Transportation

Richard K. Brail
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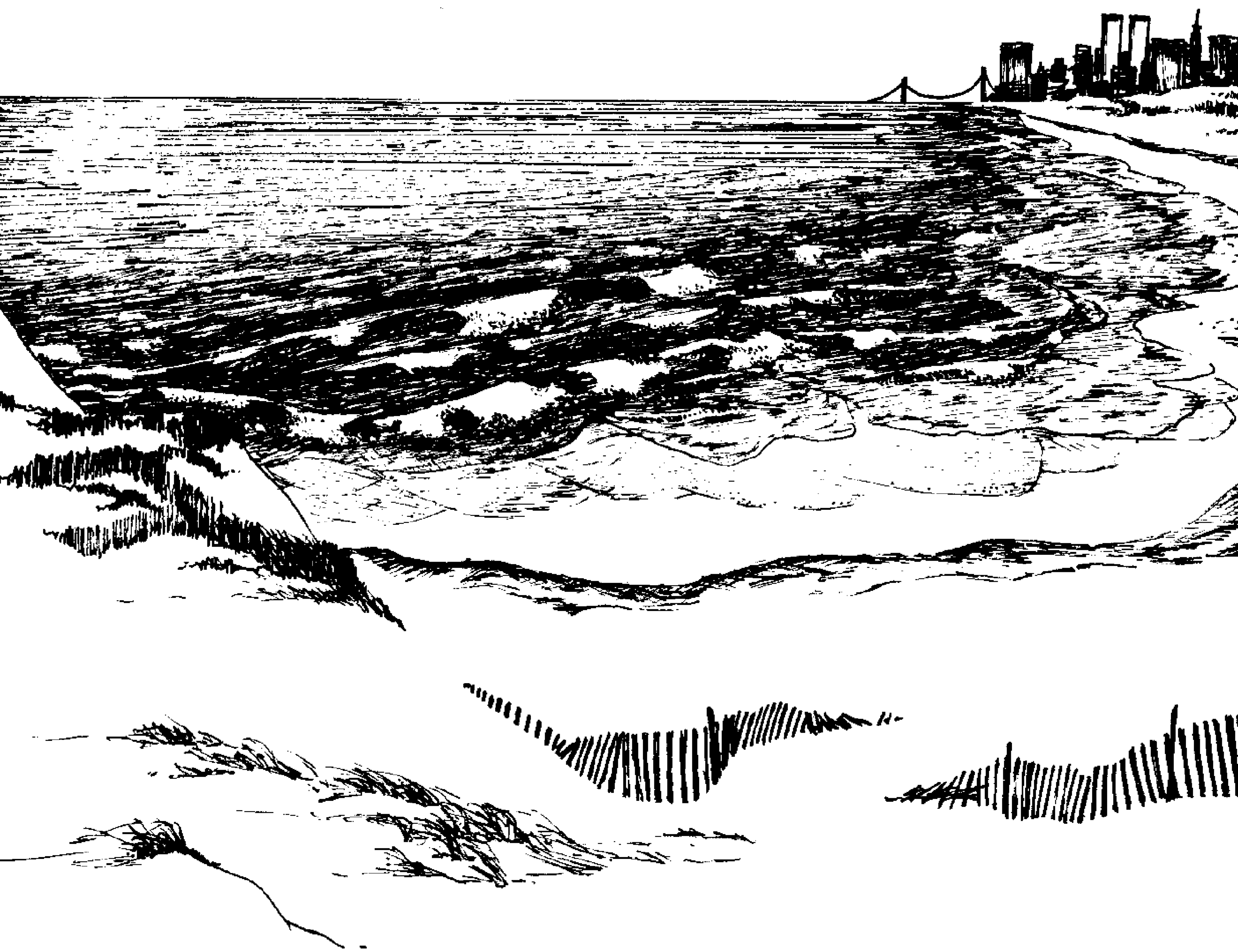

MESA NEW YORK BIGHT ATLAS MONOGRAPH 24

The offshore water in the bend of the Atlantic coastline from Long Island on one side to New Jersey on the other is known as New York Bight. This 15,000 square miles of the Atlantic coastal ocean reaches seaward to the edge of the continental shelf, 80 to 120 miles offshore. It's the front doorstep of New York City, one of the world's most intensively used coastal areas—for recreation, shipping, fishing and shellfishing, and for dumping sewage sludge, construction rubble, and industrial wastes. Its potential is being closely eyed for resources like sand and gravel—and oil and gas.

This is one of a series of technical monographs on the Bight, summarizing what is known and identifying what is unknown. Those making critical management decisions affecting the Bight region are acutely aware that they need more data than are now available on the complex interplay among processes in the Bight, and about the human impact on those processes. The monographs provide a jumping-off place for further research.

The series is a cooperative effort between the National Oceanic and Atmospheric Administration (NOAA) and the New York Sea Grant Institute. NOAA's Marine EcoSystems Analysis (MESA) program is responsible for identifying and measuring the impact of man on the marine environment and its resources. The Sea Grant Institute (of State University of New York and Cornell University, and an affiliate of NOAA's Sea Grant program) conducts a variety of research and educational activities on the sea and Great Lakes. Together, Sea Grant and MESA are preparing an atlas of New York Bight that will supply urgently needed environmental information to policy-makers, industries, educational institutions, and to interested people.

ATLAS MONOGRAPH 24 looks at transportation facilities for both people and freight in the New York Bight region. The automobile is used for 70% of all weekday trips, rail rapid transit for only 13%, and buses for 12%, of weekday trips. The movement of people and employment away from aging inner cities has increased suburban growth and suburban dependence upon the automobile for transportation. Unless mass transit is encouraged, new mass transit systems developed, and metropolitan economic environments bolstered, this dependence on the automobile, say Brail and Hughes, will bring about more and more air pollution and traffic congestion.

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New York Sea Grant Institute
Albany, New York
February 1977

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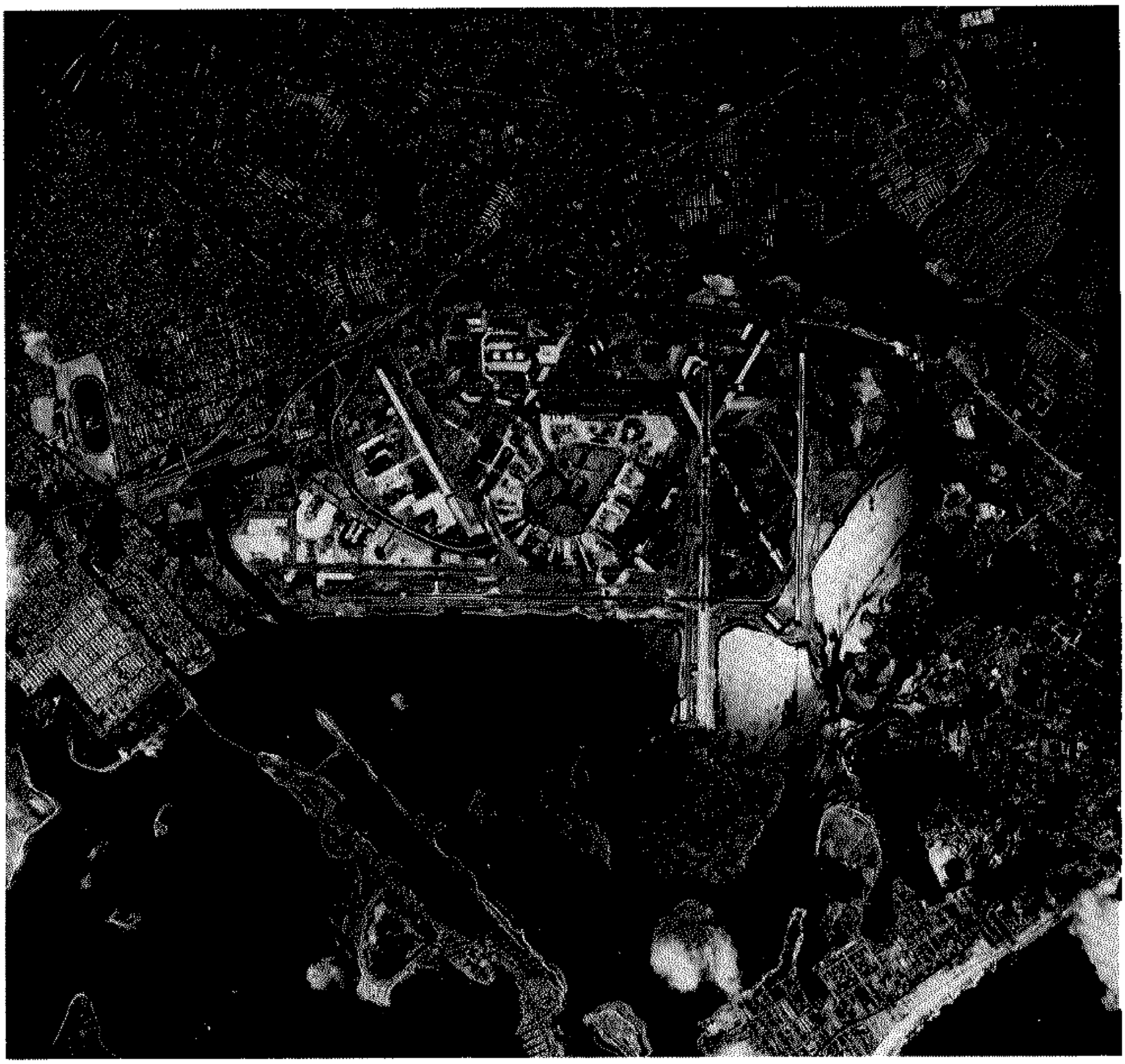
Acknowledgments

The authors wish to thank Efraim Lozada of the Tri-State Regional Planning Commission, Ellen M. Hemminger of the Port Authority of New York and New Jersey, and John J. Santarsiero of the New Jersey Department of Transportation for their generous assistance. Vera Lee and Barbara Swan of the Department of Urban Planning and Policy Development, Rutgers University, contributed very able secretarial aid. Finally, Cynthia Williams of the New York Sea Grant Institute provided excellent editorial assistance.

Manuscript accepted October 1975, revised June 1976.



Frontispiece. Aerial view of John F. Kennedy International Airport (Courtesy of Port Authority of New York and New Jersey)

Abstract

Transportation facilities in the New York Bight region include extensive highways, subways, railroads, airports, tunnels, and bridges. In 1970, 14.9 million people lived in the Bight region; there were 6.8 million jobs. The dominant mode of transportation is the automobile. Fully 70% of all weekdays trips in 1970 were made by car; 13% were made by rapid transit (predominantly the subway) and 12% by bus. Though New York City contained most of the region's employment (60%) and population (53%) in 1970, decentralizing influences are at work. As the suburban and outer fringe counties grow, their almost total dependence on the automobile will mean increased congestion and pollution unless mass transit utilization is encouraged.

Introduction

Both public and private transportation systems, in their birth, geography, and fate, are inextricably bound to the form of major metropolitan areas. Land use patterns not only determine the requirements (demand) for specific types of transportation but also adjust to new transportation systems (supply). For example, the rapid development of freeways, the growth of the automobile industry, and the abundance of cheap gasoline encouraged an unprecedented degree of regional dispersion after World War II. This decentralized land use is served most efficiently not by public transportation but by highways.

Urban regions are generally described by the *doughnut model:* all major economic activities surround a thinning central city—the hole in the doughnut (Hughes 1973). A prototype of this model is sprawling Los Angeles. Such low-density, doughnut-shaped cities evolve when automobiles and other private transportation are ubiquitous and permit complete freedom of movement. In fact, one consequence of this doughnut pattern has been a crippled public mass transit system. Yet this is only one model, one whose future viability is doubtful in light of the apparent long-term energy problem. Take away the automobile's freedom of movement and public transportation reasserts itself, drawing people within its reach. High-density, mixed-use central cities built on a firm infrastructure of public transportation may not be as impractical and inefficient as the experience of the 1960s indicated.* High-density but uncongested Toronto, for instance, is perhaps the urban form of the future. The city may then be energy-

*During the 1960s, poor adaptation to the automobile and truck resulted in severe highway congestion; multifloored industrial structures had limited capacity for accommodating modern production facilities.

saving because it fosters close proximity of people, offices, stores, and entertainment—all linked by public mass transit. Urban movement patterns will be profoundly affected by the reemergence of central cities.

Land use and transportation are thus interdependent. The location of social and economic activities governs the demand for, and is in turn governed by the supply of, urban and suburban transportation services. In fact, certain land uses can be served only by particular transport modes, and certain transport modes will generate predictable land use patterns. A review of the changing distribution of employment and residences will help in understanding the demand governing transportation within the New York Bight region.

This monograph summarizes how people and freight are moved on and over the land bordering the Bight. For this study, the Bight region will include: New York City (Bronx, Kings, New York, Queens, Richmond counties), Nassau and Suffolk counties (New York State); Atlantic, Bergen, Cape May, Essex, Hudson, Middlesex, Monmouth, Ocean, and Union counties (New Jersey). These are not the same counties used by various regional agencies to define the New York metropolitan area (see Table 1). For some statistics, data of the Tri-State Regional Planning Commission are the most practical or the only ones available. In those cases we have displayed information on Bight region counties only, except on Ocean, Atlantic, and Cape May counties, which are not within Tri-State's defined area.

Table 1. Counties in Bight region

	Study Area	Regional Plan Association[a]	Tri-State Regional Planning Commission and Port Authority of New York and New Jersey[a]
NEW YORK	New York City	New York City	New York City
	Bronx	Bronx	Bronx
	Kings (Brooklyn)	Kings (Brooklyn)	Kings (Brooklyn)
	New York Co (Manhattan)	New York Co (Manhattan)	New York Co (Manhattan)
	Queens	Queens	Queens
	Richmond (Staten Island)	Richmond (Staten Island)	Richmond (Staten Island)
	Nassau	Nassau	Nassau
	Suffolk	Suffolk	Suffolk
		Dutchess	Dutchess
		Orange	Orange
		Putnam	Putnam
		Rockland	Rockland
		Westchester	Westchester
		Sullivan	
		Ulster	
NEW JERSEY	Essex	Essex	Essex
	Hudson	Hudson	Hudson
	Bergen	Bergen	Bergen
	Union	Union	Union
	Middlesex	Middlesex	Middlesex
	Monmouth	Monmouth	Monmouth
	Ocean	Ocean	
	Atlantic		
	Cape May		
		Hunterdon	
		Mercer	
		Morris	Morris
		Passaic	Passaic
		Somerset	Somerset
		Sussex	
		Warren	

[a] Excludes areas in Connecticut

Population, Employment, and Travel Demand

Our study region has the common structure of metropolitan areas, that is, a high density, centralized *core* surrounded by a *suburban ring*—the doughnut model. The core is the historic center of employment and the locus of public transportation facilities—one primary pattern of travel demand. It is also the destination point for many worktrips starting in the suburbs—a second primary pattern of travel demand. The suburban ring is now rapidly urbanizing and becoming a workplace location itself. This generates a new worktrip pattern—suburb-to-suburb, a third primary pattern—superimposed on the historic suburb-to-city movement. Moreover, the suburbs are increasingly becoming a destination for freight and industrial traffic—a fourth pattern—as they compete with the central city by offering industry and manufacturing. This general model applies to the Bight region since most of its counties are integral parts of the New York metropolitan area; each county's function as a workplace or residential community can be interpreted within the framework of the metropolitan system.

Secondary travel demands stem from the many recreational facilities along the Bight's shores. Some counties' heaviest traffic occurs during the summer when people journey to beaches and state parks for recreational activities.

In addition to general intrametropolitan transportation patterns, the Bight region has intermetropolitan or city-to-city movement on regional, national, and international scales. New York City is one of a chain of cities from Richmond to Boston. This broad, urbanized swath, called megalopolis by Gottman (1961), defines a multistate corridor within which heavy travel demand is manifested.

Shifts in Job Distribution

The Bight region's economic activities are closely tied to those of the New York metropolitan area. New York City is the headquarters and control center on which the surrounding counties in both New York and New Jersey depend. New York City, along with New Jersey's Essex and Hudson counties, historically has been the convergence point of many bistate public transportation systems, which is to say, the location of a dominant portion of the region's jobs. In fact, immediately after World War II and before the real push to suburbia began, most employment opportunities were in this central core and were accessible by public transit. The core has also been the destination of many international, intermetropolitan, and interregional transportation systems: rail-freight marshalling yards, intercity rail passenger depots, port facilities for oceanborne commerce, and major air terminals for passengers and freight are located here (Figure 1).

In the last 20 years, however, decentralization has continued at a remarkable pace and still has considerable momentum despite recent energy and fuel shortages. More and more jobs are springing up (James and Hughes 1973) in the suburban ring counties (Nassau and Suffolk in New York State; Bergen, Middlesex, Monmouth, and Union in New Jersey). A major shift in workplace locations is taking place, creating new worktrip destinations geared to freeway locations. The suburban ring is also attracting freight facilities. A large arc—an employment band—is forming around the core, though the core still predominates.

New York City was the paramount center of employment in 1970, containing over 4 million—or about 60%—of the 6.8 million jobs in the region (Table 2). Add to this the 743,000 employed in Essex and Hudson counties and the overall core employment is 4.8 million, or about 71% of the total. The suburban ring accounts for over 1.8 million jobs, or about 27% of the total, whereas the outer fringe (Ocean, Atlantic, and Cape May counties) contains only 127,000 jobs, slightly less than 2% of the total.

Despite the massive postwar suburbanization, approximately two-thirds of the Bight region's employment in 1970 could still be considered centralized; the remaining third was dispersed. This means that many work destinations could be reached by mass transportation; a minority were apparently accessible only by private automobile. The same applied to freight shipments: only the new, dispersed facilities were not tied into existing rail networks. We must look at the magnitudes of growth, however, to fully gauge the shifting structure of the region's transportation systems.

Between 1970 and 1980, employment in the core is not expected to grow very much (Table 2). Within the core will be pockets of both growth and decline. What growth there is will take place in the

Table 2. Employment by county, 1970 and 1980

	Number Employed (in thousands) 1970	1980	Change 1970/1980 Number	Percent
Core	**4,805.3**	**4,810.1**	**4.8**	**0.0**
New York City	4,062.0	4,090.2	28.2	0.7
Bronx	285.0	278.0	– 7.0	–2.4
Kings (Brooklyn)	665.0	630.4	–34.3	–5.2
New York Co (Manhattan)	2,518.8	2,547.7	28.9	1.1
Queens	535.5	557.0	21.5	4.0
Richmond (Staten Island)	57.7	77.1	19.4	33.6
Essex	466.6	457.7	– 8.9	–1.9
Hudson	276.7	262.2	–14.5	–5.2
Suburban Ring	**1,840.2**	**2,269.3**	**429.1**	**23.3**
Nassau	590.6	655.1	64.5	10.9
Suffolk	278.0	367.0	89.0	32.0
Bergen	354.3	466.3	112.0	31.6
Union	270.0	308.0	38.0	14.1
Middlesex	222.4	292.7	70.3	31.6
Monmouth	124.9	180.2	55.3	44.5
Outer Fringe	**126.8**	**164.2**	**37.4**	**29.5**
Ocean	44.1	72.2	28.1	63.7
Atlantic	67.8	73.6	5.8	8.6
Cape May	14.9	18.4	3.5	23.3
Total	**6,772.3**	**7,243.6**	**471.3**	**7.0**

Sources: New Jersey employment figures and estimates from James and Hughes 1973; New York employment figures and estimates from Port Authority of New York and New Jersey 1974.

most centralized area (New York County) and in those counties most suburban in character (Queens and Richmond). The in-between sectors (Essex, Hudson, Bronx, and Kings counties) will have absolute decline. The suburban ring, on the other hand, will dominate the economic growth. While the core stagnates, the ring counties will gain about 430,000 jobs, adding significantly to the number of dispersed worktrip areas.

The forecast 1980 employment reflects this suburbanization. Bight region jobs will increase by 471,000, to over 7.2 million; the core will account for only about 5,000 of this increase (Table 2). The suburban ring and the outer fringe will account for 99% of the growth. The core will consequently account for 66.4% of the region's jobs in 1980, a decline from 71.4% in 1970. At the same time, the suburban and outer fringe counties will increase their share to almost 30%.

The change in job distribution is further emphasized in Table 3. The core's density remains relatively constant while the suburban ring and outer fringe densities increase substantially. The suburban ring will be about one-tenth as dense as the core in 1980, compared to about one-thirteenth in 1970. Although economic growth will be primarily horizontal and dispersed, the associated suburban densities will not

Figure 1. Port Newark, Elizabeth-Port Authority Marine Terminal, and Newark International Airport (Courtesy of Port Authority of New York and New Jersey)

Table 3. Workplace density by county, 1970 and 1980

	Area (mi²)	Workplace Density (people/mi²) 1970	1980
Core	**471**	**10,202**	**10,212**
New York City	300	13,540	13,634
Bronx	41	4,071	3,971
Kings (Brooklyn)	70	9,500	9,006
New York Co (Manhattan)	23	109,513	110,770
Queens	108	4,958	5,157
Richmond (Staten Island)	58	995	1,329
Essex	127	3,674	3,604
Hudson	44	6,289	5,959
Suburban Ring	**2,342**	**786**	**969**
Nassau	289	2,044	2,267
Suffolk	929	299	395
Bergen	235	1,508	1,984
Union	103	2,621	2,990
Middlesex	308	722	950
Monmouth	478	261	377
Outer Fringe	**1,436**	**88**	**144**
Ocean	642	69	112
Atlantic	566	120	130
Cape May	288	65	81
Total	**4,249**	**1,594**	**1,705**

Sources: New Jersey figures and estimates from James and Hughes 1973; New York figures and estimates from Port Authority of New York and New Jersey 1974

increase enough to stimulate a corresponding public transportation expansion. Also, the suburban ring's link to the rail-freight system will still be tenuous.

Residential Patterns

Most analyses of urban spatial structure assume that people choose residences partly in relation to their jobs and worktrips. When jobs are centralized, residence patterns form adjacent to the transportation systems converging on the urban center. Historic suburbs—such as Short Hills, NJ, and Scarsdale, NY—that built up around outlying rail stations attest to this.

As jobs suburbanize, there is a concomitant dispersion of population and housing. Economic growth occurs in what used to be bedroom communities. Job expansion not only generates pressure on old suburbs and less developed areas on the suburban ring counties but also enhances the residential appeal of areas beyond the industrializing ring. As with employment, most residential growth is occurring in the suburban counties (Tables 4 and 5), which means increasingly widespread worktrip origins.

Following closely behind the migration of people and jobs to the suburbs are various service industries and businesses. Retailers and legal and medical services locate close to their clients. Whether drawn from old city areas to new suburban locations or originating in the suburbs, they tend to undercut or bypass services in old, rural town centers. Suburban counties in the Bight region now provide many of the facilities and services once offered exclusively by city and town centers. Many nonworktrips—shopping and daytime activities, for example—have noncentral destinations, increasing automobile travel on suburban roads. Service industries further contribute to the cycle of dispersion as service employees seek suburban residences. Moreover, those who provide maintenance for and supply products to these facilities become ever more insulated from established rail systems.

As jobs disperse into the suburban ring, people tend to live in or beyond that ring. This is clearly illustrated in Ocean County, NJ, projected as one of the two fastest-growing counties in the Bight region between 1970 and 1980 (Suffolk is the other; Table 4). Ocean County is a thriving resort area with seaside beaches from Point Pleasant to Long Beach Island. The county's population doubles every summer as vacationers from the New York-Philadelphia corridor flock to beaches easily accessible from the Garden State Parkway.

As urban employment redistributes outward, Ocean County becomes increasingly attractive for residential development. With the spread of employment opportunities to Middlesex, Monmouth, and Somerset counties, new commuting patterns emerge. Jobs in areas along the New Jersey Turnpike, Interstate 287 (circumscribing the metropolitan region), and the Garden State Parkway are within feasible commuting distance from much of Ocean County.

This introversion of traditional urban spatial structure—that is, residences beyond defined metropolitan areas and geared to decentralized workplaces along suburban freeways—has contributed to Ocean County's growth. Population increases since 1950 show a doubling every 10 years; the county's 56,000 residents in 1950 increased to more than 208,000 in 1970. The current expansion of the Garden State Parkway and the proposed Toms River Expressway will increase the links to employment in the suburban ring counties, underlining the emergence of Ocean County as a significant commuter residence place.

On Long Island, the eastern part of Suffolk County appears to be another prime area.

Table 4. Population by county, 1970 and 1980

	Persons (in thousands)		Change 1970/1980	
	1970	1980	Number	Percent
Core	**9,433**	**9,349**	**– 84**	**–0.9**
New York City	7,894	7,763	–131	–1.7
Bronx	1,472	1,442	– 30	–2.0
Kings (Brooklyn)	2,602	2,501	–101	–3.9
New York Co (Manhattan)	1,539	1,450	– 89	–5.8
Queens	1,986	2,025	39	2.0
Richmond (Staten Island)	295	345	50	16.9
Essex	930	971	41	4.4
Hudson	609	615	6	0.1
Suburban Ring	**5,037**	**5,789**	**752**	**14.9**
Nassau	1,428	1,483	55	3.9
Suffolk	1,125	1,401	276	24.5
Bergen	898	1,059	161	17.9
Union	543	627	84	15.5
Middlesex	584	678	94	16.1
Monmouth	459	541	82	17.9
Outer Fringe	**442**	**515**	**73**	**16.5**
Ocean	208	259	51	24.5
Atlantic	175	189	14	8.0
Cape May	59	67	8	13.6
Total	**14,912**	**15,653**	**741**	**5.0**

Sources: New York figures from Port Authority of New York and New Jersey 1974; New Jersey figures estimated by Division of Planning and Research, Department of Labor and Industry, Trenton, NJ 1975

Table 5. Population density by county, 1970 and 1980

	Area (mi^2)	Population Density (people/mi^2)	
		1970	1980
Core	**471**	**20,027**	**19,849**
New York City	300	26,313	25,877
Bronx	41	35,902	35,170
Kings (Brooklyn)	70	37,171	35,729
New York Co (Manhattan)	23	66,913	63,043
Queens	108	18,389	18,750
Richmond (Staten Island)	58	5,086	5,948
Essex	127	7,323	7,646
Hudson	44	13,840	13,977
Suburban Ring	**2,342**	**2,151**	**2,691**
Nassau	289	4,941	5,131
Suffolk	929	1,211	1,508
Bergen	235	2,821	4,506
Union	103	5,272	6,087
Middlesex	308	1,896	2,201
Monmouth	478	960	1,132
Outer Fringe	**1,436**	**308**	**359**
Ocean	642	324	403
Atlantic	566	309	334
Cape May	228	259	387
Total	**4,249**	**3,510**	**3,684**

Sources: New York figures from Port Authority of New York and New Jersey 1974; New Jersey figures estimated by Division of Planning and Research, Department of Labor and Industry, Trenton, NJ 1975

Because rural lands will no doubt continue to be converted to suburbs, natural shore environments such as beaches, dunes, and bluffs will be altered by urban, residential, and recreational development. Consequent uses—housing, industrial plants, sewage treatment plants, power plants, docks and piers, oil and cargo transfer facilities, solid waste disposal, shellfishing, beach assess—all compete for space along the shore. Each of these modifications has substantial, often conflicting effects. Intelligent land use management in growing suburban areas like Ocean County and western Suffolk County helps accommodate the rising population without increasing the conflicts over access and usage, hopefully preserving valuable areas like coastal wetlands.

Recreational Travel

Superimposed on worktrip and freight transportation demands are those arising from the abundant recreational facilities along the Bight shores. Some counties that are recreation destinations—like Monmouth, Nassau, and western Suffolk—are also within the rapidly urbanizing suburban ring. Ocean County and mid-Suffolk County are the starting point for many worktrips as well as the destination for many recreational trips. Here, however, the recreational travel demand is less complex and heavy than in the inner suburban ring counties.

Finally, the outer fringe counties of Atlantic and Cape May in New Jersey and the easternmost end of Suffolk on Long Island are geared primarily to recreation and serve mainly as destinations for much of the region's resort travel. The opening of the Garden State Parkway in the 1950s, for instance, contributed to the development of New Jersey's outer fringe counties.

The Intermetropolitan Corridor

Through the Bight region extends a travel corridor linking the major cities in the northeastern United States. Within our study area, the New Jersey Turnpike, the New England Thruway (I-95), and the

Penn Central Railroad (Amtrak) best define the spine of this corridor. The major urban centers here generate immense volumes of traffic and attract many economic activities. Old industrial settlement parallels the Penn Central Railroad in New Jersey, the Hudson River to upstate New York, and the New Haven Railroad right-of-way to New England. New industrial development is wedded to the freeways rather than to railroads and rivers. Taken together, most ground-based freight shipments into and out of the Bight region move along the spine.

The increasing emphasis on trucking puts strong development pressures on the suburban counties with open land along transportation routes like the New Jersey Turnpike. Residences as well as workplaces are firmly linked to the intermetropolitan corridor, setting up noncentral origins and destinations for much of the local traffic. This corridor not only has massive volumes of intermetropolitan travel, but it will continue to stimulate growth along its length, generating transportation patterns typical of the suburban ring counties—that is, mainly highway travel.

Transportation for People

Transportation systems that carry people fit into five basic types, each influenced by the distribution of jobs, residences, and recreational facilities within the region (Wilson 1967). The rapid growth of both suburban ring counties and former recreation areas has changed the demands placed on these transportation systems.

Traditional public transit, operating principally within the city, focuses on the central business districts (CBD) of the older cities of the region. Subways, elevated lines, buses, and some ferries are included here. Since substantial subway and elevated systems are presently limited to New York City and Newark, buses bear the burden of city movements elsewhere. The main purpose of public transit is to serve CBD workers who live relatively close to the downtown area, as well as workers who transfer from other modes of transportation; its ancillary uses include shopping, visiting, and other off-peak-hour trips. The users typically will be secretaries, clerical staff, the poor, and minority group people. Fares have traditionally been moderate and trips short in both time and distance.

Long-distance commuting moves suburban workers from dispersed residences into highly centralized workplaces within major cities, mainly the CBDs. The major mode of movement is suburban railroad but express buses and the private automobile are also important. Since this type of commuting is generally characterized by high speed, overall travel times are proportionally shorter than the distances covered. The users are typically employed in professional-managerial occupations and have above-average incomes and socioeconomic characteristics appropriate to the system's higher fares. Newark and New York City (especially Manhattan) are the principal destinations of this system.

Cross-commuting or cross-hauling emerges from dispersed origins and destinations. It comprises mainly private vehicular trips from one noncentral point to another. Its users, who live and work in suburban areas, represent a cross section of the metropolitan population—blue collar, service, professional, managerial, and clerical workers. This system serves primarily those commuters who are captive automobile users but also includes a few bus lines. This system is outstanding for its phenomenal growth, which appears likely to continue unabated.

The inside-out system is the reverse of long-distance commuting. Its worktrips proceed from highly centralized origins to dispersed suburban destinations. Typical of its users are the domestic worker who works in Scarsdale and lives in Manhattan or the blue-collar worker at the Ford plant in Mahwah, Bergen County, NJ, who lives across the Hudson River in Harlem. These outward-bound trips cannot be adequately handled by the empty "backhauls" of commuter trains because workplaces are rarely convenient to suburban rail stops. Thus, the inside-out system usually centers around the private automobile. Domestic workers may be able to use public transit, however, if their jobs are in the inner suburbs. Inner-city residents who work in suburban manufacturing plants most often use carpools.

Shore-recreational is not as clearcut as the previous systems because parts of it belong to the other four systems. Its movement is seasonal and proceeds from residential areas, both city and suburban, along distinct access routes to resorts along the Bight shores. The same shore rail routes that provide long-distance commuting are included here. By far the most significant mode of shore-recreational travel is the automobile. The users represent a cross section of the Bight's population: blue-collar, white-collar, service, professional, managerial, and clerical.

Travel Patterns

Actual travel patterns in the Bight region follow the types just outlined. Travel behavior reflects strong connections among the counties. Table 6 shows that the percent of individuals working outside their county of residence varies from a high of 65.1% for Bronx residents to a low of 15.7% for Atlantic County residents. A high percentage of people in New York City (except Manhattan) work outside their county of residence whereas a low percentage of people in Manhattan and Atlantic and Cape May counties work outside their county of residence. In the suburban ring counties, the percentage is between 30% and 44%.

Table 6. Persons working outside county of residence, 1970

	Reporting Place of Work	Working out of County	Percent
Core	**3,323,493**	**1,578,588**	**47.5**
New York City	2,768,386	1,397,704	50.5
Bronx	450,418	293,429	65.1
Kings (Brooklyn)	834,367	436,636	52.3
New York Co (Manhattan)	596,756	103,629	17.4
Queens	786,040	507,821	64.6
Richmond (Staten Island)	100,805	56,189	55.7
Essex	332,740	98,961	29.7
Hudson	222,367	81,923	36.8
Suburban Ring	**1,826,753**	**718,881**	**39.4**
Nassau	521,784	226,445	43.4
Suffolk	360,963	131,605	36.5
Bergen	359,150	155,096	43.2
Union	213,799	78,978	36.9
Middlesex	221,198	81,675	36.9
Monmouth	149,859	45,082	30.1
Outer Fringe	**136,375**	**33,833**	**24.8**
Ocean	59,538	21,430	36.0
Atlantic	59,327	9,304	15.7
Cape May	17,510	3,099	17.7
Total	**5,286,621**	**2,331,302**	**44.1**

Sources: Tri-State Regional Planning Commission 1973*e*; US Bureau of the Census 1972*a*, *b*

Clearly, Manhattan is the magnet attracting workers from the rest of New York City and the surrounding suburban areas (Table 7), as illustrated by the 1963 home-interview survey in Figure 2. The shifts in employment distribution since 1963 would change somewhat the width of the bands (indicating the number of trips made). Figure 3 shows that the number of jobs below 60th Street in Manhattan was 5% less in 1973 (2,020,000 jobs) than in 1963 (2,122,000 jobs). This slight reduction in employment contrasts with a growth in floor space—9% more in 1973 than in 1963 (Figure 3).

Although travel to Manhattan is dominant, travel does occur between the other four boroughs in New York City and in the surrounding New York and New Jersey area (Figure 4, Table 8). The significant increase in employment and residential growth in the suburban counties since 1963 dramatizes even more the cross-commuting links between counties.

Relevant to understanding travel behavior are the timing of trips and the choice of mode. The urban transportation problem centers on the movement of workers during the morning and evening rush hours (Meyer, Kain, and Wohl 1965). One example of peak-period flow is the trans-Hudson automobile and truck traffic in Lincoln Tunnel (Figure 5), Holland Tunnel, and on the George Washington Bridge (Figure 6). Of all weekday automobile traffic on these crossings, 47% occurs between 7 and 10 am and between 4 and 7 pm; only 26% occurs between 10 am and 4 pm. Truck traffic tends to be more evenly spread over the day than automobile traffic. Of all truck traffic, 42% travels during the 7 to 10 am and 4 to 7 pm periods; 29% occurs during the morning peak period and 13% during the evening peak period. Another 32% uses the tunnels and bridge between 10 am and 4 pm (Port Authority of New York and New Jersey 1972).

A second example of peak-period flow is bus travel. Of all daily short-haul bus passengers, 54% boarded their buses at the Port Authority Bus Terminal in Manhattan during the 4 to 7 pm peak period and 31% during the 5 to 6 pm peak hour. Short-haul bus routes end within 30 mi (48 km) of the Port Authority Bus Terminal; medium-haul bus routes end 20 to 70 mi (32 to 113 km) from the terminal. The predominant destinations of short-haul bus routes were Bergen, Hudson, and Essex counties in New Jersey. Medium-haul passengers were headed for outer Bergen County and for Middlesex, Monmouth, and Morris counties. Of all medium-haul bus departures, 66% occurred during the 4 to 7 pm period

Table 7. Worktrip by all means, 1970

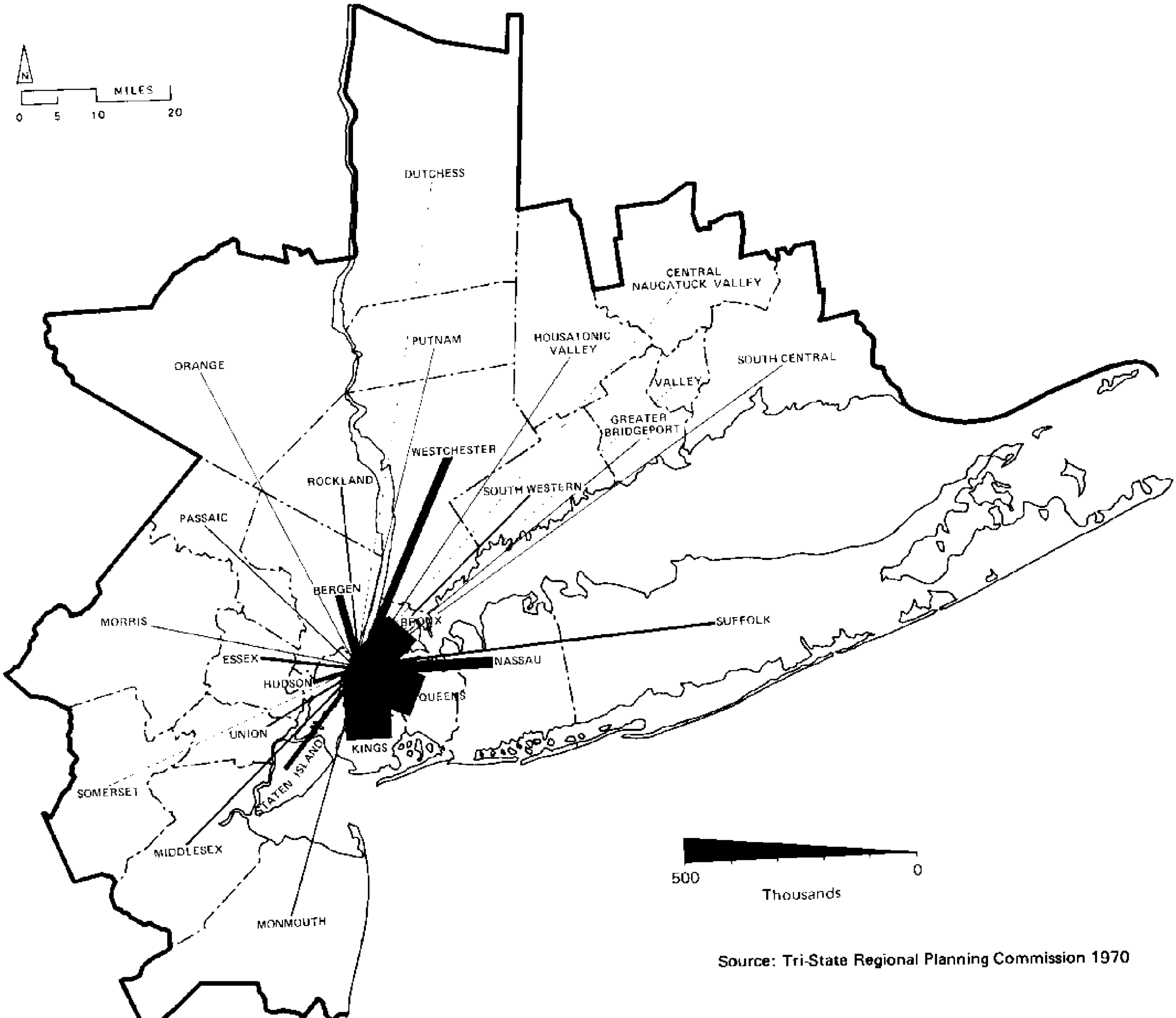
County of Residence	County of Worksite: Bronx	Kings	New York (CBD)	New York (non-CBD)	Queens	Richmond	Nassau	Suffolk	Bergen	Essex	Hudson	Middlesex	Monmouth	Union	Other Counties	Total
Bronx	184,811	14,422	200,045	57,154	16,913	382	2,731	932	4,033	1,034	1,940	132	104	339	23,554	508,576
Kings	11,144	458,578	354,488	25,583	50,161	3,313	10,556	2,462	3,214	1,990	4,411	606	97	1,170	3,859	931,632
New York (CBD)	4,380	8,556	198,291	18,703	6,492	285	1,388	327	1,241	712	972	226	52	220	2,063	243,908
New York (non-CBD)	21,935	13,130	221,034	148,349	12,525	372	2,305	628	4,075	930	1,955	278	124	476	6,941	435,057
Queens	21,053	78,726	337,637	37,510	313,242	1,178	43,370	6,320	3,049	1,175	2,235	415	63	528	7,054	853,555
Richmond	708	9,689	38,419	1,533	1,569	51,401	296	161	377	761	1,519	762	48	1,049	502	108,794
Nassau	6,811	29,560	98,543	6,668	53,356	419	326,046	24,113	1,309	348	740	188	17	147	3,740	552,005
Suffolk	2,780	9,561	28,113	2,404	20,769	129	63,928	247,498	443	184	170	77	27	153	1,465	377,701
Bergen	5,206	2,367	54,503	9,345	2,800	124	550	190	216,574	14,723	22,468	787	167	2,854	39,894	372,552
Essex	487	743	18,661	1,006	670	635	117	42	9,030	254,913	16,200	4,657	557	29,311	20,348	357,377
Hudson	1,651	1,245	38,728	1,992	1,247	342	120	107	16,076	17,050	156,537	1,592	179	4,689	3,852	245,407
Middlesex	168	616	11,627	443	462	687	112	30	1,453	13,996	5,331	153,165	3,418	26,892	10,051	228,441
Monmouth	138	667	12,694	424	451	454	148	26	842	6,231	2,759	10,257	118,064	4,672	1,216	159,043
Union	303	556	12,839	378	463	488	122	22	1,773	34,726	6,312	12,057	616	147,811	9,006	227,350

Source: Tri-State Regional Planning Commission 1975*d*

Table 8. Person-trips for all purposes, 1970 (thousands)

County of Trip Origin	County of Trip Destination: Bronx	Kings	New York	Queens	Richmond	Nassau	Suffolk	Bergen	Essex	Hudson	Middlesex	Monmouth	Union	Other Counties	Total
Bronx	721.1	32.2	373.0	54.3	2.1	14.9	5.3	13.5	1.6	3.8	0.4	0.3	1.1	93.8	1,317.4
Kings	31.8	1,752.2	455.8	195.9	14.1	54.3	14.7	7.1	4.4	6.3	0.9	0.8	1.9	13.0	2,553.2
New York	381.1	468.8	1,653.6	438.5	44.0	114.0	31.6	77.5	25.5	48.3	14.4	12.5	16.0	151.3	3,477.1
Queens	52.0	192.7	425.3	1,476.2	2.8	189.7	36.4	8.2	2.9	4.0	2.4	1.3	1.0	21.6	2,416.5
Richmond	2.1	14.2	42.8	3.1	288.4	0.7	0.3	0.4	1.7	3.0	4.2	0.5	2.1	1.8	365.3
Nassau	14.8	51.2	109.8	187.3	0.7	2,618.7	170.5	2.2	2.2	1.4	2.5	0.2	1.6	8.8	3,171.9
Suffolk	4.6	15.3	31.0	38.2	0.3	182.8	2,358.9	0.9	2.1	0.6	1.8	0	0.7	2.2	2,639.4
Bergen	13.0	6.9	73.7	8.1	0.4	2.3	1.0	1,800.1	33.1	62.9	2.3	2.3	6.1	169.7	2,181.9
Essex	1.5	4.4	26.1	2.9	1.6	2.5	1.4	34.2	1,147.5	48.5	22.3	9.0	106.4	93.1	1,501.4
Hudson	4.2	7.3	46.0	4.2	3.1	2.0	0.2	64.8	48.6	580.4	7.1	4.2	14.9	16.8	803.8
Middlesex	0.3	0.9	14.0	2.0	4.0	2.3	2.1	2.4	22.6	6.9	871.7	21.7	76.4	63.3	1,090.6
Monmouth	0.2	1.0	13.4	1.4	0.8	0.8	0.2	2.3	9.7	4.3	21.7	753.5	7.2	4.3	820.8
Union	1.2	1.9	16.3	1.0	1.9	1.5	0.8	5.7	107.5	14.6	75.6	7.6	867.9	63.1	1,166.6

Source: Tri-State Regional Planning Commission 1975*d*

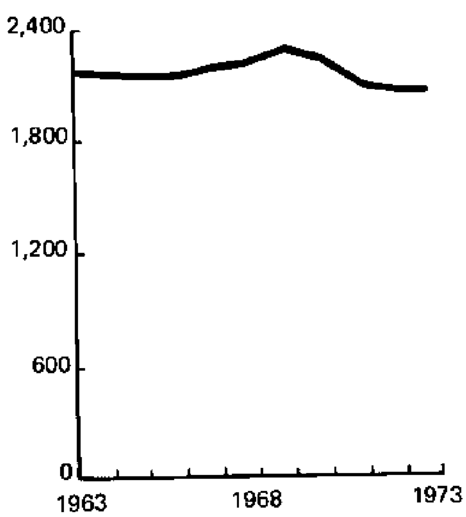


Source: Tri-State Regional Planning Commission 1970

Figure 2. Daily travel between Manhattan and surrounding counties, 1963

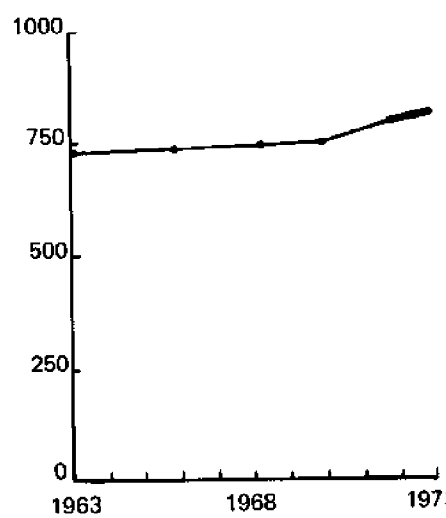
EMPLOYMENT (thousands)

1963	2,122
1964	2,114
1965	2,109
1966	2,124
1967	2,146
1968	2,171
1969	2,230
1970	2,201
1971	2,064
1972	2,030
1973	2,020



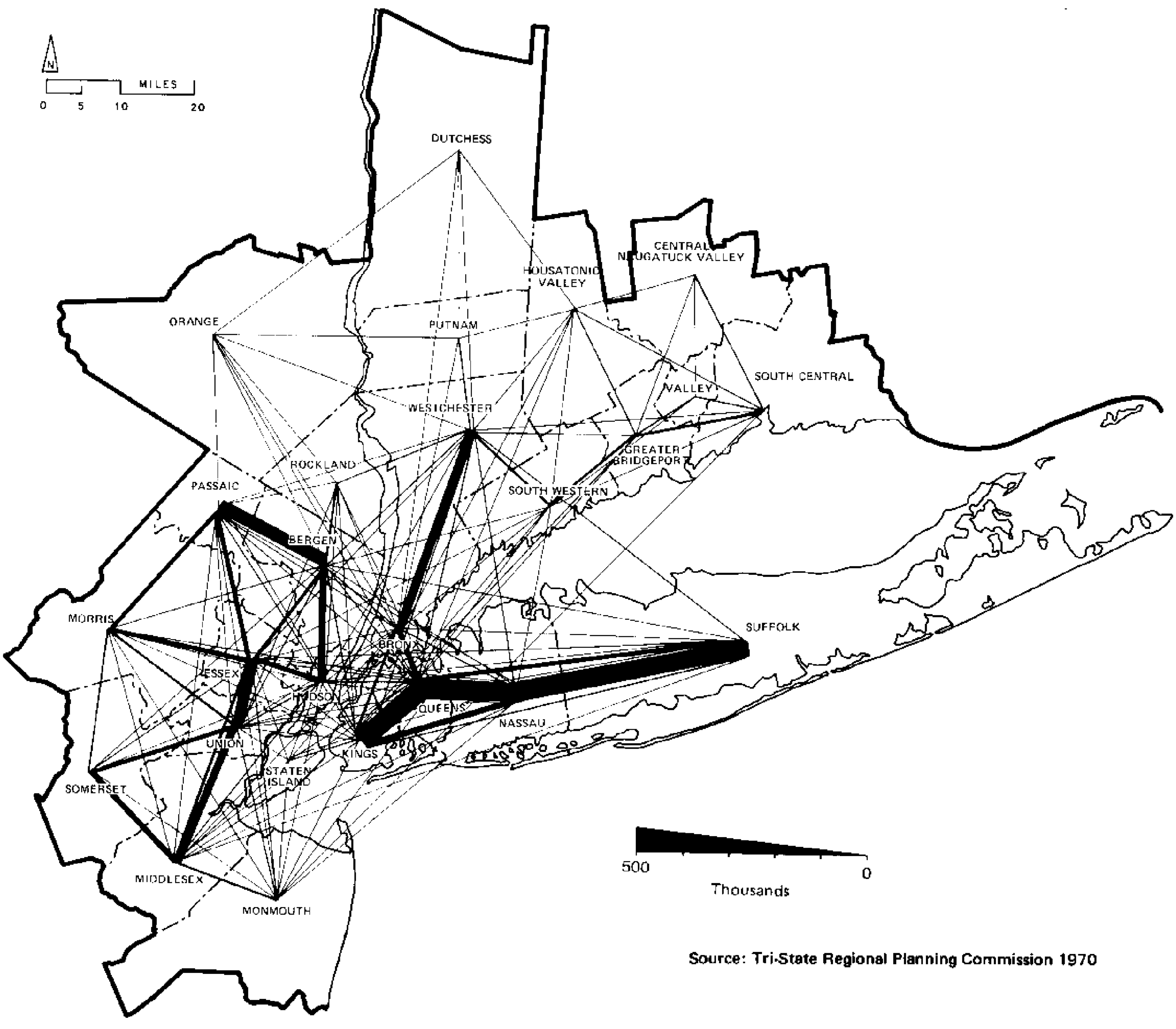
FLOOR SPACE (millions ft^2)

1963	723
1966	735
1968	743
1970	746
1972	786
1973	797



Source: Tri-State Regional Planning Commission 1975c

Figure 3. Employment and floor space in Manhattan below 60th Street, 1963-1973



Source: Tri-State Regional Planning Commission 1970

Figure 4. Daily travel between counties, excluding Manhattan, 1963

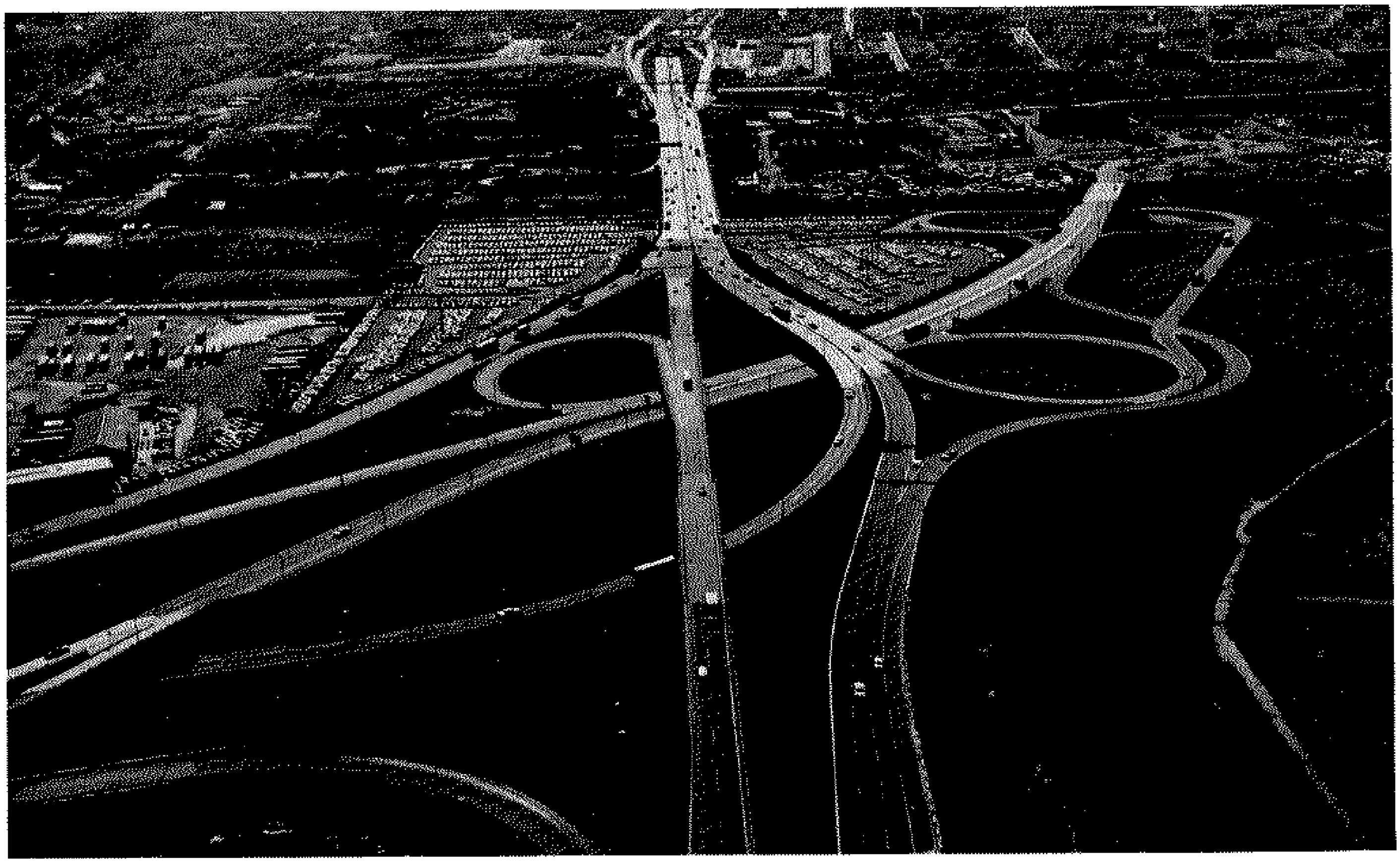


Figure 5. New Jersey Turnpike approach to Lincoln Tunnel (Courtesy of Port Authority of New York and New Jersey)

Figure 6. View of George Washington Bridge across Hudson River (Courtesy of Port Authority of New York and New Jersey)

and 40% during the 5 to 6 pm peak hour (Port Authority of New York and New Jersey 1970). Increased suburban cross-commuting also fills little-traveled country roads with peak-period flows from new industry.

The Automobile

In the Bight region, the predominant mode of transportation is the automobile. In 1963, 70% of all weekday person-trips in the Tri-State region (see Table 1) were made by automobile (Tri-State Transportation Commission 1967). The automobile's availability in different areas of the Bight region and its use for worktrips vary.

Whereas in New York City (except Richmond County) and three New Jersey counties (Essex, Hudson, and Atlantic) over 25% of the households had no automobile in 1970; in the other counties less than 20% had no automobile (Table 9). In Manhattan only 1.6% of the households had two or more automobiles, but in the six suburban ring counties over 40% had two or more automobiles.

The clear connection between automobile availability and the choice of transportation for the worktrip can be seen in Table 10. Generally, between 70% and 90% of the suburban county work force took an automobile to work in 1970 in contrast to about 26% in New York City. In five core counties (Bronx, Kings, New York, Queens, and Hudson) less than half the workers commuted by automobile during 1970.

Long-term trends in travel behavior indicate an ever-increasing reliance on the automobile. Vehicles registered in the Tri-State region have increased by 38% from 1963 to 1973—5.5 million to 7.6 million vehicles (Figure 7). Also, daily person-trips have increased 19% from 1963 to 1973 and daily vehicle-miles of travel (VMT), 32% (Figure 8). Unless a drastic reversal in automobile use takes place, the growing Bight region population will continue to increase automobile registrations and vehicle-miles of travel. How the energy crisis is affecting long-term trends in automobile ownership and driving patterns is not yet clear. Obviously, population and employment growth in suburban areas will place additional burdens on the principal transportation system there—that is, the highway.

Table 9. Automobiles available by county, 1970

	Occupied Housing Units	Automobiles Available				Percent Autos Available	
		One	Two	Three+	None	None	Two+
Core	**3,346,953**	**1,242,228**	**259,084**	**34,555**	**1,729,301**	**51.7**	**8.7**
New York City	2,836,872	1,015,111	171,166	19,856	1,630,739	57.5	6.7
Bronx	497,222	163,524	21,143	2,291	310,264	62.4	4.7
Kings (Brooklyn)	876,119	317,307	42,424	3,685	512,703	58.5	5.3
New York Co (Manhattan)	687,283	136,772	9,343	1,700	539,468	78.5	1.6
Queens	690,056	349,073	79,902	9,956	251,125	36.4	13.0
Richmond (Staten Island)	86,192	48,435	18,354	2,224	17,179	19.9	23.9
Essex	302,582	129,464	66,003	11,626	95,489	31.6	25.7
Hudson	207,499	97,653	21,915	3,073	3,073	40.9	12.0
Suburban Ring	**1,451,154**	**638,723**	**566,218**	**107,310**	**138,903**	**9.6**	**46.4**
Nassau	401,056	170,190	164,743	32,883	33,240	8.3	49.3
Suffolk	295,587	132,948	122,534	19,791	20,314	6.9	48.1
Bergen	279,625	124,126	106,001	20,782	28,716	10.3	45.3
Union	171,580	76,301	58,986	12,001	24,292	14.2	41.4
Middlesex	168,076	75,271	63,366	12,579	16,860	10.0	45.2
Monmouth	135,230	59,887	50,588	9,274	15,481	11.4	44.3
Outer Fringe	**150,225**	**74,348**	**41,121**	**7,460**	**27,326**	**18.2**	**32.3**
Ocean	68,362	35,544	21,807	4,021	6,990	10.2	37.8
Atlantic	60,716	27,280	14,154	2,541	16,741	27.6	27.5
Cape May	21,177	11,524	5,160	898	3,595	17.0	28.6
Total	**4,948,332**	**1,955,299**	**866,423**	**149,325**	**1,895,530**	**38.3**	**20.5**

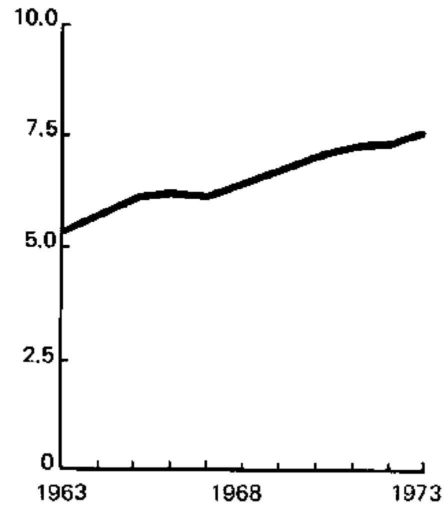
Source: US Bureau of the Census 1972c

Table 10. Persons using automobile for worktrips, 1970

	Total Employed	Persons Using Automobile	Percent
Core	**3,717,157**	**1,154,732**	**31.1**
New York City	3,106,029	803,626	25.9
Bronx	512,269	127,049	24.8
Kings (Brooklyn)	938,653	236,170	25.2
New York Co (Manhattan)	686,176	70,162	10.2
Queens	859,043	312,635	36.4
Richmond (Staten Island)	110,029	57,610	52.4
Essex	362,949	230,762	63.6
Hudson	248,179	120,344	48.5
Suburban Ring	**1,955,354**	**1,503,200**	**76.9**
Nassau	558,931	398,739	71.3
Suffolk	382,497	318,949	83.4
Bergen	378,474	285,443	75.4
Union	230,908	176,482	76.4
Middlesex	235,737	192,944	81.8
Monmouth	168,807	130,643	77.4
Outer Fringe	**149,746**	**119,837**	**80.0**
Ocean	66,279	57,288	86.4
Atlantic	63,864	47,278	74.0
Cape May	19,603	15,271	77.9
Total	**5,822,398**	**2,777,769**	**47.7**

Sources: Tri-State Regional Planning Commission 1973*e*; US Bureau of the Census 1972*a, b*

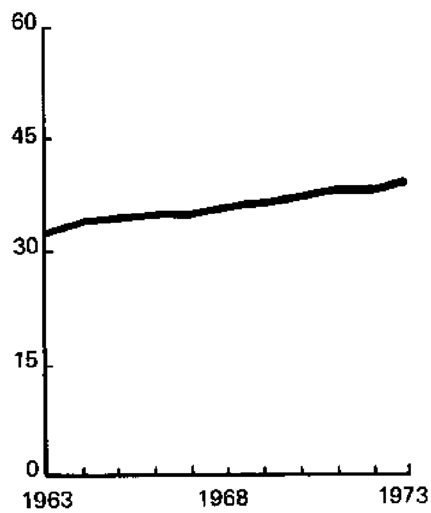
	(millions)
1963	5.5
1964	5.9
1965	6.2
1966	6.4
1967	6.3
1968	6.6
1969	6.8
1970	7.1
1971	7.3
1972	7.4
1973	7.6



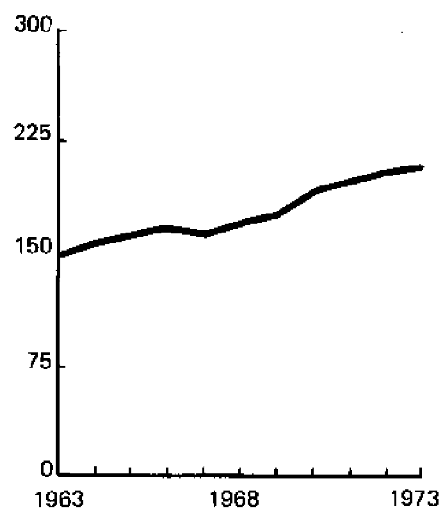
Source: Tri-State Regional Planning Commission 1975*c*

Figure 7. Vehicles registered in Tri-State region, 1963-1973

PERSON TRIPS (millions)	
1963	32.4
1964	33.1
1965	33.8
1966	34.6
1967	35.3
1968	36.1
1969	36.5
1970	37.4
1971	38.2
1972	38.8
1973	38.6



VEHICLE MILES OF TRAVEL	
1963	143.0
1964	152.8
1965	160.0
1966	164.5
1967	161.3
1968	168.3
1969	172.7
1970	189.2
1971	195.9
1972	203.3
1973	208.9



Source: Tri-State Regional Planning Commission 1975*c*

Figure 8. Daily person-trips and vehicle-miles, Tri-State region, 1963-1973

Highways

The Bight region's net of arterial highways and expressways is impressive in scale. The Regional Plan Association (RPA 1973) estimated that the RPA-defined 31-county region (see Table 1) in 1971 contained 1,605 mi (2,583 km) of expressways—highways of four or more lanes with controlled access (Table 11).

Roughly 50% of all vehicle-miles traveled occur on arterials and expressways, so their importance should not be underestimated (Creighton, Hamburg, Inc. 1974). The spectacular growth in expressways from 1927 to 1971 was a definitive shaping force in the New York region. Expressway mileage rose from 3.6 mi (5.8 km) in 1927 to 1,605 mi (2,583 km) in 1971. Note in Table 12 the high annual growth rates of expressway construction outside New York City. In New Jersey, for example, expressway mileage increased 1,073% between 1950 and 1971.

Of course not all travel occurs on expressways. Major and secondary arterial highways, not grade-separated, carry significant traffic. US Route 1 across New Jersey is a classic example of a nongrade-separated highway of high volume.

Table 12. Expressway mileage, 1927-1971

	New York City	New York State[a]	New Jersey[b]	Connecticut[c]	Total	Annual Rate of Construction In NYC	Annual Rate of Construction Outside NYC
1927	1.6	1.0	1.0	–	3.6		
1930	9.7	35.4	2.0	–	47.1	2.4%	9.4%
1935	25.7	112.2	10.5	–	147.4	3.2%	16.9%
1940	96.2	163.3	20.5	40.0	320.0	14.0%	20.5%
1945	111.9	171.5	20.5	45.0	348.9	3.1%	2.7%
1950	119.9	213.5	37.5	71.0	441.9	1.6%	17.0%
1955	149.8	377.0	217.6	74.0	818.4	6.0%	69.3%
1960	163.3	477.3	266.5	157.5	1,064.6	2.7%	46.5%
1965	201.0	601.4	323.5	227.0	1,352.9	7.5%	50.2%
1971[d]	210.5	751.0	402.5	241.0	1,605.0	1.7%	44.1%

[a]Includes Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, and Westchester counties

[b]Includes Bergen, Essex, Hudson, Middlesex, Monmouth, and Ocean counties

[c]Includes Fairfield, Litchfield, and New Haven counties

[d]As of July 1

Source: Regional Plan Association 1973

Table 13 lists the miles of roadways and the roadway density in the Bight region. Note the decrease in roadway density in counties distant from the core. Suffolk, Middlesex, and Monmouth counties, and especially the outer fringe counties in New

Table 11. Expressways in New York metropolitan region

	1971 Route Miles	1971 Lane Miles	Lane Miles Per 1,000 Motor Vehicles	Route Miles Per Mi^2 Built-up Land[a]	Area Served by Freeways[b]	VMT on Freeways 1963	Fatalities per 100 million VMT 1964 Freeways	Fatalities per 100 million VMT 1964 Non-Freeways
New York City	210.5	1,266	0.72	1.5	84%	40%[c]	1.6	3.1
Bronx	44.0	267	1.01	2.5	100%	47%	2.8	14.1
Kings (Brooklyn)	34.5	207	0.39	1.0	68%	30%	2.1	11.0
New York Co (Manhattan)	33.5	204	0.88	2.6	100%	43%	1.0	13.0
Queens	80.5	490	0.77	1.5	90%	47%	1.3	5.2
Richmond (Staten Island)	18.0	98	0.86	0.9	75%	–	–	2.8
Environs	1,394.5	6,967	1.17	0.7	na	26%[d]	–	–
Long Island	240.5	1,264	0.95	0.7	na	30%[d]	1.5	4.6
Northern NYS[e]	510.5	2,258	2.44	1.8	na	43%[d]	3.4	4.8
New Jersey[f]	402.5	2,310	0.83	0.6	na	19%[d]	2.0	4.3
Connecticut[g]	241.0	1,135	1.29	0.6	na	31%[d]	2.5	3.0
Total (31 counties)	1,605.0	8,233	1.06	0.8	na	30%	2.1	5.4

[a] Built-up land includes lots with buildings, exclusive of streets, parks, etc.

[b] Area within 1 mi of freeways, existing or under construction

[c] Probably overestimated due to underassessment of travel in the CBD

[d] Only within intensively developed area, excluding outer counties and parts of counties

[e] Includes Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, and Westchester counties

[f] Includes Bergen, Essex, Hudson, Middlesex, Monmouth, Ocean, and Union counties

[g] Includes Fairfield, Litchfield, and New Haven counties

Source: Regional Plan Association 1973

Table 13. Miles of roadway and roadway density by county, 1970

	Miles[a]	Density (mi/mi²)
Core	**7,888**	**16.75**
New York City	5,735	19.12
Bronx	723	17.63
Kings (Brooklyn)	1,525	21.79
New York Co (Manhattan)	509	22.13
Queens	2,287	21.18
Richmond (Staten Island)	691	11.91
Essex	1,558	12.27
Hudson	595	13.52
Suburban Ring	**18,665**	**7.98**
Nassau	4,027	13.93
Suffolk	6,042	6.50
Bergen	2,677	11.39
Union	1,353	13.14
Middlesex	2,030	6.59
Monmouth	2,546	5.33
Outer Fringe	**4,777**	**3.33**
Ocean	2,140	3.34
Atlantic	1,797	3.17
Cape May	840	3.72
Total	**31,330**	**7.36**

[a]Roadways include all state and local streets

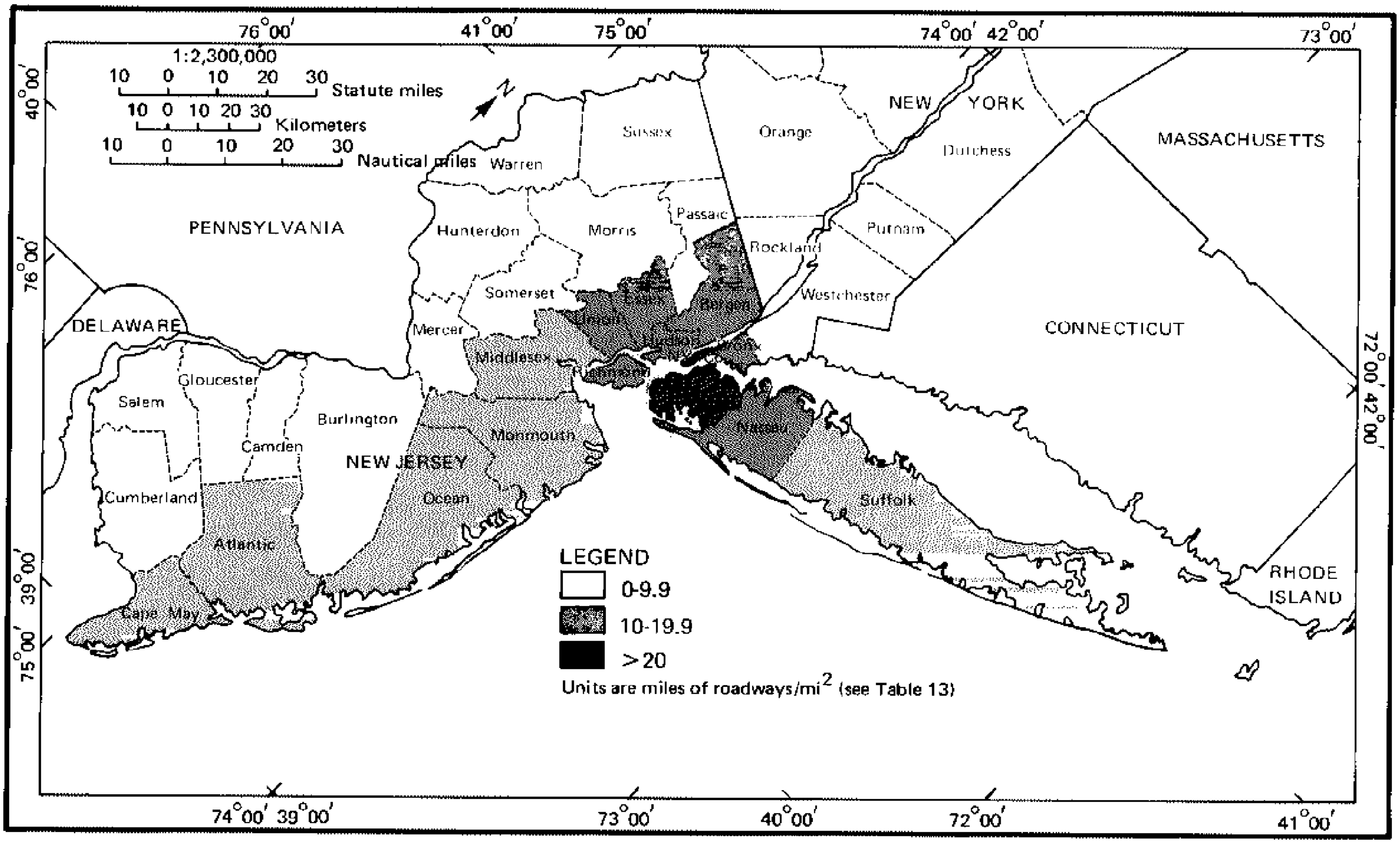
Sources: Creighton, Hamburg, Inc. 1974; New Jersey Department of Transportation 1974

Jersey, have roadway densities of only a fraction of the heavily urbanized core counties around Manhattan (Map 1).

High roadway density in the core helps explain the traffic density variations in Table 12—that is, traffic density is greatest in Manhattan and lowest in the outer fringe counties. The table also clearly indicates the vast differences in traffic density in suburban counties, depending on the presence of expressways carrying high volumes of traffic. Suffolk County, for example, has a lower roadway density (Table 13), fewer jobs (Table 2), fewer people (Table 4), and more land area (Table 5) than Nassau County. It is not surprising then that Suffolk County also has a lower traffic density (19.1 thousand) than Nassau County (63.3 thousand). Comparisons between northern and southern New Jersey counties yield similar results.

Traffic density estimates are useful indicators of the pollutant generation characteristics of the counties. Basically, high traffic density causes heavier pollutant concentration in the air. The expected growth in suburban counties surrounding the core will raise air pollutant concentrations even higher unless federal requirements for less-polluting engines are strict enough to counteract the increase in the number of vehicles on the highway. Other pollutants

Map 1. Roadway density



Transverse Mercator Projection

related to higher traffic densities include salt runoff from road de-icing, oil from street runoff and service station dumping, and noise from highways near residential areas.

Table 14 also demonstrates the inverse correlation between traffic density (Map 2) and vehicle-miles traveled per capita: the farther the county is from the core, the greater the per capita vehicle-miles. We can also see a correlation between the use of the automobile for worktrips (Table 10) and the per capita vehicle-mile estimates (Table 14): the more vehicle-miles per capita, the higher the number of people using automobiles for worktrips. Mass transportation availability and use in getting to jobs will directly affect the vehicle-miles traveled within a county. If mass transit use does not rise with the expected growth in jobs and population in the suburban counties, in future years the suburban counties may have relatively consistent per capita vehicle-miles but tremendous increases in total county vehicle-miles. Without shifts to mass transportation in these suburban counties, there will be severe impacts on the road systems. The counties bordering the Bight have a potentially serious transportation situation. If we add automobile traffic from new Bight region residents to the already congested

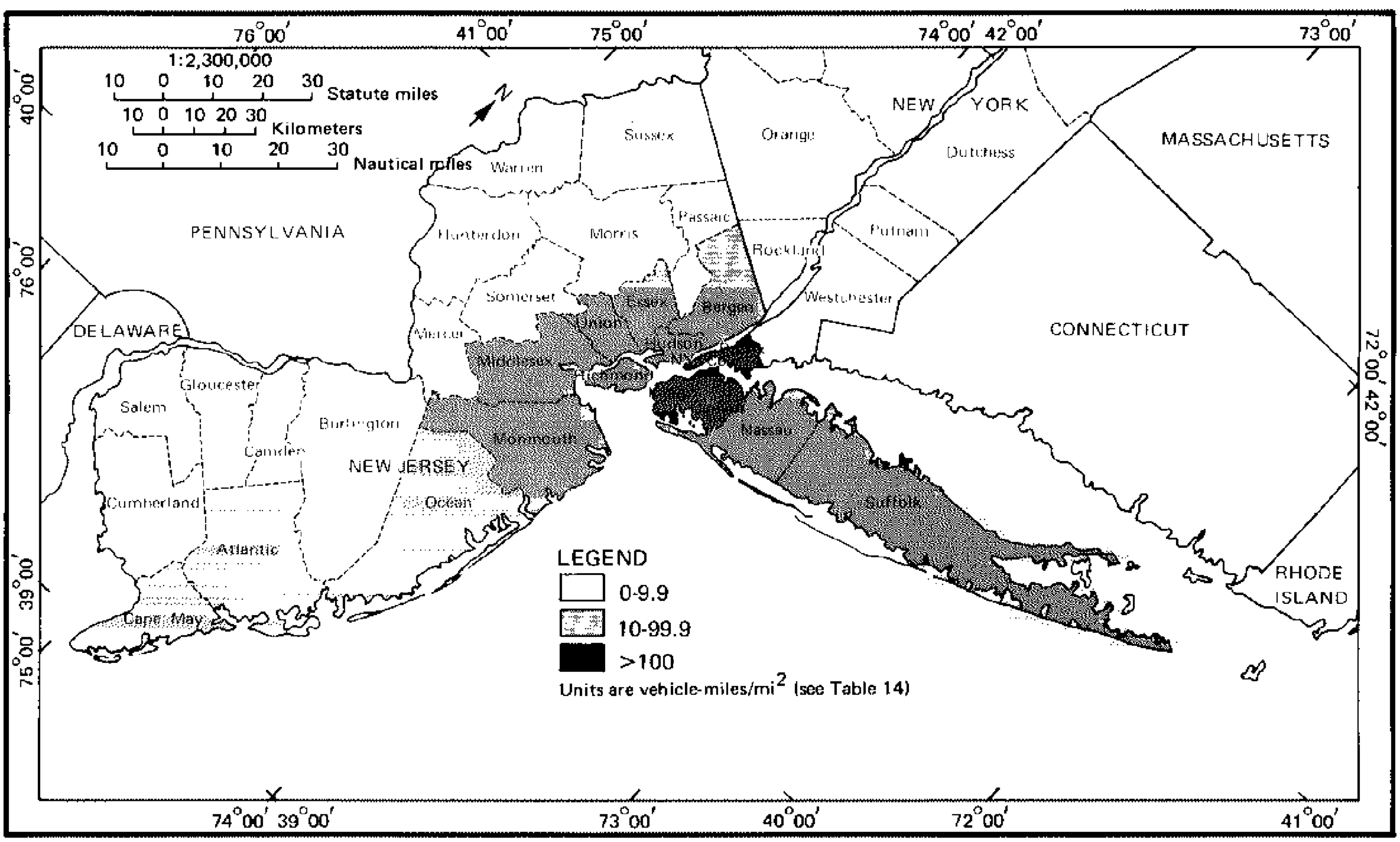
Table 14. Daily vehicle-mile estimates by county, 1970

	Vehicle-miles[a] (millions)	Traffic Density (thousands VM/mi²)	Vehicle-miles Per Capita
Core			
New York City			
Bronx	6.4	156.1	4.4
Kings (Brooklyn)	9.0	128.6	3.5
New York Co (Manhattan)	6.5	282.6	4.2
Queens	15.8	146.3	8.0
Richmond (Staten Island)	2.6	44.8	8.8
Essex	8.4	66.1	9.0
Hudson	4.2	95.5	6.9
Suburban Ring			
Nassau	18.3	63.3	12.8
Suffolk	17.7	19.1	15.6
Bergen	11.8	50.2	13.1
Union	6.4	62.1	11.8
Middlesex	10.1	32.8	17.2
Monmouth	6.0	12.6	13.1
Outer Fringe			
Ocean	3.2	5.0	15.3
Atlantic	3.1	5.4	17.7
Cape May	1.1	4.8	18.3

[a]Includes travel by residents of counties and by cars, trucks, buses passing through

Sources: Creighton, Hamburg, Inc. 1974; New Jersey Department of Transportation 1974

Map 2. Traffic density



Transverse Mercator Projection

Long Island Expressway (daily) and Garden State Parkway (particularly on weekends), the result is likely to be increased traffic congestion. Mass transit then becomes an important variable in determining the quality of life in Bight region counties.

Mass Transit

The current environmental concerns and energy crisis have given new impetus to interest in mass transportation systems—rapid transit, railroad, and bus. Mass transit is seen as particularly appropriate for worktrips, which are very routine and usually do not involve all family members or large amounts of goods. For worktrips, mass transit becomes a preferable alternative to the automobile.

Table 15 shows that people in the suburban ring and outer fringe counties, which face the largest growth in population and jobs in the next decade and beyond, predominantly used the automobile to get to work in 1970. Mass transit trips comprised only about 27% of the total daily trips; rapid transit and bus travel made up most of these trips (Table 16). The New York City subway system carries the bulk of mass transit ridership in the region, about 46% (Table 17). The only real competitors are the New York City buses, which carry 30%.

The core of the New York region presently has an extensive rapid transit system, including the New York City Transit Authority (NYCTA), Port Authority Trans-Hudson (PATH, Figure 9), Staten Island Rapid Transit (SIRT), and the Newark system. In 1970, for instance, there were 268 mi (431 km) of rapid transit routes and 521 stations (Table 18). In

Table 16. Weekday trips in Tri-State region, 1970

	Number of Trips[a] (thousands)	Percent of Total
Rapid transit	4,473	13.0
Bus	4,230	12.3
Commuter railroad	548	1.6
Total mass transit	9,251	26.9
Taxi	927	2.7
Automobile	24,076	70.2
Other	75	0.2
Total	34,329	100.0

[a]If trip involved more than one means of transportation, each was counted as a separate trip

Source: Governors' Special Commission on the Financing of Mass Transportation 1972

Table 15. Percent use of transportation systems for worktrip, 1970

	Total Employed	Auto	Bus	Subway, Elevated, or Railroad	Walk	Other[a]
Core	**3,717,298**	**31.1%**	**16.4%**	**39.1%**	**9.7%**	**3.7%**
New York City	3,106,170	25.9	14.9	45.7	9.6	3.9
Bronx	512,269	24.8	13.5	51.4	7.3	3.0
Kings (Brooklyn)	938,653	25.2	12.8	51.1	8.6	2.3
New York Co (Manhattan)	686,176	10.2	20.9	43.7	17.2	8.0
Queens	859,043	36.4	12.4	42.5	6.4	2.3
Richmond (Staten Island)	110,029	52.4	20.4	11.9	5.5	9.8
Essex	362,949	63.6	22.0	3.6	7.7	3.1
Hudson	248,179	48.5	28.0	7.3	13.9	2.3
Suburban Ring	**1,955,354**	**76.9%**	**5.6%**	**8.2%**	**5.6%**	**3.7%**
Nassau	558,931	71.3	3.5	15.9	5.4	3.9
Suffolk	382,497	83.4	1.0	7.3	3.9	4.4
Bergen	378,474	75.4	12.2	3.4	5.5	3.5
Union	230,908	76.4	7.6	5.8	7.1	3.1
Middlesex	235,737	82.9	5.5	3.4	6.4	1.8
Monmouth	168,807	77.4	5.3	5.2	7.5	4.6
Outer Fringe	**149,746**	**80.0%**	**5.2%**	**0.8%**	**7.8%**	**6.2%**
Ocean	66,279	86.4	2.7	1.2	4.4	5.3
Atlantic	63,864	74.0	8.9	0.4	10.3	6.4
Cape May	19,603	77.9	1.5	0.9	11.0	8.7

[a]Includes those who worked at home

Sources: US Bureau of the Census 1972*a,b;* New Jersey Task Force on Energy 1974

Table 17. Mass transit operations, Tri-State region, 1969-1970

Facility	Number of Cars or Buses	Number of Employees	Number of Passengers: Weekday (in thousands)	Number of Passengers: Annual (in millions)
Rapid transit total	**7,249**	**35,544**	**4,473**	**1,305.8**
New York City subways	6,919	34,839[a]	4,266	1,257.6
PATH	252	1,139	173	39.0
SIRT	48	346	18	4.8
Newark subway	30	220	16	4.4
Commuter Railroads total	**2,793**	**11,953**	**548**	**152.0**
Connecticut-New York				
Penn Central-New Haven (West End)	430	1,300[c]	71	20.8
New Jersey				
Central Railroad of New Jersey	142	500[c]	25	6.3
Erie-Lackawanna	418	920[b]	64	15.9
Penn Central-Northern New Jersey[b]	184	800[c]	55	16.4
New York				
Long Island Railroad	1,332	7,233	255	70.1
Penn Central-Harlem and Hudson Division	287	1,200[c]	78	22.5
Buses total	**11,180**	**28,927**	**4,230**	**1,292.4**
Connecticut—private	1,133	1,834	216	58.4
New Jersey—private	3,669	8,884	1,002	270.5
New York				
Transit Authority	2,738	8,149	1,354	409.0
MABSTOA	1,957	6,321	1,006	372.5
Private—New York City	754	1,746	458	129.6
—Other than New York City	929	1,993	194	52.4
TOTAL	**21,222**	**77,424**	**9,251**	**2,750.2**

[a]Includes 4,197 transit police
[b]Includes New York-Long Branch RR
[c]Estimated

Source: Governor's Special Commission on the Financing of Mass Transportation 1972

Table 18. Rapid transit, 1970

	Route Miles of Line			Passenger Stations		
	NYCTA	Other	Total	NYCTA	Other	Total
New York City	237	17	254	477	26	503
Bronx	38	–	38	84	–	84
Kings (Brooklyn)	85	–	85	173	–	173
New York Co (Manhattan)	70	3	73	138	6	144
Queens	44	–	44	82	–	82
Richmond (Staten Island)	–	14	14	–	20	20
Hudson County	–	10	10	–	6	6
Newark	–	4	4	–	12	12
Total route miles[a]	237	31	268	477	44	521
Track miles	720	62	782			

[a]1 route mile but 2 track miles (if 2 sets of tracks)

Source: Regional Plan Association 1973

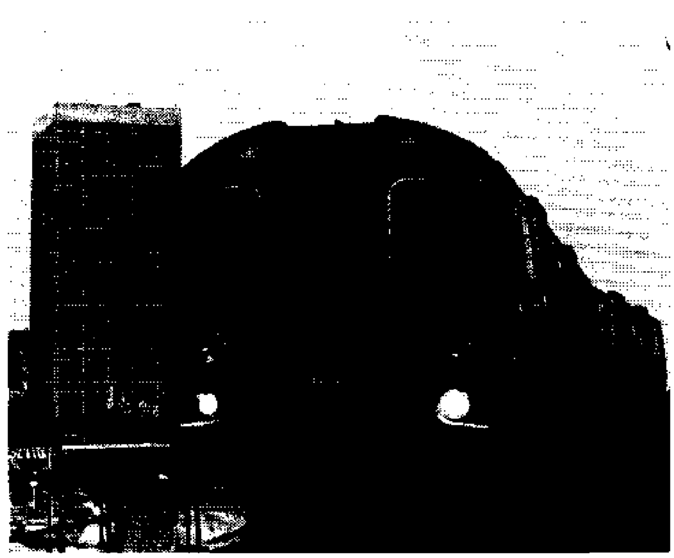
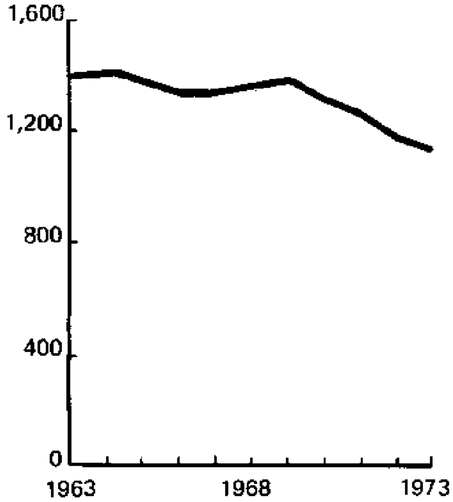


Figure 9. PATH rapid transit cars (Courtesy of Port Authority of New York and New Jersey)

(millions)	
1963	1,400
1964	1,413
1965	1,398
1966	1,333
1967	1,339
1968	1,348
1969	1,377
1970	1,306
1971	1,244
1972	1,192
1973	1,140



Source: Tri-State Regional Planning Commission 1975c

Figure 10. Rapid transit patronage in Tri-State region, 1963-1973

spite of this extensive system, rapid transit ridership has declined over the long term—19% from 1963 to 1973 (Figure 10). Transit travel to Manhattan below 60th Street declined 9% in the same period, while vehicular travel increased 15% (Figure 11). Although these changes are not large, they do reflect the difficulty mass transit faces today in attracting riders: because fewer people need to travel to Manhattan and because train travel is slow, expensive, and unpleasant.

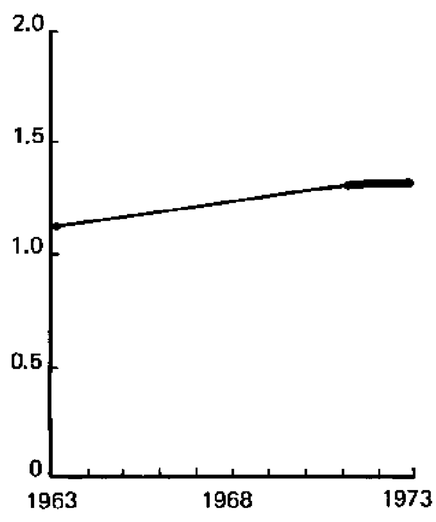
The explosive growth in the suburban counties will be in cross-commuting trips, cross-hauling from one suburban county to another. Long-distance commuting there has usually been by railroad or bus. Rapid transit systems and rail passenger service focusing on Manhattan will not cease to exist but will carry a dwindling portion of the total worktrips in the region.

The increasing tensions between dispersed land use patterns and personal choice, favoring the automobile, on the one hand, and environmental and energy considerations, favoring mass transit, on the other, can be clearly seen in the suburban and outer fringe counties.

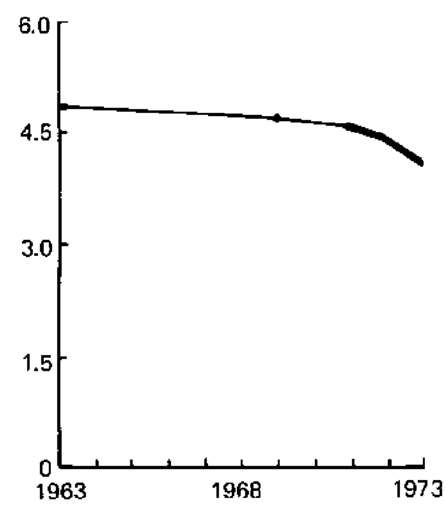
Much of northern New Jersey and Long Island have access to suburban rail. Although the Long Island Railroad has been severely criticized, it does exist. Nevertheless, the suburban passenger railroads in Table 17 carried only 6% of all mass transit ridership in the Tri-State region. As the suburban areas of the Bight region develop, the absolute number of railroad commuters will not change significantly—most suburban workplaces are not convenient to existing or potential mass transit services.

Buses, on the other hand, carry a large percentage of mass transit ridership in the region. In 1970, 46% of weekday mass transit passengers traveled by bus. Most of these commuters rode buses belonging to the New Jersey systems, the New York Transit Authority, and the Manhattan and Bronx Surface Transportation Operating Authority (MABSTOA). As Table 15 illustrates, commuters preferred the automobile but the bus was usually the second choice. In New Jersey counties, the bus was used for worktrips more than the train was. We can expect the bus to become increasingly dominant as a mass transportation carrier in the suburban areas of the Bight region, but without significant shifts in the future, all mass transportation modes will still be overshadowed by the automobile.

VEHICLE TRAVEL (million vehicles)	
1963	1.14
1969	1.26
1971	1.29
1972	1.31
1973	1.31



TRANSIT TRAVEL (million persons)	
1963	4.84
1969	4.68
1971	4.51
1972	4.39
1973	4.10



Source: Tri-State Regional Planning Commission 1975c

Figure 11. Daily vehicle and transit travel to and from Manhattan below 60th Street, 1963-1973

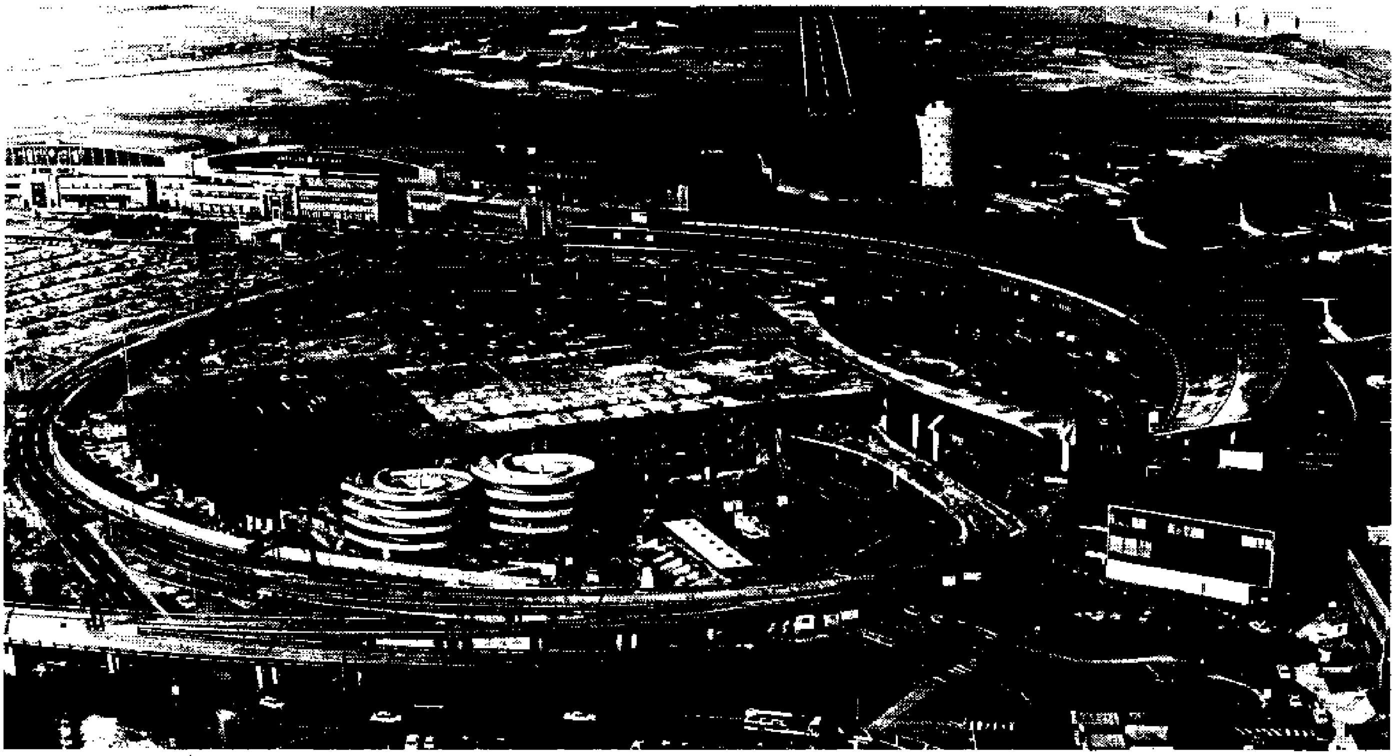


Figure 12. La Guardia Airport (Courtesy of Port Authority of New York and New Jersey)

Airways

Airports are important links in the transportation system: they not only provide quick access to almost anywhere in the world, they also give the Sunday flier a place to take off and land. The Bight region has three major air terminals—Kennedy, La Guardia (Figure 12), and Newark—plus numerous small airports. Map 3 shows the fairly even distribution of general aviation airports throughout the region and the concentration of the major air carrier facilities around New York City.

The major airports have an impact on the Bight region population and directly affect the Bight. The four airports in Table 19 carried 40 million revenue (ticket-buying) passengers in 1974; Kennedy carried 50% of the total. The smaller airports serving general aviation needs also have significant numbers of flights, albeit of small aircraft. Six of these airports have annual operations (takeoffs and landings) over 100,000 (Table 20). Estimates indicate that air transportation in the New York-New Jersey metropolitan area generated 77,800 direct jobs in 1971 at airports and off-airport locations and approximately $1 billion in wages and salaries. Another 107,000 jobs were created indirectly by goods and services purchased by airlines, airport employees, and visitors (Howard 1972).

Table 19. Revenue passenger traffic, 1973-1974

Airport	1973	1974	Change
Kennedy International	21,389,159	20,216,436	− 5.5%
La Guardia	14,027,360	13,703,028	− 2.3%
Newark	6,835,203	6,451,857	− 5.6%
Islip MacArthur	225,743	105,928	−53.1%
Total	42,477,465	40,477,249	− 4.7%

Source: Tri-State Regional Planning Commission 1975*b*

On the other hand, estimates show that at major airports such as Kennedy, ground-level concentrations of carbon monoxide, hydrocarbons, and nitrogen dioxide sometimes exceed federal standards. Of course, both land use and ground transportation, as well as aircraft, contribute to pollution at airports. Until engine modifications and improved operations are successfully put into effect, airports will contribute to regional and local air pollution (Platt and Bastress 1973).

Other adverse effects of airports are detailed in the National Academy of Sciences/National Academy of Engineering study (1972) on Jamaica Bay and Kennedy Airport. A great number of residences and institutions are currently affected by noise from Kennedy. A proposed new runway extending into Jamaica Bay would not reduce noise levels significantly. In fact, the new runway would not do as

Map 3. Airports

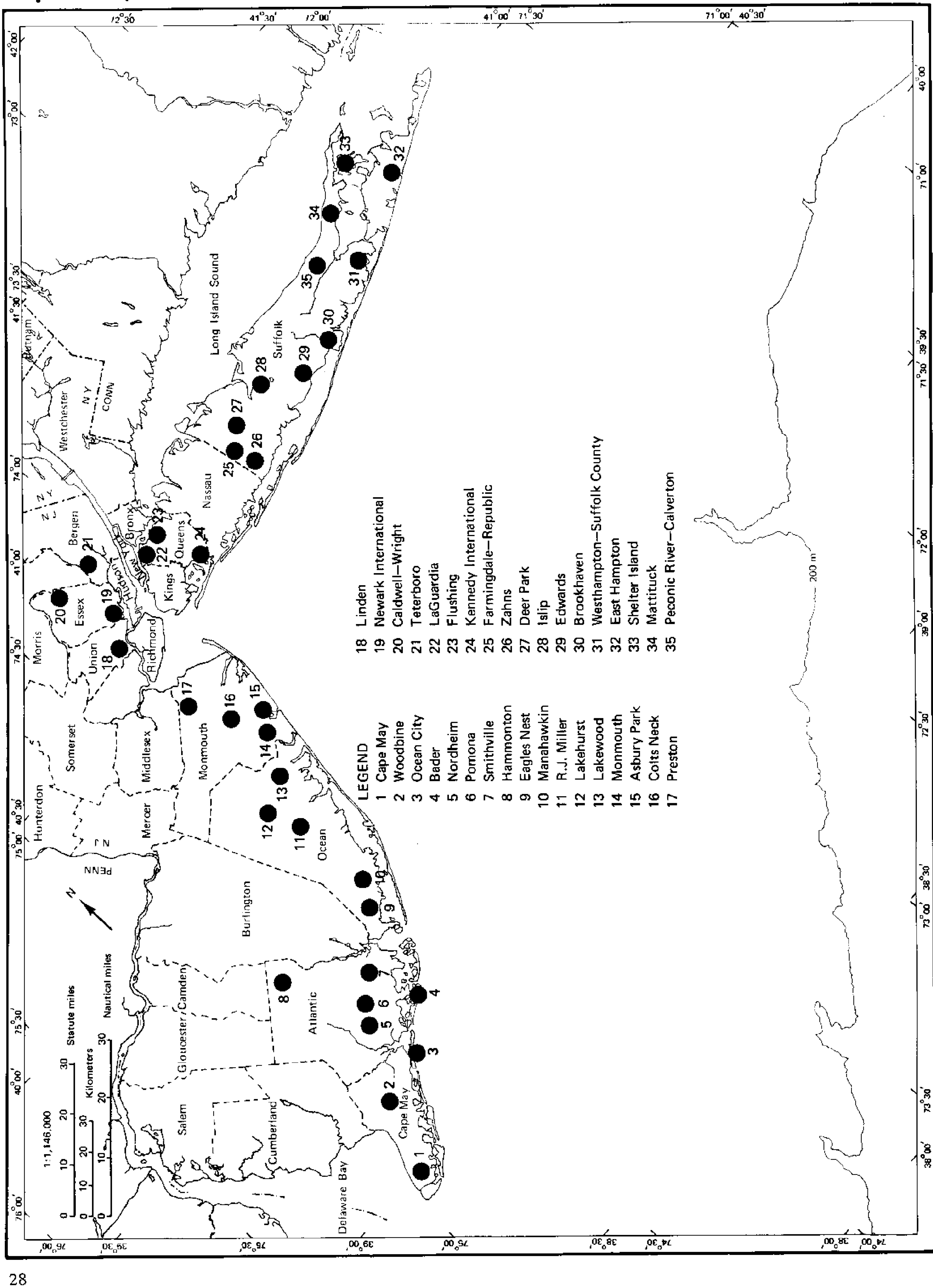


Table 20. Aircraft operations by airport, 1973-1974

Airport	Annual Operations[a]
NEW YORK	
Brookhaven	183,000
Deer Park	180,000
East Hampton	28,000
Edwards	6,400
Farmingdale-Republic	158,763
Flushing	61,000
Islip	218,351
Kennedy International	325,000
La Guardia	334,000
Mattituck	16,000
Peconic River-Calverton	31,000
Shelter Island	5,000[b]
Westhampton-Suffolk County	71,000
Zahns	297,000

Airport	Annual Operations[a]
NEW JERSEY	
Asbury Park	20,500
Bader	45,000
Caldwell-Wright	200,800
Cape May	44,000
Colts Neck	55,000
Eagles Nest	5,000
Hammonton	45,000
Lakehurst	55,000
Lakewood	35,000
Linden	49,400
Manahawkin	6,000
Monmouth	120,000
Newark International	213,968
Nordheim	8,000
Ocean City	10,000
Pomona	108,500
Preston	19,000
R.J. Miller	63,000
Smithville	15,000
Teterboro	267,076
Woodbine	10,000

[a] Airports with less than 5,000 annual operations not included
[b] Estimated

Sources: Tri-State Regional Planning Commission 1974; New Jersey Department of Transportation, personal communication 1976

much for noise reduction as quieter engines would. Also, the runway extension would damage the ecology of the waterway and lessen its recreational potential.

The SST (supersonic transport) is another major potential noisemaker. At supersonic speeds the SST generates a sonic boom—a pressure disturbance that increases normal atmospheric pressures at sea level (14.7 lb/in^2) by 1 to 3 lb/in^2—that sounds like a very loud, nearby explosion. SSTs are currently banned from supersonic flights over the continental United States, but even subsonic takeoffs and landings are noisy. At this writing, the Concorde is operating on a trial basis out of Dulles Airport near Washington, DC, and noise levels are being monitored.

Transportation for Freight

Like movement of people, freight movements within the Bight region can be categorized into basic types, distinguished by function rather than by mode: freight movement *into, out of,* and *within* the region.

The first type involves commodities originating or produced outside the region being moved into the region (imports). Freight carriers here are trucks, rail cars, ships, oil pipelines, gas pipelines, and airplanes. Ships are predominant, trucks are second; railcars, pipelines, and aircraft lag substantially behind.

These same freight carriers contribute to the second type—movement out of the region—exports produced in or passing through the region. Truck transportation dominates the outflows; water transportation is second. Railways and oil pipelines fall behind along with air transport. In fact, air cargo represents less than 1% in each of the first two types.

The third type—internal distribution—is almost completely dominated by the highway. The only significant competitor is water transportation. Both the origins and destinations of internal distribution are within the region—that is, products made here are moved to intraregional markets, and shipments ultimately leaving or entering the region are distributed and collected here.

Except for shipments into the region, trucks have become the most important carrier. In total volume of movements, trucks account for over half the total freight traffic and almost twice as much as their nearest competitor, freight-carrying ships. Despite a large infrastructure, the railroads carry a small proportion of freight. As in movements of people, freight movements are the province of the highway system.

Table 21, the latest available information from Tri-State Regional Planning Commission's monitoring of freight traffic data, categorizes the total freight traffic of the Tri-State region, from which can be estimated how much each mode of transportation contributes. From 1973 totals (Table 21):

Truck	51.0%
Water	33.3%
Oil pipeline	6.1%
Rail	5.1%
Freight substitutes	4.3%
Air	0.2%

Let us look in some detail at the key carriers.

Table 21. Estimated freight traffic in Tri-State region by mode and direction, and tons per capita, 1970-1973 (million short tons)

	Conventional Freight Modes									Freight Substitutes (Coal Equivalent)					
	Water			Truck	Rail	Oil Pipe-line	Air Cargo (Incl. Mail)			Natural Gas	Power by Wire	Nuclear Power	Total All Modes	Direction-al Share	(Actual) Population and Tons Per Capita
	D	F	T				D	F	T						
1970															
Into	41.8	57.9	99.7	49.7	33.6	28.8	0.3	0.2	0.5	22.3	6.3	0.1	241.0	37.3%	18,725,002
	17.3%	24.0%	41.4%	20.6%	13.9%	12.0%	0.1%	0.1%	0.2%	9.2%	2.6%	0.1%	100.0%		12.9
Out of	21.9	7.6	29.5	49.7	8.6	8.2	0.4	0.2	0.6	–	–	–	96.6	15.0%	5.2
	22.7%	7.9%	30.6%	51.4%	8.9%	8.5%	0.4%	0.2%	0.6%	–	–	–	100.0%		
Within	66.0	–	66.0	233.2	3.6	5.0	–	–	–	–	–	–	307.8	47.7%	16.4
	21.4%	–	21.4%	75.8%	1.2%	1.6%	–	–	–	–	–	–	100.0%		
Total	129.7	65.5	195.2	332.6	45.8	42.0	0.7	0.4	1.2	22.3	6.3	0.1	645.5	100.0%	34.5
	20.1%	10.1%	30.2%	51.5%	7.1%	6.5%	0.1%	0.1%	0.2%	3.5%	1.0%	*	100.0%		
1971															
Into	40.7	55.4	96.2	50.4	29.9	30.4	0.3	0.3	0.6	22.9	6.3	0.3	237.0	36.3%	18,894,309
	17.2%	23.4%	40.6%	21.3%	12.6%	12.8%	0.1%	0.1%	0.2%	9.7%	2.7%	0.1%	100.0%		12.5
Out of	22.6	5.8	28.4	50.4	8.3	8.9	0.4	0.2	0.6	–	–	–	96.6	14.8%	5.1
	23.4%	6.0%	29.4%	52.2%	8.6%	9.2%	0.4%	0.2%	0.6%	–	–	–	100.0%		
Within	74.3	–	74.3	234.8	3.5	6.2	–	–	–	–	–	–	318.8	48.9%	16.9
	23.3%	–	23.3%	73.7%	1.1%	1.9%	–	–	–	–	–	–	100.0%		
Total	137.6	61.2	198.9	335.6	41.7	45.5	0.7	0.5	1.2	22.9	6.3	0.3	652.4	100.0%	34.5
	21.1%	9.4%	30.5%	51.4%	6.4%	7.0%	0.1%	0.1%	0.2%	3.5%	1.0%	*	100.0%		
1972															
Into	40.7	64.7	105.4	52.8	26.1	31.4	0.4	0.3	0.6	23.0	6.6	0.3	246.2	36.3%	18,963,293
	16.5%	26.3%	42.8%	21.4%	10.6%	12.8%	0.2%	0.1%	0.2%	9.3%	2.7%	0.1%	100.0%		13.0
Out of	21.0	5.9	26.9	52.8	8.0	10.1	0.4	0.3	0.7	–	–	–	98.5	14.6%	5.2
	21.3%	6.0%	27.3%	53.6%	8.1%	10.3%	0.4%	0.3%	0.7%	–	–	–	100.0%		
Within	84.9	–	84.9	238.3	3.4	6.5	–	–	–	–	–	–	333.1	49.1%	17.6
	25.5%	–	25.5%	71.5%	1.0%	2.0%	–	–	–	–	–	–	100.0%		
Total	146.6	70.6	217.2	343.9	37.5	48.0	0.8	0.6	1.3	23.0	6.6	0.3	677.8	100.0%	35.8
	21.6%	10.4%	32.0%	50.8%	5.5%	7.1%	0.1%	0.1%	0.2%	3.4%	1.0%	*	100.0%		
1973															
Into	32.7	82.0	114.7	56.3	25.1	28.6	0.4	0.3	0.7	21.4	8.2	0.9	255.9	36.3%	18,934,815
	12.8%	32.0%	44.8%	22.0%	9.8%	11.2%	0.2%	0.1%	0.3%	8.4%	3.2%	0.3%	100.0%		13.5
Out of	24.9	7.2	32.1	56.3	7.7	8.5	0.4	0.4	0.8	–	–	–	105.4	15.0%	5.6
	23.6%	6.8%	30.4%	53.4%	7.3%	8.1%	0.4%	0.4%	0.8%	–	–	–	100.0%		
Within	87.7	–	87.7	247.0	3.2	5.7	–	–	–	–	–	–	343.6	48.7%	18.1
	25.5%	–	25.5%	71.0%	0.9%	1.7%	–	–	–	–	–	–	100.0%		
Total	145.3	89.2	234.5	359.6	36.0	42.8	0.8	0.6	1.4	21.4	8.2	0.9	704.8	100.0%	37.3
	20.6%	12.7%	33.3%	51.0%	5.1%	6.1%	0.1%	0.1%	0.2%	3.0%	1.2%	0.1%	100.0%		
Change 1973/1970	12.0%	36.2%	20.1%	8.1%	−21.4%	1.9%	14.3%	50.0%	16.7%	−4.0%	30.2%	800.0%	9.2%		Population 1.1% Per Capita 7.8%

D—domestic F—foreign T—total *—less than 0.05%

Source: Tri-State Regional Planning Commission 1975a

Trucks

Trucks use the same basic road network that private vehicles do and thus tend to magnify the environmental problems (salt, runoff, oil runoff, noise pollution, etc.) associated with automobiles. Trucks are typically 5% to 10% of the total traffic volume on highways.

Truck tonnage trends show rapid growth within the region (Table 22). Most trucking distributes freight within the region; consequently, trucking serves as a link between other modes of transportation bringing commodities into and carrying them out of the region.

Table 22. Estimated truck tonnage, Tri-State region, 1970-1973 (million short tons)

	1970	1971	1972	1973	Increase 1970/1973
Into	49.7	50.4	52.8	56.3	13%
Out of	49.7	50.4	52.8	56.3	13%
Within	233.2	234.8	238.3	247.0	6%
Total	332.6	335.6	343.9	359.6	8%

Source: Tri-State Regional Planning Commission 1975*a*

Waterborne Commerce

Surprisingly, waterborne commerce increased by about 20% between 1970 and 1973 (Table 23), a result of the import and distribution of petroleum and related products. Only petroleum products are shipped through pipelines; crude oil, brought in by tanker, is not. Waterborne commerce represents 33% of the region's total freight movements (Table 21).

The Bight region's major port, the Port of New York, leads the 11 largest US continental seaports in ship arrivals and in tons of cargo. In 1972, for instance, over 9,000 vessels arrived at the port and over 626,000 overseas passengers moved through the port. Of the nearly 197 million short tons of cargo handled in the port in 1972, two-thirds were domestic, mainly petroleum; most of the foreign trade was import—principally kerosene and fuel oils (Hammon 1976).

Table 23. Waterborne commerce, Tri-State region, 1970-1973 (estimated short tons)

	1970	1971	1972	1973	Change 1970/1973
Domestic	63.7	63.2	61.8	57.6	−10%
Foreign	65.5	61.2	70.4	89.2	36%
Regional	66.0	74.4	84.9	87.7	33%
Total	195.2	198.8	217.2	234.5	20%

Source: Tri-State Regional Planning Commission 1975*a*

Railroads

Rail freight nationally has not grown over the past 15 years. Rail-freight movements in the Bight region have declined markedly during the same period (Table 24).

Table 24. Estimated railroad freight, Tri-State region, 1970-1973 (million short tons)

	Base Year 1961	1970	1971	1972	1973
Into	43.8	33.6	29.9	26.1	25.1
Out of	9.6	8.6	8.3	8.0	7.7
Within	4.0	3.6	3.5	3.4	3.2
Total	57.4	45.8	41.7	37.5	36.0
% decline vs. 1970			−9.0%	−18.1%	−21.4%

Source: Tri-State Regional Planning Commission 1975*a*

Although all directions of rail movement decreased, the largest decline occurred in shipments into the region. This is because coal is not now widely used as an energy source. The substantial drop in the use of the rail-freight network is bringing an increasing dependence on more environmentally questionable modes of shipment. In energy consumption and air pollution, the railroad is more efficient for shipping than the truck.

Airways

The growth in air shipments of goods and products is vigorous, increasing by about 25% from 1970 to 1973 (Table 25). Most overseas shipments are moved only through Kennedy Airport (Figure 13), which also handles the bulk of domestic freight and mail.

The growth of air freight represents a shift away from truck and containership traffic.

Table 25. Air cargo, Tri-State region, 1970-1973 (short tons)

	1970	1971	1972	1973
Inbound	535,465	587,041	632,409	679,511
Cargo	451,669	502,023	545,831	588,702
Mail	85,796	85,018	86,578	90,809
Outbound	626,599	638,626	698,369	770,284
Cargo	504,993	511,133	571,739	647,017
Mail	121,606	127,493	126,630	123,267
Total	1,162,064	1,225,667	1,330,778	1,449,795
Cargo	956,662	1,013,156	1,117,570	1,235,719
Mail	205,402	212,511	213,208	214,076

Source: Tri-State Regional Planning Commission 1975*a*

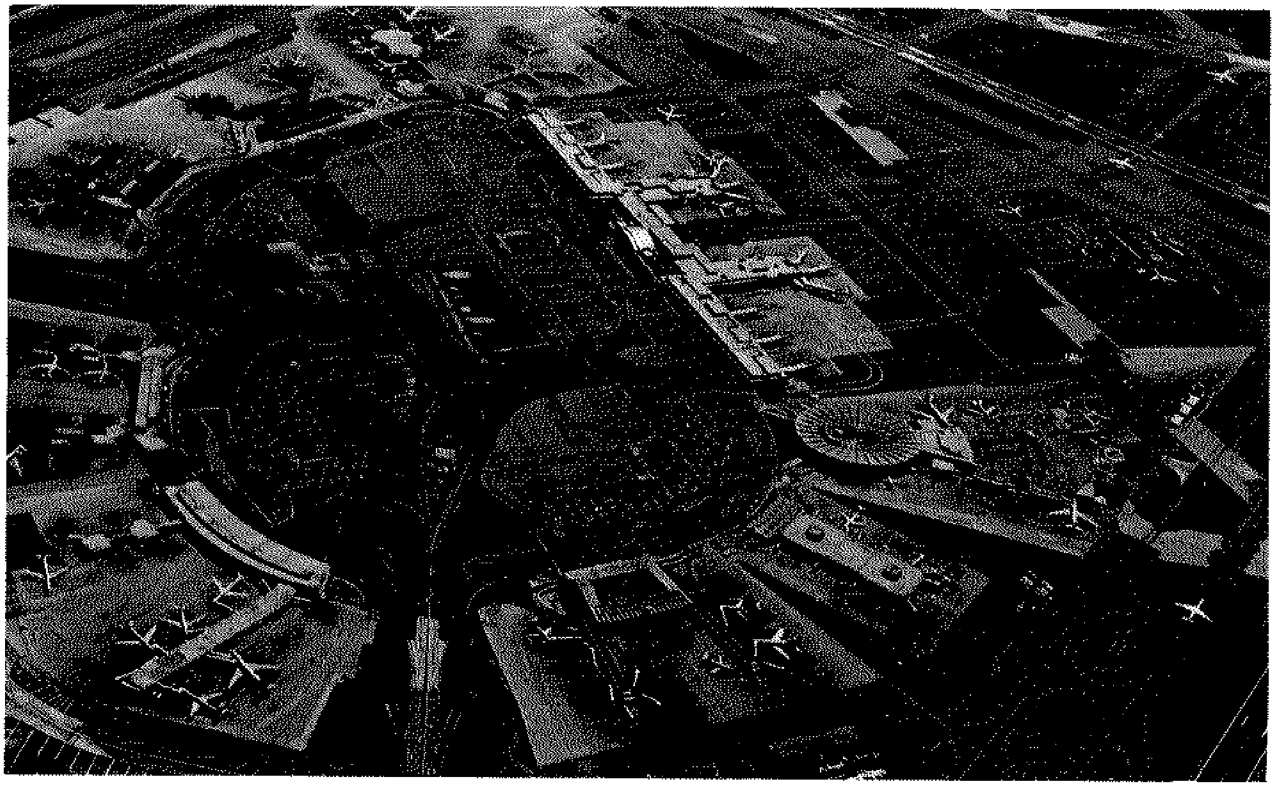


Figure 13. John F. Kennedy International Airport (Courtesy of Port Authority of New York and New Jersey)

Table 26. Oil pipeline shipments, Tri-State region, 1970-1973 (in thousands; tons are estimated)

	Capacity		1970		1971		1972		1973	
	Tons	Barrels	Tons	Barrels	Tons	Barrels	Tons	Barrels	Tons	Barrels
Inbound	49,373	355,084	28,775	208,009	30,375	219,967	31,474	227,286	28,676	206,077
Outbound	11,127	82,709	8,216	57,766	8,925	62,842	10,089	71,074	8,513	60,732
Within	14,532	108,770	5,009	35,583	6,164	44,090	6,476	46,015	5,658	40,652
Total	75,032	546,563	42,000	301,358	45,464	326,899	48,039	344,375	42,847	307,461

Source: Tri-State Regional Planning Commission 1975*a*

Oil Pipelines

The trend shown in Table 26 (2% increase, 1970-1973) may be distorted by the energy crisis that surfaced in 1973 and will continue. Oil pipelines account for 6% of the region's total freight traffic. If we divide the pipeline system into its component parts–inbound, outbound, and internal–we find their use substantially less than capacity.*

Except during construction or when a line breaks, pipelines are one of the least environmentally harmful means of freight transportation.

Freight Substitutes

The freight substitutes–the invisible forms of fuel used for energy, that is, natural gas, power by wire, and nuclear power–account for about 4% of total freight movements. All are import-type only (Table 21).

As indicated in Table 27, natural gas is the most significant freight substitute. Again, the 1973 energy shortage makes it difficult to forecast future use by present trends. Nuclear power and power by wire, although growing rapidly, are still relatively insignificant.

Table 27. Freight substitutes, Tri-State region, 1970-1973 (million short tons, coal equivalent)

	1970	1971	1972	1973	Change 1970/1973
Natural gas	22.3	22.9	23.0	21.4	4.4%
Power by wire	6.3	6.3	6.6	8.2	30.2%
Nuclear power	0.1	0.3	0.3	0.9	800.0%
Total	28.7	29.5	29.9	30.5	6.3%

Source: Tri-State Regional Planning Commision 1975*a*

*In 1973 inbound pipelines operated at about 58% of capacity, outbound at 77%, and internal at 39% (Tri-State Regional Planning Commission 1974*a*).

Alternative Futures

The future of transportation systems in the New York Bight region depends on the answers to these basic questions: what land use patterns are practical choices and what kind of transportation development would fit these land use patterns? One solution to the transportation-versus-the-environment problem would be coordination of transportation and land use to reduce travel requirements—that is, to place heavier emphasis on more efficient public transportation and consequently reduce energy demands and environmental pollution from the total transportation system.

Why then are we moving toward dispersed rather than centralized urbanization where travel demand and pollution are minimized? As we suggested at the beginning of this report, land use and transportation must be understood as interdependent. When we examine the agencies governing these two activities, however, we find them at opposite ends of the hierarchy. Transportation is, for the most part, the province of the federal government and the states; land use is controlled almost exclusively by local governments and their constituencies. Consequently, decisions on transportation are made independently of those on land use. Federal and state agencies have little direct effect on local government's control of land use, but local government may determine the demand and utility for the transportation system formulated at higher levels. Such decisions should be interdependent, reflecting the functional interrelationship of transportation and land use.

The only way to forge a link is to decentralize transportation planning to the regional level and to recentralize land use planning to the same level. Effective, overall transportation planning in the Bight region depends on coordinated decision-making in three areas: transportation, land use, and environmental controls.

Such a shift may maximize the potential for moving toward any alternative future but it is not a sufficient threshold for change in actual regional land use patterns. How Bight region residents choose to live can be very influential. For example, citizen pressure on local government can bring about changes in zoning ordinances. Government, whether local or federal, will continue to be restrained by and responsible to such political forces.

Transportation Alternatives

Two basic land use patterns, *trend* and *infill*, seem to be the options for accommodating future growth in the Bight region. Infill would limit suburbanization and emphasize filling vacant land and recycling existing structures within present urban limits. This would foster recentralization of economic and residential activities, creating compact, high-density land use. This kind of growth implies a significant public transportation role, whereas the trend toward dispersed land use leads to increasing dependence of private automobiles and highways.

The trend land use alternative represents a continuation of the historic pattern of population and job dispersion. This spread of jobs to the suburbs and the nongrowth of central city employment imply no increase in demands on either long-distance commuting or traditional public transit. Barring the enactment of contravening public policies, job expansion in metropolitan areas will not increase the utility of existing urban-centered public transit operations.

The explosive growth in the suburban ring and outer fringe areas generates heavy demands for cross-commuting; the cross-haul trip is rapidly becoming the dominant mode of work and nonwork movement in urban regions. Since this type of movement is the least adaptable to a public transportation solution, there will be increasing dependence on the automobile. Add to this more dispersed residences, and more demand on the inside-out system (an automobile-centered mode) and on the shore-recreational system (because of population growth and increased leisure time), and the result is a transportation system almost exclusively dominated by the automobile and the highway.

The trend alternative suggests that capital investment might best be in the highway system rather than in mass transportation. Additional bus service from newly developing population areas to jobs may be the prime mass transportation investment option. Thus, improving electrification (including purchasing new equipment) of the Erie-Lackawanna Railway (New Jersey Department of Transportation 1974) or the track and yard of the New York and Long Branch Railroad (Burks 1974) will be only marginally effective in shifting worktrips from the automobile to mass transit. Since railroads serve the core, and the core is not growing substantially, only those who find improved rail service a definite attraction for traveling into the core will switch.

With the infill alternative, existing radial corridors would become even more populated. Assuming that rail or bus service could be established in most densely populated areas and that confluences of workplaces could be built up, then the worktrip could be made by mass transit.

The development of new mass transportation carriers for nonworktrips as well as worktrips improves the infill land use alternative. With *dial-a-ride,* for instance, residents call a minibus to pick them up and return them to their doorsteps. Currently being used in Haddonfield, NJ, and other cities, dial-a-ride could replace a second or third car in suburban families. *Personal Rapid Transit (PRT)* is a computerized horizontal elevator. Capsules carrying four to twenty passengers travel over guideways built through cities and suburbs. Finally, there are *dual-mode vehicles* that travel automatically on guideways for the express portion of the trip and can be operator-driven on local streets.

These new mass transit modes, when coupled with greater use of the traditional bus and rail systems, could minimize per capita vehicle-miles as well as cut down on the environmental and energy consequences of the automobile. To be sure, federal regulations on allowable emissions from automobiles and trucks will reduce future pollution problems, but current federal controls affect only carbon monoxide, hydrocarbons, and nitrogen oxides. Asbestos and lead are not controlled. Large numbers of even relatively pollution-free automobiles will still pollute, even assuming that emission-control mechanisms work efficiently at all times.

It can be argued that energy is not a good reason for reducing per capita vehicle-miles. Lighter and more efficient automobiles may get more miles to the gallon. However, the projected population and employment growth in the Bight region means more automobiles competing for gasoline. Higher gasoline consumption means the need for more oil, and that oil may come from offshore drilling in the Bight.

Summary

The future of the New York Bight region's economic and environmental health rests squarely on the access available to its residents via highways and mass transit. The automobile, the major form of transportation in the region, implies a level of comfort, convenience, and flexibility that fosters suburban development in growing areas like Ocean County, NJ. At the same time, the automobile uses petroleum products and pollutes the environment. The land use patterns that will emerge in future years are intertwined with the transportation available. Decisions about what land use Bight residents want, including coastal development, must be related to decisions concerning what transportation systems should be fostered. To think otherwise is to misunderstand the dynamics of metropolitan structure.

The Bight region must face up to the unpleasant possibility of economic decline. The mid-1970s fiscal crisis in New York City is an example of difficulties the northeast industrialized portion of the United States can look forward to. Aging metropolitan areas without access to the immense capital necessary to renew physical structures face uncertain futures. The new rail rapid transit systems recently constructed in San Francisco and underway in Atlanta contrasted with the existing New York City subway system points up the differences between old and new, noisy and quiet, ugly and attractive.

Coupled with the aging process is the emigration of population and jobs from the central city. From 1970 to 1973 New York City lost 2.3% of its population; the city lost 300,000 jobs between 1970 and 1974 and an additional 80,000 jobs between spring 1974 and spring 1975. Similar data from the New York region, including northeastern New Jersey, are not quite as dramatic but still show decline. During 1970 to 1973 the region lost 0.4% of its population and 1% of its jobs (Sternlieb and Hughes 1975).

The decline in employment and population is not in itself bad. The waters of the Bight, for example, might benefit from less industrial activity and stabilized recreational use. The danger is that in a stable or declining socioeconomic environment the Bight will not receive a fair share of the resources needed to clean up docks and harbors, reduce industrial pollution, promote shore recreational uses, or maintain and upgrade onshore transportation facilities providing critical access to jobs, homes, and beaches. The potential neglect of a stabilizing or declining area while the "sunbelt" grows and prospers, is one of the Bight region's most pressing issues.

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NYSSGP-AM-77-005

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