowlands Development Commission.

The Hackensack Meadowlands Development Commission

As set forth by the 1968 legislation the Meadowland Commission is charged with regulating the use of the 19,730 acre Meadowland District in public interest. The District as established includes part of 14

municipalities. In compliance with their mandate in 1972 the Commission adopted zoning regulations and an official zoning map or Master plan. This plan most closely resembles the fourth concept of the former Development Agency with the Meadowlands being a center in the region, but with several medium-sized urban communities located throughout the area rather than a single community at the geographic center.

The pivotal part of the plan is a six square mile open corridor running the length of the District. All the parts of the plan then relate to this corridor. The main features include a water oriented business, shopping and civic complex which will include educational and medical institutions, museums and other cultural facilities, office buildings and a regional shopping center. Space has also been allocated for four transportation centers which were to be at Moonachie on a 35 acre site adjacent to Teterboro Airport and Conrail's Pascack Valley Line, at Kearny on a 92 acre site adjacent to Conrail, PATH, the New Jersey Turnpike and I-280, at Secaucus on a 26 acre site where Conrail's (EL) Main Line, Bergen County Line and (PC) Mainline intersect, and at Berrys Creek in East Rutherford on Conrail's (EL) Bergen County Line. The plan calls for an ultimate residential population of approximately 125,000 persons and a potential employment base far exceeding this number. This plan for the development of the Meadowlands was designed to reflect the local needs of Northeastern New Jersey and the needs of the larger metropolitan Region. It is this plan that dictates the transportation needs developed in the remainder of this report.

CHAPTER IV

EXISTING TRANSPORTATION SYSTEM

This chapter describes the existing highway, bus and rail services in the Meadowlands. While this report deals primarily with passenger transportation, rail freight and aviation activities in the District also are described. Information includes existing demand on and capacity of key highway links. Bus routes are described and the number of passengers and buses are noted. The commuter rail routes, services and patronage at stations near the Meadows also are reviewed because of the obvious potential for these lines to carry residents from suburban locations to jobs in the District.

Highway Facilities

Much of the present development of the Meadowlands is directly related to the existing highway system. The extensive network of highways serving the Meadowlands includes, for planning purposes, three types of routes: regional, feeder and internal.

Regional Routes

As shown in Figure IV-1, there are a large number of excellent multi-lane expressways surrounding the Meadowlands. North-South routes include the easterly and westerly spurs of the New Jersey Turnpike and, to the west, the Route 21 Freeway and the Garden State Parkway. East-West routes include I-80 on the north and I-280

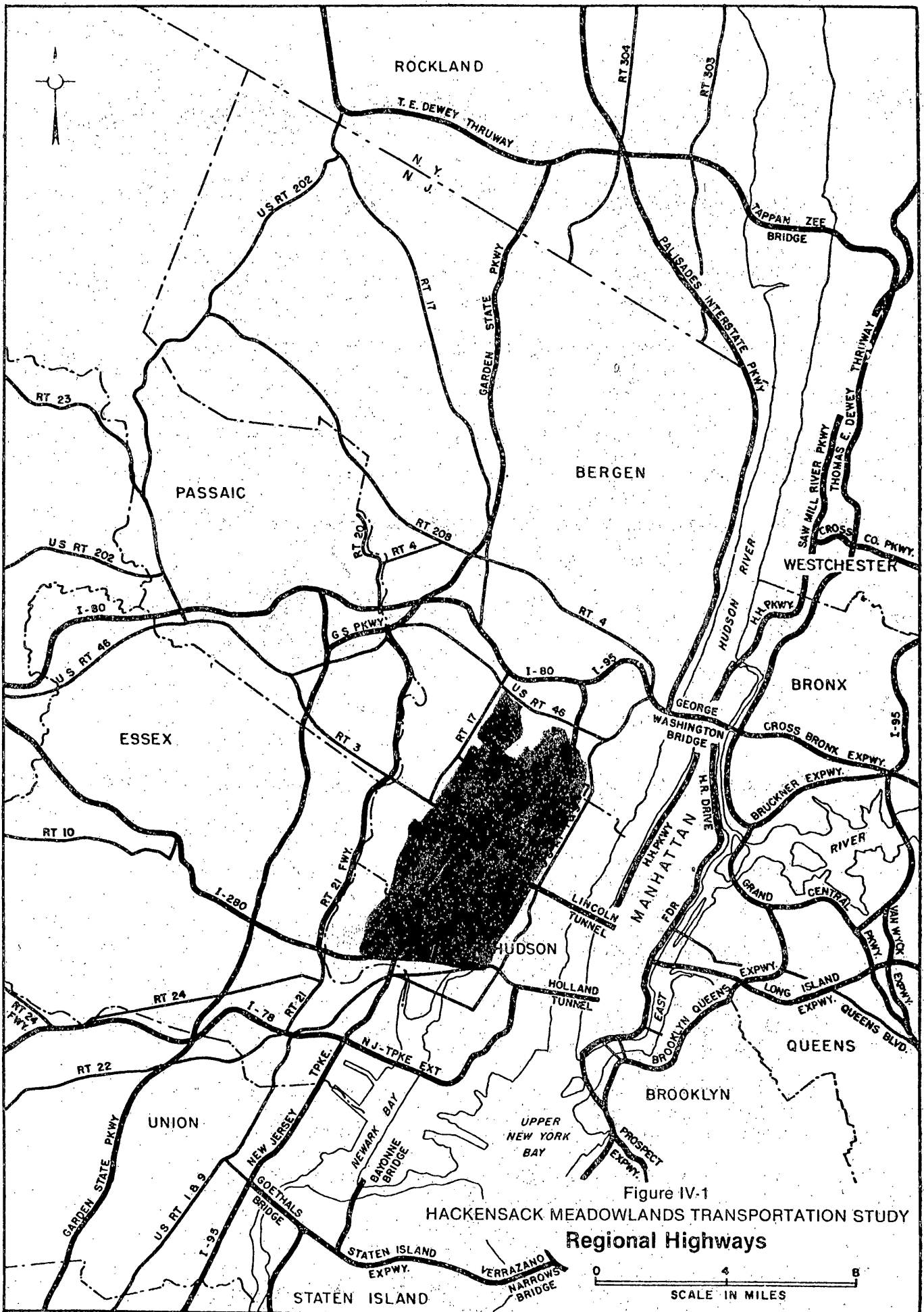


Figure IV-1
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Regional Highways

IV-2

and I-78 on the south. These routes are **supplemented** by Routes 17, 4, 46 and the Pulaski Skyway (Routes 1&9). These regional highways are linked to New York via the George Washington Bridge and the Lincoln and Holland Tunnels.

In the future, it is expected that the number of Meadowlands jobs will increase, and hence the number of auto trips. The two important roles for these regional highways will be to provide (1) access to the Meadowlands from other portions of the region, and (2) alternate routes around the Meadows for vehicles not destined for the Meadowlands.

Feeder Routes

Many of the regional highways also act as feeder routes to the Meadowlands. These include the Turnpike, I-80, I-280, Routes 3, 17, 46 and the Pulaski Skyway. In addition, there are several local routes that act as gateways to the Meadows including Schuyler Avenue from Lyndhurst, and U.S. 1&9 from Hudson County. All vehicular trips entering the Meadowlands must use one of these feeder highways.

Internal Routes

Once in the Meadowlands District, employees use local streets to reach their jobs. Some of the feeder highways, such as Routes 1&9, 3 and 17 also act as distributors. Existing local

east-west roads used for this purpose include Moonachie Avenue, Paterson Plank Road, Belleville Turnpike, Secaucus Road, and County Road. The north-south routes are Moonachie Road, Washington Avenue, Route 20, Meadowland Parkway, and Fish House Road.

Each of these roadway systems will play an important role in any future transportation plan which in part will depend upon available unused capacity as related to future demand. The existing traffic volumes, computations of capacity and identification of critical links are discussed in the following paragraphs.

Existing Traffic Volumes

To determine existing volumes, manual and mechanical traffic counts were made between June 9 and July 1, 1976 and during the winter and spring of 1977 at selected locations on the feeder routes to the District as well as on important routes within the District. At the manual count locations classified counts (autos, trucks or buses) were made on a typical weekday (Tuesday, Wednesday or Thursday) for the morning (6:30-9:30 A.M.) and evening (3:30-6:30 P.M.) peak periods. At the mechanical count locations, non-classified counts were made on a typical weekday for a minimum of 48 hours. Because of the large number of locations where manual counts were desired, it was necessary to schedule these counts over a period of eight weekdays. To reflect any significant day-to-day volume variations, and permit volume

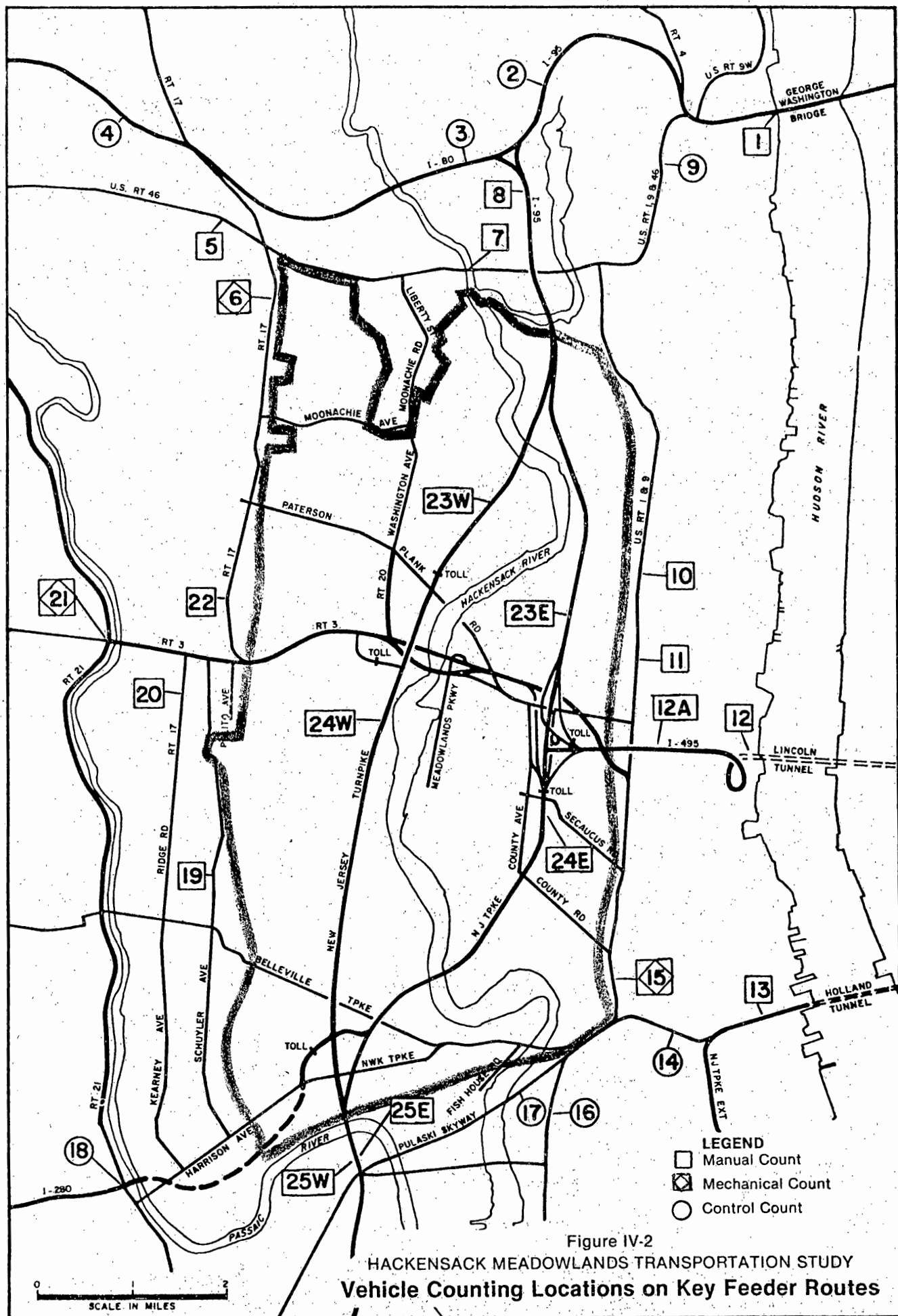
adjustments if necessary, machine control counts were also taken at three locations on each of the eight survey days. To supplement the field counts, data on current volumes was obtained from the Port Authority and the Turnpike Authority. The traffic count locations are shown on Figures IV-2 and IV-3.

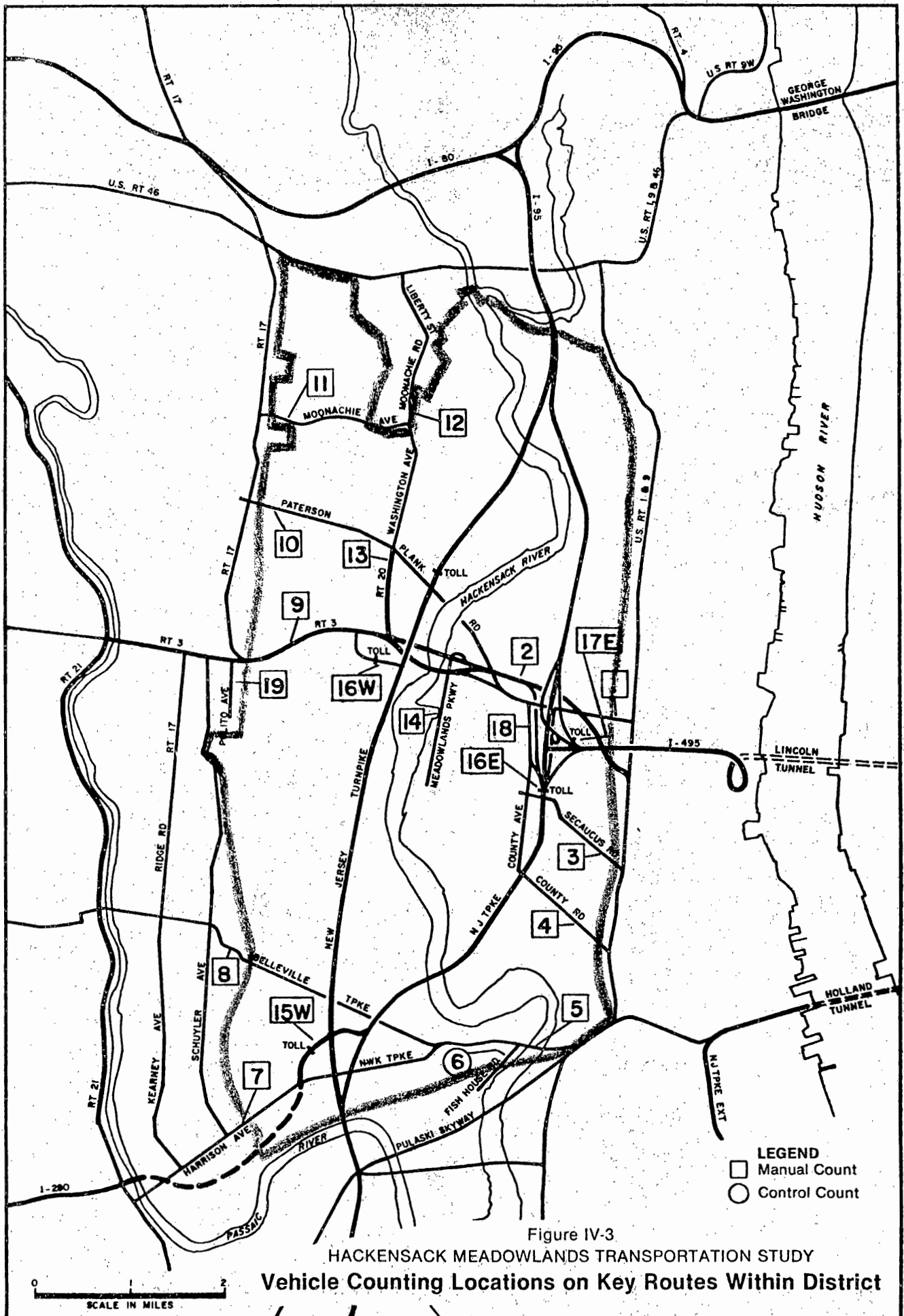
From all these data a summary map was drawn and compared to Sky Comp data. Sky Comp is a method of evaluating rush hour traffic conditions using aerial photography. The Sky Comp data permitted resolution of several discrepancies between existing daily data and the special hourly counts for this study. Morning and evening peak hour traffic volumes were then developed.

Determination of Roadway Capacity

Capacity is defined as the maximum number of vehicles which can be reasonably expected to pass over a given section of a roadway in one direction in one hour under prevailing roadway and traffic conditions. The method of determining capacity as described below is based on the methods contained in the 1965 Highway Capacity Manual. The manual utilizes the "Level of Service" concept to describe and evaluate quality of traffic flow as follows:

Level of Service A describes a condition of free flow, with low volumes, low density, and high speed.





Level of Service B describes a condition of stable flow with operating speeds beginning to be restricted somewhat by traffic conditions.

Level of Service C describes a condition of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. This level of service is typically used for the design of urban highways.

Level of Service D describes a condition approaching unstable flow with tolerable operating speeds being maintained though considerably affected by changes in operating conditions.

Level of Service E describes a condition where volumes are at or near the capacity of the roadway. Flow is unstable and there may be momentary stoppages. This level of service is used as capacity in this study because it, in many instances, represents the existing level of service on feeder routes to the District, particularly during the rush hour.

Level of Service F describes a forced flow operation at low speed with volumes at less than capacity.

The classified traffic data provided the truck percentages for the capacity analysis. (At mechanical count locations, the truck percentage was assumed to be 10 percent). In addition, data were also collected as to roadway widths, number of lanes, lateral clearances and grades. At signal controlled locations the signal timings were obtained. The collected data were then applied to the two basic roadway sections where capacities were determined in the following manner:

Open Highways

The capacity of a single lane of a two lane highway is considered to be 1000 passenger cars per hour under ideal conditions. The capacity of a multi-lane highway under ideal conditions is 2000 passenger cars per lane per hour. Ideal conditions are defined as 12' lane widths, lateral clearances of 6' on each side of the roadway, uninterrupted flow, and no trucks. Adjustment factors provided in the Highway Capacity Manual are applied to reduce the ideal volumes to the prevailing roadway and traffic conditions. To determine the capacity of an open highway, the number of lanes is multiplied by 2,000. That product is multiplied by the lane width and lateral clearance factor to get the capacity in passenger vehicles per hour. The truck percentage and roadway grades are inter-related to provide the truck factor, which when multiplied by the passenger vehicle capacity provides the roadway capacity in vehicles per hour.

Signalized Intersections

At signal controlled locations the capacity is determined by the number of lanes at the signal, number of lanes beyond the signal, turning lanes, and percentage of green time provided to the movement in question. For this study a general approximation of capacity was obtained by multiplying the number of lanes by 1,200 or 1,500 vehicles per hour and by the percentage of green time. The 1,200 or 1,500 value was selected based upon prevailing roadway characteristics or geometry.

Capacity and Volumes at Key Locations

In total the existing capacity and volume were computed for 29 locations on the feeder routes to the Meadowlands. Of these locations the George Washington Bridge, I-95 in Fort Lee, I-80, and the New Jersey Turnpike have reserves of capacity. A number of other feeders such as Schuyler Avenue south of Route 3, Route 1&9 north of Route 3, Route 46 eastbound at Little Ferry Circle have smaller reserves of capacity. The Lincoln Tunnel, Holland Tunnel, Route 1&9 south of Route 3, Route 46 westbound at Little Ferry Circle, and Route 17 south of Route 46 have virtually no additional capacity. Table IV-1 shows the morning peak hour volumes and capacity at the 11 most key points of entry to the Meadowlands.

The designation, location, width, and volumes for most major Meadowlands routes are summarized in Appendix IV-1. Future improvements for these routes are discussed in Chapter VII. Volume and capacity data on all 29 locations on the feeder routes is in Appendix IV-2, and Appendix IV-3 includes usage and capacity on the internal routes for use in future studies of internal flow. Appendices IV-4 and IV-5 show additional detail on feeder and internal routes, respectively.

Table IV-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Capacity and Volume at Key Locations^a
(1976)

<u>Location</u>		<u>Capacity</u>	<u>Demand</u>	<u>Unused Capacity</u>
6	Route 17 SB - South of Williams Avenue	3,000	2,920	80
7	Route 46 WB @ Little Ferry Circle	2,080	2,080	0
11	Route 1&9 NB - North of 51st Street	1,700	1,210	490
11	Route 1&9 SB - North of 51st Street	1,700	1,370	330
12	Lincoln Tunnel WB	2,400	2,400	0
12A	I-495 WB Union City Underpass	3,400	2,580	820
13	Holland Tunnel WB	2,200	2,200	0
14	Route 1&9 (Bus) WB Jersey City Cut	1,930	1,930	0
15	Route 1&9 NB - North of Skyway	1,800	1,800	0
15	Route 1&9 SB - North of Skyway	1,600	1,490	110
21	Route 3 EB @ Passaic River	5,300	5,280	20

^avehicles per hour, 8-9 A.M., typical weekday

Bus Service

Today 11 intra and interstate bus routes serve the Meadows and 3 other interstate routes pass through the Meadows. In addition there are a large number of employees who use "industrial trippers" or buses that are hired by individual companies to operate under contract directly between a terminal point and that company and carry only employees of the company.

The largest existing passenger volume in the morning rush hour is the eastbound or reverse flow of city residents from the Port Authority Bus Terminal to the Hartz development in Secaucus via the Hudson Bus Company. Another major service operates from the Port Authority Bus Terminal to the Bellemead Industrial Park in Lyndhurst. Scheduled services and trippers also operate from Journal Square to both the Hartz and Lyndhurst areas.

Other services to the center portion of the District include Blue and White 97 between Journal Square and Elmwood Park, Transport of New Jersey (TNJ) 15 between Hoboken and Secaucus and De Camp 22 between Caldwell and Journal Square. In the southern portion of the District, TNJ operates Route 43 between Newark and Journal Square. TNJ also operates Route 102 between Newark and Paterson via Hackensack. Two recent additions in the northern portion of the District are TNJ Route B4 between the Garden State Plaza and Wood Ridge and B72 between Dumont and Moonachie. These last two routes are subsidized and were instituted at the request of the Bergen County Freeholders. These routes supplement Maplewood Equipment Company Route 35 which travels from East Rutherford to Manhattan via Paterson Plank Road, Route 20 and Route 3 and Manhattan Bus Company's

#51 line to Manhattan which travels Washington Avenue and Route 20.

All regular routes now serving the District are summarized on Table IV-2 and Figure IV-4. More than 135 daily trips serve nearly 1.4 million passengers annually.

Bus services to the Meadows employment centers have developed in two ways. The first are existing routes that are modified to serve the new centers. Appendix IV-6 includes a partial list of bus operating rights that indicate which carriers might participate in future services of this type. The second are entirely new routes designed to achieve the same goal. Frequently these are express routes that operate between an external terminal and a specific Meadowlands industry. It is this type of personalized express service that is the most successful of today's public transit services to the Meadows.

There is the potential to develop additional service to the Meadows utilizing those interstate services that now pass through the Meadows via Route 3 or the Turnpike enroute to the Port Authority Bus Terminal in Manhattan. This involves 30 short, intermediate and long distance carriers that operate over 80 routes. These routes might include an enroute stop at new transportation centers within the Meadowlands, thus providing access to the Meadows from a wide range of suburban communities. At least three routes do stop today. This includes the Manhattan Transit Park-Ride that originates in Bergen County and stops at the park-ride lot at the Vince Lombardi Service Plaza on the New Jersey Turnpike prior to continuing to the Port Authority Bus Terminal. However, the plaza is not near any Meadows jobs so this route does not now carry passengers from Bergen County residences to the Meadowlands. Appendix IV-7

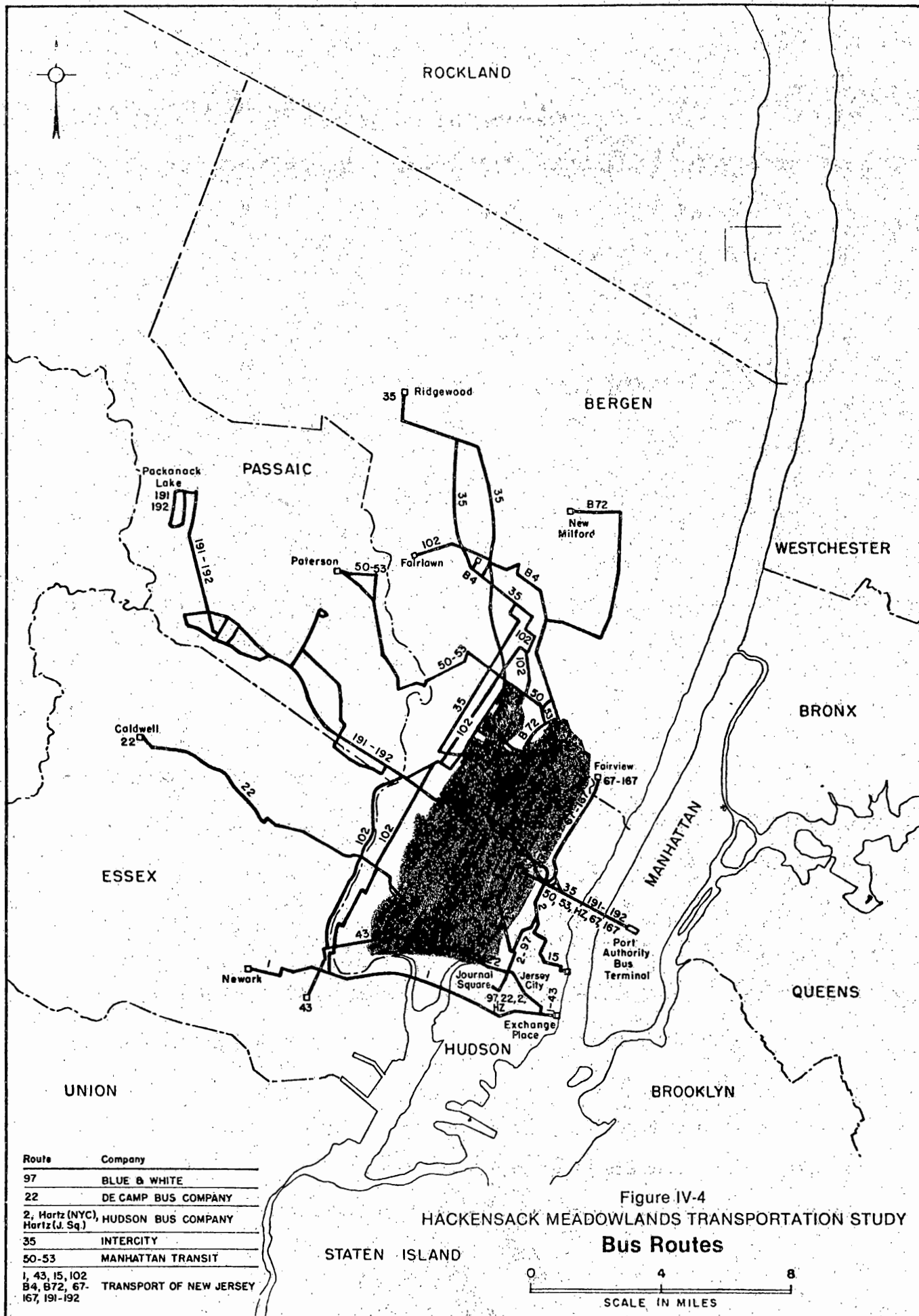


Table IV-2.

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Bus Routes Serving District (a)

<u>Route Number</u>	<u>Company</u>	<u>Origin and Destination</u>	<u>Daily Bus Trips To District (b)</u>	<u>Annual Passengers (c)</u>
INTRA STATE				
97	Blue & White	Journal Square - Elmwood Park	n.a.	n.a.
22	DeCamp Bus Company	Caldwell - Journal Square	8 buses	n.a.
2	Hudson Bus Company	Journal Square - Secaucus	32	197,500 pass.
Hartz	Hudson Bus Company	Journal Square - Secaucus	5	85,100
43	Transport of New Jersey	Newark - Exchange Place	33	597,300
3	" " " "	Paterson - E. Rutherford	18	80,800 (73)
102	" " " "	Newark - Hackensack - Paterson	2	13,800
B4	" " " "	Garden State Plaza - Moonachie - Wood Ridge	4	39,300
B72	" " " "	Dumont - Carlstadt - Moonachie	8	71,200
			<u>110</u>	<u>1,085,000</u>
INTERSTATE TO MEADOWS				
Hartz	Hudson Bus	Port Authority Bus Terminal - Secaucus	20	260,600
191-192	Transport of New Jersey	Port Authority Bus Terminal - Bellemead	5	41,800
			<u>135 buses</u>	<u>1,387,400</u>
INTERSTATE THRU MEADOWS				
35	Intercity	Ridgewood - Port Authority Bus Terminal	68	(d)
50-53	Manhattan Transit	Paterson - Port Authority Bus Terminal	96	(d)
67-167	Transport of New Jersey	Fairview - PABT via Tonnelle Ave.	39	(d)
TOTAL			<u>338 buses</u>	<u>1,387,400 pass</u>

^a Excludes contract and charter bus trips referred to as "industrial trippers".

^b For intrastate thru Meadows, only eastbound buses shown.

^c Includes destinations both within and outside Meadowlands.

^d Meadows patronage small per cent of total use.

SOURCE: Meadowlands Commission, 1975 & 1976 data, PUC reports, and current bus schedules.

is a map of the bus companies and routes serving the Port Authority Bus Terminal.

Port Authority Bus Terminal and Exclusive Bus Lane

The Port Authority Bus Terminal at 8th Avenue and 40th Street in Manhattan has 184 berths and served 60 million passengers in 1975. An extension to the terminal is now being constructed, which will increase capacity by 50 percent. Completion is scheduled in 1979. Many of the buses travelling to the Bus Terminal also make use of the I-495 Exclusive Bus Lane on the New Jersey approach to the Lincoln Tunnel. During morning rush hours, a normally westbound lane is made available for the exclusive use of eastbound buses. This lane carries an average of 1,050 buses daily, saving passengers 10-15 minutes a day. A study of evening peak period operations through the tunnel approach system will be undertaken in the near future aimed in part to improve bus travel.

Continued good bus access between the Meadowlands and Midtown Manhattan will be useful to both commuters from east of the Hudson to the Meadows, and to the Meadows residents who will commute to Manhattan.

New Jersey Bus Studies

Recent increases in subsidy requests for local bus routes have resulted in many changes in bus routes and fares in the north-eastern New Jersey area, and additional service adjustments are entirely possible. In addition, the New Jersey State Department of Transportation (NJDOT) has recently completed two major studies which could significantly affect bus service in the region. The first study dealt with route alignments, route competition, and intermodal competition. The objective was to coordinate the various modes and routes, providing maximum services with

a minimum of duplication and overlap. The second study addressed the state's subsidy program, and resulted in proposed criteria for the allocation of state funds. Legislation based upon these studies has been drafted and is now awaiting action by the State Legislature. If adopted, this legislation will significantly affect the manner in which new public routes can be introduced in the Meadows. As communities elsewhere request additional state funds, the amount available for Meadows routes may be reduced.

Park-Ride Lots

Two major park-ride lots are located in the Meadowlands District. Both lots offer non-stop express bus service to the Port Authority Bus Terminal. The New Jersey Turnpike Authority operates a 950-space lot at the Lombardi service area in Ridgefield. Bus fare is \$2.50 for a round trip (\$2.30 if purchased in books of five), with no parking charge. In 1975, this lot offered 24 daily bus trips to Manhattan and served 550 cars per day.

The Port Authority operates a 1,450-space lot in North Bergen, just off the approach road to the Lincoln Tunnel. Parking fee and round trip bus fare is \$2.25, with additional bus tickets for passengers at \$1.40. In 1975, this lot offered 94 daily bus trips to Manhattan and averaged 1,300 cars per day.

Both of these park-ride facilities are designed to serve Manhattan destined travelers. There are no comparable facilities designed to serve Meadowlands destined trips.

Rail Passenger Services

Northern New Jersey is served by an extensive rail passenger network, including commuter service, Amtrak intercity service, and PATH rapid transit service. Many of these services are located within or near the Meadowlands District (see Figure IV-5).

Prior to April 1976, commuter rail services were provided by three railroads: the Erie Lackawanna, Penn Central, and Central R.R. of New Jersey. In April, all commuter operations were taken over by the quasi-governmental Consolidated Rail Corporation (ConRail) which continues to operate these services under contract to the State of New Jersey. For convenience, the commuter rail services will be referred to in this report by their names prior to April, 1976. Only one of these lines had a commuter station next to the Meadows. As a result there is virtually no rail commutation by District employees. The system is described in detail however with the view of possible future use. Train and passenger data for commuter rail services are shown in Table IV-3.

Erie-Lackawanna

The Erie Lackawanna has five commuter rail lines serving northern New Jersey, all of which terminate in Hoboken. The Bergen County Line bi-sects the Meadowlands District and runs through Bergen County to Waldwick, with some trains continuing to Suffern or Port Jervis, New York. The nearest Meadowlands stop is the Rutherford Station, about one-half mile northwest of the District. The brick station building, in fair condition, is manned by a freight agency. There is also a flag stop at County Avenue, used mainly by railroad employees.

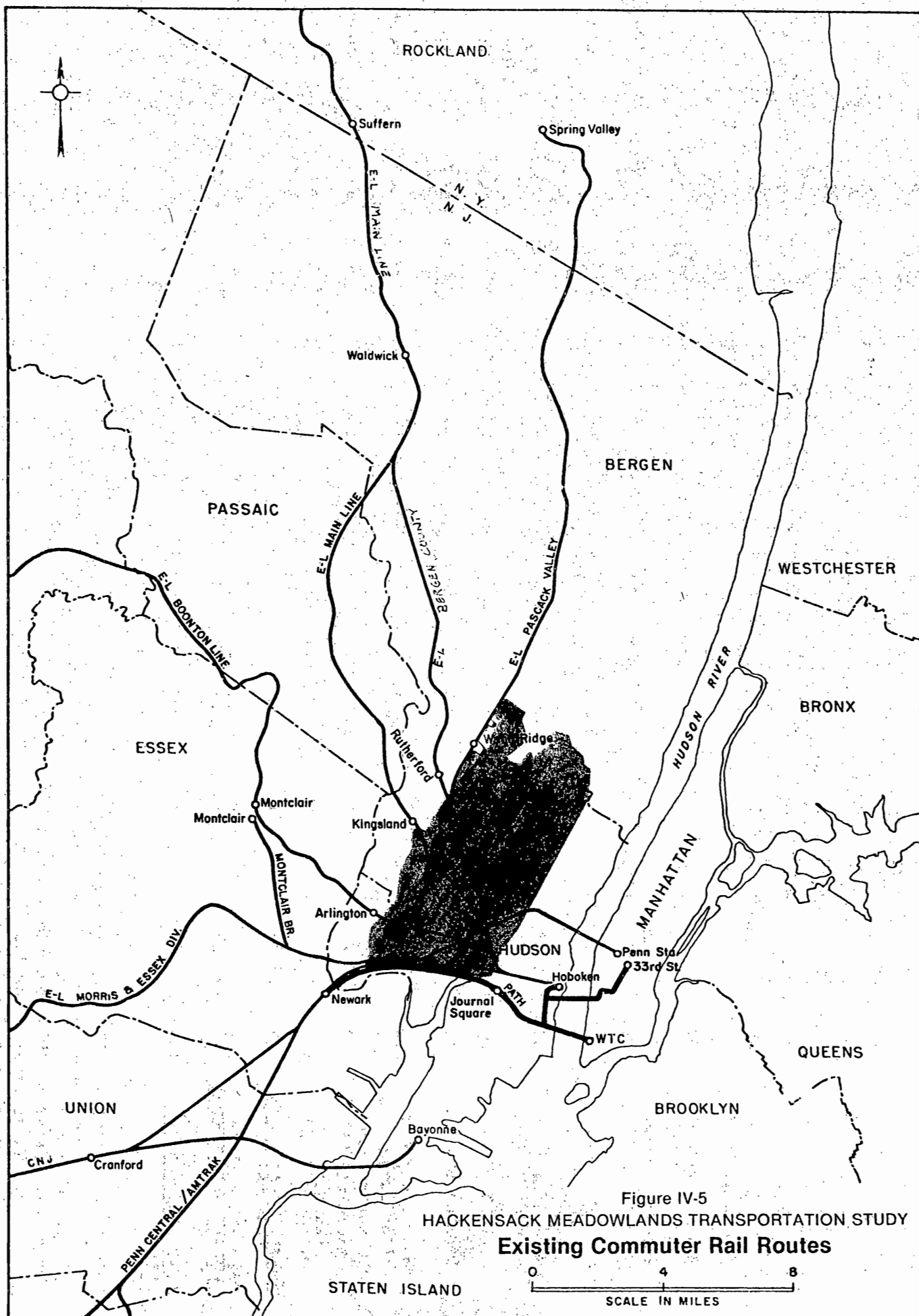


Figure IV-5
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Existing Commuter Rail Routes

Table IV-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Line	Existing ConRail Commuter Operations				Station	Travel Time To Hoboken	24-Hour Eastbound Ridership ¹		Off-Street Parking
	24-Hour Trains	Eastbound Ridership ¹	8-9 a.m. Trains	Eastbound ² Ridership ¹			On	Off	
<u>Former</u>									
<u>Erie-Lackawanna</u>									
Bergen County	14	6,540 pass	6	3,740 pass	Rutherford	15 min.	524 pass	47 pass	none
Pascack Valley	6	3,560	3	2,050	Wood Ridge	18	185	3	68 spaces
					Williams Avenue	22	65	83	n.a.
Main Line	17	2,120	2	590	Kingsland	15	203	12	20
					Lyndhurst	17	226	13	80
Boonton Line	12	3,400	6	2,320	Arlington	13	66	6	none
Morris & Essex (including Gladstone and Montclair branches)	70	19,980	16	9,190	Harrison	11	8	116	none
<u>Former Penn Central</u>	76	22,800	10	7,540	None ³	--	--	--	--
<u>PATH - Newark to WTC</u>	168	26,000	19	12,600	None	--	--	--	--

- Notes: 1. Based on 1975 conductors counts.
 2. Times refer to arrival in Hoboken or Penn Station NYC.
 3. Travel time from Newark to Penn Station, Manhattan is 15 minutes.

The Main Line serves Bergen and Passaic Counties, with most trains continuing through to Suffern, New York. The right-of-way crosses the Meadowlands District to the southwest of the Bergen County Line. The nearest stop is Kingsland, just beyond the District's western boundary. This station is only in fair condition due to extensive vandalism. A freight agent is on duty. A larger station is located at Lyndhurst, a half-mile beyond Kingsland. This station is in fair condition, with much vandalism in evidence.

The Pascack Valley Line runs through eastern Bergen County to Spring Valley, New York, and provides rush hour service only. The Pascack Valley is a single track line that branches off the Bergen County Line within the Meadowlands, and then follows the District's northwest boundary. Two stops are made along the edge of the District, at Wood Ridge near Route 17 and Moonachie Avenue and at Williams Avenue in Hasbrouck Heights. The Wood Ridge station is in excellent condition and has a freight agent on duty. Although just across the boundary it can be considered to be "in" the District.

The Boonton Line, which provides primarily rush hour service to Dover and Netcong, serves parts of Passaic, Essex, and Morris Counties. The right-of-way crosses the southern portion of the Meadowlands, with the nearest stop at Arlington, about one-half mile beyond the District. The station is a concrete block shelter in fair condition.

The Morris & Essex Division includes the main line to Morristown and Dover, with branches to Gladstone and Montclair. The right-of-way follows the southern boundary of the Meadowlands District. The nearest station, Harrison, is badly deteriorated. These lines also stop at Broad Street in Newark.

All Erie Lackawanna lines except the M&E Division are operated with push-pull diesel equipment and have new, air conditioned coaches. The Morris & Essex lines are electrified, with overhead 3Kv catenary, and use a fleet of antique coaches. A program is currently underway to re-electrify the M&E, using 25Kv, and purchase a new fleet of cars. Federal funds have already been approved, and completion is anticipated in 1980 or 1981.

All Erie Lackawanna trains terminate at Hoboken Terminal, where most passengers transfer to PATH for the trip to Manhattan. The station, located on the waterfront, includes a train shed and a passenger service area. The City of Hoboken has studied the feasibility of constructing a new transportation center on the site of the Hoboken Terminal, but no definitive plans have been made. Some Erie Lackawanna trains could carry additional passengers from New Jersey and Manhattan to the Meadowlands if Meadows stations were available. Table IV-4 shows, for example, the passenger capacity currently available on each line. However, subsequent analysis shows that the primary demand occurs on the Pascack Valley and Bergen County routes, where most trains are already fully loaded.

Other Commuter Rail Systems

In addition to the Erie Lackawanna, there are three other commuter rail systems in northeastern New Jersey. The Penn Central mainline has commuter service from Penn Station, New York, through Penn Station, Newark, to New Brunswick and Trenton. Some trains continue beyond to Philadelphia. This right-of-way traverses the southern portion

Table IV-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Existing E-L Passenger Demand By Line
(Eastbound Peak Hour)

<u>Line & Train Number</u>	<u>Time (1)</u>	<u>Passengers On Trains (2)</u>	<u>No. of Cars</u>	<u>Excess Capacity (3)</u>
<u>Bergen County Line</u>				
1252	7:55a.m.	436 pass	4 cars	- 36 pass.
1154	7:58	790	8	10
1254	8:05	403	4	- 3
52	8:09	697	6	- 97
1156	8:22	875	9	25
1256	8:34	463	5	37
54	8:45	490	5	10
<u>Main Line</u>				
1204	8:18	360	3	- 60
1206	8:40	181	2	19
<u>Pascack Valley Line</u>				
1604	7:57	712	6	-112
1606	8:07	508	5	- 8
1608	8:20	715	6	-115
1610	8:55	371	4	29
<u>Boonton Line</u>				
1004	8:02	361	4	39
1006	8:11	367	4	33
1052	8:19	402	5	98
1008	8:33	399	4	1
1010	8:50	155	2	45
1030	9:01	175	4	225
<u>Morris & Essex</u>				
304	8:00	748	10	52
506	8:08	752	10	48
608	8:12	731	8	- 91
306	8:19	374	8	106
610	8:21	596	10	204
508	8:30	716	8	- 76
612	8:42	645	7	- 85
308	8:46	370	6	110
310	8:51	274	6	206
614	8:55	320	6	120
<u>Gladstone</u>				
406	8:02	616	8	24
408	8:04	568	8	72
410	8:32	660	8	- 20
412	8:52	357	6	123
<u>Montclair</u>				
102	7:59	219	4	101
104	8:24	158	4	162
106	8:49	64	4	256

(1) Time given is 10 minutes earlier than scheduled stop at Hoboken.

(2) From on-board counts taken in May, 1976. (Typical weekday).

(3) Assuming current train makeup. Seating capacity of 100 for diesel lines, 80 for electrified service.

of the Meadowlands District. These tracks are also used by Amtrak for its Boston-Washington corridor service. Amtrak now owns this Boston-Washington rail line.

The Central Railroad of New Jersey (CNJ) provides commuter service from Penn Station, Newark to Cranford via the Aldene connection, and then west to Plainfield and Raritan on CNJ right-of-way. There is also a limited rush hour service to Phillipsburg and Philadelphia via the connecting Reading Railroad. This rail line will be upgraded in the near future.

The New York and Long Branch Railroad (NY & LB) serves the north Jersey coast through South Amboy to Bay Head. All trains serve Penn Station Newark, with some continuing on to Penn Station New York.

Commuter service was operated on the former New York Central's West Shore Division, in eastern Bergen County, prior to being abandoned in 1959. This right-of-way follows in part the eastern boundary of the Meadowlands District. Numerous efforts have been made to restore service on this route, using either rail or bus transit. A Federally-sponsored technical study of the corridor is now being conducted by the Tri-State Regional Planning Commission.

Port Authority Trans-Hudson (PATH)

PATH provides rapid-transit service connecting Newark, Harrison, Jersey City, and Hoboken with Manhattan. The system was purchased in 1962 by the Port Authority from the bankrupt Hudson & Manhattan Railroad. Since then, the Port Authority has undertaken a major rehabilitation program, including a new fleet of air-conditioned cars, station renovations, and track and signal improvements.

Four separate routes are operated at frequent intervals throughout the day: Penn Station Newark to the World Trade Center; Journal Square to 33rd Street, Manhattan; Hoboken to the World Trade Center; and Hoboken to 33rd Street. The right-of-way follows the southern edge of the Meadowlands District.

PATH's new Journal Square Transportation Center, located in the heart of Jersey City, opened in 1974. This multi-modal facility includes a PATH station; a bus terminal serving 28 local routes, including several to the Meadowlands industrial parks; off-street parking facilities; consumer services; and the PATH Control Center. Journal Square is located about a half-mile southeast of the Meadowlands District.

In 1972, the Port Authority proposed extending the PATH to Plainfield, replacing the Jersey Central commuter service. The proposed Plainfield Extension would follow the Penn Central right-of-way to Elizabeth, and then run west to Plainfield along the CNJ mainline. A stop at McClellan Street, Newark, would serve Newark International Airport, with passengers transferring to shuttle buses or an automated peplemover. This proposed extension has been superceded by the upgrading of the existing rail line.

Rail Freight

All rail freight services in the Meadowlands area are operated by ConRail. Freight is carried on most of the previously described rights-of-way used for passenger service. In addition, there are several lines within the Meadowlands used exclusively for freight traffic. The Erie-Lackawanna Newark branch diverges from the Boonton Line west of the Hackensack River. It continues west through Kearny and Harrison, and then

turns north to meet the Main Line. The Harrison branch, to be purchased by NJDOT from ConRail, leaves the M&E Division and follows the Meadowlands District western boundary, meeting the Main Line near the Kingsland station.

Along the eastern boundary of the District are freight lines from the Erie Lackawanna Northern branch and the Penn Central West Shore Division, both under ConRail. There is also New York, Susquehanna and Western property which was not taken over by ConRail and is used for rail freight operations.

Four major yard facilities are located in the Meadowlands District. The Meadows yard on the Penn Central mainline and the North Bergen yard on the West Shore line are major intermodal facilities. Activity at both of these yards is scheduled to increase under ConRail operations. Local freight is also handled at the Croxton yard on the Erie Lackawanna and at the Little Ferry yards on the West Shore line and New York, Susquehanna and Western. These yards will also continue in operation under ConRail.

CHAPTER V

TRAVEL CHARACTERISTICS OF MEADOWLANDS WORKERS

The study agreement calls for the measurement of existing travel within the Meadowlands District, including the development of origin-destination data for employment-based and residential-based travel by all modes. This chapter describes the planning, administration and results of a survey of 7,600 Meadowlands employees and 116 employers to determine the magnitude and characteristics of existing travel within the District and its immediate environs.

Need for Survey

In recent years, the Meadowlands area has become a center for economic activities. A land use survey by the Hackensack Meadowlands Development Commission in 1972 showed that about 7500 acres or approximately one-third of the District was committed to a permanent use. Because of the historical development pattern, much of the developed land is devoted to uses which serve to move persons, goods, and services across the Meadows or to store them in transit, but some 3000 acres are devoted to industrial, commercial and utility uses - all substantial generators of employment-based travel.

No firsthand employment surveys have ever been undertaken in the Meadowlands District, and because the District crosses several municipal boundaries, it is not possible to derive detailed employment statistics

exclusive to the District from existing federal, state or regional sources. However, based on a review of available Meadowlands land-use data, area industrial directories, chamber of commerce information and various regional and local planning studies, it can be reasonably estimated that more than fifty-thousand people are employed in the District.

Since no characteristics of this labor force were known, a decision was made to survey a representative cross-section of the establishments in the District. The sample of firms selected was geographically balanced, included a diversity of industrial and commercial activity, and ranged from the old, established firms to those newly arrived in the District.

Two questionnaires were prepared - one to be completed by the employee and the other by the company (see Appendices V-1 and V-2 for sample forms). The forms were also printed in Spanish for the use of Spanish speaking employees.

The Meadowlands Chamber of Commerce and area industrial directories provided the names and titles of corporate officials at the selected companies to which the survey requests were directed.

The following steps were then taken toward the implementation of the survey:

1. A letter signed by the Executive Director of the Hackensack Meadowlands Development Commission was sent to all selected

companies explaining the purpose and nature of the survey and asking for the company's cooperation. The names of HMDC staff members responsible for carrying out the survey were given as references in the letter (For text of letters, see Appendices V-3 and V-4).

2. A news-release was issued by the Commission explaining the purpose and objectives of the survey and asking for public support of the effort (For text of news release, see Appendix V-5).
3. The survey and the questionnaires were made public at a regular meeting of the Commission to further increase the public awareness of the impending survey.
4. A follow-up phone call was made to the company contacts approximately a week after the letters had been sent. During all contacts, the voluntary nature of the survey participation was emphasized.

The surveys, which were accomplished between July and October, 1976, were most successful and provided necessary data for both short and long-range transportation planning. The reaction of the company officials was very favorable and they offered useful and practical comments on employment-oriented travel patterns and problems in the District.

Of 164 companies asked to participate, 116 company questionnaires were filled out and returned - a participation rate of 71%. A total of 18,511 employee survey forms were distributed and 7,573 were completed and returned - a response rate of 41%. Figure V-1 displays the locations of the firms participating in the surveys. The pie chart in Figure V-2 illustrates the composition of the employment types contained in the sample.

Description of Study Zones

For the purpose of analyzing the survey results, the Meadowlands District was subdivided into six areas. These are shown in Figure V-3. Area "A" is the town of Secaucus excluding the areas not in the District. Areas "B", "C" and "D" are the portions of Jersey City, North Bergen and Kearny respectively which lie within the District. Area "E" includes portions of the towns of North Arlington, Lyndhurst, Rutherford and East Rutherford, and Area "F" comprises all or portions of the towns of Carlstadt, Moonachie, Teterboro, Little Ferry, Ridgefield and South Hackensack. Each area represents a regional grouping based upon geography, planned development and transportation access.

The origin areas for the journey-to-work trips were similarly divided into twenty-seven **geographic** groupings. The map in Figure V-4 illustrates that 17 origin zones were defined in the four county area (Hudson, Bergen, Passaic and Essex) immediately surrounding the Meadowlands. Three general areas, defined as North, West, and South, were

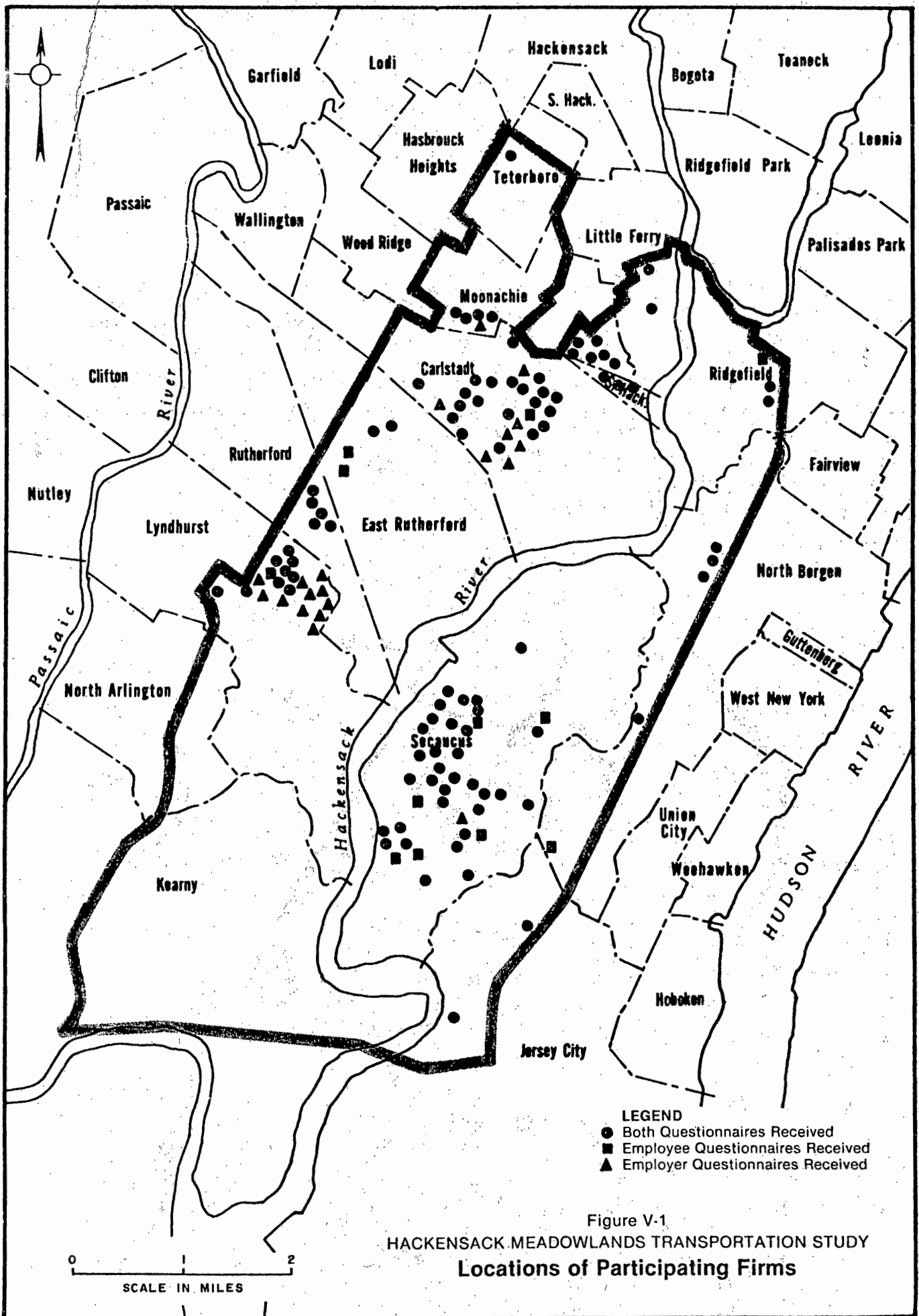
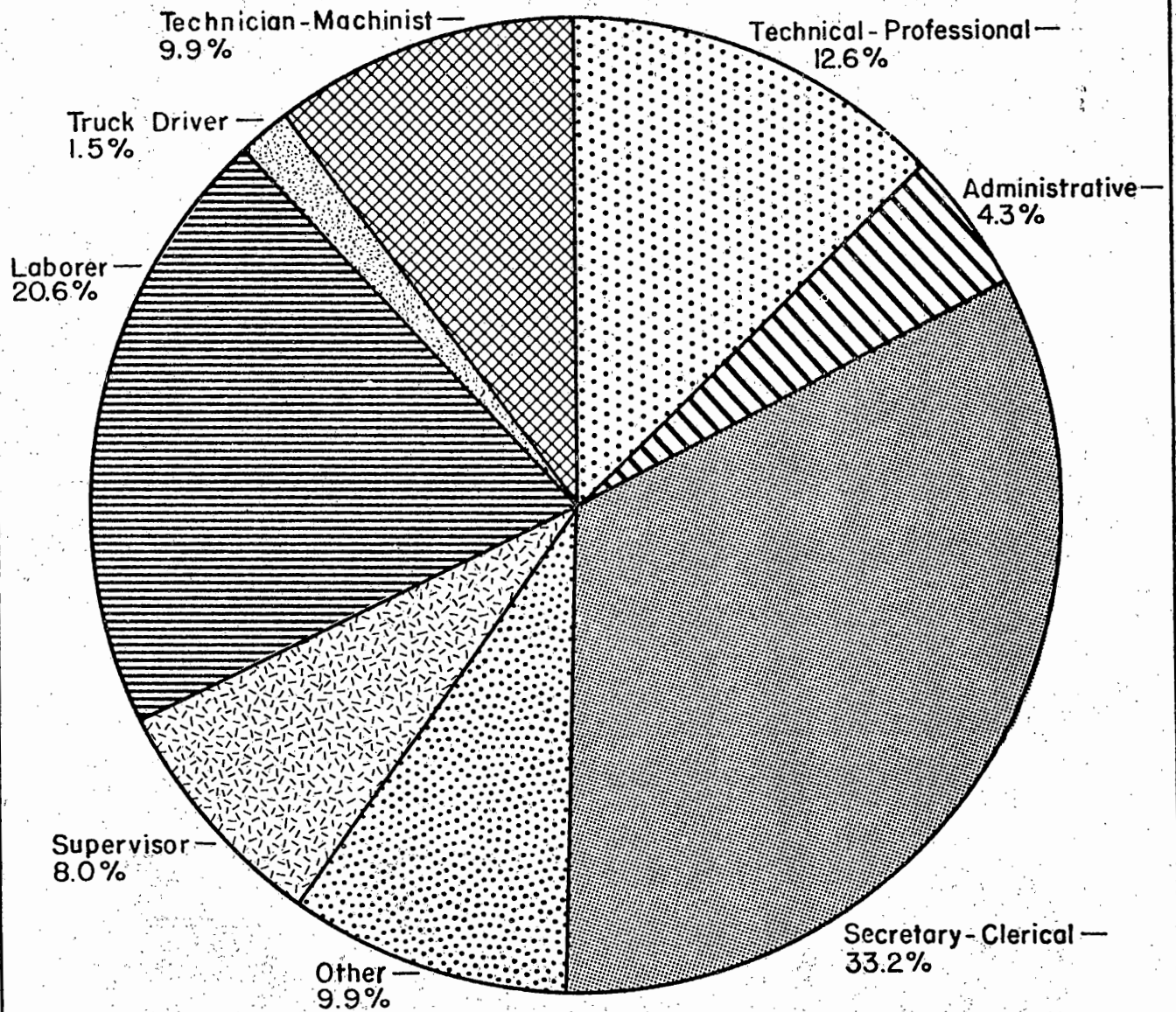
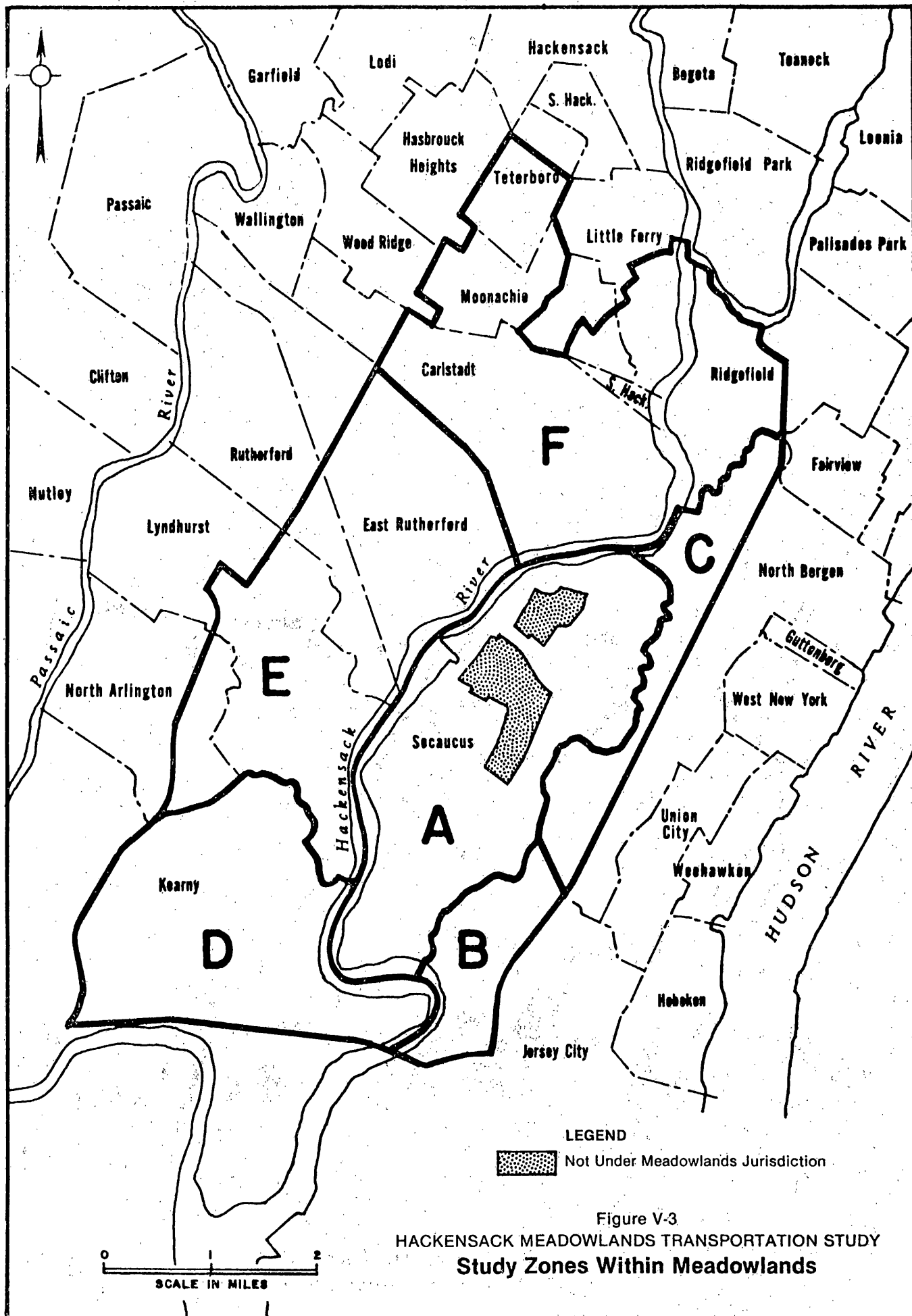


Figure V-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Job Classifications





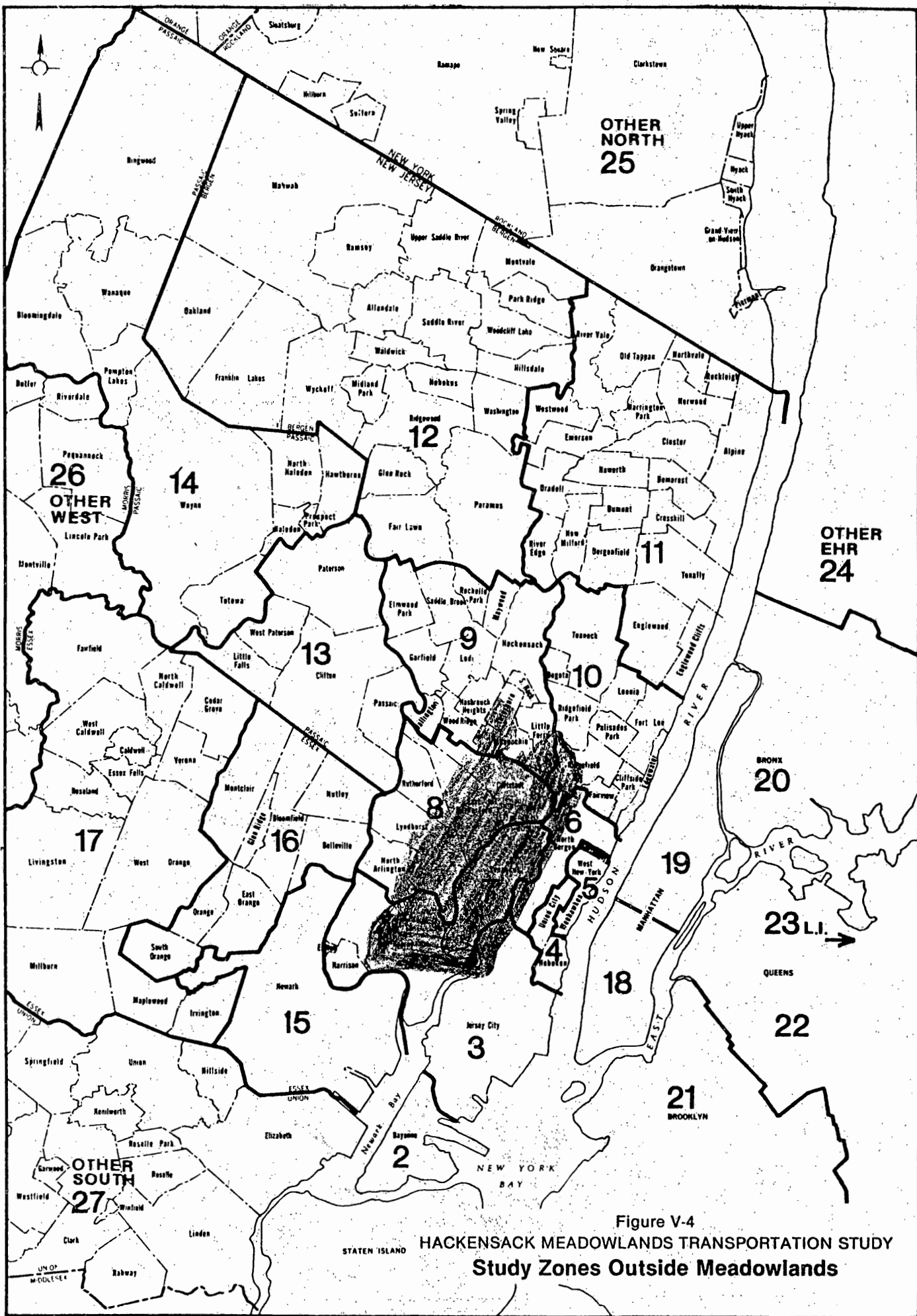


Figure V-4
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Study Zones Outside Meadowlands

established to accommodate origins west of the Hudson River beyond this immediate area. In addition seven areas were defined for locations east of the Hudson River. These were designed to be grouped into corridors leading to the Meadows.

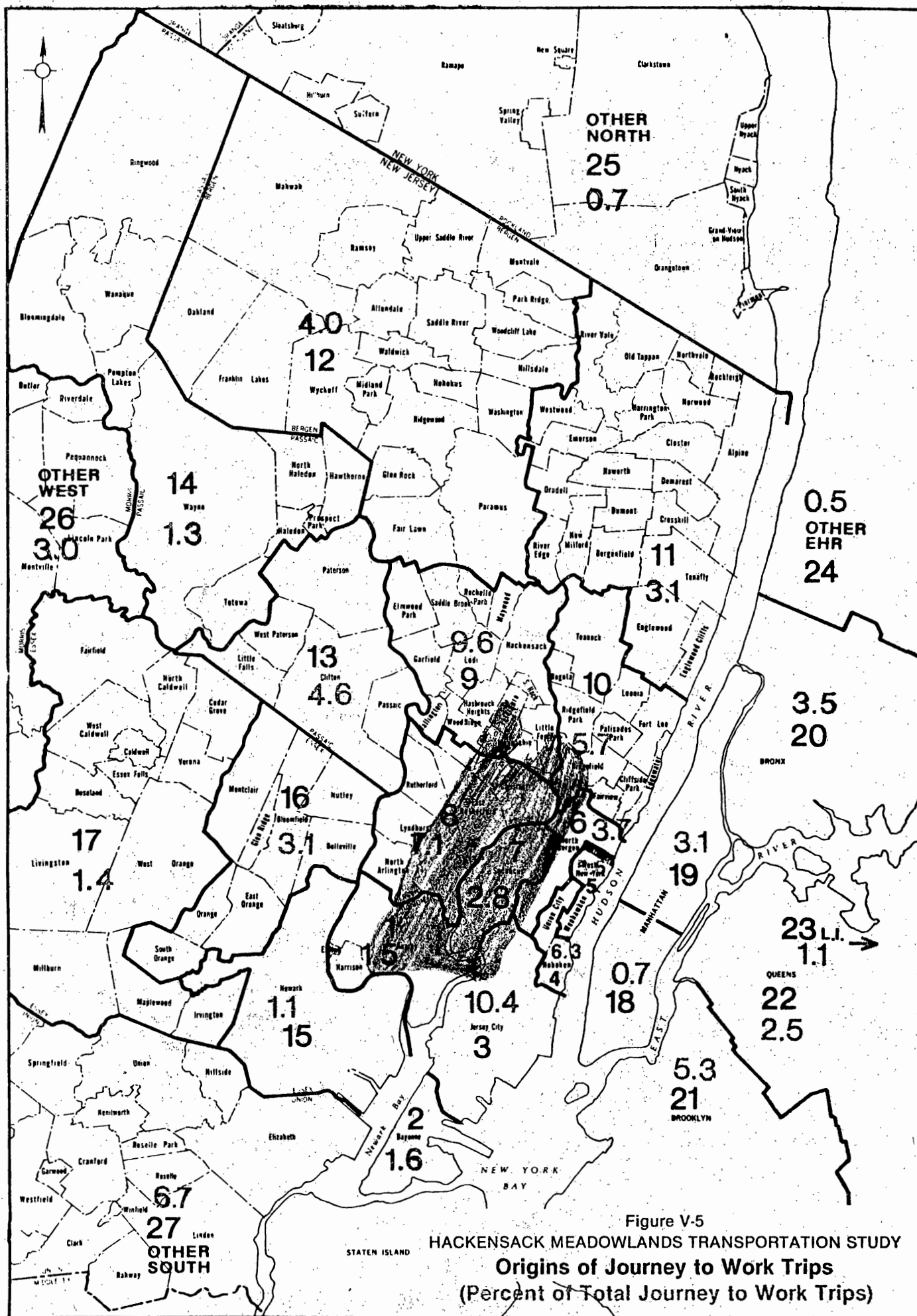
EMPLOYEE SURVEY RESULTS

Origin of Journey-to-Work Trips

The data displayed in Figure V-5 shows the proportion of workers employed in the Meadowlands who come from each of the twenty-seven study zones. These data indicate that approximately 40 percent of the labor force reside in the communities in or adjacent to the District. Hudson and Bergen Counties, which include these areas, account for approximately 60 percent of the trip origins, and in total, the 17 inner zones (Hudson, Bergen, Essex and Passaic Counties) account for nearly three-fourths of the trip origins.

In contrast to this clustering pattern, about 17% of the employees originate east of the Hudson River and nearly 10% originate in Union, Middlesex and other New Jersey counties to the south and west. Less than 1% originate in the New York Counties to the north.

The origin pattern for journey-to-work trips to the Meadowlands developed from this survey was generally corroborated by data from the 1970



census and from estimates made by the Tri-State Regional Planning Commission.

Modal Choice

The responses summarized in Table V-1 indicate that 90% of the journey-to-work trips to the Meadowlands are automobile oriented. This is comprised of three components: auto drivers (63%), auto passengers dropped off by someone (11%), and carpool users (16%). Public transportation accounted for only 9% and other modes constituted the remaining one percent.

In other words, the only mode of transit access, the Meadowlands bus routes described in Chapter IV, now deliver 9 percent or 2,657 employees to the Meadows in the rush hour.

When the mode choice is examined by area of origin, a greater proportion of public transit usage is evident from the more densely settled communities in Hudson County and east of the Hudson River. A factor is the availability of an automobile for the journey-to-work trip. The survey revealed that workers originating in Hudson County and the densely settled areas east of the Hudson River were less likely to have an automobile available for their trip. Specifically, only 44% of the Meadowlands workers residing east of the Hudson River and 73% from Hudson County had an automobile available for the journey-to-work-trip. This compares with over 90% for the workers originating in other areas.

The use of carpools from all areas is significant and ranges from a low of about 9% in Bergen County to a high of over 25% from east of the Hudson River and areas to the south of the Meadowlands. The large amount

Table V-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Mode Used for Journey-to-Work
(Percent Distribution)

<u>Origin Area</u>	M O D E					<u>Total</u>
	<u>Auto Driver</u>	<u>Auto Dropped Off</u>	<u>Carpool</u>	<u>Transit</u>	<u>Other</u>	
Hudson County	58.3	18.6	14.6	7.0	1.5	100.0
Bergen County	81.2	7.2	9.2	1.8	0.6	100.0
Passaic County	82.9	5.4	10.7	0.5	0.5	100.0
Essex County	78.9	7.2	10.4	3.2	0.3	100.0
East of Hudson	24.0	12.9	26.3	35.9	0.9	100.0
North	66.0	7.5	18.9	5.7	1.9	100.0
West	76.0	2.3	20.7	0.5	0.5	100.0
South	67.6	3.1	27.0	1.7	0.6	100.0
Total	63.2	11.3	15.5	9.1	0.9	100.0

Source: Hackensack Meadowland Employee Survey.

of existing car pooling suggests that formal car and van pooling programs could be used to reduce future vehicular flows to the Meadows.

Travel Times

Workers in the Meadowlands travel, on average, only 30 minutes between home and their work sites. However, there is a considerable dispersion around this mean. For example, approximately one quarter of the total sample reported travel times of less than 20 minutes with another 25% traveling between 20 and 29 minutes from home to work. In contrast, slightly over 17% of the sample reported travel times of one hour or more.

The average travel time computed from the survey for each of the twenty-seven origin areas is shown on Figure V-6. To a considerable degree, the high travel times for east-of-the-Hudson residents reflects the greater use of transit, which requires one or more transfers, as well as the greater degree of highway congestion traveling through New York City.

Work Start Times

The data presented in Figure V-7 describe the distribution of work start times. As is evident from these data, over one-half of the journey-to-work trips are made to meet work start times within the peak hour from 8:00 to 8:59 a.m. and the second, between 8:30 and 8:44. These most probably reflect shift start times scheduled for 8:00 and 8:30 a.m.. Other major start times appear to be 7:00 a.m. and 9:00 a.m. The

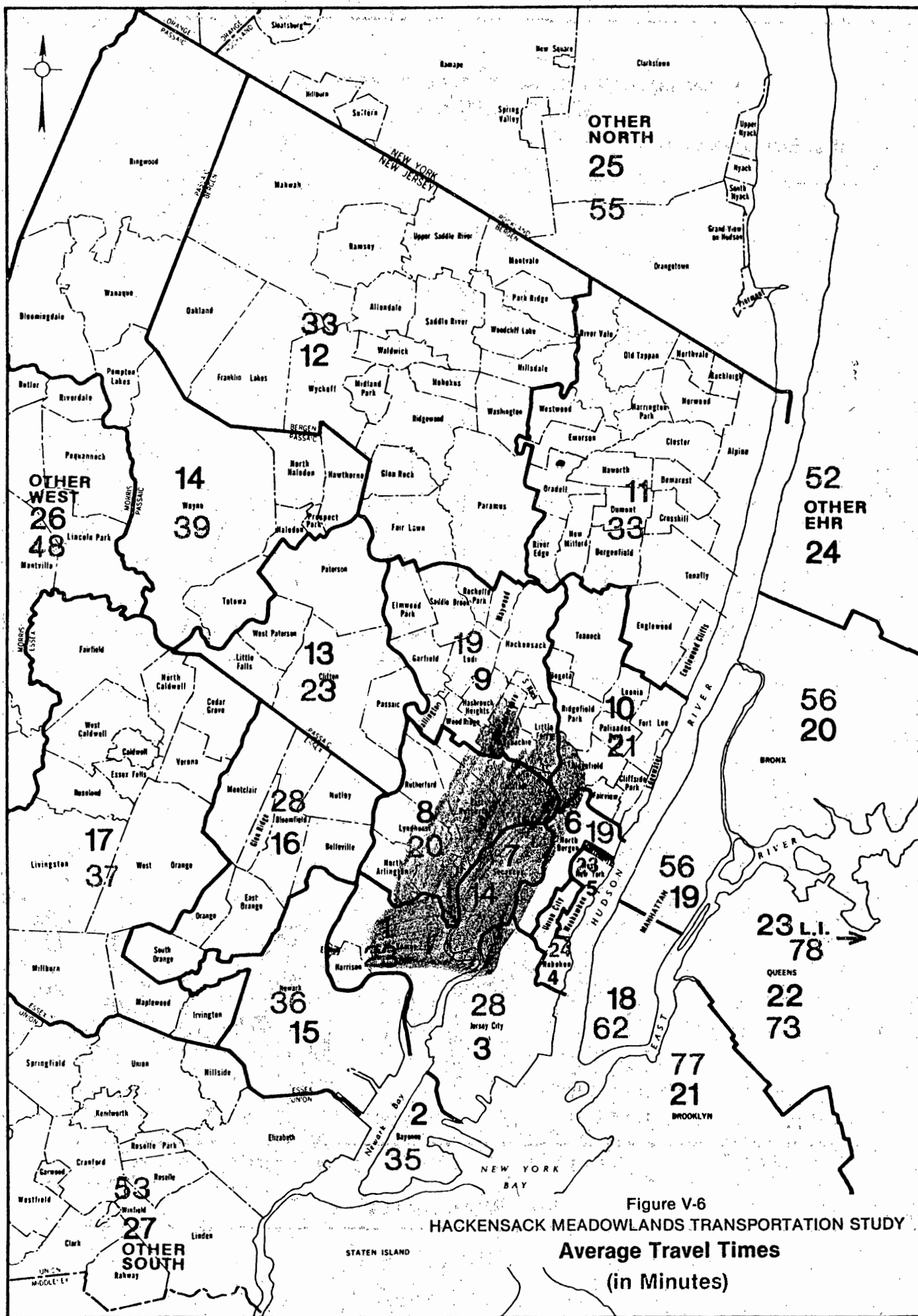
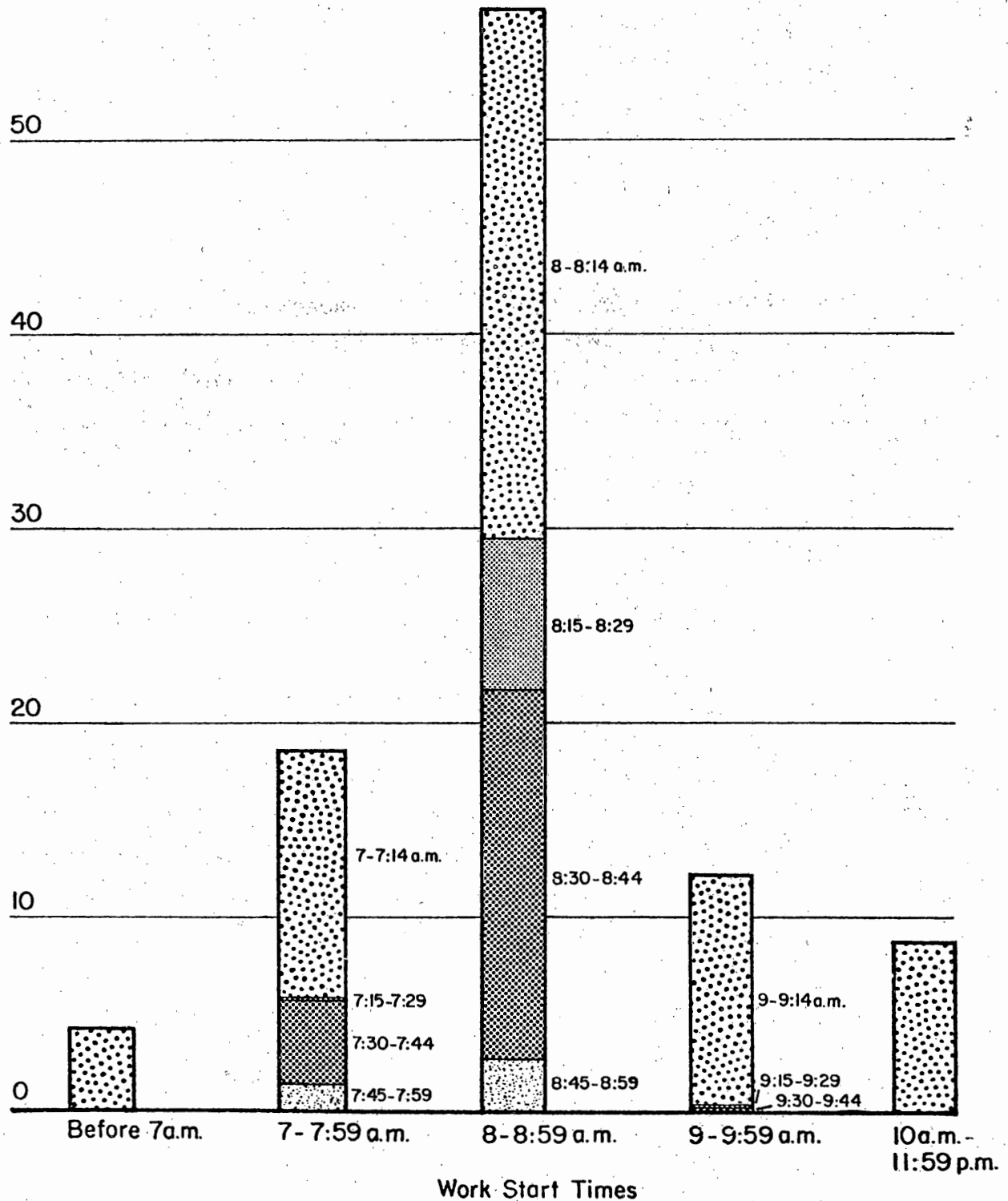


Figure V-6
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 Average Travel Times
 (in Minutes)

Figure V-7
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Work Start Times

Percent of Employees:
60



impact of this sharp peaking in the access to various work areas might be eased by moving some of the shift starts by 15 minutes.

Although the main focus of this study is the morning peak hour, the equivalent time period in the afternoon was examined. The data showed that the afternoon was less peaked with 48% of the workers leaving their job sites in the heaviest hour.

Travel Costs

Another characteristic of the journey-to-work trips is the cost of travel. Each worker filling out a questionnaire was asked to indicate his or her daily travel expense to and from work. These data are displayed in Table V-2.

Examining these data, it becomes apparent that workers originating closer to the Meadows generally pay less for their journey to and from work than do workers from further away. For example, of the workers from Hudson, Bergen, Passaic and Essex Counties - the 17 inner zones - between 45% and 60% pay less than \$1.50 per day. In contrast, the proportion of workers from East of the Hudson, and areas to the North, West and South who spend less than \$1.50 per day ranges from only 14% to 18% while 39% to 56% of this group pay \$3.00 or more.

In order to be attractive to riders, the fare structures for any proposed Meadows transit systems should approximate these costs.

Table V-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Average Daily Travel Costs
(Percentage Distribution)

<u>Origin Area</u>	<u>Under \$.50</u>	<u>\$.50- \$.99</u>	<u>\$1.00- \$1.49</u>	<u>\$1.50- \$1.99</u>	<u>\$2.00- \$2.49</u>	<u>\$2.50- \$2.99</u>	<u>\$3.00 & up</u>	<u>Total</u>
Hudson County	5.0	12.8	43.3	12.3	16.5	1.8	8.3	100
Bergen County	5.4	22.5	34.1	11.0	15.0	2.8	9.2	100
Passaic County	3.6	12.7	39.2	12.5	20.8	4.4	6.8	100
Essex County	2.2	13.5	28.8	10.9	21.3	5.1	18.2	100
East of Hudson	0.4	0.4	13.3	5.1	15.6	21.0	44.2	100
North	-	4.0	12.0	10.0	16.0	2.0	56.0	100
West	1.1	3.2	13.2	9.5	24.9	9.0	39.1	100
South	0.7	4.5	10.8	9.0	17.5	8.5	49.0	100
Total	3.6	12.4	30.6	10.2	16.7	6.6	19.9	100

Source: Hackensack Meadowlands Employee Survey.

Labor Force Composition

The mix of male and female workers in the Meadowlands labor force is illustrated in Table V-3. Overall approximately 60% of the workers are male and 40% female. However, the mix varies considerably by origin area. For example, male and female workers comprise nearly equal proportions of the labor force from Hudson and Bergen Counties compared with a distribution of approximately 90% male and 10% female from the more distant counties.

The relatively high proportion of female workers in the labor force, particularly from the towns immediately adjacent to the Meadows, is indicative of the general theory that women tend to seek employment close to their place of residence.

Satisfaction with Trips

In addition to the time and cost data, each surveyed employee was asked to indicate the overall degree of satisfaction with his or her trip. Table V-4 summarizes these responses.

From these data, nearly two thirds of the workers are satisfied or very satisfied with their journey-to-work trip, although the percentage varied somewhat by geographic area. For example, workers from east of the Hudson River had the smallest proportion of satisfied travelers (53%), while Bergen County had the greatest (70%). In general, the proportion of satisfied travelers from the remaining areas fluctuated around the average of 64%.

Table V-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Labor Force Composition
(Per Cent Distribution)

<u>Origin Area</u>	<u>Labor Force Composition</u>	
	<u>Male</u>	<u>Female</u>
Hudson County	53%	47%
Bergen County	48	52
Passaic County	69	31
Essex County	69	31
East of Hudson	63	37
North	94	6
West	87	13
South	89	11
All Areas	59	41

Sources: Hackensack Meadowlands Employee Survey.

Table V-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Satisfaction With Trip
(Percentage Distribution)

<u>Origin Area</u>	<u>Very Satisfied</u>	<u>Satisfied</u>	<u>Dissatisfied</u>	<u>Very Dissatisfied</u>	<u>No Response</u>	<u>Total</u>
Hudson County	18.0	46.7	21.0	10.4	3.9	100
Bergen County	19.6	50.8	20.8	7.1	1.7	100
Passaic County	9.1	51.0	15.5	3.2	21.2	100
Essex County	13.8	54.2	21.7	9.3	1.0	100
East of Hudson	9.7	43.3	23.4	19.4	4.2	100
North	8.9	51.8	23.2	12.5	3.6	100
West	10.5	50.2	29.7	8.7	0.9	100
South	8.8	50.3	23.8	15.4	1.7	100
Total	15.3	48.4	21.5	10.7	4.1	100

Source: Hackensack Meadowlands Employee Survey.

About one-third of the workers, both satisfied and dissatisfied, commented on their work trip. Over 20% noted poor highway conditions as their major complaint. Among the other comments were poor or non-existent transit service (8%), and excessive cost and travel time (3%).

A press release summarizing the survey results is included as Appendix V-6.

Implications of Survey Results

Several important implications can be drawn from the survey results, particularly as concerns possible future transit usage. While the automobile is by far the predominant mode of travel, the extent of existing carpooling to this area suggests that formal car and vanpooling programs might be used to reduce future vehicular flows to the Meadows.

The Meadows appears to be an attractive work area for female employees particularly from the immediately adjacent towns. If this pattern continues into the future, it would be supportive of mass transportation usage. Studies have shown that women are more likely to use mass transportation than men, particularly if the female workers is not the primary job holder in the family.

Finally, the mass transit facilities that do currently exist connect the most densely settled residential areas to the most developed work site areas in the Meadowlands. A small but significant number of current employees expressed dissatisfaction with existing poor or

non-existent transit indicating a latent demand for transit in some form if it were made available.

EMPLOYER SURVEY RESULTS

The employer survey was primarily to establish the relationship between the type and extent of development and employment. Specifically, employers were asked to identify the type of business in which they were engaged, the number of square feet of space they occupied and the size of their work force. Six categories of business activity were identified: manufacturing, warehousing, office buildings, retail sales, wholesale trade and other.

These data were compiled for each of the six study areas to develop the appropriate trip generation rates. In general, the sample of companies for the light industrial category was the largest and most complete. Other categories of activity, retail trade and office buildings for example, do not exist in sufficient size within the District today to provide a reliable base. Therefore, in the final determination of generation rates, other data sources were also used.

Other data obtained from the Employer Survey regarding where companies had relocated from and parking space allotments etc. are not applicable to this study but will be used by the Meadowlands Development Commission for their ongoing planning.

CHAPTER VI

EXISTING AND FUTURE DEMAND

The years selected for analysis are 1975 as the base year to represent existing demand, 1985 as an intermediate design year to incorporate those projects that could be put into effect immediately, and 2000 as a convenient ultimate design year in which the entire Meadowlands would be developed in accordance with the present master plan.

The heaviest volume of work-oriented trips are experienced in the morning peak hour which is used as the design hour for examining transportation needs. In 1975 there were about 28,000 peak hour trips to Meadowland jobs. For 1985 the design hour forecast is 34,500 trips to and from the Meadowlands and for ultimate development the forecast is 99,700 trips.

This chapter develops the several design year volumes.

Forecast Years

The 1975 or existing demand is based on 1975 surveys of land use and 1976 surveys of traffic. Forecasts of future travel demand were prepared for two years, 1985 and 2000. The year 1985 was selected as a short-term or intermediate goal. Transportation planning for 1985 could begin immediately and required improvements could be completed to accommodate the needs of developments now underway. The year 2000 was considered as a convenient year to represent ultimate development. The target date can, of course, fluctuate with the national economy, the intensity of construction activity, and a host of other factors.

Demand estimates for 2000 would generate the maximum transportation needs under the Meadowlands master plan. These needs would be met by long-term transportation proposals.

The Estimating Process

The standard traffic estimating process for a transportation planning study includes:

1. Trip Generation which developes total trips based on the type and extent of future land uses.
2. Trip Distribution which distributes the generated trips between origin and destination areas.
3. Modal Split where all trips are separated by mode, usually auto versus transit.
4. Trip Assignment where the trips on a particular mode are assigned to specific highway or transit routes.

This process usually addresses to 24-hour, two-way traffic, and may be carried out separately for each of several trip purposes. To assess the adequacy of a travel network or transportation system, the 24-hour trip totals are factored down to peak hour volumes by trip purpose since the various trip purposes have significantly different peaking characteristics. In this study, as outlined in the following sections, this standard process was followed except that the emphasis was on the morning peak hour in which the journey-to-work trip is the preponderant trip purpose.

The discussion that follows also is limited to the first two steps as they were performed for this study. The final steps, modal split and trip assignment, are covered in Chapter IX.

Types of Trips

The process used to produce transportation demand for the years 1985 and 2000 examined four components of peak hour travel, namely:

1. Journey-to-work trips
 - a. Meadowlands residents to Meadowlands jobs
 - b. Non-Meadowlands residents to Meadowlands jobs
 - c. Meadowland residents to non-Meadowlands jobs
2. Shopping and recreational trips by Meadowlands residents
3. Truck trips
4. Through traffic

After examining various sources concerning the nature of peak hour travel, it was determined that the non-work elements would be too small to warrant separate consideration. As will be discussed in later sections of this chapter, truck travel was handled on a link-by-link basis, and, for a number of reasons, through traffic on the Meadowlands roadway system was held constant.

Projected Land Use

The extent and type of land use is the base for generating journey-to-work trips. For example, an office with a floor area of 100,000 square feet will employ 400 people, while a warehouse of similar size will have only 100 persons. The impact on transportation needs is obvious.

As a first step existing land uses were identified from surveys conducted by the Meadowlands Commission. These data were then used in conjunction with the travel characteristics developed from the employee and employer surveys to estimate existing Meadowland-oriented travel on the highway and transit systems.

Land use projections for the year 1985 were prepared by the Meadowlands staff from an evaluation of the short-range and intermediate-range development potentials in the District. Commission staff were requested to mark off the areas on a block and lot map of the District where, in their opinion, development input could take place in the next eight-year period. Land use projections for the year 2000 were prepared by the Commission on the basis of full development in accordance with the revised Meadowlands District Master plan.

Table VI-1 is a summary of the existing and projected land uses by subareas of the Meadowlands expressed in appropriate units for projecting travel. Appendix VI-1 relates dwelling units to the anticipated number of District residents.

Converting Land Use to Peak Hour Trips

The existing land use and estimates of future land use are converted into employee journey-to-work trips using the relationships derived from the employer survey conducted in the District and from other published sources. The survey results generate full employment trips on a daily basis. These trips are then factored to account for those employees not working on a given day because of illness, vacation or business travel -- assumed to be 10% - and to convert daily trips to peak hour trips -- assumed to be 50%. This produces the trip generation rates used for this study. The rates are shown in Table VI-2. The total peak hour trips by Meadowlands employees are shown in Table VI-3. The 1975 development generated 28,000 trips which are forecast to grow to 34,500 trips in 1985 and 84,400 trips in 2000.

Land Uses by Sub Area of Meadowlands
(1975-1985-2000)

<u>Areas In Meadowlands</u>	<u>Type of Land Use</u>				
	<u>Commercial</u> (000)	<u>Office</u> (000)	<u>Light Industrial</u> (000)	<u>Heavy Industrial</u> ⁽¹⁾	<u>Residential</u> ⁽²⁾
<u>Area A</u>					
1975	458.7	250.5	8 876.2	79.0	--
1985	1 983.7	1 159.5	10 876.2	79.0	2 000
2000	4 596.0	5 110.0	20 106.0	97.2	12 248
<u>Area B</u>					
1975	9.1	3.5	1 200.3	318.0	--
1985	9.1	3.5	1 200.3	323.7	--
2000	--	--	5 201.0	439.5	--
<u>Area C</u>					
1975	--	--	2 612.4	138.5	--
1985	--	--	2 919.4	152.5	--
2000	--	1 774.0	9 409.0	108.4	--
<u>Area D</u>					
1975	--	55.1	2 759.4	248.6	--
1985	--	529.1	3 009.4	248.6	--
2000	1 655.0	3 072.0	3 720.0	497.5	--
<u>Area E</u>					
1975	190.8	674.9	5 570.8	173.6	--
1985	190.8	1 774.9	8 110.8	173.6	--
2000	2 078.0	7 051.0	11 989.0	51.8	19 338
<u>Area F</u>					
1975	672.3	0.5	12 404.1	432.0	--
1985	835.3	514.5	13 675.1	432.0	--
2000	887.0	2 060.0	31 143.0	--	15 948
<u>Total Meadowlands</u>					
1975	1 330.9	984.5	33 423.2	1 389.7	--
1985	3 018.9	3 981.5	39 791.2	1 407.7	2 000
2000	9 216.0	19 067.0	81 568.0	1 194.4	47 534

Note: Data in square feet of development except where noted.

(1) Acres of development

Table VI-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Generation Rates for Journey to Work Trips
(Full Development)

<u>Land Use Type</u>	<u>24 Hour Conversion Factors</u>	<u>Peak Hour Trip Generation Rates</u>
Commercial	1,000 sq. ft. per employee	.45 trips/1,000 sq. ft.
Office	250 sq. ft. per employee	1.8 trips/1,000 sq. ft.
Light Industrial	900 sq. ft. per employee	.5 trips/1,000 sq. ft.
Heavy Industrial	6 trips per acre	2.7 trips/acre
Residential	1.3 trips per household	.585 trips/household

Note: The trip generation rates assume that the peak hour represents 50 percent of the daily journey-to-work trips.

Table VI-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Peak Hour Journey-to-Work Trips by Meadowlands Employees

<u>Land Use</u>	<u>Number of Trips</u>		
	<u>1975</u>	<u>1985</u>	<u>2000</u>
Commercial	697	1,358	4,147
Office	2,101	6,784	34,321
Light Industrial	21,641	22,757	42,729
Heavy Industrial	<u>3,595</u>	<u>3,646</u>	<u>3,225</u>
Total	28,034	34,545	84,422

Work Trips By Meadowlands Residents

The process to determine the origins of the Meadowlands work trips begins with work trips by the Meadowlands residents since many of these will also work in the District. However, the residential working population will be far less than the jobs that are planned, and the remainder of the District jobs will be filled by people living outside the Meadowlands area. The job locations for the Meadowland residents were forecast in the following order:

- a. The District.
- b. Manhattan.
- c. Other areas east of the Hudson River.
- d. Other parts of New Jersey.

The Meadowlands Resident Labor Force

The first step in estimating the number of work trips by residents is determining the number of workers per household. As shown in Table VI-4, the 1970 census for the areas surrounding the Meadows indicates a range of 1.12 to 1.67 workers per household with an overall average of 1.29. This also approximates the experience at Harmon Cove in the Meadowlands when it was opened. Based on these data it has therefore been estimated that each household in the District will generate 1.3 workers.

Residents Who Work in District

The number of District residents who will work in the Meadows depends upon both the mix of available housing and the type of jobs. For example, the combination of high-income housing and low-income

Table VI-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Workers Per Household

<u>Locality</u>	<u>Employed Civilian Labor Force</u>	<u>Households</u>	<u>Workers Household</u>
Belleville	15 672	11 256	1.39
Bloomfield	23 598	17 837	1.32
East Orange	35 012	28 618	1.22
Irvington	27 871	23 497	1.19
Montclair	18 813	14 536	1.29
Newark	137 134	121 041	1.13
Nutley	13 944	10 218	1.36
Orange	14 681	12 046	1.22
West Orange	18 702	13 473	1.39
Total Essex County	374 686	302 582	1.24
Bayonne	31 119	24 517	1.27
Hoboken	16 542	14 741	1.12
Jersey City	105 172	87 835	1.20
Kearny	16 246	12 587	1.29
Union City	25 758	20 703	1.24
West New York	18 774	14 588	1.29
Total Hudson County	254 881	207 499	1.23
Bergenfield	14 340	10 247	1.40
FairLawn	17 318	11 713	1.48
Fort Lee	15 714	12 329	1.27
Garfield	14 145	10 796	1.31
Hackensack	17 343	13 647	1.27
Lodi	11 706	8 336	1.40
Paramus	12 489	7 492	1.67
Ridgewood	10 383	8 111	1.28
Total Bergen County	385 289	279 625	1.38
Clifton	37 988	27 996	1.36
Passaic	23 673	19 305	1.23
Paterson	56 959	47 746	1.19
Total Passaic County	191 609	147 214	1.30
Total Four Counties	1 206 465	936 920	1.29

Source: 1970 Census of Population

jobs would mean that residents would commute to jobs outside the District while non-residents must be delivered to the Meadows to fill the available jobs. The more nearly the housing and job mixes complement each other, the greater the opportunity for self containment in this study, it is assumed that appropriate housing would be available for workers in a broad range of job classifications and income levels and that the experience in the Meadowlands would be similar to that in adjacent areas.

The proportion of Meadowlands residents who will work in the Meadowlands was estimated based on 1970 census data. Table VI-5 shows the per cent of intra-municipality work trips for nine communities in northern New Jersey. Similar data on intra-county journey-to-work trips are displayed in Table VI-6. The communities are smaller in area than the District while the Counties are larger. From this data, it was estimated that 45 percent of the resident work force would be employed within the Meadowlands District.

Residents Who Work in Manhattan

The Manhattan central business district (CBD) is close to the Meadows. It offers a very large number of job opportunities, and potentially the transportation services between the Meadows and Manhattan will be excellent.

Table VI-7 shows the extent to which work trips are generated between 16 towns in northern New Jersey and the Manhattan CBD. This varies from a low of 4 to 5% (Bloomfield, Clifton and East Rutherford) to a high of 31.7% for Ft. Lee. An average of 15% of the work trips from these communities are to Manhattan.

Table VI-5

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Work Trips to the Same and Adjacent Towns

<u>Town</u>	<u>Percent of JTW Trips to</u>		
	<u>Same Town</u>	<u>Adjacent Town</u>	<u>Total</u>
Secaucus	26.7%	25.5%	52.2%
Carlstadt	20.6	15.9	36.5
Paramus	33.0	12.6	45.6
Fort Lee	14.0	8.9	22.9
East Rutherford	25.8	17.8	43.6
Montclair	33.8	n.a.	
Wayne	29.5	n.a.	
Demarest	11.4	n.a.	
Haworth	8.7	n.a.	

Source: 1970 Census of Population. Town defined as minor civil division.

Table VI-6

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Work Trips To The Same County

<u>Resident County</u>	<u>Per Cent of Work Trips to Same County</u>
Hudson	63.7%
Bergen	58.1
Passaic	65.5
Union	65.0
Middlesex	67.0
Essex	71.3

Source: 1970 Census of Population

Table VI-7

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Work Trips to Manhattan
(1970)

<u>Town</u>	<u>Population</u>	<u>Total Jobs</u>	<u>Total Work Trips</u>	<u>Per Cent of Work Trips to Manhattan</u>
Bloomfield	52 029	21 500	23 128	5.0
Clifton	82 437	45 300	37 068	4.3
East Rutherford	8 536	12 000	3 923	5.5
Fort Lee	30 631	6 600	15 316	31.7
Hackensack	36 008	33 000	16 836	9.0
Jersey City	260 545	97 000	101 849	16.9
Lyndhurst	22 729	7 500	9 812	9.5
North Bergen	47 751	26 700	20 841	19.4
Nutley	31 913	14 000	13 688	6.2
Paramus	28 381	33 000	11 776	11.9
Ridgefield	11 308	7 200	5 004	16.8
Ridgewood	27 547	7 500	7 234	22.0
Rutherford	20 802	5 600	8 804	16.9
Secaucus	13 228	12 500	4 887	14.9
Teaneck	42 355	12 000	18 326	22.2
Weehawken	13 383	5 400	6 020	28.9

X

Considering the type of residential development expected in the Meadows, the availability of future jobs and the potential for improved transportation services throughout the area, it was therefore estimated that approximately 15 percent of the Meadowlands residents would work in the Manhattan CBD.

Residents Who Work At Other Locations

The 1970 census data indicate that two to three percent of New Jersey residents commute to areas east of the Hudson River outside the Manhattan CBD. Therefore, it was assumed that three percent of the Meadowlands work force would journey to non-CBD locations east of the Hudson.

The remaining 37 percent of the Meadowlands work force would then be employed in communities in New Jersey surrounding the Meadowlands. Destinations of trips in this category were determined using projections of jobs for communities in northern New Jersey weighted on the basis of their distance from the Meadowlands, with the more distant points attracting fewer workers.

Work Trips By Non-Residents

In 1985 there will be only 2000 dwelling units in the Meadows. These units will provide less than one percent of the total Meadowlands work force so at that time nearly all of the people who work in the Meadows will live outside the District. By the year 2000 the resident work force will hold 15 percent of the jobs in the District, but still the majority of Meadows employees (85 percent) will live outside its boundaries.

The communities in which these workers lived in 1975 was approximated using the 1976 survey data for Meadowlands workers and the 1970 census data. A similar distribution was used for 1985, after taking account of the small number of resident workers.

By the year 2000, the assumption was made that the non-resident work force in the Meadowlands would still be drawn from all areas of the region generally in line with the current distribution of origin area. However, the projected job mix in 2000 is more heavily oriented toward office employment which may attract more workers who live in suburban locations. In addition, the residential areas near the Meadowlands have lagged behind the rest of the region with respect to population and job growth. For these reasons, the distribution of employee origins for the year 2000 is weighted slightly in favor of the less densely populated areas surrounding the Meadowlands.

It also is assumed the New York City will continue to lose blue collar jobs at a faster rate than blue collar workers. The development of the Meadowlands, as was mentioned earlier, is consistent with the concept of centrality concerning the location of employment centers. The Meadowlands could serve as an important area for the unemployed New York City workers to find new jobs. The various types of development which are locating in the Meadowlands, especially the distribution centers, require large single story buildings with good access to the regional highway system. Based on the concept of centrality it is desirable to have these industries locate closer to the core of the region and be connected with it. Therefore, New York City will continue to have workers who will travel to jobs in the Meadowlands.

Journey-to-Work Summary Tables

Tables VI-8, VI-9 and VI-10 show the distribution of the origins and destinations of Meadowlands-connected peak hour work trips for 1975, 1985 and 2000 respectively. In 1975, there were an insignificant number of resident workers so, as shown on Table VI-8, the total of 28,000 Meadowlands oriented peak hour work trips is by non-resident workers. By 1985, there will be a small resident work force but these workers will primarily commute to out-of-district work sites as shown on Table VI-9. The total of 35,500 trips represents an increase over 1975 of about 7,500 peak hour trips or about 27%. At full development (2000), as shown on Figure VI-1 and Table VI-10, there will be about 99,700 peak hour Meadowland-oriented work trips of which 71,900 (72%) are by non-residents to Meadowlands jobs, 12,500 (13%) are by Meadowlands residents to Meadowlands jobs, and 15,300 (15%) are by Meadowlands residents to out-of-district jobs.

The difference between the trips in 1985 and 2000 and those shown for 1975 represent the future transport demand addressed in the remainder of this study.

Shopping and Recreational Trips

The primary focus of the Hackensack Meadowlands Transportation Study is on peak hour demand. Non-work related trips are made for a number of reasons such as shopping, school, recreation and personal business. However, they are a very small proportion of total peak hour travel. For example, the non-work related travel on the PATH system in the peak hour is slightly over 1% of total peak hour travel. Similarly, non-work trips at the Port Authority Bus Terminal represent less than 4% of total afternoon peak hour passenger movements.

Table VI-8

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Estimated Peak Hour Work Trips In 1976

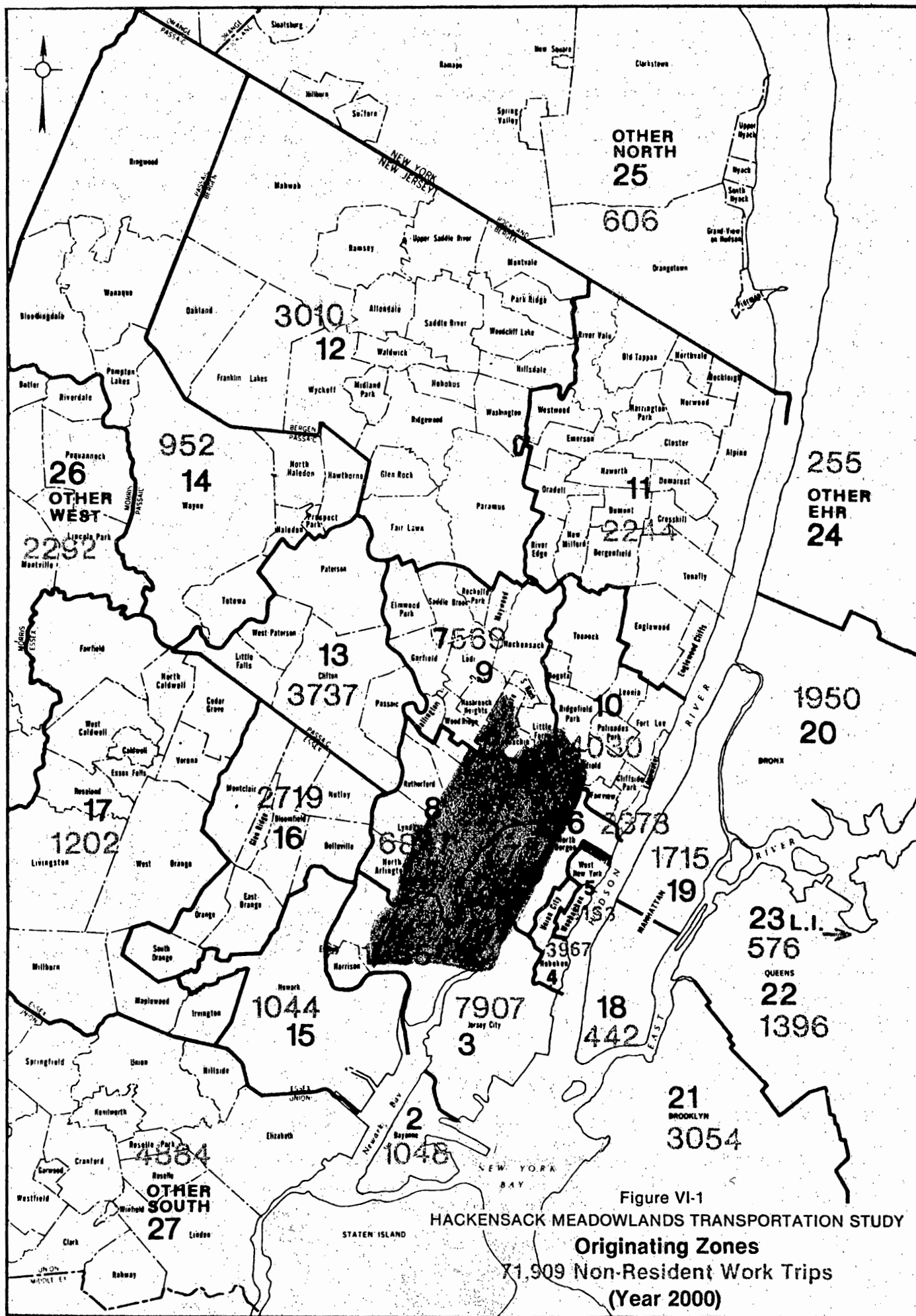
Origin Areas		In the Meadowlands							
		A	B	Cn	Cs	D	E	F	Total
Outside the Meadowlands	1	112	43	17	2	35	34	62	305
	2	138	70	14	1	27	17	42	309
	3	1,053	330	283	31	231	175	175	2,278
	4	329	31	708	79	18	254	414	1,833
	5	224	9	509	56	10	158	632	1,598
	6	276	25	457	51	7	102	175	1,093
	7	573	16	14	1	5	34	51	694
	8	263	38	34	4	15	1,458	650	2,462
	9	408	17	131	14	9	785	2,008	3,372
	10	349	15	293	32	14	107	1,067	1,877
	11	224	12	92	11	3	107	567	1,016
	12	197	7	45	5	1	232	911	1,398
	13	125	20	34	4	15	616	652	1,466
	14	86	2	7	1	6	90	175	367
	15	40	27	7	1	46	34	41	196
	16	138	42	48	5	65	209	269	776
	17	79	15	34	4	26	85	114	357
	18	51	9	24	3	2	42	48	179
	19	192	12	175	20	5	90	279	773
	20	209	12	88	10	3	164	388	874
	21	428	62	137	15	10	207	421	1,280
	22	178	7	53	6	2	122	253	621
	23	72	10	21	2	--	48	106	259
	24	28	0	21	2	1	5	57	114
	25	66	2	17	2	1	45	83	216
	26	125	28	59	6	42	186	270	716
	27	619	111	117	13	68	243	434	1,605
Total		6,582	972	3,439	381	667	5,649	10,344	28,034

Table VI-9
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Estimated Peak Hour Work Trips in 1985

Work Areas																	
In the Meadowlands									Outside the Meadowlands								
Origin Areas	A	B	Cn	Cs	D	E	F	Sub Total	Other Hudson 1-7	Other Bergen 8-12	Passaic 13-14	Essex 15-17	Manhat. 18	Other Areas E. of Hudson 19-24 W. of Hudson 25-27		Total	
Outside the Meadowlands	1	144	52	17	2	98	46	68	427							427	
	2	179	84	14	1	76	24	45	423							423	
	3	1,365	402	283	31	646	240	190	3,157							3,157	
	4	428	38	708	79	50	350	449	2,102							2,102	
	5	291	11	509	56	28	217	683	1,795							1,795	
	6	358	30	457	51	20	141	190	1,247							1,247	
	7	744	20	14	1	13	46	56	894							894	
	8	342	46	34	4	41	2,003	705	3,175							3,175	
	9	529	21	131	14	25	1,080	2,176	3,976							3,976	
	10	453	18	293	32	38	148	1,155	2,137							2,137	
	11	290	15	92	11	8	149	614	1,179							1,179	
	12	256	9	45	5	3	318	986	1,622							1,622	
	13	161	25	34	4	42	848	705	1,819							1,819	
	14	111	2	7	1	17	124	190	452							452	
	15	51	33	7	1	130	47	45	314							314	
	16	179	51	48	5	182	287	292	1,044							1,044	
	17	103	18	34	4	72	117	123	471							471	
	18	66	11	24	3	5	58	52	219							219	
	19	249	15	175	20	14	124	303	900							900	
	20	271	15	88	10	10	226	420	1,040							1,040	
	21	555	76	137	15	28	284	456	1,551							1,551	
	22	232	8	53	6	4	168	274	745							745	
	23	93	12	21	2	0	65	114	307							307	
	24	36	0	21	2	4	7	62	132							132	
	25	85	2	17	2	4	61	89	260							260	
	26	162	34	59	6	116	256	292	925							925	
	27	802	135	117	13	190	335	471	2,063							2,063	
Sub Total	8,535	1,183	3,439	381	1,864	7,769	11,205	34,376								34,376	
In the Meadowlands	A	51	5	9	1	13	36	54	169	268	187	87	189	169	56	0	1,125
	E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	8,586	1,188	3,448	382	1,877	7,805	11,259	34,545	268	187	87	189	169	56	0	35,501	

Table VI-10
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Estimated Peak Hour Work Trips in 2000

Work Areas																	
Outside the Meadowlands																	
Origin Areas	In the Meadowlands							Sub Total	Other Hudson 1-7	Other Bergen 8-12	Passaic 13-14	Essex 15-17	Manhat. 18	Other Areas		Total	
	A	B	Cn	Cs	D	E	F							E. of Hudson 19-24	W. of Hudson 25-27		
Outside the Meadowlands	1	298	139	24	8	405	99	92	1,065								1,065
	2	371	225	21	7	312	50	62	1,048								1,048
	3	2,830	1,067	422	141	2,676	510	261	7,907								7,907
	4	888	100	1,061	354	208	740	616	3,967								3,967
	5	604	29	761	254	116	461	938	3,163								3,163
	6	742	81	686	229	81	298	261	2,378								2,378
	7	1,543	53	21	7	58	99	76	1,857								1,857
	8	782	130	50	17	198	4,544	1,126	6,847								6,847
	9	1,210	58	194	64	118	2,448	3,477	7,569								7,569
	10	1,034	51	434	144	185	335	1,847	4,030								4,030
	11	663	41	137	46	39	336	982	2,244								2,244
	12	586	24	68	21	13	721	1,577	3,010								3,010
	13	377	73	51	17	213	1,818	1,188	3,737								3,737
	14	260	7	11	4	85	265	320	952								952
	15	128	89	10	4	629	107	77	1,044								1,044
	16	440	139	70	23	888	652	507	2,719								2,719
	17	251	50	50	16	356	265	214	1,202								1,202
	18	120	29	39	13	30	129	82	442								442
	19	453	41	281	93	91	277	479	1,715								1,715
	20	491	42	140	47	61	504	665	1,950								1,950
	21	1,010	213	219	73	183	635	721	3,054								3,054
	22	420	24	84	28	31	375	434	1,396								1,396
	23	169	35	34	11	0	146	181	576								576
	24	66	0	33	11	30	17	98	255								255
	25	273	0	26	9	17	139	142	606								606
	26	364	89	78	26	596	607	532	2,292								2,292
	27	1,819	368	182	60	894	781	780	4,884								4,884
Sub Total	18,192	3,197	5,187	1,727	8,513	17,358	17,735	71,909									71,909
In the Meadowlands	A	874	152	247	82	248	619	1,002	3,224	974	678	315	684	1,075	215	0	7,165
	E	1,379	240	389	130	392	978	1,583	5,091	1,118	1,176	599	1,293	1,697	339	0	11,313
	F	1,137	198	321	107	324	806	1,305	4,198	821	1,406	435	790	1,400	280	0	9,330
	Total	21,582	3,787	6,144	2,046	9,477	19,761	21,625	84,422	2,913	3,260	1,349	2,767	4,172	834	0	99,717



The Meadowlands District is anticipated to have few land uses which would attract non-work travellers particularly in the morning peak hour. Since the non-work component of peak hour travel is so small at other facilities, the non-work portion of peak hour passenger travel was excluded from this analysis. Several non-work traffic generators that could impact the evening peak hour in the future years are projected to develop within the Meadowlands. These include the sports arena and the 2,000-acre park. The additional traffic that may be generated by these facilities presumably will be described when these projects are reviewed by the Commission.

Truck Traffic

The 1976 traffic surveys included classification of vehicles by type. This yielded the per cent of trucks on each highway link. Trucks ranged from 5 % of total traffic at Little Ferry Circle on Route 46 to a maximum of 31% on the west spur of the Turnpike north of Exit 16W. These percentages were applied to total volumes developed for 1985 to provide the truck traffic for that year. By the year 2000, the land use forecasts for the Meadowlands includes an increasing per cent of non-residential development devoted to office space which is not a major truck generating use. Therefore, the per cent of trucks on highway links connecting directly to the District at full development was reduced to 75% of the 1985 percentages. Where applicable truck volumes then are converted to passenger car equivalents at the rate of two car equivalents each.

Travel Through the District

Total vehicular traffic in the years 1985 and 2000 is computed by adding the forecasted additional Meadowlands generated traffic to the volumes identified from the 1976 traffic counts. For the purposes of this study, it is assumed that in the future the roadways immediately surrounding and passing through the Meadowlands District would handle the same volume of non-Meadowlands traffic

as they carry today. This assumption is based on several considerations.

First, the population and employment in the areas immediately surrounding the Meadowlands is projected to remain relatively stable over the next 25 years, as indicated by studies by the Tri-State Regional Planning Commission and others. Employment growth in the Manhattan CBD also is anticipated to be relatively small. Therefore, the demand for auto travel on roadways feeding Hudson County and the Hudson River Crossings is projected to remain stable.

Second, not all of the peak hour journey-to-work travel to the Meadowlands will be new to the surrounding highway network. Some workers will shift their employment location to the Meadows because of the greater employment opportunities available in the Meadows at full development. In doing so, these workers may not add to the travel demand on local roads even though they are included in the projected Meadowlands growth. For example, a worker who resides in Hasbrouck Heights and shifts his place of employment from Harrison to East Rutherford may take Route 17 for both trips. Thus, his trip to the Meadows does not represent newly generated traffic on this section of highway. There is no way to reliably estimate the extent to which this may occur; however, it is likely to occur to a sufficient degree to offset any modest growth which might occur in through travel.

Third, as traffic on highways in the District increases, congestion and delays increase. When this occurs, motorists who have an option are expected to divert to alternate routes such as I-80 or the New Jersey Turnpike that bypass the Meadowlands and have unused capacity.

Finally, many of these roads are at or near capacity today. In addition to the restraints on through routes and local roadways, peak hour auto travel to Manhattan CBD is limited by capacity at the Lincoln and Holland Tunnels. Expansion

would be out of the question because of environmental considerations and the policy of the City that auto traffic in Manhattan should not be increased.

Therefore, traffic growth on routes feeding these facilities will also be limited.

CHAPTER VII

CURRENT TRANSPORTATION PLANS

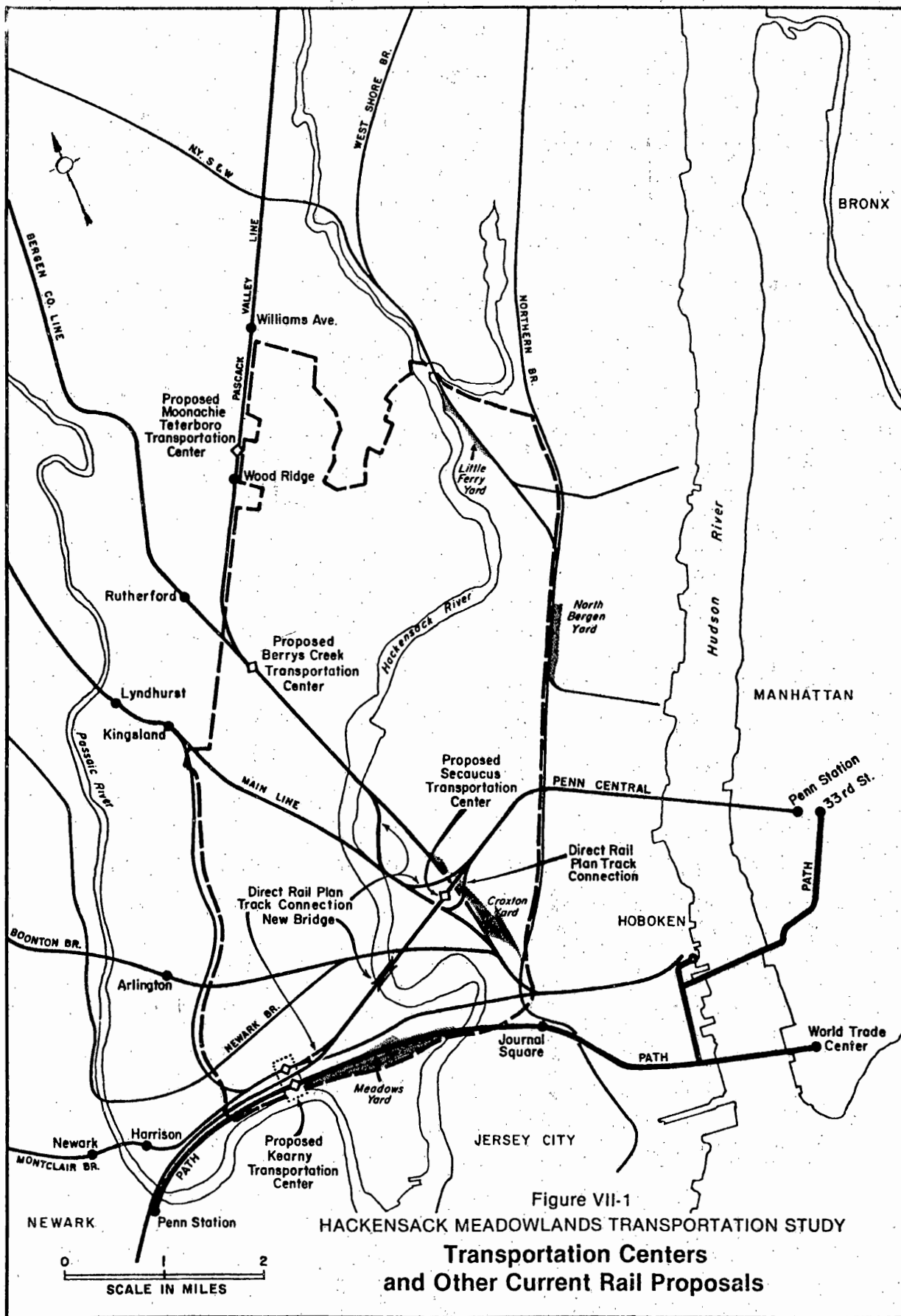
The most recent transportation concepts for the Meadows include the transit planning found in the 1972 Meadowlands Master Plan and the programs for highways in and around the Meadows in the 1974 New Jersey DOT Master Plan. Both would require large amounts of capital and take several years to implement.

Bus services to the Meadows, intra-Meadows transportation, special pedestrian facilities, truck routes, and bike and moped routes are not highlighted in current plans. Also missing are any low-capital interim programs that could be rapidly implemented.

1972 Commission Plan

The Hackensack Meadowlands Development Commission in its 1972 Master Plan acknowledged the importance of mass transportation by calling for the retention of certain rail lines in the District and providing for four Transportation Centers in key locations throughout the District. These centers represent a substantial capital investment, would take a year or more to implement. They would be the major multi-modal terminals on existing rail lines and would connect Meadowlands development to the regional transit system. Additional provisions are contained for local mass transportation in all Specially Planned Areas. Other important transportation facilities are the Sports Complex and the proposed Hartz station.

These proposed facilities are shown in Figure VII-1 and are described in the following paragraphs:



Berrys Creek Center

In accordance with the Master Plan, the Berrys Creek Center (BCC) will be the focus of the Hackensack Meadowland's commercial and retail development. The BCC, located just south of the Sports Complex on almost 300 acres of land, will contain commercial, retail, residential, cultural and office facilities, and one of the Meadowland's principal transportation centers. In addition, the center has a projected residential population of 10,000 persons.

The center is bordered on the north by Route 3 and on the east by the New Jersey Turnpike (western spur). In addition, both Routes 17 and 20 are located nearby. There are numerous commuter bus lines which pass this site on Routes 3 and 20. The Erie Lackawanna Railway's Bergen County Line and the Berrys Creek Canal bisect the site.

At the Berrys Creek Transportation Center, incoming rail and commuter bus riders walk or ride local buses to jobs in the surrounding commercial buildings. Residents of the center could board the same trains and buses to reach jobs elsewhere. Auto parking would be available. Through bus and rail riders could change modes at this point. Berrys Creek Transportation Center would also be a logical point for the future transit connection to the Meadowlands Sports Complex that was proposed by the State of New Jersey in 1973.

Secaucus Transportation Center

The proposed Secaucus Transportation Center consisted of approximately 77 acres (since reduced to 20 acres) situated at the intersection of the Erie Lackawanna's Bergen County Line and the Penn Central's Mainline.

The eastern spur of the New Jersey Turnpike borders the site on the west. County Road bisects this site.

The Secaucus Transportation Center would provide Meadows residents access to Erie Lackawanna trains to Hoboken and Penn Central trains to New York and Newark, and for non-residents served by these lines, access to Meadowlands jobs. Local bus routes would link the center to Meadowlands housing and industry. A connection to the Turnpike would be unlikely, due to the proximity of Interchange 18E.

The site also is the location of the proposed direct rail connection between the Erie Lackawanna and the Penn Central. The connection is part of the Direct Rail Access Plan (DRAP) discussed later in this chapter, which would provide Meadowlands and Bergen County residents direct access to Midtown Manhattan.

ConRail, the largest property holder, owns 40 percent of the land at the site.

Moonachie/Teterboro Transportation Center

The proposed Moonachie/Teterboro Transportation Center consists of approximately 35 acres located adjacent to the Erie Lackawanna's Pascack Valley Line, Teterboro Airport, and Moonachie Avenue.

The Erie Lackawanna, with the financial assistance of the New Jersey DOT, has received new passenger equipment and has laid welded rail on the Pascack Valley line and the existing Wood Ridge station is within walking distance of the site. In addition, Route 17, which is on the western side of the railroad and directly across from the center, carries

numerous New York bound commuter buses that could provide service to this center.

The 1972 plan proposes an expanded parking lot at the center with a possible station relocation. This would provide a park-and-ride facility for Meadowlands and other Bergen County residents who work in New York. Passengers could also transfer from trains and commuter buses to local routes serving Meadowlands industries. This center might also serve Teterboro Airport if future demand develops.

The principal land owner of the site is the Port Authority of New York and New Jersey.

Kearny Transportation Center

The proposed Kearny Transportation Center consists of approximately 92 acres located adjacent to the Penn Central Railroad's Mainline, the Erie Lackawanna Railway's Morristown Line, and PATH's Newark to World Trade Center line. Its primary purpose, therefore, would be to provide access between these three rail services and planned developments in this portion of the District via local buses. It would also provide an interconnection between the lines. A rail connection between this center and the Berrys Creek Center has also been proposed. The center is also bordered by the New Jersey Turnpike (exit 15W is next to the site), the Newark-Jersey City Turnpike, and Interstate I-280. Any buses on these routes could stop at the site.

The site, which is only two miles from downtown Newark, could offer employment opportunities and other benefits to the people of Newark and surrounding urban areas. The Town of Kearny owns the land at this site.

The Sports Complex

The New Jersey Sports and Exposition Authority has constructed a stadium and racetrack in East Rutherford just north of Route 3 and west of Route 20 and the New Jersey Turnpike. The football stadium has a seating capacity of 76,500 while the horse racing facility is designed for 35,000. Construction of an indoor arena is scheduled for 1979-1980. Eventually the complex may contain a theme park, a hotel and exposition center, a baseball stadium and related service facilities. It will be the single largest attraction in the Hackensack Meadowlands District. The plan calls for an integrated mass transportation system that would serve both the Sports Complex and Berrys Creek Center just to the south.

Hartz Mountain Station

The Meadowlands Commission and Hartz Mountain Industries had initiated discussions with the State of New Jersey to locate a commuter rail station on the Bergen County rail line just west of Meadowland Parkway to serve the Harmon Cove residential area. This station opened on June 19, 1978. People living nearby would walk or take a shuttle bus to the station for commuting to lower Manhattan via a transfer to PATH at Hoboken, or to Midtown Manhattan via a transfer at Secaucus as outlined above, or via the Direct Rail Connection when completed as discussed below.

Direct Rail Access Project (DRAP)

This program, announced in 1972, will provide direct access for Erie Lackawanna trains into Penn Station, New York. Outside of the Transportation Centers, it is the proposal that will have the most impact on Meadowland's rail planning. The project consists of four elements:

- A track connection in Kearny between the M&E Division and the Penn Central mainline;
- A track connection in Secaucus between the Bergen County and Main Lines and the Penn Central mainline;
- A new Penn Central bridge over the Hackensack River; and
- Improvements to Penn Station, New York.

The re-electrification of the M&E Division, now underway, will make those trains compatible with the Penn Central electrical system, allowing them to operate into Penn Station. The Erie's diesel trains cannot operate into Penn Station. However, New York's Metropolitan Transportation Authority is currently developing a gas turbine electric (GTE) car which can operate either under its own power or from a trackside electrical system. Once this car is available, it could be used on the Bergen County and Main Lines to permit direct access into Penn Station.

NJDOT is scheduled to construct the first element of DRAP, plus some improvements at Penn Station. Engineering design is currently in progress. However, project financing is still in questions. It is possible that the project will be staged, with the Kearny connection for the M&E Division to be constructed first.

Rail Equipment

As mentioned in Chapter V, the Penn Central, Erie Lackawanna and PATH either have or have on order modern, air-conditioned equipment.

Bus Service

There are no proposals at this time for further modification of bus services to the Meadowlands. In the past, however, the Bergen Freeholders and carriers such as Transport of New Jersey and Hudson Bus have adjusted routes to meet new needs. Most bus companies in New Jersey now operate modern, air-conditioned equipment purchased by the State using Federal capital grant funds.

Intra-Meadows Transportation

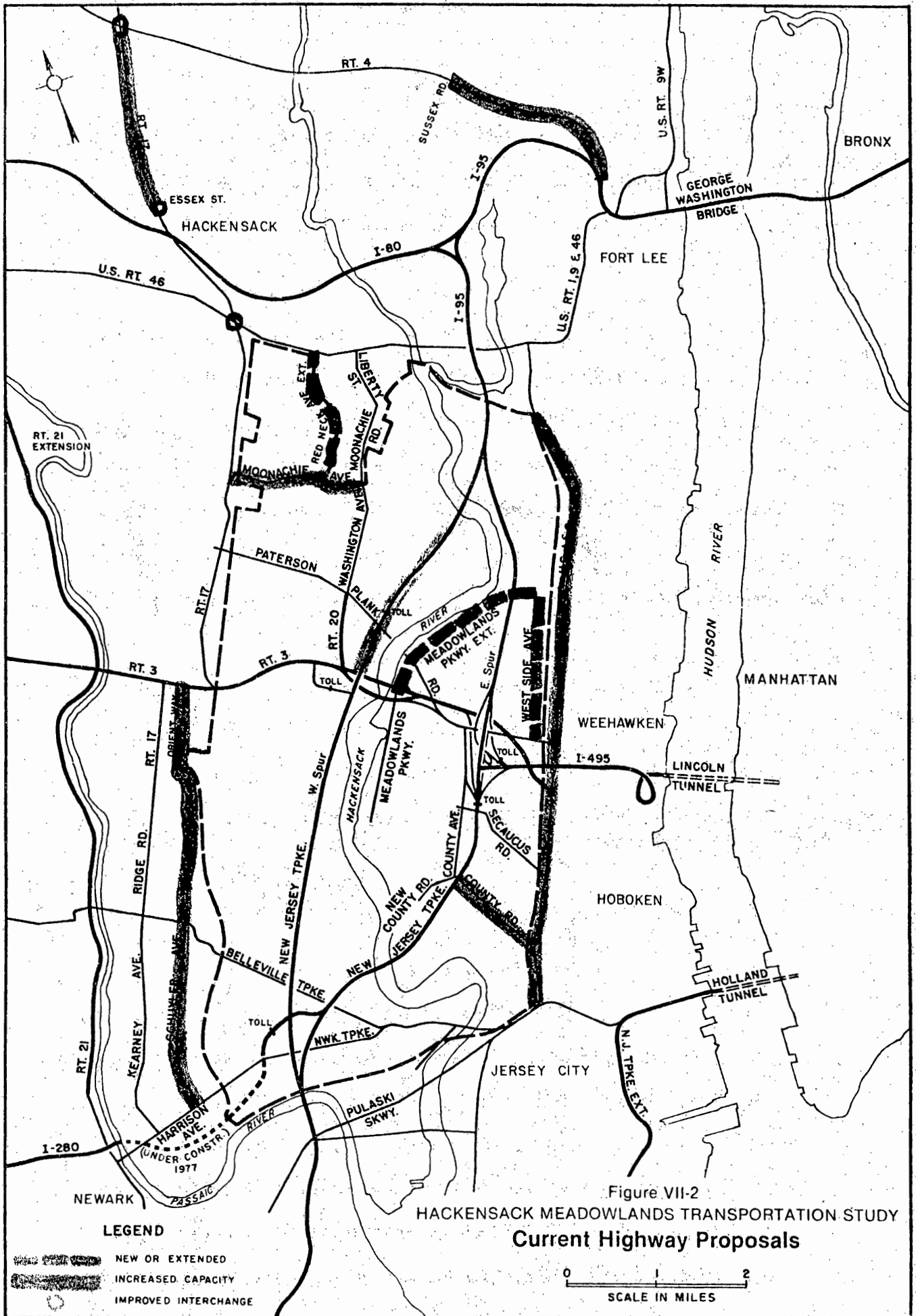
At the present time there is no specific plan for providing an intra-Meadowlands transit circulation system. Chapters IX and X discuss the several alternatives coming out of this study to provide this important future need. Today trips between the small amount of existing housing and the employment areas are via the existing street and highway system.

Highway Improvements

By far the major mode of access to the Meadowlands is the auto. For this reason, existing highway improvement plans in and around the Meadows are critical to a future transportation plan for the area. These plans generally are capital intensive and would require several years to complete. The list includes only those projects that are currently planned or under study by the responsible agency.

Major Feeder Routes

The first group of highway improvements are for three of the major feeder routes leading to the Meadowlands. These are shown on Figure VII-2 and are as follows:



I-280

The final section of I-280 between the Stickle Bridge in Harrison and Interchange 15W on the New Jersey Turnpike in Kearny is now under construction. It should be available in early 1980.

N.J. Route 17

In their 1972 "Master Plan for Transportation" NJDOT called for a \$114 million (1976 dollars) improvement of Route 17, exclusive of right-of-way between Routes 46 and 4 including widening to six lanes as necessary plus interchange improvements at Route 46, Essex Street and Route 4, all generally north of the Meadowlands. Subsequently the Tri-State Regional Planning Commission's report "Maintaining Mobility" of November, 1976, listed the need for improving this section of Route 17, but only as a "future proposal."

Another project for Route 17 is a proposed extension south of Route 3. The 1972 NJDOT master plan included this extension as a freeway at an estimated cost of \$50 million. Subsequently the concept for this roadway has been reduced in scope to a land-service roadway. The Commission and Hudson and Bergen Counties have passed resolutions supporting the southerly extension of Route 17 as a land-service route.

U.S. Route 1&9

The 1972 NJDOT master plan called for a \$200 million freeway (1976 dollars) extending from the Pulaski Skyway area in Jersey City north to Route 46 in Ridgefield or to I-80/95 located in the Meadows area west of the existing congested land-service route. This ultimate need was also included in "Maintaining Mobility." However, recent information from NJDOT indicates that cost, environmental considerations and other factors have caused the agency to concentrate on achieving additional capacity by

improvements to the existing route, including traffic engineering improvements and widening.

N.J. Turnpike

Widening of the westerly spur of the Turnpike to six lanes northward from N.J. Route 3 (Interchange 16W) is under study by the Authority.

Local Routes

The second group of highway improvements are for local routes within the Meadowlands. These also are shown on Figure VII-2 and are as follows:

Moonachie Avenue

Consultants for NJDOT are currently studying the feasibility of improving Moonachie Avenue between Route 17 and Moonachie by minor widening, dualization and better signalization.

Red Neck Avenue Extension

The Red Neck Avenue Extension is a planned improvement by Bergen County to provide a four-lane signalized route along the eastern border of Teterboro Airport between Route 46 and Moonachie Avenue, utilizing portions of existing Red Neck Avenue.

County Road

NJDOT is scheduled to widen County Road to four lanes between U.S. 1&9 and County Avenue in Secaucus.

Washington Avenue

NJDOT and Bergen County are planning to improve intersections on this route between Moonachie Avenue and Route 20.

New County Road

Consultants for NJDOT are currently studying three alternate improvement schemes all involving a grade separation with a railroad crossing and a tie-in with Meadowland Parkway.

Schuyler Avenue - Orient Way
(Bergen Co.)

Consultants for NJDOT are currently studying the feasibility of widening Schuyler Avenue and Orient Way in Bergen County to provide either a three or four lane roadway for moving traffic.

Schuyler Avenue
(Hudson Co.)

Consultants for NJDOT are currently studying the feasibility of widening Schuyler Avenue between Route 7 and Harrison Avenue to provide an additional lane for parking.

Meadowland Parkway

HMDC proposes to extend this arterial northward from N.J. Route 3 along the east bank of the Hackensack River to Cromakill Creek, thence swinging eastward to tie-in with 69th Street in North Bergen. At the same time local trucking interests have proposed a new interchange with the easterly spur of the N.J. Turnpike from 69th Street which could affect the easterly end of the Parkway.

West Side Avenue

A 70-foot right-of-way has been established for the uncompleted portion of this street southward from 69th Street to Paterson Plank Road.

Plans are now being developed for the completion of this road.

Major Bypass Routes

A final group of improvements are those proposed for the major routes that bypass the perimeter of the Meadowlands. These also are indicated on Figure VII-2 and include the following:

N.J. Route 4

The NJDOT 1972 master plan proposed the widening of Route 4 to six lanes from I-95 in Ridgefield Park to the present six lane section in Teaneck at a cost of \$16.5 million (1972 dollars) to relieve peak hour congestion. Tri-State's 1976 "Maintaining Mobility" substantiates the future need for such a widening to this 4.0-mile section.

N.J. Route 21 Freeway

The 1972 NJDOT plan called for building the final 3.7 miles of this freeway from Passaic to I-80 at a cost of \$26 million (1972 dollars) in order to provide an unimpeded highway connection between the Newark and Paterson areas. Tri-State's "Maintaining Mobility" included this project as a "priority proposal".

Local Service Streets

Existing zoning regulations will determine street widths and other design features of local Meadowlands streets. However, there is no existing comprehensive street plan because proposed developments are still conceptual. The locations of proposed streets are currently reviewed as part of the Commissions' normal review of land subdivisions and Specially Planned Areas.

Truck Movements

Existing highway proposals will substantially benefit trucks, but no plan is advanced specifically for this activity.

Bike and Moped Routes

These vehicles are accommodated on existing streets. No special roadway or parking facilities are provided.

Low Capital Intensive Programs

Low capital intensive transportation programs include operational measures such as priority lanes for bus, car pools, or trucks; transportation services such as car pool and van pool programs, dial-a-ride para-transit and subscription services; schemes to reduce peak hour congestion such as staggered work hours, flexible hours, pricing restrictions or limiting the parking supply; or passenger amenity programs such as bus information services and bus shelters. These programs are inexpensive and can be implemented rapidly. None of these programs had been under active consideration at the outset of this study.

CHAPTER VIII

THE PROPOSED NETWORKS

In this chapter five alternate long-term, capital intensive transportation plans for the Hackensack Meadowlands are selected. The first depends on the highway network with no additional transit provided. The other four networks emphasize transit and are oriented to bus, rail, personal rapid transit, and busways, respectively. Also identified for analysis are several immediate action, low capital intensive proposals. The plans described in this chapter will be analyzed in Chapter IX, including a comparison of their costs and their ability to handle the trips generated in the year 2000.

Background

In much of the earlier transportation planning for the Meadowlands (see Chapter III) the area was seen as an assembly point for trips directed toward Manhattan. When viewed in terms of the present concept of Meadowlands development in which the District is a place where people live and work, these earlier plans are no longer appropriate. Thus such proposals as new rail connections to Manhattan can be set aside at the outset for a number of reasons such as:

1. The demand by Meadowlands residents for public transit to Manhattan during the morning rush hour would not overload the existing commuter rail system.
2. The greater demand during the morning rush hour is for rail service from New York City to the Meadows, and in this direction there is more than adequate rail capacity.
3. The cost of a new tunnel is prohibitive, some \$2 billion including necessary approaches and a Manhattan terminal.

Another proposal was to make extensive use of the Meadowlands for park-ride facilities for Manhattan-bound commuters. This too can be set aside because:

1. Commuters would be driving their cars to those lots from more distant points. It is the policy of the State of New Jersey that such commuters should board bus or rail service as close to their home as possible to reduce highway congestion, pollution and energy consumption.
2. In the long term, the highway capacity and parking areas required for these facilities will be needed instead for commuters to the Meadowlands.

Another concept upon which most of the earlier plans depend is the construction of transit systems outside the Meadowlands District. Such connections are an integral part of the earlier plans but are difficult to incorporate in today's concepts. The environmental impact of entirely new transit lines and highways outside the District are extreme, the costs are very high, and the facilities that are constructed would not be used primarily by Meadowlands employees or residents. Therefore, these types of proposals are not considered, and the only exception would be if a direct connection to a nearby transportation center would be used primarily by Meadowlands employees and/or residents.

Highway Alternatives

A large portion of the peak hour trips generated by full development in the Meadowlands will arrive by highway. Many of the highways feeding and distributing traffic in the area are already near capacity. Others, such as the Turnpike, are still experiencing annual increases in through traffic. Therefore, it is obvious that substantial highway improvements must be contemplated under any transportation alternative considered for the Meadowlands.

However, recent inflation, a lack of local funding and environmental concerns have drastically curtailed New Jersey's highway construction programs. Thus, it is expected that except for I-280 which is now under construction few of the highway improvements proposed in New Jersey (see Chapter VII) would be completed by the time the Meadowlands is fully developed. These would include the widening of the west spur of the Turnpike between Exit 16W and the Vince Lombardi Service Plaza, and the development of the Red Neck Avenue Extension between Route 46 and Moonachie Avenue. The existing highway system augmented by these additions constitutes the basic highway network.

This highway network is analyzed under five different conditions. The first will assume no additions to transit by the year 2000. The other four will be associated with the transit networks developed later in this chapter and accordingly reflect reduced demands. For example, the highway requirements under the rail network will be computed by subtracting trips assigned to rail from total trips. The remaining trips would then determine the highway needs for the rail network. The specific highway links involved in this analysis depend on assigned volumes, and are described in detail in Chapter IX.

Initial Transit Networks

As a first step in developing alternate transit networks several preliminary networks were defined. These networks were merely sketch plans that could be used to develop planning concepts or findings which could be applied in developing the detailed networks for analysis. The following paragraphs outline these preliminary networks.

Preliminary Bus Network

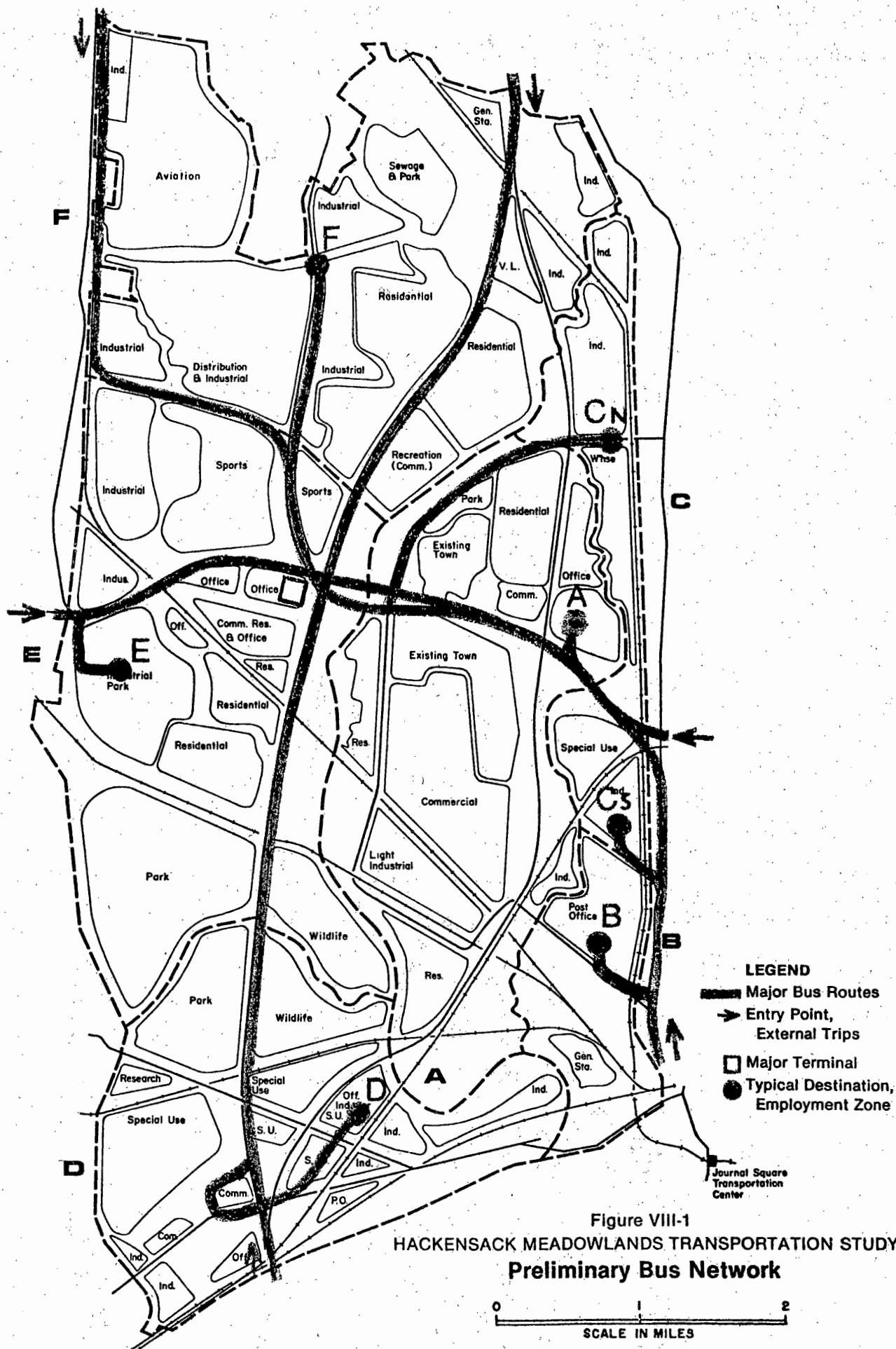
In this network a single bus facility would be developed at the intersection of Route 3 and the western spur of the New Jersey Turnpike since this location could be easily reached from all major access roads to the Meadowlands. Employees from external origins could then travel by scheduled over-the-road carriers which would stop at this bus facility where the employees would transfer to local bus routes connecting the facility and the six employment zones (see Figure VIII-1). Since the buses would use the available highway system, this network would require a minimum capital investment. The use of the street system also implies that franchises or other permission to establish new routes will be necessary as part of the transportation program.

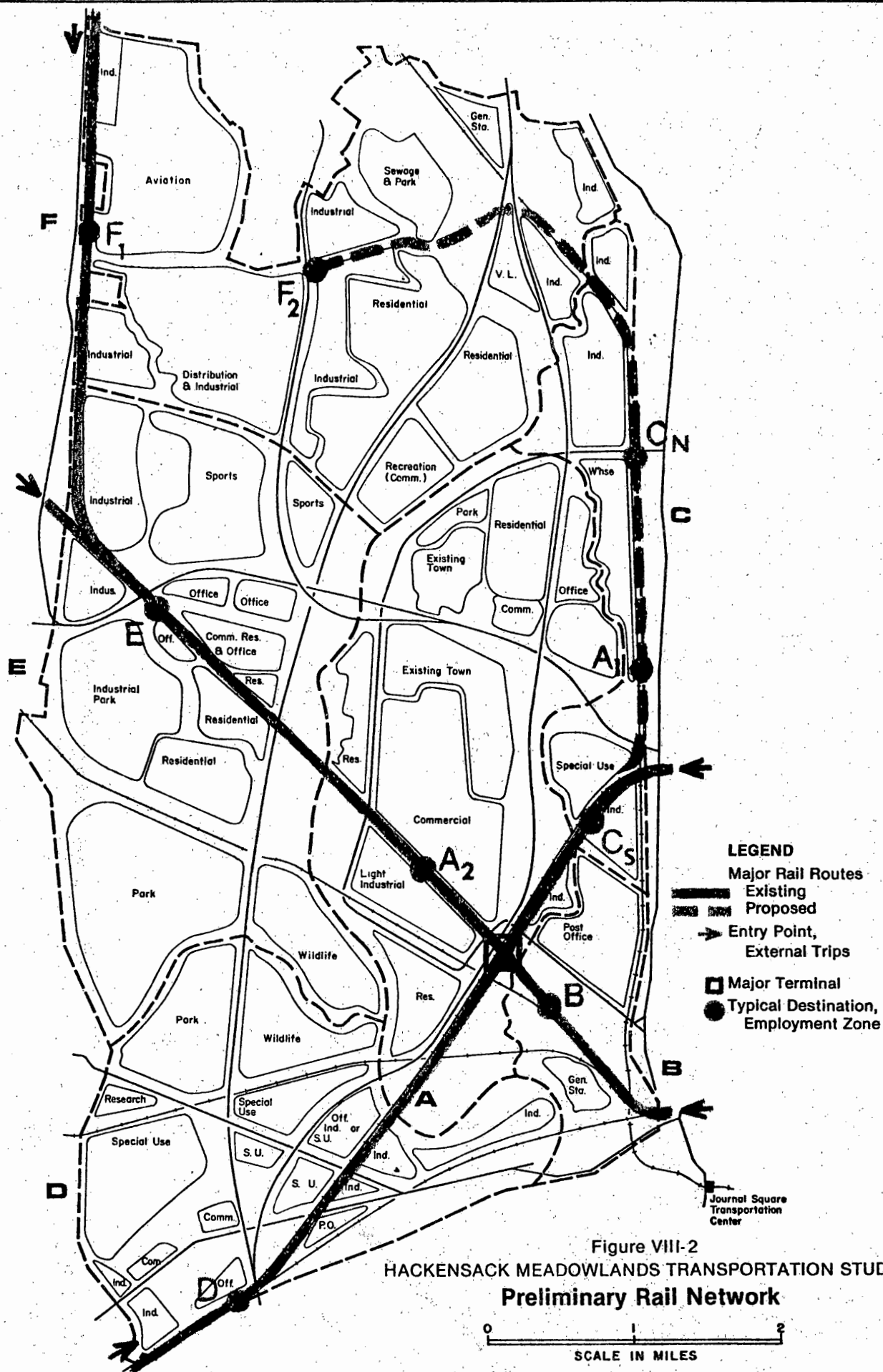
Preliminary Rail Network

This network would use existing rail lines to the maximum extent possible. Stations or transfer stations would be located at the sites suggested in the 1972 Meadows Master Plan; that is, Berrys Creek, Secaucus, Kearny and Wood Ridge. Since there is no rail service available to the northeast corner of the Meadowlands, a new rail line was extended northward from the Secaucus transfer to the northern boundary of the District via the Penn Central and New York, Susquehanna and Western right-of-way. A 1.5-mile spur from this line to the industrial area along Empire Blvd. was also included (See Figure VIII-2).

Preliminary Automated Guideway Network

The bus and rail networks brought employees to a central point or points from which they would go to the places where they worked. As an alternative, a loop network was considered in which employees would be intercepted on their approach route to the Meadows and transfer to a system which travels





around the perimeter of the Meadows to a point opposite an employment zone and then transit directly to that zone. A new technology, automated guideway transit (AGT) was considered for this alternative. The system uses electrically operated cars on a two-way, paved, grade-separated structure. Called peplemovers, these cars carry as many as 50 passengers and are now in use at several airports in the United States. The 27-mile guideway is shown in Figure VIII-3.

Findings from Preliminary Networks

In order to analyze these networks, preliminary passenger volumes were assigned to each segment of each network. In addition, travel times and transfers were computed for travelling from the perimeter of the Meadows to each of seven points of destination within the District. Finally, preliminary capital cost factors were applied. From this analysis certain planning concepts or findings as listed below were developed and applied to the final networks.

1. None of the preliminary systems would bring more than a few employees close to their place of work. The Master Plan calls for a spread or dispersed employment pattern which can only be served by a separate internal distribution network. This dispersed employment pattern is primarily found in the light industrial zones where warehouses are the dominant land use.
2. A large number of employees who would use transit will originate east of the Hudson River and work in the area of the Meadows between US 1-9 and the East Spur of the Turnpike. This suggests a new transportation center in the center of this area. The most logical place appears to be Meadows East just east of the East Spur of

- the Turnpike and immediately north of N.J. Route 3.
3. For optimum service any bus system serving the Meadowlands District should have origin or destination in the Meadowlands and not simply pass through. Also internal distribution would be simplified if more than one bus facility was provided.
 4. The transportation centers included in the 1972 Master Plan appear quite logical for a rail oriented network.
 5. The new commuter rail line included in the preliminary rail network to serve the northeast corner of the District was inappropriate because stops would be needed at frequent intervals, and commuter rail stations are usually spaced a mile or more apart.
 6. A peripheral loop system would not move passengers as quickly as a centrally located system because the loop requires users to ride "around" the Meadows.

Selected Transit Networks

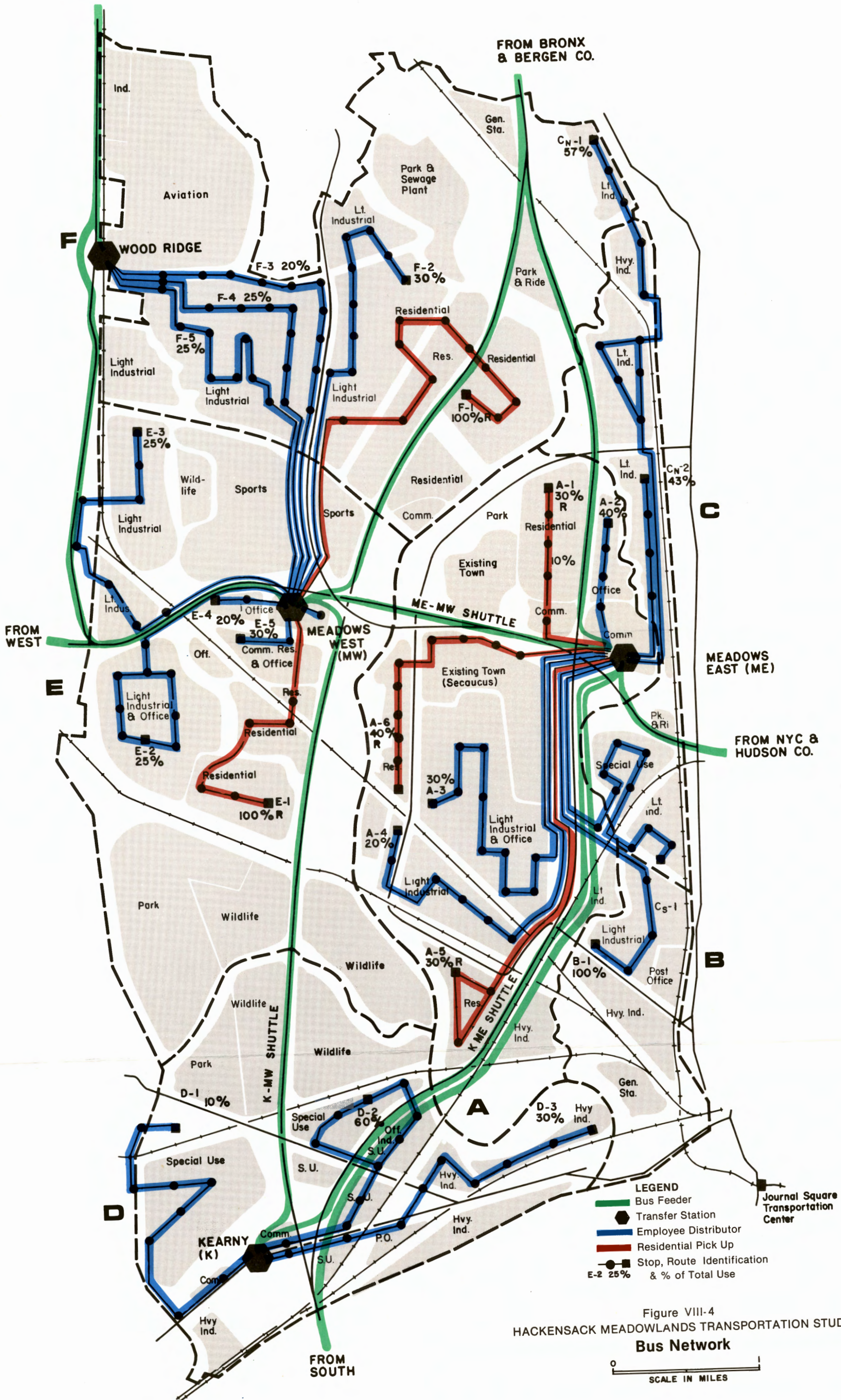
Based on the analysis of the preliminary networks, four transit networks were developed for final analysis. These networks were picked to provide a variety of technology, cost and service features, all within the realm of do-ability. The following sections describe these networks namely a bus network, a rail network, a **personal** rapid transit network and a busway-van pool network.

Bus Network

The selected bus network, as shown in Figure VIII-4, improves upon the preliminary plan by incorporating the above listed planning concepts.

FROM BERGEN
& PASSAIC CO.

FROM BRONX
& BERGEN CO.



The network still represents a minimum capital investment plan because the buses would operate over the available highway and street system for both the line haul movement between external origin and the Meadows and for internal distribution within the Meadows.

To broaden the base coverage, four bus facilities are shown at Meadows East, Meadows West at Route 3 and the western spur of the N.J. Turnpike, at the Kearny Transportation Center and at the rail station at Wood Ridge. The existing station at Wood Ridge is used in lieu of a transportation center because demand at the site is too small to justify a more costly development.

The preliminary analysis indicated that an internal distribution system is of paramount importance if transit is to be effective. A suggested system is incorporated in this network designed to provide 100% coverage at full development including both the internal residential areas and the employment zones. Ultimate densities should be great enough so that each internal distribution route can serve a small area with less than a dozen stops. Initially the system would operate on existing streets but if future demand put greater densities on one or more routes, then separate right-of-way for these particular routes might be necessary. The routes and stops for each route are based on a maximum walk of 100 feet or four minutes.

The network assumes that the buses serving the Meadowlands are only for that service. Thus a line-haul bus from an external origin would arrive at say the Meadows Center where it would stop to drop off and pick up passengers and then continue its trip over an internal route before returning to the Meadows Station to return to its origin point.

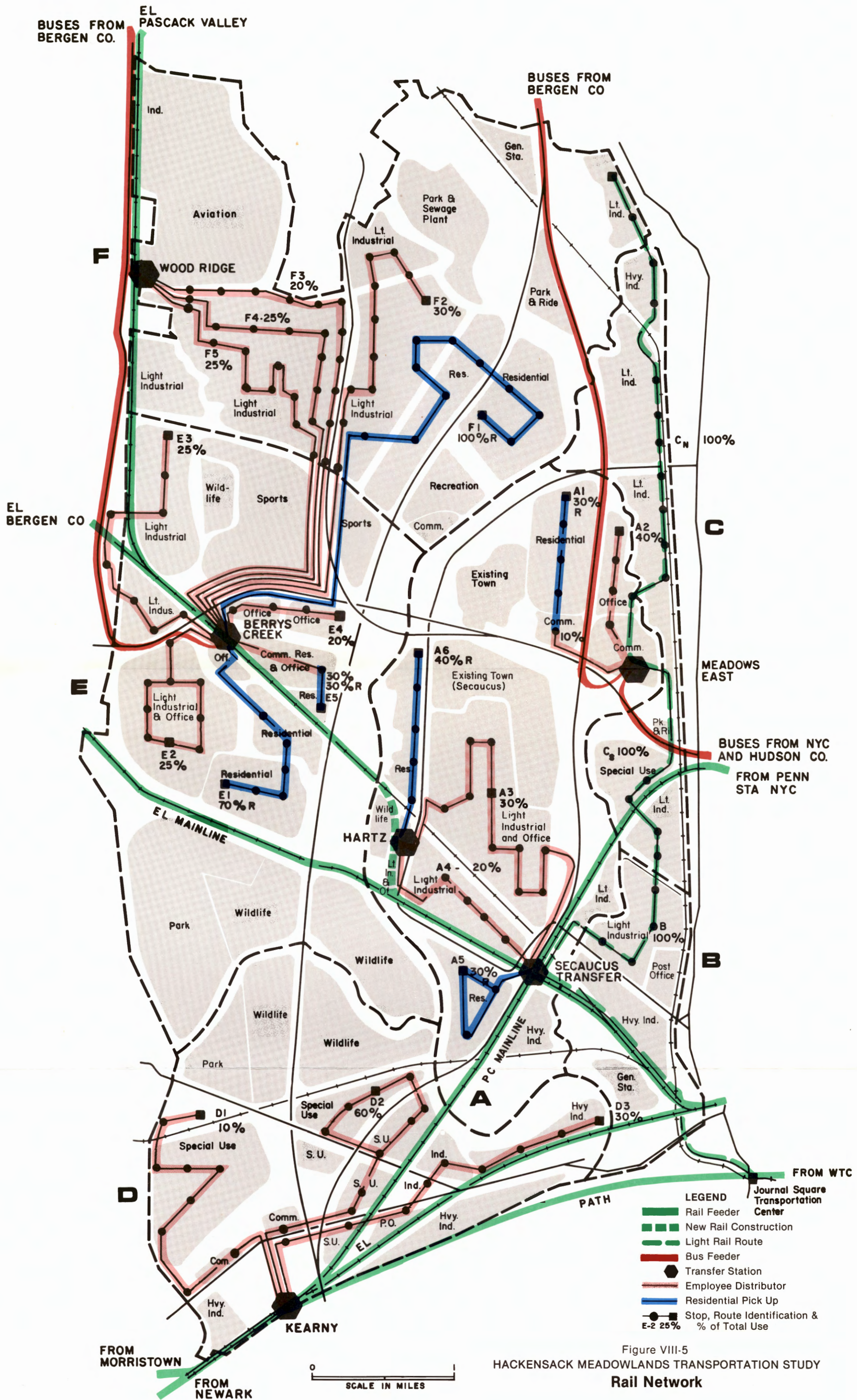
No peak hour service would operate on more than 15 minute headways. Modern buses would be used and mini buses would be assigned to lightly patronized routes. The regular buses could have 40 seats instead of the normal 50 to increase comfort.

The bus facilities would be clean, well-lit and would be sited in the midst of shopping malls and/or office complexes, where a full range of consumer services would be offered. The Wood Ridge facility would include approximately 100 parking spaces for Meadowlands employees, and Meadows West up to 1,000 spaces.

Shuttle bus routes would interconnect Meadows East, Meadows West and Kearny Terminals with each other and with the Port Authority Bus Terminal in Manhattan. The Meadows East Terminal would also offer direct connections to the Journal Square Transportation Center, the George Washington Bridge Bus Station and downtown Newark and Paterson.

Rail Network

The selected rail network, as shown in Figure VIII-5, takes advantage of the existing rail lines to the maximum extent possible in order to reduce investment and environmental problems. As included in the preliminary plan transportation centers are provided at Berrys Creek, Secaucus and Kearny. At Wood Ridge, the existing rail station is improved. The transfer facility at Secaucus is selected initially in lieu of a direct connection not only because it is shown in the Master Plan, but also because it would appear to be less costly than the proposed direct connection (See page VII-6). Beyond this, and in anticipation that eventually a rail connection would still be made with the Penn Central at Secaucus, a new connection is shown between the Bergen and Main Line just east of the Hackensack River. The Hartz Mountain Station would be relocated to this line. Further, in lieu of a commuter rail service to the northern portion of the District, a new light rail line would be provided from Secaucus Transfer via destination zone B and C (South) to Meadows East and northward to zone C (North). The line would also extend via existing rail trackage to the Journal Square Transportation Center.



Even with this base rail network large areas of Northern New Jersey, such as North Bergen, do not have access to the Meadows if only rail routes are offered, nor can these rail lines deliver passengers to all areas of the Meadows. Therefore, a supplemental system of bus routes is integrated into this network to deliver passengers from external residences not served by rail or from intermediate collection points such as Journal Square and the Port Authority Bus Terminal to transportation centers at Wood Ridge, Berrys Creek, Meadows East and Kearny. A system of bus routes providing for the internal distribution to and from the transportation centers is also shown. As in the bus network, line haul bus routes would act also as distributors or collectors so that some through (non-transfer) trips would be possible.

Headways on buses and train would be no greater than 15 minutes at any stop. New local service would be provided from Manhattan to Secaucus on the Penn Central. On the Erie-Lackawanna routes, existing trains would be used, and new cars would be purchased and added to trains. Additional peak hour service would be offered in the reverse direction between Hoboken and Wood Ridge. New, modern air-conditioned buses would be used on the bus routes.

The Transportation Centers would be clean and well-lit and offer a variety of consumer services. Provision would be made for approximately 100 commuter parking spaces at each Center.

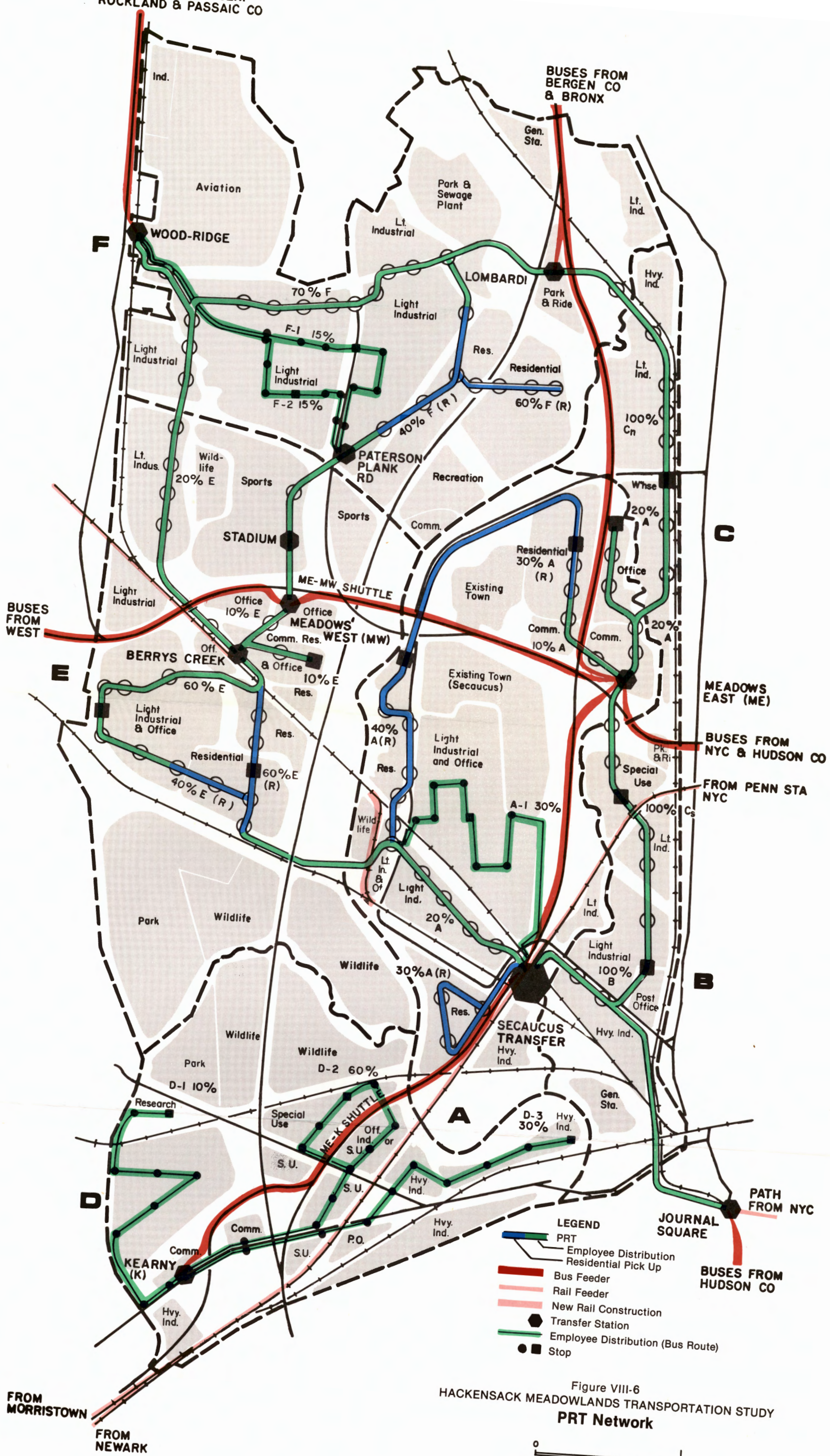
PRT Network

In both the bus and rail networks the employees in large part must use the internal bus system to reach their job site. Since these buses are operating on the local street system, an average speed of 15 miles per hour would be good. Further for the majority of trips one transfer at least is

necessary, although for some, two transfers, each with its inconvenience and delay, are required as for a Manhattan resident who rides the Penn Central to Secaucus, transfers to the Erie-Lackawanna to Berrys Creek and then has to take a distributor bus to reach his job.

For purposes of comparison, a network has been designed to improve the internal services. Called personal rapid transit, or PRT, the proposal uses 6 seat electric-powered, rubber-tired automated vehicles operating on a separate, grade separated right-of-way. The concept is thus free from traffic interference and can operate at 30 miles per hour. It differs from the AGT system considered in the preliminary analysis in that PRT cars can go direct from the place they are boarded to the station closest to the users job. This eliminates delays at intermediate stops while passengers load or step off. A pool of PRT cars is held at each station so that no time is spent waiting. PRT systems are obviously more expensive because of these added service features. Systems now operate at both Morgantown, West Virginia and the Dallas-Fort Worth Airport.

The specific system proposed for the Meadowlands, as shown on Figure VIII-6 includes a central 13.3-mile loop supplemented by ten spur routes. The PRT cars could switch from the central loop to any of the spur routes without stopping. Beginning at Secaucus Transfer, the central loop proceeds in a clockwise direction to Berrys Creek by a new bridge over the Hackensack River. Enroute it passes light industrial areas in Zone A and serves proposed residential development in Zone E. Continuing north from Berrys Creek, the loop serves the proposed Meadows Bus Terminal, enters the Sports Complex with stops at the stadium and race track, crosses over Moonachie Road to a local



bus transfer point at Paterson Plank Road and proceeds northeast through the proposed Empire Housing Tract to Empire Boulevard. From here it crosses the Hackensack River on a second new bridge, stops at the Vince Lombardi service area and then proceeds south along the west side of the West Shore Railroad right-of-way to Meadows East. It then continues south through Zones C (south) and B to Secaucus Transfer. This loop is unlike the preliminary AGT loop in that it is shorter, and it passes through several employment areas so that a transfer and a second delivery mode are not needed.

To complete the coverage of the Meadowlands up to ten spur routes are required in addition to five distributor bus routes including two to the northwest section of the Meadows (Zone F) and three in the southwest corner (Zone D) where employment densities do not warrant PRT. The spur routes are described as follows:

1. Journal Square Spur

This 2.6-mile spur is designed to provide direct access from Journal Square. Existing rail right-of-way is used to avoid highway congestion at Tonnelle Circle. This spur provides convenient public transportation access from Bayonne and Jersey City, two very important sources of Meadowlands employment.

2. Housing Spur

This 1.7-mile spur would connect the Secaucus transfer with the housing tract located to the southeast on the Laurel Hill property.

3. Harmon Cove Spur

This 1.7-mile segment extends north from the intersection of the main loop with the Meadowland Parkway to the Harmon Cove residential and office areas.

4. Berrys Creek Spur

This 2.9-mile segment leaves the main loop just west of the Hackensack River and circulates throughout the entire Berrys Creek area, returning to the main loop at the proposed transportation center and proceeds north across the Creek to the proposed office developments between the center and Route 3.

5. Murray Hill - Empire Spur

This 5.3-mile segment leaves the main loop at the Berrys Creek Center, follows the railroad to a point just north of Route 3 and then proceeds in a northerly direction parallel to and east of Route 17 to Continental Avenue where it turns east and connects into the main loop just west of the Hackensack River. This loop provides distribution throughout many parts of Zones E and F.

6. Wood Ridge Spur

This 0.8-mile extension connects the Murray Hill - Empire Spur with the Wood Ridge rail station where bus and rail connections would be made.

7. Empire Housing Spur

This 0.9-mile spur leaves the main loop north of

Paterson Plank Road and serves the proposed Empire Housing tract.

8. Hartz Office Spur

This 0.9-mile extension proceeds north through Meadows East to serve the office complex to the north.

9. Hartz Housing Spur

This 1.5-mile spur proceeds east from Meadows East across the Turnpike and then swings north to the proposed Hartz housing area.

10. Secaucus Loop

An optional 1.8-mile segment could connect the Harmon Cove Spur and the Hartz Housing Spur via the proposed Meadowland Parkway right-of-way north of N.J. Route 3.

The entire 33.4-mile PRT could be constructed in increments as development are completed. For employee trips to and from locations outside the Meadowlands, the PRT system would interface with the commuter rail lines at Wood Ridge, Berry's Creek, and Secaucus Transfer and with various bus services, as in the rail network, at Wood Ridge, Berrys Creek, Meadows East, Meadows West and the Vince Lombardi service area where an existing park-ride lot would also be available. Headways on these buses and trains would be no greater than 15 minutes at any stop. A new local Secaucus service would be provided between Manhattan and Newark on the former Penn Central. On the Erie-Lackawanna routes, existing trains would be used and new cars would be purchased and added to trains. New, modern, air-conditioned, 40-

passenger buses would be used on the bus routes. The transportation centers would be clean and would offer a variety of consumer services. Some commuter parking would be available in conjunction with surrounding shopping facilities.

Busway - Van Pool Network

One important service characteristic that is not met by the PRT network is the desire to give passengers a no-transfer ride between origin and destination. The inconvenience and delay in transferring is an important factor in a commuters' decision whether to drive or take public transportation. To meet this objective a fourth network is proposed termed a Busway - Van Pool Network. As shown on Figure VIII-7 this would follow the same route as the PRT loop and its spurs but would be a two-lane paved roadway on which would be operated conventional buses and vans. Employees could board a bus, mini-bus or van at or near their home. The vehicle would then proceed to the Meadowlands where it would enter the special busway - van pool network. Access to the network would be controlled by a gate activated by a magnetic card issued to the vehicle operator. The exit from the network would also be gate controlled but activated by a loop detector on the exit ramp. Once on the network the vehicle would proceed directly to the area in which the occupants worked and make local stops in that zone. The vehicles assigned would be modern, air conditioned and have spacious seating, with the buses equipped with 40 seats, the mini bus with 15 seats, and the vans with 12 seats to provide a high level of service.

In addition to these services, a special busway connection with Journal Square would be provided for buses and other qualifying vehicles from Jersey City and Bayonne.

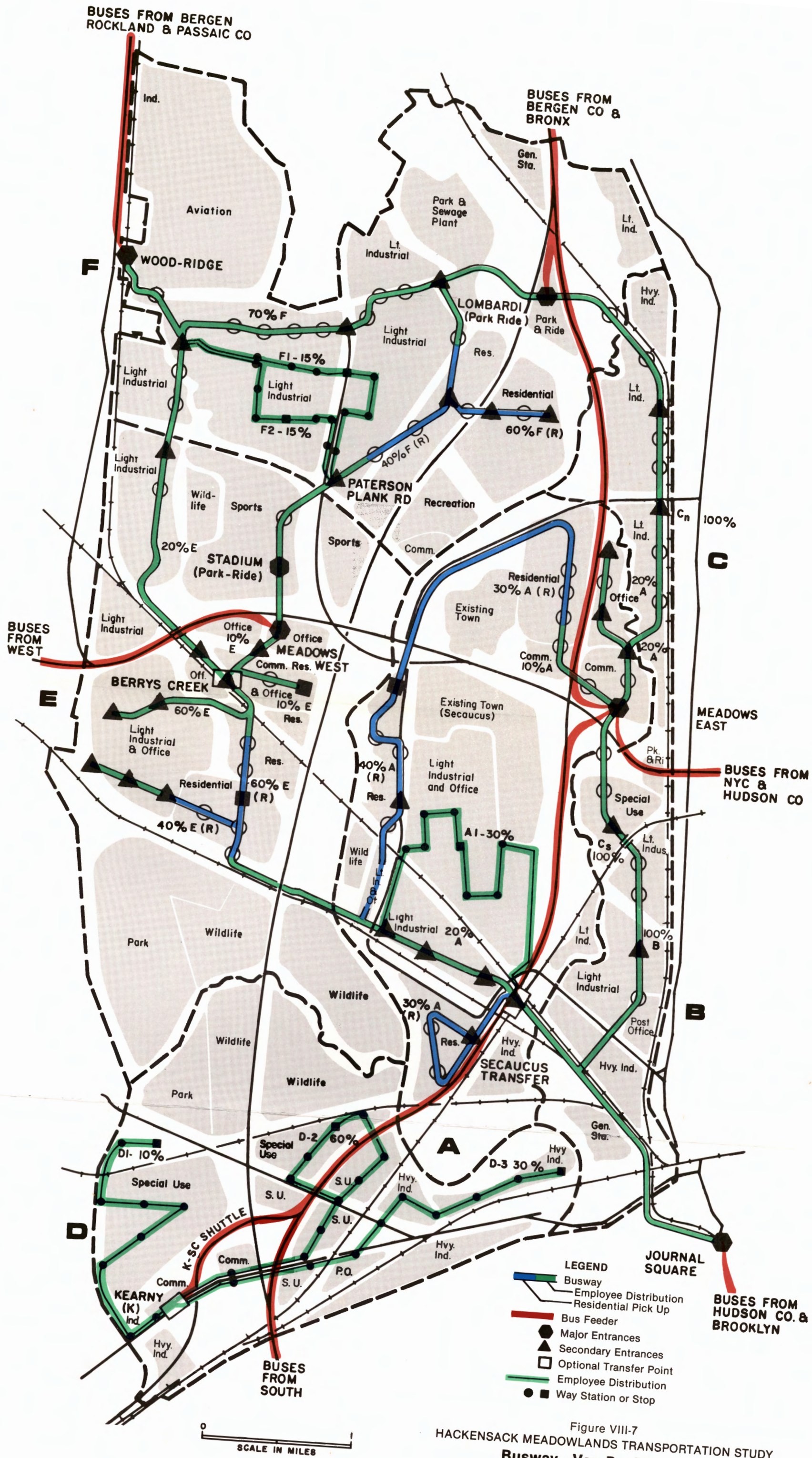


Figure VIII-7
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Busway - Van Pool Network

The major access-egress points on the busway - van pool network would be Berrys Creek, Meadows West, Meadows East, Wood Ridge and the Lombardi park-ride lot. However, since this system minimizes the need to transfer, the need for stations would be greatly reduced. Nevertheless, they would be modern, well-lighted, and integrated into consumer service areas and the other developments. In addition to the major terminals there would be 84 way stations under this concept. Of these, 26 would be local entrance and exit points located at logical points for connecting to the major roadways within the commercial, industrial or residential areas, and 58 would be pull-outs where the bus roadway would be widened to four lanes and a shelter would be provided.

For any passengers who might find it convenient to transfer from another mode - for example provision could be made at Berrys Creek for the transfer of passengers from rail - an intra-Meadowlands service would be provided. This would use similar buses and would serve selected points based on demand. Also for Zone D a separate service would be developed because the demand to this area would not warrant the special busway - van operation. This service would begin at Meadows East, where employees would transfer from other services. The buses would travel via the Turnpike to Interchange 15W and then on local streets to job locations within Zone D.

The capital cost for the busway - van pool network would be somewhat less than for the PRT network. In the busway concept only one set of equipment would be required, terminal requirements would be reduced, and automation, guidance and power distribution systems would not be needed. Offsetting costs may include increased structural loadings for buses as compared to PRT vehicles

and, as an increment, the added cost associated with carrying trucks on the network during off peak hours if such operation is desired.

Other Transit Modes and Networks Considered

In the process of selecting the above described transit networks, three other concepts were also considered but rejected for the Meadowlands District: light rail, monorails, and use of the Turnpike right-of-way for transit.

Light rail systems are similar to conventional rail rapid transit but involve a somewhat less expensive investment, and are capable of operating at grade in existing street systems. At first glance this would appear to be an attractive mode for use in the Meadowlands. Light rail vehicles could be installed in either the center median or on the shoulder of Meadowlands roadways which would reduce the need for expensive construction. However, as development got more intense, grade separation would eventually be required or service would deteriorate and be only slightly faster than surface buses. As a grade separated facility, the installation of an entire light rail system would be expensive, and when compared to the PRT example, would require an additional wait for service and many intermediate stops before one reached his destination. Furthermore, it would be difficult to schedule light rail trains to serve the many spurs that are needed to serve the dispersed development proposed for the Meadowlands.

The best application of light rail in the Meadowlands would be where a rail right-of-way was in close proximity to existing or proposed development. This occurs along West Side Avenue and is the reason for selecting light rail to supplement the basic commuter rail network in this area.

Another frequently mentioned transit mode is the monorail. This concept is more expensive than PRT systems because a completely grade separated right-of-way is required at all times. In those places where the facility may be constructed at grade, a substantial structure is still required, particularly if a suspended monorail is used. Thus, monorail is more expensive than other transit alternatives and produces no improvement in service. Further, since the monorail cannot leave its right-of-way to service local employment areas, it is at a disadvantage compared to the busway - van pool concept. For these reasons monorail has not been given further consideration this time.

Another concept that has been considered is the use of the presently available portions of the 200' wide Turnpike right-of-way for transit. Both spurs of the Turnpike pass through critical areas of the Meadowlands. Since only a small portion of the right-of-way is presently used for Turnpike operations, conceivably, the remaining portion on either side of the existing pavement could be devoted to a right-of-way for rail, bus, or PRT operations.

In general, however, the Turnpike follows the border or perimeter of the proposed developments. Therefore, a transit system that used the Turnpike right-of-way would need to have spurs into each development area that it passed. This would add to travel time and cost and would be a more cumbersome arrangement. In addition, the Turnpike is elevated and there would be many structures associated with a parallel transit system. In contrast the PRT and busway networks could be brought to grade and integrated with proposed developments in such a way that expensive embankment and structures could be avoided. For these reasons it was not considered feasible to use the Turnpike right-of-way in the transit networks.

Travel Times

Appendices VIII-1 through VIII-5 give travel times for the highway network and the four transit networks from each external origin residential zone to each internal destination zone. In computing these times existing rail schedules or observed speeds on highways are used. Speeds for no service on exclusive rights-of-way are set at 30 miles per hour. Transfer time including an average waiting time for the next vehicle are included, as necessary, as are access times from home to vehicle and walking time from vehicle to office. The number of transfers for each transit trip are also listed.

Low Capital Proposals

The long-term proposals for transit and highway construction require heavy capital commitments. These can frequently be reduced through the use of several low capital transportation operation techniques developed in recent years. Furthermore, these techniques can provide needed relief quickly. Selected techniques to soften peak demand such as bus route planning, priority lanes, staggered work hours, van and car pooling, peripheral parking lots, and differential pricing techniques will be examined in Chapter XII.

CHAPTER IX

EVALUATION OF NETWORKS

Five major networks are evaluated, the all highway solution and four transit options, bus on existing highways, rail, personal rapid transit (PRT) and exclusive busways.

Of these the all highway solution is clearly unacceptable in terms of the costs and social and environmental consequences. Each of the transit networks vastly reduce the amount of new highways required. However, improvements from the west, northwest and Hudson County are needed in any network in order for the Meadowlands to achieve the employment levels now projected.

Evaluation of the transit networks includes examination of peak hour demand, volumes on individual transit routes, preliminary design, capital costs for facilities, and estimates of revenues, operating costs and deficits. The second part of the transit evaluation covers investment and operating deficit per daily rider. All costs are summarized on Table IX-1. Travel times are shown on Table IX-2.

The bus network is the least expensive transit proposal and represents the least investment and operating deficit per passenger. However, it also offers the poorest service, as expressed in travel time. The rail network offers slightly improved service at a much higher cost. The PRT network offers the best travel time, but the cost is extremely high. The busway minimizes the need for additional highway capacity. It offers a good average travel time and eliminates many of the transfers required in the other schemes. While very expensive, it lends itself very well to a fast implementation that keeps pace with Meadowlands development.

TABLE IX-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Economic Summary of Alternates*

	Highways Only	Bus		Rail		PRT		Busway/Van Pool	
	Total	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit
Transit									
Passenger Trips/Year		12.8M		9.9M		18.0M		21.0M	
Capital Costs									
Transit									
Buses	--	\$ 49M		\$ 23M		\$ 24M		\$ 63M	
Rail Equipment	--	--		54		23		--	
Fixed Facilities	--	11		334		1,699		801	
Total Transit	--	60	\$ 2,326 **	401	\$20,300 **	1,743	\$48,400 **	864	\$20,600 **
Highway	\$1,396M	582		1,183		1,109		461	
Total Capital	\$1,396M	\$642M		\$1,584M		\$2,852M		\$1,325M	
		Per Trip		Per Trip		Per Trip		Per Trip	
Operating Statement-Transit									
Revenues Per Year		\$ 8.2M	\$.64	\$ 6.3M	\$.64	\$11.0M	\$.61	\$13.6M	\$.65
Less: O&M		-10.7	.84	- 7.3	.74	-19.8	1.10	-18.4	.88
Annual Deficit		(\$ 2.5M)	(.20)	(\$1.0M)	(.10)	(\$ 8.8M)	(0.49)	(\$ 4.8M)	(.23)
Annual Highway O&M*	\$23.7M	\$ 1.6M		\$23.2M		\$23.1M		\$ 1.1M	

Note: No annual debt service charge is shown. At this time it appears that both highway and transit improvements will require at least 20 percent local funding. If the local share of these investments is financed with bonds, then an annual debt service should be added to the annual operating costs. Annual highway operating costs are based on average existing maintenance costs*, including \$21.5M in those instances where future demand suggests the need for additional trans-Hudson capacity.

* Escalated to 1985.

** Per transit passenger.

Table IX-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Average Travel Time

<u>Network</u>	<u>Zone Of Destination</u>								<u>Other</u>	<u>Average</u>
	<u>A</u>	<u>B</u>	<u>Cn</u>	<u>Cs</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>18</u>		
Bus	47	49	50	56	53	45	50			48
Rail	45	45	48	44	56	43	36			43
PRT	32	30	31	32	57	33	27			31
Busway	33	30	33	32	60	41	33			36

Existing average travel time = 30 minutes.

Modal Split

Chapter VI discussed the trip generation and trip distribution steps used to generate total Meadowlands travel in 1985 and 2000. The third step in the traffic estimating process is the modal split where all trips are separated by mode, usually auto and transit. The following sub-sections describe several methods for deriving the modal split and suggest the possible range in overall transit use in Meadowlands-oriented trips. This is followed by detailed estimates for each specific network.

Three methods were tested for determining transit trips. The first method is based on historical use of transit between various residential areas and the Meadows. The second uses a Regional Plan Association model which predicts transit usage based upon the density of employment at the work site and auto ownership at the point of origin. The third method was a residual method in which transit use is the difference between total demand and trips by auto assuming the highway system is operated at its capacity. Total trips for 1975, 1985 and 2000, and transit trips estimates using each of the three methods is shown in Table IX-3.

Historical Method

In this approach the assumption is made that future transit service between any origin and the Meadows will be comparable to the existing service. Thus it will not yield transit riders from an area unless a transit service already exists. The results, therefore, reflect maximum auto demand and minimum transit usage. As shown on Table IX-3, today about 9.5 percent of the total peak hour Meadowlands work trips are

Table IX-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Methods of Estimating Transit Use

<u>County of Origin</u>	<u>Total Peak Hour Work Trips</u>	<u>Historical Method</u>		<u>Regional Plan Assoc. Method</u>		<u>Residual Method</u>	
		<u>Transit Trips</u>	<u>Per Cent</u>	<u>Transit Trips</u>	<u>Per Cent</u>	<u>Transit Trips</u>	<u>Per Cent</u>
<u>1975</u>							
Hudson	8,100	725	8.9%	2,284	28.2%		
Bergen	10,125	473	4.7	1,418	14.0		
Passaic	1,833	11	0.6	280	15.3		
Essex	1,329	21	1.6	237	17.8		
East of Hudson	4,100	1,400	34.1	1,472	35.9		
Other	<u>2,537</u>	<u>27</u>	<u>1.1</u>	<u>254</u>	<u>10.0</u>		
Total	28,034	2,657	9.5	5,945	21.1		
<u>1985</u>							
Hudson	10,045	1,000	10.0	2,853	26.5		
Bergen	12,089	561	4.6	1,491	12.2		
Passaic	2,271	12	0.5	333	14.4		
Essex	1,829	42	2.3	271	13.5		
East of Hudson	4,894	1,668	34.1	1,763	35.2		
Other	<u>3,248</u>	<u>31</u>	<u>1.0</u>	<u>289</u>	<u>8.4</u>		
Total	34,376	3,314	9.6	7,000	19.6		
<u>2000</u>							
Hudson	21,385	2,502	11.7	5,453	25.5	3,655	17.1%
Bergen	23,700	1,122	4.7	2,749	11.6	2,577	10.9
Passaic	4,689	23	0.5	572	12.2	1,433	30.6
Essex	4,965	163	3.3	700	14.1	818	16.5
East of Hudson	9,388	3,196	34.0	3,182	33.9	4,384	46.7
Other	<u>7,782</u>	<u>62</u>	<u>0.8</u>	<u>661</u>	<u>8.5</u>	<u>649</u>	<u>8.3</u>
Total	71,909	7,068	9.8%	13,317	18.5%	13,516	18.8%

by transit. Extrapolation to 2000 suggests that only about 7,000 of the 72,000 peak hour workers who live outside the Meadows will arrive by transit.

Regional Plan Association Method

The procedure followed in this method is derived from the May 1976 Regional Plan Association (RPA) publication entitled, "Urban Density for Public Transportation". This publication states that if adequate transit is available, its use is dependent on the non-residential development density at the job site in terms of millions of square feet per square mile (MSF/SM) and the auto ownership per household at the point of origin - auto ownership being a reflection of residential density.

The non-residential density for the Meadowlands was calculated by utilizing the land use map and the square footage of projected non-residential development. Table IX-4 shows that at full development, most of the Meadowlands will have a density of 9 to 12 MSF/SM. For calculation purposes 11.0 MSF/SM is used.

The RPA model requires that auto ownership be separated into zero-car, one-car and two or more-car households. This data for 1960, 1970, 1985 and 2000 was derived from Tri-State Regional Planning Commission reports. Auto ownership for areas smaller than county size were derived from the Tri-State 1963 home interview survey and keyed into total county levels from the Tri-State reports.

As shown on Table IX-3, the RPA formula predicts for 1975 that slightly over 20 percent of the Meadows employees would ride transit, whereas actual ridership was only 9.5 percent. The reason for the difference

Table IX-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Non-Residential Density - Full Development

<u>Zone</u>	<u>Light Industrial</u>			<u>Office</u>			<u>Commercial</u>			<u>Total</u>		
	<u>Floor Space</u> ¹	<u>Square Mile</u> ²	<u>Density</u> ³	<u>Floor Space</u>	<u>Square Mile</u>	<u>Density</u>	<u>Floor Space</u>	<u>Square Mile</u>	<u>Density</u>	<u>Floor Space</u>	<u>Square Mile</u>	<u>Density</u>
A	20.1	1.64	12.3	5.1	.22	23.2	4.6	.58	7.9	29.8	2.44	12.2
B	5.2	.48	10.8	----	----		----	----		5.2	.48	10.8
C	9.4	1.09	8.6	1.8	.09	20.0	----	----		11.2	1.18	9.5
D	3.7	.86	4.3	3.1	.29	10.7	1.7	.23	7.4	8.5	1.38	6.2
E	12.0	1.52	7.9	7.2	.17	42.4	2.1	.25	8.4	21.3	1.94	11.0
F	31.1	2.70	11.5	2.1	.06	35.0	.9	.14	6.4	34.1	2.9	11.8
TOTAL	81.5	8.29	9.8	19.3	.83	23.3	9.3	1.20	7.8	107.1	10.32	10.4

1) Floor Space = Non-Residential Floor Space in Millions of Square Feet.

2) Square Miles = Area in Square Miles.

3) Density = Floor Space Density in Million Square Feet Per Square Mile.

is that the model assumes that transit is available whereas present transit service from many areas is poor or non-existent. Where transit service is available the approximation from the model is good. For example, from East of the Hudson areas, the RPA system produced about 36 percent via transit whereas the observed value was approximately 34 percent.

The forecasts for 1985 and 2000 are general indications of transit use if service is available, and thus would probably represent the maximum transit potential, particularly for ultimate development. The model predicts that transit trips in 2000 could amount to 13,317 peak hour trips, an increase of 5,231 trips or nearly two-thirds, over the 8,086 trips based on the historical trend.

The current regional forecast by Tri-State indicates that auto ownership will increase for most areas in the region between 1975 and 2000. The impact of this on transit use is clearly shown by the RPA model which shows a 21.1 percent transit use in 1975 declining to 19.6 percent in 1985, and 18.5 percent at full development.

Residual Method

The residual method was applied only for the year 2000. Based on estimates prepared early in this study, 58,592 of the forecasted 71,909 peak hour trips could be accommodated in automobiles if a series of planned highway improvements were implemented by the residual method, the remaining 13,317 trips must use transit.

While the residual method provides a general indication of transit needs, it is not related directly to residential development or auto ownership at individual points of origin. Thus, as shown in Table IX-3,

it predicts a very high percent of transit usage from Passaic County, an area that is lightly settled and, hence, difficult to serve efficiently with transit. In this instance, therefore, the more accurate interpretation is that additional transit service and highway capacity will be needed from Passaic County. Interestingly, the total needed transit use of 13,516 trips in the year 2000 under this method corresponds closely to the RPA data which predicted that 13,317 trips could be attracted.

Selected Method

The method adopted for this study to determine the modal split is best defined as an adaptation of the RPA method. In this case the transit potential as given by the RPA model is amended to reflect the differences in service characteristics, i.e. travel time and number of transfers, between the auto network and each of the transit alternatives outlined in Chapter VIII. Since the number of transfers is a known deterrent to transit use, an additional time penalty for each transfer is introduced to reflect the difference in this service characteristic in each transit alternative.

The results of the modal split analysis, as summarized in Table IX-5, forecasts that transit ridership in the year 2000 would vary depending upon the transit alternative from a low of 9,876 peak hour trips for the rail network to a high of 20,989 trips for the busway/vanpool network.

Traffic Assignment

The fourth and last step of the traffic estimating process is traffic assignment, where journey-to-work trips given by the modal split

Table IX-5

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Estimated Peak Hour Transit Ridership
(Year 2000)

<u>Travel Corridors</u>	<u>Total Peak Hour Passengers</u>	<u>Auto Network</u>			<u>Bus Network</u>			<u>Rail Network</u>			<u>PRT Network</u>			<u>Busway/Vanpool Network</u>		
		<u>Auto Pass</u>	<u>Transit Pass</u>	<u>Percent Transit</u>	<u>Auto Pass</u>	<u>Transit Pass</u>	<u>Percent Transit</u>	<u>Auto Pass</u>	<u>Transit Pass</u>	<u>Percent Transit</u>	<u>Auto Pass</u>	<u>Transit Pass</u>	<u>Percent Transit</u>	<u>Auto Pass</u>	<u>Transit Pass</u>	<u>Percent Transit</u>
<u>To the Meadowlands from Surrounding Areas</u>																
Hudson County	21,385	20,660	725	3.4%	18,872	2,513	11.8%	19,782	1,603	7.5%	18,525	2,860	13.4%	17,408	3,977	18.6%
Bergen County	23,700	23,227	473	2.0%	21,624	2,076	8.8%	22,037	1,663	7.0%	21,085	2,615	11.0%	20,651	3,049	12.9%
Other West of Hudson	17,436	17,377	59	0.3%	17,032	404	2.4%	17,342	94	0.5%	16,959	477	2.7%	6,816	620	8.5%
East of Hudson	9,388	7,988	1,400	14.9%	6,407	2,981	31.8%	8,119	1,269	13.5%	6,433	2,955	31.5%	5,106	4,282	45.6%
Total	71,909	69,252	2,657	3.7%	63,935	7,974	11.1%	67,280	4,629	6.4%	63,002	8,907	12.4%	59,981	11,928	16.6%
<u>Within the Meadowlands</u>	12,513	12,513	---	---	11,014	1,499	12.0%	10,604	1,909	15.3%	6,790	5,723	45.7%	6,790	5,723	45.7%
<u>From the Meadowlands to Surrounding Areas</u>	15,295	15,295	---	---	11,958	3,337	21.8%	11,958	3,337	21.8%	11,958	3,337	21.8%	11,958	3,337	21.3%
Total Peak Hour Passengers	99,717	97,060	2,657	2.7%	86,907	12,810	12.8%	89,842	9,875	9.9%	81,750	17,967	18.0%	78,729	20,988	21.1%

analysis are assigned on the proper network. This section briefly describes the highway traffic assignment process.

The first step was to define the centroids for each of the 27 external and 6 internal zones. For the external zones, these were located to reflect the population center of the zone and are shown in Appendix IX-1. For the internal zones, the centroids were situated on arterial routes near the geographic center of the zone.

The zone centroids were then connected into network representations of the major routes in the highway system for each of the study years. Travel times were computed for competitive routes between origin and destination centroids and a diversion curve based on travel time differences was used to assign 1976 traffic to the network to see how well the model "predicted" Meadowlands generated journey-to-work trips. The predicted trips were compared with total traffic at various key locations as determined by traffic counts and with the Meadowlands generated traffic in the stream as determined by the Tri-State Regional Planning Commission. This was achieved by having Tri-State complete two vehicular traffic assignments, one with travel generated by all development in the region and a second yielding travel generated by all development except the Meadowlands. The difference, when converted to a one-way peak hour, was compared to the predicted volumes. From this it was recognized that some of the traffic assigned to the basic network would be accommodated on lesser routes not included in the network. Therefore, a portion of the traffic from several close-in origin zones, namely 2, 3, and 9, was re-assigned to these lesser routes.

Using this calibrated model, the additional journey-to-work trips between each origin and destination for 1985 and 2000 were applied to the highway links on feeder routes entering the Meadowlands. These additional trips were then converted to vehicles using passenger per vehicle ratios based on the 1976 employee questionnaire. Commercial vehicles were added based on the method described in Chapter VI. These computed volumes were then added to the existing volumes to give the 1985 and 2000 volumes for each link for the all-highway alternative.

Each of the four transit networks has a different impact on highway traffic. A similar assignment process was done for each transit alternative to produce the 2000 highway volumes for that alternative.

The Highway Needs

The critical highway links for 2000 can be identified for each of the alternatives by subtracting the capacity of each link from the demand volume as derived above. These critical links and the amount by which demand exceeds capacity in each case are listed in Table IX-6 and their locations are shown on Figure IX-1. The following sections discuss the improvements required to meet highway demand in each of the alternatives.

All-Highway Network

With the All-Highway Network no additions to the existing transit are assumed and the entire impact of the Meadowlands-generated traffic must be absorbed on the routes feeding the area. To meet this sort of demand major improvements to all the feeder routes would be required as follows:

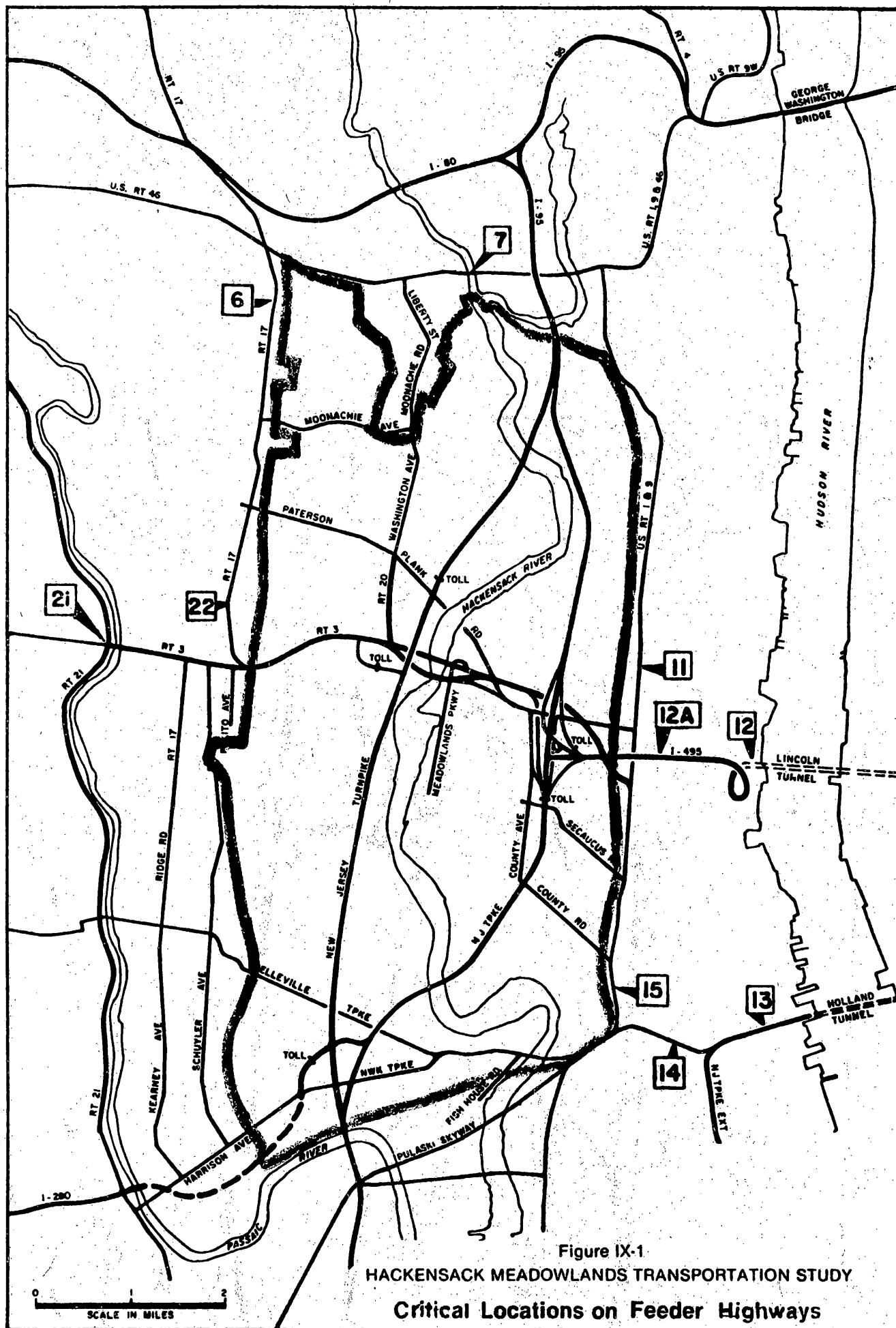


Table IX-6
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Vehicles in Excess of Roadway Capacity
(Full Development)

Description	Location*	Direction	Peak Hour Vehicles				
			All Hwy	Bus	Rail	PRT	Busway/ Vanpool
Rt. 17 btw. Williams Ave. and Franklin Avenue	6	SB	2,400	1,520	1,740	1,480	1,340
Rt. 17 South of Meadow and Highland	22	NB	600	470	530	440	430
Rt. 3 on Bridge over Passaic River	21	EB	3,150	2,850	3,080	2,830	2,730
Rt. 1&9 North of Skyway Interchange	15	NB	2,650	860	1,300	990	490
		SB	660	610	640	630	630
Rt. 1&9 North of 51st Street	11	NB	1,570	1,040	1,220	680	620
		SB	510	380	380	320	210
Holland Tunnel	13	WB	760	110	570	430	110
Rt. 1 (bus) Jersey City Cut	14	WB	760	110	570	430	110
Lincoln Tunnel	12	WB	1,450	280	760	490	330
Union City Underpass	12A	WB	630	130	340	280	150
Rt. 46 East of Little Ferry Circle	7	EB	810	430	600	300	270
		WB					

* Figure IX-1.

Route 17 would need to be improved between Route 3 and at least the Garden State Parkway to accommodate a deficiency of up to 2,400 vehicles. This would involve eliminating the signalized intersections between Route 3 and Route 46, widening from Route 46 to Route 4 including interchange improvements at Route 46, Essex Street and Route 4, as previously proposed (see Chapter VII), and finally a widening by one lane in each direction from Route 4 at least to the Garden State Parkway interchange. The estimated cost of these improvements would be \$291 million, including right-of-way. These and other highway costs are project costs based upon completion of construction within six years.

Route 3 would need new capacity to accommodate 3,150 vehicles. This would require expanding the route between Route 17 and Route 21 to a ten-lane cross section including a new five-lane bridge for eastbound traffic over the Passaic River and converting the existing bridge for westbound operation, as well as widening the route to eight lanes from Route 21 to the Garden State Parkway Interchange 153. These improvements would cost \$94 million, including right-of-way.

Route 1&9 would need capacity to handle 2,650 additional vehicles between the Pulaski Skyway and the Lincoln Tunnel, and 1,570 vehicles north of the tunnel. This would require a new four-lane freeway located to the west of the existing route from the Skyway north to Ridgefield or to I-80/95. The cost of such a route, with provision to expand to six lanes, would be \$328 million including right-of-way.

Between the Holland and the Lincoln Tunnels there would be a total deficiency of 2,210 vehicles. This would require either a third tube at the Holland Tunnel or a fourth tube at the Lincoln Tunnel together

with new capacity through the Palisades between the Hudson River and Routes 1&9. In both instances the new tubes would have to be integrated with the existing tubes to permit up to four lanes in one direction at the Holland Tunnel and five lanes at the Lincoln Tunnel. The cost for the Holland Tunnel project would be \$589 million and for the Lincoln Tunnel, \$635 million.

Finally, Route 46 would be deficient by 810 vehicles. This would require widening the route to a six-lane divided facility, as required between Route 17 and the New Jersey Turnpike, grade separation of major intersections including the Little Ferry circle and a new Hackensack River Bridge. The estimated costs of these improvements is \$94 million, including right-of-way.

All-Highway Evaluation

The cost of the highway improvements required by this network is \$1,396 million, including right-of-way, as summarized on Table IX-7. It would also require an expansion of either the Holland or the Lincoln Tunnel. The Port Authority of New York and New Jersey, which operates these tunnels, has no plans for any such expansion and in fact has publicly stated on numerous occasions that an expansion of either tunnel would be counter to the transportation goals of the region. For these reasons, as well as the social and environmental consequences of the construction program required, the all-highway solution is clearly unacceptable.

Table IX-7
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Capital Costs - Highway Network
(Preliminary)

Route 17

Two lane widening (Rte. 4 to GSP Interchange #163)	\$ 12 million	
New Rte. 4-17 Interchange*	129	
Two lane widening (Essex Street to Rte. 4)*	52	
New Rte. 17-Essex Street Interchange*	13	
New Rte. 46-17 Interchange*	54	
Four new interchanges (Rte. 3 to Franklin Avenue)	<u>31</u>	\$291 million

Route 3

Two lane widening (Rte. 21 to GSP Interchange #153)	5	
Four lane widening (Rte. 17 to Rte. 21) including new five-lane crossing of Passaic River and Rte. 21 interchange modifications	<u>89</u>	94

Route 1&9 Freeway

Four lanes with provision for six lanes (Sip Avenue to Ridgefield Circle)*		328
--	--	-----

Holland Tunnel

New two-lane tunnel and approaches at Holland Tunnel	516	
Holland Tunnel - Jersey City Cut (Jersey Avenue to JFK Boulevard)	<u>73</u>	589

Lincoln Tunnel

New two-lane tunnel and approaches at LT, including a new tunnel approach to Rte. 1&9		635
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Route 46

Two lane widening, where required; NJT to Rte. 17 including new bridge over Hackensack River and separations at major intersections**		<u>94</u>
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Total (Excluding Lincoln Tunnel) \$1,396 million

* NJDOT Estimates 1976 and 1972. These figures were escalated at 7 percent per year to 1978 and then converted to total project costs with the same procedure used for Port Authority estimates.

Note: See Appendix IX-5 for real estate components of costs estimated by Port Authority.

Highway Needs With Transit

As indicated on Table IX-6 and Figure IX-2, any of the four transit proposals will reduce the demand on the feeder highway system to a greater or lesser extent. The necessary improvements to meet the highway needs for each transit alternative are discussed below.

On Route 17 the demand would be reduced by 660 to 1,060 vehicles depending upon the transit plan. However, this would not significantly reduce the extent of the \$291 million improvement program outlined under the all-highway network.

On Route 3 none of the transit alternatives would have any impact and the \$94 million widening program between Route 17 and the Garden State Parkway outlined for the all-highway network would still be required.

On Route 1&9 the transit alternatives would have a very significant impact. Between the Skyway and the Lincoln Tunnel the demand would be reduced by 1,350 to 2,160 vehicles and north of the Tunnel by 350 to 950 vehicles. This means that the demand could then be met by improving the existing route rather than constructing a new facility. For the rail, bus and PRT alternatives, the route would need to be upgraded and widened by four lanes from the Skyway to the vicinity of 69th Street and by two lanes from 69th Street to Route 46. The estimated cost of this improvement is \$115 million including right-of-way. For the Busway alternative only a two-lane widening is required between the Skyway and 69th Street and nothing is needed north of 69th Street. This reduces the cost to \$56 million.

At the Holland and Lincoln Tunnels the total excess demand

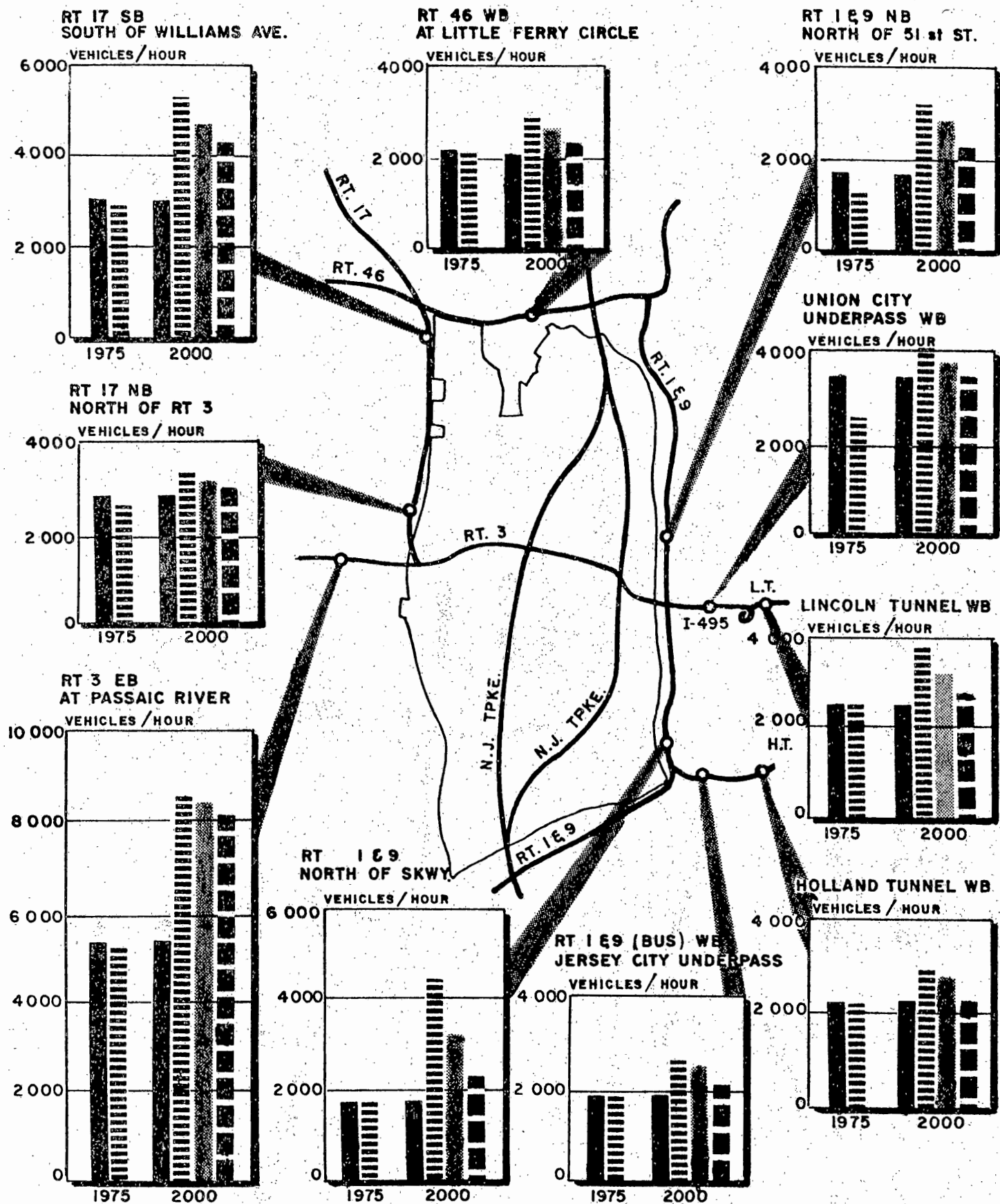


Figure IX-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Highway Network Volumes

ranges from 1,330 for the rail network down to 390 for the bus network. The PRT deficit is 920 vehicles and the busway, 440 vehicles. While the excess for the PRT and rail networks is considerably reduced from the all-highway deficit, it is still of sufficient enough magnitude to suggest that a new tube at either the Holland or Lincoln Tunnels, including new capacity through the Palisades would be required as with the all-highway solution. However, for the Bus and Busway alternatives the deficiency would not warrant the expansion.

On Route 46 the excess demand for the Busway (270 vehicles) and PRT (300 vehicles) are small and could well be met by a modest operational-oriented improvement program costing in the range of \$20 million. However, for bus and rail networks a widening program similar to the \$94 million program outlined for the all-highway solution would be necessary.

Highway Needs with Transit Evaluation

Even though the several transit alternatives reduce the highway needs compared with the all-highway network, the fact that the auto will still be the primary mode of travel still results in the need for a major highway improvement program as shown below:

<u>Transit Alternative</u>	<u>Highway Construction (Millions)</u>
Bus	\$ 583
Rail	1,183
PRT	1,110
Busway/Vanpool	462

In two of the alternatives, Rail and PRT, the needed improvements include new trans-Hudson vehicular capacity which, as previously stated, is contrary to the transportation goals of the region. This

suggests that for either of these alternatives to be acceptable, they should include the trans-Hudson transit provisions of the bus or busway alternatives, namely a strong bus service linking the expected employee concentrations in Brooklyn directly with the Meadowlands.

Bus Network

The first transit proposal, the bus network, is specifically designed to provide an acceptable level of transit service at a minimum cost. In this alternative employees board Meadowlands-bound buses near their homes. These feeder buses would travel to a transfer station in the Meadows where they would be routed onto one of the internal distribution routes serving that station. It is expected that about two-thirds of the users would have to change buses at the transfer stations to complete their journey. The remaining one-third would be able to stay on the same bus to reach their destination. Chapter VIII contains a complete description of this network.

Modal Split and Assignment

Based on the comparative travel time and cost relationship it is forecasted that with the bus network, 12,810, or 12.8 per cent, of the total Meadowlands-oriented peak hour trips would be on buses. In arriving at this modal split it was assumed that the bus services would operate between 7:00 and 10:00 A.M. and from 4:00 to 7:00 P.M. each weekday except major holidays, and that in the peak hour the maximum headway on any route would be 15 minutes. Frequency of service during the two hours surrounding the morning and evening peak hours would be one-half of the peak hour.

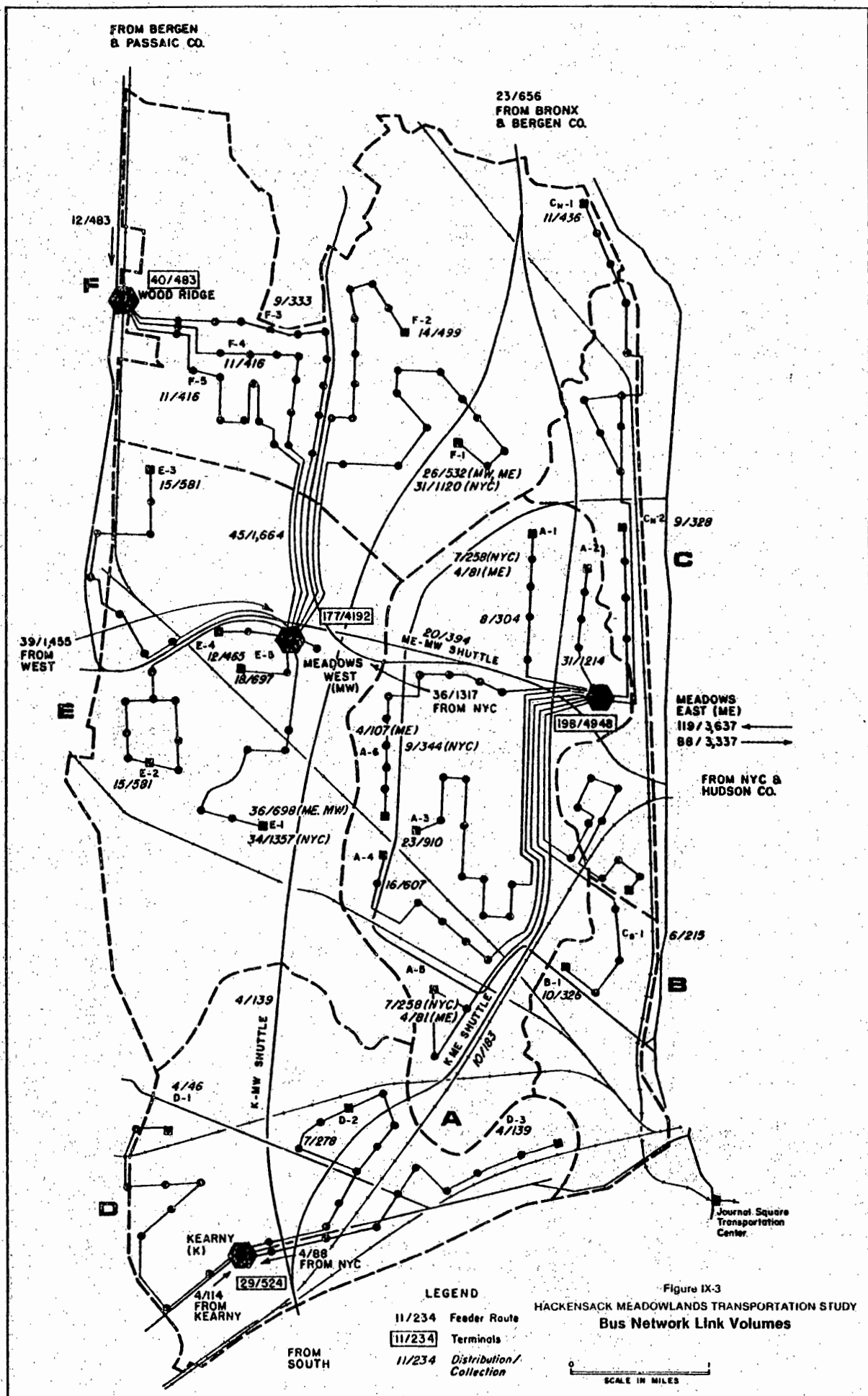
Table IX-8 shows the origin-destination pattern of the bus demand and indicates that of the total bus trips, 7,976 are by employees from outside the District traveling to Meadowlands job sites, and 4,836 by Meadowlands residents - 3,337 commuting to Manhattan and 1,499 commuting to job sites within the Meadows. The largest sources of work trips to the Meadowlands include Jersey City (Zone 3), 1,346 trips, and Brooklyn (Zone 21), 1,493 trips.

The volumes derived by the modal split were then assigned to the various internal and external services. Figure IX-3 shows the results of this assignment in terms of peak hour bus and passenger volumes on each internal route.

Capital Needs

As shown on Table IX-9, the initial capital requirement for the public transit element of the bus network is \$60 million total project cost as of the earliest possible completion of the system in 1981. This includes \$9 million for bus transfer stations, including property, \$2 million for shelters at the on-route stops, and \$49 million for 511 buses and 7 minibuses. Equipment needs assume that 15-passenger minibuses would be used on routes where the demand does not justify 40-passenger buses. In this and all other networks, the capital costs include provisions for the elderly and handicapped.

The sizing of the bus transfer stations is derived from the assignments shown in Figure IX-3. These indicate that these stations will handle the following peak hour volumes:



<u>Transfer Station</u>	<u>Total Buses</u>	<u>Total Passengers</u>
Meadows East	198	4,948
Meadows West	177	4,192
Kearny	29	524
Wood Ridge	40	483

As discussed earlier in this section, the capital cost for the highway improvements required in conjunction with the bus network is \$582 million. When transit and highway costs are combined, the total requirements for the bus network is about \$642 million.

Operating Costs and Revenues

The operating and maintenance costs for the bus network as shown on Table IX-10 total \$10.7 million annually. The bus route operating costs are based upon hourly costs associated with drivers' wages, mileage expenses for fuel and maintenance and annual costs for insurance and other items. Costs for operation of the major bus stations include expenses for maintenance, lighting, policing and either a full or part-time agent. A detailed explanation of these and other cost assumptions is included in Appendix IX-2.

Revenues for the bus network are computed by multiplying the number of passengers assigned to a route by an average fare for that route. The fare structure is similar to existing intrastate bus and rail fares as described in Appendices IX-3 and IX-4. The fare assigned to each route was based on a 10-trip ticket and a free transfer when required at the transfer station. The total bus revenue was \$8.2 million annually, which translates to an overall average fare of \$0.64 per one-way trip for each of the 12,810,000 annual passengers.

Table IX-8

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Peak Hour Demand - Bus Network
(Year 2000)

<u>Zone of Origin</u>	<u>Zone of Destination</u>								<u>Total</u>
	<u>A</u>	<u>B</u>	<u>Cn</u>	<u>Cs</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>18</u>	
1	30	10	2	1	53	9	9		114
2	82	34	4	1	0	5	6		132
3	764	230	127	20	54	122	29		1,346
4	98	10	127	25	23	22	18		323
5	66	4	76	25	14	0	0		185
6	89	11	41	23	9	9	5		187
7	201	8	3	1	4	5	4		226
8	16	4	1	0	0	591	113		725
9	145	5	16	0	2	343	243		754
10	134	6	39	13	0	33	240		465
11	53	3	5	2	0	17	29		109
12	23	0	0	0	0	0	0		23
13	8	3	2	0	15	127	107		262
14	5	0	0	0	0	0	6		11
15	0	0	0	0	0	7	6		13
16	31	0	0	0	0	59	35		125
18	46	11	15	5	9	32	23		141
19	181	15	84	31	23	69	96		499
20	88	15	17	6	5	111	133		375
21	525	98	105	26	88	305	346		1,493
22	168	9	28	8	3	135	122		473
A	87	23	37	4	37	31	50	860	1,129
E	138	24	19	13	59	49	396	1,357	2,055
F	57	10	16	11	65	242	131	1,120	1,652
TOTAL	3,035	326	764	215	463	2,323	2,147	3,337	12,810

Table IX-9

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Capital Costs - Bus Network
(Preliminary)

Transit Improvements

Bus Stations

Meadows East \$ 4.8 million

Meadows West 3.6

Wood Ridge 0.3

Kearny 0.2

Bus Shelters 1.7

Bus Equipment

511 40-passenger 48.2

7 15-passenger 0.3

Land Acquisition (Bus Stations) 0.5

Subtotal Transit \$ 59.6 million

Feeder Highway Improvements*

Rte. 1&9 - Four lane widening (Skyway
to 69th Street) and two lane widen-
ing (69th Street to Ridgefield Circle) \$115 million

Rte. 17 291

Rte. 3 94

Rte. 46 94Subtotal Highway \$582 million

Total Improvements \$641.6 million

* See Highway Network for complete description.

Combining the revenues with the costs yields an annual operating deficit of \$2.5 million or \$0.20 per passenger.

Implementation and Financing

The bus network has the greatest flexibility of all the transit alternatives because it can be implemented as needed. The basic capital requirement is the buses. These may be purchased and introduced into service in increments. While there is no funding source presently available for these purchases, the State Department of Transportation has bought buses in the past and may logically be expected to do so again.

The bus transfer stations at Meadows East, Meadows West, Wood Ridge and Kearny can also be staged. Initially they could be simple, inexpensive shelters funded possibly by the local towns, developers, or the Chamber of Commerce. As adjoining projects such as shopping centers or office complexes are built, it would be logical to expand these initial facilities as part of the cost for the development since many of the users of the station would work within the project area. A similar reasoning could be used for all or part of the station operating costs.

Private operators could probably be enlisted to provide the necessary bus services and presumably any of the operating subsidy, as computed based on existing fare schedules would be paid by the State, as augmented by federal subsidy payments. There are other options for reducing the subsidy requirements. For example, the analysis shows that certain bus routes will break even or make a slight profit at existing fare levels. A slight increase in all Meadowlands bus fares would bring

additional routes to the breakeven point and provide a surplus of income that could be used to defray the losses suffered on the less economically viable routes. Implied in this arrangement is a single bus operator or operating agency.

Evaluation

As shown in Table IX-1, the Bus Network is the least expensive transit network. It also is the most capital efficient, requiring an investment of only \$2,326 per daily passenger for transit facilities. It has the second smallest deficit, 20¢ per passenger. Unfortunately, it also is the slowest. As shown on Table IX-2, the average peak hour travel time is 48 minutes, or 18 minutes above the existing travel time. This feature, coupled with the transfers and local delays in this system and the poor image it presents (even with new buses) suggest that the feasibility of more sophisticated transit plans be explored.

Rail Network

The rail network is designed to use existing rail services and rights-of-way to the maximum possible extent. For this network, commuters board trains (or buses from areas where train service is not available) to travel to stations in the Meadowlands where they would transfer to buses for distribution to job sites in Zones A, D, E or F. These stations would be at Secaucus, Wood Ridge, Berrys Creek, Harmon Cove (Hartz) or Kearny. A light rail vehicle line would also be provided linking Journal Square, the Secaucus transfer station, Zone B, Zone Cs, the Meadows East and Zone Cn. Chapter VIII contains a complete description of this network.

Modal Split and Assignment

Based on the comparative travel time and cost relationships it is forecast that with the rail network, 9,875, or 11.0 percent, of the total Meadowlands oriented peak hour trips would be on transit. Table IX-11 shows the origin-destination pattern of this network demand and indicates that of the total trips, 4,629 are by employees from outside the District traveling to Meadowlands jobs sites and 5,246 by Meadowlands residents - 3,337 commuting to Manhattan and 1,909 to job sites within the Meadows.

The volumes derived from the modal split were then assigned to the various external and internal services. Figure IX-4 shows the results of this assignment in terms of the peak hour rail, LRV and bus passenger volumes on each internal route.

Capital Needs

As shown on Table IX-12, the initial capital requirements for the public transit element of the rail network is \$401 million. This includes \$107 million for transfer stations, \$9 million for connecting the Erie mainline with the Bergen County line west of Secaucus Transfer, \$197 million for the light rail line, \$54 million for rail locomotives and cars, \$23 million for buses, \$2 million for bus shelters, and \$9 million for land acquisition.

The rail equipment costs are based upon the additional equipment needed to handle Meadowlands passengers. On the Pascack Valley route, the maximum additional peak hour demand is 758 passengers immediately north of the Wood Ridge station. This requires one new cab car, seven coaches, a spare coach, and a locomotive.

Table IX-11

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Peak Hour Demand - Rail Network
(Year 2000)

<u>Zone of Origin</u>	<u>Zone of Destination</u>								<u>Total</u>
	<u>A</u>	<u>B</u>	<u>Cn</u>	<u>Cs</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>18</u>	
1	30	17	2	1	49	0	0		99
2	59	36	5	1	0	5	5		111
3	396	139	89	17	0	112	47		800
4	0	3	0	0	0	0	0		3
5	54	5	91	43	0	0	0		193
6	74	13	55	39	0	12	0		193
7	185	9	4	1	0	5	0		204
8	31	9	2	1	0	409	79		531
9	121	7	10	6	0	245	382		771
10	83	6	0	12	0	37	222		360
11	0	1	0	0	0	0	0		1
12	0	0	0	0	0	0	0		0
13	26	7	2	1	0	0	0		36
14	0	0	0	0	0	0	0		0
15	0	0	0	0	0	0	0		0
16	26	18	7	2	5	0	0		58
18	43	13	16	5	12	52	26		167
19	136	15	84	34	27	83	96		475
20	59	11	4	9	9	50	0		142
21	121	21	44	11	37	87	58		381
22	42	4	12	4	4	38	0		104
A	175	23	12	4	25	124	50	860	1,273
E	345	48	58	26	39	147	317	1,357	2,337
F	57	10	16	11	0	161	261	1,120	1,636
TOTAL	2,063	415	513	228	207	1,569	1,543	3,337	9,875

Table IX-12

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Capital Costs - Rail Network
(Preliminary)Transit Improvements

Stations

Secaucus Transfer	\$ 63 million
Hartz	2
Berrys Creek	12
Wood Ridge	8
Meadows East	5
Kearny	11
Journal Square	6
Rail Connection (Bergen County to Mainline)	9

Light Rail

Track and Supports	162
Catenary, Signals and Communications	10
Transfer Stations	6
Local Stations	8
Cars	11

Bus Shelters

2

Rail Equipment

35 MUs	41
4 Locos	3
5 Cab Cars	2
22 Coaches	8

Bus Equipment

204 - 40-passenger	22
14 - 15-passenger	1

Land Acquisition

9

Subtotal Transit

\$401 millionFeeder Highway Improvements*

Rte. 1&9 - Four lane widening (Skyway to 69th Street) and two lane widening (69th Street to Ridgefield Circle)	\$115 million
--	---------------

Rte. 17 291

Rte. 3 94

Holland Tunnel 589

Rte. 46 94

Subtotal Highway

\$1,183 millionTotal Improvements

\$1,584 million

* See Highway Network for complete highway improvement description.

On the Bergen County line, there is a peak hour demand of only 37 additional passengers from the west to jobs in the Meadows and no additional equipment is required for this purpose. The primary demand is for 3,044 Manhattan-bound residents of Zones E and F who will board trains at Berrys Creek. Some 637 of these can occupy space on Pascack Valley trains that has been vacated by Bergen County residents who get off at Wood Ridge and Berrys Creek. The remaining 2,407 would be carried by a new shuttle service between Berrys Creek and Hoboken with stops at Hartz and Secaucus. The return trip would carry Meadowlands employees from New York. Equipment needed for the shuttle includes three locomotives, four cab cars and fourteen coaches, including spares and equipment to meet the off-peak demand.

For the Penn Central, the maximum peak hour demand is 3,079 passengers boarding at Secaucus for Penn Station, Manhattan. Under the direct rail access plan it is assumed that eight 12-car trains would be operated from the Morris and Essex Division via a direct rail connection to the former Penn Central highline at Kearny. Examination of traffic forecasts for the direct rail plan indicates that four of these eight trains could be stopped at Secaucus and that 20 cars or 2,000 seats could be used for Meadows passengers. The remaining 1,079 passengers would be handled with one additional 11-car Secaucus to New York shuttle train. This train and the addition of cars to the M and E trains represents one of many anticipated addition demands for the already limited platform capacity at Penn Station, Manhattan. Such demands would therefore receive close scrutiny by NJDOT. Total equipment requirements for this service, including spares, would be 35 multiple unit cars.

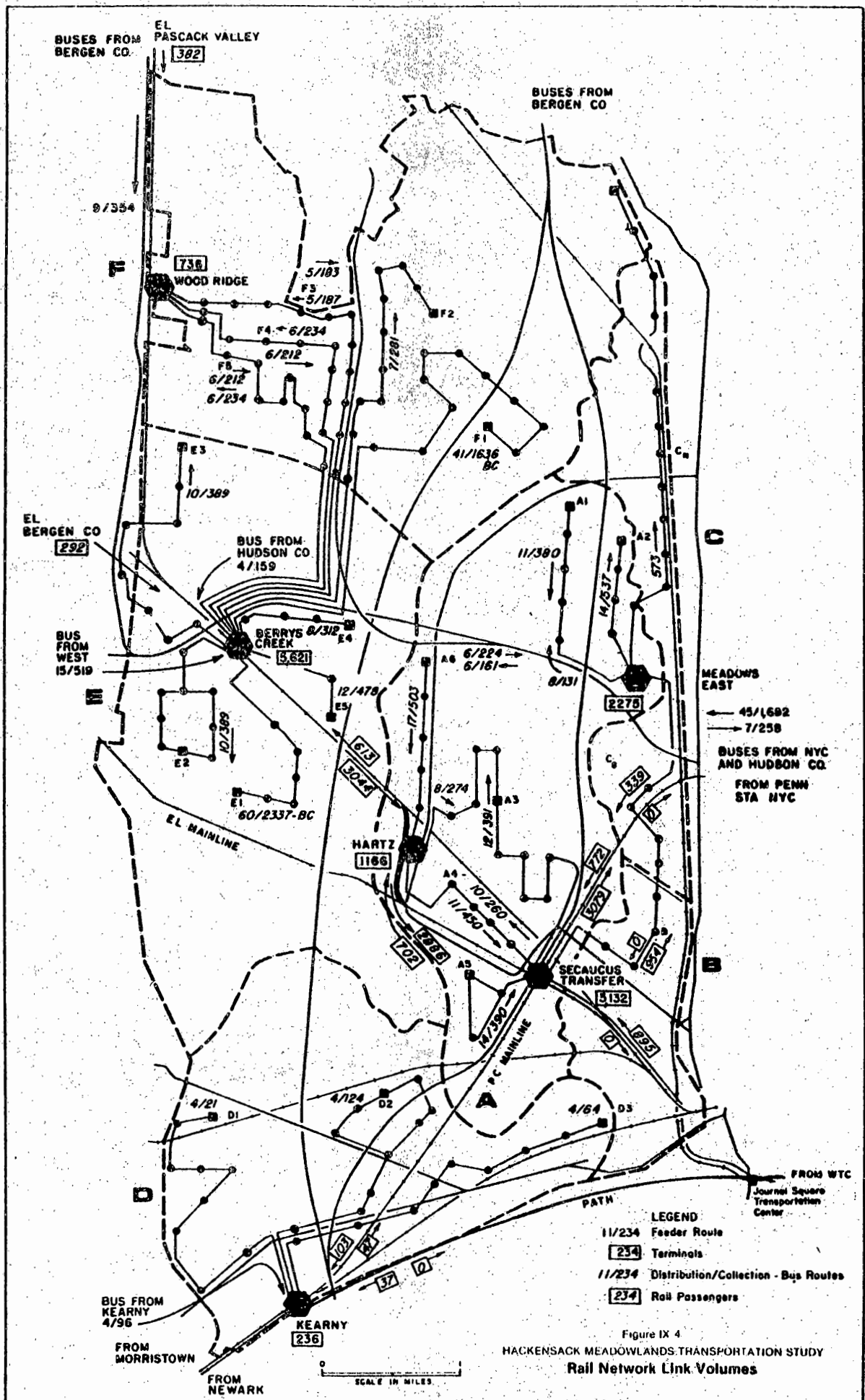
For the light rail vehicle system, the maximum peak hour demand is for 954 passengers boarding northbound trains at Secaucus. At 200 passengers per two-car train and a round trip travel time of 48 minutes, four trains would be required. A spare set of equipment would bring total requirement to five trains.

For PATH, the maximum peak hour loads are in the reverse direction and are much smaller than peak direction demand - 37 passengers. No additional PATH equipment or operating costs occur.

The sizing of the transfer stations is derived from the assignments shown in Figure IX-4. These indicate that these stations will handle the following peak hour volumes and services.

<u>Transfer Station</u>	<u>No. of Buses</u>	<u>No. of Rail Services</u>	<u>LRV Trains</u>	<u>Total Passengers</u>
Secaucus	27	3	8	5132
Hartz	32	2	-	1166
Berrys Creek	126	2	-	5621
Meadows East	66	-	8	2305
Wood Ridge	27	1	-	736
Kearny	16	2	-	236

As discussed earlier in this chapter the cost for the highway improvements required in conjunction with the rail network is \$1,183 million. When transit and highway costs are combined, the total requirements for the rail network is \$1,584 million.



Operating Costs and Revenues

Operating and maintenance costs for the rail network are described in Appendix IX-2 and summarized in Table IX-13. For rail operations, the costs include additional crew costs, fuel costs, equipment maintenance costs and right-of-way maintenance expenses. For the light rail segment, a single operating cost per mile is used to account for operation and maintenance. As with the bus network, operating costs include costs associated with drivers' wages, fuel, maintenance and insurance. Costs for operation of the major stations include maintenance, lighting and an agent, if appropriate. Maintenance costs for light rail stops and local bus shelters also are computed. Annual operating costs of \$7.3 million include:

Rail	\$2.8 M
Light Rail	0.4
Bus	3.5
Stations	<u>0.6</u>
	\$7.3M

Revenues for the rail network are computed by multiplying the number of rail and light rail passengers by the existing intrastate rail fare for a trip of the same distance. Rail passengers who transfer to bus for travel to their place of employment are assumed to pay an additional 30¢ bus fare. Passengers in this network who do not use rail are assumed to pay the same bus fares as in the bus network, including a free transfer from feeder to distributor bus as necessary. The fare schedules are discussed in Appendix IX-3 and are summarized in Appendix IX-4. The revenues

Table IX-13

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Economics - Rail Network
(Preliminary)

Operation and Maintenance Costs

Transportation Costs (includes trains supplies, insurance, loss and damage, fuel, super- intendence)	\$1,519,000
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Maintenance of Equipment	1,158,000
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Maintenance of Way	<u>174,000</u>
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Sub Total	2,851,000
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LRV (including LRV shelters)	382,000
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Feeder Bus Routes (including Meadowlands to PABT)	999,000
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Distributor Bus Routes	<u>2,513,000</u>
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Stations (six major)	520,000
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Bus Shelters (140)	<u>70,000</u>
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Total O&M	\$7,335,000
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Less: Revenues - Rail, LRV (including bus transfer fees), and bus	<u>6,332,000</u>
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Operating Deficit	1,003,000
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Revenue Per Passenger Trip (9,875,000)	0.64
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Deficit Per Passenger Trip	0.10
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for the rail network are \$6.3 million annually which translates to an overall average fare of \$0.64 per one-way trip for each of the 9,875,000 annual passengers.

Combining the revenues with the costs yields an operating deficit of \$1.0 million or \$0.10 per passengers.

Implementation and Financing

The recently opened Hartz station in the Harmon Cove development typifies one way in which rail improvements can be constructed. In this instance, the housing developer surveyed occupants of his housing units and determined that a demand existed for rail access to Manhattan. He agreed to finance the cost of the station and worked out a construction plan with ConRail. The State of New Jersey agreed to provide service by stopping trains, specifying that cars be added as needed and paying any additional operating deficits incurred by ConRail. It is possible that rail stations at Berrys Creek and Kearny might be provided in similar fashion.

The direct rail access plan represents a second means of financing rail improvements. The E-L to Penn Central connection at Kearny is part of an application by the State of New Jersey to the Federal Urban Mass Transportation Administration for an 80 percent federal grant. The 20 percent local share would be financed by funds obtained from the New Jersey bond issue of 1972. However, the additional state and federal monies are not presently available to finance the final stage of the direct rail access plan, the track connections at Secaucus between the E-L mainline and the Bergen County, and between the Erie Lackawanna mainline and the Penn Central

Highline. Additional capital construction expenditures are likely to be authorized for public transit at both the federal and state level in future years, but use of the funds for the direct connection would depend upon the State's priorities at that time.

It might be possible to obtain one or two rail passenger cars from the existing commuter car fleet to serve initial demands. However, the additional rail cars needed to handle demand at full development must be ordered. Unfortunately, the manufacturers will not accommodate the small orders that are involved. Therefore, it probably will be necessary to tie the order for Meadowlands-generated cars to one or two orders by the state for new rail cars. This presents a certain inflexibility to the introduction of additional rail service for the Meadowlands.

The operation of the necessary trains and stations for the rail portion of this proposal would be by ConRail under contract to the New Jersey Department of Transportation. The bus and light rail portions would be by private carriers under contract to the State as in the bus network, with the bus and LRV stations being manned by bus carrier employees and/or personnel hired by the development in which the station is located. The operating deficit could then be paid under the State's transit subsidy program.

Evaluation

As shown on Table IX-1, the rail network is the second least expensive transit network, costing \$401 million, and has the lowest operating deficit. However it carries 4.3 million less annual passengers than the bus

network which results in an investment of \$20,300 per passenger for transit. It does offer a 5-minute improvement in travel time as compared with the bus network but the 43 minute average shown in Table IX-2 is still 13 minutes longer than the existing average. Also it requires additional trans-Hudson capacity unless improved transit connections from other Meadowlands oriented residential centers in New York (such as Brooklyn) are provided. This bus service would greatly reduce the investment associated with the highway portion of this network.

From this it would seem that a modified version of the rail network might be considered which would further reduce capital investment without seriously impacting service. For example consideration might be given to eliminating the Kearny station from the network on the basis that its \$11 million cost is not justified by its small patronage, or as an alternative reducing the scope by eliminating the PATH connection. This connection costs \$3.5 million and serves only 74 daily passengers. Further the light rail service represents an investment of \$209 million to serve 3,392 daily passengers. An alternate bus service, while perhaps not as fast or convenient would only cost \$7 million. Other reductions in the scope of the network might also be found. On the other hand some additions to the network could result in a regional service improvement such as substituting a direct rail connection at Secaucus for the transfer now included (additional cost: \$22 million). The direct connection could also eliminate possible delays associated with stopping trains on the main line between Newark and New York.

PRT Network

The purpose of the PRT network is to present the best possible connections between the developments in the Meadowlands and the transit system feeding the District by providing an automated system operating on its own grade separated right-of-way with sufficient vehicles held at any station to reduce waiting time to a minimum. The main system would be a 13-mile loop supplemented by 20 miles of spur lines so that the system would be within 1000 feet of virtually all major trip destinations. Local bus distribution would be provided in those areas where demand could not support a PRT line. Chapter VIII contains a complete description of this network.

Modal Split and Assignment

Based on the comparative travel time and cost relationships it is forecast that with a PRT system 17,967, or 18.0% of the total Meadowlands oriented peak hour trips would be on this network. Table IX-13 shows the origin-destination pattern of the PRT demand and indicates that of the total trips, 8,907 are by employees from outside the District and 9,060 by Meadowlands residents - 3,337 commuting to New York and 5,723 commuting to job sites in the Meadows.

The volumes derived by the modal split were then assigned to the various internal and external services. The link volumes and typical station demands are shown schematically on Figure IX-5. Also shown are volumes assigned to the bus distribution routes.

Capital Needs

As shown on Table IX-15, the initial capital requirement for the public transit element of the PRT network is \$1,743 million. This includes \$644 million for the main guideway and bridges, \$719 million for the spur lines,

BUSES FROM BERGEN,
ROCKLAND & PASSAIC CO

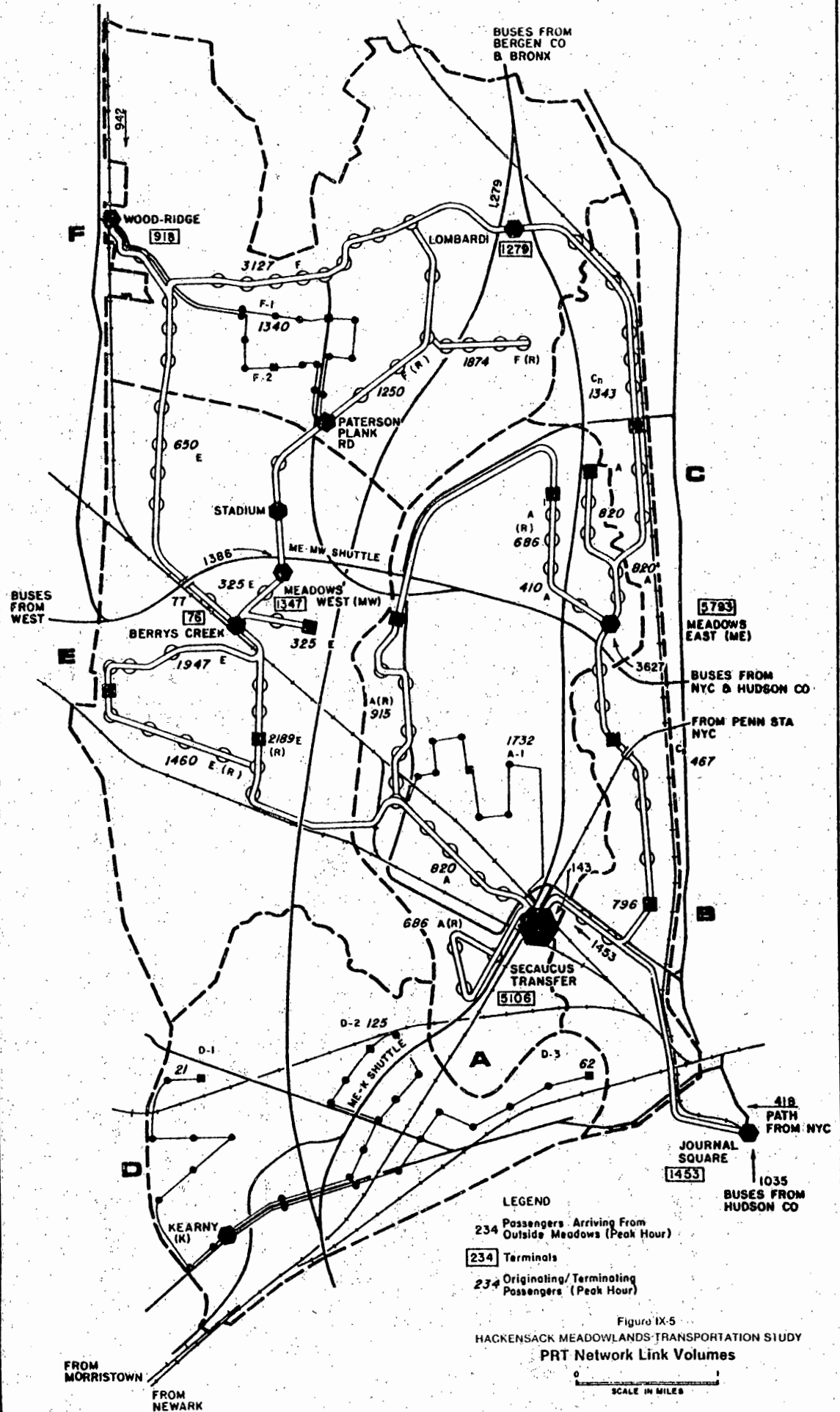


Table IX-14

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Peak Hour Demand - PRT Network
(Year 2000)

Zone of Origin	Zone of Destination								Total
	A	B	Cn	Cs	D	E	F	18	
1	42	21	4	1	0	20	19		107
2	67	41	4	1	0	8	11		132
3	424	235	84	24	0	92	44		903
4	133	15	159	53	10	89	92		551
5	109	6	114	51	6	46	141		473
6	134	16	68	46	5	33	37		339
7	309	11	4	1	4	14	12		355
8	109	17	6	2	0	545	158		837
9	133	7	27	8	0	245	487		907
10	124	7	74	20	0	40	296		561
11	60	4	16	5	0	30	118		233
12	0	1	0	0	0	29	47		77
13	23	9	5	2	0	200	143		382
14	5	0	1	0	0	3	26		35
15	0	0	0	0	0	0	0		0
16	0	7	2	1	0	20	30		60
18	54	13	18	6	9	52	33		185
19	149	14	84	33	18	78	120		496
20	319	28	98	31	24	323	472		1,295
21	202	43	77	15	0	216	144		697
22	97	6	18	7	3	60	91		282
A	350	76	124	41	25	310	501	860	2,287
E	690	120	195	65	39	391	729	1,357	3,649
F	569	99	161	54	65	403	653	1,120	3,124
TOTAL	4,102	796	1,343	467	208	3,247	4,467	3,337	17,967

Table IX-15
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Capital Costs - PRT Network
(Preliminary)

Transit Improvements

PRT System		
Main Loop (incl. superstruct., foundations, power, etc.)		\$ 644 million
Transfer Stations		
Secaucus	46	
Meadows East	5	
Lombardi	3	
Paterson Plank	3	
Meadows West	3	
Berrys Creek	3	
Hartz	<u>3</u>	66
Minor Stations		66
Maintenance Facility		4
600 car off-line storage		25
Spurs		
Journal Square	91	
Harmon Cove	67	
Harmon Cove Extension	46	
Berrys Creek	108	
Murry Hill/Empire	201	
Wood Ridge	28	
Empire Housing	32	
Hartz Office	29	
Hartz Housing	55	
Laurel Hill	<u>62</u>	719
PRT Vehicles (600)		143
Rail		
Rail Cars (20)	23	
Kearny Transfer & Bergen Track Connection	<u>9</u>	32
Bus		
Bus Shelters	1	
Buses 184 - 40 passenger	20	
11 - 15 passenger	<u>1</u>	22
Land Acquisition		<u>22</u>
Subtotal Transit		\$1,743 million

Feeder Highway Improvements

Rte. 1&9 - Four lane widening (Skyway to 69th Street) and two lane widen- ing (69th Street to Ridgefield Circle)		\$ 115
Rte. 17		291
Rte. 3		94
Holland Tunnel		589
Route 46		<u>20</u>
Subtotal Highway		<u>\$1,109</u> million

Total Improvements \$2,852 million

\$132 million for stations, \$143 million for 600 cars and \$38 million for rail connections and storage and maintenance facilities. In addition, to handle the demand between Secaucus and Manhattan requires 20 MU cars at a cost of \$23 million. For the internal and external bus needs, some 195 buses and minibuses are required, as well as 50 bus shelters for a bus cost of \$22 million. Total real estate costs are \$22 million.

The sizing of the transfer stations is derived from the assignments shown in Figure IX-5. These indicate that these stations will handle the following peak hour volumes:

<u>Transfer Station</u>	<u>Passengers</u>		<u>Total Volume</u>
	<u>Originating Or Terminating</u>	<u>Thru Trips</u>	
Meadows East	5,793	646	6,439
Secaucus Transfer	5,106	906	6,012
Berrys Creek	76	3,450	3,526
Meadows West	1,347	2,122	3,469
Vince Lombardi	1,467	2,771	4,238
Journal Square	1,440	0	1,440
Wood Ridge	918	0	918

As discussed earlier in this chapter the highways associated with the PRT network would cost \$1,109 million including the need for additional trans Hudson capacity. When transit and highway costs are combined, the total requirements for the PRT network amount to \$2,892 million. Even if the system is redesigned to eliminate the need for the new trans Hudson capacity the total cost still exceeds \$2.2 billion or nearly \$1 billion more than the next most expensive transit alternative.

Operating Costs and Revenues

As shown in Table IX-16, PRT operating costs include vehicle maintenance, operation and maintenance of control equipment, and maintenance of stations, guideway, guideway systems and structure, for a cost of \$14.2 million annually. In arriving at this cost it was assumed that the vehicles will carry six passengers per revenue trip during peak hours and three during off peak hours. Additional mileage of 25 percent is assumed to return unloaded vehicles to the busiest stations. In addition to the PRT costs, the cost of operating an additional rail service between Penn Station, Manhattan and Newark is \$0.8 million annually with another \$0.6 million for the transfer stations. The bus requirements would amount to \$4.2 million giving a total annual operation and maintenance cost of \$19.8 million for the PRT network.

Revenues for the PRT network are computed by multiplying the 17,967,000 passengers by a PRT fare of 30¢. To this is added the revenue from the feeder bus and rail routes based upon existing (minimum) fare schedule shown in Appendix IX-4. A free transfer is permitted between the PRT and the distributor bus routes to Zones A and F. However, an additional 30¢ would be charged for the longer distributor bus routes to Zone D.

Revenues average \$0.61 per one way trip or \$11.0 million annually, yielding an operating deficit of \$8.8 million or 49¢ per passenger. This is more than twice as much as any other transit network.

Table IX-16

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Economics - PRT Network
(Preliminary)

Operation and Maintenance Costs

PRT Operations

Maintenance of Way and Structures	\$ 452,000
Maintenance of Guideway Subsystems	1,629,000
Vehicle Maintenance	2,030,000
Computer Control Equipment	6,861,000
PRT Stations	1,444,000
Yard Operations	1,740,000
	<u>\$14,156,000</u>

Rail Operations

Transportation Costs	\$ 438,914
Maintenance of Equipment	307,132
Maintenance of Way	51,352
	<u>\$ 797,398</u>

Bus Operations

Feeder Bus Routes	\$ 3,383,000
Distributor Bus Routes	863,000
Bus Shelters	26,000
	<u>\$ 4,245,000</u>

Maintenance of Intermodal Stations	\$ 600,000
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Total O&M	\$19,798,000
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Less: Revenues (17,967,000
annual passengers)

PRT	\$ 5,390,000	
Feeder Bus	4,565,000	
Feeder Rail	1,051,000	
	<u>\$11,006,000</u>	\$11,006,000

Annual Operating Deficit	8,792,000
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Revenue Per Passenger Trip	0.61
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Deficit Per Passenger Trip	0.49
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Implementation and Evaluation

The PRT network is probably the most difficult to implement and finance. There is no state program available for supplying capital and the federal program is totally committed. As shown on Table IX-1, the transit element of the PRT network is by far the most expensive in both capital and operating dollars. It is also the least capital efficient requiring an investment of \$48,400 per daily passenger. On the other hand, Table IX-2 illustrates that these additional costs reduce average travel time to 31 minutes, or only one minute over today's average. This improvement in speed is remarkable when compared to the bus and rail network. As in the rail network, the needed trans-Hudson highway improvements could be eliminated by providing direct bus service from Brooklyn. However the cost to build the transit portion of this network would remain extremely high and suggests that the PRT network be dropped from further consideration.

Busway/Van Pool Network

The Busway Network is designed to enhance the attractiveness of transit by eliminating the transfer from feeder route to distributor route. This is achieved by providing express bus services directly from each area of origin to each place of employment in the Meadowlands. Within the district the buses would use a two-way exclusive bus roadway on the same alignment as the PRT, but unlike the PRT, the buses could leave the right-of-way as necessary to serve a given area. Authorized van pools also would be allowed on the roadway. Chapter VIII contains a complete description of this network.

Modal Split and Assignment

As a result of the improved service characteristics of the Busway Network, it is forecast that this network will attract 20,988, or 21.1 percent, of the total peak hour trips, the highest of any of the transit alternatives. Table IX-17 gives the origin-destination pattern of the Busway demand and indicates that 11,928 of the trips are by employees from outside the District including large numbers from Jersey City, Brooklyn and the Bronx. Of the 9,060 Meadowlands residents, 5,723 would use the network to reach job sites in the District and 3,337 would be commuting to Manhattan.

The peak hour bus and passenger volume assigned to each segment of the Busway are shown on Figure IX-6. The heaviest volume on the main loop of the Busway is 120 buses northbound just north of the Secaucus junction. The heaviest entry/exit volume is 165 buses at Meadows East.

Capital Needs

As shown on Table IX-18, the initial capital requirement for the public transit element of the Busway is \$864 million. This includes \$459 million for the main bus roadway, \$309 million for the various spurs, \$8 million for stations and shelters, \$63 million for buses and \$25 million for real estate.

A major savings from other networks is in the station costs. By eliminating the need for the majority of transfers, the large transfer stations found in the other networks are not necessary and smaller facilities

BUSES FROM BERGEN CO & BRONX

BUSES FROM WEST

BUSES FROM NYC & HUDSON CO

BUSES FROM SOUTH

BUSES FROM HUDSON CO. & BROOKLYN

LEGEND

12/345 Buses/Passengers Post Location Shown (Peak Hour)

345 Originating or Terminating Passengers (Peak Hour)

Figure IX-6

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Busway - Van Pool Network Link Volumes

Figure IX-6
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Busway - Van Pool Network Link Volumes

Table IX-17

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Peak Hour Demand - Busway/Van Pool Network
(Year 2000)

<u>Origin</u>	<u>Zone of Destination</u>							<u>18</u>	<u>Total</u>
	<u>A</u>	<u>B</u>	<u>Cn</u>	<u>Cs</u>	<u>D</u>	<u>E</u>	<u>F</u>		
1	48	25	5	1	0	22	21		122
2	93	56	6	2	22	14	16		209
3	849	320	135	42	0	153	78		1,577
4	160	16	191	57	10	96	99		629
5	121	6	152	56	6	46	234		621
6	156	19	103	50	5	45	47		425
7	339	13	5	2	4	16	15		394
8	78	21	77	2	0	682	180		970
9	145	8	31	9	0	294	522		1,009
10	165	9	78	26	0	47	314		639
11	80	6	19	6	0	37	137		285
12	12	1	3	1	0	50	79		146
13	34	10	7	2	0	255	166		474
14	8	0	1	0	0	8	29		46
15	0	0	0	0	0	2	3		5
16	0	10	4	1	0	39	41		95
18	60	15	20	7	11	52	39		204
19	199	16	93	37	23	83	144		595
20	344	31	101	34	24	338	492		1,364
21	606	128	142	44	13	413	433		1,779
22	118	7	25	8	3	75	104		340
A	350	76	124	41	25	310	501	860	2,287
E	690	120	195	65	39	391	792	1,357	3,649
F	569	99	161	54	65	403	653	1,120	3,124
TOTAL	5,224	1,012	1,608	547	250	3,871	5,139	3,337	20,988

Table IX-18

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Capital Costs - Busway/Vanpool Network
(Preliminary)Transit Improvements

Main Loop (5.8 miles elevated; 8.8 miles at grade)	\$ 290 million	
Access Ramps	49	
Bridges	98	
Stations	13	
Bergen Track Connection	<u>9</u>	\$459 million
Spurs		
Journal Square	23	
Harmon Cove	51	
Harmon Cove Extension	23	
Berrys Creek	34	
Murry Hill/Empire	128	
Empire Housing	16	
Hartz Office	10	
Hartz Housing	18	
Laurel Hill	<u>6</u>	309
Other		
Bus Maintenance Facility	7	
Roadside Shelters & Kearny Transfer	1	
Buses		
521 - 40 passenger	57	
138 - 15 passenger	6	
Land Acquisition	<u>25</u>	<u>96</u>
Subtotal Transit		\$864 million

Feeder Highway Improvements *

Rte. 1&9 - Two lane widening (Skyway to 69th Street)	56
Rte. 17	291
Rte. 3	94
Rte. 46	<u>20</u>

Subtotal Highway \$ 461 million

Total Improvements \$1,325 million

* See Highway Network for complete description of highway improvements.

at such key locations as the Meadows East, Secaucus (bus only), Berrys Creek, the Meadows West station and the Vince Lombardi Plaza, can be substituted.

A major factor in the attractiveness of the Busway is the time advantage gained by use of the exclusive roadway. However in other than the peak periods this roadway could be used by other traffic including trucks. It is estimated that this option would increase the cost of the roadway and structures by \$68 million.

As discussed earlier in this chapter the cost of the highway improvements associated with this network are the least for any of the alternatives, \$461 million. When highway and transit costs are combined, however, the total is \$1,335 million, the second highest.

Operating Costs and Revenues

Operating and maintenance costs for the Busway Network are shown on Table IX-19. The \$18.4 million total includes \$17.4 million for bus route operation and \$1.0 million for maintenance of the busway and shelters. Operating costs are computed as described for the bus network. The underlying cost consumptions are detailed in Appendix IX-2.

Revenues for the Busway network are based upon the recommended fare schedule shown on Appendix IX-4. Revenues for the 20,988,000 annual passengers are \$13.6 million or \$0.65 per passenger trip. This results in an operations deficit of \$4.8 million per year or 23¢ per trip.

Table IX-19

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Economics - Busway/Van Pool Network
(Preliminary)

Operation and Maintenance Costs

Feeder Bus Routes	\$13,939,000
Distributor Bus Routes	3,485,000
Busway Maintenance	885,000
Bus Shelters	<u>69,000</u>
Total O&M	\$18,378,000
Less: Revenues (20,988,000 annual passengers)	13,599,000
Annual Operating Deficit	4,779,000
Revenue Per Passenger Trip	0.65
Deficit Per Passenger Trip	0.23

Implementation and Financing

An important advantage of the Busway concept is its flexibility in equipment and other capital needs. The network itself can be built in small sections as needed to bypass congested areas, spreading this capital investment over a number of years. Equipment can also be purchased as demand increases, thus permitting expenditures to be made in small amounts from anticipated State and Federal purchase programs. Equipment can also be shifted from route to route as internal patterns change.

If this network is adopted, it is suggested that the right-of-way be set aside as applications for development are received by the Commission. The developer could then construct the roadway and local stations as part of his development scheme. About one-half of the cost of the network could be met in this manner. The remaining costs could possibly be met in part through Federal grants since both transit and highway monies are available for this type of improvement.

As with the Bus Network, there could be a pooling of revenues so that profitable bus routes could be used to assist in the establishment of new routes. Under this concept, a single operator or operating agency would be desirable. A single operating agency concept could also facilitate daily maintenance and operating functions such as policing, issuing the magnetic cards, repairs, snow removal etc. This agency should also have a role in fare setting. Since the network offers superior service, the patrons could well accept a higher fare. A 20 percent increase would reduce the annual deficit from \$4.8 million to \$2.1 million or only 10¢ per trip.

Evaluation

As shown in Table IX-1, the Busway Network is the second most expensive transit network. However, it is relatively capital efficient on an annual basis, requiring a total investment of \$20,600 per daily passenger. It also has a low operating deficit, 23¢ per passenger. For this investment, as shown on Table IX-2, the network produces an average travel time of 33 minutes, or only 3 minutes over today's average. This is very comparable to the PRT times, but at considerably less cost.

Although the cost is high, the Busway network appears possible to finance and implement, and its operational characteristics make for an attractive service. It requires the least improvements to feeder highways and is the only network that also can accommodate internal bus and van trips.

Internal Highway and Road Network

NJ Route 3

Without doubt, one of the most important internal highways in the Hackensack Meadowlands District is NJ Route 3. This highway, in addition to its regional role as a major feeder to the Lincoln Tunnel and thus New York City, also acts as the primary east-west road for travel in the Meadowlands. It crosses the Hackensack River at a key location in the middle of the District. The two nearest Hackensack River bridges serving east-west travel are about four miles south, the Wittpen Bridge on NJ Route 7, and about four miles north, the NJ Route 46 Little Ferry Bridge. NJ Route 3 is thus considered an important internal highway.

In the previous analysis of feeder routes, it was shown that the demand generated by the full development of the Meadowlands would require, under

any transit alternate considered in this study, substantial improvements to Route 3. These improvements included the need for expanding the highway from six to eight lanes between the Garden State Parkway and NJ Route 21 and from six to ten lanes between Route 21 and Route 17. East of Route 17 and within the Meadowlands, Route 3 improvements will also be required.

A preliminary analysis of the demand associated with the full development of the Meadowlands at the Route 3 Berrys Creek Bridge indicates that this highway link will need additional capacity. Under the rail alternate this highway link would need new capacity to handle 4,550 vehicles. Under the busway alternate additional capacity would be needed to handle 4,130 vehicles. In both instances this would require expansion of this highway link from six to twelve lanes, including the bridge.

At the Route 3 Hackensack River Bridge (actually there are two bridges, one for eastbound and one for westbound traffic), Route 3 would need new capacity to handle an additional 2,350 vehicles under the rail alternate and 1,135 vehicles under the busway alternate. The addition of this new capacity would mean expanding the highway from eight to twelve lanes under the rail transit alternate and from eight to ten lanes under the busway alternate.

Other approaches to meeting these additional demands along Route 3 might involve entirely new bridges over the Berrys Creek Canal and the Hackensack River as part of a more expansive internal land use service road network. The Meadowlands' internal road needs will be discussed in the following section.

An analysis of other internal roadways under full development demand is also required. The latter will measure at entering locations, where current volume/capacity data is available, the ability of the roadway to function under the future demand. At those locations deficient in capacity,

roadway expansion and/or new entering routes would be required.

Other Internal Roads

Currently, the Commission, as reflected in its Master Plan, has planned for two major internal roads, Meadowlands Parkway and an Extension of Route 17 South. Meadowlands Parkway currently runs from Route 3 south about four miles to a point just south of a major ConRail line. It serves the needs of the land uses adjacent to it and someday is planned to be extended so that it will connect with US 1&9 in the south in Jersey City and, again, US 1&9 in the north in North Bergen. To date, this four lane parkway has been constructed using private funds. The extension of Route 17 south of its present interchange with NJ Route 3 in Rutherford and Lyndhurst to an eventual connection with the NJ Turnpike/I-280 interchange in Kearny is a proposal which this Commission and other local governing bodies, Bergen and Hudson Counties in particular, are supporting. These two internal roads are examples of the types of land use service roads which the District will need to serve its growing development.

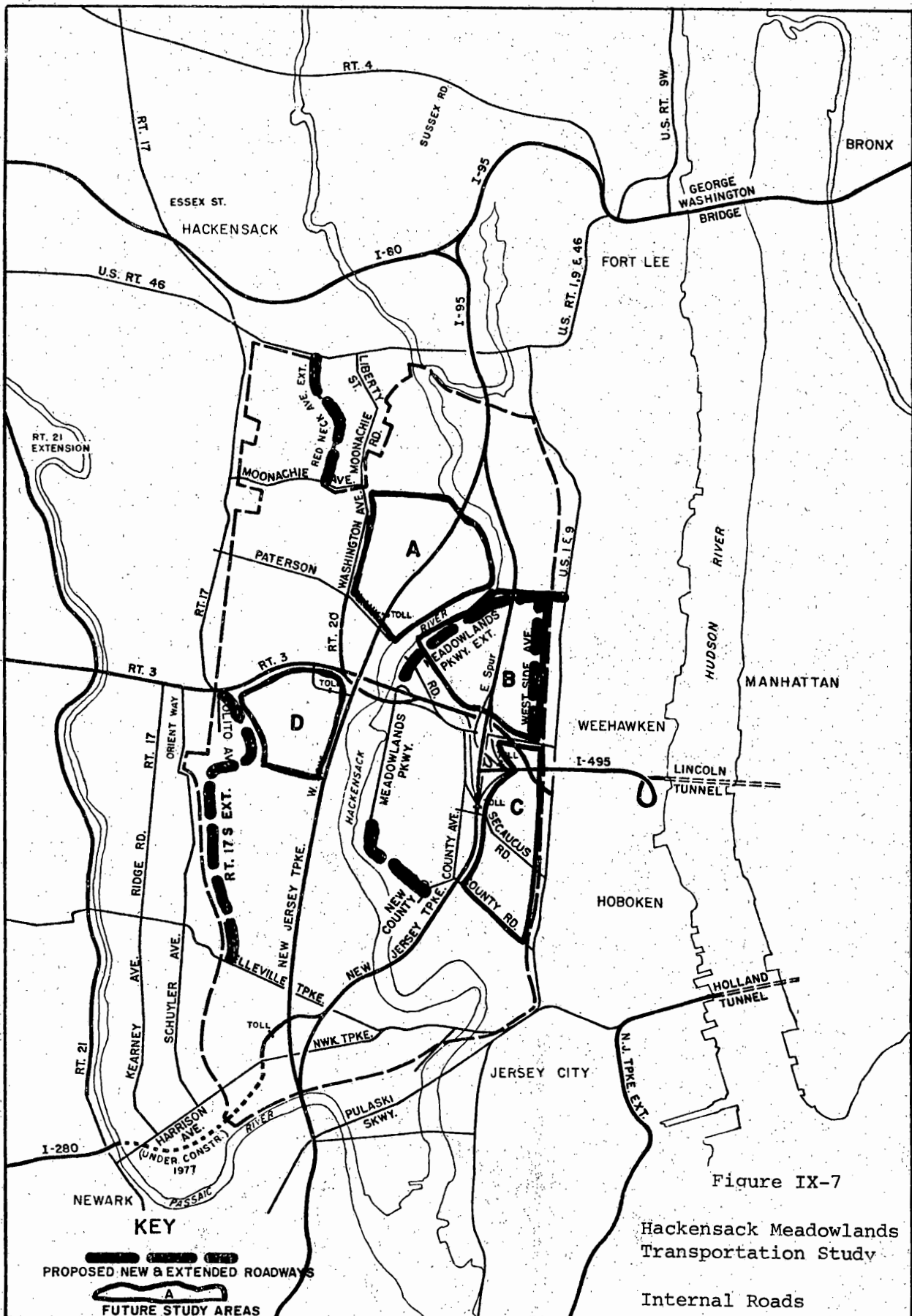
Since we do not have available to us, at this time, the specifics on the types and location of major future developments, it was not possible to develop a detailed internal road plan. In addition to the additional crossings at Berrys Creek Canal and the Hackensack River mentioned earlier, there are many areas of the District, which, when they develop, will require additional road construction. These areas are:

- A. the portion of the Town of Carlstadt east of Washington Ave.
- B. the northeast portion of Secaucus and adjacent western portion of North Bergen
- C. the Jersey City portion of the Meadowlands and adjacent portions of Secaucus and North Bergen

- D. the Rutherford portion of the Meadowlands and adjacent portions of East Rutherford, specifically the area zoned Berrys Creek Center, and Lyndhurst.

These areas are outlined in Figure IX-7 for easy identification. In addition to these road expansions, other improvements will be needed to handle future traffic volumes.

In light of the complexity of developing a detailed plan for an internal vehicular circulation network and the limited amount of information available on some of the potential major developments in the Meadowlands, it is suggested that further study be given to the internal road needs of the Meadowlands. Using computer models and more sophisticated information it may be possible to develop a capability to assess on a project by project basis, the internal road circulation needs of the Meadowlands. It is anticipated that using computer models as an aid, the Commission will be able to not only determine internal road circulation needs, but quantify this need and test possible alternate solutions to meeting this need.



Chapter X

Environmental Analysis, Parks and Recreation and Bikeways

Environmental Analysis: Reciprocal Relationships Between Land Use Planning and Transportation/Transit Planning

Perspective

The first major environmental question raised by this transportation study is the same one raised by the transportation components incorporated into the original Land Use Plan for the Hackensack Meadowlands: "What are the environmental relationships between Land Use Planning and Transportation Planning in the Hackensack Meadowlands?" The task now, as it was then, is to distinguish between the impacts of alternative transportation networks on the land use plan and the induced impacts of alternative land use plans on proposed transportation networks.

And the major difference between this exercise then and now is that the first such exercise was totally an encounter with the future. This exercise, 9 years after the Hackensack Meadowlands ~~enabling~~ legislation is reflective: we have a land use/transportation and environmental impact record to consult this time around.

Land Use, Transportation and Environmental Experience in the Hackensack Meadowlands: 1972-1978

This Transportation Study began, in fact, with that record. Building on the results of an extensive transportation survey, the researchers applied the results of the various, discovered commuter patterns, transit and auto from land uses already in existence to the unassembled balance of the Master Plan's mix of developed and open spaces. Where are today's points of congestion? What will be the future's experience? How can solutions be derived? What is/will be the impact of the regional commuter crush on Hackensack Meadowlands land uses? What will be the impact of

future land development/preservation patterns in the Hackensack Meadowlands District on those who pass through? Can the Master Plan's balance between people who live here and work here be attained? What could be the consequence of losing that balance? Can transportation improvement steps taken here at the core of the region benefit that larger region whose other travel patterns converge here at the center?

Beyond the scope of this study is an environmental question not asked. It needs answering. It is the question which goes to the heart of urban sprawl and its land use/environmental consequences in this, the Northeast's biggest metropolitan region. "Will there be more peripheral development in the suburbs and exurbs, that is in the farm lots and the wood lots which now dot the heart and frame the rim of this urbanized region? If so, will such developmental diffusion patterns aid or harm the region's environmental and economic health? Or if the region declines, will transportation/transit improvements here at the center still be necessary? If not, then it is entirely conceivable that economic vitality at the urban core will tail off as the traffic does. Surprisingly, urban congestion in this regional economic framework isn't perceived by the metropolitan work force as all bad. People have tolerated congestion for centuries to gain its urban benefits. It is only recently, however, that automobiles have become part of that crowding. So now we must ponder the air quality impacts of congestion on the health of its headlong participants, on those who now live here at the region's center, and on those who, responding to new jobs here, will choose to live either at the center of the region or at its ever more remote periphery. These last questions are questions of air quality and of the regional effects, on people and on natural resources, of land use planning. The air quality aspects are

treated at length in the second part of this chapter.

Infrastructure corridors--roadways, rail lines, aqueducts, sewer lines, and other utilities--always get fatter at their common points of destination. Thus the sewers delivering sewage to the region's estuaries get wider and wider as the lines converge. The rail yards get fatter and fatter to accommodate the single trains that left many small stations an hour ago. Consider the Secaucus, Kearny and Jersey City rail yards. The roads attain more and more lanes as their feeders from distant points join at the center. Consider the Turnpike's intersection with Route 3 and Route 1 and 9. Thus the natural resource penalties are invariably greater at the region's center. Our task as planners is to resist widening these corridors unconscionably to accommodate the periphery's commuters at the expense of people who live here now--air quality control plans go to the heart of this enterprise; and to devise plans which attempt to serve, on one hand, the existing region and on the other, the Hackensack Meadowlands Master Plan which was designed to respond to some of that region's needs; and to aggregate both sets of needs into implementable planning steps.

Similarities To Transportation Components in the 1972 Master Plan (As Amended in 1977)

We find it informative to ask, next, how close this study's recommended transportation "centers" are to those in the original (1972) Hackensack Meadowlands Master Plan. They are very close. In many ways, then, the original transportation planning was remarkably prescient. Its sense of the region's growth, as this growth would reciprocate with the Hackensack Meadowlands land use planning, was sound. The reasons for this are

not obscure. The Hackensack Meadowlands District's mix of open and developed spaces, as these relate back to the original real estate and natural resource inventories, is appearing very much as planned. The open, remaining pockets of light industrial and research park development have been filling in at the District's developed periphery, as expected.

16,000 new jobs have resulted. The River, its health key to the conservation, the recreational open space and the residential plan components, is recovering. Of note, the United States Environmental Protection Agency, Office of Water Planning and Standards has just released (January 1978) a report on the Recovery of the Hackensack Estuary entitled, "A Water Quality Success Story: The Hackensack River and its Meadowlands."

11 wetland areas, ranging from 3 to 1186 acres in size, and totalling nearly 50% of the Master Plan's total open space goal, have been protected with the variety of open space techniques assembled in the Open Space Plan (and designated officially in the Open Space Map). The end of the landfill era is in sight; with this cost to date born in ever higher, but never wider landfills since 1970. The Commission's solid waste baler, this designed to accommodate up to 2,000 tons per day of the 8,000 ton per day solid waste flow to the Hackensack Meadowlands, is now under construction. Its bales are to be used as fill for parkland within the Richard W. DeKorte State Park, for which feasibility studies are now under way. Clustered residences have been built, and approved as designated, in the Harmon Cove Specially Planned Areas. The rail station anticipated as needed for this zone has been constructed.

Regarding new transportation facilities in the Hackensack Meadowlands District 1972-1978, Meadowland Parkway in Secaucus was constructed and

connected to Route 3 by Hartz Mountain Industries; 2 bus stations were built, also by Hartz, on that Parkway to accommodate new bus routes to the Secaucus Industrial Park and the Harmon Cove housing (where a third bus stop has been added); a new train stop has been constructed at Harmon Cove, this to connect with the existing industrial park and the housing; and a bus shuttle has been provided by Hartz to deliver rail commuters to their industrial jobs and to deliver new residents to the new rail facility. The Secaucus Industrial Park generates jobs for 8,000 workers. Transportation planning for this part of the Hackensack Meadowlands District has been extensive, and it has, as noted subsequently in this chapter, been complemented by air quality monitoring and traffic management studies, projections, and impact analyses.

Other transportation improvements over the period 1972-1978 in the Hackensack Meadowlands District, some connecting the Hackensack Meadowlands District to the region and others improving its internal connectives, have included the following:

- o A new Turnpike interchange 18W bypass also known as Interchange Exit 17W and the widening and signalization of Paterson Plank Road, these in conjunction with the traffic management planning for the New Jersey Sports and Exposition Authority;
- o Route 3 widening in Rutherford;
- o The Route 280 extension of Exit 15W of the Turnpike, now under construction;
- o The Route 3/17 Interchange, completed in 1973-1974;

- o The Route 7/Harrison Avenue interchange in Kearny;
- o The construction of Valley Brook Avenue extension by Bellemead Corporation in Lyndhurst, opening up new portions of the Lyndhurst Industrial Park;
- o Construction of internal roads by Hartz Mountain Industries in Secaucus--Hartz Way, Seaview Drive, Aquarium Drive, Southern portion of Enterprise Avenue;
- o Widening of New Jersey Turnpike's eastern spur; and the addition of a lane to the western spur;
- o The design of Redneck Avenue extension, a county road in Little Ferry and Moonachie, with construction anticipated to begin late this year;
- o The construction of an internal road system, privately owned, within Harmon Cove (by Hartz Mountain Industries);
- o The construction of four new internal roads in the Lyndhurst Industrial Park by Bellemead Corporation--Chubb Avenue, Wall Street West, Clay Avenue, Garland Way.

Thus the transportation planning of 1972, as it keyed to the mix of land uses incorporated into the Master Plan and to those actually constructed since then, is still applicable as to basic location and function. So our land use experience in the Hackensack Meadowlands, the factor which differentiates the first transportation plan from this one, is remarkably close to our original land use planning projections. It is that land use experience, in combination with an analysis of the remaining portions of the Master Plan, that provides the context for this environmental analysis.

But land use patterns are not the only index of planning to consult. Land use pace must also be consulted. And the environmental consequences of both pattern and pace have been monitored over the 1972-1978 period. It is these monitoring tools which permit an environmental assessment of transportation/land use impacts to date and which suggest the patterns of the future. Figure X-1 shows these areas of development and preservation over that period 1972-1978.

This monitoring has taken many forms. Some occur as part of the Commission's various, on-going monitoring and research programs. Other monitoring occurs as the required environmental tracking, by developers, of projects for which environmental impact statements were prepared for the Commission before development; and for which monitoring of the operational stages is conducted afterwards--this to check the earlier impact predictions, and to produce a continually updated record concerning the District's various carrying capacities. This latter aspect of environmental planning is discussed below.

Commission research has also investigated, and continues to investigate such matters as nutrient cycling, hydrology, water quality, wetland management, air quality monitoring and modeling, regular biozone inventorying, regional water supply use patterns, bio-assay research into the response of plankton to proposed sewage treatment plant expansions (in size and in treatment level) and to various industrial effluents.

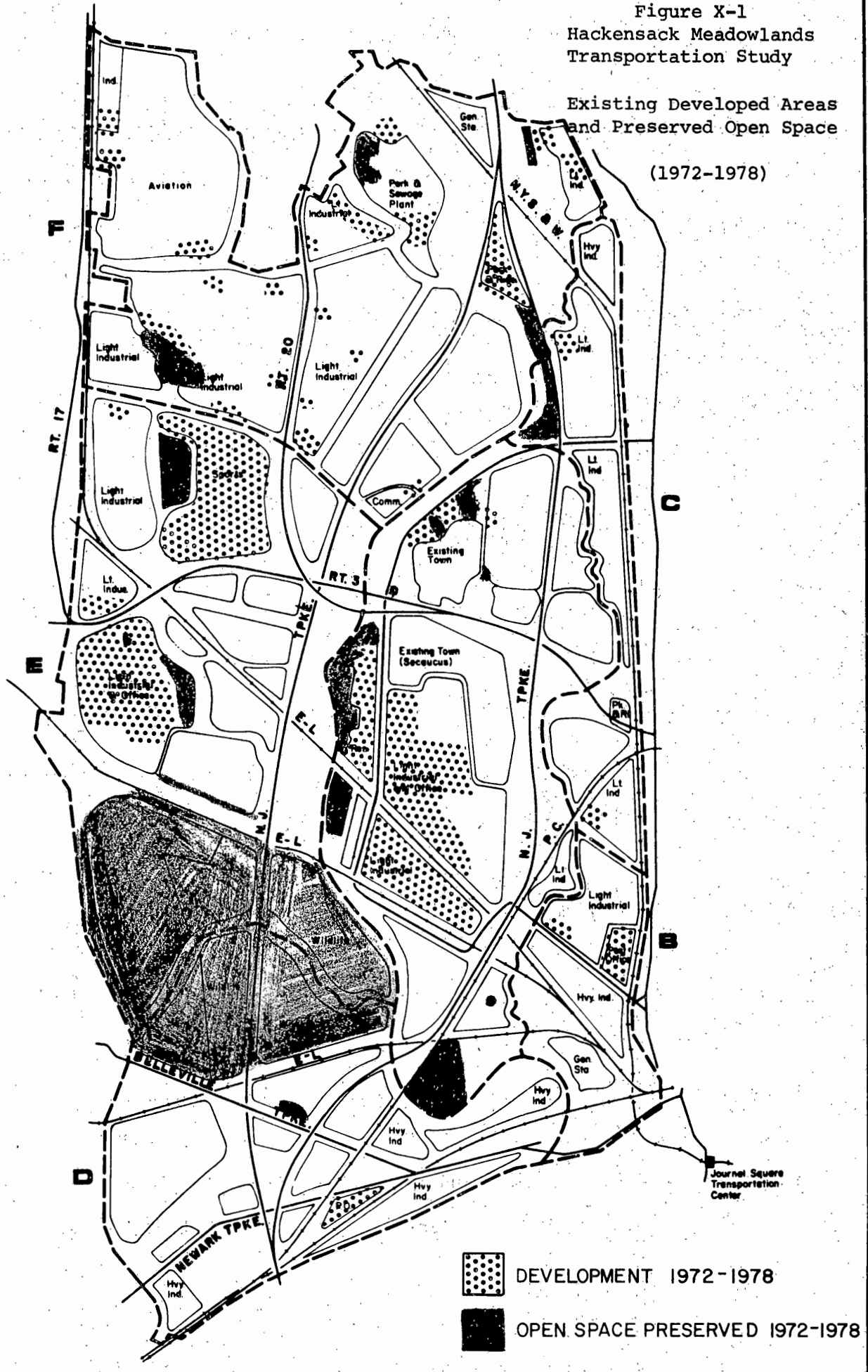
A detailed report of the findings is, of course, not possible in this space. But they can be read in such reports of the Commission as:

- o C. Mattson and N. Vallario, "Water Quality in a Recovering

Figure X-1
Hackensack Meadowlands
Transportation Study

Existing Developed Areas
and Preserved Open Space

(1972-1978)



Ecosystem, A Report On Water Quality Research And Monitoring
In The Hackensack Meadowlands 1971-1975." January, 1976.

- o D. Smith, M. Saks, C. Mattson, "Wetland Biozones of the Hackensack Meadowlands: An Inventory," 1975.
- o R. Kane, "The 1975 Fall Shorebird Migration in the Hackensack Meadowlands," 1976.
- o Annual Counts of Bird Species in the Hackensack Meadowlands.
- o C. Mattson, R. Trattner, J. Teal, I. Valiela, "Nitrogen Import and Uptake Measured on Marshes of the Hackensack River in New Jersey, " 1975.
- o Seining Inventories In The Hackensack Estuary.
- o HMDC, Mall Decision, September 15, 1976.
- o Biological Inventories of the Proposed Losen Slote Creek State Park Site, 1973.
- o Position of HMDC on Dredging the Hackensack River (March 13, 1974).
- o Position of HMDC on the Proposed Lake Hackensack Project
January 10, 1978
- o HMDC, MSLA Decision, October 4, 1974.
- o C. Mattson, N. Vallario, D. Smith, S. Anisfield, G. Potera,
"Hackensack Estuary Oil Spill: Cutting Oil-Soaked Marsh
Grass As An Innovative Damage Control Technique." 1977.
- o G. Potera, "Results of the Preliminary Investigation of the
Bergen County Sewerage Authority Pond," 1970.
- o Proceedings of University Seminar on Pollution and Water Resources.
- o HMDC, "The Kearny Meadows: A Land Use Study," 1976.
- o HMDC, Solid Waste Management Plan. 1975.
- o HMDC, "Intermunicipal Tax Sharing Theory and Operation." 1972.

- o Various Investigations for Heavy Metals in Sediments of the Hackensack Meadowlands.
- o I. Black, "Past and Present Status of Birds of the Lower Hackensack River Marshes," 1969.
- o J. McCormick Associates, Environmental Impact Assessment on the Construction and Operation of a Residential and Commercial Developments on SPA 1, Town of Secaucus, Hudson County, New Jersey. 1974
- o W. Sipple, "The Past and Present Flora and Vegetation of the Hackensack Meadows." 1971.
- o Hearing Officers Report and Recommendations: In the Matter of the Hearings Held on the Proposed Sports Complex in the Hackensack Meadowlands, July 10 - August 11, 1972.
- o G. Potera, "A Preliminary Ecologic Study and Evaluation of a Section of the Hackensack Meadowlands," 1970.
- o HMDC, Open Space Plan, 1972.
- o C. Mattson, "Water Quality in a Disorder Ecosystem," 1972.
- o R. LoPinto, "A Biological Assay Procedure for Determining the Effects of Industrial Effluents on Some Key Aspects of the Hackensack Meadowlands Estuary." 1973
- o C. Mattson, "The Hackensack Meadowlands, An Ecological Perspective." 1970.
- o R. LoPinto, "Wastewater Treatment--A Determination of Limiting Factors Through Biological Assay." 1974.
- o HMDC, "Water Needs In The Hackensack Meadowlands: A Case Study."

- o HMDC, EIA for Baler Project, 1976.
- o C. Mattson, "An Ecological and Resource Management Plan for the Hackensack Meadowlands." 1978.

These documents are available on request at the Commission's Offices.

Included in the various documents listed above are the environmental monitoring programs which provide the Commission its data base for understanding the impacts of development and preservation to date, and the capacity to make projections, as we do here, about the range and relative magnitude of impacts which can be anticipated from the various transportation alternatives studied in this report.

Regional Carrying Capacity

This brings us to the next major question of land use/environmental impact raised and discussed in this Chapter--the matter of comprehending the environmental context of land use/transportation decisions and land/use transportation projections in this District. This environmental context is the concept of carrying capacity.

Carrying capacity refers to the ability of a given system to absorb stress without undue harm. It allows, as well, the analytical framework for planning choices to properly manage each such system. For example, the concept of carrying capacity establishes a framework for making sewage treatment plant location and treatment level decisions, based on the River's nutrient and oxygen carrying capacities; or for making wetland management decisions as to where to induce greater productivity via such techniques as tidal impoundments. The Commission's Ecological and Resource Management Plan for the Hackensack Meadowlands discusses such matters in detail for

each of the Estuary's wetland basins.

Since the system for which we seek herein an environmental framework--the land use/transportation system--is one affected by a number of interrelated components, we must consider the properties of each component in making the necessary choices. The balance of the land use mix achieved and projected in the Hackensack Meadowlands Master Plan suggests certain stresses to be expected on the transportation system. Five alternative networks have been proposed as means to alleviate those stresses. At issue, next, is the delineation of components affecting the choice of system and their definition within the five networks. These were evaluated in Chapter 9 and included the following factors which influence transportation network choice: air quality--the emissions and air quality consequences of various transportation strategies; cost--the fiscal implementability of the chosen network; convenience--the attractiveness of the system to ridership and thus its ability to deal with system stress; administrative implementability--its attractiveness to appropriate agencies and its compatibility with regional goals; and, finally, the impact of the specific network on the land use configuration--will it encourage or deter development and preservation as envisioned?

To illustrate the Hackensack Meadowlands Development Commission's experience in calculating carrying capacity, the most extensive analysis of the District's carrying capacity, to date, was conducted in response to an application to build two clusters of housing in Island Residential Specially Planned Area I along the Hackensack River--one cluster adjacent to the ConRail (former Erie-Lackawanna) Bergen County Line; the second

cluster one mile to the north. In weighing that proposal we looked not only to the capacity of roads, rails and bus routes to handle traffic generation; but, as well, to the carrying capacity of the Hackensack Meadowlands District regarding open space, water and air quality, water supply, solid waste, fiscal impact, schools, municipal services, noise, drainage, and flooding, and energy supply. These analyses can be found at pp. 37-252 of the Commission's decision of January 25, 1978 and March 15, 1978.

That decision determined, for example, that the open space for the project, keyed to a total general plan, indicated sufficient carrying capacity in the open space network to meet recreation demands generated by the entire development; to provide open space available to the public; and to preserve important and viable links in the larger estuarine ecosystems. Similarly, the projection of school costs, into the Hackensack Meadowlands District Intermunicipal Tax Sharing Account, found that pool to be capable of absorbing the costs.

In the area of air quality, however, the Decision held that while State and Federal air quality standards could be maintained in the project area until 1982--the date for completion of the first cluster--the impact on carrying capacity could not now be projected beyond that date. The same was judged to be true of sewage treatment capacity, assisted housing demand, and transportation capacity. Thus approval was granted for the reason that impacts on carrying capacity could not adequately be determined at this time.

But what would be the secondary impacts which would associate with the various transportation alternatives posed in this study--that is,

what would be the relative magnitude, at District-wide scale, of impacts on air quality, open space, on wetland productivity, on water quality?

To the extent that the land use mix prescribed in the Master Plan is adequately served by these networks, the environmental losses and benefits associated with that mix are attained.

To cite several examples:

1. The Specially Planned Areas

Created in response to our mandates to provide homes and to protect the delicate balance of nature in the Hackensack Meadowlands District, the residential SPA's, for example, are designated as a zoning framework for the extension of the District's open space network. The densities they allow at once provide needed homes and compensate a developer for the 50% of his property zoned into wetland open space. A transportation network which efficiently serves these SPA's, without disrupting their environmental preservation and protection components, both enhances the developmental attractiveness of those zones and achieves open space preservation as well. Given the small amount of state-owned tidelands in the Hackensack Meadowlands District, these Specially Planned Area required open spaces are critical to the estuary's survival. Additionally, that same transportation network is self-fulfilling. By aiding in providing Meadowlands homes for Meadowlands workers it decreases commuter demands on the regional transportation network. Furthermore, all the SPA's carries with it the further and required capability to monitor the anticipated effects over time. A continuous record of carrying capacity is thereby attained. The Commission's 287 page Hartz Decision on January 25, 1978 and March 15, 1978, contains a detailed accounting of how these procedures work.

2. The Zones.

Keyed for the most part to the Plan's employment mandate, the traditional zones, through the financial mechanism of the Intermunicipal Tax Sharing Account, aid in the economic support of the Master Plan. Contributing extensively to the ratable base of that Intermunicipal Tax Sharing Account, the development of these zones helps to make possible the taxes anticipated from the Master Plan and equitable the differential impacts on municipal services and the differential returns on tax ratables generated within the 14 towns of the District. Once again, a transportation network that efficiently delivers employees and transports goods and services through the District enhances the likelihood that those zones will develop in the best possible manner. This, in turn, provides the economic support for the open space and preservation components.

3. Open Space.

The major parks, as described in the Parks section of this Chapter, become accessible to the local and regional populations for which they are targeted. In this area, then the provision of a viable transportation network serves directly the environmental concerns expressed in the enabling statute. For example, we seek to address, through the Losen Slote Creek State Park and the 2000 Acre Richard W. DeKorte Park, some of the recreational needs of this urban region. Without the connecting networks between the centers and these open spaces, this potential is severely reduced.

PRIMARY IMPACTS

Regarding primary impacts from the construction of facilities contemplated in the various transportation alternatives evaluated in this Study,

(auto, bus, busway, rail, personal rapid transit) the Wetlands Order, the Environmental Performance Standards, the Open Space Map, the Marshland Preservation Zones, and the conceptually portrayed required open space of the Specially Planned Areas all constitute ecological restraints on transportation planning. How does this transportation plan succeed in running this gamut?

First, it is important to emphasize the conceptual nature of these alternative networks proposed here. Prior to the implementation of any transportation network, detailed plans would have to be drawn and studied, with specific locational environmental impacts addressed at that time. As noted above, the Master Plan's environmental protective devices are stringent and comprehensive.

It is our preliminary judgment that primary impacts from the five alternatives pose no significant impact on water quality and on wetland productivity.

Why is this so?

First, is the matter of corridors. We are all familiar with the types of environmental impacts which associate with new, extended or widened sewer lines, power lines, rail lines, or highway routes. Streams, rivers, woodlands, prime agricultural lands, or wetlands may have to be crossed or circumnavigated. Specific habitats can be lost; so careful steps have to be taken which predict possible losses ahead of time, and which generate land use decisions that avoid or minimize these losses and/or replacement them elsewhere in the ecosystem.

One of the major thrusts of this Chapter has been to demonstrate that a system of regulations for identifying and protecting such natural

resources against such negative impacts has existed in the Hackensack Meadowlands Zoning Regulations since 1972. How the corridors for new or expanded transportation facilities are chosen predicts the locations, levels and intensities of environmental impacts to follow. All five networks utilize, to the maximum extent possible, existing rights-of-way. In the various bus and rail networks, proposed as alternatives in this transportation study, existing rights-of-way are maximally employed. Where new transportation lines are required, concern is taken to skirt, rather than slice, parkland and preservation areas. Figure X-1 provides one illustration; the HMDC Master Plan's stipulated right-of-way for Route 17 South has been deployed to deliver people to the DeKorte State Park in such a way that the road's impacts on the upland parkland are minimized and that impacts on the wetland wildlife refuge portion of the park (1,186) are totally avoided.

Points of unavoidable impact that appear in the highway, and in the busway/van pool networks, occur at creek and river crossings. These can be seen in Figures VIII-6 and VIII-7. Examples of these crossings can be further extrapolated from Figure IX-6 which, in the busway/van pool alternative, contemplates how Hackensack River crossings and additional crossings, as increments of this alternative occurred, of Bellman's Creek, Moonachie Creek, and Berrys Creek Canal. These crossings could, of course, if conducted carelessly, be accomplished with extensive damage to wetland buffer strips and creek bottoms. But there is a stringent permit system, which as noted elsewhere in this Chapter, requires that each in its turn be properly studied as to its timed needs, its possible alternatives, its impacts, its protective minimizing strategies, and its

monitoring. And as also noted above, there is a track record of such crossings in the Commission's monitored experience with new pipeline and bridge crossings completed over the period 1970-1978.

Another point of interest regarding primary impacts is the cluster principle employed in designing the networks. That is, network design has located transfer stations only in areas of dense development, thus at once providing transit supply at ridership demand points and avoiding construction in the remaining open, environmentally sensitive areas. This clustering principle, discussed extensively in its dollar cost and open space benefits in The Cost Of Sprawl, has wider implications for land form and developmental patterns than for the transportation networks alone. Utilities, sewers and water mains can also be shorter, less expensive, and less disruptive when development is clustered as in the Master Plan's Specially Planned Areas. SPA's call specifically for the design of internal roadway and transit systems which are environmentally compatible with the open spaces within them.

The Region

There are four key documents which map and describe in detail the wetland inventories, the open space preservation techniques, and the environmental control techniques by which wetlands are preserved and protected in the Hackensack Meadowlands District. These, also listed on pages X-8 and X-9, are: "Biozones of the Hackensack Meadowlands"; "Water Quality in a Recovering Ecosystem;" the Hackensack Meadowlands Wetlands Order; the Hackensack Meadowlands Development Commission's Open Space Map.

The intermodal transportation centers, as proposed in this study at Woodridge, Berrys Creek Center (Meadowlands West); Meadowlands East, Kearny, and in Secaucus, are designed, as they were within the Master Plan's originally designated Transportation Center Specially Planned Area's, to pick off travellers and commuters entering the Hackensack Meadowlands; to redirect those with a Hackensack Meadowlands destination into local access routes (road, bus, busway, PRT) within the Hackensack Meadowlands District; or, in the case of through commuters, to provide them with opportunities to switch to alternate modes (rail, bus) of travel to their ultimate destinations. The internal systems are designed, as well, to permit the Hackensack Meadowlands District resident workforce to move between the residential zones and their jobs inside, or outside, the Hackensack Meadowlands District. The numbers are instructive.

For example, the Master Plan at full development projects 99,717 peak hour work trips added to the "background" flow of traffic--that is, to those who pass through the District from and to somewhere beyond. This transportation study projects, from existing trip data, the journeys-to-work that will be taken by those who come here from beyond the District to work at new jobs, and the split between those who live and work here and those who live here but work outside the Hackensack Meadowlands District. Some of these trips will be by transit; others by auto, some are in the rush hour flow directions; some are not.

All of these journey-to-work patterns have significant consequences for environmental quality in the Hackensack Meadowlands District and in the region for people who use the Hackensack Meadowlands District or pass

through it.

How? Figure X-2 makes several important points. The large circle represents the Hackensack Meadowlands District. And as shown, at full completion of the Master Plan there will be 71,909 journey-to-work trips from outside the Hackensack Meadowlands to jobs in the Hackensack Meadowlands at A.M. peak hour. That is to say, of the total projected jobs to be generated by the entire Master Plan--200,000--71,909 represents those trips which would result during that peak hour.

The calculations regarding the Hackensack Meadowlands District residential workforce are based on a statistical analysis that shows 1.3 workers per household, 47,500 dwelling units within the Master Plan's residential components, and 45% of that resident work force working within the Hackensack Meadowlands District. $(1.3 \times 47,500 \times 45\%)$ equals 27,808 residents working in the Hackensack Meadowlands, of which 12,513 will travel to jobs in the Hackensack Meadowlands District during A.M. peak hour, and 15,295 will travel to jobs outside the Hackensack Meadowlands District in peak hour periods. This last figure divides into 4,172 trips to Manhattan; and 11,123 trips elsewhere.

When this chart is read in context with the Transportation Survey data summarized in this study, several patterns emerge immediately:

A. Residential Land Use

For one, the residential component of the Master Plan is an important traffic reducer, if we assume that people will come from somewhere to take the jobs provided in the employment zones (warehouses, offices, research park, etc.). Those who travel within the Hackensack Meadowlands between homes and jobs without entering the primary rush hour flows

SURROUNDING COMMUNITIES

71,909 Journey-to-Work Trips from outside
HACKENSACK MEADOWLANDS DISTRICT (HMD)
to jobs inside HMD in the Peak Hour.

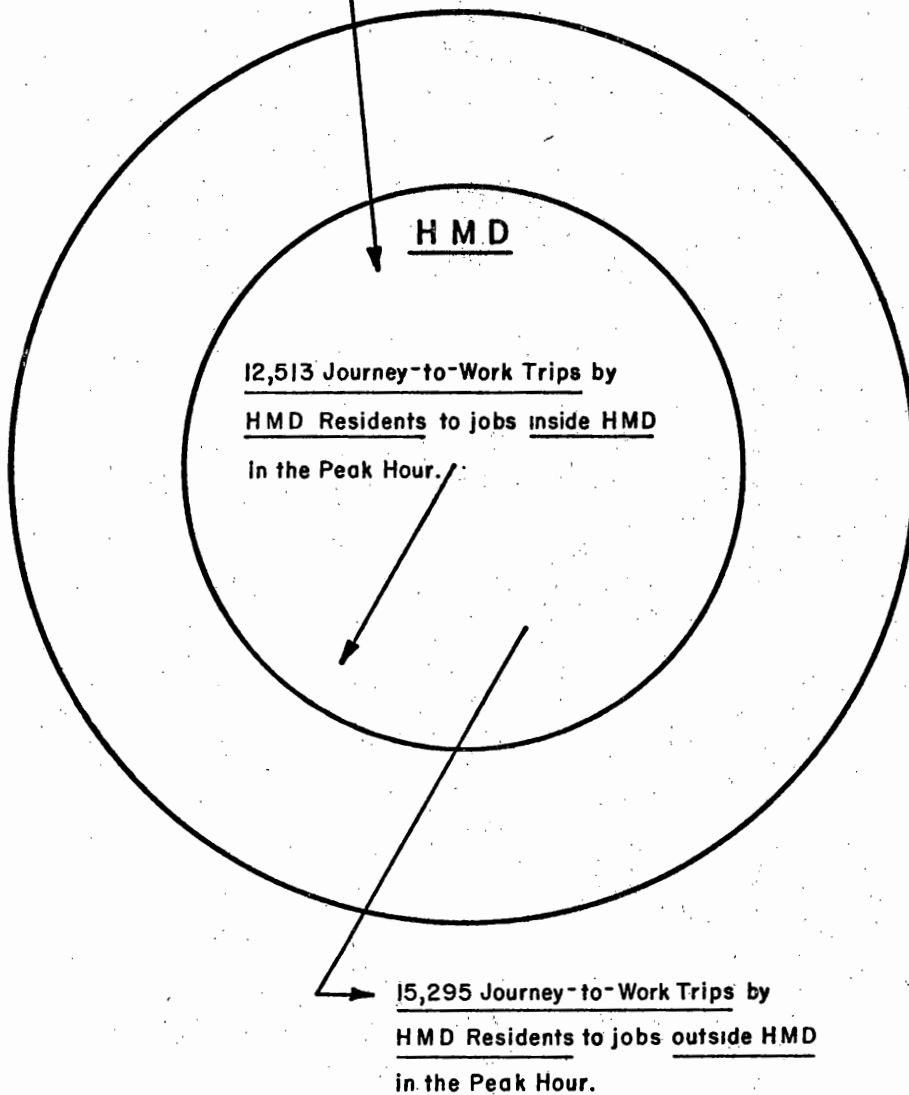


Figure X-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
IMPACT OF PLACE OF RESIDENCE
ON JOURNEY-TO-WORK TRIPS

(east in the A.M.; west in the P.M.) do not pose added burdens to the through-traffic patterns.

Secondly, those who live here whose journeys-to-work take them against the rush hour flows to jobs outside the Hackensack Meadowlands District do not contribute, either, to rush hour congestion.

Thirdly, those who live here and use mass transit to attain destinations on the routes of primary flow, such as to Manhattan, will not crowd the highways in heaviest use at peak hours. All the transit alternatives pursue this goal.

Of great significance, in addition, is the fact that residential zones generate substantially less traffic per 1000' square foot of development at peak hours than do office and warehouse uses. To cite one example, offices generate 1.8 trips per 1,000 square feet at peak hours; while SPA housing densities generate 0.585 trips per 1,000 square feet of dwelling unit. That is to say, offices generate at least 3 times the peak hour traffic than the same square footage of housing. And the denser the offices, (the higher they are on the same acreage), the greater the differential stress.

As well, the direction of traffic flow from (and to) residences is primarily against the regional peak hour pattern, while office and warehouse peak hour traffic is into the District in the A.M., out of it in the P.M.. One need only to compare the difference in morning traffic levels northbound (from residential) on the Meadowlands Parkway with those southbound (to employment) to see this principle at work. In fact, direction of traffic flow has significant a bearing on traffic congestion as does the number of trips.

Thus this transportation study seeks to generate pathways which most efficiently serve both the region's existing commuter patterns and the District's future land use patterns--recreational, residential, employment.

Finally, regarding the Plan's residential component, the residential SPA's generate wetland open space--a land use which is universally favored by those who abhor congestion. It pleases us, of course, that wetland open space serves a much wider set of ecological goals than merely failing to generate traffic.

B. Recreation Areas

For a second example, and discussed in greater detail in X-C below, the peak hour traffic patterns are not expected to clash with regional travel patterns to the major recreation areas designated in the land use plan.

C. Employment Zones

For a third example, the job producing zones--research park, offices, warehouses and light industry--generate both the greatest percentage of the District's total commuter trips and the highest peak hour loadings as well. For example, as noted previously, warehouses generate 0.5 trips/1000 square feet at peak hours; and offices generate 1.8 peak hour trips per 1,000 square feet. Thus one standard warehouse (of 220,000 square feet; 50% lot coverage) occupying a 10 acre site generates on the order of 109 trips at peak hours; and a 5 story office building (of 540,000 square feet; 25% lot coverage) on 10 acres of research park site generates 980 trips at peak hours. As towns all over the country have learned, it does not take offices long to absorb available roadway carrying capacities.

The impacts on air quality are measurable. The discomforts, unless avoided beforehand through planning are merely endured.

These facts are further reasons why each Specially Planned Area is designed in its land use mix to generate a variety of traffic flow patterns--to reduce uniformity in direction of flow; and to reduce trips at peak hours as well.

To illustrate the positive impact of the residential zones on regional and on inside-the-District traffic flow at peak hours, let us postulate a 50% reduction in the Master Plan's housing acreage component with a corresponding increase in its warehouse acreage component. In this scenario, total peak hour traffic increases from 99,717 trips to 105,575 trips, but the patterns of those trips change much more dramatically. Because the total number of jobs has increased and the Hackensack Meadowlands resident working population has decreased, journey-to-work trips from outside the Hackensack Meadowlands District to jobs inside the Hackensack Meadowlands increases in this scenario, at peak hours, from 71,900 to 91,800. Correspondingly, the 4,172 peak hour trips by Hackensack Meadowlands residents to Manhattan (the critical flow direction) decreases to 2,070.

Other major environmental impacts include, of course, the lost wetland open space required in the reduced residential zones, and the lost economies of clustering roads and utilities that come with residential zones and that do not inhere to warehouse zones.

The net traffic change, then (91,800 - 71,900) represents, at one scale, an addition, from this land use change, of 19,900 trips at peak hours into the Hackensack Meadowlands along critical directions of flow. At a second scale, the corridor between the District's eastern boundary

and the Lincoln Tunnel experiences a reduction from 4,172 to 2,070 trips at peak hour.

Translated into highway lanes, using a general factor of 1,800 autos per hour per lane, this A.M. peak hour traffic increase could represent a pavement increase of 11 new lanes, with their associated increases in tail pipe emissions, over the number of lanes calculated for the highway alternative.

While the illustration is oversimplified, being incapable of showing, for example, where the 11 lane increase would occur, this scenario makes the unmistakeable point that land use locations and types impose key impacts on environmental quality.

The section which follows, which analyzes the impacts on air quality which associate with the five transportation alternatives incorporated into this Study, quantifies, through monitoring and modeling, the specific transportation-related impacts on air quality of these various alternatives.

Air Quality Assessment

Companion to and in conjunction with the transportation elements of this study, a detailed analysis of the current and future impacts of vehicle trips and their alternatives upon existing air quality in the Hackensack Meadowlands District has also been completed. This analysis describes existing air quality on the basis of actual measurements, the impact of existing transportation elements upon both local and regional air quality, the impact of future traffic flows on local and regional air quality in the absences of any alternative transportation plan (All Highway Network) and the impact of four alternative transportations networks developed in the study herein. Projections of air quality levels in parts per million (PPM) using various types of mathematical models and emission loadings (in tons/yr.) have been made for each of the cases described above and were compared with Federal and State Air Quality Standards and Policies. The results of these comparison, when considered with the other elements of this study, allow the alternative transportation strategies to be ranked.

It should also be noted that none of the analyses focus directly on the current or future levels of photochemical oxidants due to transportation planning in the Hackensack Meadowlands. Photochemical oxidants, a pollutant generated in the atmosphere by a chemical reaction of hydrocarbons, nitrogen oxides and sunlight, are strongly related to state wide and interstate transportation strategies which are beyond the scope of this study. In addition, no accepted standards exist at this time. Future study work by the HMDC or the New Jersey Department of Environmental Protection (NJDEP) will be needed to identify the interfaces between area wide photochemical oxidant

problems and transportation planning elements in the Hackensack Meadowlands. Such an oxidant study in accordance with Section 174 of the Clean Air Act Amendments of 1977 would form a logical progression of the work completed in this study. Finally, it should be noted that while photochemical oxidants cannot be directly assessed by this study, reductions in hydrocarbon emissions, either through improved vehicle emission controls, improvement of vehicle emission controls, reduction of vehicle miles travelled (VMT) or replacement of motor vehicle travel by transit alternatives, are a goal of this study.

Environmental Setting

A particularly important factor in any air quality analysis of the Hackensack Meadowlands is the existing environmental setting. As described in Chapter III, the Hackensack Meadowlands were created by action of the Wisconsin Glacier, which caused a lake to be formed between two escarpments along the easterly and westerly boundaries of the Hackensack Meadowlands District. As the glacier receded, this lake dried up into a river, running north/south through a vast flat tidal marshland. The result of this natural phenomena was a high rock ledge, ranging from 80 to 200 feet above mean sea level (AMSL) bordering a tide marsh having an elevation of -1 to 3 feet AMSL. The existing physical situation of the Hackensack Meadowlands is, thus, very similar to a valley between two mountains and has many of the characteristics of this physical situation. Wind speeds in the Meadowlands have been known to increase significantly (+10 MPH or more) over other areas to the north or south. The natural wind direction tends to be channelized by the two escarpments to a south westerly flow in the Hacknesack Meadowlands (see Section on air monitoring data). A result of a 1973 federally funded air quality study (Final Task Report-AQUIP Model) on the Hackensack Meadowlands showed that 97-99% of the background air quality levels in the Hackensack Meadowlands

was due to sources outside of the Meadowlands. For these reasons, special care must be taken in preparing air quality analyses for the study.

Previous Land Use/Air Quality Planning in the Hackensack Meadowlands

As mentioned briefly above, the Hackensack Meadowlands was the site of a pioneering study on air quality started in 1971. In this study, jointly funded by the United States Environmental Protection Agency (USEPA) and HMDC, a unique computer modeling system was developed to relate land use planning to air quality. This modeling system, known as AQUIP (Air Quality in Urban and Industrial Planning), consists of five separate computer models which take background emissions plus emissions from various land use plans being assessed and converts them into air quality concentrations displayed on a grid system. By comparing the land use plotted on the same grid system as the air quality concentrations, a detailed air quality analysis of the particular land use plan can be prepared.

Using background emissions from the NY-NJ-Conn. Air Quality Control Region, an intensive air quality analysis of five alternative master land use plans for the Hackensack Meadowlands in the year 1990 was prepared. Three of these plans were taken from a 1964 New Jersey Division of State and Regional Planning Study,¹ one was a completely industrial plan and one of these plans was the number and type of transportation elements being used (motor vehicle, rail, water transit and airplane). Transportation related emissions and air quality levels were calculated by the AQUIP system for each land use plan.

Based upon the AQUIP air quality analysis, the proposed HMDC Master

¹(See Chapter III, pp. III-13 & 14, Plan Nos. 2, 4 and 5)

Plan was found to have the least negative impact on air quality. This proposed land use plan in a modified form (more open space, less residential) was subsequently adopted by the HMDC on November 8, 1972 as the zoning plan for the Hackensack Meadowlands. During the background computer runs for this plan, it was found that air quality in the Hackensack Meadowlands was somewhat insensitive to land use plans for the Meadowlands, so much so that the HMDC zoning plan would add only 1 to 3% to existing background air quality levels above the Hackensack Meadowlands District in the year 1990, estimated full development of the zoning plan. The result of this air quality/land use planning technique was that the HMDC zoning plan is one of very few land use plans developed that have a minimum negative affect on air quality.

Since the HMDC adopted a number of changes to its zoning plan in 1977, additional computer runs of AQUIP were completed for this study. However, it is expected that these changes, which generally decrease industrial and residential use in the HMDC land use plan while increasing open space, will only have a positive impact on Hackensack Meadowlands air quality, based upon the past results produced by the 1973 AQUIP analysis.

Air Quality Monitoring Data

In accordance with Task 3 of the study, detailed traffic counts were made at 42 locations; both inside the Meadowlands District and at selected locations on feeder routes through or near the District. Each of these locations were selected to provide data for both traffic and air quality related uses. Additionally, five of the traffic monitoring sites were selected as sites for air quality monitoring (see Figure X-3 for location). Air quality data was then compiled by continuous (24 hour a day) air sampling

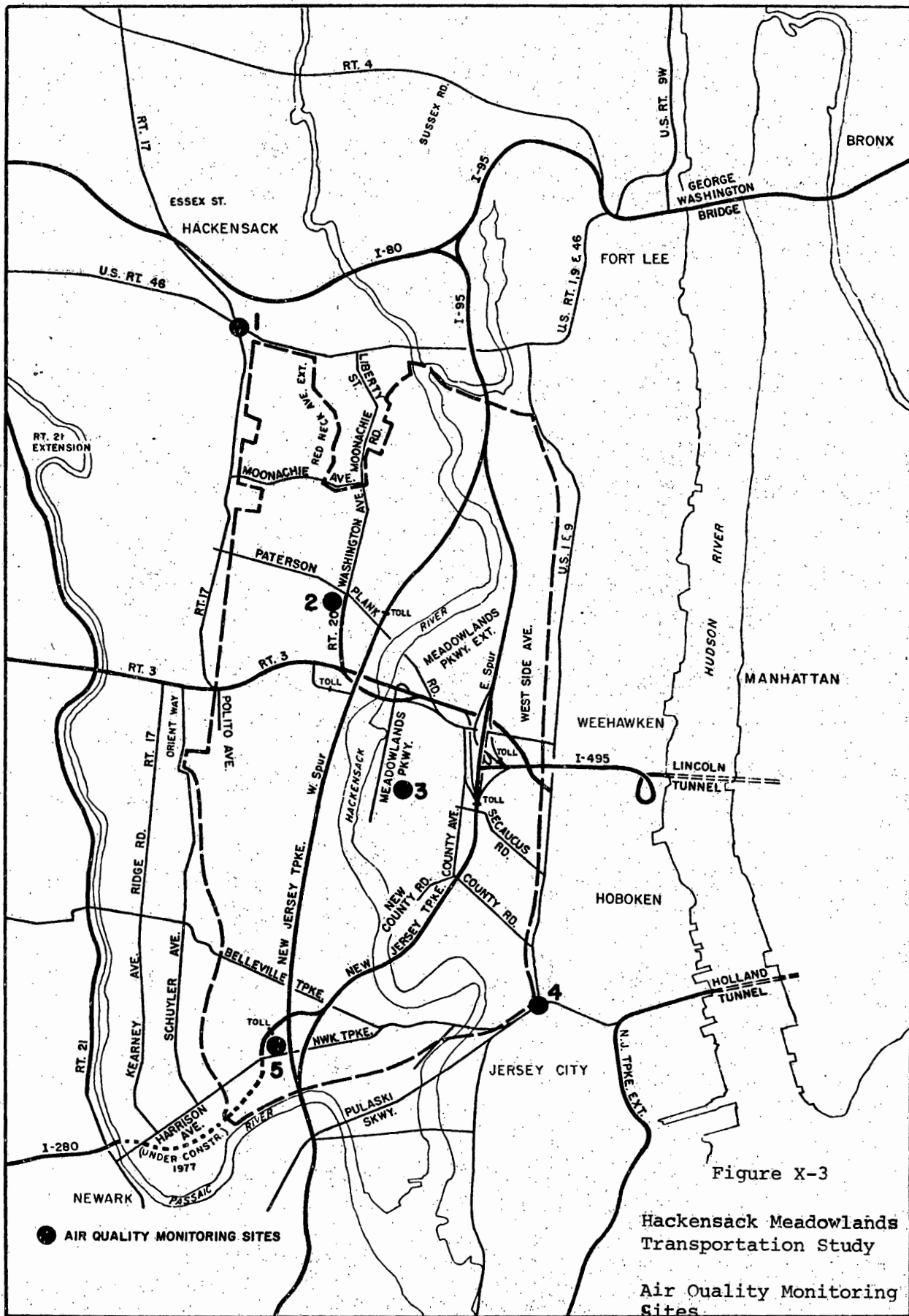


Figure X-3

Hackensack Meadowlands
Transportation Study

Air Quality Monitoring
Sites

equipment temporarily installed at each of the sites for periods of four to six weeks.

Analysis of the data from these sites allows a characterization to be made about existing background air quality levels in the Meadowlands District. This is particularly important since there are no NJDEP permanent air monitoring stations in the Hackensack Meadowlands District, and only one permanent monitoring station operated by the N.J. Sports Authority in the District (where two years of data has been accumulated). Thus, actual air monitoring data in the Meadowlands District taken in the study work was the first comprehensive characterization of background Meadowlands air quality levels.

Additionally, the choice of monitoring sites was made to allow an analysis of known trouble spots by local scale air quality modeling. Sites such as N.J. Route 17 adjacent to Teterboro Airport are already heavily travelled by motor vehicles. Tie-ups at this point are common. Monitoring at these type of sites can help determine the direct contribution of peakhour traffic to background air quality, an important consideration in light of the expected traffic increases on Meadowlands roads due to implementation of the HMDG Master Plan.

A list of the five monitoring sites used to collect air quality data are as follows:

- (1) (TRAFFIC SITE #19) - Parking lot of shopping center, 300 feet west of the southbound lanes of N.J. Route 17.
- (2) (TRAFFIC SITE #41) - Parking lot of N.J. Sports Authority Site, adjacent to the east gate for the racetrack grandstand, approximately 500 feet from N.J. Route 20.

- (3) (TRAFFIC SITE #39) - Parking lot of former Hartz Mountain Industries office building (now HMDC offices), adjacent to northbound lanes of Meadowland Parkway, approximately 200 feet east of the roadway.
- (4) (TRAFFIC SITE #13) - Near eastbound ramp from southbound lanes of Pulaski Skyway approach.
- (5) (TRAFFIC SITE #8A) - Near interchange 15W of the New Jersey Turnpike, just off Harrison Avenue, in an infield area just south of the toll booth.

Air monitoring data was compiled at each of these sites using a mobile air monitoring laboratory provided to the HMDC by the Bureau of Air Pollution Control, NJDEP. Calibration, start-up and routine surveillance was provided by Daniel Roberts of the Bureau of Air Pollution Control. This laboratory contained eight major pollution monitoring devices packaged into a 32-foot specially modified mobile home. Using the onboard equipment, continuous air samples for carbon monoxide, total hydrocarbons, methane hydrocarbons, sulfur dioxide, particulates, nitrogen oxides, smoke-shade and wind speed/direction were taken. Readings of the various pollutants and wind data were logged automatically on strip charts. At the end of the sampling at a particular site, the charts were collected and sent to the Trenton office of the Bureau of Air Pollution Control for data reduction and further processing. The air sampling data was compiled into one hour averages by summing the readings of the 30 samples taken during a particular hour and then computing the average. Summary sheets of the one hour averages were prepared by NJDEP for each pollutant and wind speed/direction determined at each of the five monitoring sites. Contained on each of these

sheets were the averages for each hour of each day that air sampling occurred at the particular monitoring site. Blank spots on the sheets represent missed data. A typical summary sheet for Site #2 is shown as Figure X-4.

Using the summary sheets prepared by NJDEP, the air sampling data was further reduced for various averaging periods to facilitate comparisons with USEPA and NJDEP air quality standards. In these comparison, the second highest value, maximum value and median value were tabulated for pollutants related to transportation elements. Tables X-1 through X-5 show this data. Wind speed/directions for Site #3 were computed as a wind rose and then compared to a twenty-year annual average wind rose for Newark Airport, the nearest major weather station of the U.S. Weather Service. (See Table X-6).

A comparison of the monitored data with USEPA and NJDEP standards shows that carbon monoxide levels, an indicator of traffic congestion, are much less than USEPA Air Quality Standards for both 1 hour and 8 hour exposures at all of the monitoring sites. Even at spots, such as Tonelle Circle where traffic is frequently at a standstill with cars and trucks emitting maximum amounts of carbon monoxide, there are no violations of the standards. Hydrocarbon levels, however, a major component of photochemical oxidants, are above USEPA standards at all of the monitoring sites. However, past mathematical and field studies of the Hackensack Meadows had estimated hydrocarbon violations of 12 times the USEPA standards while the monitored data shows violations of 7 to 8 times the standards, a significantly lower value. An additional measurement, smoke shade, measured as the coefficient of haze, is also less than half of the NJDEP standard of 3.0, indirectly

Hackensack Meadowlands Transportation Study

Location: Van at NJ Sports Complex, East Rutherford, N.J. Pollutant: Total Hydrocarbons in Parts Per Million (PPM) Time Period: October 1976

	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400		
																3.2	3.0	3.2	3.0	3.0	3.2	10.4	9.0	
	10.0	7.4	8.0	8.0																				
														2.6	3.0	3.2	4.0	4.0	4.6	4.0	5.6	4.2	2.4	
	3.8	3.6	3.2	1.9	2.2	2.8	2.0	1.7	2.6	1.9	2.4	2.5	2.5	2.4	2.4	2.4	2.4							
																2.2	2.2	2.2	2.3	3.2	3.0	3.6	16.0	18.
	720	720	5.0	13.0	7.6	7.6	6.0	5.6	4.4	3.2	2.8	3.0	3.2	3.2	3.4	4.0								
																3.0	3.0	3.2	3.4	3.2	3.6	3.6	3.4	5.6
	5.2	2.6	1.8	1.6	1.6	2.0	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.8	1.8	1.8	1.9	2.2	1.8	1.8	1.8	
	1.8	1.8	1.8	1.9	2.0	1.9	1.8	1.8	1.8	1.9	1.9	1.8	1.6	1.6	1.6	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
	1.8	1.8	1.7	1.7	1.6	1.7	1.8	1.8	1.6	1.6					1.8	1.8	1.8	1.8	2.1	1.9	1.9	2.0	2.4	
	3.0	3.4	3.3	3.0	3.2	4.8	4.5	3.2	2.4	2.1	2.2	2.0	2.0	2.0	2.1	2.5	2.6	2.6	2.6	2.6	2.6	2.6	3.0	
	4.2	3.4	3.2	3.0	3.6	3.2	3.9	3.5	3.1	2.9	5.6	6.9	7.6	3.2	2.6	2.4	2.1	2.0	2.2	2.0	2.0			
	2.8	2.0	1.8	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9	2.0	2.4	2.5	2.2	2.2	2.4		
	4.6	4.4	3.0	2.3	2.1	2.4	1.8	1.8	1.8	1.8	1.7				1.9	1.9	2.0	2.3	2.3	2.1	2.2	2.8		
	2.0	2.0	1.9	2.0	2.0	2.2	2.1	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.1	2.8	3.1	3.4	12.0	20.		
	20.0	13.2	15.6	14.8	7.2	4.3	4.1	4.1	6.8	7.2	3.2	3.0	2.3	2.3	3.4	3.8	4.4	3.0	6.0	6.8	5.2	4.8		
	6.4	9.6	5.6	4.0	6.2	5.0	6.8	3.8	3.0				2.8	3.4	3.0	3.2	4.0	5.2	4.0	4.8	5.2	4.6		
	3.0	2.4	2.0	2.0	2.0	1.8	2.2	2.2	2.2	2.2	2.0		2.0	2.0	2.0	1.8	1.8	1.8	2.0	1.8	1.8	2.2		
	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.0		
	2.6	2.8	3.0	2.6	2.2	2.6	3.4	2.4	2.2	2.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.2	2.6	2.6		
	5.0	12.0	6.0	4.0	5.0	3.2	4.4	4.0	4.4	2.8	2.8	2.4	2.0	2.0	2.0	2.0	3.4	11.0	7.2	4.8	4.8	9.6		
	8.8	7.0	5.0	13.0	12.6	18.0	10.4	4.8	2.8	2.8	3.6	3.2	2.8	2.6	3.2	3.2	3.6	3.8	6.0	5.0	7.6	5.6		
	2.2	3.2	2.4	2.2	2.2	2.8	6.0	10.0	2.0	3.2	2.2	2.0	2.2	2.8	2.2	2.0	2.0	1.8	1.8	1.8	1.6	1.6		

Table X-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Site #1 Air Monitoring Data (PPM)

<u>Pollutant</u>	<u>Maximum</u>	<u>Median</u>	<u>2nd Highest</u>	<u>Air 5 Quality Standard</u>
Smoke Shade				
24 hr.	1.82	.7	1.60	3 ¹
NO ₂				
1 hr.	.085	.03	.08	2
NMHC (non meth. (HC) 6 - 9 A.M. 1hr.	1.9 3.1	.9 1.3	1.7 2.8	.24 ³
CO				
8 hr.	4.5	1.2	3.5	9 ⁴
1 hr.	9.0	2.1	8.3	35 ⁴

Notes: (Apply to all tables X-1 through X-5)

1. PPM = Parts Per Million
2. Smoke shades is an NJDEP standard.
3. Dashes in standard's column indicate that no standards exist for the particular averaging period.
4. National primary and secondary ambient air quality standards for hydrocarbons (See 40CFR 50.10).
5. National primary and secondary ambient air quality standards for carbon monoxide (See 40CFR 50.8).
6. To be compared with 2nd highest value.

Table X-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Site #2 Air Monitoring Data (PPM)

<u>Pollutant</u>	<u>Maximum</u>	<u>Median</u>	<u>2nd Highest</u>	<u>Air Quality Standard</u>
Smoke Shade 24 hr.	1.5	.6	.95	3.0
NO ₂ 1 hr.	.095	.035	.090	—
NMHC 6 - 9 A.M.	1.8	.8	1.7	.24
1 hr.	3.3	1.0	2.8	—
CO 8 hr.	4.5	1.8	3.4	9
1 hr.	7.0	1.5	6.5	35

Note: See Table X-1 for general notes.

Table X-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Site #3 Air Monitoring Data (PPM)

<u>Pollutant</u>	<u>Maximum</u>	<u>Median</u>	<u>2nd Highest</u>	<u>Air Quality Standard</u>
Smoke Shade 24 hr.	1.5	.6	1.28	3
NO ₂ 1 hr.	.07	.018	.068	—
NMHC 6 - 9 A.M.	1.08	.54	.67	.24
1 hr.	2.0	.41	1.8	—
CO 8 hr.	6.44	1.97	4.25	9
1 hr.	8.00	2.02	7.0	35

Note: See Table X-1 for general notes.

Table X-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Site #4 Air Monitoring Data (PPM)

<u>Pollutant</u>	<u>Maximum</u>	<u>Median</u>	<u>2nd Highest</u>	<u>Air Quality Standard</u>
Smoke Shade 24 hr.	1.35	.7	1.63	3
NO ₂ 1 hr.	.050	.022	.045	—
NHMC 6 - 9 A.M.	1.93	.98	.8	.24
1 hr.	2.2	.75	2.0	—
CO 8 hr.	4.6	1.0	3.5	9
1 hr.	6.5	1.5	6	35

Note: See Table X-1 for general notes.

Table X-5

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Site #5 Air Monitoring Data (PPM)

<u>Pollutant</u>	<u>Maximum</u>	<u>Median</u>	<u>2nd Highest</u>	<u>Air Quality Standard</u>
Smoke Shade 24 hr.	1.83	-	-	3
NO ₂ 1 hr.	ND	ND	ND	-
NMHC 6 - 9 A.M.	1.74	-	1.36	.24
1 hr.	3.76	1.28	3.68	-
CO 8 hr.	4.37	3.21	3.31	9
1 hr.	10.0	3.50	8.50	35

Note: See Table X-1 for general notes.

indicating that photochemical oxidants may also be lower in the Meadowlands than originally predicted.

An explanation of this behavior might be found in the wind rose data, shown in Table X-6. By comparing this data to the Newark Airport wind rose, one finds that winds from the southwesterly directions (the same orientation as the Hackensack Meadowlands District) are almost twice as frequent in the District as they are at Newark Airport. Hence, they are being channeled. Additionally, winds in the southwesterly directions, and in most other directions, are faster than at Newark Airport. It therefore appears from the limited data taken, that the two escarpments bordering the Hackensack Meadowlands District are channelizing and accelerating winds through the Meadowlands. Air in the District, which might otherwise be highly polluted is being dispersed by winds resulting from the two escarpments bordering the Hackensack Meadowlands District. It appears to indicate that the air quality carrying capacity of the District may be higher than originally forecasted. This does not mean, however, that maximum efforts should not be made to reduce current air pollutant emissions from the Hackensack Meadowlands District.

Regional Analysis of Air Quality in the Hackensack Meadowlands District

As previously discussed, the land use and zoning plans for the Hackensack Meadowlands District were developed using a computerized air quality prediction system known as AQUIP. Transportation related emissions from line sources (roads, highways, etc.) and area sources (parking lots) were studied in relation to the proposed land use and zoning plans and became a major input into the five computer models comprising AQUIP. Predictions of 1990 air quality were made for the various plans in terms of scaled

Table X-6

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Wind Rose Data For Site #3

<u>Direction</u>	<u>S I T E # 3</u>		<u>N E W A R K A I R P O R T</u>	
	<u>% Occur</u>	<u>Speed(MPH)</u>	<u>% Occur</u>	<u>Speed(MPH)</u>
North	2.8	6.0	6.44	11.2
+22 1/2°	1.4	9.8	6.72	9.8
+45°	.3	10.6	3.08	10.3
+67 1/2°	.1	9.5	3.08	8.7
East	.1	3.0	3.92	9.8
+22 1/2°	.2	9.0	4.20	9.2
+45°	.6	10.7	5.18	9.4
+67 1/2°	9.1	2.0	3.92	9.4
South	12.1	12.8	8.26	5.8
+22 1/2°	13.0	10.1	5.18	8.0
+45°	20.2	14.4	9.66	9.2
+67 1/2°	16.4	19.4	10.64	9.8
West	9.8	18.1	9.1	10.7
+22 1/2°	5.4	8.5	9.66	14.7
+45°	3.8	8.8	6.02	8.9
+67 1/2°	4.5	9.9	3.36	9.6

Notes:

1. % Occur = Number of times direction occurred during sample period.
2. Speed = Average speed in MPH.
3. Newark Airport data is a 20-year annual average.
4. Site #3 % Occurrences have been adjusted slightly downward in the south/south westerly directions for bias due to adjacent building interferences at the monitoring site.

isopleth maps. These maps, overlaid on a base map of the Hackensack Meadowlands, allowed a direct determination of the contribution of each of the line or area sources to the tabulated air quality levels. Changes to the land use and zoning plans could then be made in a way which would give better air quality.

A number of concerns became evident during the review of the AQUIP results. One, there were no NJDEP permanent air quality monitoring stations which could be used to calibrate AQUIP in the Hackensack Meadowlands District. Thus, the AQUIP system had to be calibrated by triangulation of the existing NJDEP stations located outside of the Hackensack Meadowlands District. Second, although it was thought that the two north/south escarpments bordering the District would influence wind speeds and directions in the District, Newark Airport, meteorological data had to be used since it was the nearest full scale meteorological monitoring site. For these two reasons, it was determined that field air monitoring sites would be established as a part of this study to provide better data for the calibration of AQUIP.

Since 1973, when the AQUIP study was completed, minor changes were made in the HMDC Master Plan, culminating in a series of separate zoning changes in 1977. Since this new land use data base was being used, in the transportation elements of this study, AQUIP needed revised land use inputs to reflect all of the changes. Coded data sheets which included the grid coordinate location of each zoning change, the type of land use, the activities occurring on the land use and the type and amount of heating and process emissions were prepared and then used as input for the LANTRAN (land use data analysis and translation) program in AQUIP.

Meteorological data was also revised in the AQUIP system. Wind rose data from the monitoring sites was used to adjust the Newark wind rose to reflect the strong southwesterly tendencies observed at the monitoring sites. Windspeeds were also adjusted upwards. Stabilities, mixing depths and dispersion coefficients remained unchanged since both budgetary and time considerations of this study precluded the acquisition of new field data.

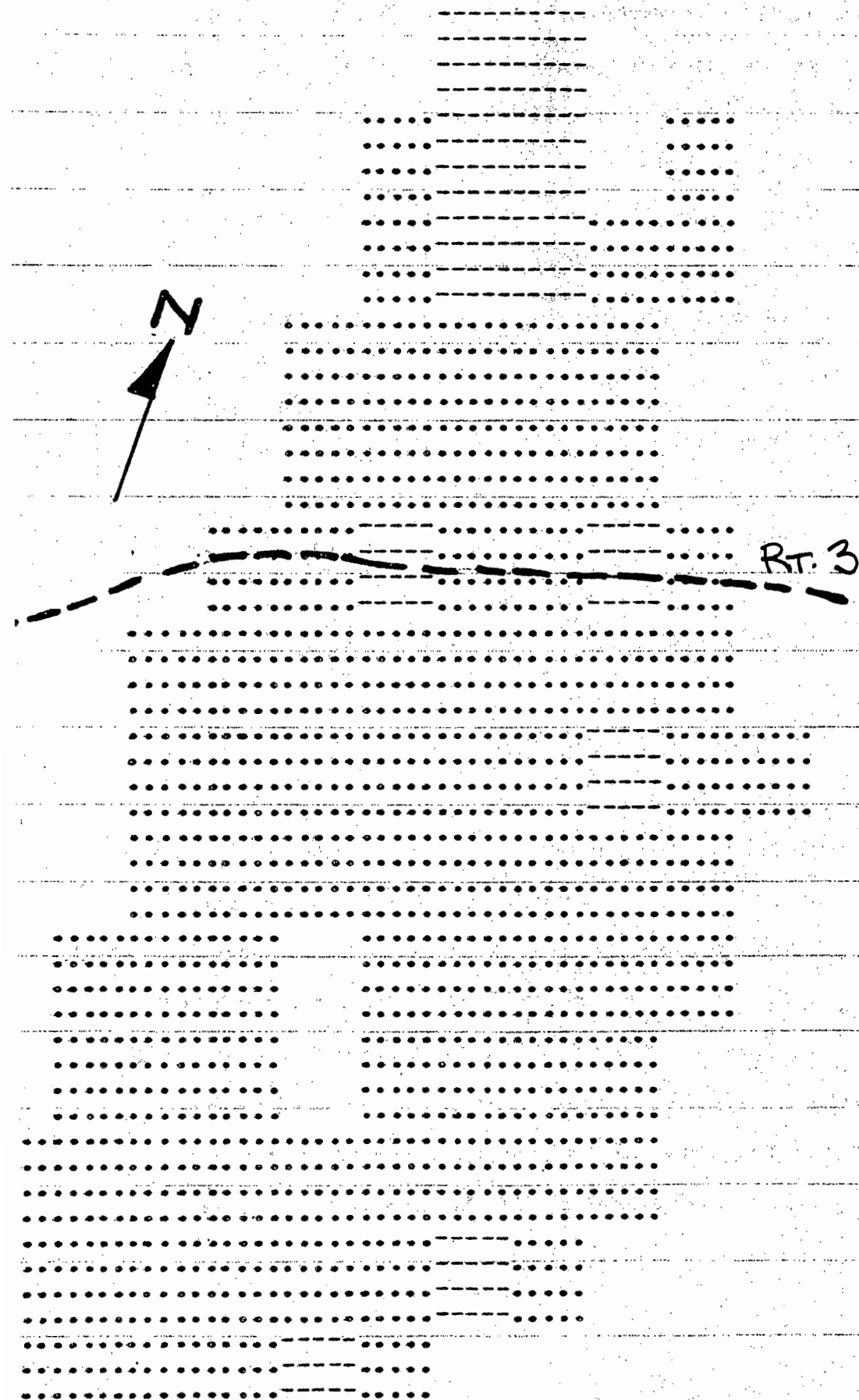
An additional change was made by NJDEP in the MarkTik (Martin-Tikvart Diffusion Model) program. As originally constructed, MarTik used the Holland equation to describe the transport properties of the emission sources. This equation was replaced by the more modern Briggs equation, which is based upon recent research into transport properties and gives a better description of "effective stack heights".

Using all of this data as input, a number of runs were made using AQUIP early in this study to give an early indication to the transit planners as to the impact full development of the Hackensack Meadowlands District would have upon regional air quality. The output of these runs which was in the form of gridded concentration plots substantiated the results of the previous (1971-1973) runs. Full scale Hackensack Meadowlands Development would have a small impact on air quality and background air quality, due to sources outside of the Hackensack Meadowlands District, might preclude compliance with USEPA and NJDEP air quality standards in the District for hydrocarbons only, a motor vehicle related pollutant. A typical computer output for total hydrocarbon levels due to the Hackensack Meadowlands Master Plan is shown in Figure X-5 and displays the calculated HC concentrations within the 80 square kilometer grids covering the Districts.

FIGURE X-5 TYPICAL AQUIP PLOT

GRID PLOT FOR VARIABLE HC :

1 2 3 4 5 6 7 8 9 10 11 12



LEVEL DESIGNATIONS...

1	2	3	4	5	6	7	8	9	10
...	...	---	==	+++	XXXX	0000	8888	8888	8888
...	...	---	==	+++	XXXX	0000	8888	8888	8888
...	...	---	==	+++	XXXX	0000	8888	8888	8888
...	...	---	==	+++	XXXX	0000	8888	8888	8888
ELL COUNT: 77	80	11	0	0	0	0	0	0	0
ALUE: 0.0	2.11	4.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AXIMUM: 0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00	0.00

Analysis of the data from these runs determined that two areas of the District deserved special consideration during transit planning work in this study. Both of these two areas showed the highest levels of hydrocarbons resulting from land uses of the HMDC Master Plan, although it must be remembered that background air quality forms the majority of Hackensack Meadowlands air quality (99% in the case of HC). These two "hot" spots, one on Route 3 at the Passaic River and one on Route 3 at Meadowlands Parkway, were identified as sites of special concern to the transit planners who reviewed the various land uses surrounding these areas.

Budget Analysis of Existing Conditions and Transit Alternatives

Since the computer runs using the AQUIP system had shown that land use planning, more specifically air quality resulting from land use planning, would have a small (1%) influence on HC air quality, consideration was given to finding a new analysis technique which would focus directly on the Hackensack Meadowlands District, not require long and costly computer runs and which would provide a direct numerical output for ranking purposes and not maps which required interpretation. Resulting from this new approach was a technique of preparing regional carbon monoxide and hydrocarbon budgets.

An analysis of traffic data, and consultations with other members of the study team revealed that seven major roadways are currently, and likely to in the future, carry the bulk of Hackensack Meadowlands District related traffic. By computing the carbon monoxide (CO) and hydrocarbon emissions (HC) for each roadway due to the existing and projected traffic volumes expected to be carried on these roadways and then by summing the seven separate roadway emissions, a budget could be determined. If this technique were

used for the existing conditions and proposed transit alternatives, it would provide a numerical ranking scheme and could also identify the relative impact of each of the roadways upon Hackensack Meadowlands air quality. Therefore, this budget technique was adopted for use in this transit study and CO and HC budgets were prepared for each of the transit alternatives and existing conditions.

These budgets focused on seven major roadways: Route 17 (from Route 3 to Route 46), Route 3 (from Passaic River to Route 495), Route 1-9 (from Tonnelle Circle to Route 46), N.J. Turnpike east and west spurs (from the north to the south District boundary), Route 46 (from Route 17 to Route 1-9), and Route 7 (from the west District boundary to Tonnelle Circle). To compute these budgets, peak hour traffic data for each of the seven roadways, either from field monitoring or by projection in the case of the five alternatives, was converted into an average daily traffic and then into annual average daily traffic (AADT) using techniques described in the Highway Capacity Manual, applicable to the particular type of each of the roadways. By multiplying this AADT by the length (in miles) of the roadway section, vehicle-miles travelled (VMT) were determined. An average roadway speed was also determined from the Highway Capacity Manual by computing the average hourly traffic volume from AADT and then selecting an average speed for this volume.

Parallel with the traffic data analysis, a computer program based on the USEPA Manual AP-42, Compilation of Air Pollutant Emission Factors, was run for a temperature of 54 degrees and a vehicle mix corresponding to the national average (80.4% automobiles, 11.8% light duty trucks, 4.6% heavy duty gasoline trucks and 3.2% heavy duty diesel trucks). From the outputs

of this program, curves of HC and CO emission factors (grams per vehicle mile) versus vehicle speeds (MPH) were generated for the years 1976 and 2000 (1990). Based upon the average vehicle speed previously determined, an emission factor was selected from the curves. Using data on the vehicle mix from classified counts taken at the traffic monitoring sites in this study, emission factors from the national average emission curves were adjusted by factors generated in accordance with the observed vehicle mixes. By multiplying the VMT by the emission factor, hydrocarbon and carbon monoxide emissions for each roadway segment were estimated. A summation of the seven roadway emissions formed the budgets for the five transit alternatives and the existing conditions.

Existing Conditions

Traffic monitoring data, more completely described in Chapter IV, shows that the seven roadways reviewed in the HC and CO budgets carry the greatest portion of Hackensack Meadowlands traffic. With the exception of the N.J. Turnpike spurs, each of the seven roadways are currently at or near their design capacity and automobiles make up the majority of all traffic on these roadways. Furthermore, the percentage of automobiles on these roadways exceeds the national average of 80.4% by more than 5% on each of the roadways. Annual travel on these roadways, estimated at 2.8 million vehicle miles travelled, is indicative of the major transportation corridor that the Hackensack Meadowlands is today.

Accordingly, the HC and CO budgets reflect these existing transportation factors. (See Table X-7). Relatively low emission factors, resulting from relatively high average speeds, are balanced by high volumes of traffic

Table X-7

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

1976 Regional CO and HC Budget

ROADWAY		AADT	VMT	SPEED	FACTOR	EXISTING TON/YEAR
Route 17	4.4 Miles	70,600	310,640	48 MPH	31 (CO) 12.8 (HC)	3,870 1,600
Route 3	5.72 Miles	116,640	667,180	40 MPH	31 (CO) 12.8 (HC)	8,310 3,430
Route 1-9	7.5 Miles	56,970	427,270	30 MPH	44 (CO) 13.8 (HC)	7,550 2,370
N.J. Tpke. West	7.5 Miles	53,350	400,130	50 MPH	31 (CO) 12.8 (HC)	4,990 2,060
N.J. Tpke. East	8.4 Miles	55,200	463,680	50 MPH	31 (CO) 12.8 (HC)	5,780 2,380
Route 46	6.2 Miles	46,370	287,490	37 MPH	34 (CO) 14 (HC)	3,930 1,620
Route 17	5.3 Miles	45,770	242,580	28 MPH	48 (CO) 19.8 (HC)	4,680 1,930
<u>TOTALS</u>						CO 39,110 HC 15,390

NOTES:

1. AADT is estimated from peak hour traffic monitoring data in accordance with Highway Capacity Manual.
2. Speed is average operating speed estimated from data in the Highway Capacity Manual.
3. Emissions factors are derived from a computer program based upon USEPA Manual, AP-42 "Compilation of Air Pollutant Emission Factors".

on the seven roads, causing significant emissions of 39,100 tons per year of CO and 15,400 tons per year of HC at this time. The high number of auto trips on the seven roads account for more than 70% of the total emissions. It is also significant to note that these two roadways were also identified by traffic monitoring to be over their design capacity during peak hours. It would, therefore, appear that future transit planning should focus on replacing vehicle trips on these two roadways with transit to gain significant air quality benefits through higher vehicle speeds and fewer vehicle miles travelled.

All-Highway Network

A major alternative that must be assessed is the all-highway strategy. In this alternative, increased traffic volumes resulting from full development of the HMDC Master Plan will continue to use the existing system of seven major roadways with major road improvements. Due to Hackensack Meadowlands development, VMT grows dramatically to nearly 4.4 million in the year 2000. (See Table X-8). No additional mass transit is provided over the 1976 utilization of bus and rail transit. Since full development is predicted to occur in the year 2000, emission controls on all motor vehicles are expected to be much improved, resulting in CO and HC emission reductions of at least 70% over existing roadway emissions. Overall, this alternative results in a decrease of 7% in the carbon monoxide emissions to 36,310 tons per year and a decrease of 75% in hydrocarbon emissions to 3,800 tons per year, over existing roadway emissions.

Significantly, all seven roadways show increased congestion, as indicated by their levels of carbon monoxide emissions. The CO levels occur in spite of improved emission controls and are strongly related to

more vehicles and lower vehicle speeds. Of major importance is the specific congestion predicted to occur along Rt. 3, which actually doubles in CO emissions over 1976 conditions, resulting from Rt. 3's use as both an interstate corridor and a major land use service road. No other roadway experiences such congestion.

On the other hand, hydrocarbons are not as strongly influenced by the traffic that is predicted to occur. All roadways show a decrease in HC emissions, since expected advances in emission control technology will more than offset the increase in VMT and the lowering of average speeds. Rt. 3 again shows the highest HC emissions of seven roads which is directly related to its high VMT emissions of seven roads which is directly related to its high VMT of 1.1 million.

Considering all of the above factors, selection of the All-Highway network would represent an unacceptable approach to the critical regional needs for emission reductions, required by USEPA air quality standards. Furthermore, this network, points up the need for effective transit programs in the Meadowlands District which will help alleviate the twin problems of traffic congestion and adverse air quality impacts.

Bus Network

The bus network, the first of four mass transit alternatives, is a system of buses on both feeder route and intra-Meadowland routes. This network is designed to divert motorists using seven major roadways to buses to four major transfer stations in the Meadows or in some cases directly to their final destinations. From these transfer stations, other buses will take them to points of destination within the Meadows. By doing so, VMT on the major roadways would be reduced, however, VMT on internal Meadowlands roadways would also be slightly increased.

Table X-8

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

All-Highway Network CO and HC Budget Breakdown by Roadway

ROADWAY		AADT	VMT	SPEED	FACTOR	TOTAL TON/YEAR
Route 17	4.4 Miles	105,990	466,330	18 MPH	21 (CO) 2.1 (HC)	3,930 390
Route 3	5.7 Miles	186,550	1,063,330	10 MPH	38 (CO) 3.2 (HC)	16,240 1,370
Route 1-9	7.5 Miles	121,130	908,470	20 MPH	19 (CO) 1.98 (HC)	6,940 720
N.J. Tpke. West	7.5 Miles	92,420	693,150	40 MPH	11 (CO) 1.71 (HC)	3,060 480
N.J. Tpke. East	8.4 Miles	76,080	639,070	48 MPH	9 (CO) 1.49 (HC)	2,310 380
Route 46	6.2 Miles	55,370	343,390	33 MPH	13 (CO) 1.74 (HC)	1,790 240
Route 17	5.3 Miles	48,000	254,400	20 MPH	20 (CO) 2.1 (HC)	2,040 220

TOTALS

CO 36,310
HC 3,800

Using Figure VIII-4 as a base for analysis, it is estimated that VMT on major roadways will be reduced to 3.8 million, a decrease of 13% from the All-Highway network. Roadway emissions of 17,600 tons per year of CO and 2,470 tons per year of HC are predicted as a result of this new VMT. To these roadway HC and CO emissions, internal transfer by buses will add 520 tons per year of CO and 70 tons per year of HC emissions. Overall, the network would reduce budget CO and HC emissions by 54% (to 18,120 tons/year) and 83% (to 2,540 tons/year), respectively, over existing roadway emissions.

Further emission reductions in this alternative could be achieved by the use of electrically-powered buses for internal networks. The use of this type of bus could provide additional reductions of 1 to 2% in the HC and CO budgets. Since the goal of the North Jersey region is to gain enough emission reduction for compliance with USEPA air quality standards, even a small decrease of 1 to 2% is worthy of further consideration.

Buses should be viewed as a viable alternate from an air quality point of view and should receive serious consideration as an element of an overall Transportation Master Plan for the Hackensack Meadowlands. Early implementation of elements of the bus network in critical areas such as Rt. 3 could gain air quality benefits quickly through large reductions in VMT and should be a prime consideration in the ultimate choice of a transit network for the Hackensack Meadowlands.

Rail Network

The rail network is a system of various types of rail vehicles operating on existing trackage, plus some new or improved trackage, delivering riders to five new, and one upgraded, train stations. Buses would provide transfers from the train stations to points of destination in the District. Commuter

parking lots would also be provided at each of the six stations to allow direct use of the train stations.

Using Figure VIII-5 as a base for analysis, roadway VMT is predicted to be 3.9 million, a decrease of 11% over the All-Highway network. Based upon this VMT, roadway emissions of 18,230 tons per year of CO and 2,560 tons per year of HC are predicted. The internal transit network using buses, operation of additional passenger trains in the District and commuter parking lots would add 300 tons per year of CO and 60 tons per year of HC emissions. Overall, the rail network reduces CO and HC emissions by 52% (to 18,530 tons/year), and 82% (to 2,620 tons/year), respectively, over existing roadway emissions. (See Table X-9).

Like the bus network, the rail network can be implemented in segments to give air quality benefits as the development pace quickens in the Meadows. The implementation of the rail network can also be keyed to the construction of Specially Planned Areas (See Chapter VI for description) where population and trip concentrations will be located in the Meadowlands, resulting in reduced air pollutant emissions due to the Specially Planned Areas. Additionally, the rail network can also benefit from the use of electric buses for internal transit resulting in another 1% reduction of CO and HC emissions for the rail network. Since rail and bus are compatible, site-specific transit planning should consider combinations of rail and bus transit to achieve the best air quality and the maximum service. Lastly, rail transit should be considered a viable air quality alternative since much of the proposed rail system exists today, making rail a practical solution to air quality planning in the Hackensack Meadowlands.

Table X-9

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Proposed Networks and 1976 HC and CO Budgets

<u>Networks</u>	<u>Highway Ton/Year</u>	<u>Alt. Ton/Year</u>	<u>Total Ton/Year</u>
1976	39,110 CO 15,390 HC	- -	39,110 CO 15,390 HC
All-Highway	36,310 CO 3,800 HC	- -	36,310 CO 3,800 HC
Bus	17,600 CO 2,470 HC	500 CO 70 HC	18,120 CO 2,540 HC
Rail	18,230 CO 2,560 HC	300 CO 60 HC	18,530 CO 2,620 HC
PRT	16,500 CO 2,320 HC	500 CO 80 HC	17,000 CO 2,400 HC
Busway/Vanpool	18,490 CO 2,590 HC	240 CO 30 HC	18,730 CO 2,620 HC

Notes:

1. All alternatives assume highway improvements are made at problem areas to gain level of service E (30 MPH).
2. Rail Network includes internal bus feeder.
3. PRT Network assumes PRT system is totally electrified.

PRT Network

The PRT Network is a system of computer-controlled automatic transit vehicles which would provide direct, no transfer service to points of destination in the Meadowlands during commuter hours (6 to 8 hours). Using Figure VIII-6 as a base of analysis, roadway VMT is expected to be 3.7 million, a decrease of 17% over the All-Highway alternate. Roadway emissions of 16,500 tons per year of CO and 2,230 tons per year of HC are predicted. The internal transit network using buses and existing trains during non-working day hours are expected to add 500 tons per year of CO and 80 tons per year of HC emissions. Overall, the PRT network, produces the greatest reduction in emissions over existing roadway emissions by a 56% (to 17,000 tons/year) reduction in CO emissions and an 84% (to 2,400 tons/year) reduction in HC emissions. (See Table X-9).

While PRT is likely to produce the greatest air quality benefits, its price tag in dollars makes it an unlikely candidate for use in the Hackensack Meadowlands, as a whole. Use of the PRT to service areas which may have a high trip generation such as the Sports Complex and the Berrys Creek Center should be pursued. The capital intensive aspects of the PRT may be offset by significant air quality benefits in these types of areas upon further analysis on a sub-regional scale. Additional studies planned by the Commission and/or major private developers could determine PRT's potential utility.

Busway/VanPool Network

In the Busway/Van Pool Network exclusive lanes or new roadways are provided for the sole use of commuter buses or vans. These exclusive right-of-ways would provide direct service to points of destination, essentially free of contact with future traffic on major roadways. When on the busway,

both buses and vans would maintain an average speed of 30 MPH to their points of destination.

Using Figure VIII-7 as a basis for analysis, roadway VMT is expected to be 3.75 million, including the use of exclusive right-of-ways by buses and van pools. Total emissions of 18,720 tons per year of CO and 2,620 tons per year of HC are expected, of which 240 tons per year of CO and 30 tons per year of HC will be caused by operations in the exclusive right-of-ways. Overall, this alternate reduces CO emissions by 52% (to 18,720 tons/year) and HC emissions by 83% (to 2,620 tons/year) over existing roadway emissions. (See Table X-9).

Like the PRT Network, this alternate will suffer from a high price tag due to the cost of constructing exclusive right-of-ways. While the costs will be high, they are not as high as the PRT. Air quality benefits produced by the Busway alternate should more than offset costs. Further major reductions in air emissions could be achieved with electric buses, which are likely to become less costly in the next ten years.

Microscale Analysis of Existing Conditions and Proposed Networks

In the preceding section, the regional impact of existing and future transit programs was assessed through the use of emission budgets. Traffic analysis of the roadways assessed in this study has also shown that six roadway intersections, in and adjacent to the Meadowlands District are of critical importance since they are currently at or above their design capacity. Like the roadways chosen for the budget analysis on a regional scale, these six roadway intersections will be key factors in local traffic and air quality conditions. Thus a local (Micro-Scale) scale impact assessment of carbon monoxide levels at these six intersections was conducted.

For this assessment, a mathematical model known as CALAIR was chosen. CALAIR, a local scale air quality model developed jointly by the California Departments of Transportation and Air Resources, has been used widely throughout the U.S. for predicting CO levels from roadway sections and intersections. Both the U.S.E.P.A. and U.S.D.O.T. have accepted the use of CALAIR for use in environmental assessments of highway and intersection improvement project.

CALAIR determines the amount of excess CO concentration caused by the operation of motor vehicles at a particular roadway section during worst case annual conditions. The use of CALAIR presupposes that adequate air quality data for background conditions are known. Furthermore, CALAIR uses meteorological data for the particular roadway area for the worst case annual conditions. Results produced by CALAIR must be added to background levels to determine predicted micro-scale air quality levels.

The Basic Equation of CALAIR for air directly over a roadway site is:

$$\Delta C = \frac{KVE}{HW \sin \theta}$$

This equation describes a turbulent mechanical mixing cell that extends vertically to a given height, determined by primarily vehicle size and speed and by wind speed and atmospheric stability to a lesser extent. This height, H in the formula, is usually assumed to be 4 meters for heavily travelled highways such as the ones in this study. The effect of the speed and type of vehicles is reflected in the product of V, the traffic volume, and E, the composite emission factor. The calibration factor, K, relates calculated values from the model to observed concentrations

at the site being assessed.

Where CALAIR parts company with other Gaussian models is in the term, $\bar{W} \sin \theta$. $\bar{W}$, the average wind speed, is determined by integrating an inverse power law relationship between worst case annual stability and wind speed. The result of this integration is that horizontal dispersion decreases less sharply with horizontal distance across a roadway than in similar Gaussian models. The angle of the wind direction with the roadway, θ , is limited in CALAIR to a minimum of 22.5 degrees since $\sin \theta$ approaches zero at angles smaller than 22.5 degrees. Thus, CALAIR is a very conservative model.

As discussed above, CALAIR produces only the added air quality concentrations and not the total concentrations. Therefore, the first step in the analysis is to determine the calibration factor at each of the six roadway intersections. This calibration factor was determined by first computing the ΔC for traffic at each of the six sites, then adding it to a regional background (NJ Sports Complex station between 12 P.M. and 4 A.M.) and then dividing the result into the air quality concentration monitored at each of the six sites. This process produced K's ranging from 1.065 to 1.07. The next step was to determine the term $\bar{H} \bar{W} \sin \theta$. From available meteorological data, worst case annual conditions of 2MPH, 36.6 degrees and stability class D were selected and then entered into the average wind speed formula. The last step was the determination of the term VE from traffic predictions and emissions predictions (see technique in Budget Analysis). The ΔC values determined by CALAIR were then added to background levels to determine the predicted results for each of the six sites. These results are shown in Table X-10.

Table X-10

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Microscale Carbon Monoxide Analyses

TRAFFIC MON. SITE	1 HR PEAK (USEPA STND = 35 PPM)				
	AH	BUS	RAIL	PRT	B/VAN
#6-Rt. 17 South	51.2	26.4	27.3	24.7	27.7
#7-Rt. 46 Circle	18.5	13.6	14.1	12.8	14.3
#11-Rt. 1-9, 69th Street	68.8	31.4	32.5	29.4	32.9
#14-Rt. 495	25.6	12.0	12.4	11.2	12.6
#15-Tonnelle Circle (NB)	55.7	23.4	27.3	24.7	27.7
#21-Rt. 3@ Pass. River	67.5	32.7	33.9	30.6	34.3

TRAFFIC MON. SITE	8 HR AVERAGE (USEPA STND = 9 PPM)				
	AH	BUS	RAIL	PRT	B/VAN
#6-Rt. 17 South	15.9	8.5	8.7	7.9	8.9
#7-Rt. 46 Circle	6.3	4.3	4.5	4.1	4.6
#11-Rt. 1-9, 69th Street	21.9	8.8	9.1	8.3	9.2
#14-Rt. 495	8.2	3.8	3.8	3.6	4.0
#15-Tonnelle Circle (NB)	17.7	7.5	8.7	7.9	8.9
#21-Rt. 3@ Pass. River	21.4	10.5	10.8	9.75	10.9

Notes:

AH = ALL-HIGHWAY NETWORK

BUS = BUS NETWORK

RAIL = RAIL NETWORK

PRT = PRT NETWORK

B/VAN = BUSWAY/VAN POOL NETWORK

An analysis of these results shows that violations of both 1 Hr. and 8 Hr. USEPA standards for carbon monoxide will occur at four of the six sites if the All-Highway network is selected. In all other transit networks, CO levels for 1 and 8 Hr. exposures will basically comply with USEPA standards.

The basic conclusions of the micro-scale analysis were that future traffic may congest existing highways and may cause violations of USEPA CO standards if additional transit is not provided, as in one of the four transit networks.

Air Quality Summary

A number of conclusions can be made by comparing the results of the preceding HC and CO budget analysis of the existing conditions and the five alternatives. As shown in Table X-11, the PRT Network produces the lowest total HC and CO emissions of the five alternatives and, thus, is expected to have the most positive impact upon the Hackensack Meadowlands. Selection of this network is conditioned upon financial and physical considerations, not part of the air quality analyses. Other networks may be more viable when these additional considerations are reviewed.

Following PRT as the top ranked network are a tightly bunched group of bus transit, rail transit and busway/van pool, respectively. A total of only 600 tons per year of CO and 80 tons per year of HC emissions separates these three networks. From an air quality point of view, any one of these three could also be selected, since each has relatively the same positive impact on HC and CO emissions and resultant Meadowlands air quality. Implementation of any one of the three would result in HC and CO emissions of only approximately 6 to 10% greater than the PRT system. When related by

Table X-11

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Total CO and HC Budgets (Tons/Year)
(Year 2000)

POLLUTANT	1976	N E T W O R K S				
		ALL-HWY	BUS	RAIL	PRT	BUS/VAN POOL
CARBON MONOXIDE	39,110	36,310	18,120	18,530	17,000	18,720
HYDROCARBONS	15,390	3,800	2,540	2,620	2,400	2,620

mathematical modeling to the total Hackensack Meadowlands air quality, additional emissions of only 6 to 10%, at full development would result in minor additional impacts on Meadowlands air quality of less than 1%, and probably will not be a significant factor in the compliance of the Meadowlands air quality with USEPA air quality standards.

At the bottom of the ranking, however, is the All-Highway Network. For example, as shown in Table X-11, implementation of this network would nearly double CO emissions and increase HC emissions more than 50% over the busway/van pool network, the alternative ranked fourth out of the five alternatives. In addition, implementation would also result in a 50% increase in VMT, which offsets the emission, (and resultant air quality) reduction benefits of improved motor vehicle emission controls. Therefore, the All-Highway Network is unacceptable when weighed against the reduction in emissions and VMT needed by the northern New Jersey to achieve USEPA Air Quality Standards.

Parks and Recreation: Transportation Needs

The New Jersey Statewide Comprehensive Outdoor Recreation Plan of 1973 determined that the Northeast Region (Bergen, Hudson, Passaic, Essex and Union Counties) has a far greater demand for outdoor recreational opportunities than is currently available. Specifically, the demand for outdoor games and sports - - bicycling, swimming, boating, picnicking and equestrian trails - - can not be adequately met by the existing recreational areas. Therefore, the demand for camping and hiking activities are now being met outside the area because of the Northeast Region's lack of recreational opportunities.

The projected percentage increases in demand for outdoor activities from 1970 to the year 2000 are as follows: camping - 161%, hiking - 137%, sightseeing - 126%, sledding - 119%, boating - 116%, outdoor games - 108%, and outdoor concerts - 106%.

Transportation Impacts on Parks

Transportation has a very important impact on park utilization. In some cases, where the park managers wish to limit the number of visitors, the amount of parking available is limited. This, of course, applies to those parks where there is no access by public transit or other means. This method of limiting park visitation obviously has a moderating impact on the demand for transportation facilities. In some cases, however, the fact that a park has a limited parking supply has an undesirable dampening effect on park demand. In these cases, where there is no alternate mode, only vehicular access, the park is not used to its capacity.

In recent years, the transportation planning perspective regarding parks and recreation areas has changed. Large numbers of autos and an extensive road network are now considered by many park planners and

managers to be undesirable because of the aesthetic, environmental and other impacts on the parks, and especially the recreational experience. National Parks and Large State Parks are now using special shuttle buses, trams, etc., to move the large numbers of people who wish to visit around the parks.

Public transit currently plays a very minor role in transporting people to parks. In a national study, called the Recreation Access Study, which was sponsored by the U.S. Departments of Transportation and the Interior, a detailed analysis was done on the current role of public transit as an access mode to parks and what would be done to improve public transit access. The study which is four volumes in size is available through the National Technical Information Service, U.S. Department of Commerce, PB-241 994. Among this study's more important conclusions was that the lack of public transit access to parks was not thought by most people to be the main reason why they did not go to a particular park. Even in Boston, where public transit is generally available and can be used on weekends to get to parks, the number of people using public transit was small. In the city of St. Paul, Minnesota, where an in depth study was done, public transit was used by only 2% of the total number of people going to a major park in the city. This park was served by a bus line and it passed through the central business district and areas where the people were more likely to be transit dependent because of income. In contrast, 15% of the park's patrons arrived by bicycle.

There were several reasons why public transit did not seem to be attractive to parks' visitors. As part of this national study, a special survey of citizens was conducted in Boston and Atlanta. It was

found that people did not perceive the available transit as operating frequently enough or being convenient. The people surveyed did not cite transit fares as a deterrent. They were, however, concerned about where to place their packages, picnic baskets, etc. since most public transit caters to people going to and from work, and thus has no accommodations for such bulky items. It was also found that people did not like to use transit to get to parks, since they found once they got there, they were limited as to where in the park they could travel. Not many of the parks surveyed had any form of internal transit.

The conclusion of this major study was that public transit could be an important access mode for parks and recreation areas. Recommendations were made regarding national policies, frequency of public transit to parks, and the lack of accommodations found on most transit vehicles for bulky items associated with recreational activities. The results of this important national study have been used in considering the transportation needs of the major parks and recreation areas in the Meadowlands.

General Description of Major Parks and Recreation Areas

Planned Parklands within the Hackensack Meadowlands District number approximately 30, with 3 being of large enough magnitude to warrant mention as they relate to special transit needs for their success. All 3 parks, Losen Slote Creek State Park, the New Jersey Sports and Exposition Environmental Education Center, and the Richard W. DeKorte-2000 Acre State Park (see Figure X-6), will help to reduce the scarcity of demand for outdoor recreational facilities within the Northeast Region.

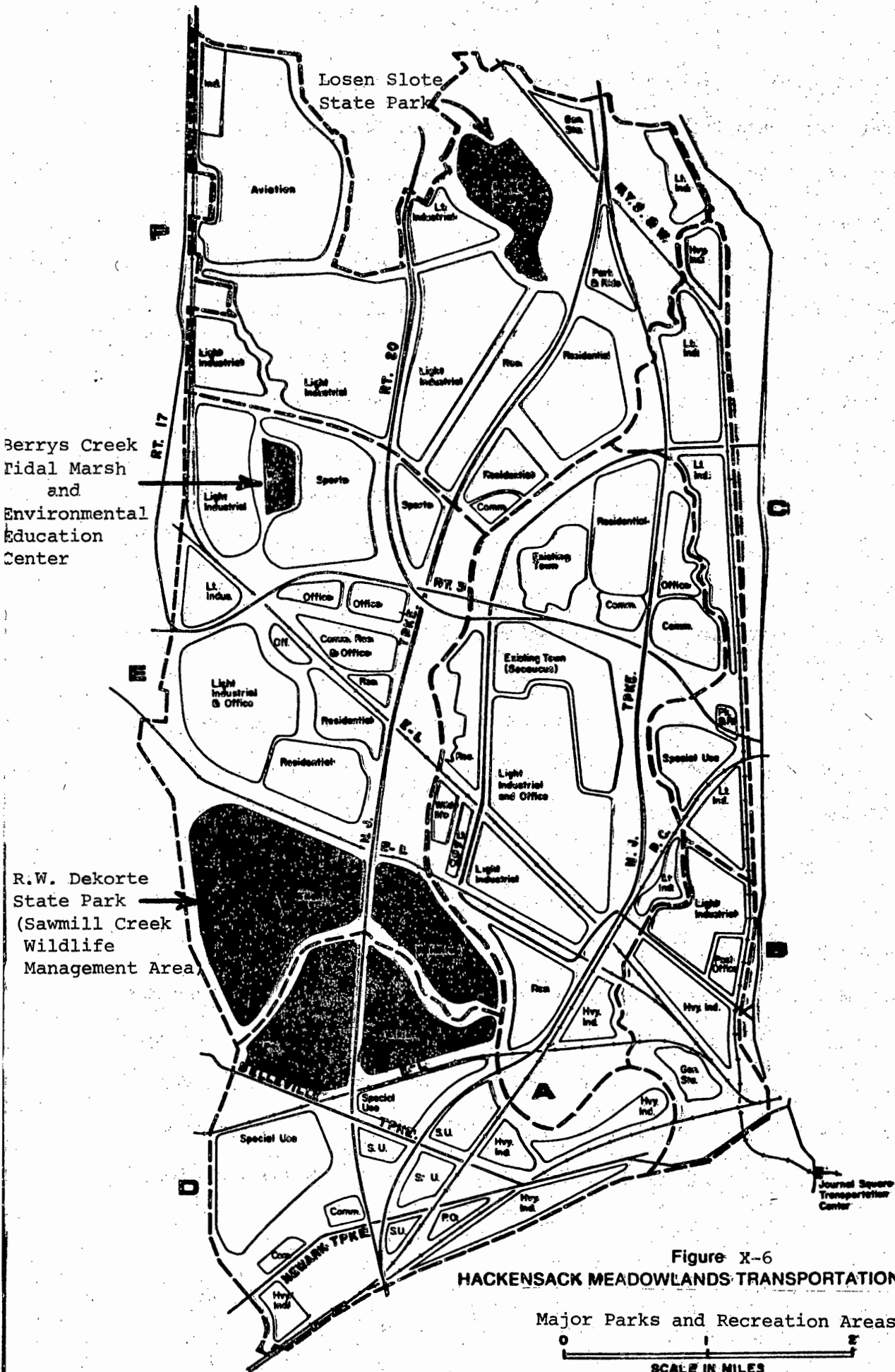
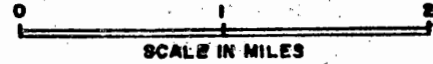


Figure X-6
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Major Parks and Recreation Areas



Berrys Creek Tidal Marsh and Environmental Education Center

In 1971, Governor Cahill signed into law an act establishing the New Jersey Sports and Exposition Authority. The Hearing Officers' report reviewing the impact of the Sports Complex and making its recommendations, stated that the Authority shall establish, finance, and maintain on a permanent basis, an Environmental Education Center on or near Berrys Creek tidal marsh. The Center shall be available to the general public as well as to recognize environmental organizations for observation and study of the marsh, its vegetation and wildlife. To insure that a proper and useful facility will be established, constructed, and maintained, the expertise of the Department of Environmental Protection and the HMDC and recognized environmental organizations shall be utilized by the Authority.

The center is expected to be located within the presently zoned Sports Complex site, however, the exact location will be determined by the two hearing agencies, NJDEP and HMDC. Current projections of average demand for the Environmental Education Center indicate that about 500 people per day could use the Center. Most of these people would arrive on weekdays during off-peak hours with the projected mix being mainly school children, civic and other organized groups. On weekends it is anticipated that the Center will also draw people who are attending other events or activities in the Sports Complex's other facilities. These people, thus, would not really add to the anticipated transportation needs for the Center. This kind of symbiotic relationship between this Center and the surrounding sports facilities will be strongest on weekends. In the more distant future, when other developments in the Meadowlands such as Berrys Creek Center are completed, it is expected that they will

be major sources of visitors.

Losen Slote State Park

The second major active park within the Hackensack Meadowlands District will be Losen Slote Creek State Park. Located in Little Ferry it encompasses approximately 100 acres. The Park is expected to serve the needs of the surrounding residential communities of southern Bergen County (see Figure X-7). The types of activities envisioned for the park are: canoeing, nature walks, picnicking, playgrounds, play fields, game courts, small education center, mini-amphitheater, and open lawns. A portion of the park already has been assembled. It encompasses 22 acres of lowland forest in which guided nature walks today take place. The previous NJDEP Commissioner, David Bardin, toured the park area and assured the public that Losen Slote Creek State Park would be transformed into reality with Green Acres assistance. This park is projected to draw crowds of from 1,500 to 1,800 people on an average day. Since this park is more locally oriented, it is anticipated that this park will be overshadowed in regional drawing power by DeKorte State Park, described next.

R.W. DeKorte State Park

The 2000 Acre Richard W. DeKorte State Park is envisioned to be the largest and most actively diverse park within the Hackensack Meadowlands District and surrounding region. The Park's assembled makeup today includes 1,186 acre tidal wetland wildlife management area and a 99 acre fresh water impoundment, both used for passive recreational activities. Future components of the park will be dictated by exactly those types of active or passive recreational activities that can be

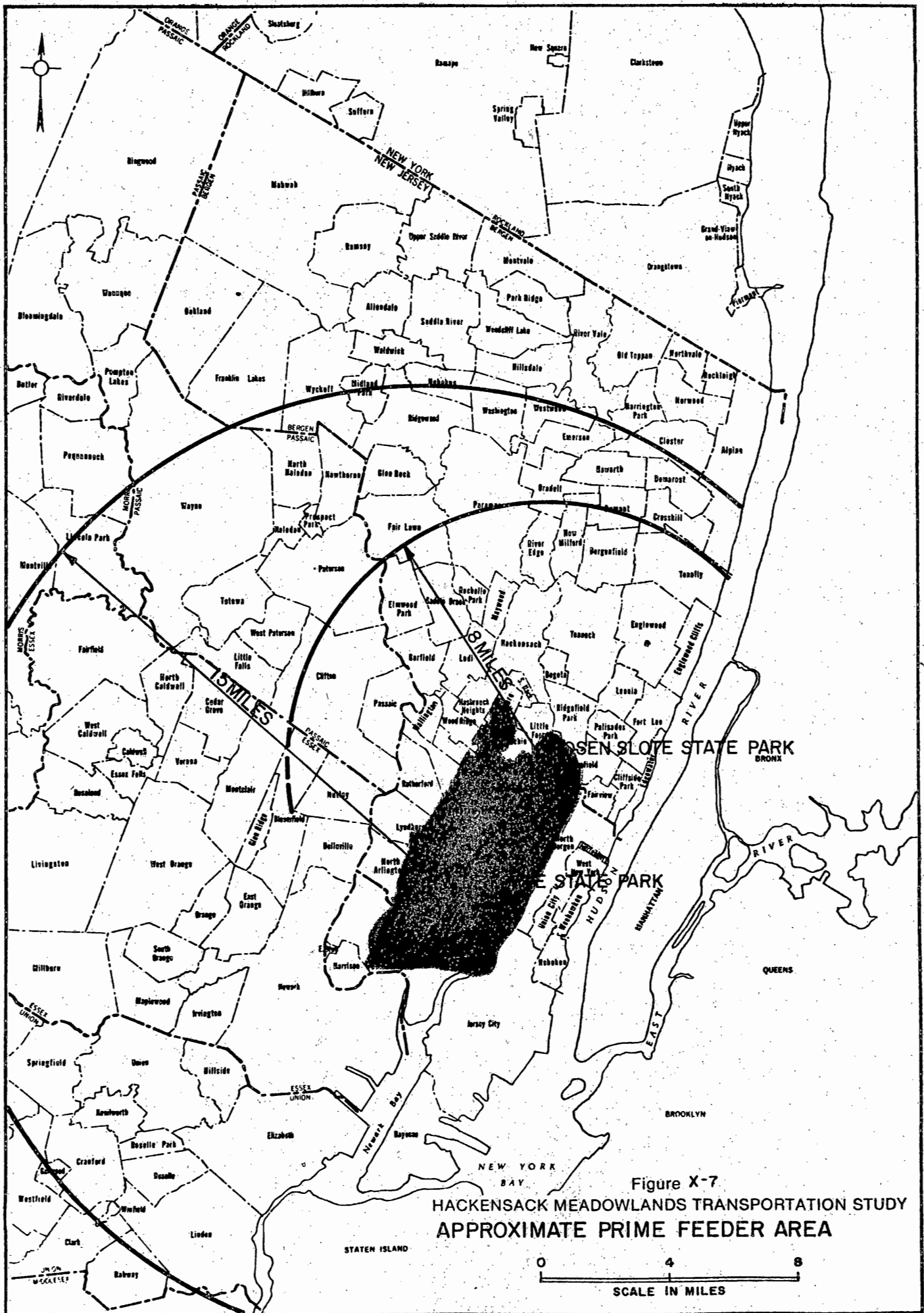


Figure X-7
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 APPROXIMATE PRIME FEEDER AREA

placed on sanitary landfills or balefills. Some of the envisioned recreational activities which could begin to take place within the next two years include: an 18-hole golf course and driving range, equestrian trails and associated stables, tennis and game courts, tot lots or children playgrounds, open lawn areas, open air amphitheaters, hiking and nature trails, camping, picnicking, boating, organized sport fields and viewing stands, winter sledding areas, mini-barnyard zoo and possibly swimming facilities.

It is difficult, of course, to predict the intensity of use, by year, which will be attained in the 2000 Acre DeKorte State Park, 1,186 of which are to remain in low salt marshes, shallow tidal bays and tidal impoundments, and the remaining 814 to be transformed from presently active and inactive landfills to the wide variety of park uses envisioned above, staged over time.

It will be easier to make such use calculations when the present engineering and landscape architecture study, to be completed by September 30, 1978, has presented its findings about the difficult engineering matters to be solved, so that parks can follow.

However, it is conceivable that the intensities of use which now characterize Bergen County's Van Saun Park could be attained over the ten year term of park planning, construction and use. If that were to occur Table X-12 would have considerably higher numbers. For example, on a given weekend in Van Saun Park today, 15,000-25,000 people per day attend, i.e. (18,000 people in attendance on Sunday, June 11, 1978). Peak months appear to be April, May and September with June, July and August those months when local park users migrate to the New Jersey shore.

Table X-12

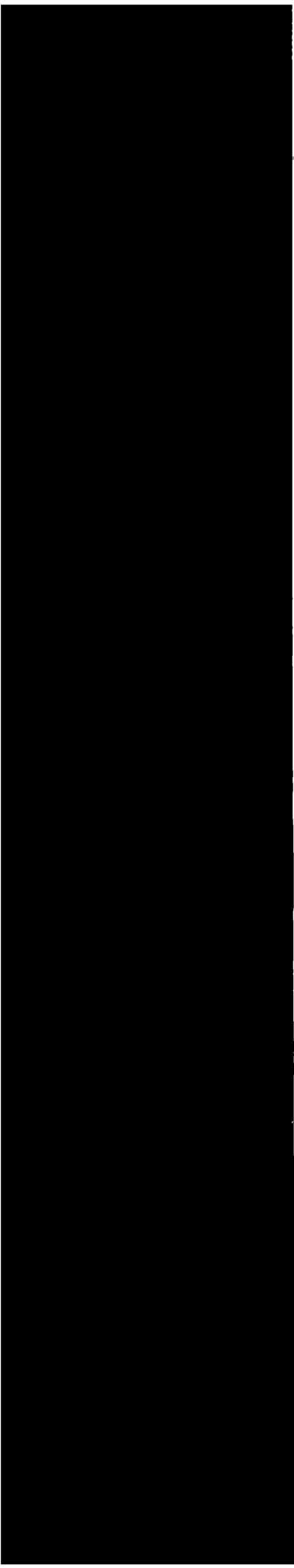
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Vehicle Trips Generated by theLosen Slote and R.W. DeKorte State Parks and the Environmental Education Center

<u>Areas</u>	<u>Acres</u>	<u>Average Vehicle Trips (Two-Way)</u>	
		<u>Per Day</u> ¹	<u>Peak Hour</u> ²
Losen Slote S.P.	100	590	40
Environmental Education Center	130	170-200	-
R.W. DeKorte S.P.			
Active	814	4,800	325
Passive	1,186	119	-

¹
Notes: The projections for average vehicle trips per day for Losen Slote and R.W. DeKorte State Parks were obtained using a factor of 5.9 trips per acre. This factor was obtained from a background listing of source data compiled by the Institute of Transportation Engineers for their report, Trip Generation: An Informational Report, 1976. Trip generation rates for average vehicle trips per weekday vary between .6 trips per acre for state parks and 60 trips per acre for city parks. County parks are listed as generating 5.1 trips per acre for Sundays. This projection for the Environmental Education Center is an HMDC staff estimate since no trip generation for this type of facility is available in published literature.

²
 These projections of peak hour trips for the two state parks are based on the same background information cited in Note 1. A factor of .4 vehicle trips per peak hour per acre was used.



Transportation Demand

At present, only a limited amount of data exists regarding trips generated by parks. The number of trips generated is more a function of the activities and facilities at the parks than either their size or location. Parks and recreation areas experience their heaviest demand during weekends, especially in warmer weather. The peak vehicle trip generating time periods are between 12:00 and 2:00 PM and 3:00 and 5:00 PM. These are somewhat different than the journey-to-work peak periods. In Table X-12 are listed the two parks and the Environmental Education Center and the projected number of vehicle trips for an average day and for the peak one hour period.

As can be seen, this demand is way below the numbers of trips generated on an average weekday for the journey-to-work peak periods. This strongly suggests that the highway and road network can generally provide sufficient capacity to handle these projected demands. One potential problem which may arise concerns the timing of a major Sports Complex event and the peak park demand for the 2000 acre DeKorte State Park. It will be defined, if indeed it does exist, when more is known about the specific activities and facilities proposed for the DeKorte State Park. This planning effort will start shortly, as has been mentioned earlier in this section.

There are several approaches which can be taken to meet the demand for transportation facilities and services generated by these parks and the Environmental Education Center. The approach taken by park and transportation planners in the past of providing the parking and road network in direct proportion to the unrestrained demand associated

with automobile access, is unacceptable. As was noted on page X-46, more recent studies of parks have found that unrestrained use of park roads and parking lots by autos significantly reduces the recreational and environmental purpose of a park. Auto travel to parks must be restrained and managed. In addition, a rational public transit and alternate mode strategy must be established. Among the specific methods which can be used to restrain the auto are:

- °providing a limited number of parking spaces in or adjacent to the park;
- °providing satellite parking areas with shuttle buses;
- °limiting the internal road network in length and purpose; and,
- °encouraging carpooling.

If these and other step are taken, it will be possible to reduce the number of vehicular trips generated, especially in the immediate vicinity of the parks, and provide some inducement for people to use public transit or other alternate means of travel. The satellite parking lots could be so located as to minimize impacts on local roads and would be connected to the park by shuttle bus or other means. If it is possible, these satellite parking lots could be located adjacent to key transfer points and stations found in the four transit networks discussed in Chapter VIII.

If people are to be encouraged to use public transit, two planning goals must be achieved. First, the frequency of the public transit service must be sufficient so that people perceive that there is public transit service available. Second, the public transit provided should be convenient and the public transit vehicle comfortable; this applies especially to the storage of sports and outdoor related equipment, etc. The perception

the public has regarding the level of service offered and its convenience is critical in attracting riders to public transit. In the Recreation Access Study, which was mentioned earlier, it was found that people would claim that they could not use public transit because it did not exist, when in fact it did exist but on an infrequent or inconvenient basis. They regarded public transit as available only if it was equal to or greater than their perceived threshold for frequent and convenient service.

Public transit use to access parks and recreation areas usually ranges between 5% and 10%. For urban parks, an additional significant percentage of the visitors to the park get there by walking. The bicycle can be a significant mode of transport for park visitors, as noted. In suburban parks and large parks and recreation areas in outlying areas, 90% to 95% of the parks' visitors arrive by auto or other vehicle type.

Transportation Planning for the Parks, Highways and Roads

The only park which is closely related to the construction of a new road is the DeKorte State Park. This park would benefit from the extension of NJ Route 17 south of its present interchange with NJ Route 3. This road extension would be a more convenient route to travel for people coming from upper Bergen County and other points north and west of this park. This road would also lessen local community impacts associated with people using local roads to gain access to the park. It is anticipated that other local road improvements and extensions to these parks will be implemented as the result of the continuing development of the Meadowlands. For example, Losen Slote State Park, which is reached via Empire Boulevard, will benefit from improvements already planned

for this road, Moonachie Avenue, Redneck Avenue, etc.

The Environmental Education Center will not require any road improvements since it will be located within the New Jersey Sports Complex which is already served by an extensive highway and road network. As can be seen in Table X-12, the number of vehicle trips generated by this center is expected to be small, and this assumes that practically all visitors came be auto.

Public Transit

The following discussion will compare the four proposed networks with strong public transit components to the needs generated by the two parks and the Environmental Education Center. The purpose of this comparison is to determine what, if any, changes to the four proposed networks are required or if additional equipment purchases, beyond those already proposed for the networks, are needed.

The demand for public transit to Losen Slote State Park will be around 150 to 180 people per day. This level of demand suggest that a special public transit service be provided which is low cost but frequent and convenient. Either the bus or rail networks could serve this park using the smaller, 15-seat buses to shuttle between this park and the primary transfer points in each network, Meadows West and Berrys Creek respectively. The shuttle bus could also connect with Wood Ridge. No additional equipment would be needed to serve this park. In the bus transit network, as shown in Figure VIII-4, link F-2 operates in the vicinity of the park and serves the surrounding industries. In the rail network, as shown in Figure VIII-5, link F-2 operates in the vicinity of this park. Both the Busway and PRT networks run right past the southern entrance to this park. Thus both could easily serve its needs.

The demand for public transit to the Environmental Education Center will be very small and can best be handled as part of the greater demand for access to the Sports Complex. The smaller 15 passenger buses could easily shuttle people to and from the nearby bus and rail networks transfer points, Meadows West and Berrys Creek respectively. This service will be off-peak and should be integrated into other service routes.

The demands for public transit to the DeKorte State Park ranges between an estimated 1,200 and 2,500 per day. The upper limit assumes that the visitation to this park reaches the same level as that found at Van Saun Park in Bergen County. This upper limit was chosen solely to establish the maximum level of public transit ridership. The proposed transit networks all have an equal ability to serve this park. The bus network would require a special bus route shuttling between Meadows West and the Park and Kearny and the Park. The larger 40 seat buses should be used on the Meadows West link and 15 passenger buses on the Kearny link. Since this service would be provided in off-peak hours and since this study has already shown the potential need for additional buses, no equipment purchases will be required to serve the Park.

In some cases, as for example between Newark and the Park, the bus service might be more direct and not require a transfer at Kearny. Another example of where direct bus service might be warranted is from Jersey City directly to the Park. If both of these services were provided, Kearny would not be needed as a transfer point. Direct rail service might also be provided if a low cost rail stop were constructed on the Main Line. Here again, we are talking of off-peak rail services. Since off-peak rail service is limited today and the frequency during

the non-rush hour periods and on weekends would have to be increased.

The PRT and Busway-Vanpool Networks both have stops near the northern edge of the DeKorte State Park. If off-peak and weekend service were provided on these networks, they could adequately serve the Park. If the daily demand for public transit were closer to the upper limit of 2,500, there might even be sufficient justification to extend either of these networks slightly so that they entered the Park.

It is assumed that in addition to the external bus, rail and PRT services, an internal shuttle system will be available. This will be necessary not only to transport people who arrive by public transit around the park but also people who come by auto. It is anticipated that auto parking for this park will only be provided at its periphery and not inside. The internal shuttle system could be small motorized trams or other appropriate technology.

In summary, depending on the availability of non-peak and weekend public transit services on the four networks, the demand for public transit access to the DeKorte State Park will be satisfied. Further analysis of each of these networks will have to be completed to provide frequent and convenient park services at these times. Neither of the two parks, nor the Environmental Education Center, require that additional transit equipment be purchased to meet the projected demand. The Busway-Vanpool Network and the PRT Network, might be extended in the more distant future to serve the DeKorte State Park. Transit needs will be further defined as more information concerning the activities and facilities at the two parks becomes available.

Bikeways

As part of the transportation study, a preliminary bikeways study was conducted. This study was divided into two phases. The first phase was designed to determine the extent to which the bicycle can serve as an alternative means of transportation, to study the general feasibility of establishing a bikeway network in the Meadowlands area and to recommend items for further study or consideration. The second phase will investigate specific bikeway routes and implementation procedures and will recommend a detailed bikeway plan for the Hackensack Meadowlands District. This chapter summarizes the findings of the Phase I Bikeways Study.

The Bicycle as an Alternative Means of Transportation

Bicycles were an important means of transportation long before the automobile. In 1897 when only a few autos were on the road, about 1 million bicycles were produced. Unfortunately, bicycle production and use declined rapidly not long thereafter and as a means of transportation was quickly overshadowed by the automobile.

While bike usage was generally low in the United States between 1900 and the 1950's, temporary resurgence did occur during the Depression and the two World Wars because of fuel scarcity and high transportation costs. Since 1950 bicycle sales have increased dramatically. More important than total sales, sales of lightweight bicycles to adults has increased. Fifty percent of all bicycles sold between 1970 and 1974 were sold to adults.

In Europe the bicycle still accounts for a considerable portion of the daily travel in some large cities. For example, in Copenhagen, Denmark, 17% of all trips are by bike, in Upsala, Sweden, 20% and in Rotterdam, Holland, 43%.

While the bike will never approach the relative importance of the automobile in this country, it can be an effective part of an overall transportation system. This importance lies not necessarily in the magnitude of ridership it might attract, but in the provision of an alternative means of transportation for those who need or want an alternative to the automobile. Bicycle availability increases mobility for the transportation deprived. It also promotes healthful exercise and can help to reduce auto traffic congestion somewhat for those who must ride. Other benefits occur through increased bike useage--reduced petroleum consumption, (the bicycle is one of the most energy efficient means of transportation), reduced air pollution (2 to 10% by EPA estimates), and monetary savings (bicycle transportation is far cheaper than even the most subsidized mass transit). There are however a number of negative aspects to bicycle transit at present:

- bicycle accidents are increasing
- bicycle thefts are increasing
- the bicyclist is exposed to air pollution along the roads
- the bicyclist is unprotected from winds and weather
- the bike is a slow means of transportation

Some of these deterrants to cycling can be at least partially overcome through a comprehensive bikeway facility improvement program.

Bikeway Definitions

"Bikeway" is a general term which refers to any right-of-way designed or improved so as to make bike travel safer, more convenient or more enjoyable. Bikeways are subdivided into three classes:

Class I - Completely separated right-of-way designed for the exclusive or semi-exclusive use of bicycles. Auto conflicts are virtually eliminated. These bikeways or "bike paths" are typically found in parks and recreation areas and large new planned developments. They are also often located along existing utility right-of-ways, railroad right-of-ways, riverbanks or other long strips of unbroken open space.

Class II - A shared right-of-way but with a designated section of the right-of-way for used by bicyclists. Auto conflicts are minimized. These bikeways are also known as "bike lanes" and are normally developed within the right-of-way of existing streets on an existing shoulder, extra wide paved lane near the curb or where parking can be eliminated along the curb.

Class III - A shared right-of-way with signing or other minor alterations to improve bike travel. Auto conflicts may be frequent. These bikeways are also known as "bike routes" with signs directing cyclists along existing streets which have been found to be relatively safe; that is roads that are wide, in good condition, and have low auto speeds and usage.

When used in the context 'bikeway study', 'bikeway plan' or 'bikeway improvement'. the term "bikeway" is meant to include items such as parking, intermodal integration improvement, education and information, etc.

Bikeway Demand

Estimating bikeway demand is the most difficult task in bikeway planning. Bikeway construction is relatively new--bikeway planning even newer. Only a few studies have been completed to date which quantify the factors relating to demand and these studies are often site specific

and do not cover all the relevant factors. Factors relating to Bikeway Demand include the following:

Geography and Land Use--Basically speaking you need people with a place to go before you need transportation--and for bicycle transportation the place to go must be relatively close. Medium or high density housing provides the people, areas of employment, recreation and shopping provide the place to go. Travel time is an important factor in all transit decisions. Because of the relatively slow speed of the bike, it can only compete with other modes of travel for short trips up to 3 to 6 miles.

Topography such as steep slopes may limit bicycle usage. Attractive scenery on the other hand can enhance riding and foster bikeway demand.

Bikeway Facilities Availability--Like other means of transportation, the bike requires a surface and an area on which and through which to traverse. For years bikes have been using the public roadways as their main, if not only, route. Roadways, however, have become increasingly crowded and the cyclist is at an obvious disadvantage, competing with automobiles and trucks for roadway space. Poor road surface, in addition to presenting a safety hazard, is a strong deterrent to bikeway usage. The cyclist is slowed and subjected to shock and vibrations and his bicycle is subjected to possible damage. Noise and air pollution are two other negative qualities which will deter the cyclist from using heavily traveled roads. What the bicyclist prefers is a wide, well paved surface removed from contact with heavy motor vehicle traffic.

Climate and Environmental Conditions--Cold weather with snow and ice curtail virtually all bicycle activity. But it is the snow and ice, not the temperature, that appears most significant.

Other factors relating to bikeway demand are; demography, trip purpose, bicycle availability, public attitude, and economics.

Fortunately, rigorous demand projections are not needed for satisfactory bikeway planning. It has been recommended that travel mode data be utilized to examine existing total travel within bikeable range, "and the estimate bike potential from that rather than attempting to synthesize bicycle trip projections directly." (FHWA's Safety and Locational Criteria for Bicycle Facilities-User Manual, Volume 1).

Demand Projections for the Hackensack Meadowlands

Within the Meadowlands District today there are a number of travel generators. Major employment centers are found in the Carlstadt/Moonachie/South Hackensack area, the East Rutherford/Rutherford/Lyndhurst areas, and the Secaucus area. Smaller employment areas can be found in North Bergen, Jersey City, and Kearny. A major recreational facility is the New Jersey Sports Complex, in East Rutherford. Downtown Secaucus along Route 3 forms a minor commercial center. Existing developed areas are shown in Figure X-8.

The employee origin-destination survey conducted as part of this transportation study serves to quantify some of the present travel within bikeable range. Origins of journey to work trips as a percentage has been shown in Figure V-5. This figure is reproduced in Figure X-9 with the following additions: 5 and 10 mile radius circles, measured from the center of the District; and, an area identified as Zone 1 which includes

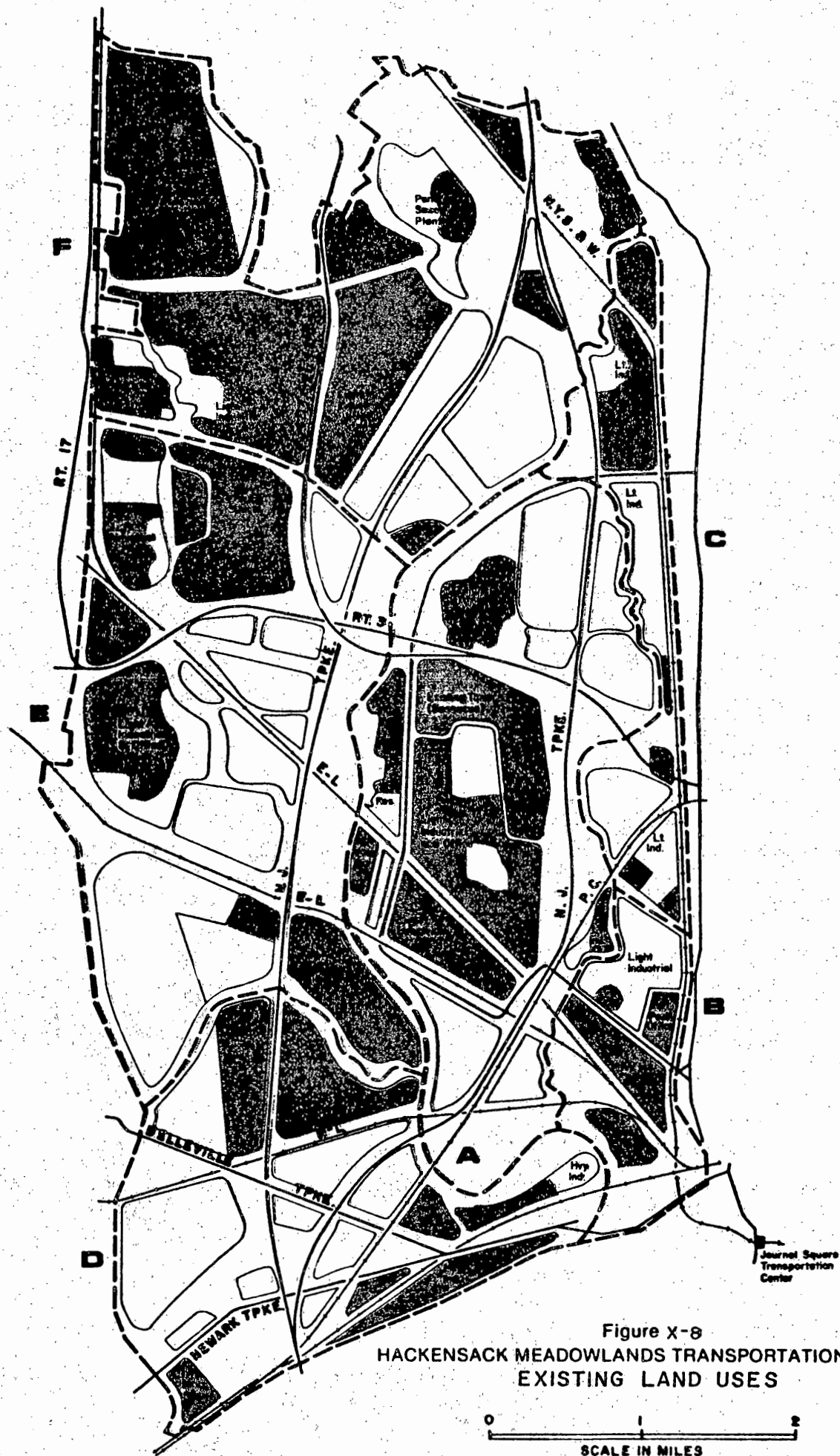
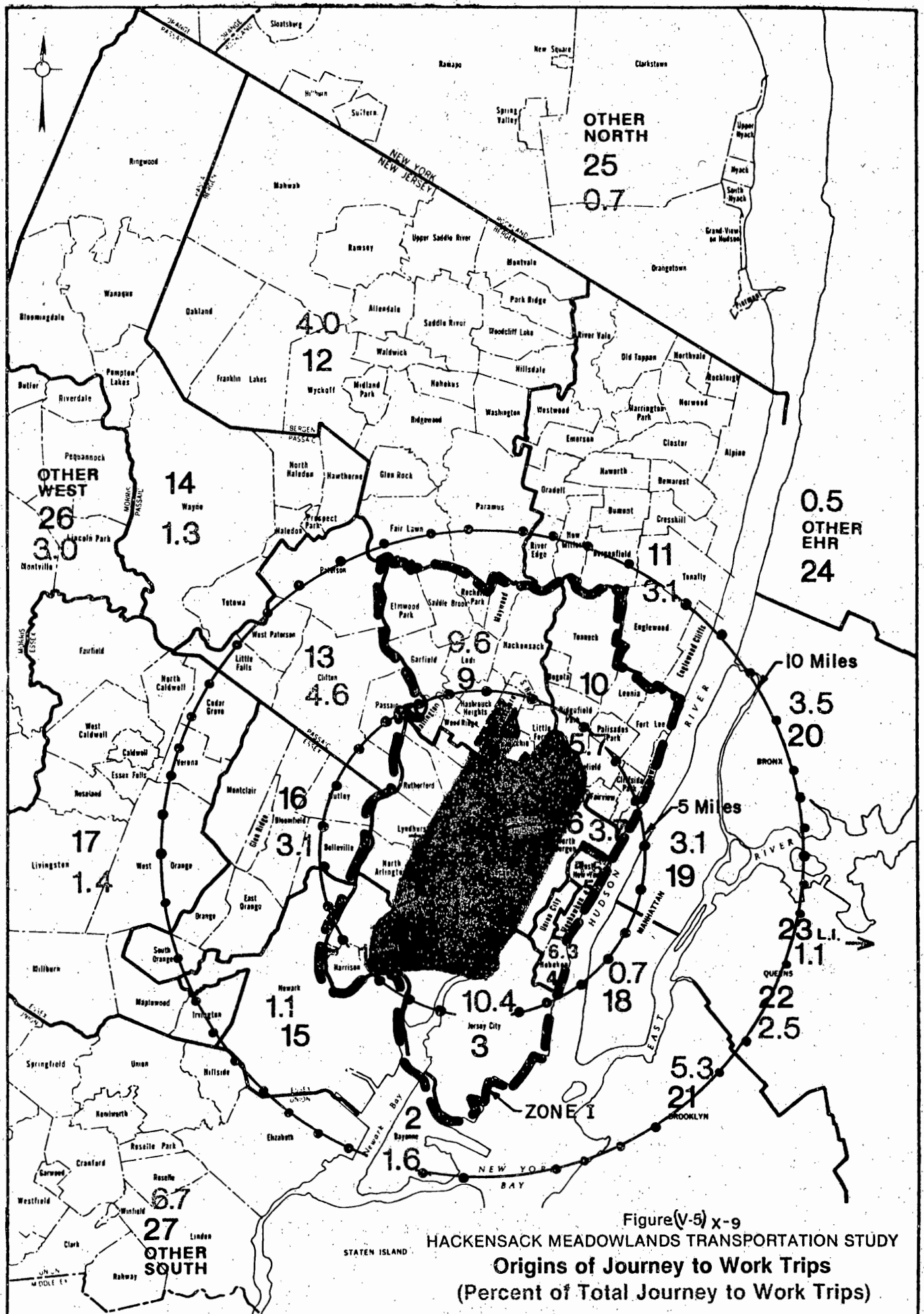


Figure X-8
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
EXISTING LAND USES

0 1 2
SCALE IN MILES



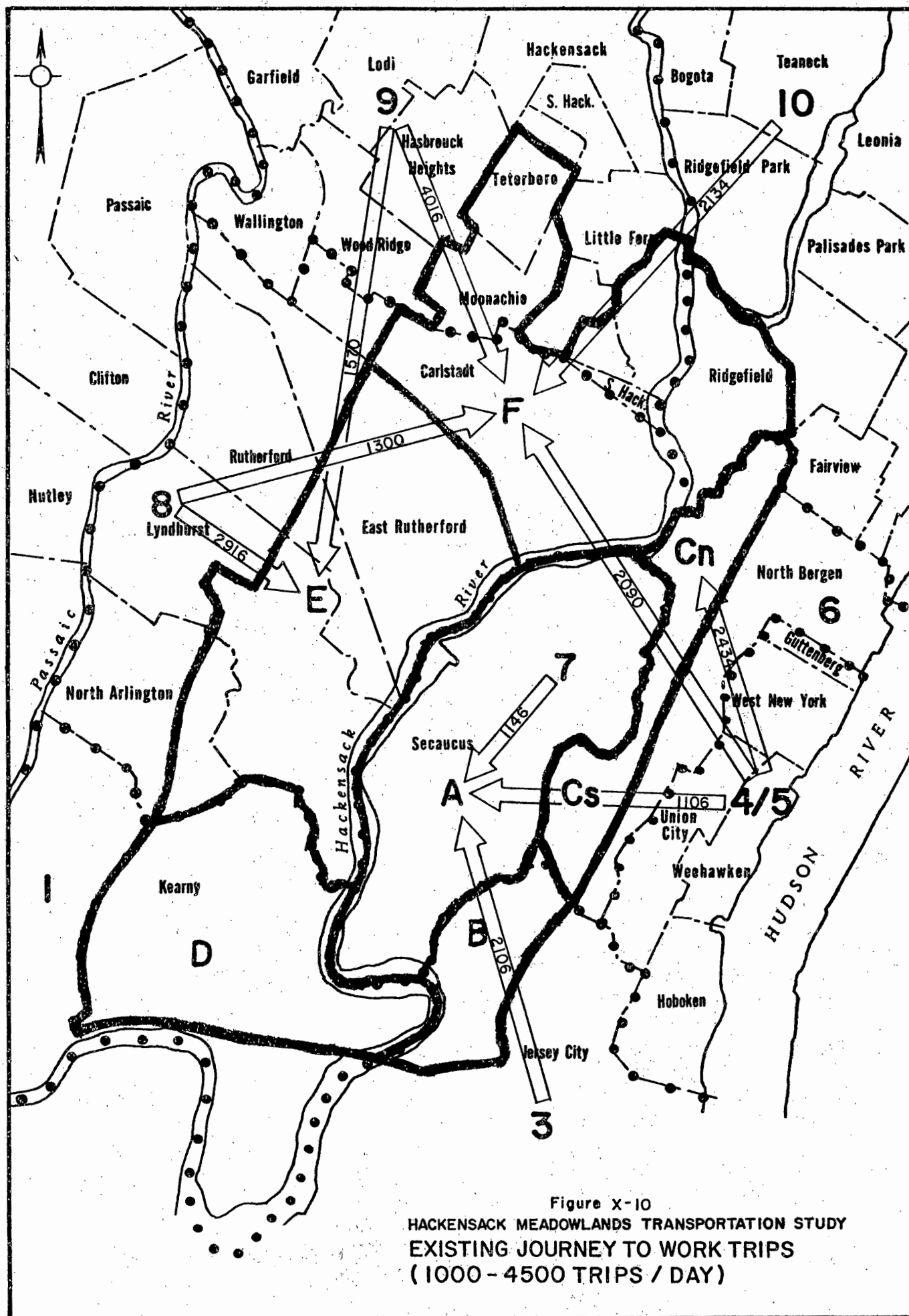
Figure(V-5) x-9
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Origins of Journey to Work Trips
 (Percent of Total Journey to Work Trips)

study origin zones 1,3,4,5,6,7,8,9, and 10. Figures X-10 and X-11 are based on the origin-destination survey and records the total journey-to-work trips for most trips from within Zone I to the HMDC for present development. The lines shown represent commuter 'desire lines'.

Future development within the District will greatly increase travel generators and therefore bikeway demand. Peak hour employment will increase from 28,034 in 1975 to 99,717 at full development. Berrys Creek Center will develop as the major commercial center within the District. Recreational activity will greatly increase in Kearny and North Arlington with the development of the proposed 2000 Acre DeKorte State Park. Most importantly, future development will add major new population centers within the District. Full development land use within the Meadowlands District was shown in Figure I-2. Figures X-12 through X-14 and X-15 through X-16 show full development journey to work trips from outside and within the HMD respectively.

In addition to riding to work, the bicycle may serve as transportation for other utilitarian trips. Riding to school is presently the most common use. Trips for shopping or for other business are also possible. Trips to recreational facilities have been classified as both recreational and/or utilitarian rides. The recreational aspect of cycling in fact deserves further discussion.

In New Jersey, bike riding has been cited as the number one recreational demand. The present supply of bike riding facilities falls far short of meeting the demand. The Commission, as one of its goals, will seek to develop recreational bikeways as part of its overall park and recreation plan. The most important recreational bikeways will probably



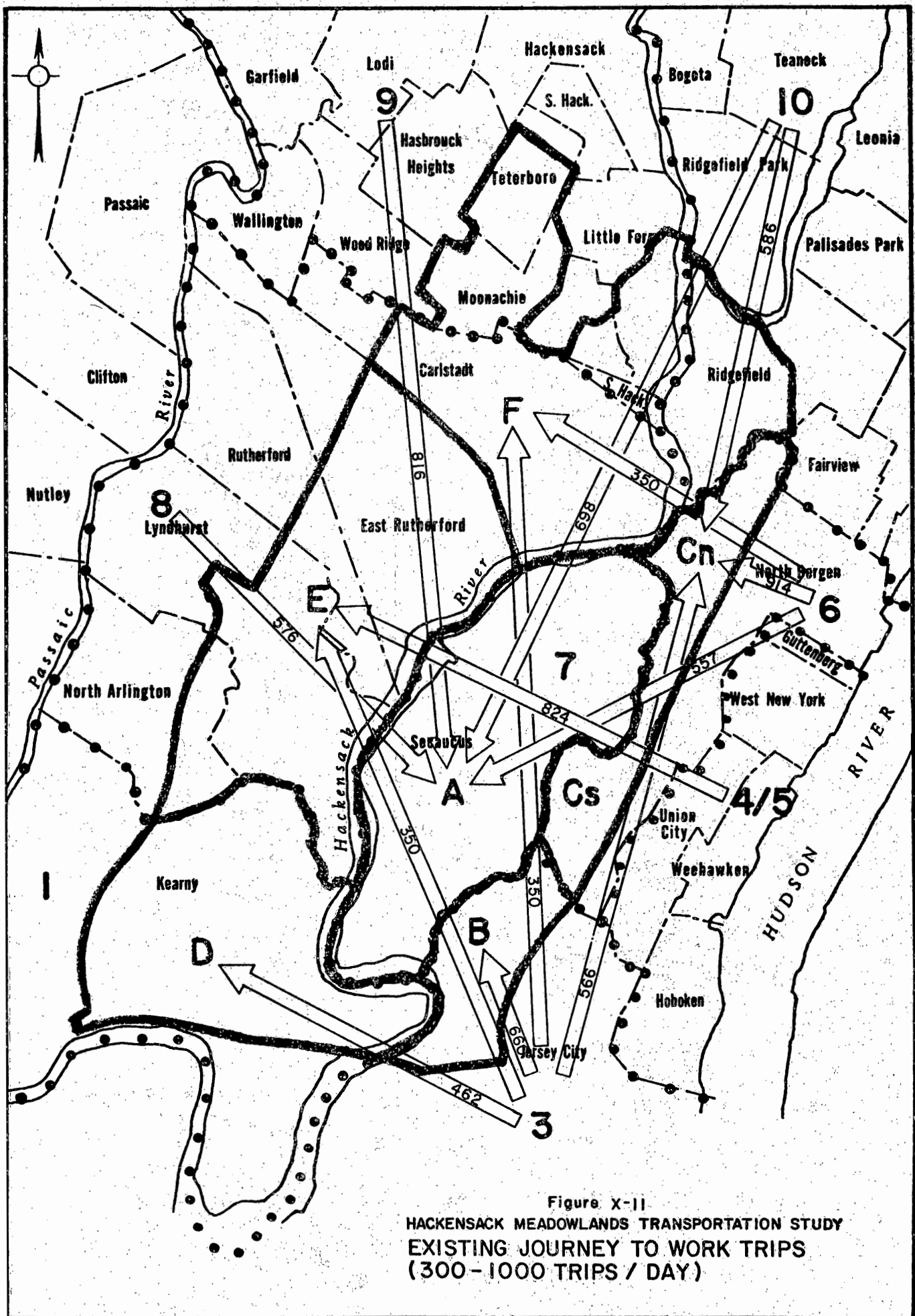


Figure X-11
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 EXISTING JOURNEY TO WORK TRIPS
 (300-1000 TRIPS / DAY)

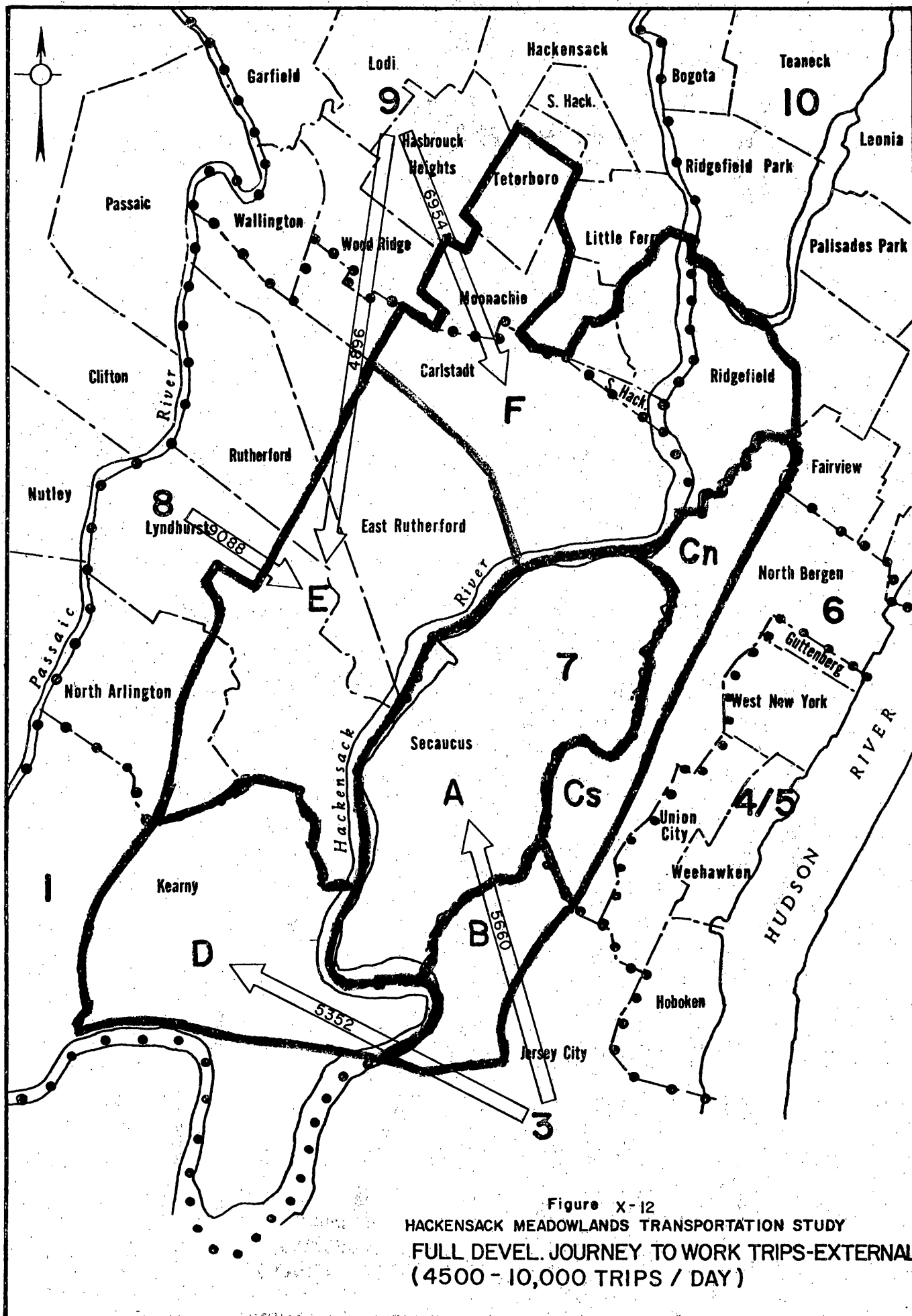


Figure X-12
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 FULL DEVEL. JOURNEY TO WORK TRIPS-EXTERNAL
 (4500 - 10,000 TRIPS / DAY)

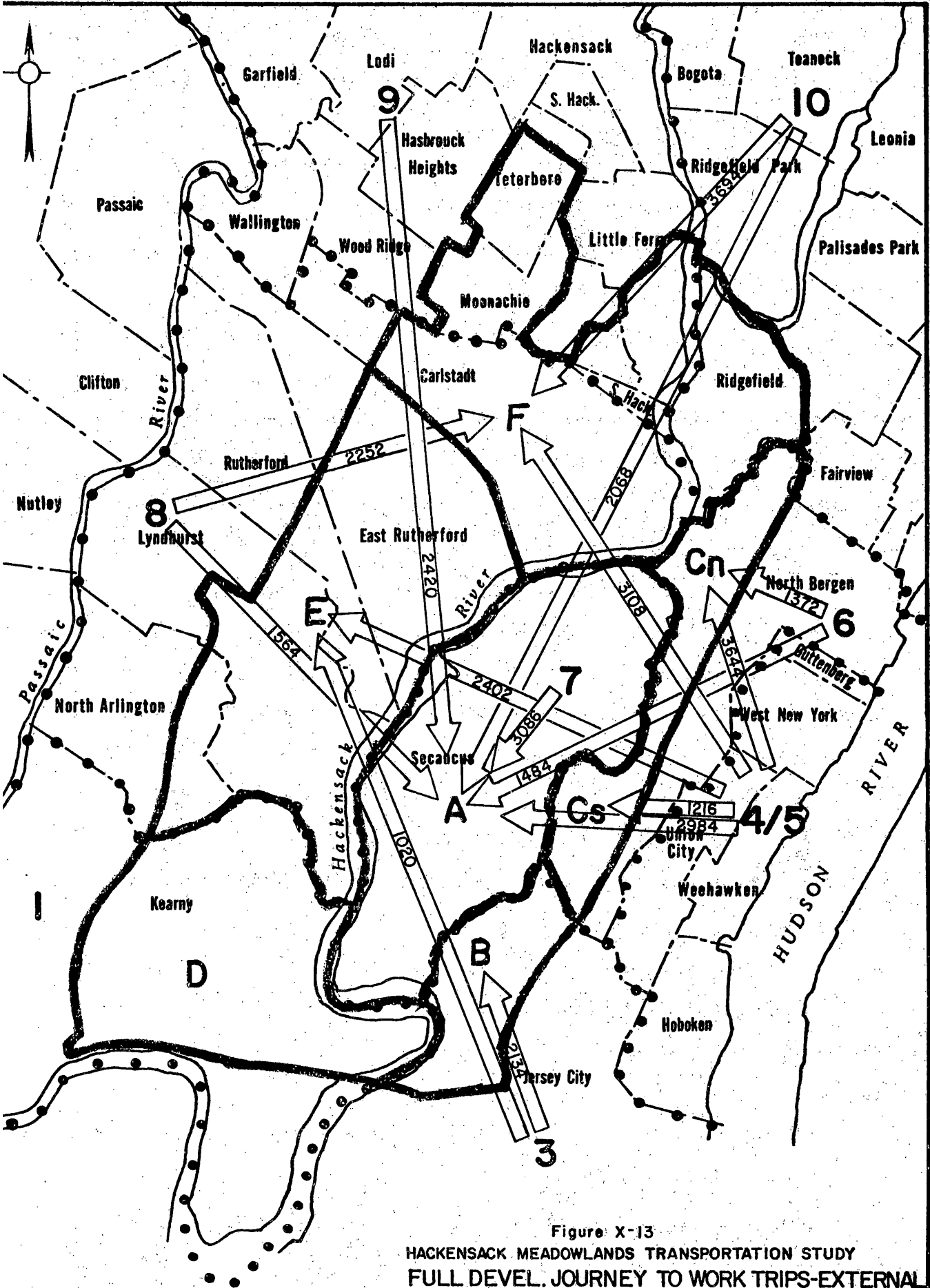


Figure X-13
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 FULL DEVEL. JOURNEY TO WORK TRIPS-EXTERNAL
 (1000 - 4500 TRIPS / DAY)

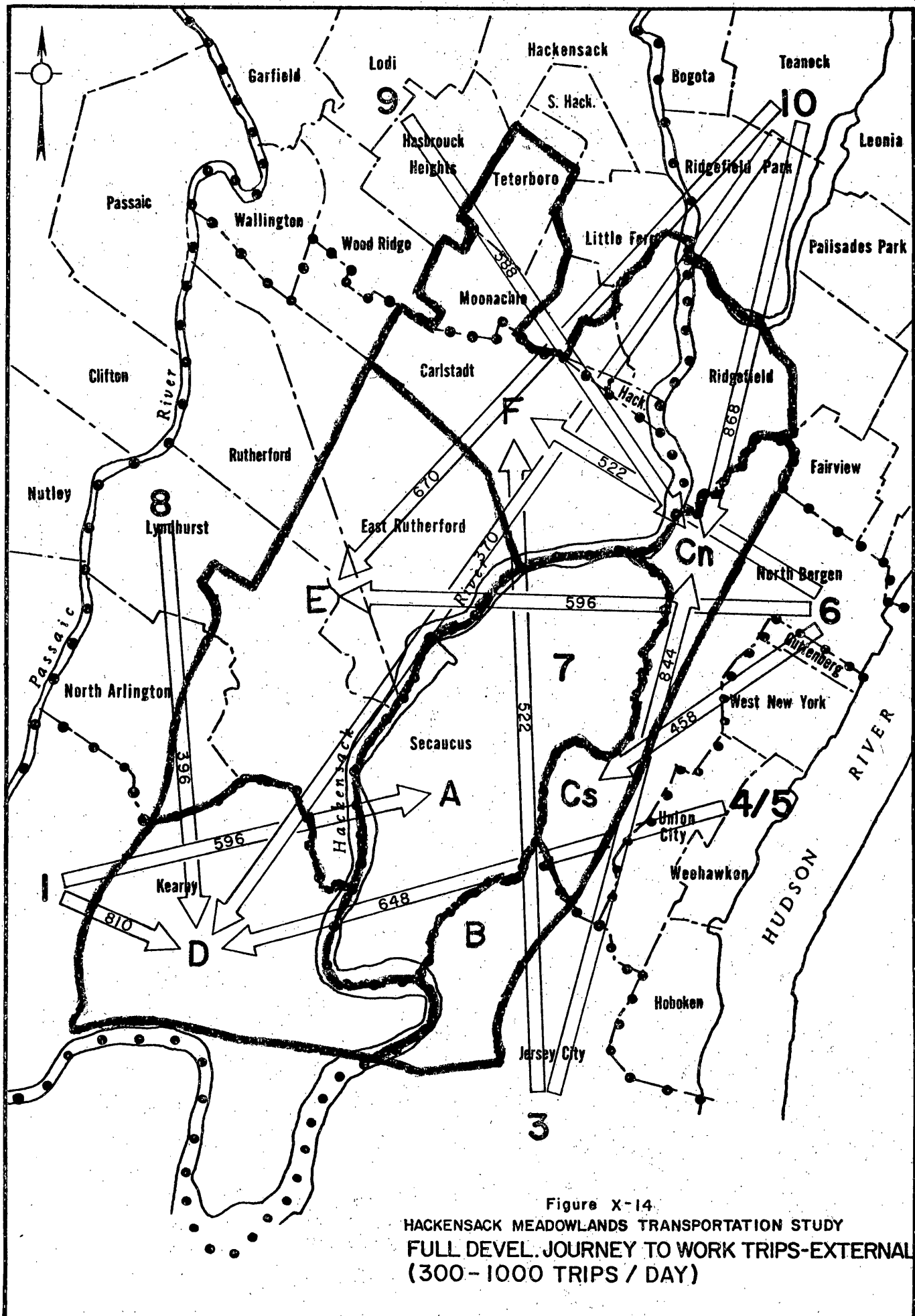


Figure X-14
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 FULL LEVEL JOURNEY TO WORK TRIPS-EXTERNAL
 (300-1000 TRIPS / DAY)

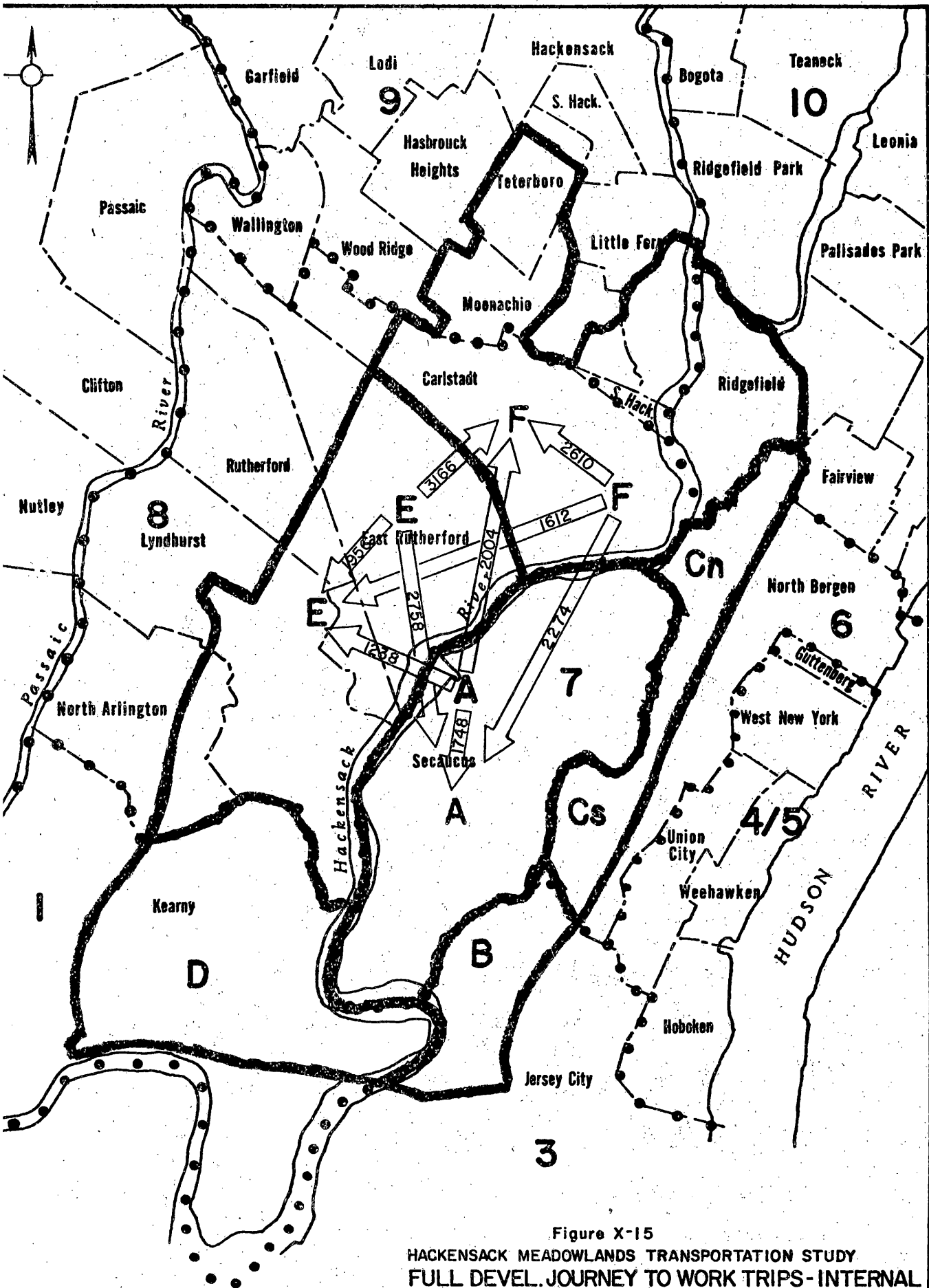


Figure X-15
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 FULL DEVEL. JOURNEY TO WORK TRIPS-INTERNAL
 (1000-4500 TRIPS / DAY)

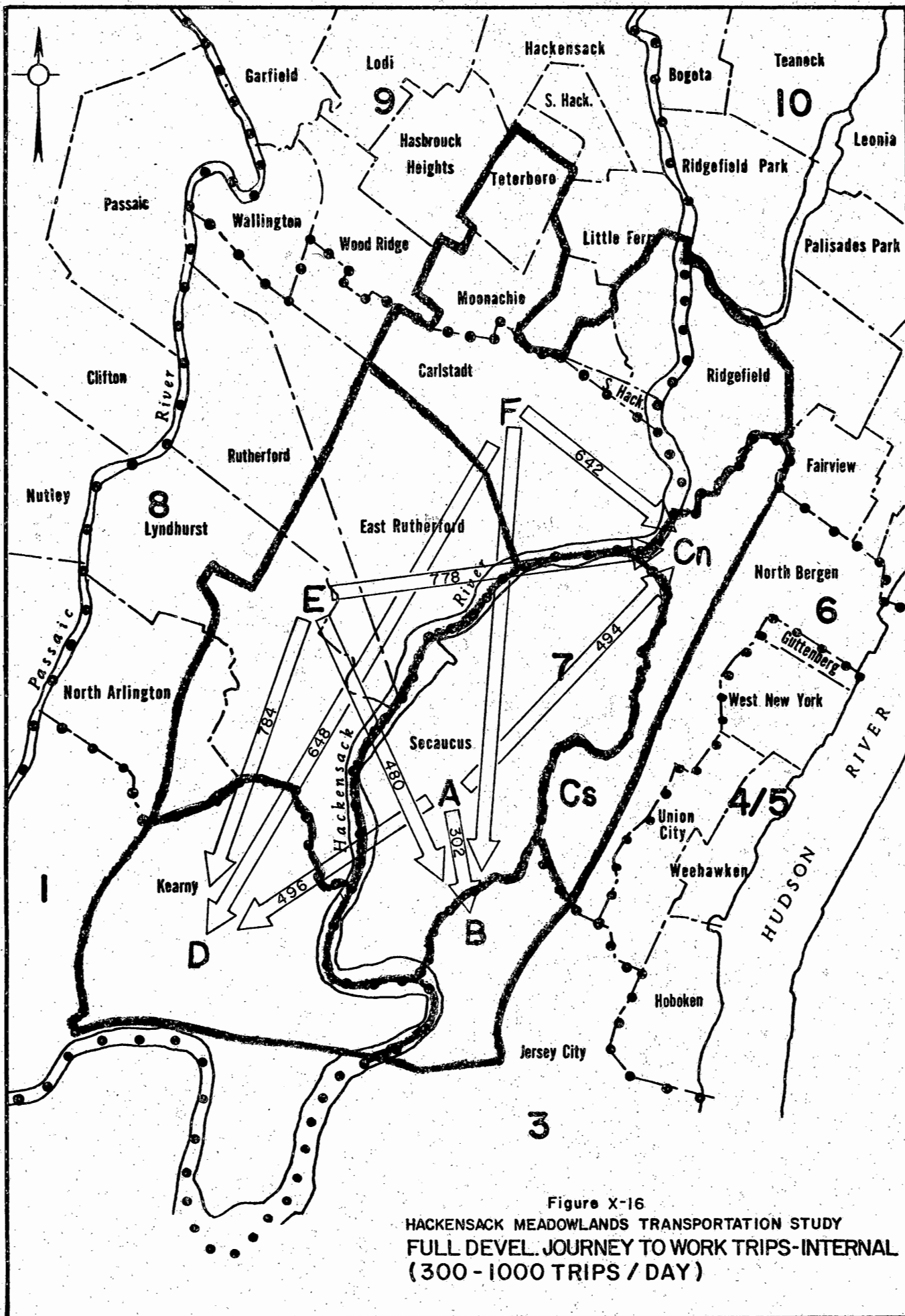


Figure X-16
 HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
 FULL DEVEL. JOURNEY TO WORK TRIPS-INTERNAL
 (300 - 1000 TRIPS / DAY)

be located within the proposed 2000 acre DeKorte State Park. Additional bikeways can be developed from this park to other recreational facilities. Many of the people who wish to ride a bike for exercise or pleasure will use their car and a bike rack to reach the park. Residents from adjacent towns, however, may wish to ride directly to the park by bike, either for further bike riding or to engage in other recreational activities. Again - some trips are both recreational and utilitarian.

Specific bikeways may serve the recreational cyclist, utilitarian cyclist, or both. For example, a bikeway along the Hackensack River through DeKorte State Park may be used by recreational bikers in DeKorte or by commuters from Carlstadt headed to jobs in Kearny.

Bikeways may serve another dual purpose. Individuals who initially buy a bike for park riding may, once introduced to the District bikeway system, realize that riding to work is both possible and practical. Present recreational cyclist are prime candidates for future commuter cyclists.

Figures X-10 through X-16 show total journey to work trips. How many of these trips might be made by bike? As stated before, few studies have been completed which quantify bikeway demand:

1. A study in Harrisburg, Pennsylvania found that about 5 of every 1000 employees commuted to work by bike, that is, one-half of one percent.
2. In Davis, California, 40% of all rush hour traffic was bicycle traffic.
3. Demand in some European cities was already cited at 17%, 20% and 43%.
4. The Harrisburg study estimated that commuter cycling would see a three fold increase in the future.
5. An estimate of 1-3% has been made for daily commuting bike usage in some Canadian cities.

6. A study for the Bicycling Institute of America estimated 1-2% of all U.S. commuting trips might be made by bike.
7. Based on a survey for the EPA in Philadelphia, it was felt that 5-10% of all commuting trips under 6 miles could be expected by bike.

In order to narrow down the above one-half to 43% range in bikeway commuter demand, the demand factors discussed in the previous section were applied to the Meadowlands District.

Geography and Land Use

The land use layout of the District and surrounding area is ideal. Large populations will be located within the 3-6 mile bikeable range of large employment, recreation and commercial centers. Average distances have been estimated for all commuters from Zone I in Figure X-9 to each District employment zone. Based on these distances and the number of journey to work trips for each zone it was determined that for full development, 53% of all journey-to-work trips originate within Zone I. The maximum Zone I trip distance is 10 miles. The average trip is only 3.6 miles long. Almost 90% of the Zone I trips are 5 miles or less. This represents about 48% of all trips and since portions of zones just outside Zone I are within five miles of the District, it is probably safe to assume that one-half of all HMD journey to work trips are 5 miles or less in length.

Unfortunately topography of the area around the District is not ideal. Ridges along both sides of the District will reduce demand for rides originating in those ridge areas.

Climate and Environmental Conditions

Snow and ice can be expected for much of the winter and will significantly reduce bicycle usage for those months and result in somewhat lowered demand during other months. Demography, bicycle availability, public attitude, and economics are probably similar in this area to other urban areas in the U.S. For future demand, the Phase I Study found the following:

1. Land use and geography are conducive to high bikeway demand although topography (steep slopes) will lower demand for trips to and from the ridges.
2. Demography and bike availability are about average and should not, in themselves, limit demand.
3. Climate and environmental conditions are not ideal and will lower demand somewhat.
4. Transportation costs are probably average and therefore promote bike demand. If auto operating costs (gas prices) increase, or parking costs increase, as appears likely, demand should increase even more.
5. Public attitude in this area is probably neutral or possibly negative due to the past disregard for cyclists, and may therefore inhibit initial demand.
6. Facilities availability thwarts all cyclists today. Future usage would appear potentially good from the above demand factors and will be determined by the quality of facilities that can be developed to serve the cyclist.

Based on all of the above, an estimate of future bikeway demand of 2-5+% for work trips under five miles seems reasonable for the Meadowlands area. Added to this will be other utilitarian and recreational trips.

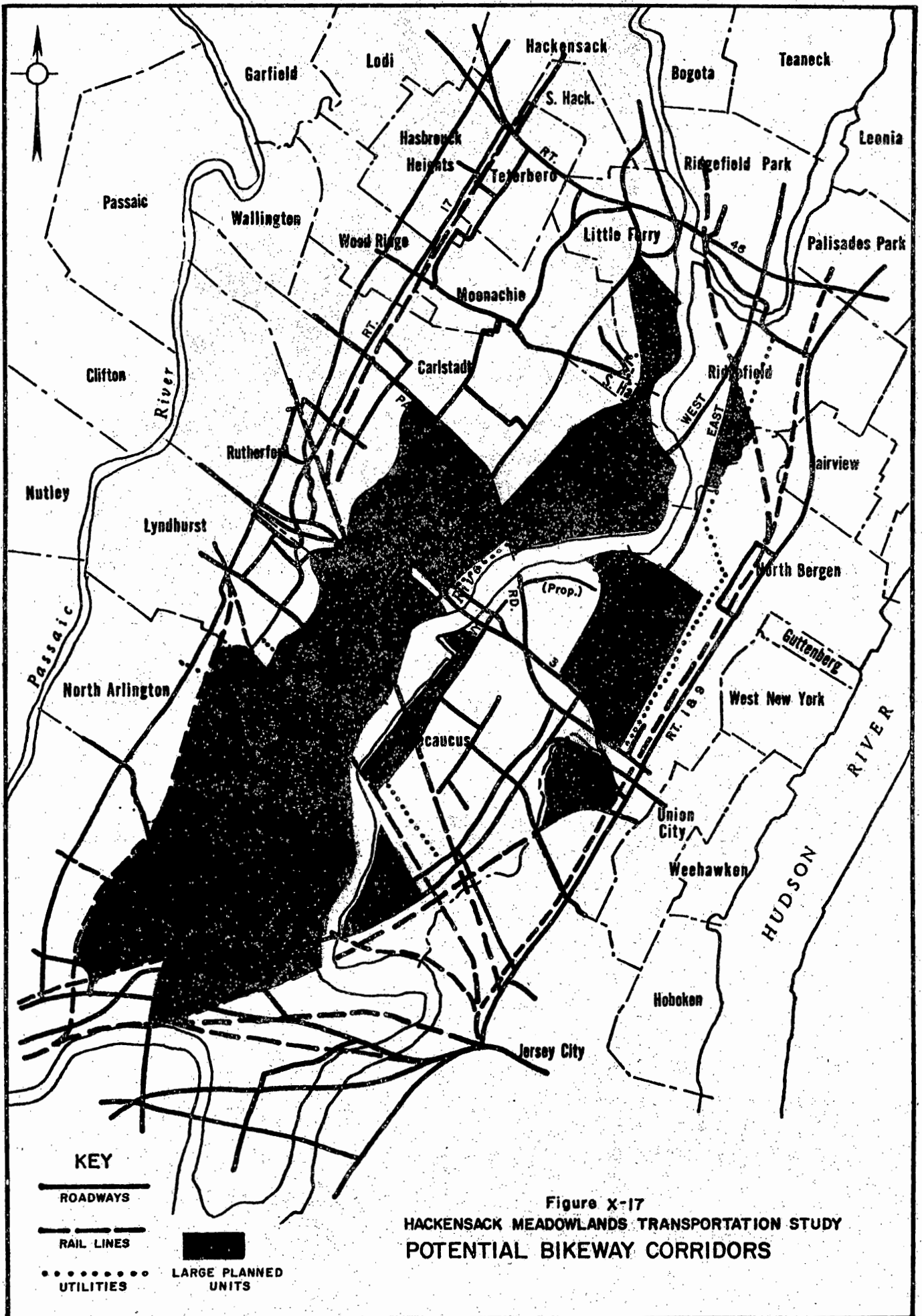
Obstacles and Corridors

Desire lines represent potential trips as a straight line and clearly for the cyclist this path is desirable because it represents the potential minimum output on his part. Physical constraints however may prevent the

cyclist from following this ideal route. Physical constraints include natural features such as waterways, wetlands, and topography, and man-made features such as rail lines and roads. Numerous physical constraints are present in the Meadowlands area and must be dealt with. The most difficult is the Hackensack River which divides the District in half. Cyclists are also constrained to existing paths or roadways. Existing bikable roads are extremely limited. It is probably the lack of existing bikeways or bikable roads that holds down present bike usage to almost nothing.

Fortunately, within the District there are numerous right-of-ways which are potential bikeway corridors. These include areas around high tension lines, underground pipelines, highways and rail lines. In addition to these linear corridors all of the HMDC Specially Planned Areas can be considered potential bikeway corridors since they are developed in a comprehensive manner where bikeways can be easily integrated into the overall plan. This is probably one of the unique qualities of the Hackensack Meadowlands District in reference to bicycle development potential. Figure X-17 show the potential bikeway corridors within the Hackensack Meadowlands District.

Since no detailed corridor evaluations have been completed to date, it is impossible to say exactly what class of bikeway will be most appropriate for each individual corridor. However, based on available data and a number of assumptions, it has been estimated that an effective recreational and utilitarian bikeway network would include about 30 miles of Class I bikeway and 60 miles of Class II bikeway. One assumption was that all bikeways within DeKorte State Park would be Class I, that a



Class I bikeway would follow the length of the Hackensack River, and that sufficient other Class I bikeways would be constructed to allow all HMDC residents to reach DeKorte State Park. A second assumption is that commuter oriented bikeways would be Class II and would follow existing or proposed roads.

Intermodal Integration and Ancillary Facilities

The bicycle as a mode of transportation can be combined in a number of ways with other forms of transportation. Such dual mode transit can be achieved in three basic ways with the bicycle. The bike can be ridden to a transit station, parked, with the rider continuing on to his final destination. The bike might also be taken aboard the second transit mode and make the complete trip with the rider. The third option sees a disembarking transit rider renting a bike at the transit station to finish his journey to work. All methods of intermodal integration could be utilized effectively in the HMD. A good example would be PR-2 residents using their bikes to reach the Berrys Creek Center transit station about a mile and a half away. Here the bike is left in a secure parking area with the traveler continuing on to New York City via a mass transit mode. Most other proposed HMDC transit stations provide this same opportunity.

The most important facility that must be provided, in addition to the bikeway itself, is secure parking. Being able to bring the bike right into the office or working area is probably the preference for most cyclists. Bike lockers which completely enclose the bike are commercially available, although expensive, and do provide the necessary security. Other parking devices are also available.

The motorized bicycle, moped, is the newest form of transportation in this area and deserves further study as to its possible integration into a bikeway study.

Legal and Institutional

There are a number of very important legal and institutional questions which must be resolved in developing, implementing and operating a comprehensive bikeway system for the Meadowlands area.

Costs

Without detailed corridor analysis, it is impossible to make true cost estimates. However, in order to arrive at an estimate, Class I bikeway construction can be assumed at \$40,000 per mile and Class II at \$4,000 per mile. It is estimated that a bikeway network in the HMD would cost between \$2 and \$3 million.

Conclusions and Recommendations

Based on the Phase I Bikeways Study, the following conclusions have been reached:

1. The bicycle is an alternative means of transportation that can form of overall transportation plan.
2. Increased bike usage can help to reduce fuel consumption, reduce air pollution, reduce traffic congestion and noise, provide exercise, and reduce transportation costs.
3. There are a number of deterrants to bike usage - lack of safety and security, exposure to pollutants, poor intermodal integration, poor weather, and low speed. Bikeways can reduce these deterrants.
4. The unique planning and regulatory powers of the Commission, combined with the vast amount of undeveloped areas in the District, and the number of road, rail, and utility ROW's crossing the

District, present an unprecedented opportunity for development of a comprehensive bikeway network.

5. Future demand within the District should be high because of extremely favorable land use and geography, and ranges from 2-10% of all work trips under 5 miles.
6. Future usage will be determined to a great extent by the quality of bikeway facilities developed to serve the cyclist.
7. Secure parking, improved intermodal integration, and proper maintenance of the bikeway riding surface are among the necessities for maximum bikeway usage.
8. The motorized bicycle may be an effective addition to the bicycle as an alternative means of transportation although they present a number of questions and difficulties.

Based on the Phase I Bikeways Study, the following recommendations are made:

1. That the Phase I Bikeway Study be disseminated to interested parties for comments and suggestions and that a public participation program be developed.
2. That a Phase II Bikeways Study be initiated and include the following: An evaluation of all potential bikeway corridors, refinement of bikeway demand projection factors and estimates of demand for each specific bikeway, substantial additional study of bicycle parking, intermodal integration, bikeway maintenance and educational programs, the moped, and development and recommendation of an overall long range bikeway plan for the HMD.

3. That consideration be given to conducting a special bikeway survey in order to gain further insight into bikeway needs and demands.
4. That an Interim Bikeway Plan be developed and adopted so that bikeway opportunities are not lost between now and adoption of an HMDC Bikeway Plan. The following items should be studied for possible inclusion in such an Interim Bikeways Plan:
including bikeways as part of proposed road improvement projects;
including bikeways in the General Plan studies for Specially Planned Areas, and providing bicycle parking in the development of major new office, public, recreation, or commercial facilities.
5. That priority be given in the Phase II Study to evaluating bikeways that presently have sufficient demand to warrant construction and that applications for funding be submitted as soon as possible.

Summary and Recommendations

The four sections of this Environmental Analysis Chapter have dealt with Land Use/Transportation Interrelationships and Impacts; Projected Air Quality Consequences of Various Transportation Alternatives; the Reciprocal Impacts of Park Planning On Transportation Network Choices; and the possibilities offered by Bikeways both as a journey-to-work alternative and as a recreational activity.

The interrelationships among the four are, of course, immediate and synergistic. Clearly, for example, the balances struck in the land use plan for the Hackensack Meadowlands have specific meaning for various transportation alternatives, and this for various air quality outcomes.

There were two theories advanced, back in 1970-1972, about Hackensack Meadowlands Air Quality:

1. That the Hackensack Meadowlands formed a wind tunnel which, because of its Southwest to Northeast valley configuration, hastened the dispersal of pollutants blown into that valley from its surrounds; or
2. The Hacksack Meadowlands, given their lower "valley" elevations, formed a "sink" into which pollutants would collect and concentrate.

The Hackensack Meadowlands 1970-1972 AQUIP (Air Quality in Urban and Industrial Planning) model study, then the nation's most sophisticated attempt to predict air quality from land use and air quality data, indicated that the first of the two alternatives was the more likely. Specifically, that model, using Newark Airport's records of wind patterns, and mathematical calibrations extrapolated from State Air Quality monitoring stations in Newark, Elizabeth, Bayonne, and Paterson, predicted that by the year 2000, then anticipated as the date when the Master Plan's complete mix of developed and open spaces would be attained, 97-99%

of the pollutants which would collect in the Hackensack Meadowlands would be blown in from its region; and that 1-3% would be generated by its "own" land uses. The model did not anticipate that these pollutants would collect and concentrate in the Hackensack Meadowlands. That study, also indicated that the Master Plan's mix of land uses were the best of the five alternatives studied--that is, it was this mix of open and developed spaces, both as to location and type of land use, which produced the 1-3% additions to what would be found here if the Hackensack Meadowlands were not developed at all.

The air quality modeling done in this study looks much more closely at that 1-3%. For one, the AQUIP model's wind rose data was adjusted this time to reflect the higher wind speeds monitored here, than those monitored at Newark Airport. Thus the "wind tunnel" effect has been shown, since 1972, through actual monitoring, to be more pronounced than was originally anticipated. Secondly, actual air monitoring data was in-putted in place of the 1972 mathematical extrapolations. Thirdly, the AQUIP model was also run again for this study to reflect the 38 zoning changes which have occurred since the original model was assembled.

It is important to note here that those changes resulted in no significant changes in the mix of land uses save to add some 300 acres of open space. Fourthly, the Transportation Study, in looking to maximize our understandings about the 1-3% range mentioned above, added transportation and air quality projections for specific transportation alternatives--roadways, rail lines, busways and personal rapid transit lines--which could associate with the Master Plan's mix of land uses.

Within the 1-3% range of room to make Environmental Quality decisions for the Hackensack Meadowlands District, the air quality analysis finds little air quality differences among the 4 transit alternatives, but a significant difference between these 4 and the all highway alternative. Thus choosing any one of the mass transit alternatives produces much the better air quality result than choosing the all highway scenario. This conclusion should be read, we feel, as the study's major environmental finding.

But other environmental effects determined in this study of transportation alternatives are also significant to note. Among them were the following:

The major environmental impact on open space, for one example, rests in the ability of particular transportation-served land use patterns to generate particular patterns of open space; with wetland open space the most ecologically significant among them. Considerable attention was given, in the first section of this chapter for example, to the capacity of the Master Plan's Specially Planned Areas to generate considerably more (and more valuable) wetland open space than can the State's tidelands claim generate alone. It is, in fact, the joining of these techniques by the Open Space Map and Plan which maximizes on wetland conservation.

Thus a transportation network which intelligently connects the region's network to the Specially Planned Areas not only capitalizes on the environmental benefits of clustering; it reduces dramatically, by so doing, the infrastructure "grid" impacts on specific waterways and on specific wetland expanses. Thus this analysis chapter concludes-- and it is the second major environmental conclusion of this study-- that

the internal, transit-oriented networks are particularly sensitive to wetland open space planning in the Hackensack Estuary.

Thirdly, this environmental analysis calls attention to the environmental data base, in research and monitoring studies performed here since 1970, which serves as the basis for the carrying capacity conclusions here. Not only does the Master Plan, at each of its steps (including its transportation steps) call for an expanding of this data base. It calls, as well, for the types of operational monitoring which permit an evolving sense of whatever changes occur in the Hackensack Meadowlands District's various indices of carrying capacity.

Regarding the environmental aspects of the Bikeway networks described in this Study as significant adjuncts to the various vehicle oriented networks, we call special attention to several aspects of environmental quality which can be advanced by such bikeway planning. First, bikeways offer a convenient and thrifty "transit" alternative or adjunct to the automobile (or to the bus, the train or Personal Rapid Transit), especially to people who live in the densely populated neighborhoods adjacent to the Hackensack Meadowlands or who live in the residential clusters. Biking all the way to work is not the only choice, however, so these benefits can extend outward from the Hackensack Meadowlands to other potential bike commuters to Hackensack Meadowlands jobs.

For as noted in this section, bikes can be used for partial trips--either to a transit stop; or from a transit stop to a bus transfer; or from either of these to a job location--if safe pathways and bike racks can be planned and provided. That this works is being shown in many European cities. In Rotterdam, for example 43% of all daily trips are

by bicycle; in Copenhagen, 17%; and in Uppsala, 20%. When we consider the high importance of reducing the 1-3% difference in air pollutant concentrations which can be affected by the way the Master Plan is administered, it goes without saying that bikeway miles traveled are less vehicle miles traveled--with the associated reductions in fuel consumption and in air emissions.

We feel from this study that the Hackensack Meadowlands offer a particularly attractive opportunity for a national demonstration of the idea that bikeways, set in this context of comprehensive and stringent Hackensack Meadowlands **land use planning** can be an important alternative means of commuter transportation.

Finally, bicycle transportation can be an equally significant means of access (and recreational access for that matter) from the nearby communities and the residential zones to the parks in the Hackensack Meadowlands which are called for in the Master Plan.

CHAPTER XI

FINANCING

There are several key questions associated with the financing of the transportation improvements outlined in the description of each of the five alternate networks. These questions set the stage for analyzing the problems associated with funding the necessary transportation improvements.

How much money will be needed? This question is partially answered in the tables associated with each alternative in Chapter IX and are summarized in Table IX-1.

When will the money be needed? This question is more difficult to answer. Certainly, the primary focus should be on getting funding for those transportation improvements which are mentioned in the Executive Summary as being necessary by 1985. The highway improvements alone total an estimated \$265 million.

Who will finance the necessary improvements? This question is even more difficult to answer than the previous question. The history of investment in transportation facilities and services in this country indicates the growing involvement of government. Government is not, however, a limitless resource for such investments. In determining the extent to which government should involve itself in funding transportation improvements, it is necessary to examine closely the benefits which accrue from the improvement as compared to its cost. This means determining the cost efficiency of a proposed improvement. The analysis contained in this report constitutes such an examination for the five alternate networks. The cost efficiency, as well as other aspects of all the proposed improvements contained in this study, will have to undergo an

even more rigorous examination before they can be considered for funding.

In the Meadowlands, we have a unique opportunity to get away from so-called crisis planning, a malady of many government agencies. There are three critical planning needs which must be acted on in order to provide a transportation network commensurate with the District's growing transportation demands. First, we need to be knowledgeable about the future demands. This requires a method for monitoring the demands, existing and projected, for major land developments. This also implies a need for a strengthening of the transportation planning staff of the HMDC in order to handle this work.

Second, an attempt must be made to manage the demands. This requires stronger efforts to implement management strategies such as staggered work hours, carpools and vanpools, public transit promotional campaigns, etc. These and other Transportation Systems Management (TSM) techniques could help to somewhat reduce the "peaking effect" usually experienced in the demand for transportation facilities and services. This in turn could help to delay crises which might occur because of the lead time needed to implement necessary major capital improvements.

Third, we need to properly time the implementation of necessary transportation improvements so that they better coincide with the actual increases in demand. One of the larger existing philosophical planning problems concerns the implementation of improvements only after a crisis has occurred. This approach should and will not be used in developing a transportation network for the District.

The Meadowlands Master Plan also has an impact on the financing of transportation improvements. Within the regulations which are used to control development are contained specific requirements regarding the responsibilities of major developers in the Specially Planned Areas to provide completely or help provide the necessary transportation improvements related to the demand generated by their proposed developments. This does not mean, however, that these developers can be expected to make regional scale improvements.

This study, within the limits of the forecasting techniques used, quantifies the transportation needs of a developing Hackensack Meadowlands District and proposes possible solutions to those problems which were identified. The next step will be to further analyze these solutions and assemble the various government and private sources of funding which will be needed. But before a transportation demand and funding management strategy is discussed, it is useful to view the current funding process used by government.

Current Capital Funding Process

The Transportation Improvement Program

Underlying the government funding process is the Transportation Improvement Program (TIP) and the Annual Element (AE). In order to better coordinate and control the funding process, the Federal, State, Regional and local government agencies prepare each year a TIP and AE. The TIP is a listing of all the projects which the government agencies, through their planning efforts, have determined are necessary to improve and expand the existing transportation network. The TIP spans

five years and each project has the costs associated with it broken down according to how much is needed each year. The AE lists only those projects which will be undertaken in the upcoming fiscal year and the required funding for each project for that year. The Federal government will only fund those projects which are included on these lists. The process obviously does allow for additions and deletions. In addition to forcing all the various agencies to think carefully about what projects they place on these lists, the planning process which leads to the preparation of these lists forces these agencies to determine what their priorities are and when they wish to implement a particular project.

UMTA and FHWA

One of the primary sources of government funds for transportation projects is the Federal government. UMTA, the Urban Mass Transportation Administration in the United States Department of Transportation (USDOT), funds public transportation projects and certain other related projects. FHWA, the Federal Highway Administration in USDOT, funds highway and road improvements and certain projects related to public transportation. In recent years, both agencies have taken steps to promote a balanced approach to the transportation needs of this country. Using the TIP and AE as a base, these two agencies fund major portions of the costs of transportation projects. The amount of funding they allocate to a project is predetermined by the Federal and local matching percentages set by the US Congress. The usual Federal-local shares are 80% Federal and 20% local for public transportation projects, 90% Federal and 10% local for interstate highways and 70% Federal and 30% local for state and local highway and road projects. Regarding the funding of

state and local highway and road projects, the Federal government requires that State and local governments determine which highways and roads, based on a special analysis, they wish to categorize as belonging to the Federal Aid Urban System (FAUS). Only those highways and roads listed as being part of FAUS can be improved using the Federal funds allocated for such a purpose. FAUS funds are not meant to be used for major highway extensions but more for major and minor road improvements. There are other UMTA and FHWA programs for funding transportation improvements but they are not on the same scale as those mentioned above.

New Jersey Department of Transportation

The New Jersey Department of Transportation (NJDOT) is another major source of funds for transportation improvements. NJDOT uses general tax revenues as a source of matching funds in order to get Federal funds and they also, but on a more limited basis, directly fund certain improvements. NJDOT has in the past proposed bond issues to pay for transportation improvements. The two most recent transportation bond issues were defeated by the voters of the State. Because of budget cutbacks in more recent years, the Department has been forced to greatly limit the direct funding of transportation improvements. The current strategy being followed by NJDOT in using its limited funds is to find ways to best match Federal funds. In this way they maximize the amount of total funds available.

Local Government

On a local level, both counties and municipalities fund certain transportation improvements. Since their funding capabilities are more limited, as compared to the Federal government, they usually try to obtain Federal funds for most transportation projects.

Tri-State Regional Planning Commission

The Tri-State Regional Planning Commission was established to coordinate planning efforts in the Tri-State Region and plan for the Region's total transportation needs. The Tri-State Region includes northern New Jersey with New York City as the focal point of the Region. Tri-State's major function in the funding process is to act as a channel through which Federal funds are dispensed to the state and local agencies. They monitor the Region's funding needs and manage, with the Federal agencies' approval, the allocation of funds.

The Planning Process and Funding

As stated earlier, the TIP and AE are the result of the transportation planning efforts of state and local agencies. The planning process and the preparation of the TIP and AE are carried on by three levels of government. On the local level is the subregional planning agency. Counties and cities with a population over 250,000 people qualify as subregional planning agencies. In New Jersey, the two cities classified as subregions are Newark and Jersey City. The counties are the local coordinators for smaller towns and cities. Each county prepares a TIP and AE annually for the county. Essex and Hudson Counties coordinate respectively with Newark and Jersey City in this exercise.

These local TIPs and AEs are then sent to NJDOT and Tri-State. NJDOT, in coordination with the counties, prepares a statewide TIP and AE. This coordinating process may result in additions or deletions to these lists. Tri-State then works with both NJDOT and the counties to prepare the New Jersey portion of the Regional TIP and AE. This process is duplicated in New York and Connecticut. The result of all this coordination is a Regional TIP and AE which are forwarded to the Federal agencies, in this case UMTA and FHWA.

Also involved in the funding process are the operating agencies in the Region, Port Authority of New York and New Jersey and the New York's Metropolitan Transportation Authority. They have an opportunity to input into the TIP and AE.

The HMDC is not a recognized subregion, nor does it have any other formal position in the just described planning and funding process. The HMDC can receive Federal funding for transportation improvements by working through NJDOT, Bergen and Hudson counties to get those improvements on the county or statewide TIP and AE.

Future Sources of Capital Funds

UMTA, FHWA, and NJDOT

These three funding sources have a limited amount of money to devote to funding major transportation projects in the Meadowlands at the present time. Most all of the Federal funds are already committed to transportation projects elsewhere in the State. There are a few improvement projects on the TIP and AE for this area which are in the District or will serve the District's needs. They are listed in Table XI-1.

In the future, there are three possible means of getting funds for the transportation improvements suggested in this report from these three sources. They are:

1. The U.S. Congress is considering bills which would increase the amount of Federal funding for public transportation projects and many highway and road projects. It may be possible for some portion of these additional funds to be made available for projects in the Meadowlands.
2. The current funding allocations in the State could be altered, to some extent, to help fund transportation projects in the Meadowlands.
3. Finally, the Governor, along with NJDOT, could propose a transportation bond issue. Some of the funds from the bond issue could be made available for Meadowlands projects.

Obviously, none of these funding sources can guarantee that they will have any funds for transportation projects in the Meadowlands. This uncertainty forces the HMDC to find ways to better use what capacity is currently available on the transportation network and to find other sources of funding.

Bergen and Hudson Counties and the Municipalities

If the current money problems Bergen County, Hudson County and the municipalities are experiencing is an indication of their future funding capability, then they will not be able to fund the types of important transportation improvements which are indicated in this study as being necessary. They may be able to help fund smaller scale projects such as bus shelters, minor road extensions, etc.

Table XI-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Hudson and Bergen Counties' Transportation Improvement Programs
for the Hackensack Meadowlands District

Bergen County

All Projects Listed Are Scheduled to Start in Fiscal Year 1979.

<u>Project Name</u>	<u>Project Cost (\$000)</u>
Redneck Avenue Extension	3,600
Schuyler Avenue Improvement ¹	1,150
Orient Way Improvement ¹	1,845
Moonachie Avenue Widening	1,000
Bus Shelter Project ¹	300
Meadowlands TOPICS ¹ - Carlstadt	365
- S. Hackensack	79
- Other	500
E. Rutherford-Rutherford Bikeways Projects ¹	
- Stage I	100
- Stage II	100
Elimination of Little Ferry Circle	370
Elderly and Hadicapped Programs ¹	65

Hudson County

Projects Listed Below Are Schelduled to Start in Fiscal Year 1979.

<u>Project Name</u>	<u>Project Cost (\$000)</u>
Newark-Jersey City Turnpike Upgrading	1,150
Schuyler Avenue Improvements ¹	2,429
Paterson Plank Road Intersection Improvements	570
New County Road Improvement	140
County Road Improvements	1,675
West Side Avenue Alignment Project	3,000
Paterson Plank Road Bed Improvement	1,567
Secaucus Street Resurfacing	215
Bus Shelters ¹	96
Buses for Elderly and Handicapped ¹	160

The Following Projects Are Scheduled to Begin in Post 1983.

Fish House Road Improvements ¹	650
Meadowland Parkway Extension	4,400
Bus Shelters ¹	400
Bus Maps ¹	25
North Bergen Bus Station/Park and Ride	4,000

¹ These projects are not specifically aimed at serving the Meadowlands but are meant to serve the county as a whole.

The Port Authority of New York and New Jersey

In the area of public transportation improvements, NJDOT may be able to help fund some transportation improvements, utilizing funds from the Port Authority as local match. NYDOT, NJDOT and the Port Authority are currently developing a program for the expenditure of about \$1,200 million for public transportation improvements. Here too, this source of funding can not be guaranteed since the larger picture must be considered when allocating funds. It is the intention of these parties to use the Port Authority funds as the local matching share to get Federal funds. For New Jersey this could mean getting \$600 million in total funding for public transportation, \$480 million from UMTA and \$120 million from Port Authority. Achievement of the program is also dependent on approval of new Federal transportation legislation. Until recently, a major portion of these funds was supposed to be used for the funding of the PATH Extension to Plainfield. This project has now been withdrawn from consideration and an analysis of how to use the monies slated for this project has begun.

Hackensack Meadowlands Development Commission

The Hackensack Meadowlands Development Commission (HMDC), at this point in time, does not have any funds for transportation improvements. The HMDC, prior to the upcoming fiscal year, was funded by certain fees, to a limited extent, and by annual loans from the State, which include interest. As of fiscal year 1978-79, the HMDC will receive an, as yet, undetermined amount of funding from the New Jersey Sports and Exposition Authority surplus. This funding will not be sufficient to undertake transportation projects. At this time, there is nothing to

indicate that the HMDC will ever be able to fund transportation improvement projects.

It should be noted that the HMDC transportation planning effort, of which this report is a result, was only made possible by funding received from UMTA, FHWA and NJDOT. It is anticipated that for the foreseeable future the HMDC will continue to rely heavily on Federal and State funds to maintain its participation in the transportation planning process.

The Hackensack Meadowlands Reclamation and Development Act, which created the HMDC, suggests that this Commission could float revenue bonds or impose a special Districtwide tax assessment for specific projects. Presently, the HMDC has no source of revenue to back a bond issue. The only way, then, that a bond issue could be possible would be if a special assessment were imposed. The HMDC will have to study further whether it could float a bond issue for transportation projects or impose a special tax on development to fund improvements.

Although the HMDC administers an intermunicipal property tax sharing account for the District, it receives none of these funds. The purpose of this account is to balance tax revenue and municipal costs associated with the different towns so no town would either bear an inequitable share of the financial burden or enjoy a disproportionate share of the financial rewards. Therefore, this intermunicipal tax sharing account can not be a source of funds.

Major Private Land Developers

An important source of funding for transportation improvements in the future will be the major land developers. The Master Plan clearly places some of the responsibility for providing for transportation improvements in the Specially Planned Areas (SPAs) on the major land developers who wish to develop this land. The SPAs make up about 40% of the remaining developable acreage in the District.

An example of what this responsibility means can be found in the case of Hartz Mountain Industries Inc., who are developing about 750 acres of land in Secaucus. Part of the land, about 550 acres, is zoned for offices and light industrial development. The remaining 200 acres is zoned as Island Residential-1. This zone is an SPA. Hartz Mountain has already completed 640 housing units and has permission to construct another 1,480 units. The General Plan for this whole zone has been approved. In order to provide for the transportation needs of this entire 750 acre development, Hartz Mountain has been required by the HMDC to construct a very costly road network, including Meadowland Parkway, a six lane road with sophisticated traffic activated signals, provide bus shelters and a railroad station, and operate a local bus service. The local bus service will be free. The train station opened and the bus service began on June 19, 1978. This monetary commitment of several million dollars is an indication of how important the major private developers can be as a source of funding.

Private/Government Funding

It seems obvious that major private land developers can contribute substantially to the funding of important transportation projects. They will not, however, be able to undertake all of the projects which

this report suggests are needed. Some of the recommended or suggested improvements are far too expensive for private sources to fund alone. Also, there is a question of the extent to which some of these improvements benefit not just the developer but the Region at large. There is a critical gap which the private land developer can fill.

In addition to providing the necessary local transportation network needed for access to a piece of land, the major private developers could help fund the larger scale improvements which not only benefit them but the region as well. The private developers could contribute the local matching share needed for these larger scale developments in order to get Federal funds.

There is nothing legally obstructing this partnership from forming today. There are a few cases where this has already happened. The only problems which appear to limit this type of relationship from occurring more often are administrative in nature. Private enterprise (developers) usually do not wish to wait long periods of time before they spend their monies when these monies have been set aside for a particular purpose. There is a need to develop a way to encourage the private developer to set aside funds for a particular improvement and speed up the decision making process which government agencies go through in committing money to that same project. A major land developer who needs a particular transportation improvement in order to continue to develop his land would rather avoid lengthy delays in getting that improvement.

One of the issues which should be mentioned in this discussion, is the need to not just provide for a barely adequate transportation network but one which will both support the developments proposed and

improve the existing transportation network. This private/government partnership then becomes, in some cases, a deciding factor affecting the overall quality of the improvement which is implemented.

The HMDC has already begun to explore this private/government partnership and how this can be encouraged. Further study will be needed to clear up any legal, administrative or other obstacles which would discourage this relationship from occurring.

Monitoring, Management and Timing

While sources of funding are developed, the HMDC will have to monitor the transportation network and future demand and manage and control demands so that they are timed to coincide with the proper improvements in the transportation network's carrying capacity.

Monitoring

As will be outlined in more detail in Chapter XII, this Commission has taken steps to make the environmental review process a key link in monitoring the present transportation network and future demands. The Environmental/Socio-Economic Impact Statement guidelines will, when applies to development in the SPAs, provide the necessary information for the HMDC to monitor the existing conditions and future demands on the transportation network. The HMDC would like to relate this information to a computer program which would model the District's transportation network. Such a model would probably be based on the Urban Transportation Planning Systems (UTPS) computer models developed by UMTA. The HMDC can also take actions which would provide for an annual update of the transportation network demands associated with major developments. The HMDC has already required this type of annual

update for the previously mentioned Island Residential-1 development.

Managing the Demand

Using Transportation Systems Management (TSM) techniques and allowing for certain para-transit solutions, it may be possible to control the level of the existing and future demands for short periods of time until action can be taken to implement major improvements. The HMDC has been actively discussing a major carpool and vanpool program with other government agencies for the last year. The HMDC, as part of its normal building plan review and permit process, has been asking and encouraging major developers of industrial buildings to consider staggered work hours programs for their respective industrial parks. The HMDC has required that Hartz Mountain Industries, as part of the Island Residential-1 decisions, help promote and coordinate public transit.

In the future, the HMDC should implement the carpool and vanpool programs and the staggered work hours program in coordination with other TSM programs. The HMDC should also develop a program for better utilization of the existing public transportation network which traverses the District but does not serve the District itself.

Timing

The HMDC, as stated in the Hackensack Meadowlands Reclamation and Development Act, has among its obligations to provide for the orderly development of the District and the preservation of the environment. These responsibilities have been translated into a variety of actions. Among those which directly pertain to the problem of increasing transportation demand is the staging of development commensurate with the carrying capacity of the transportation network existing at that point in time. Chapter X addresses the meaning of carrying capacity in more detail.

If funding for some of the major transportation improvements suggested in this report is not available, then the HMDC will have to seek other solutions. Staging is one approach to striking a balance between the need for more transportation facilities and services, and the funding and other constraints which prevent the necessary improvements from being made immediately.

Capital Cost Calculations

The costs listed in this report for capital improvements are very conservative. They include, in addition to basic construction cost factors, factors for inflation, contingencies, extra work, preliminary engineering, insurance, and the cost of borrowing money. In Appendix IX-2, there is a more detailed description of the cost estimating process.

Loans Vs. Grants

In the estimating process used in this study, it was assumed that money for all the capital improvements would be borrowed as needed each year at 7% and paid back over a period of time related to the type of project. This is a very conservative approach and should be contrasted with the more typical method of funding, the grant.

If for example it were possible to obtain a Federal grant for the Secaucus Transfer Station, the total cost of the construction of this facility, including design costs, etc., would drop to approximately \$54.4 million as contrasted with the \$63 million listed elsewhere in this report. A cost of \$54.4 million for this facility also assumes that the local matching funds are not borrowed or bonded.

It is important that simple comparisons between the cost estimates in this report and those normally given in government reports NOT be made.

CHAPTER XII

MEETING 1985 NEEDS - A RECOMMENDED ACTION PROGRAM

Chapter IX discussed four transit options, including financing and implementation possibilities, to meet the needs of the Meadowlands at ultimate development. However, the question that still remains is how the Commission can move from present levels of development with very little public transit to full development by the year 2000 with a complete public transit system. This Chapter attempts to answer this question by first considering the near term (1985) transportation needs and then suggesting an action program to meet those needs and prepare for the future.

Meeting 1985 Needs

It has been forecasted that by 1985 the Meadowlands will generate about 35,500 work trips in the peak hour, an increase of some 7,500 trips over the current level of 28,000 trips (Table VI-8 and VI-9). The bulk of this increase will be in Zones A, D, E and F.

In the period from now to 1985, it is not expected that any comprehensive transit improvements will be available for Meadowlands employees. However, a number of localized improvements will be operated as part of developments now under construction. These will include a bus passenger facility at the proposed Meadows East station in Secaucus, and rail stations on the Erie Lackawanna Bergen County Line at Berrys Creek and Harmon Cove, as well as the existing station at Wood Ridge. Some internal bus distribution routes should also be available.

On the basis of these improvements a modal split of the forecasted work trips would indicate a demand of 31,190 trips by auto and 4,310 by transit. Thus the percent of trips by transit is expected to be almost 14 percent, as compared with the present 9.5 percent (Table IX-11).

Highway Needs

In Chapter IX it was noted that at ~~ultimate~~ development the vehicular demand would exceed the available capacity at twelve key points on the highway system feeding the Meadowlands. Most importantly, however, is the fact that today traffic at eight of these locations is virtually at capacity (see Table IV-1).

When the anticipated growth in auto demand by 1985 is applied to the existing highway system there are several critical locations where demand is predicted to exceed capacity. Those locations along with the excess demand are described in Table XII-1 and in the following paragraphs. If no further highway improvements are provided by 1985, then the peak hour forecast would be reduced by 1,325 vehicular trips or 1,965 jobs.

Route 3

On Route 3 eastbound at the bridge over the Passaic River, the demand for the intermediate year is predicted to exceed the available roadway capacity by 470 vehicles during the A.M. peak hour. A possible means of accommodating this excess demand would be under a staged construction program based on the Route 3 improvements suggested for ultimate development. Improvements provided by 1985 under this program are listed. In all cases

Table XII-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Vehicles in Excess of Roadway Capacity - 1985

<u>Description</u>	<u>Location</u>	<u>Direction</u>	<u>Excess Vehicles (Peak Hour)</u>
Rt. 3 on Bridge over Passaic River	21	EB	470
Rt. 1&9 North of Skyway Interchange	15	NB	580
Lincoln Tunnel	12	WB	275

the improvements should be compatible with the suggested plan for ultimate development.

1. A new five-lane bridge for eastbound travel at the Passaic River with four moving lanes and interchange modifications with Route 21;
2. Conversion of the existing six-lane, two-way bridge to accommodate four moving lanes of westbound traffic; and
3. A widening of the section of Route 3 from the Route 17 interchange west to Route 21 from a cross section of six lanes to eight lanes.

Route 1&9

On Route 1&9 northbound, immediately north of the Skyway circle the demand for the intermediate year would exceed the available roadway capacity by 580 vehicles during the A.M. peak hour. A possible means of accommodating this excess demand would be under a staged construction program based on 1&9 improvements suggested under the Busway/Vanpool proposal for ultimate development. Under this program, Route 1&9 would be widened from four to six lanes between the Skyway circle and 69th Street. (It should be noted that based on more detailed projections, the northerly limit at 69th Street could be relocated to some appropriate location further to the south). This improvement should be compatible with eventual expansion to the eight-lane cross section suggested under the Rail, Bus and PRT transit schemes plans if one of these latter plans is selected by the Commission. It would meet the suggested improvement under the Busway/Vanpool scheme.

Lincoln Tunnel

For the intermediate year, westbound traffic at the Lincoln Tunnel would exceed the tunnel capacity by 275 vehicles. No physical improvements could be provided to meet this excess demand although the possibility for some increased bus transit in this corridor does exist which would reduce the demand.

Other Locations

While less critical than the three locations identified, it should be pointed out that increased congestion could occur at several other locations during the A.M. peak hour. These include Route 46 westbound at the Hackensack River, the westbound Holland Tunnel and the Jersey City cut. Again no improvements are contemplated for these locations although some relief might be available through operational planning.

On Route 17 southbound, south of Route 46, traffic diversion to the Redneck Avenue Extension would minimize any excess demand for the intermediate year. However, the critical capacity restraints previously identified on Route 17 to the north would virtually preclude any growth from this corridor. A possible means of overcoming this problem would be under the improvement program suggested for the year 2000 for Route 17 between Routes 4 and 46.

Cost for these various highway improvements are detailed in Chapter IX.

1985 Transit Facilities

The origin-destination pattern for the 1985 peak hour transit demand is shown on Table XII-2. As indicated the trips from Zone 8 to Zone E and Zone 9 to Zone F, a total of 499 trips, would be by rail.

Table XII-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Peak Hour Demand - Transit
(1985)

Origin Areas		Zone of Destination							18	Total
		A	B	Cn	Cs	D	E	F		
Outside the Meadowlands	1	14	4	2	0	13	4	7		44
	2	39	13	3	0	0	2	5		62
	3	369	88	85	4	84	58	21		709
	4	47	4	85	6	6	11	13		172
	5	32	2	51	6	3	0	0		94
	6	43	4	27	5	2	4	4		89
	7	97	3	2	0	1	2	3		108
	8	17	1	1	0	0	260*	71		350
	9	63	2	10	0	1	151	239*		466
	10	59	2	26	3	0	15	150		255
	11	23	1	4	0	0	7	18		53
	12	10	0	0	0	0	0	0		10
	13	3	1	1	0	3	59	63		130
	14	2	0	0	0	0	0	4		6
	15	0	0	0	0	0	3	4		7
	16	13	0	0	0	0	26	20		59
	17	0	0	0	0	0	0	0		0
	18	25	4	9	0	2	15	15		70
	19	100	5	52	6	4	31	61		259
	20	49	5	11	1	1	50	84		201
	21	289	35	66	5	13	136	219		763
	22	93	3	18	2	1	60	77		254
Sub Total		1,387	177	453	38	134	894	1,078		4,161
In the Meadows lands	A	5	1	1	0	2	2	3	135	149
	Total	1,392	178	454	38	136	896	1,081	135	4,310

*Rail

The remaining trips would be by bus. In total, the 1985 transit demand represents an increase of 1,653 trips over current levels of which 256 would be by rail and 1,397 by bus.

As indicated above, it was assumed in arriving at these demand figures that two new rail stations and a bus facility would be made available by the developers of the Berrys Creek area and by Hartz in Secaucus and at Harmon Cove. In addition, up to four new rail passenger coaches and some 35 to 40 buses would be needed. This additional equipment could probably be purchased by the New Jersey Department of Transportation as part of their next equipment purchases.

Entirely separate from these weekday work trip needs, it is possible that a portion of the PRT or busway system would be made available between the Berrys Creek Station and the Sports Complex.

Bikeway Needs

Demand for bikeways presently exists, and will continue to grow through 1985, for corridors connecting the following zones; Zone 3 to Zone A, Zone 9 to Zone F, and Zone 8 to Zone E. A large demand should also exist at present for a bikeway crossing of the Hackensack River, however, without sufficient bikeways leading to the crossing present usage would probably be low.

Development through 1985, will include continued industrial development through out the District, commercial development along Route 3, expansion of DeKorte State Park and the Sports Complex area, the beginning of Berrys Creek Center (BCC), and completion of the IR-1 residential area. The following bikeways will be required to serve the needs of this develop-

ment; internal bikeways between BCC and adjacent industries, BCC and DeKorte State Park, BCC and the Sports Complex, IR-1 and northern Secaucus, a bikeway running north-south along the eastern edge of the District, and possible a Hackensack River crossing south of Route 3. At least one Hackensack River crossing should be available to serve the needs of the 1985 cyclists.

An Action Program

The Meadowlands and the residential communities immediately surrounding the District will, by the year 2000, have an estimated residential population of 572,000. For comparison purposes this would be similar to such metropolitan areas as New Brunswick, New Jersey; Richmond, Virginia; Omaha, Nebraska; Tulsa, Oklahoma; Grand Rapids, Michigan; and Youngstown, Ohio. What makes the Meadowlands District unique from these other areas is that as of now, only a small part of the District is developed. This offers an unprecedented opportunity to plan and build a good transit and street system. The following paragraphs outline a program of capital and operational planning, including staff requirements, to take advantage of this opportunity.

Planning for Capital Construction

Accommodating three-fourths of the short-term (1985) demand for the Meadows will not require any major investment or change in State or Commission policies. But unless transportation planning and actual development proceed together, the accommodation of the remaining transportation demand for 1985 and all demand beyond 1985 could be costly and disruptive.

To avoid this possibility it is recommended that the proposed highway improvements and networks set forth in this report be reviewed and an official long-term transportation plan be adopted by the Commission. This plan could adopt suitable elements from each transit network. It could include a map that would show the location of proposed terminals, any rights-of-way that are to be set aside for highway or public transit use, and any other areas that might be required for road or transit purposes, such as interchanges, storage yards or maintenance facilities. The applicable property could be deeded or otherwise dedicated to highway or transit purposes at the time that applications for adjoining property development are approved.

A second area that the plan could address is the phasing of transit construction with specifications as to when various portions of the recommended internal transit should be constructed. One criterion could be development density. For example, as shown on Table XII-3, there would be a density of 14 employees per acre for employment Zone Cn but only 6 employees per acre for Zone D. It is logical that the plan first provide public transit for the zones with the highest employment densities.

An integral part of the transportation plan would be an internal road plan, but that in turn depends on the selected public transit policy. The specific location of arterial and local streets need not be pinpointed.

but the plan should indicate where links to major access roads and inter-zone connections should occur and the amount of highway and parking that should be provided both initially and ultimately for a given size and type of development. The plan should also recognize that whatever the transit plan adopted, there will be the need for the construction of some feeder highway improvements. The Commission should work closely with Federal, State and local officials to implement these improvements as Meadows employment increases. Additional traffic demands will probably occur to the west and north of the Meadows. The Commission staff should also follow these developments closely and determine if they will add traffic to major feeder routes needed for Meadows employees. If this occurs, further highway development in these areas may be needed. One way this demand could be eased is by strengthening the regional highway system that bypasses the Meadows such as I-80 to the north and the Garden State Parkway to the west.

There must be a continuing feedback process in considering the development and transportation plans. As the Meadowlands develops there will no doubt be changes in the overall master plan for land development. This in turn will require changes in the master plan for transportation. At the same time the needs expressed in the transportation plan could suggest changes in the land development plan. For example, public transit can be encouraged by additional clustering within each zone. Existing single-story warehousing in the Lyndhurst Industrial Park is likely to generate fewer transit trips than the nearby two- and four-story office buildings. Thus, in this zone, higher office buildings

Table XII-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Employment Density
(Full Development)

<u>Employment Zone</u>	<u>Acres In Zone</u>	<u>Employment In Zone</u>	<u>Employees Per Acre</u>
A	3,420	43,164	13
B	900	7,574	8
Cn	900	12,288	14
Cs	360	4,092	11
D	3,240	18,954	6
E	4,500	39,522	9
F	<u>4,680</u>	<u>43,250</u>	9
	18,000	168,844	

clustered at potential transportation nodes, such as the proposed Berrys Creek rail station, would produce even greater transit potential than the present master plan.

Operational Planning

Capital planning in and of itself would be insufficient to assure the adequate accommodating of transit needs. Planning for daily operations is equally important, and this planning goes along with capital planning. For example, even when properly phased and on schedule, major transportation building programs cause congestion due to the construction process. Operational planning can alleviate much of the resulting delays and inconvenience to commuters and commercial interests.

In recent years, transportation planners have extended the scope of operational planning from basic traffic control to programs aimed at getting the maximum in transportation from existing capacity such as freeway ramp metering to improve expressway flow under capacity operating conditions, car and van pooling to increase the number of people per commuter auto from the current national average of 1.3 persons, and staggered work hours to spread demand over a wider time span. Several of these innovative approaches are applicable in the Meadows and all can improve service on existing facilities. In certain instances, such techniques, which are often implementable in less than 12 months, have reduced the need for new highway and transit facilities and equipment.

The following paragraphs set forth specific operational programs for improving transportation in the Meadowlands.

a) Bus Route Planning

All four transit networks rely on buses for the final distribution phase. Under the least patronized network (rail), there would be approximately 200 buses circulating employment zones in the peak hour by the year 2000, while, if the busway is adopted, almost 700 buses would be in circulation. With the anticipated bus activity, it will be necessary for the Commission itself to mount a program of planning bus routes and phasing them into operation as new offices and industries are completed. The Commission program should also include assistance to carriers in securing operating rights, purchasing equipment and obtaining operating subsidies, if needed.

Of the recommended operational planning efforts, this should be one of the first. The Meadowlands represents a unique opportunity to tailor construction and transit to each other to take maximum advantage of the proposed transit system. At a more advanced stage in development, this effort could include computer simulation of the Meadowlands highways and transit network so that alternate routes could be tested in terms of their relative ability to serve new users.

Bus route operations planning should also be extended to the Meadowlands highway network. Pullouts, informational signing and shelters should be provided at bus stops. New highways should include adequate turning radii for buses at intersections and ramps. Where possible, traffic engineering techniques should be used to give public transit a travel time advantage over the private auto. Possible techniques could include bus actuated signals at major intersections, and where volumes warrant, separate bus lanes to pass areas of highway congestion. Such

lanes could be extended from major highways and terminal points, and from the busway itself, if that network were adopted.

Of immediate concern, a rail station on the former Erie Lackawanna Bergen County line to serve the Hartz residential development at Harmon Cove has just been opened. Regardless of which overall network is selected, this station and the proposed rail station on the same line at Berrys Creek would prove useful to Meadowlands residents and employees. Operational planning should include appropriate assistance in the planning and construction of the Berrys Creek station and possible expansion of the station at Harmon Cove. Special efforts should be undertaken to assure that proper feeder bus services are introduced at these stations.

b) Priority Lanes

In recent years highway capacity has been measured not by the number of vehicles a lane can carry, but by the number of people it transports. The exclusive bus lane on the Lincoln Tunnel approaches in New Jersey carries 27,000 people in the rush hour. The same highway lane would carry only 2,200 people if they were all in automobiles. The concept of increasing the people capacity of a highway through use of exclusive or priority lanes should be considered for both the highways approaching the Meadowlands and those within the Meadowlands, such as Route 3.

In several areas, the concept of buses sharing the highway with carpools has also been used. In this instance the number of buses is less and the carpools make use of otherwise empty highway capacity during the rush hour. Since the Meadowlands is also an important truck distribution center, priority lanes for trucks could also be considered. Note that

these operational measures do not require the construction of new highways, but rather the reallocation of existing roads for more efficient use. Hence, they may be implemented easily and rapidly.

c) Staggered Work Hours

Staggered work hours has been successful in reducing peak hour demand and improving the commuter trip. In Lower Manhattan, for example, 25 percent of the work force have changed their schedules by as little as 30 minutes with the result that peak loadings on transit facilities have been reduced up to 25 percent. This could mean a considerable reduction in the investment required to meet future increases in demand.

In the Meadowlands, a program of staggered work hours could be implemented rapidly and inexpensively. For these reasons, such a program is recommended as a near-term operational improvement for the District. The primary objective of the program would be to reduce peak hour demand, thereby reducing the need for highway construction. Also, it is likely that a spread of employee start times over the peak period would result in more convenient, less congested commutation and consequently less pollution due to stop-and-go driving.

It is reasonable to assume that job start times in a given 15-minute period translate into arrivals or travel in the previous 15-minute period. Using data on start times from the 1976 survey (see Chapter V) it can be estimated that 57 percent of the Meadowlands work force is arriving in the peak hour (7:45 to 8:45 A.M.) with 27 percent - 48 percent of the peak hour - arriving in the peak 15 minutes (7:45 to

8:00 A.M.). This extreme peaking is shown below and suggests that shifts in starting times could be accomplished easily and could smooth the peaking of demand.

Existing Work Schedule

<u>15-min. Beginning</u>	<u>Percent Of Day</u>	<u>Percent Of Peak Hour</u>	<u>Number of Employees Arriving</u>
7:00 A.M.	0%		
7:15	4		2,000 employees
7:30	1		500
7:45	27	48	13,400
8:00	8	14	3,900
8:15	19	33	9,300
8:30	3	5	1,400
8:45	11		5,400
9:00	0		
Other	27		
	<u>100%</u>		

While the Meadowlands-oriented traffic has a sharply peaked pattern, when it is combined with the other traffic on the highways entering the Meadows, the peaking within the peak disappears. Three of the major routes delivering employees to the Meadowlands are Route 17 southbound at Teterboro Airport, Route 46 at the Little Ferry Circle, and U.S. 1 north of Tonnelie Circle. In all three instances 1976 counts showed that the percent of traffic in any 15-minute period of the peak hour ranged from 22 to 27 percent.

The first question to answer is whether changes in start times for Meadowlands employees will effect total demand on Meadowlands highways. Today, Meadowlands employees account for about 33 percent of total traffic

on the major highways adjacent to the District. Since approximately 25,000 employees now commute by auto to the Meadowlands, (28,000 total trips minus 3,000 transit trips) then other traffic represents approximately 50,000 trips for a total of 75,000 persons entering via the selected highways during the rush hour.

In considering future travel to the Meadowlands, it has been concluded that non-Meadowlands traffic will not grow. On the other hand, at ultimate development it is forecast that there will be about 72,000 peak hour trips entering the Meadowlands to work. If 12,000 are assumed to use transit (bus network), then 60,000 trips will enter the District by auto. If this is the case, then the proportion of Meadowlands trips to total trips will have increased from 33 percent to 55 percent. Furthermore, the magnitude of trips will have increased from 75,000 to 110,000.

From this analysis it can be concluded that as Meadowlands employment increases, the Meadowlands will represent an increasingly large proportion of total demand. With this in mind, it becomes clear that less peaking of Meadowlands trips can be tolerated in the peak hour. (As a matter of fact, the present situation in which 48 percent of all peak hour trips to the District arrive between 7:45 and 8:00 cannot occur in ultimate development unless it is assumed that absolutely no other traffic will be using the highways during that time.)

The forecast of 60,000 peak hour trips by auto assumes in itself a shift of trips out of the peak since it is based on the peak hour representing 50 percent of daily demand instead of the present 57

percent. At the same time there would be a need to flatten out the peaking in the peak hour to achieve an even distribution of 25 percent for total traffic in each 15-minute segment of the peak hour. This situation is summarized below in which the peak is reduced to 50 percent and the peak within the peak is reduced to 35 percent.

Required Shift Within Peak Hour
At Ultimate Development

<u>15-min.</u> <u>Beginning</u>	<u>Percent</u> <u>Of Day</u>	<u>Percent</u> <u>Of Peak Hour</u>	<u>Number of</u> <u>Employees</u> <u>By Auto</u>
7:00 A.M.	1		1,200
7:15	4		4,800
7:30	4		4,800
7:45	17	35	21,000
8:00	10	20	12,000
8:15	14	28	17,000
8:30	9	17	10,000
8:45	11		13,200
9:00	3		3,600
Other	27		32,400
	<u>100%</u>		<u>120,000</u>

60,000 in
Peak Hour

If traffic conditions will force trips to move anyway, it seems obvious that a rational program could be established to move them to the most efficient 15-minute periods. Obviously this would be outside the present peak hour. One such proposal is advanced. In this concept, 10,000 people would be moved to the 15-minute period immediately preceding the peak hour, and an additional 5,000 would be asked to start work 15 to 30 minutes prior to the peak hour. This simple shift would move 15,000 persons out of the rush hour. At 1.4 passengers per vehicle, this equates to six inbound lanes of limited access highway (two new

freeways) or 11 lanes of signalized arterial highways. The program is shown below:

Use of Staggered Hours
To Reduce Peak Hour Demand

<u>15-min. Beginning</u>	<u>Percent Of Day</u>	<u>Percent Of Peak Hour*</u>	<u>Number of Employees Arriving By Auto</u>
7:00 A.M.	1		1,200
7:15	8		9,800
7:30	12		14,800
7:45	14	38	17,000
8:00	7	19	8,500
8:15	11	29	13,200
8:30	6	14	6,300
8:45	11		13,200
9:00	3		3,600
Other	27		32,400
	<u>100%</u>		<u>120,000</u>

45,000 in
Peak Hour*

*All traffic.

A shifting of the work pattern seems possible to achieve. Certainly its cost would be low and its benefits in terms of capital facility needs large. The program would have to be carefully planned and monitored. However, it would appear that a program of this sort should be considered as part of operational planning for the District.

d) Car and Van Pools

Both carpools and vanpools are a recent addition to a growing list of immediate-action, low-capital operational improvements. The primary purpose of pooling is to reduce the number of vehicles needed to deliver employees to their jobs. Therefore, as a program it is designed to complement staggered work hours by further reducing the number

of vehicles that must be accommodated in the peak hour. There are also side benefits. Pooling reduces the number of parking spaces that need to be provided at the place of work and also reduces the amount of energy consumed per employee for transportation.

Pooling is best applied in areas where population density is too low to support traditional transit with its larger vehicles, fixed route and fixed schedule. This would be characteristic of those residential areas 20 to 30 miles distant from the Meadowlands.

Car pooling has been in use in many areas of the country in an informal manner for many years. With the high vehicle occupancy rates associated with Meadowlands commuters from east of the Hudson River, it is obvious that carpooling already plays an important role in Meadowlands transportation. Vanpooling, on the other hand, is a relatively recent concept, made possible with the introduction of large, comfortable passenger vans. As with carpools, participants in a van pool are picked up at their doorstep and are delivered directly to their place of work. They are guaranteed a seat on the vehicle and there is no waiting for transfer enroute. While a carpool may have three passengers, the van may carry eight to twelve passengers.

Companies have provided vanpools in the past by first determining the residence locations of interested employees. If enough workers live in a cluster that will support a van route, the employer then purchases and insures the van and provides it to one of the employees selected as the driver. The driver then pays for the use of the van by charging a weekly fee to the passengers. The driver is given weekend use of the van

and is allowed to keep fees received from any passengers over the eight usually required by the company. A backup driver is also selected in case the primary driver becomes ill or is on vacation. The first proponent of the vanpool concept, 3M in Minneapolis, now has 92 vans in service and reports a significant savings in parking lot requirements. In the New York-New Jersey area Prudential Life Insurance in Woodbridge operates 61 vans and Hoffman-LaRoche in Nutley operates 18 vans.

So far, it has been primarily the employer who arranges the van pool. More recently the Federal government through the Emergency Highway Energy Conservation Act has permitted the Federal Highway Administration to provide funds to local public agencies for leasing vans.

The amount of participation that can be expected in a car and vanpooling program is difficult to predict. While the number of additional employees using car and van pools has not been estimated, literature available on the subject indicates a participation rate of five percent. At the 3M Company, participation is 32 percent, including 20 percent in carpools and 12 percent in vanpools. The effect of five percent participation in vanpooling would be a reduction of four percent in peak hour traffic, or the equivalent of one freeway lane. A 20 percent participation rate would yield a 17 percent reduction or four new freeway lanes. Peak hour volumes would be less for similar participation rates in car pool programs.

It is recommended that current discussions between the Commission and the State lead to a formal effort to introduce additional car and van pooling to the District. Meadowlands staff could provide

operational assistance to employers in the form of appropriate literature and technical assistance in planning and arranging van routes. Further, the Division of Transportation, Operations and Local Aid in the New Jersey Department of Transportation Bureau of Traffic Operations will provide interested parties with a computer matching service. This would permit pools to be comprised of employees of more than one firm, thereby increasing the potential for a cluster of interested riders living close enough to each other to justify a new route. If sufficient interest is generated, the Commission might also consider acting as a qualified leasing agent under the federal program of van leasing. As demand increases, the van pooling portion of the program also would provide a data source for possible new bus routes.

e) Other Para-Transit Options

There are other forms of para-transit that could be considered by the Commission to reduce auto commutation between the Meadows and adjoining communities, including the community subscription and dial-a-ride services now operating in California, Michigan and other states. In the community subscription arrangement, a small vehicle such as a van or minibus also is used, but it is operated by a public agency, such as a town or regional transportation authority. The rider subscribes to a monthly commutation service from his home to his place of business. Each work day, the vehicle picks him up at his residence and delivers him to his job. Other passengers may board or leave the vehicle along the route. Another version of this service, dial-a-ride, is obtained by telephoning each time a ride is needed.

f) Peripheral Parking Lots

The two park-ride lots in the Meadows, at the Vince Lombardi Turnpike service plaza and in North Bergen at the intersection of Routes 1 and 3, are presently used by commuters to Manhattan. The Meadowlands Commission might also consider park-ride lots for commuters to the District. To be attractive to auto users, such lots need good highway access and direct transit service from the lot to job site.

Two possible locations within the Meadows include the Meadowlands Stadium lot for commuters from the west and the Lombardi lot for motorists living north of the District. Both the PRT and Busway networks provide stops at these areas. The stadium lot could be used during weekdays, since the bulk of the commuters would leave before evening events begin. The present Lombardi lot is full and use of this site would require that additional spaces be paved. Use of these facilities would require discussion between the HMDC staff and representatives of the Sports and Exposition Authority and Turnpike respectively. The North Bergen Park Ride lot would attract commuters from East of the Hudson River. This lot would not be considered because (1) its capacity is limited and (2) the market is better handled by transit.

A more desirable approach would be to develop smaller lots at locations closer to employees' homes to get commuters on public transit at the start of their trip, thereby reducing auto traffic and the associated pollution and congestion on highways approaching the Meadows. Some lots may already be available in local towns for use by trans-Hudson commuters, and a sharing arrangement might be considered. This would occur, for example, if a Waldwick resident parked his car at the local railroad station, boarded an Erie Lackawanna Bergen County train and debarked at the proposed Hartz Mountain station for a Meadowlands job.

For this effort District staff should work with bus and rail operators, the State and local communities.

g) Differential Pricing and Limiting Parking Space

Other techniques that the Commission might consider for reducing peak hour traffic are to restrain demand through either pricing or parking policies. In the pricing concept, tolls and parking charges are raised during the rush hour to discourage people from using their auto to commute to jobs during the peak. On the parking side the supply of spaces is regulated so that people will be encouraged to use transit instead of their automobile. These methods of reducing demand may also be put into effect rapidly. However, entry to the Meadows does not require a toll and the existing employee parking lots are free, so the conditions that encourage their adoption are absent. To be successful these policies also require complimentary policies such as reduced off peak rates or the provision of alternate transit.

h) Recreational Planning

Because the Meadowlands highway network must be sized to meet the demands during the weekday commutation peak, it will generally be adequate to meet the demands put on it at other times such as for recreational activities. For example, the sports complex is a very large generator of auto travel. While experience has demonstrated that with proper scheduling it will be possible to accommodate most events, there may be instances when a forecast would indicate that capacity may be inadequate for specific movements such as between Manhattan and the complex

and additional transit must be provided. In such instances the large fleet of transit vehicles used for commutation could be made available through charter or other arrangements to handle the additional demand. Also on occasions when two recreational peaks might occur simultaneously, such as a major attraction at the Sports Complex on a day when family travel demands are expected to be heavy, special transit provisions may be necessary. Thus as part of its operational program, the Meadowlands could assist the Sports and Exhibition Authority in securing additional public transportation to meet these peaks. It would also be most desirable if the sports complex could also be included in the District's capital program for transit. Major transit stops at the sports complex are included in the PRT and Busway networks. As noted, such a connection could be available as early as 1985.

Another example of recreational planning would be in terms of transit access to the various park areas proposed in the Meadowlands, and particularly to the large 2,000-acre park adjacent to the town of North Arlington on the westerly boundary of the District. This park will include a golf course, ball fields, and other activities that will attract users from outside the Meadowlands, particularly on weekends. Since it is intended that parking spaces be limited, other means must be found to meet the expected demand. An operational planning program might suggest special recreational bus routes linking the park with the various transportation centers or other assembly points, such as Journal Square, with its connections to PATH. These routes could be served by buses from the commutation fleet.

A Transportation Planning GroupInstitutional and Financial Considerations

The planning and development of transportation services and facilities in the Meadowlands region must be accomplished within the framework of existing organizations and institutions and the constraints of financing.

On the institutional side the large number of involved agencies places a premium on coordination and cooperation. At the local level, the Meadowlands includes portions of fourteen separate towns and municipalities. These municipalities are located in two counties, Bergen and Hudson, with each county adding a second level of government. A third level is provided by the Hackensack Meadowlands Development Commission (HMDC), in its role as a special agency established by the State to oversee and coordinate development in the Meadowlands.

Responsibility for transportation programs is also shared with several other agencies. The New Jersey Department of Transportation (NJDOT) has overall responsibility for highway and public transportation planning and construction in the State, including State highways passing through the District. The New Jersey Commuter Operating Agency has specific authority over the state's subsidy program for commuter rail and bus lines. The commuter rail lines are operated by ConRail, a national quasi-governmental corporation, while the bus lines are operated by a large number of private carriers, the largest of which is Transport of New Jersey. Other important agencies include the New Jersey Turnpike Authority and The Port Authority of New York and New Jersey, who is

responsible for certain airports, bridges, tunnels, terminals, the PATH rapid transit line, and other regional facilities adjoining the area. Finally, the Tri-State Regional Planning Commission is the official planning organization for the metropolitan region, and has responsibility for developing the regional transportation plan.

As transportation planning continues and as operating responsibilities are added to planning functions, additional effort and new institutional arrangements may be needed. For example, a subsidiary to the Commission such as a Meadowlands Transportation Operating Authority may be considered to operate long-term capital projects such as the PRT or Busway. Bus routes also could be operated if arrangements with existing carriers are not satisfactory. Such an authority would allow the Commission to initiate needed construction and service.

The need to raise funds for capital and operating costs is often the major constraint in project planning. Many possible sources of funds can be identified, but no single source can be selected as the "best". Generally, financing must be evaluated on a project-to-project basis, and, in each separate case, the most appropriate methods must be sought. Some of the major sources of funds which Meadowlands staff should consider for various projects include:

The Federal government which provides funds through the Urban Mass Transportation Administration (UMTA) for mass transit projects and through the Federal Highway Administration (FHHA) for highway projects. These federal programs require local matching funds;

State funds for both highway and mass transit projects are administered by NJDOT. Capital funds are generally used to provide the

local share of Federal grants. Operating funds are used for highway maintenance and for subsidies to rail and bus carriers;

County and local governments provide funds for highway and street projects, and sometimes for mass transit projects, especially those which serve only a small area. Good examples are the Mercer Metro bus system, which is heavily subsidized by Mercer County, and the existing Bergen County subsidy program for local bus routes. Local sources might also assist in financing small capital projects such as bus shelters;

Special-purpose authorities, such as the Sports and Exposition Authority, the Turnpike Authority, and the Port Authority, are often a source of funds for projects which are directly related to each authority's own facilities;

Where programs affect more than one locality, special districts are often created. The Meadowlands itself is a special district, and its intermunicipal tax sharing pool is a fiscal device to assist in school financing. Conceivably, similar mechanisms could be created to provide transportation funding; and projects which can be self-supporting can often be financed privately. For example, privately-built and maintained bus shelters might be financed through the sale of advertising space. Other examples are company-sponsored bus and car or van pool services.

Staff Requirements

The physical process of planning transportation facilities must be guided by various institutional, financial, and policy considerations. In order to make the most effective use of our limited resources, these

issues must be fully integrated into an expanded transportation planning effort. Therefore, it is recommended that a Transportation Planning Group be established within the Hackensack Meadowlands Commission. This group would be charged with development and implementation of a transportation master plan and operational programs for the District. The group would include a Supervising Engineer, a Highway Engineer, a transportation Systems Engineer, and a Public Transportation Planner. Initially, the duties of the group could be divided among two people. However, the scope of transportation improvements required, the size of the Meadowlands, and the increased coordination required today to implement transportation projects suggests the group be fully staffed at the earliest possible date. The duties of the four members of this group are outlined as follows:

Group Head

1. Direct activities of the group.
2. Seek funds from external sources to support group activities.
3. Maintain liaison with all external parties concerning with transportation, including:

USDOT	Hudson County
Tri-State	ConRail
NJDOT	Local Communities
Bergen County	Consultants
Developers	

4. Develop and update the Master Plan for transportation in the Meadows.
5. Devise and carry out methods for funding and implementing elements of the Master Plan.
6. Coordinate environmental impact studies of transportation project with other HMDC staff.

Highway Engineer

1. Acquire and maintain traffic counts of all existing roads in and around the Meadowlands.
2. Design or supervise the design (using consultants) of all new roads within the Meadowlands.
3. Participate jointly with NJDOT and other agencies in the design of new roads leading to the Meadowlands.
4. Design and coordinate the construction of all additions and expansions of existing highways within the Meadowlands.
5. Develop a signal and control plan for Meadowlands highways and supervise or review the signalization and signing of highways in the Meadowlands.
6. Work with Transportation Systems Engineer on development of plans for bus activation of signals, priority treatment for transit vehicles and other highway operational techniques.
7. Coordinate the development of new highways with transit proposals.

Transportation Systems Engineer

1. Coordinate and develop bus routes to bring employees to jobs in the Meadowlands.
2. Coordinate and develop bus routes to distribute residents and employees among home, job and shopping sites within the Meadowlands.
3. Develop and administer a system of obtaining operating rights and franchises for these and other transit services based upon Meadowlands need and operators merit.

4. Determine what, if any, subsidy requirements are needed for these and other transit routes and assist operators in obtaining the required financial aid.
5. Assist operators in obtaining necessary equipment for these and other transit services, including assistance in Federal grant applications for capital funds.
6. Develop and administer a staggered work hours program for Meadowlands employment. This program would include an information and advisory service for individual employers designed to reduce the number of employees that arrive at the Meadows in the peak hour.
7. Monitor car and van pooling programs developed by local employers and assist and develop a program to increase the number of people who commute in this manner.
8. Investigate the feasibility of subscription transit services to connect local communities with Meadowlands job sites.
9. Develop procedures such as signal activation, priority traffic lanes, and other improvements designed to give priority or preferential treatment to buses, vans, and car pools.

Transportation Planner

1. Develop and maintain a transportation plan for the Meadowlands. This plan would be in the form of an official map and would be amended from time to time as the Meadowlands develops.
2. Conduct surveys of Meadowlands employees and residents; facilitate all elements of transportation planning.

3. Prepare forecasts of all elements of all components of Meadowlands commutation, including future employees and residents.
4. Prepare transit demand estimates by corridor, highways facility, or transit system for use by the Transportation Group in its planning efforts.
5. Develop plans for mass transportation terminals, park-ride facilities, rail, PRT, AGT light rail, busway and other facilities within the Meadowlands.
6. Obtain funding for approved facilities and coordinate their design with developers and consultants.
7. Review all transportation and other plans received by the Meadowlands for their ability to accommodate pedestrians.
8. Develop and coordinate a transportation program for the aged and handicapped who use Meadowlands facilities.

Monitoring Development and Transportation Needs

Within the Hackensack Meadowlands District there are thirteen zones classified as Specially Planned Areas. This classification means that any development occurring in these areas must be reviewed in a more rigorous manner. The land contained within these zones is critical in determining the future transportation needs of the District. This land accounts for about one-half of the remaining vacant acreage on which development can occur. The types of development allowed in these zones include: residential, office, commercial, industrial, transportation facilities, cultural and various service facilities. The residential development is especially critical since practically all of the new residential development planned for the District will be located in the Specially Planned Area zones called Island Residential 1-4, Parkside Residential 2&3 and Berrys Creek Center.

In order to properly monitor and regulate land uses within these zones, the Master Plan requires that the developer go through a three-stage planning process. The first stage requires the developer to present to the HMDC a General Plan. The General Plan is a overview of the planned development within the zone with sufficient detail so that the HMDC can make judgments concerning the compliance of the plan with the Commission's regulations. The other two stages require the developer to submit a Development Plan and an Implementation Plan. Each of these submittals require more detailed information regarding the proposed development.

As part of the General Plan submission, the HMDC requires the developer to submit an environmental impact assessment. The HMDC had prepared a set of guidelines for the required environmental impact assessments in 1974. These

guidelines have been used since that time. Over the last four years, the Commission has been continually reviewing these guidelines in an effort to identify where improvements in the guidelines might be made.

As a result of this continual review, it was determined that the guidelines for the transportation section of the required environmental impact assessment needed to be more detailed. This transportation study provided the Commission with a working knowledge of the transportation network which previously did not exist. Using this knowledge and after researching Federal, State and other governmental environmental impact reporting requirements, the transportation guidelines were revised.

In keeping with the Commission's general approach to determining the adequacy of the land, sewers and sewage treatment plants, water supply facilities, government services, etc. to handle new developments, transportation was viewed in terms of "carrying capacity". This term is analagous to the usual measures of highway, road and public transit capacity used by transportation planners. The approach is geared to highlighting any deficiencies which will/might occur in the infrastructure, all the items referred to previously including transportation, as a result of the construction of new development. The Commission also talks in terms of staging development in an effort to mitigate overburdening the existing and anticipated infrastructure components.

Specifically regarding the transportation guidelines, the sections dealing with the inventory of transportation facilities and services, the transportation impacts generated by the proposed development, methods for handling any adverse impacts on the transportation network and other reporting requirements were revised. These revisions were structured in an effort to

give the HMDC the type of information needed not only to determine the impacts of the proposed developments on the transportation network, but also sufficient information so that the HMDC can monitor both the changing capacity constraints on the transportation network and the current utilization of the network. These guidelines will thus result in making available to the Commission information which can be used to manage transportation demand resulting from proposed new developments and address some of the associated problems prior to their becoming intractable.

On June 7, 1978, the HMDC Commissioners adopted a revised set of guidelines titled Environmental/Socio-Economic Impact Guidelines for Specially Planned Areas. Included were the revised transportation guidelines. These guidelines, which resulted, in part, from this study effort, are now available so they can be used by developers in reporting the impacts of proposed development in the Specially Planned Areas. The revised transportation guidelines can be found in Appendix XII-1.

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

List of Appendices

Appendix Number	Title
II-1	Objectives
III-1	Previous Transportation Proposals
IV-1	Description of Highways
IV-2	Capacity and Volume on Feeder Routes to District (1976)
IV-3	Capacity and Volume on Routes Within District (1976)
IV-4	Details of 1976 A.M. and P.M. Peak Hour Volumes on Feeder Routes To District
IV-5	Details of 1976 A.M. and P.M. Peak Hour Volumes on Routes Entering or Within District
IV-6	Bus Operating Rights
IV-7	Trans-Hudson Bus Routes - Port Authority Bus Terminal
V-1	Hackensack Meadowlands Transportation Survey - 1976 (Employee (Questionnaire)
V-2	Hackensack Meadowlands Transportation Survey - 1976 (Employer Questionnaire)
V-3	Letter to Companies (Employee Survey)
V-4	Letter to Companies (Employer Survey)
V-5	HMDC to Conduct District Travel Survey (Press Release)
V-6	First Stage of Transportation Study Completed: Additional Mass Transit Urged by HMDC Officials (Press Release)
VI-1	Revised Master Plan Population Projections
VIII-1	Travel Times - Highway Network
VIII-2	Travel Times - Bus Network
VIII-3	Travel Times - Rail Network
VIII-4	Travel Times - PRT Network
VIII-5	Travel Times - Busway/Van Pool Network
IX-1	Centroids of Origin Zones
IX-2	Cost Assumptions
IX-3	Fare Assumptions
IX-4	Proposed Fare Structure
IX-5	Land Acquisition Cost Estimates - Highway Network
XII-1	Excerpts of transportation guidelines contained in "Environmental/Socio-Economic Impact Guidelines," adopted by HMDC on June 7, 1978.

Appendix II-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Objectives

	<u>Check One Box For Each Objective</u>			
	<u>Critical</u>	<u>Very Important</u>	<u>Important</u>	<u>Not Important</u>
Improve transportation between various centers within the Meadowlands District.	☐	☐	☐	☐
Improve transportation between centers within the Meadowlands District and Cities and towns outside the District.	☐	☐	☐	☐
Connect centers within district with external Modes of Public transportation.	☐	☐	☐	☐
Reduce reliance on auto within District, increase reliance on public transportation.	☐	☐	☐	☐
Minimize adverse impacts on environment, particularly air quality.	☐	☐	☐	☐
Improve utilization of existing transportation systems within Meadows.	☐	☐	☐	☐
Utilize existing transportation corridors within District when possible.	☐	☐	☐	☐
Minimize impacts of additional transportation demand on existing transportation systems within Meadows.	☐	☐	☐	☐
Encourage participation of the private sector in implementation of transportation proposals.	☐	☐	☐	☐
Develop programs that minimize the capital investment that is required.	☐	☐	☐	☐
Maximize both private and public financing of additional transportation within District.	☐	☐	☐	☐
Develop transportation proposals that are easy to implement.	☐	☐	☐	☐
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐

Appendix III-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Previous Transportation Proposals

The following is a list of major, previously developed transportation plans that included specific references to the Meadowlands area.

1. Paterson - Times Square Rapid Transit. A plan advanced in the early 1900's for a direct rail link between Bergen and Passaic Counties and Mid-Manhattan. Included was a proposal for a transfer point in the Hackensack Meadows for the passengers of the Erie, New Jersey and New York, Susquehanna, West Shore and Northern Railroads. Even though a charter was obtained, the project was abandoned due to financial difficulties.
2. The New York-New Jersey Port and Harbor Development Commission's 1920 Plan. This plan called for an underground, electrically operated and automatically controlled rail freight line looping between New Jersey and Manhattan. It included provision for the creation of a freight rail terminal in the Hackensack Meadows with facilities for transferring freight from New York City into specially built small freight cars. The proposal was deemed impractical and fell into oblivion.
3. The Jenny 1921 Plan - The Port of New York Development Belt and Loop Plan. This was a revision and expansion of the previous plan to also take care of the passenger transportation problems. It called for a passenger loop to traverse through the Meadows with extensive transfer facilities provided at every point at which the loop intersected with the New Jersey railroads.

4. The Wilgus 1952 Plan. This plan was prepared for the New York Regional Plan Study, the forerunner of the Regional Plan Association, Inc. The proposal also called for a rail loop system, a leg of which would run in a north-south direction through the Meadows. Transfer stations were proposed in Jersey City and one further north in North Bergen. It also called for a new rapid transit link between New Jersey and New York at approximately the location of the present George Washington Bridge.
5. The North Jersey Transit Commission's Plan of 1926. This was basically a loop system through the Meadows with transfer stations provided at the juncture of the Erie Railroad, the Delaware, Lackawanna and Western Railroad, the West Shore Railroad, the New York Susquehanna and Western Railroad, and the Northern Railroad.
6. The Suburban Transit Engineering Board and its 1930 Plan. This plan, too, was based on a loop concept. A portion of the loop would have extended from Jamaica through 57th Street, Manhattan and thence along the West Shore Railroad right-of-way to a junction with the Erie Railroad at Bergen Township where a transfer station would have been located. A possible extension of this partial loop to Lyndhurst was contemplated, thus linking the Erie main line, the Boonton Branch of the Delaware, Lackawanna and Western Railroad and the New Jersey and New York Railroad with this line. Thus construction of a new railroad bridge to span the Hackensack River was contemplated.

7. Regional Plan Association General Plan and Loop Plan of 1928.

This proposal is similar to several previous ones. It calls for an inner passenger rapid transit loop, commencing at the juncture of the Erie Railroad and West Shore Railroad in North Bergen and going east to about 59th Street in Manhattan, thence down to the Battery and west under the Hudson River to the terminal of the Central Railroad in Jersey City and then north over existing railroads to the place of beginning. An extension of the northern link west across the Hackensack River to the juncture of New Jersey and New York Railroad and Erie Railroad in East Rutherford was also part of the plan. The plan received wide publicity nationally.

8. The Jenny 1934 Plan for a Railroad Terminal and Rapid Transit

Development. According to this plan, the railroads in New Jersey would have been brought together over new lines to a point in North Bergen, and then through an underwater tunnel to an underground station, or Union Passenger Terminal, at 6th Avenue in midtown New York. Additional tunnels into New York were proposed.

9. The North Jersey Transit Committee and the Jenny 1935 Rapid

Transit Plan. This plan provided for a new open railroad artery starting at Kingsland and then going east across the Hackensack Meadows to North Bergen then in tunnels to 50th Street, New York, then down to the Battery, and a new tunnel over to the presently abandoned Central Railroad of New Jersey Terminal in Jersey City. Also included was a proposal for a

high-speed line from Newark Airport to North Bergen Transfer Station and thence to Manhattan. Rail transfer stations were provided at Lyndhurst with the Boonton Branch of the Delaware, Lackawanna and Western Railroad in North Bergen to receive the traffic of the Susquehanna, the West Shore and the Northern railroads. A station was proposed for Secaucus.

10. The Jenny 1936 Union Terminal Project. This plan also called for a new line from Newark Airport to North Bergen and from Kingsland, across the Hackensack Meadows, to North Bergen, where interchange facilities would have been provided. This would have been linked directly to a new underground Union Passenger Terminal at 6th Avenue in midtown New York. Eight railroads would have been involved in this project.

11. The Port Authority 1937 Suburban Rapid Transit System Plan. This plan was mainly oriented towards providing better transportation between Passaic and Bergen Counties and New York City. It called for electrification of the Erie Railroad from Paterson to a point near Rutherford and for the construction of a new line from this point to North Bergen where a transfer station would have been provided. The fact that the plan did not consider any improvements on the line linking Newark was considered its major shortcoming, and the plan was shelved.

12. The Port Authority 1949 New Jersey Rapid Transit System Plan. This plan was designed primarily for the purpose of bringing about improved transportation between the Newark Airport and Manhattan. The proposal called for a new electrified link,

partly over existing railroads, from the Hudson and Manhattan to downtown New York. Another link from the Hudson and Manhattan line to Susquehanna Transfer in North Bergen with a transfer from this rail line to Manhattan-bound buses was contemplated. A Meadows Transfer Station (south of the Pennsylvania Railroad Meadows Yards), a station between Communipaw Avenue and the Pulaski Skyway and a South Kearny Station were part of the plan. These were intended to serve industrial workers at Kearny Point. Because of the excessive number of transfers involved and the limitation of new equipment to Hudson and Manhattan standards, the plan was doomed to failure.

13. Meadows Terminal and Rapid Transit Project (The Driscoll Plan of 1948). This was a plan to bring the New Jersey railroads to a terminal in the Hackensack Meadows and linking such a terminal with Manhattan by railroad tunnels. Included was a new railroad link from a point near Newark Airport to a terminal (referred to as the Union Terminal) in North Bergen, a new link from Kingsland to this terminal, and a short link to the north to tie in the other railroads (The West Shore Railroad and others). The Union Terminal in North Bergen would have been tied into 50th Street Manhattan via a rapid transit system. No economic feasibility studies were made on this project although lower land values in the Hackensack Meadows were cited as one reason for the location of the terminal on the New Jersey side of the Hudson River instead of Manhattan.

14. Metropolitan Rapid Transit Commission Plan for Rapid Transit for the New York-New Jersey Metropolitan Area. In June of 1954, the States of New York and New Jersey created a temporary bi-state agency known as the Metropolitan Rapid Transit Commission. The agency was established to study the present and prospective rapid transit needs of the New York-New Jersey Metropolitan area and to develop, recommend, and report possible measures for improving such needs. Final recommendations called for the construction of an independent bi-state rapid transit loop which would provide transfer connections with all suburban railroads in New Jersey. The construction of a new subway line in Manhattan under Madison Avenue, and two new subway tunnels, one in downtown Manhattan at the Battery and another at 59th Street in Midtown was called for. Also proposed was the construction of a spur of the Erie-Railroad from the point where its mainline crosses the Hackensack River to the proposed Susquehanna Transfer Station.

One leg of the rapid transit loop would run along the fringe of the Hackensack Meadows just west of and parallel to the tracks of the Erie Railroad and the New York, Susquehanna and Western Railroad. This loop would enter the Meadows from a railroad juncture in Jersey City where a Lackawanna Station would be located. Another transfer facility - the Susquehanna Transfer - was to be built at the juncture of the Pennsylvania Railroad and the New York Susquehanna and Western Railroad. From thence the line would run northwardly to the point of

juncture with the West Shore Railroad where another transfer station - the West Shore Transfer - would be provided. Thus the Hackensack Meadowlands would have played a prominent role in this plan. It can be assumed, however, that the proposal, at the present time, is infeasible as railroad patronage has dropped considerably, and, in fact, has been completely eliminated from the West Shore Railroad, the locale of one of the proposed transfer stations. Even though public response to the plan was favorable, the failure to establish a bi-state government body with powers to develop, finance, and operate the proposed facility sealed its apparent doom.

15. Morris County Board of Public Transportation Proposals. In 1959 the Board of Chosen Freeholders of Morris County established a Board to work for the promotion co-ordination and improvement of all public transportation facilities and services in and for Morris County. In its role, the Board has set forth several proposals which transcend the political boundaries of the County, yet would directly benefit the County residents. One such proposal calls for the extension of the Flushing Avenue IRT under the Hudson River to Paterson. The Paterson terminal would be reasonably accessible to Morris County residents and its Manhattan-bound commuters. The proposal calls for the construction of a new trans-Hudson tunnel, and a line extending across the Hackensack from North Bergen to Kingsland Station and thence along the existing Delaware,

Lackawanna and Western Railroad right-of-way. The link across the Meadows seems to be based on the Jenny and North Transit proposal of the 1930's.

Another proposal of the Morris County Board of Public Transportation calls for the four-tracking of the Pennsylvania Railroad from Newark into Penn Station with a Transfer Station in the Meadows and a new Hudson River tunnel. Neither of the proposals is under active consideration at the present time.

Appendix IV-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Description of Highways

Regional Arterial Highways

East-West Routes

N.J. Route 4	IV-2
Interstate Route 80	IV-2
U.S. Route 46	IV-3
N.J. Route 3	IV-3
N.J. Route 7	IV-4
Interstate Route 280	IV-5
Interstate Route 78	IV-5
U.S. Route 22	IV-5

North-South Routes

U.S. Routes 1&9	IV-6
Interstate Route 95 (N.J. Turnpike)	IV-6
N.J. Route 17	IV-8
N.J. Route 21 Freeway	IV-8
Pulaski Skyway	IV-13

Trans-Hudson River Crossings

George Washington Bridge	IV-14
Lincoln Tunnel	IV-15
Holland Tunnel	IV-16

HMDC District Routes - Arterial Streets

East - West

Moonachie Avenue	IV-9
Paterson Plank Road	IV-9
County Route 508	IV-9
County Road	IV-10
Secaucus Road	IV-10

North - South

Red Neck Avenue	IV-11
Schuyler Avenue/Orient Way	IV-11
County Road 503	IV-12
Meadowland Parkway	IV-12
County Avenue	IV-13
Huyler Street	IV-13
West Side Avenue	IV-14
N.J. Route 20	IV-24
Gotham Parkway/South Commercial Avenue	IV-29

Appendix IV-1
Description of Highways
p.2

N.J. Route 4

- o Land service arterial running east-west between the George Washington Bridge (GWB) in Fort Lee and Paterson.
- o 4-lane divided highway located 3-4 miles north of the Meadowlands District.
- o Average Annual Daily Traffic
 - 1968 - 75,970 to 87,500
 - 1970 - 81,380 to 87,500
 - 1972 - 81,900 to 101,000
- o Non limited-access

Interstate Route 80

- o Limited access route connecting with I-95 at Teaneck, N.J. The I-80/I-95 combination provides a continuous route across the State from the GWB to the Delaware River.
- o Situated on the northern fringe of the District about 1.0 miles from the northern boundary.
- o 10-lane divided highway with 3 lanes for local traffic and 2 lanes for express traffic in each direction.
- o Average Annual Daily Traffic

	<u>Local</u>	<u>Express</u>
1968	22400	8600
1972	28900	18800
1975	32800	17900

U.S. Route 46

- o Non-limited access, land service type of facility
- o Alternates between a 4-lane undivided highway in Little Ferry and a 6-lane divided facility between Huyler Avenue and N.J. Route 17 adjacent to Teterboro Airport.
- o A primary east-west truck facility between the GWB and the Delaware River, passing along the northern fringe of the District.
- o Average Annual Daily Traffic

<u>Year</u>	<u>West of Tpk.</u>	<u>Hackensack River Bridge</u>	<u>East of Rt. 17</u>
1968	43,400	47,200	39,250
1970	-	48,400	38,350
1972	-	43,500	33,900
1974	35,500	47,000	38,100

N.J. Route 3

- o A limited access route running east-west through the central portion of the District.
- o 6-lane divided facility with service roads flanking the section adjacent to the Sports Complex and also the section through the town of Secaucus.
- o Major commuter route from Passaic, northern Essex and eastern Morris counties to the Lincoln Tunnel.
- o Average Annual Daily Traffic (2-way)

1968 - 67,300

1970 - 68,600

1972 - 70,800

1974 - No count available

- o Average Annual Daily Traffic (one-way in Clifton west of Passaic River eastbound)

1969 - 41,600

1970 - 42,600

1972 - 44,200

1973 - 44,400

N.J. Route 7 (Belleville Pike)

- o A non-limited-access route crossing the southern portion of the District in an east-west direction.
- o Presently operates as a 4-lane undivided highway on a sub-standard pavement width. (No shoulders).
- o Two overpasses of ConRail track have substandard roadway widths and restricted sight distances.
- o Existing right-of-way is 50 feet.
- o Average Annual Daily Traffic (2-way)

1968 - 17,200

1970 - 18,160

1972 - 18,200

1974 - 18,900

Interstate Route 280

- o A limited access route scheduled for construction in 1976 and completion by 1980.
- o Will interchange with I-95 (NJ Tpk) in the extreme southwest area of the District providing another outlet to the west via connection with I-80.
- o Assumed minimum of 6 lanes divided, 3 each direction with shoulders.

Interstate Route 78

- o A limited-access east-west route currently under construction about 3 miles south of the District's southern boundary.
- o Interchanges with I-95 (NJ Tpk) in Newark; with US Rt 1&9 and the Garden State Parkway.
- o 10-lane facility; 5 lanes each direction with three local lanes and two express lanes between Newark and Springfield.
- o Newark to Springfield section scheduled for completion in 1977.

U.S. Route 22

- o Four to six lane divided land service arterial running east-west about four miles from the District's southern boundary.
- o Construction underway in the Newark area will increase the capacity of the viaduct section over the Waverly Yards of the ConRail system.

o Average Annual Daily Traffic (2-way)

1968 - 31,440

1970 - 29,750

1972 - 29,850

1973 - 29,500

U.S. Routes 1 & 9 (Tonnelie Ave.)

- o Four-lane divided land-service route running north-south along the eastern border of the District.
- o Heavily utilized truck route that provides the free alternate to the N.J. Tpk and links the GWB, LT and HT with NYC and the region.
- o Currently lacks shoulders; has poor lighting and drainage; traverses heavily commercialized areas of Jersey City, North Bergen, Fairview and Ridgefield.
- o Average Annual Daily Traffic (2-way)

	<u>South of RT 3</u>	<u>North of Rt 3</u>
1968 -	48,200	30,000-32,000
1970 -	47,000	30,000-34,000
1972 -	46,700	29,000
1974 -	42,900	30,500

Interstate Route 95 (N.J. Turnpike)

- o A dual system of north-south roadways that courses through the District in the eastern and central sectors. The dual system of roadways divides south of Interchange #15 in Newark

and merges at U.S. Route 46 in Ridgefield Park where the Turnpike designation ends. North of the merge the road is under NJDOT jurisdiction.

- o The eastern sector roadway or eastern spur is a 6-lane divided limited access facility that provides a direct link to the Lincoln Tunnel, and also serves the GWB.
- o The roadway system located in the central sector of the District along the western bank of the Hackensack River and signed as I-95, is also a 6-lane divided limited-access facility. However, this 6-lane segment ends at N.J. Route 3 (Interchange 16W) and becomes a 4-lane facility north of this interchange. The westerly spur serves the GWB directly.
- o Major state and local routes interchange at the following locations:

#15E - U.S. Rt. 1 & 9

#15W - Harrison/Jersey City Tpk; Future I-280

#16E - Rt. 3, US 1&9, I-495 (Lincoln Tunnel Connectors)

#16W - Rt. 3, Rt. 20

#18 - US 46, I-80, GWB

- o Average Annual Daily Traffic

	<u>Eastern Spur</u>	<u>Western Spur</u>
1968	73,100	Under Const.
1970	80,950	" "
1972	49,800	51,000
1974	56,200	50,100

N.J. Route 17

- o A 6-lane divided land service (non-limited access) route running north-south along the western periphery of the District between Routes I-80 and N.J. Rt. 3. South of Route 3 this facility jogs west to Ridge Road and continues south to N.J. Route 7 where it terminates as a State Highway. The portion signed as Route 17 on Ridge Road passes through the commercial centers of Lyndhurst and North Arlington.
- o Recently upgraded between U.S. Rt. 46 on the north and N.J. Rt. 3 on the south with grade-separated interchanges at Moonachie Avenue and Paterson Plank Road -- two east-west collector-distributor roads that serve the District.
- o Average Annual Daily Traffic (2-way)
 - 1968 - 39,500
 - 1970 - 34,000 to 43,000
 - 1972 - 46,000 to 60,000
 - 1974 - to 60,400

N.J. Route 21 Freeway

- o A 6-lane divided limited-access facility serving the north-south corridor between Paterson and Newark.
- o Located along the west bank of the Passaic River about 1.5 miles from the District's western boundary.
- o Interchanges with such east-west routes as Rt. 3, Rt. 7 and I-280.

o Average Annual Daily Traffic (2-way)

1968 - 33,200

1970 - 41,750

1972 - 42,200

1974

Moonachie Avenue

- o East-west collector-distributor between NJ 17 and Moonachie Rd.
- o 4-lanes undivided
- o Right-of-way varies between 61 and 63 feet.
- o Jurisdiction - Bergen County
- o Forms southern boundary of Teterboro Airport

Paterson Plank Road

- o East-west connector between NJ 17 and NJ 20
- o Widening to four lanes with median divider has been completed between NJ 17 & NJ 20.
- o Forms northern boundary of Sports Complex
- o Right-of-way - 70 to 80 feet.
- o Jurisdiction - NJDOT

County Route 508 (Jersey City - Harrison Avenue - Newark Turnpike)

- o East-west collector-distributor road situated in the southerly portion of the District.
- o At reduced speeds, 4-lanes of traffic could be maintained on the existing sub-standard roadway width.

- o Road surface is deteriorating, drainage is inadequate and lighting is poor.
- o Right-of-way - 66 feet
- o Jurisdiction - Hudson County

County Road

- o East-west collector-distributor penetrating the southeasterly portion of the District from US 1&9 (Tonnelle Ave.)
- o Presently 2 lanes wide.
- o Right-of-way - 100 feet
- o Jurisdiction - Hudson County

Secaucus Road

- o East-west collector-distributor entering the southeasterly portion of the District from US 1&9 (Tonnelle Ave.)
- o Presently 2 lanes wide in a right-of-way that varies from 50 feet in Secaucus to 60 feet in North Bergen.
- o Intersects with County Avenue, a north-south route in Secaucus and penetrates the Hartz Mountain Industrial complex.

- o Extension of route from County Avenue westbound to Meadowlands Parkway is in existence.
- o Jurisdiction - Hudson County

Red Neck Avenue

- o A collector - distributor route that begins at Liberty Ave. in Little Ferry and intersects with Moonachie Ave., an east-west route at its southern end.
- o Situated at eastern boundary of Teterboro Airport
- o 2-lane facility partially in residential area with a right-of-way of 50 feet.
- o Jurisdiction - Bergen County

Schuyler Avenue/Orient Way

- o A minor north-south arterial located along the westerly border of the District linking the Harrison-Newark Turnpike with N.J. Route 3.
- o This arterial is located in the towns of Harrison, Kearny, North Arlington and Lyndhurst and in the counties of Hudson and Bergen.
- o It is a 2-lane facility throughout its length within a variable right-of-way of 50 to 60 feet.
- o 1973 ADT volumes in the Hudson Co. section were 12,800 as reported in the Richard P. Browne Associates Topics Study for the Towns of East Newark, Harrison and Kearny, dated 8/74. This same study projects ADT volumes of 14,800 for 1983.

- o Resurfacing is necessary because of heavy truck useage.
- o Jurisdiction - Hudson & Bergen Counties.

County Road 503

- o Comprised of Liberty Ave. in Little Ferry,
Moonachie Road in Moonachie and Washington
Avenue in Carlstadt. Joins NJ Route 20 in East
Rutherford.
- o A major north-south arterial linking N.J. Route 3
on the south with U.S. Route 46 on the north.
Continues northward through Bergen County to
N.Y. Route 304 in Pearl River.
- o That portion of route through Carlstadt and
Moonachie is four lanes, while southerly section
in East Rutherford (NJ Rt. 20) adjacent to Sports
Complex has been widened to six lanes.
- o Jurisdiction - Bergen County for sections north
of Paterson Plank Road, NJDOT south of Paterson
Plank Road.
- o Moonachie Rd. R.O.W. - 50 feet
- o Washington Ave. R.O.W. - 60 feet

Meadowlands Parkway

- o A north-south collector-distributor serving the Hartz
Mountain industrial complex in Secaucus, and in the
future the residential development of Harmon Cove.

- o Extends southward from an interchange with N.J. Rt. 3 as a four-lane facility within a R.O.W. of 100 feet.
- o Proposal under study to connect with New County Rd. at the southern border to create a "ring road" concept for this industrial area.
- o Jurisdiction - Hartz Mountain Industries for existing section; not yet determined for section under study.

County Avenue

- o A short, minor arterial located in Secaucus. Connects New County Road on the south with Paterson Plank Road on the north.
- o Two-lane facility within a 60 foot right-of-way.
- o Connects with Secaucus Road and New County Road, both of which serve as outlets to U.S. Route 1 (Tonnelles Ave.)

Huyler Street

- o A minor north-south arterial street that connects the northwestern corner of the District and Interstate Route 80 as well as U.S. Route 46, both east-west routes.
- o The use of this artery when coupled with Wesley Street on the north side of I-80 and North Street on the south

side of I-80 provides full east-west interchange capabilities with this interstate highway.

- o Proposed realignment of Red Neck Avenue to meet Huyler Street at U.S. Rt. 46 would improve access into the District from the arterial highway system along the northern boundary.

West Side Avenue

- o A north-south collector-distributor located in North Bergen at the extreme easterly border of the District.
- o Presently extends from 69th Street to 83rd Street in North Bergen with another 2 mile section running northward from Paterson Plank Road at the southerly end of community.
- o This local arterial serves as a collector-distributor for the industries sandwiched between the railroads, which forms the District's easterly boundary and the N.J. Turnpike.
- o Jurisdiction for this route rests with the local municipality.

Appendix IV-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Capacity and Volume on Feeder Routes to District*
(1976)

<u>Location</u>	<u>Description</u>	<u>Direction</u>	<u>Capacity</u>	<u>Volume</u>	<u>Unused Capacity</u>
1	GWB (On Bridge)	WB	11,200	7,400	3,800
2	I-95 North of Fort Lee Road Interchange	WB	9,010	4,655	4,355
3	I-80 West of I-95 Interchange	EB	8,830	5,560	3,270
4	I-80 West of Route 17 Interchange	WB	8,830	4,670	4,160
		EB	7,280	4,860	2,420
5	Route 46 Bridge over Terrace Avenue	EB	3,610	2,210	1,400
6	Route 17 Between Williams Avenue and Franklin	SB	3,000	2,920	80
7	Route 46 East of Little Ferry Circle	EB	2,200	1,370	830
		WB	2,080	2,080	-0-
8	I-95 South of I-80 Interchange	SB	8,860	5,040	2,810/1,010
9	Route 1&9 South of I-80 Interchange	WB	3,570	1,640	1,930
10	Route 1&9 North of 69th Street	SB	1,700	1,120	580
11	Route 1&9 North of 51st Street	NB	1,700	1,210	490
		SB	1,700	1,370	330
12	Lincoln Tunnel	WB	2,400	2,400	-0-
12A	I-495 Union City Underpass	WB	3,400	2,580	820
13	Holland Tunnel	WB	2,200	2,200	-0-
14	Route 1 (Bus) Jersey City Cut	WB	1,930	1,930	-0-
15	Route 1&9 North of Skyway Interchange	NB	1,800	1,800	-0-
		SB	1,600	1,490	110
18	I-280 on Bridge over Passaic River	EB	2,800	2,800	-0-
19	Schuyler Avenue - North of Belleville Turnpike	NB	840	450	390
		SB	930	620	310
20	Route 17 (Ridge Road) North of Kingsland Avenue	NB	860	600	260
		SB	800	350	450
21	Route 3 on Bridge over Passaic River	EB	5,300	5,280	20
22	Route 17 South of Meadow and Highland Road	NB	2,750	2,510	240
23W	NJT West Spur Between 16W and 18W	SB	3,040	2,060	980
23E	NJT East Spur Between Interchange 17 & Rt. 46	SB	5,510	3,730	1,780
24W	NJT West Spur Between Interchange 15W and 16W	NB	4,910	2,530	2,380
		SB	4,910	2,900	2,010
24E	NJT West Spur Between Tpk Split & Interchange 16E	NB	4,850	2,240	2,610
		SB	4,730	2,290	2,440
25W	NJT West Spur Between Tpk Split and 15W	NB	4,950	2,740	2,210
25E	NJT East Spur Between Int. 15E and Tpk Split	NB	4,860	2,080	2,780

* Vehicles per hour, AM Peak Hour, typical weekday.

Appendix IV-3
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Capacity and Volume on Routes Entering or Within District*
(1976)

<u>Location</u>	<u>Description</u>	<u>Direction</u>	<u>Capacity</u>	<u>Volume</u>	<u>Unused Capacity</u>
1	Paterson Plank Rd. West of Rt. 1&9	WB	1,250	890	360
2	Rt. 3 - Main and Service Rd. West of NJT - East Spur	WB	9,100	3,910	1,720/3,420
3	Secaucus Rd. West of 1&9	WB	850	780	70
4	County Rd. West of 1&9	WB	890	890	0
5	Rt. 7 (Willpen Bridge)	WB	2,750	1,070	1,680
6	Fish House Rd. South of Rt. 7	NB	890	610	280
7	Harrison Ave. East of Schuyler Avenue	EB	3,150	1,350	1,800
8	Bellville Tpk. East of Schuyler Avenue	EB	1,700	1,560	140
9	Rt. 3 at Berry's Creek Br.	EB	5,460**	5,460	0
10	Paterson Plank Rd. East of Rt. 17	EB	2,400	1,260	1,140
11	Moonachie Ave. East of Rt. 17	EB	3,600	1,530	2,070
12	Moonachie Rd. North of Moonachie Ave.	SB	1,500	1,460	40
13	Rt. 20 North of Rt. 3	{ NB SB	5,180 5,410	1,580 1,690	3,600 3,720
14	Meadowland Parkway	SB	3,310	1,370	1,940
15W	NJT Interchange 15W	--	***	(see Appx. IV-5)	***
16W	NJT Interchange 16W	--	***	"	***
16E	NJT Interchange 16E	--	***	"	***
17E	NJT Interchange 17E	--	***	"	***
18	County Ave. South of Paterson Plank Rd.	SB	1,400	1,320	80
19	Polito Ave. South of Rutherford	SB	3,080	760	2,320

* Vehicles per hour, AM Peak Hour, typical weekday.

** Calculated capacity = 4,350 mph (Observed volume exceeded capacity).

*** Not calculated.

Appendix IV-4
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
Details of 1976 AM & PM Peak Hour Volumes on Feeder Routes to District*

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>	<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>
1	GWB	Eastbound Upper Level 7301 Lower Level 4001 Total 11,302(9) 7:00-8:00AM Westbound Upper Level Lower Level Total 10,337 ^a (13) 5:00-6:00PM	Westbound Total 7,142 ^a (14) 7:00-8:00AM Eastbound Total 8164(7) 5:00-6:PM
2 **	I-95	Southbound Express 2366 7:30-8:30AM Local 2289 7:15-8:15AM Southbound Express 2566 4:30-5:30PM Local 2470 4:15-5:15PM	Northbound Express 1574 7:00-8:00AM Local 2241 7:45-8:45AM Northbound Express 2005 4:15-5:15PM Local 2532 4:45-5:45PM
3 **	I-80	Eastbound Express 1877 7:45-8:45AM Local 3684 7:45-8:45AM Westbound Express 2430 4:45-5:45PM Local 3394 4:45-5:45PM	Westbound Express 1774 7:15-8:15AM Local 2895 7:30-8:30AM Eastbound Express 1601 4:45-5:45PM Local 3816 4:45-5:45PM
4 **	I-80	Eastbound Express 2055 7:30-8:30AM Local 2797 8:00-9:00AM Westbound Express 2350 4:45-5:45PM Local 3185 4:30-5:30PM	Westbound Express 1790 7:30-8:30AM Local 2095 8:00-9:00AM Eastbound Express 1629 4:30-5:30PM Local 2552 4:45-5:45PM

() Truck Percentage

a From Traffic Measuring System (TMS) 1975

* Vehicles Per Hour

** Mechanical Count

Appendix IV-4

p. 2

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>	<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>
5	Route 46	Eastbound 2210(5) 7:30-8:30AM Westbound 2475(2) 4:30-5:30PM	Westbound 999(11) 8:00-9:00AM Eastbound 1366(5) 4:30-5:30PM
6	Route 17	Southbound 2918(7) 7:30-8:30AM Northbound 3145(4) 4:30-5:30PM	Northbound 2521(13) 7:45-8:45AM Southbound 2324(10) 4:14-5:15AM
7	Route 46	Westbound 2080(5) 7:15-8:15AM Eastbound 2284(4) 4:15-5:15PM	Eastbound 1368(14) 7:45-8:45AM Westbound 1765(6) 4:30-5:30PM
8	I-95	Southbound From N&E 2538(12) 7:15-8:15AM From N&W 2506(14) 7:15-8:15AM Northbound To N&W 2413(10) 5:15-6:15PM To N&E 2432(9) 5:15-6:15PM	Northbound To N&W 1259(20) 7:30-8:30AM To N&E 1155(31) 7:30-8:30AM Southbound From N&E 1481(27) 4:15-5:15PM From N&W 1432(14) 4:15-5:15PM
9**	Rt. 1 & 9	Southbound 1644 7:30-8:30AM Northbound 2120 4:15-5:15PM	Northbound 1511 7:15-8:15AM Southbound 1495 4:30-5:30PM
10	Rt. 1 & 9	Southbound 1121(15) 7:15-8:15AM Northbound 1272(7) 4:30-5:30PM	Northbound 861(8) 6:30-7:30AM Southbound 979(14) 3:30-4:30PM
11	Rt. 1 & 9	Southbound 1366(16) 7:00-8:00AM Northbound 1481(10) 4:30-5:30PM	Northbound 1214(13) 7:00-8:00AM Southbound 1356(16) 4:00-5:00PM

Appendix IV-4

p. 3

Designation	Facility	Predominant Direction		Minor Direction	
		Peak Hour Volume - vph		Peak Hour Volume - vph	
12	LT	Eastbound(4 lanes)		Westbound(2 lanes)	
		4649(13)	8:00-9:00AM	2372 ^a	7:00-8:00AM
		Westbound(4 lanes)		Eastbound(2 lanes)	
		4835 ^a	5:00-6:00PM	2892(10)	4:00-5:00PM
12A	Union City Underpass	Eastbound*** (3 lanes)		Westbound (2 lanes)	
		3874(10)	7:00-8:00AM	2577(8)	7:00-8:00AM
		Westbound(3 lanes)		Eastbound(3 lanes)	
		3951(12)	3:30-4:30PM	3509(6)	4:30-5:30PM
13	HT	Westbound		Eastbound	
		2372***	7:00-8:00AM	2278(26)	7:00-8:00AM
		Westbound		Eastbound	
		2590***	5:00-6:00PM	2409-(10)	5:00-6:00PM
14 **	Rt. 1 (Bus.)	Westbound		Eastbound	
		1999	6:15-7:15AM	1932	6:45-7:45AM
		Westbound		Eastbound	
		1961	4:15-5:15PM	1648	3:30-4:30PM
15	Rt. 1&9	Northbound		Southbound	
		1798(10)	6:30-7:30AM	1494(12)	6:30-7:30AM
		Northbound		Southbound	
		1739(16)	4:30-5:30PM	1354(16)	4:30-5:30PM
16**	Rt. 1 & 9 (Tr.)	Southbound		Northbound	
		1278	7:30-8:30AM	1051	6:45-7:45AM
		Northbound		Southbound	
		1413	2:15-3:15PM	1340	3:45-4:45PM
17**	Pulaski Skyway	Eastbound		Westbound	
		2295	6:45-7:45AM	2231	6:15-7:15AM
		Eastbound		Westbound	
		2479	4:30-5:30PM	1651	5:00-6:00PM

*** TMS 1976

**** XBL Vol. not included

Appendix IV-4

p. 4

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>		<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>	
18 **	I-280	2976	Eastbound 6:30-7:30AM	2314	Westbound 7:15-8:15AM
		2786	Westbound 4:15-5:15PM	2050	Eastbound 3:45-4:45PM
19	Schuyler Avenue	619(11)	Southbound 7:15-8:15AM	449(16)	Northbound 7:15-8:15AM
		883(6)	Northbound 4:30-5:30PM	552(12)	Southbound 4:00-5:00PM
20	Ridge Road	606(7)	Northbound 7:30-8:30AM	345(9)	Southbound 7:15-8:15AM
		833(4)	Southbound 4:30-5:30PM	513(5)	Northbound 4:15-5:15PM
21 **	Rt. 3	5284	Eastbound 7:15-8:15AM	3148	Westbound 7:45-8:45AM
		4273	Eastbound 4:30-5:30PM	4154	Westbound 4:45-5:45PM
22	Rt. 17	2508(11)	Northbound 7:30-8:30AM	2326(11)	Southbound 7:30-8:30AM
		2751(8)	Southbound 4:30-5:30PM	2228(11)	Northbound 3:30-4:30PM
23E *****	NJT	3729(11)	Southbound 7:30-8:30AM	1298(19)	Northbound 7:30-8:30AM
		4311(6)	Northbound 4:30-5:30PM	1761(19)	Southbound 4:00-5:00PM

*****Furnished by NJTA

Appendix IV-4
p. 5

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>	<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>
23W *****	NJT	Southbound 2058(31) 7:00-8:00AM Northbound 2327(9) 5:00-6:00PM	Northbound 2004(16) 7:30-8:30AM Southbound 1448(10) 5:00-6:00PM
24E *****	NJT	Southbound 2294(26) 7:00-8:00AM Southbound 2652(17) 5:00-6:00PM	Northbound 2238(23) 8:00-9:00AM Northbound 2574(16) 4:30-5:30PM
24W *****	NJT	Southbound 2898(22) 7:00-8:00AM Northbound 2762(11) 4:30-5:30PM	Northbound 2528(22) 7:30-8:30AM Southbound 2622(17) 4:30-5:30PM
25E *****	NJT	Southbound 2194(26) 7:00-8:00AM Southbound 2547(15) 5:00-6:00PM	Northbound 2076(23) 8:00-9:00AM Northbound 2373(17) 4:30-5:30PM
25W	NJT	Southbound 3026(17) 7:00-8:00AM Northbound 3401(12) 4:00-5:00PM	Northbound 2774(20) 7:30-8:30AM Southbound 3019(14) 4:30-5:30PM

Appendix IV-5

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Details of 1976 AM & PM Peak Hour Volumes on Routes Entering or Within District*

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>	<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>
1	Pat. Plank Rd.	Eastbound 1783 (6) 7:15-8:15AM Eastbound 1172 (13) 3:30-4:30PM	Westbound 891 (7) 6:45-7:45AM Westbound 841 (6) 5:30-6:30PM
2	Rt. 3	Eastbound Express 3233 (10) Ser. Rd. 1014 (11) Total 4247 6:45-7:45AM Westbound Express 3991 (10) Ser. Rd. 191 (5) Total 4182 5:00-6:00PM	Westbound Express 3730 (8) Ser. Rd. 180 (3) Total 3910 7:00-8:00. Eastbound Express 2915 (7) Ser. Rd. 1098 (11) Total 4013 4:15-5:15
3	Secaucus Rd.	Westbound 781 (6) 7:30-8:30AM Eastbound 814 (7) 4:15-5:15PM	Eastbound 410 (26) 8:00-9:00AM Westbound 452 (14) 3:30-4:30PM
4	County Rd.	Westbound 919 (7) 7:15-8:15AM Eastbound 616 (9) 4:00-5:00PM	Eastbound 410 (26) 8:00-9:00AM Westbound 390 (27) 3:30-4:30PM
5 **	Rt. 7	Eastbound 1529 7:15-8:15AM Westbound 2041 3:30-4:30PM	Westbound 977 7:15-8:15AM Eastbound 1314 4:30-5:30PM

* Vehicles per hour

() Truck Percentage

** Mechanical Count

Appendix IV-5

p. 2

<u>Designation</u>	<u>Facility</u>	<u>Predominant Direction</u> <u>Peak Hour Volume - vph</u>		<u>Minor Direction</u> <u>Peak Hour Volume - vph</u>	
6 **	Fish House Road	607	Northbound 6:45-7:45AM Southbound 3:30-4:30PM	343	Southbound 8:15-9:15AM Northbound 2:15-3:15PM
7	Harrison Ave.	1346 (10)	Eastbound 6:45-7:45AM Westbound 4:45-5:45PM	1006 (7)	Westbound 7:15-8:15AM Eastbound 4:30-5:30PM
8	Beleville Tpk.	1559 (7)	Eastbound 7:00-8:00AM Westbound 3:30-4:30PM	566 (34)	Westbound 8:00-9:00AM Eastbound 4:30-5:30PM
9	Rt. 3	5461 (12)	Eastbound 7:00-8:00AM Westbound 4:30-5:30PM	3166 (14)	Westbound 7:30-8:30AM Eastbound 4:30-5:30PM
10	Pat. Plank Rd.	1258 (5)	Eastbound 7:00-8:00AM Westbound 4:15-5:15PM	400 (17)	Westbound 7:30-8:30AM Eastbound 3:45-4:45PM
11	Moonachie Ave.	1529 (5)	Eastbound 7:30-8:30AM Westbound 4:30-5:30PM	445 (27)	Westbound 8:00-9:00AM Eastbound 3:45-4:45PM
12	Moonachie Rd.	1460 (9)	Southbound 7:00-8:00AM Northbound 3:30-4:30PM	513 (20)	Northbound 7:00-8:00AM Southbound 3:45-4:45PM

Appendix IV-6

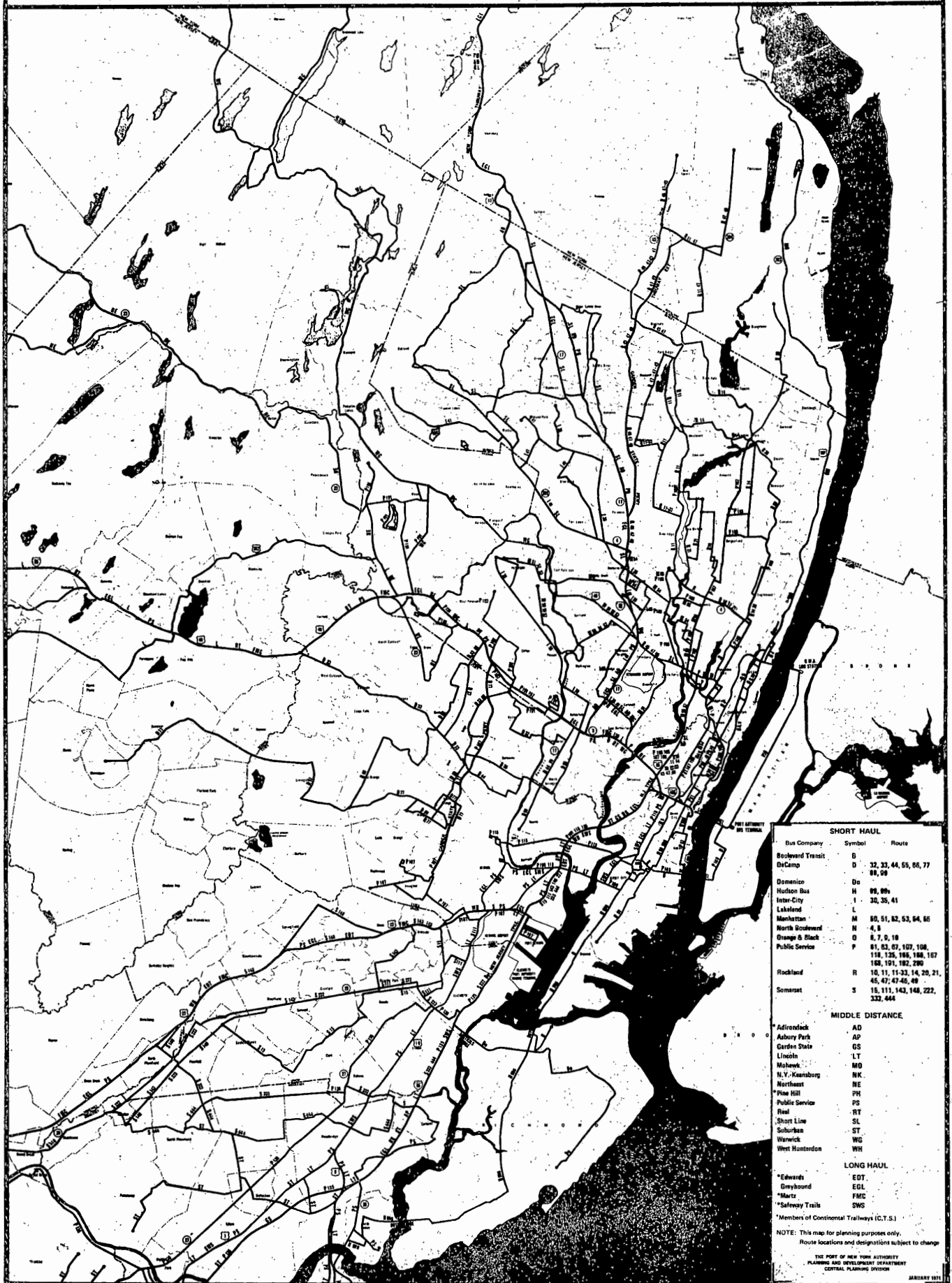
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Bus Operating Rights (Major Routes)

<u>Company</u>	<u>Territory</u>
Blue & White	Meadowlands Hospital
DeCamp Bus Company	Route 3, Route 7, Secaucus
Hudson Bus Company	Secaucus, Hartz area except for Blue & White to Hospital
Manhattan Bus Company	Route 20, Washington Avenue and Moonachie Road, Moonachie Avenue, Route 46 (via Route 51), Vince Lombardi Park and Ride
Maplewood Equipment Company ¹	Route 20, Secaucus, Sports Complex (to NYC)
Short Line Bus Company	Route 17
Transport of New Jersey	Route 3, Paterson Plank Road, Harrison Avenue, New Jersey Turnpike, Secaucus, North Bergen (Tonnelles Avenue), North Bergen Park and Ride

¹Subsidiary of Transport of New Jersey

Appendix IV-7
TRANS-HUDSON BUS ROUTES
PORT AUTHORITY BUS TERMINAL



SHORT HAUL

Bus Company	Symbol	Route
Boulevard Transit	B	
DeCamp	D	32, 33, 44, 55, 66, 77 88, 99
Dominion	Do	
Hudson Bus	H	88, 99
Inter-City	I	32, 35, 41
Lakeland	L	
Manhattan	M	65, 51, 52, 53, 54, 55
North Boulevard	N	4, 5
Orange & Black	O	6, 7, 8, 18
Public Service	P	61, 63, 67, 107, 108, 118, 125, 185, 188, 187, 189, 191, 192, 280
Rockland	R	10, 11, 11-33, 14, 20, 21, 45, 47, 47-48, 49
Somerset	S	15, 111, 143, 148, 222, 332, 444

MIDDLE DISTANCE

*Adirondack	AD
Arbony Park	AP
Garden State	GS
Lincoln	LT
Mohawk	MO
N.Y.-Kearnsburg	NK
Northwest	NE
Pine Hill	PH
Public Service	PS
Real	RT
Short Line	SL
Suburban	ST
Warwick	WG
West Haverstron	WH

LONG HAUL

*Edwards	EDT
Greyhound	EGL
*Hart	HMC
*Safeway Trails	SWC

*Members of Continental Trailways (C.T.S.)

NOTE: This map for planning purposes only.
 Route locations and designations subject to change

THE PORT OF NEW YORK AUTHORITY
 PLANNING AND DEVELOPMENT DEPARTMENT
 CENTRAL PLANNING DIVISION
 JANUARY 1971

HACKENSACK MEADOWLANDS TRANSPORTATION SURVEY -- 1976

To help improve your transportation please fill out this questionnaire concerning travel to your job. This information will be a vital part of the transportation study now underway by the Hackensack Meadowlands Development Commission, a land use planning and regulatory agency of the State of New Jersey, in cooperation with the Port Authority of New York and New Jersey.

The study will recommend ways to improve present and future public transportation and highway systems in the Hackensack Meadowlands District, located in portions of Bergen and Hudson Counties.

Your cooperation in completing the questionnaire and returning it promptly is appreciated. Remember your answers will be the basis for planning tomorrow's transportation.

FOR OFFICE USE

1. Name of Company _____

2. Your job title _____

3a. When did you start working with your present company at this location?

_____ and _____
Month Year

3b. Did you work for this company at any other location?

☐ Yes ☐ No

If yes, where else did you work for this company?

_____ city or town _____ state _____ zip code

4a. Where do you live?

_____ street address or nearest intersection

_____ city or town _____ state _____ zip code

4b. How long have you lived at this address? _____ Years

4c. Did you change your residence primarily because your job location changed?

☐ Yes ☐ No ☐ Never Changed Residence

4d. If yes, where did you live before this?

_____ city or town _____ state _____ zip code

5. What are your official work hours?

Starting time _____ : _____ AM
_____ PM

Ending time _____ : _____ AM
_____ PM

6. Do you have a car available to drive to work?

☐ Yes ☐ No

	6	8
	9	10
	11	14
		15
{	16	20
	21	25
{	26	30
	31	35
	36	39
		40
{	41	45
	46	50
	51	54
	55	58
		59

How do you normally travel to work?

- ☐ Car, drive alone
- ☐ Car, dropped off by someone
- ☐ Carpool, how many are in the carpool? _____
including yourself
- ☐ Public bus, _____
Company Route No.
- ☐ Company bus
- ☐ Walk only
- ☐ Railroad _____
Name
- ☐ Other _____
Please specify

7b. If you usually drive your car to work, do you use it during the day for personal or business reasons?

☐ Yes☐ No

8. How long on the average does it take you to get to work?

_____ hours _____ minutes

9. How much does it cost you to travel to and from work daily? \$ _____.
(If you drive or are dropped off, give your estimated "operating" costs; for example, gas, tolls, parking fees, etc. If you are in a carpool, give your share of the costs.)

10a. In general, how do you rate your present trip? (Please check appropriate box.)

Very
Satisfied

Satisfied

Dissatisfied

Very
Dissatisfied

☐☐☐☐

10b. If you checked Dissatisfied or Very Dissatisfied, please give reason(s) why you are not satisfied.

11. Please check appropriate boxes:

Sex: ☐ Male

Age: ☐ Under 25 ☐ 45 - 64

☐ Female

☐ 25 - 34

☐ 65 and over

☐ 35 - 44

Annual Family Income:

☐ Under \$7,500

☐ \$15,000 - \$19,999

☐ \$7,500 - \$9,999

☐ \$20,000 - \$24,999

☐ \$10,000 - \$14,999

☐ \$25,000 and over

Please return completed questionnaire to your company coordinator.

"The preparation of this questionnaire has been financed in part through funds from the U.S. Department of Transportation, Federal Highway Administration under the Federal Highway Act of 1956, as amended, and the Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964, as amended."

Appendix V-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Hackensack Meadowlands Transportation Survey - 1976

1. Name of company _____
Person completing form _____

2. Present address _____
Number and Street City or Town Zip Code

3. What type of business is your company engaged in?

☐

manufacturing

☐

retail sales

☐

warehousing

☐

wholesale trade

☐

office building

☐

4. How many square feet of space does your company occupy at this location?
_____ sq. ft.

About what proportion of this space is devoted to the following activities?

office space _____%

warehousing _____%

manufacturing _____%

5. Is this a new company or did the company relocate from another site?

☐

New company

☐

Relocated company

6. If your company has relocated from another site:

a) where was your company formerly located?

Street Address

City or Town

State

Zip Code

b) when did your company move to its present location? _____ and _____
Month Year

7. Employee Data

- a. Please indicate the number of employees who begin work during the following time periods:

<u>Begin Work Between</u>	<u>Total Employees</u>	<u>No. of Office Employees</u>	<u>Number of Plant or Warehouse Employees</u>
6 AM & 9:59 AM	_____	_____	_____
10 AM & 2:59 PM	_____	_____	_____
3 PM & 6:59 PM	_____	_____	_____
7 PM & 5:59 AM	_____	_____	_____
b. How many employees do you expect to employ by 1980?	_____	_____	_____

8. On a typical work day, approximately how many of the following types of trips are made in and out of your company?

salesman _____ visits per day
other visitors _____ visits per day
truck movements _____ per day

9. Approximately how many parking spaces does your company provide?

for employees _____
for visitors _____
Total _____

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Hackensack Meadowlands Development Commission

1099 WALL STREET WEST • LYNDBURST, NEW JERSEY 07071 • (201) 935-3250



TRICIA Q. SHEEHAN
Chairman

LIAM D. McDOWELL
Executive Director

To Whom It May Concern:

The Hackensack Meadowlands Development Commission, a land use planning and regulatory agency of the State of New Jersey, in cooperation with the Port Authority of New York and New Jersey is conducting a comprehensive transportation study of the Hackensack Meadowlands District. This study will recommend ways to improve the public transportation and highway systems of the District.

We don't have detailed up-to-date information on the average worker's journey-to-work so it's necessary to conduct a survey to determine where people work, where they live, how they travel to work and other pertinent information. We also need to survey companies in the area to determine where growth areas will be and obtain suggestions so that we can plan for the transit and traffic needs.

Two questionnaires have been developed, one to be completed by the company and another for employee use. A member of the study team will be contacting you soon to ask for your cooperation in carrying out the survey. I sincerely urge that you join with all of your Meadowlands neighbors in helping us to get the information needed to plan better transportation for you.

Please call us if we should contact a different person in your company or if you have any other questions concerning the survey. Calls should be directed to Mr. Richard Roberts or Mr. Juhan Simonson at (201) 935-3250.

Sincerely,

A handwritten signature in dark ink, appearing to read "Liam D. McDowell", written over a horizontal line.

WILLIAM D. MCDOWELL
EXECUTIVE DIRECTOR

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY



Hackensack Meadowlands Development Commission

1099 WALL STREET WEST • LYNDHURST, NEW JERSEY 07071 • (201) 935-3250

PATRICIA Q. SHEEHAN
Chairman

WILLIAM D. McDOWELL
Executive Director

September , 1976

To Whom It May Concern:

The Hackensack Meadowlands Development Commission, a land use planning and regulatory agency of the State of New Jersey, in cooperation with the Port Authority of New York and New Jersey is conducting a comprehensive transportation study of the Hackensack Meadowlands District. This study will recommend ways to improve the public transportation and highway systems of the District which includes parts of Bergen and Hudson Counties.

As part of our efforts to identify the transportation needs of this District we are surveying the companies in the District. We would appreciate it if someone in your company would fill out the enclosed questionnaire and mail it back to us as soon as possible. The answers we get in this questionnaire are a vital part of our transportation planning efforts.

If you have any questions, please contact either Mr. Richard Roberts or Mr. Juhan Simonson at (201) 935-3250.

Sincerely,

A handwritten signature in dark ink, appearing to read "William D. McDowell".

William D. McDowell
Executive Director

/jc

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
From: HACKENSACK MEADOWLANDS
DEVELOPMENT COMMISSION

ews

Contact:

Robert C. Grant
KEYES, MARTIN & COMPANY
(201) 376-7300

FOR APPROVAL:

HMDC TO CONDUCT DISTRICT TRAVEL SURVEY

An extensive travel survey will be conducted during July and August to determine travel patterns within the Meadowlands District. The survey is an essential element of the multi-modal Hackensack Meadowlands Development Commission in cooperation with the Port Authority of New York and New Jersey.

The end result of the study will be recommendations to improve public transportation and highway systems of this 20,000 acre Northern New Jersey area. Federal and state financing is underwriting the project.

Travel survey questionnaires will be distributed to some 250 companies and organizations within the District, bounded roughly by Route 46 on the north, the PATH rapid transit rail line on the south, Route 17 on the west and Routes 1 & 9 on the east.

HMDC executive director, William McDowell, urged all organizations to cooperate with the survey and encourage everyone they come in contact with to help in supplying this extremely valuable information.

more...

The questionnaires will provide up-to-date, detailed information about workers' method of travel, to-and-from-work patterns, place of residence and other pertinent data. Organizational data will help identify growth areas which will be generating additional or altered travel patterns.

The Meadowlands Chamber of Commerce has agreed to assist in arranging contact with its members' firms. Direct contact activities will be conducted by the HMDC staff.

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7.76

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Appendix V-6
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

From:

HACKENSACK MEADOWLANDS
DEVELOPMENT COMMISSION

Contact:

Robert C. Grant
KEYES, MARTIN & COMPANY
(201) 376-7300

FOR IMMEDIATE RELEASE

FIRST STAGE OF TRANSPORTATION STUDY COMPLETED:
ADDITIONAL MASS TRANSIT URGED BY HMDC OFFICIALS

The first stage of a comprehensive transportation study to determine travel patterns and make transportation recommendations in the Hackensack Meadowlands District has been released. The study was conducted jointly by the Hackensack Meadowlands Development Commission and the Port Authority of New York and New Jersey.

The findings, based on a survey of 107 firms and 7,573 workers in the District, show that 15.5 percent of the work force uses carpools; 11.2 percent are dropped off from autos at work; 63.2 percent drive alone, and 8.8 percent use either public or company buses; and about 2/10ths percent go to and from work by rail.

Almost 90 percent of the total work force in the District, estimated at 60,000, either drive or ride in automobiles to get to the work place.

The study was funded by the New Jersey Department of Transportation, the Urban Mass Transportation Administration, and the Federal Highway Administration, through a contract with the Tri-State Regional Planning Commission.

more...

The survey costs are estimated at approximately \$15,000. Of the 126 companies asked to participate in the survey, 107 did. In the participating companies 18,511 of the 24,789 employees were given questionnaires of which 7,573 were completed and returned to the HMDC for tabulation. Cooperating with the HMDC was the Meadowlands Chamber of Commerce which assisted in contacting area firms and requesting their cooperation with the survey.

Richard Roberts, HMDC transportation project manager, said, "We noted some interesting results of this survey. For example, although our survey was taken in the middle of a bus strike affecting certain portions of the district, we were able to ascertain that where bus service is available a significant portion of the work force will use it. The bus service in and out of New York City is good and some 36.5 percent of the people working in the District who live in New York use it. The same holds true for certain portions of Hudson County where people have come to be able to rely on buses. Bus service to and from Jersey City is usually available to a considerable number of workers, and a considerable number of them use it, although there was a strike at the time."

Mr. Roberts noted that almost 66 percent of the people working in the Meadowlands District live outside of the District's 14 constituent municipalities, "which indicates that what happens to the transportation web in the

more...

Meadowlands District will effect the entire New Jersey, New York, southern Connecticut area." The survey also shows that fully 17 percent of the workers live in New York City, southern Connecticut, Staten Island and Long Island.

The survey shows that the bulk of the work force, 61.2 percent, lives in Hudson or Bergen counties, with Passaic, 5.8 percent, Essex, 5.4 percent, western New Jersey, 3.0 percent and southern New Jersey (south of Essex County including Staten Island) 6.6 percent making up the remainder. Thirty-four percent of the workers also live within the constituent municipalities of the District, which covers parts of two counties and 14 towns.

"Intrastate transit appears to be our major problem area," Mr. Roberts said. "When we look at the auto use figures for New Jersey counties, we find that in every instance, at least 90 percent of the workers get to the District by auto. We were pleased to see a significant percentage of people using carpools (15.5 percent) to get to work in the District. But, more than 63 percent of the cars coming into the District's industrial and commercial locations have only one person in them."

The percentage of the work force which depends on autos for transportation by New Jersey counties is as follows: Hudson, 90.6 percent; Bergen 97.2 percent; Passaic, 99 percent; Essex 96.5 percent; western New Jersey, 98.6 percent and southern New Jersey 97.1 percent. Commuters

more...

HMDC/4

from New York and Long Island make the greatest use of mass transit with 36.5 percent of the city dwellers and 35 percent of the Islanders using buses to get to the District.

The survey was conducted by the HMDC with the Port Authority of New York and New Jersey assisting in study design and providing computer and technical services.

Michael J. Breslin, Chairman of the HMDC's Transportation Committee, said, "The proper planning of the District's transportation network is a key ingredient in its future development. We are fortunate in having an opportunity to anticipate our problems rather than react after they have become catastrophic. We can begin now to formulate not just individual solutions, but an overarching philosophy of transportation control."

According to Mr. Roberts the survey was needed to provide up-to-date information for a more current data base upon which to make transportation decisions. "We looked at the 1970 census data and decided that there had been a number of changes in the figures collected then. We found at the conclusion of this aspect of our transportation study that the information contained in the 1970 census was useful, but not current enough for our planning purposes."

more...

HMDC/5

Mr. Roberts said the study provided the following types of information:

Where people live who work in the District;

What modes of transportation they use;

The characteristics of the commuter such as when they arrive at the work place, their attitudes toward method of transportation and its rough cost;

Information which provides a basis for forecasting not only where people will come from, but which modes of transportation they will take to and from the work place in the future, assuming alternate modes of transportation are created;

Data for making broad estimates as to the routes people will use to get to and from work and would provide a means of making recommendations for road improvements and upgrading or building of mass transit facilities."

"One of the immediate conclusions we can draw,"

Mr. Roberts said, "is that we have to try to make better use of the existing mass transit facilities. Where there is decent and dependable bus service, for example, people do use it in significant numbers. We can't, of course, make accurate predictions, but we can say that if bus service was promoted and expanded in this area, as many as ten percent of the driving population would take the transit facilities offered. This could amount to a daily reduction of some 4,500 cars on the road."

more...

"There is virtually no rail transit available to and from the Meadowlands District," Mr. Roberts noted, "which suggests that we quickly make better use of those buses which now travel through the District, but don't discharge passengers. There is one respondent from Hackensack who says she takes a bus into New York City and then another one back into New Jersey to reach her office in Teterboro."

Some of the comments made by respondents about transportation methods they use include:

A South Amboy resident who works in Secaucus: "There is no public transportation (intrastate). If travelling by bus, I must go into New York and then to Secaucus."

A North Jersey resident who travels Route 17 to Moonachie: "Too much truck traffic for two-lane Route 17 from Paramus to Hasbrouck Heights."

The bus strike adversely affected some riders such as this Queens, New York, resident who works in Secaucus: "Due to the strike, I have to get up at 5 a.m. to get here by 9 a.m. I get penalized if late."

A Little Ferry resident who lives within three miles of his work place said, "It takes me an average of 14 minutes to drive 2.7 miles whether I take Redneck Avenue or Liberty Street. Northbound traffic on Liberty Street (Route 20) blocks traffic at the intersection of Moonachie Road and Empire Boulevard."

more...

A North Arlington resident commenting on a railroad crossing in Secaucus; "Due to the congestion on County Avenue and the railroad crossings plus a bad road surface makes travelling on them unbearable."

Community Affairs Commissioner Patricia Q. Sheehan, chairman of the HMDC, said "The data base created through this survey will enable us to do some very careful advance planning. The development in the Meadowlands District, as significant as its been in the past, will increase sharply in the next few years. We want to be in a position to solve problems before they begin. We saw that careful planning eliminated the possible traffic problems, at the Sports Complex, and we think the same should be done for the Meadowlands District as an entity."

"The next major step in the process," says William McDowell, HMDC executive director, "is to start the actual transportation planning process. We will begin to forecast trips by highway and public transportation, determine capacity of existing modes of transportation, and develop recommendations for the District's future highway and mass transit systems' needs."

Appendix VI-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Revised Master Plan Population Projections¹

<u>Zone</u>	<u>Acres</u>	<u>Dwelling Units</u>	<u>Median* Population</u>	<u>Density</u>
Berrys Creek Center	295	4,000	11,378	70 DUA**
Parkside Residential-2	689	15,338	43,628	35-40
Parkside Residential-3	167.5	3,915	11,133	35-40
Island Residential-1	257.8	4,604	13,167	20-25
Island Residential-2	228	3,729	10,631	20-25
Island Residential-3	304	5,583	15,916	20-25
Island Residential-4	<u>572</u>	<u>10,365</u>	<u>29,548</u>	20-25
	2,513.3	47,534	135,401	

* Ranges from a minimum of 117,286 persons to a maximum of 153,504.

** Dwelling units per acre.

Table VI-6

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Work Trips To The Same County

<u>Resident County</u>	<u>Per Cent of Work Trips to Same County</u>
Hudson	63.7 %
Bergen	58.1
Passaic	65.5
Union	65.0
Middlesex	67.0
Essex	71.3

Source: 1970 Census of Population

APPENDIX VIII-1
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TRAVEL TIMES - HIGHWAY NETWORK
(Peak Hour-1976)

Origin Zone	Destination Zone																	
	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers
1	16	24	0	14	22	0	21	29	0	17	25	0	8	16	0	15	23	0
2	26	34	0	21	29	0	32	40	0	24	32	0	21	29	0	27	35	0
3	16	24	0	10	18	0	21	29	0	13	21	0	10	18	0	19	27	0
4	7	15	0	7	15	0	12	20	0	4	12	0	12	20	0	10	18	0
5	5	13	0	12	20	0	5	13	0	9	17	0	18	26	0	8	16	0
6	8	16	0	14	22	0	0	8	0	11	19	0	20	28	0	11	19	0
7	1	9	0	7	15	0	6	14	0	5	13	0	14	22	0	4	12	0
8	8	16	0	14	22	0	12	20	0	13	21	0	9	17	0	4	12	0
9	16	24	0	22	30	0	19	27	0	20	28	0	21	29	0	12	20	0
10	12	20	0	19	27	0	13	21	0	17	25	0	19	27	0	13	21	0
11	22	30	0	29	37	0	23	31	0	27	35	0	29	37	0	23	31	0
12	28	36	0	34	42	0	32	40	0	32	40	0	32	40	0	24	32	0
13	19	27	0	26	34	0	26	34	0	24	32	0	23	31	0	15	23	0
14	28	36	0	34	42	0	35	43	0	32	40	0	32	40	0	24	32	0
15	16	24	0	20	28	0	21	29	0	18	26	0	13	21	0	16	24	0
16	17	25	0	26	34	0	24	32	0	24	32	0	11	19	0	14	22	0
17	26	34	0	29	37	0	31	39	0	28	36	0	20	28	0	25	33	0
18	18	26	0	24	32	0	21	29	0	21	29	0	29	37	0	21	29	0
19	26	34	0	32	40	0	21	29	0	31	39	0	37	45	0	29	37	0
20	27	35	0	33	41	0	25	33	0	30	38	0	34	42	0	27	35	0
21	31	39	0	25	33	0	36	44	0	28	36	0	27	35	0	35	43	0
22	32	40	0	38	46	0	35	43	0	35	43	0	43	51	0	35	43	0
23	60	68	0	52	60	0	64	72	0	63	71	0	71	79	0	63	71	0
24	36	44	0	42	50	0	34	42	0	39	47	0	43	51	0	36	44	0
25	42	50	0	48	56	0	46	54	0	46	54	0	46	54	0	38	46	0
26	38	46	0	45	53	0	45	53	0	43	51	0	43	51	0	35	43	0
27	29	37	0	33	41	0	34	42	0	31	39	0	27	35	0	29	37	0
A	3	11	0	6	14	0	11	19	0	7	15	0	20	28	0	12	20	0
E	16	24	0	14	22	0	12	20	0	15	23	0	23	31	0	2	10	0
F	12	20	0	14	22	0	14	22	0	16	24	0	21	29	0	13	21	0

Zone 18		
	T.T.	Trans.
A	28	39
E	32	43
F	31	42

APPENDIX VIII-2
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TRAVEL TIMES - BUS NETWORK
(Peak Hour-Year 2000)

Origin Zone	Destination Zone																				
	A			B			Cn			Cs			D			E			F		
	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers
1	51	62	2	53	64	2	53	64	2	57	68	2	38	43	1	49	60	2	51	62	2
2	52	52	0	56	62	1	58	64	1	62	68	1	74	85	2	68	80	2	70	82	2
3	37	37	0	39	39	0	39	39	0	47	53	1	59	70	2	45	45	0	55	67	2
4	43	49	1	45	51	1	45	51	1	49	55	1	45	50	1	61	67	1	63	69	1
5	39	45	1	41	47	1	41	47	1	45	51	1	47	57	2/1	51	63	2	53	65	2
6	37	43	1	39	45	1	39	45	1	43	49	1	45	56	2	49	61	2	51	63	2
7	28	34	1	30	36	1	30	36	1	34	40	1	46	57	2	40	52	2	42	54	2
8	45	57	2	47	59	2	47	59	2	51	63	2	49	60	2	29	29	0	35	41	1
9	38	38	0	44	50	1	44	50	1	60	66	1	46	57	2	29	29	0	43	43	0
10	38	38	0	40	46	1	40	46	1	44	50	1	54	65	2	38	44	1	36	36	0
11	53	53	0	55	61	1	55	61	1	59	65	1	69	80	2	53	59	1	55	61	1
12	62	62	0	68	74	1	68	74	1	72	78	1	84	95	2	66	66	0	57	62	1
13	55	67	2	57	69	2	57	69	2	61	73	2	56	61	1	52	52	0	45	51	1
14	59	65	1	61	67	1	61	67	1	65	71	1	75	86	2	59	65	1	61	67	1
15	68	80	2	70	82	2	70	82	2	74	86	2	72	83	2	56	62	1	58	64	1
16	49	49	0	59	71	2	59	71	2	63	75	2	61	72	2	41	41	0	47	53	1
18	53	79	2	55	81	2	55	81	2	59	85	2	71	101	3	65	97	3	67	99	3
19	64	84	1	70	96	2	70	96	2	74	100	2	86	116	3	80	112	3	82	114	3
20	72	101	3	74	103	3	74	103	3	78	107	3	81	116	3	69	95	2	71	97	2
21	66	66	0	69	69	0	72	78	1	76	82	1	69	69	0	76	76	0	78	78	0
22	59	59	0	65	71	1	65	71	1	69	75	1	81	92	2	57	67	0	73	79	1
23	104	131	3	106	133	3	106	133	3	110	137	3	122	154	3	116	149	3	118	151	3
25	70	76	1	72	78	1	72	78	1	76	82	1	88	99	2	82	94	2	84	96	2
26	73	84	2	75	86	2	75	86	2	79	90	2	60	65	1	64	64	0	70	76	1
27	57	57	0	59	65	1	59	65	1	63	68	1	75	86	2	69	81	2	71	83	2
A	29	35	1	31	37	1	31	37	1	35	41	1	47	58	2	41	53	2	43	55	2
E	36	48	2	38	50	2	38	50	2	42	54	2	40	51	2	24	30	1	26	32	1
F	40	52	2	42	54	2	42	54	2	46	58	2	44	55	2	28	34	1	30	36	1

Zone 18

	T.T.	Adj.	Trans.
A	50	76	2
B	57	89	3
F	61	93	3

APPENDIX VIII-3
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TRAVEL TIMES - RAIL NETWORK
(Peak Hour-Year 2000)

Origin Zone	Destination Zone																				
	A			B			Cn			Cs			D			E			F		
Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	
1	48	59	2	40	51	2	55	66	2	44	55	2	40	45	1	60	81	3	69	90	3
2	58	64	1	54	60	1	53	59	1	50	56	1	91	117	3	65	77	2	74	86	2
3	50	56	1	46	52	1	45	51	1	50	56	1	75	101	3	42	48	1	51	57	1
4	52	73	2	44	65	2	59	80	2	48	69	2	66	91	3	54	75	2	63	94	2
5	42	48	1	38	44	1	37	43	1	34	40	1	69	86	3	49	61	2	58	70	2
6	40	46	1	36	42	1	35	41	1	32	38	1	67	84	3	47	59	2	56	68	2
7	31	37	1	27	33	1	26	32	1	23	29	1	58	75	3	39	51	2	48	60	2
9	36	41	1	36	42	1	44	56	2	40	46	1	61	81	2	32	38	1	28	33	1
10	45	56	2	45	57	2	49	61	2	49	61	2	68	88	2	37	43	1	34	39	1
11	67	79	2	67	81	2	75	95	3	71	85	2	92	112	2	63	77	2	58	70	2
12	62	74	2	62	76	2	70	90	3	66	80	2	87	114	3	58	72	2	67	81	2
13	44	56	2	43	57	2	58	72	2	47	61	2	68	95	3	63	92	3	72	101	3
14	59	71	1	58	72	2	71	91	3	62	76	2	74	86	2	59	73	2	68	82	2
15	61	90	3	53	82	3	68	97	3	57	86	3	56	83	3	73	117	4	82	126	4
16	40	52	2	39	45	1	54	50	1	43	49	1	42	47	1	59	80	2	58	88	2
18	56	82	2	48	74	2	52	78	2	49	75	2	63	87	2	58	84	3	67	93	3
19	70	100	3	64	94	3	66	96	3	63	93	3	79	108	3	74	104	4	83	113	4
20	76	105	3	68	97	3	83	112	3	72	101	3	83	110	3	78	107	4	87	116	4
21	79	109	3	71	101	3	76	106	3	73	103	3	70	93	2	81	111	3	90	120	3
22	76	102	2	69	95	2	71	97	2	68	94	2	84	108	2	79	105	3	88	114	3
23	97	123	2	89	115	2	102	128	2	93	119	2	104	128	2	99	125	3	108	134	3
25	100	105	1	100	106	1	108	120	2	104	110	1	125	145	2	96	102	2	91	96	2
26	82	102	3	74	94	3	89	109	3	78	98	3	77	95	3	94	129	4	103	138	4
27	68	74	1	60	66	1	75	81	1	64	70	1	53	58	1	80	101	2	89	110	2
8	39	50	2	39	51	2	43	55	2	40	52	2	58	75	3	31	37	1	40	46	1
A	20	25	1	23	34	2	38	49	2	27	38	2	42	58	3	27	38	2	36	47	2
E	28	39	2	28	40	2	32	44	2	29	41	2	47	64	3	20	26	1	29	35	1
F	40	51	2	40	52	2	44	56	2	41	53	2	59	76	3	32	38	1	20	26	1

Zone 18		
	T.T.	Adj. Trans.
A	49	74 2
E	56	82 2
F	68	94 2

APPENDIX VIII-4
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

TRAVEL TIMES - PRT NETWORK
(Peak Hour-Year 2000)

Origin Zone	Destination Zone																				
	A	B	Cn	Cs	D	E	F														
	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers
1	43	48	1	38	43	1	40	45	1	40	45	1	74	89	3	39	34	1	30	35	1
2	49	61	2	44	56	2	51	63	2	46	58	2	80	102	4	51	63	2	56	68	2
3	40	52	2	35	47	2	42	54	2	37	49	2	71	93	4	42	54	2	47	59	2
4	34	39	1	37	42	1	36	41	1	35	40	1	62	72	2	48	53	1	43	48	1
5	30	35	1	33	38	1	32	37	1	31	36	1	58	68	2	44	49	1	39	43	1
6	28	33	1	31	36	1	30	35	1	29	34	1	56	66	2	42	47	1	37	41	1
7	19	24	1	22	27	1	21	26	1	20	25	1	47	57	2	33	38	1	28	33	1
9	36	39	1	38	41	1	32	35	1	36	39	1	67	80	3	33	36	1	25	28	1
10	32	37	1	35	40	1	28	31	1	33	38	1	60	70	2	35	38	1	27	30	1
11	44	49	1	47	52	1	40	43	1	45	50	1	72	82	2	47	50	1	39	42	1
12	66	71	1	61	66	1	63	68	1	63	68	1	97	112	3	52	57	1	53	58	1
13	53	58	1	48	53	1	50	55	1	50	55	1	84	99	3	39	44	1	40	45	1
14	63	66	1	65	68	1	59	62	1	63	66	1	94	107	3	60	63	1	52	55	1
15	84	89	1	79	84	1	81	86	1	81	86	1	115	130	3	70	75	1	71	76	1
16	63	68	1	58	63	1	60	65	1	60	65	1	94	109	3	49	54	1	50	55	1
18	44	69	2 PABT	46	72	2 PENN	46	71	2 PABT	45	70	2 PABT	72	102	3 PABT	53	79	2 PENN	53	78	2 PABT
19	59	95	3 "	62	98	3 PABT	61	97	3 "	60	96	3 "	87	128	4 "	69	106	3 "	68	104	3 "
20	46	51	1	49	54	1	42	45	1	47	52	1	74	84	2	49	52	1	41	44	1
21	69	99	3 PABT	64	94	3 (J ²)	71	91	3 PABT	66	96	3 (J ²)	97	132	4 PABT	71	91	3 J ²	76	106	3 J ²
22	76	81	1	79	84	1	78	83	1	77	82	1	104	114	2	90	95	1	85	90	1
23	92	118	2	87	113	2	94	120	2	89	115	2	114	145	3	94	120	2	99	125	2
25	94	97	1	96	99	1	90	93	1	94	97	1	125	138	3	91	94	1	83	86	1
26	69	75	1	64	70	1	71	77	1	66	72	1	100	116	3	71	77	1	77	83	1
27	76	88	2	71	83	2	78	90	2	73	85	2	107	129	4	78	90	2	84	96	2
8	39	44	1	34	39	1	36	41	1	36	41	1	70	85	3	25	30	1	28	33	1
A	15	15	0	10	10	0	17	17	0	12	12	0	46	56	2	9	9	0	14	14	0
E	19	19	0	14	14	0	18	18	0	16	16	0	50	60	2	3	3	0	10	10	0
F	14	14	0	17	17	0	10	10	0	15	15	0	45	55	2	14	14	0	6	6	0

	Zone 18		
	<u>T.T.</u>	<u>Adj.</u>	<u>Trans.</u>
A	41	67	2
E	45	71	2
F	47	72	2

APPENDIX VIII-5
HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
TRAVEL TIMES - BUS WAY/VAN POOL NETWORK
(Peak Hour-Year 2000)

Origin Zone	Destination Zone																				
	A			B			Cn			Cs			D			E			F		
	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers	Travel Time	Adj. T.T.	Trans- fers
1	43	43	0	38	38	0	40	40	0	40	40	0	74	89	3	29	29	0	30	30	0
2	41	41	0	36	36	0	43	43	0	38	38	0	72	82	2	43	43	0	48	48	0
3	32	32	0	27	27	0	34	34	0	29	29	0	63	73	2	34	34	0	39	39	0
4	34	34	0	37	37	0	36	36	0	35	35	0	62	72	2	48	48	0	43	43	0
5	30	30	0	33	33	0	32	32	0	31	31	0	58	68	2	44	44	0	39	39	0
6	28	28	0	31	31	0	30	30	0	29	29	0	56	66	2	42	42	0	37	37	0
7	19	19	0	22	22	0	21	21	0	20	20	0	47	57	2	33	33	0	28	28	0
9	36	36	0	38	38	0	32	32	0	36	36	0	67	80	3	33	33	0	25	25	0
10	32	32	0	35	35	0	28	28	0	33	33	0	60	70	2	35	35	0	27	27	0
11	44	44	0	47	47	0	40	40	0	45	45	0	72	82	2	47	47	0	39	39	0
12	58	58	0	67	67	0	53	53	0	62	62	0	92	102	2	58	58	0	50	50	0
13	53	53	0	48	48	0	50	50	0	50	50	0	84	99	3	39	39	0	40	40	0
14	63	63	0	65	65	0	59	59	0	63	63	0	94	107	3	60	60	0	52	52	0
15	84	84	0	79	79	0	81	81	0	81	81	0	115	130	3	70	70	0	71	71	0
16	63	63	0	58	58	0	60	60	0	60	60	0	94	109	3	49	49	0	50	50	0
18	41	61	1	44	64	1	43	63	1	42	62	1	69	94	2	55	75	1	50	70	1
19	56	87	2	59	90	2	58	89	2	57	88	2	84	120	3	70	101	2	65	96	2
20	46	46	0	49	49	0	42	42	0	47	47	0	74	84	2	49	49	0	41	41	0
21	59	59	0	54	54	0	61	61	0	56	56	0	95	110	3	61	61	0	66	66	0
22	76	76	0	79	79	0	78	78	0	77	77	0	104	114	2	90	90	0	85	85	0
23	80	80	0	86	91	1	85	90	1	84	89	1	111	121	2	97	102	1	92	97	1
25	94	94	0	96	96	0	90	90	0	94	94	0	125	138	3	91	91	0	83	83	0
26	61	61	0	64	69	1	63	68	1	62	67	1	89	99	2	75	80	1	70	75	1
27	45	45	0	51	56	1	50	55	1	49	54	1	76	86	2	62	67	1	57	62	1
8	39	39	0	34	34	0	36	36	0	36	36	0	70	80	2	25	25	0	28	28	0
A	15	15	0	10	10	0	17	17	0	12	12	0	46	56	2	9	9	0	14	14	0
E	19	19	0	14	14	0	18	18	0	16	16	0	50	60	2	13	13	0	10	10	0
F	14	14	0	17	17	0	10	10	0	15	15	0	45	55	2	14	14	0	6	6	0

	Zone 18		
	<u>T.T.</u>	<u>Adj.</u>	<u>Trans.</u>
A	47	67	1
E	51	71	1
F	46	66	1

Appendix IX-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
CENTROIDS OF ORIGIN ZONES

(p. 1)

<u>Origin Zone No.</u>	<u>Municipalities in Origin Zone</u>	<u>Location of Centroid within Zone</u>
1	Kearny Harrison East Newark	Kearny Ave. & Bergen Ave.
2	Bayonne	JFK Blvd. & 32nd St.
3	Jersey City	JFK Blvd. & Communipaw Ave.
4	Hoboken - Union City	Paterson Plank Rd. & (south wing) Viaduct St.
5	Weehawken Guttenburg West New York	East Kennedy Blvd. & 48th St.
6	North Bergen	Tonnelle Ave. (Rt. 1&9) & 69th St.
7	Secaucus	Paterson Plank Rd. & Rt. 3 (east of NJT east spur)
8	Lyndhurst - Rutherford Carlstadt East Rutherford North Arlington	Rutherford Ave. & Orient Way
9	Lodi Wallington Woodridge Hasbrouck Heights Garfield East Paterson Saddle Brook Maywood Hackensack Teterboro Moonachie Little Ferry South Hackensack	Rt. 46 & Main St.
10	Teaneck Ridgefield Park Palisades Park Fort Lee Ridgefield Fairview Cliffside Park Leonia Edgewater	Teaneck Rd. & Degraw Ave.

Appendix IX-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
CENTROIDS OF ORIGIN ZONES

(p. 2)

<u>Origin Zone No.</u>	<u>Municipalities in Origin Zone</u>	<u>Location of Centroid within Zone</u>
11	Dumont Englewood Cliffs Englewood Tenafly Bergenfield New Milford Riveredge Oradell Cresskill Demarest Haworth Closter Emerson Westwood Harrington Park Alpine Norwood Rivervale Old Tappan Northvale Rockleigh	Washington Ave. & Madison Ave.
12	Waldwick Mahwah Upper Saddle River Montvale Park Ridge Saddle River Allendale Ramsey Oakland Franklin Lakes Wyckoff Midland Park Woodcliff Lake Hillsdale Hohokus Ridgewood Washington Glen Rock Fairlawn Paramus	Rt. 17 & Prospect St.
13	Clifton Paterson Passaic	Rt. 46 & Main Ave.

Appendix IX-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY
CENTROIDS OF ORIGIN ZONES
 (p. 3)

<u>Origin Zone No.</u>	<u>Municipalities in Origin Zone</u>	<u>Location of Centroid within Zone</u>
14	Wayne Ringwood Wanaque Bloomingdale Pompton Lakes Totowa Haledon North Haledon Prospect Park Hawthorne	Valley Rd. & Ratzer Rd.
15	Newark	Market St. & McCarter Highway (Rt. 21)
16	Bloomfield Montclair Glen Ridge Nutley Belleville Orange South Orange East Orange	Garden State Pkwy & Belleville Ave.
17	West Orange Irvington Maplewood Millburn Livingston Roseland Essex Falls West Caldwell Caldwell Verona North Caldwell Fairfield Cedar Grove	Rt. 280 & Pleasant Valley Way
18	Manhattan (So. of 59th St.)	3rd Ave. & 56th St.
19	Upper Manhattan	125th St. & Lenox Ave.
20	Bronx	Fordham & Webster Ave's.
21	Brooklyn	Flatbush & Linden Ave's.
22	Queens	Grand Central Pkwy - Van Wyck Expressway Interchang
23	Long Island	Jerico Tpk. & Oyster Bay Expressway
24	Other East of Hudson	

Appendix IX-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY CENTROIDS OF ORIGIN ZONES

(p. 4)

<u>Origin Zone No.</u>	<u>Municipalities in Origin Zone</u>	<u>Location of Centroid within Zone</u>
25	NYS West of Hudson	Spring Valley
26	Western NJ	Morristown
27	Southern NJ	Rahway

Appendix IX-2

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Capital and Operating Cost Assumptions

Capital Cost Assumptions

1. The capital cost assumptions for the networks, except the all highway, were divided into two sections - transit improvements and feeder highway improvements.
2. In all cases the costs expressed are total project costs including land acquisition.
3. All project costs are based upon a project approval date of January 1, 1979.
4. Total project costs were derived in the following manner:
 - a. Initial base construction estimates were escalated at 7 percent per year to 1978.
 - b. An appropriate contingency factor was then added, depending on the precision of the estimate and its sources.
 - c. Extra work requirements of 10 percent were then factored into the construction cost.
 - d. Insurance requirements were next added as needed, i.e., rail network.
 - e. The new figure was then escalated (construction escalation), with a factor based on the length of the construction period (three, five or six years).
 - f. Escalated preliminary design and construction estimates were then added to the previously computed number in (e) above.

Appendix IX-2

p. 2

g. Interest on construction borrowing over the construction period was then added to the new total in (f) above. It was assumed that money would be borrowed at 7 percent on July 1 of the year in which it was needed.

h. Interest in buses, trains or PRTs purchased in the year prior to project completion was then added to (g) above, giving the final total.

5. Land acquisition costs are expressed in 1978 dollars. Costs per acre are assumed for the following areas:

<u>Area</u>	<u>Cost/Acre</u>
1. Inside Meadowlands District	\$100,000
2. Along Route 46	400,000
3. Along Route 17	300,000
4. Along Route 3	300,000
5. At Holland & Lincoln Tunnel	500,000

6. The life of all structures is assumed to be 50 years; rail equipment, 15 years; and bus and PRT equipment, 15 years. Only initial costs, not depreciation of rolling stock are included in the estimate.

7. All systems have been designed with enough capacity to permit a seated ride for all passengers.

8. Major stations have been designed for full development.

9. In every transit network, feeder highway improvement estimates have been provided. These improvements are necessary to handle the expected demand not accommodated on the transit network.

Bus Network

1. Provisions for the handicapped and elderly have been made utilizing ramps, elevators where required, and high-level platforms at all rail stations within the Meadowlands.
2. Fare control is assumed to be on-board.
3. Bus carriers are assumed to possess adequate facilities to maintain the bus fleets; therefore, no maintenance facilities have been planned for the bus network. However, maintenance costs have been allocated in the O&M analysis.
4. All required utilities have been assumed to be available within 500' of each station.
5. Two types of buses are planned to operate in the Meadowlands; a 40-passenger bus for the heavy demand regions and a 15-passenger minibus for more lightly traveled zones. They are estimated to cost \$80,000 and \$30,000 respectively (1978 dollars).
6. Bus gates were designed in two fashions; parallel loading platforms for express buses and 45° sawtooth loading platforms for collector and distributor buses.
7. Separate entrances have been provided for the handicapped at all major bus stations.
8. All bus stations were designed to handle peak of the peak loads (peak 15 minutes of the peak hour). The demand during this period is expected to be 33 percent higher than the remainder of the peak hour.
9. Bus waiting areas in major stations are designed to accommodate 30 percent

of the peak hour passenger load.

10. Major stations have enclosed structures, selectively heated. Bus shelters are open air with a steel-framed canopy with wind screens.
11. The construction period for the bus network is assumed to be three years.

Rail Network

1. Provisions for the handicapped and elderly have been made utilizing ramps, elevators where required, and high-level platforms at all stations within the Meadowlands.
2. All heavy rail fare control is assumed to be on-board. Light rail fare control zones have been budgeted in the estimate, but fare control hardware has not been included.
3. No maintenance facilities have been provided for the heavy rail network. The additional rail cars are assumed to be maintained at existing rail maintenance yards. A facility capable of maintaining 10 percent of the light rail vehicles is provided (5,000 sq. ft).
4. All required utilities have been assumed to be available within 500' of each station.
5. The cost of each rail car was estimated as follows (in 1978 dollars):

MU	\$856,000
Cab Car	342,000
Cab Coach	278,000
Locomotive	535,000
LRV	800,000
6. All heavy rail platforms have been designed for ten-car consists, and the light rail platforms for two cars.
7. All rail traffic flows are assumed to be reversible between the morning and

evening peak, facilitating more efficient station design.

8. All stations are designed to permit direct transfers for the heaviest passenger flows.
9. All major stations will be enclosed and portions heated. Minor way stations will be open air and have a steel-framed canopy.
10. The construction period for the rail network was assumed to be five years.

PRT Network

1. Provisions for the handicapped and elderly have been made utilizing ramps, elevators where required, and high-level platforms.
2. Fare control will be accomplished prior to boarding.
3. A PRT maintenance facility is included in the capital costs.
4. The PRT network is designed so that all passengers will obtain a seated ride to their destination with no more than four intermediate stops.
5. Each PRT vehicle is capable of seating eight passengers and has provision for seven standees. The base cost per car is estimated at \$150,000 in 1978 dollars. The vehicles are capable of 30 mph operation and can climb a 10 percent grade. Power is provided by a wayside electric pickup.
6. The planned loading and unloading time is 12 seconds per vehicle.
7. Stations are designed for bi-directional operation.
8. The line stations are designed to handle 200 vehicles/hour; transfer stations can handle 400 vehicles per hour.
9. Snow and ice removal are provided by a heated guideway. The base cost of this heating is estimated at \$2 per square foot of guideway.

10. All PRT operations will be computer controlled, with the station and general computer costs included in the capital estimate.
11. The stations are assumed to be spaced approximately 2,000 feet apart.
12. The construction period for the PRT network is assumed to be six years.

Busway Network

1. Provisions for the handicapped and elderly have been made utilizing ramps at way stations, curb cuts and elevators where required at larger stations and on the elevated portion of the busway.
2. Busway fares will be collected on-board.
3. A bus maintenance facility has been provided to handle 10 percent of the systems' buses at any one time.
4. All bridges spanning the rivers within the Hackensack Meadowlands are designed for 50' clearance above the water.
5. Two types of buses are employed - a 40-passenger bus and a 15-passenger minibus. The base 1978 cost of these vehicles is estimated at \$80,000 and \$30,000 each, respectively.
6. The two-way on-grade busway is designed to be a 30 foot wide asphalt roadway with three foot shoulders. The elevated portion is a 30 foot wide concrete structure with a traffic railing.
7. Ice and snow removal is assumed to be by snow plow, sanding and roadway salting.
8. Major access ramps onto the busway are included in the estimate.
9. Both large, heated and enclosed transfer stations and small way stations, screened from the wind are planned. The way stations will be approximately 2,000 feet apart.

Appendix IX-2

p. 7

10. The construction period for the busway is assumed to be five years.

Operating and Maintenance Assumptions

Bus Network*

1. All O&M costs are based on 1978 dollars escalated at 7 percent/year to project completion.
2. Both 40-passenger and 15-passenger minibuses will be used on the service, consistent with demand forecasts.
3. Station agents are provided at the shopping center and two at Meadows in addition to four part-time agents; two at Wood Ridge and two at Kearny. Janitorial, long-term station maintenance and police coverage are also assumed and costs allocated for these.
4. The O&M costs do not include a bus maintenance facility. Vehicle maintenance is assumed to be the responsibility of each carrier and these costs are included in the \$1.90/mile O&M for the buses.
5. Buses are projected to operate six hours per day, during the three-hour morning and evening peaks.
6. \$500/year is assumed as a reasonable maintenance estimate for the small bus shelters.

* Source for bus statistics: West Shore Corridor - Transit Alternative Study - January 1978

Rail Network

1. All O&M costs are based on 1978 dollars escalated at 7 percent/year to project completion.
2. Operating and maintenance costs are computed for each major service which is scheduled to use the rail system: Penn Central Mainline, Pascack Valley Line, Bergen County Line, and the new light rail line.
3. Two station agents are provided at each of the six large stations. Janitorial, long-term maintenance and police coverage are also assumed for the system and costs calculated for these.
4. The O&M costs for the rail lines are divided into three main categories - transportation costs, maintenance of equipment and maintenance of way. None of the heavy rail services have exclusive use of track. Maintenance of way was therefore computed on the basis of the percentage of the day that passenger (Meadowlands) train services utilize the track. Freight usage of this track for non-Meadowlands trips was also factored into the computations.
5. Rail and distributor bus costs are based on a six-hour (two 3-hour peak periods), 250-day operation. Distributor bus assumptions are the same as in the bus network.
6. \$500/year is assumed as a reasonable long- and short-term maintenance charge for the small bus and rail stops.
7. Electric power consumption for both the heavy and light rail is assumed to be \$.21/mile, using today's electric rates for the PATH system.
8. All light rail computations assume the exclusive use of this new trackage by the Meadowlands LRV system.

* Source for rail statistics: Peabody Associates under the approval of the New Jersey Commuter Operating Agency. The maintenance per mile cost figures were supplied by the Regional Engineer (Atlantic Region) of ConRail.

PRT Network*

1. All O&M costs are based on 1978 dollars escalated at 7 percent/year to project completion.
2. Vehicle maintenance is computed on a weight basis (\$0.50/vehicle ton) and a per hour basis (\$3.50/hour of operation).
3. Two station agents are provided at each major station (six men total); janitorial, long-term maintenance and policing are also provided.
4. Yard operations are calculated on the basis of \$2,500 annually per PRT vehicle.
5. All costs are based upon a six-hour-per-day, 250-day peak operation.
6. Operations costs are estimated at \$65,000 per station for computer control equipment.
7. Maintenance costs are divided into maintenance of way (\$12,500/mile), maintenance of the stations (\$15,000/station) and maintenance of the guideway (\$45,000/mile).

Busway And Vanpool Network**

1. All O&M costs are based on 1978 dollars escalated at 7 percent/year to project completion.
2. Both 40-passenger and 15-passenger minibuses will be used for the service, consistent with demand forecasts.

* Source for PRT statistics: Automated Small Vehicle Fixed Guideway Systems Study, Twin Cities Area Metropolitan Transit Commission, DeLeuw, Cather and Company, March 1975

** Source for bus operating costs: Transport of New Jersey 1975 Bus Cost Model

3. Two station agents are provided at the Meadows West and Meadows East Terminals; one at Journal Square and Kearny. Janitorial and long-term maintenance services also were calculated. Roadway policing (highway opening, closing, monitoring, and traffic compliance) are assumed to be performed by four men daily.
4. O&M costs include costs for vehicle maintenance and maintenance facility upkeep. Bus maintenance costs are included in the calculation. Operating and maintenance costs are \$1.90/mile for buses.
5. Buses are projected to operate six hours per day (three-hour morning and evening peaks), 250 days annually.
6. \$500/year is assumed as a reasonable maintenance estimate for the small bus shelters.
7. Annual roadway lighting was assumed to cost \$7,000/mile; snow removal, \$2,800/mile and bridge maintenance, \$7,500/bridge.
8. Roadway maintenance costs are computed at \$4,000/mile.

Appendix IX-3

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Fare Assumptions

The Hackensack Meadowlands Employee Survey asked respondents to state their daily commutation cost. These costs indicate that, as with other transportation, the commutation cost for Meadowlands employees increases as the distance of the commutation trip increases. However, there is a certain basic cost associated with all trips no matter what mileage is involved. For analyzing the transit networks, it was necessary to develop a proposed fare structure. For this reason, the existing intra-state rail and bus fares to points in and near the Meadowlands were also plotted. The resultant graph indicated that the daily costs reported by Meadowlands employees are higher than fees on existing bus and rail services. This reflects heavy use of auto by the employees and the higher costs associated with this mode. Of the auto, bus and rail modes, the costs for the rail mode were lowest. Bus fares fell midway between existing rail fares and costs reported by employees for what are mostly auto trips.

It was decided that the fares assumed for the proposed transit networks should resemble today's transit fares. This was accomplished by selecting a recommended fare schedule that fell midway between existing bus and rail fares. The recommended fare schedules, the reported costs, and the existing bus and rail fares are summarized in Appendix IX-4. These fares are developed in increments of 2-1/2 to 5 miles for trips that are up to 45 miles in length. The average trip length, however, is approximately 10 miles.

Appendix IX-3

p. 2

The recommended fare schedule is modified somewhat to reflect the differing physical characteristics of the four transit networks. For the bus network, the trip distances were computed from the point of origin to the transfer station in the Meadowlands District. In this network it is anticipated that 2/3 of the passengers would transfer to another bus to reach their place of employment. The trip from the transfer point to the final destination is approximately 2.5 miles. It is assumed that the transfer would be free, and the revenue for the additional 2.5 miles of travel is produced by charging the bus passenger the recommended fare for the next most distant zone.

Passengers using the existing train services in the rail network will pay the minimum fare schedule which is identical to the existing intra-state rail fares, as shown on Appendix IX-4. However, many of the employees in the rail network ride the bus from their point of origin to the District. These passengers would use the same fare schedule as used for the bus network and will be entitled to a free transfer to another bus if it is needed to reach their final destination. The rail passengers also must transfer to buses to reach their final destination. These passengers would pay a 30¢ fare.

For the PRT network, all passengers would be required to ride the system to reach their final destination. A 30¢ fee will be charged for riding on the PRT. The minimum (existing rail) fare schedule would be used for all rail and bus services that connect to the PRT.

Appendix IX-3

p. 3

In the busway network, the commuter is provided with a trip directly from his point of origin to his place of employment. In this instance the recommended fare schedule on Appendix IX-4 is used.

Appendix IX-4

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Proposed Fare Structure

<u>Distance Traveled</u>	<u>Existing Costs*</u>	<u>Transit Fares</u>		
		<u>Maximum (Existing Bus)</u>	<u>Recommended</u>	<u>Minimum (Existing Rail)</u>
0-2.4 mi.	\$.80	\$0.55	\$0.40	\$0.35
2.5-4.9	.85	.55	.40	.35
5.0-7.4	.80	.80	.55	.50
7.5-9.9	1.10	.90	.70	.65
10.0-12.4	1.15	1.00	.80	.75
12.5-14.9	1.30	1.10	.90	.80
15.0-17.4	1.45	1.20	1.00	.85
17.5-19.9	1.50	1.30	1.10	.95
20.0-24.9	1.65	1.45	1.25	1.05
25.0-29.9	1.75	1.60	1.35	1.15
30.0-34.9	1.75	1.75	1.50	1.25
35.0-45.0	--	1.90	1.60	1.45

* Without Trans-Hudson tolls.

Appendix IX-5

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Land Acquisition Cost Estimates - Highway Network

Route 17

Two-lane widening Rte. 4 to Parkway: 5.3 acres @ \$0.3M/acre	\$ 1.6 M
Two-lane widening, Essex Street to Rte. 4: 18 acres @ \$0.3M/acre	5.4
Four new interchanges, Rte. 3 to Franklin Avenue: 25.5 acres @ \$0.3M/acre	7.7

Route 3

Four-lane widening, Rte. 17 to Rte. 21: 27 acres @ \$0.3M/acre	8.1
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Holland Tunnel

Approaches: 18 acres @ \$0.5M/acre	9.0
Jersey City Cut: 6 acres @ 0.5M/acre	3.0

Lincoln Tunnel

Approaches: 23 acres @ \$0.5M/acre	11.5
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Route 46

Two-lane widening, Turnpike to Rte. 17: 31.5 acres @ \$0.4M/acre	12.6
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Appendix XII-1

HACKENSACK MEADOWLANDS TRANSPORTATION STUDY

Excerpts of transportation guidelines contained in "Environmental/
Socio-Economic Impact Guidelines," adopted by HMDC on June 7, 1978.

J. Transportation

1. Inventory of Existing Facilities and Services

a. Highways and Roads

- i. Describe existing highway and road network surrounding the proposed development site (Procedure: Verbally describe highway and road network while making reference to map. Prepare a list of proposed highway and road improvement projects on most current Transportation Improvement Program (TIP) available from county or state transportation officials which could affect the access to the proposed development site and list proposed date for start of project.)
- ii. Obtain traffic counts on highway and road network in immediate vicinity of proposed development site (Procedure: Subdivide highway and road network in immediate vicinity of proposed development site into appropriate subsections and either take traffic counts or otherwise obtain counts for either 24 hour period or peak morning and evening hours, 6:30 a.m. to 9:30 a.m. and 3:30 p.m. to 6:30 p.m., or other appropriate time period. These counts shall not be more than one year old and shall be properly modified for current year. The subsections selected should be so chosen as to clearly

Appendix XII-1.

p.2

indicate the existing traffic flows and allow for a determination of the capacity of the subsection and the impact of the proposed development on it. Prior to undertaking this work effort the applicant shall contact HMDC staff to determine adequacy of proposed traffic count locations and times, etc.)

- iii. Obtain or calculate highway and road capacities for subsections chosen for traffic counting effort listed above (Procedure: For each subsection for which a traffic count has been obtained, see subsection ii., either obtain, possibly from government sources, or calculate the capacity, expressed in vehicles per hour (VPH), using level of service "C" or higher and state level of service assumed for each subsection. Note any special factors limiting the capacity of a subsection and time(s) these limitations exist.)
- iv. Summarize above subsections, i.-iii., by constructing a table identifying the highway or road subsections on which the existing level of service is less than "C" and indicate the level of service at which it does operate. (Any additional information deemed important which impacts on either traffic flows or subsection capacities should be clearly highlighted at this time.)

b. Public Transit

- i. Indicate public transit facilities and services in area surrounding the proposed development site (Procedure: Using

maps, public transit schedules, etc., outline the existing public transit network. As in the highway and road inventory, list those public transit improvements which are contained on the Transportation Improvement Program (TIP), available from either county or state transportation officials, which are in vicinity of the proposed development site and the date proposed for the start of work on the improvement.)

ii. Indicate current estimated utilization of services and facilities listed in subsection i. and their estimated capacity. (Procedure: In most cases the operators of the public transit facilities and services or government transportation officials can supply the above data).

iii. Discuss other factors which would influence the use of public transit, (Procedure: If the proposed development is located in an area in which public transit use is especially high or low discuss reasons. Reference may be made to demographic characteristics discussed elsewhere in the total submission.)

iv. Summarize the above subsections, i.-iii., by listing those public transit services and facilities which could serve the proposed development, note frequency of existing services and capacity, especially for peak rush hours.

c. Other Modes of Transport

In some cases it may be necessary to discuss other modes of transport where such modes are vital to the activities associated with the proposed development.

J. Transportation

2. Forecast of Impacts^{1,2}

1. Trip Generation³

- a. Determine the total number of trips over a 24 hour period which will be generated by the proposed development (Procedure: Prepare a forecast of the total number of trips over a 24 hour period by type of development. For example, residential development should be broken down by density and shopping centers should be listed as being neighborhood, community or regional, etc.).
- b. Determine the number of trips generated during the peak hours of activity for each development type (Procedure: Prepare a forecast of the number of trips during the peak hours of traffic generating activity for each type of proposed development.)
- c. Distinguish between internal, on-site, trips and external trips.

2. Trip Distribution

- a. Determine broad geographic distribution of trips using results from subsection 1. (Procedure: Prepare a forecast indicating the distribution of trips using appropriate forecasting method. Results shall be available in both tabular and graphic form.)

3. Trip Assignment

- a. Determine trip assignments for specific links of existing and possible future transportation network (Procedure: Prepare a forecast showing how many trips, based on subsection 1, are

assigned to different links in the existing and possible future transportation network. In preparing this forecast allowance is made for assuming that a particular mode of transport not currently available can be made available without undue difficulty. These assumed modes and/or links should be clearly identified and a fuller explanation of the implications of these assumptions should appear in later sections of this submission.)

4. Modal Split

- a. Determine how many trips will be accommodated on what modes of transport (Procedure: Using an appropriate forecasting method prepare a forecast of what number of trips will be accommodated on what modes of transport. In preparing this forecast, as with the above described trip assignment forecast, it may be necessary to allow for possible new modes of transport. These possibilities should be clearly indicated and further discussion on them appear later in this submission.)

IMPORTANT NOTES:

1. All assumptions, data sources, factors, methods, etc., employed throughout the forecasting process, should be identified and, in some cases, a discussion as to their applicability should be presented. Also, if the forecasting process selected involves complex mathematics or new forecasting techniques, please include sample of calculations in an appendix.

2. The order in which the forecasting process is carried out will obviously depend on the process selected and the associated forecasting logic. Therefore, the forecasting process need not follow the progression of steps outlined in the preceeding subsection. This outline is a guide as to what the final forecast should contain.
3. The factors or methods available for forecasting the number of trips, generated by a particular development, are usually based on either person trips, trip ends, vehicle trips, etc. Please clearly indicate the factors used and what they measure. In cases where there is the likelihood of considerable truck traffic being generated by a development, please include a forecast of truck trips.

Transportation Network Carrying Capacity

Techniques To Expand Carrying Capacity

Using the results of the above analysis of the proposed development's impact on the carrying capacity, prepare and submit, in tabular form and on a map, a listing of those subsections of the transportation network whose carrying capacity is not capable of handling the impact of the proposed development or have associated adverse environmental impacts. Using this listing as a base and the following sample list of possible solutions, discuss how the impact on the different subsections can either be reduced or the carrying capacity of the subsection increased.

1. Highway and Roads

- a. Determine the impacts on the transportation network's carrying capacity caused by the proposed development. (Procedure: Compare the capacities, traffic flows, and levels of service determined in the inventory section of this submission for different highway and road subsections with the forecasts prepared in the impact section of this submission. The results of this comparison should be expressed in terms of combined traffic flows and levels of service.)

2. Public Transit

- a. Determine impact on the public transit network's carrying capacity caused by the proposed development (Procedure: Compare available public transit services and facilities, their utilization and capacities taken from the inventory section with the results from the forecast section. It will be difficult in some cases to make a direct comparison due to assumptions which may have been made in the forecast section. Please consult with HMDC staff regarding this comparison.)

Techniques To Expand Carrying Capacity

1. If a subsection of a highway or a road is the problem, you might consider:
 - i) improvements to highway or road;
 - ii) additions to highway or road network;
 - iii) reducing amount or location of parking;
 - iv) use of remote parking lots, existing or proposed;

- v) staggering peak traffic flows generated by proposed development;
- vi) providing and facilitating use of public transit;
- vii) vanpool and/or carpool programs;
- viii) clustering development around public transit lines, existing and/or proposed;

There are many other sections of the impact guidelines which ask for information related to the transportation network but which are not as specific as those just listed. Among these sections are:

- a general description of the proposed project;
- an assessment of aggregated impacts of the proposal discussed in the assessment in combination with other major development proposals for which information exists;
- an assessment of the carrying capacity of the existing infrastructure and the possibility of staging the proposed development, so as not to exceed the carrying capacity of the available infrastructure; and,
- a discussion of any adverse impacts determined as part of the analyses required by the guidelines.

