

*New Jersey in the Automobile Age:
A History of Transportation*

THE NEW JERSEY HISTORICAL SERIES

Edited by

RICHARD M. HUBER

WHEATON J. LANE

New Jersey from Colony to State—1609-1789

New Jersey and the Civil War

New Jersey and the English Colonization of
North America

The Story of the Jersey Shore

Princeton and Rutgers: The Two Colonial
Colleges of New Jersey

Architecture in New Jersey

Elementary Education in New Jersey: A History

The New Jersey High School: A History

The New Jersey Proprietors and Their Lands

The Early Dutch and Swedish Settlers of
New Jersey

New Jersey and the Revolutionary War

Fundamental Laws and Constitutions of
New Jersey

Medicine and Health in New Jersey: A History

New Jersey in the Automobile Age: A History
of Transportation

Religion in New Jersey: A Brief History

The New Jersey Governor: A Study in Political
Power

The Research State: A History of Science in
New Jersey

Radicals and Visionaries: A History of Dissent
in New Jersey

Historic New Jersey Through Visitors' Eyes

The Decorative Arts of Early New Jersey

Where Cities Meet: The Urbanization of
New Jersey

A Narrative and Descriptive Bibliography of
New Jersey

The Literary Heritage of New Jersey

Painting and Sculpture in New Jersey

Life in Early New Jersey

The Geology and Geography of New Jersey

SUPPLEMENTS

Woodrow Wilson, Reform Governor

Banking and Insurance in New Jersey: A History

Tours of Historic New Jersey

Richard P. McCormick
Earl Schenck Miers

Wesley Frank Craven
Harold F. Wilson

George P. Schmidt
Alan Gowans
Roscoe L. West
Robert D. Bole and
Laurence B. Johnson
John E. Pomfret

Adrian C. Leiby
Alfred Hoyt Bill

Julian P. Boyd
David L. Cowen

H. Jerome Cranmer
Wallace N. Jamison

Duane Lockard
John R. Pierce and
Arthur G. Tressler

Morris Schonbach
Miriam V. Studley
Margaret E. White
John E. Debout and
Ronald J. Grele

Nelson R. Burr
Laurence B. Holland
Nathaniel Burt and
Arthur W. Litz
William H. Gerds, Jr.
Harry B. Weiss
Kemble Widmer

David W. Hirst
Bruce H. French
Adeline Pepper

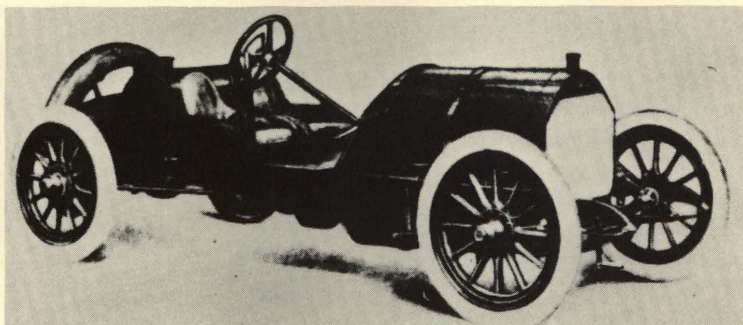
DO NOT CIRCULATE

Volume 23

The New Jersey Historical Series

New Jersey in the Automobile Age:

A History of Transportation



H. JEROME CRANMER

1964

JAN 6 1965

D. VAN NOSTRAND COMPANY, INC.

Princeton, New Jersey

New York, N. Y. • Toronto, Canada • London, England

New Jersey State Library,
Archives and History,
Trenton, N. J.

J385
C891 copy 1

D. VAN NOSTRAND COMPANY, INC.
120 Alexander St., Princeton, New Jersey (*Principal office*)
24 West 40 Street, New York 18, New York

D. VAN NOSTRAND COMPANY, LTD.
358, Kensington High Street, London, W.14, England

D. VAN NOSTRAND COMPANY (Canada), LTD.
25 Hollinger Road, Toronto 16, Canada

COPYRIGHT © 1964, BY
THE NEW JERSEY TERCENTENARY COMMISSION

Published simultaneously in Canada by
D. VAN NOSTRAND COMPANY (Canada), LTD.

*No reproduction in any form of this book,
in whole or in part (except for brief quota-
tion in critical articles or reviews), may be
made without written authorization from
the publishers.*

PRINTED IN THE UNITED STATES OF AMERICA

To
Carol, Susan, Charles, and Thomas

who share their father's love
for New Jersey history

FOREWORD

Many tracks will be left by the New Jersey Tercenary celebration, but few will be larger than those made by the New Jersey Historical Series. The Series is a monumental publishing project—the product of a remarkable collaborative effort between public and private enterprise.

New Jersey has needed a series of books about itself. The 300th anniversary of the State is a fitting time to publish such a series. It is to the credit of the State's Tercenary Commission that this series has been created.

In an enterprise of such scope, there must be many contributors. Each of these must give considerably of himself if the enterprise is to succeed. The New Jersey Historical Series, the most ambitious publishing venture ever undertaken about a state, was conceived by a committee of Jerseymen—Julian P. Boyd, Wesley Frank Craven, John T. Cunningham, David S. Davies, and Richard P. McCormick. Not only did these men outline the need for such an historic venture; they also aided in the selection of the editors of the series.

Both jobs were well done. The volumes speak for themselves. The devoted and scholarly services of Richard M. Huber and Wheaton J. Lane, the editors, are a part of every book in the series. The editors have been aided in their work by two fine assistants, Elizabeth Jackson Holland and Bertha DeGraw Miller.

To D. Van Nostrand Company, Inc. my special thanks for recognizing New Jersey's need and for bringing their skills and publishing wisdom to bear upon the printing and distributing of the New Jersey Historical Series.

My final and most heartfelt thanks must go to H. Jerome Cranmer, who accepted my invitation to write *New Jersey in the Automobile Age: A History of Transportation*, doing so at great personal sacrifice and without thought of material gain. We are richer by his scholarship. We welcome this important contribution to an understanding of our State.

January, 1964

RICHARD J. HUGHES
*Governor of the
State of New Jersey*

PREFACE

Many people have contributed to the creation of this book, and, while it is impossible to acknowledge my debt to them all, I would like to express appreciation to the principal contributors. I am indebted to President Robert F. Oxnam of Drew University for making available a research grant in support of the work. Thanks are due also to the students in my course in American Economic Development at Drew whose individual projects in the spring of 1963 accomplished much of the preliminary spadework on the subject. My research assistant, Francis W. Rode, III, contributed above and beyond the call of duty in performing the innumerable tasks required. I would like to thank also the Public Information and Railroad Transportation divisions of the New Jersey State Highway Department for making available the four maps. Particular appreciation is due the members of the staff of the Highway Department and Professor Sidney Ratner of Rutgers University, who read the manuscript and whose suggestions were most helpful. I am indebted also to Professors Wheaton J. Lane and Richard M. Huber, Editors of the New Jersey Historical Series, for their guidance and assistance throughout the process of research and writing.

H. JEROME CRANMER

*Madison, New Jersey
April, 1964*

TABLE OF CONTENTS

Foreword	vii
Preface	ix
List of Illustrations	xiii
I. Transportation and Economic Change	1
II. The Railroad	24
III. The Automobile	56
IV. Planes, Pipes, and Ports	89
V. The Role of Government	106
Bibliographical Note	129
Index	133

LIST OF ILLUSTRATIONS

The Beginning of the Automobile Age	21
Railroad Map of Northern New Jersey	26
Railroad Map of Southern New Jersey	27
Railroad Map of Metropolitan New Jersey	28
Route U. S. 1 in the Early 1920's	60
The Garden State Parkway	65
Port Authority's George Washington Bridge	73
New Jersey Highways Including Proposed Improvements	116
A Modern Highway Interchange	118

I

TRANSPORTATION AND ECONOMIC CHANGE

THE AMERICAN STANDARD of living is based on the advantages of mass production industry. Most of us associate mass production with specialized machinery, the use of power, and assembly line techniques. We think of it largely in terms of technology. But production on a large scale calls for far more than machines and power. It requires above all else effective means of transportation for assembling the raw materials and distributing the product. Only when a nation is tied together by adequate transportation facilities can mass production technology emerge.

The American people are able to consume and enjoy more only because they are able to produce more. American farmers, miners and factory workers are able to turn out floods of goods unknown one hundred years ago and unknown to two thirds of the world's people today. American farmers make up less than 10 per cent of our labor force; yet few as they are, they are able to produce enough to feed and clothe not only the rest of our people but large portions of the European population as well. By contrast, in Russia it takes nearly 50 per cent of the labor force to feed the Russian people. In Peru, 80 per cent of the population is required in agricultural work, with few if any steaks or lamb chops forthcoming, or, indeed, little meat of any kind. So pro-

ductive is the American farmer that in recent years his productivity has created embarrassing surpluses of agricultural products. A West Virginia coal miner is the highest paid coal miner in the world, yet so productive is he that we are able to deliver coal to the Ruhr Valley for more than a dollar a ton cheaper than it can be mined there. American steel workers earn a wage some ten times higher than Italian workers, yet American steel undersells Italian steel in world markets. The superior standards of nutrition, health, and education enjoyed by the American consumer derive from the superior productivity of our farms, mines, and factories.

The superior productivity of the American economy grows directly out of the advantages accruing to the mass production techniques so characteristic of American industry. Principal among the benefits of producing on a large scale are the opportunities provided for the intense specialization of tasks for labor and management and for the design of highly specialized machinery. Whether it be the tractor on the farm, the power shovel in the mine, or the hydraulic press in the factory, the use of machinery makes possible the application of artificial power to the production of goods. The typical American workman, in contrast to his foreign counterpart who works with simple tools requiring human muscle power, is principally a machine tender—guiding, controlling, or regulating a machine. In addition to the advantages in using specialized machinery and artificial power, large-scale production permits buying raw materials in large quantity, thus reducing production costs, and also permits shipping materials and finished products in bulk, thus reducing transport costs.

The advantages of producing on a large scale for a single plant may be enhanced if a number of plants are assembled in a single locality. The greatly enlarged scale of operation may justify the construction of more efficient methods of transportation. The existence of other plants will generate a large, trained labor force. The fact that there are a number of plants in operation

may justify the establishment of subsidiary industries to service, repair, or in some other way facilitate the functioning of the basic industry. In all these ways, efficiency is raised and cost reduced.

The story of industrialization, the transition from handicraft to mass production methods, is usually told in terms of inventions: Watt and the steam engine, Arkwright and the spinning jenny, McCormick and the mechanical reaper, and so on. There can be no question that these developments did give rise to increased production of goods. However, in a market or private enterprise type of economy, recognition of the need for increased output of goods could come only as a response to increased demand for goods. The extent to which inventions would be sought and technological innovations effected depended on the extent of the demand for the product. Output could be expanded only to the degree that markets were expanded. The extent to which mass production methods could be employed was limited by the extent of the market. Thus a complete explanation of the process of industrialization must give primary attention to the expansion in the market for goods.

The colonial blacksmith or shoemaker working at his anvil or bench in Salem or Morristown was a skilled worker, producing for a very narrow market: the village in which he worked and its immediate environs. The major constraint limiting the market was the extremely high cost of overland transportation. Should a craftsman seek to break out of this market and sell his product in an adjacent village, the cost of moving the product to the new market when added to the original production cost would force the craftsman to charge a price so high as to prevent him from competing with local producers. The high cost of overland transportation may be illustrated by the fact that in the early nineteenth century, in moving bulky agricultural products from Pittsburgh to Philadelphia, it was cheaper to load them on a raft or flatboat and float them down the Ohio and Mississippi rivers to New Orleans, reload them on ships,

and sail through the Gulf of Mexico, along the Atlantic Coast, and up the Delaware River, than to move them by wagon or horseback across the Appalachian Mountains. Small wonder, then, that producers, faced with such costs, were limited to very narrow markets.

The consequence of the small size of the market which he served was that the craftsman produced on a very small scale. His methods and tools were simple, and the extent to which specialization within a particular trade might take place was extremely limited. When, as in the larger towns, the market might be sufficient to support shops employing several journeymen, workers would function in parallel rather than in series, with each worker performing all the operations with little resort to specialization of tasks. For so constricted a market, the scale of operations did not justify the use of much more than the most rudimentary sort of hand tools and the application of power other than human muscle was limited to a relatively few operations such as flour milling, sawing timber, fulling cloth, and the like. The high cost of overland transportation restricted the market and thus prevented the adoption of mass production techniques.

Although the cramped market prevented the craftsman from adopting more efficient methods of production, it served to insulate him from competition. If high cost of transportation prevented him from penetrating his neighbor's market, it also prevented his neighbor from penetrating his. Sheltered from the threat of competition, there was little incentive to devise new methods or to seek to reduce costs. In this protected situation, production methods became routinized and the pressure for change disappeared.

In a market economy such as that of the United States, production of goods and services is not planned by some overall authority. Rather it is the result of the decisions of thousands, indeed millions, of people. In retrospect some of these decisions turn out to have been right, and some wrong. Such decisions are judged right in that

the goods to be produced are those that consumers will buy, the processes chosen are those that are most efficient, the materials employed are the most substantial, or the locations where production is to be accomplished are most suitable. Through competition in the marketplace the right combination of decisions leads to profit and success; the wrong combination leads to losses and the ultimate disappearance of the firm. Thus producers will tend either through their own decision or through the weeding out of competition to locate in the places most suitable for their particular process. It is this decision regarding location which is most influenced by transportation and thus most relevant to our study.

The decision regarding location is influenced by two conditions: (1) the cost of making the product at that particular location—the production costs, and (2) the cost of assembling the necessary materials and of moving the finished product to market—the transport costs. Not all industries are affected by these two considerations in the same way. Some are more influenced by production costs, others by transport costs. Industries which depend upon natural resources are more likely to be influenced primarily by production costs. Obviously iron or zinc mines must be located where the minerals occur. Industries may be affected primarily by costs of labor, or of land, or by tax rates. For other industries, however, the first consideration may be the costs of transporting the raw material to the plant or of transporting the finished product to the market. Where the materials are bulky, fragile, or perishable, transport costs will be minimized by locating the plant close to the source of these materials. Where it is the finished product that is bulky, fragile, or perishable, transport costs will be minimized by locating the plant close to the market. Thus due to the bulkiness and perishability of tomatoes, it is most efficient to locate the canning plant in South Jersey and ship the canned tomatoes to the supermarket in Montclair. On the other hand, transport costs will be reduced if a bakery is located in Montclair with the flour being

shipped from the mill at Minneapolis-St. Paul, rather than locating the ovens in the Twin Cities and flying the loaves of bread to Montclair.

Decisions regarding the location of industry and the adoption of mass production techniques have consequences for the distribution of population, also. People move to centers where the jobs are. Where production is being accomplished by handicraft methods to meet local needs, the industrial population will be widely dispersed to serve the needs of local farmers and villagers. Towns or cities exist then to serve commercial or governmental functions—the seaport town or the county seat. However, as economic development takes place and industry moves out of the local shop and into the factory, the jobs go with it, and hence so do the people. Thus has industrialization given rise to the factory towns—Paterson, Dover, Camden. Moreover, the industrial workers and their families moving into these towns need food, clothing, shelter, entertainment, protection, education, and the like. Thus, in addition to the primary industry or industries which give rise to the factory town, there develop secondary or service industries whose function it is to provide for the needs of the workers in the primary industries. These secondary industries provide more jobs and pull more people into the community. Thus is created the modern industrial city.

The history of America in the nineteenth century may be told in terms of the impact of transportation innovations on a predominantly agricultural economy. The advent of turnpikes, canals, steamboats, and above all, railroads worked a tremendous transformation. The essence of this transformation lay in so drastically reducing transport costs as to create a single nation-wide market within which all producers could compete. No longer were producers sheltered in local markets by prohibitively high transportation costs. The isolated local markets so characteristic of the colonial period had been destroyed.

The impact of the transportation revolution in New Jersey may be suggested by her experience in the case of

the canal and the railroad. Two canals were built in New Jersey in the 1820's and early 1830's. The Morris Canal extended from Jersey City on the Hudson via Newark and Paterson, across the mountainous part of the State to Phillipsburg on the Delaware, connecting the coal fields of the Lehigh Valley with the iron works of Morris County, the factories of Paterson, and the markets in New York City. The Delaware and Raritan Canal stretched from New Brunswick on the Raritan across the "waist" of the State to Trenton on the Delaware, providing a connection between the ports of New York and Philadelphia. Though much the less profitable of the two, it was the Morris which appears to have had the greater impact on the economy of New Jersey. Among other benefits, it revitalized the iron industry of the northwest part of the State.

New Jersey ironmasters as late as the 1820's were complaining that it cost more to move bar iron from western Morris County to tidewater markets than it did to bring it by ship from England. In effect, British iron-makers were closer to New York, Newark, and New Brunswick than were forges and furnaces in Morris County. Only the cheaper charcoal fuel provided by New Jersey's forests enabled them to compete with imported iron. That these forests were rapidly being depleted boded no good for the future of iron manufacture in New Jersey. A survey in 1822 indicated that many forges and furnaces had already been forced to close down. Moreover, the use of charcoal as flux and fuel imposed a severe constraint upon the scale of operations of a single ironworking plant. Once again, it was the cost of overland transportation that acted to limit the size of the enterprise. The ironmaker had a voracious appetite for charcoal, and, once the adjacent forest had been cut, regrowth was slow and resort was had to more remote sources. This meant increasing transport costs. A general rule of thumb at the time called for four square miles of forest to support the typical iron plant. A forge or furnace enough larger to afford significant savings

through large scale production would have required an enormous land area to provide the necessary flux and fuel. Increasing the land area would drastically increase the distance the charcoal had to be carted. Since the advantages of increasing scale were offset by higher transport costs for fuel, forges and furnaces were uniformly small with annual production of only a few tons. The inevitable consequence of small scale operation was the absence of specialization of labor and equipment and only a very rudimentary use of artificial power. Industrialization of the North Jersey iron industry was retarded by the high cost of transporting the product to market on the one hand, and by the necessarily small scale of its operations on the other.

Completion of the Morris Canal in 1831 by providing a cheap means of moving the product to market and by providing a superior fuel—coal—accomplished a major breakthrough for the North Jersey iron maker. In response to the opportunity thus afforded, ironmakers soon developed the necessary technical methods for substituting coal for charcoal, and the New Jersey iron industry experienced a renaissance that justified the continued title of the "Iron State." However, the effect of the Morris Canal was not only to revitalize the industry, but to transform its characteristics and thus to transform the communities in which it operated. With forges and furnaces no longer dependent on charcoal from the surrounding forests, a constraint upon their location and size had been removed. Indeed, with coal now available along the line of the canal, location on the canal became imperative. To haul the coal from the canal dock overland to the forge or furnace in the countryside would impose a cost which plants located along the canal need not bear. Since it took some six tons of coal to work one ton of iron ore, the advantage of moving to canalside is obvious. Those entrepreneurs who recognized the benefits moved their enterprises and succeeded. Those who were unable or unwilling to recognize the benefits soon failed and their forges and furnaces were abandoned. The re-

moval of this constraint on scale of operations opened up the iron industry to the advantages of large scale production. The process of developing more and more specialized equipment and the use of artificial power led to increasingly efficient production of iron and steel. The open-hearth furnace, the Bessemer converter, and the rolling mill were all responses to the opportunities provided by expanded markets and ample fuel supplies. The highly automated operations at United States Steel's Fairless Works on the Pennsylvania side of the Delaware, provide a most dramatic twentieth-century comparison to the primitive operations conducted at a site such as the Oxford Furnace in eighteenth-century New Jersey.

Although many communities along the line of the Morris Canal were affected by the transformation which it wrought—Rockaway, Boonton, Little Falls, Paterson, Newark—the city of Dover provides perhaps the best illustration of its effects. A sleepy farming village in 1820, by 1840 it had assumed the industrial characteristics which it displays today. All through the nineteenth and into the early twentieth century, Dover was an important iron and steel and metal fabricating center. This was largely responsible for the decision to locate an arsenal for the production of artillery shells in the Dover area. In this way the location of a basic or a primary industry tends to attract other industries using its product. The advent of industry meant the creation of jobs which attracted workers and their families—the familiar pattern of urbanization was clearly at work. The concentration of Morris County's iron manufacture, from its dispersed location in the open countryside, into industrial centers in response to the Morris Canal is characteristic of the impact of mass transportation in the nineteenth century. The process may be characterized as a "centripetal" movement, pulling industry, population, and services into urban centers. This took place in industry after industry as transportation facilities were extended across the Nation.

The Morris Canal did not affect New Jersey industry alone. Its effect upon farmers is rather charmingly pointed out in the following passages.

We may here mention as a large increase of freight to the canal, of profit to the farmer, and of good morals to the community, that apples and cider would be exported instead of being converted into ardent spirits. The land carriage renders it at present necessary to have recourse to distilling as the only means of conveying the produce of our orchards to market.*

How much would be gained by the carriage of our cider to New York, instead of being obliged to distil it into poison; a poison which is now beginning to be made so copiously at New Orleans, that we must in a very few years be under sold and driven out of every market. . . . we may cut down half our orchards, or what is much worse, be obliged to drink all our whiskey ourselves.**

Though Morris and Sussex farmers continued to produce "Jersey Lightning" from their cider in considerable quantities, the records of the Morris Canal demonstrate the movement of vast stocks of agricultural produce to the markets of Newark, Jersey City, and New York. The transition of New Jersey agriculture from production of staples such as wheat, corn, salt pork, and wool to fresh fruits and vegetables and dairy products could come only after rapid and inexpensive transportation was made available. The "Garden State" owes as much to its transportation system as it does to the fertility of its soil or its climate.

It must not be assumed that innovations in transportation come as an unmixed blessing. As with virtually

* *Report of the Commissioners appointed by the Legislature of the State of New Jersey, for the purpose of exploring the route of a Canal to unite the river Delaware, near Easton, with the Passaic, near Newark (Morris-Town, 1823).*

** *Palladium of Liberty (Morristown), September 5, 1822.*

all economic progress, while the majority benefit, some groups are adversely affected—even destroyed. This ambivalence in the impact of economic change is amply illustrated by the effect of the railroad upon particular groups in the New Jersey economy. We may employ the same industries to illustrate this point: New Jersey iron and steel and agriculture.

By the time of the Civil War the railroad network, begun in the east in the 1830's, had been extended into the Mississippi Valley and beyond. As railroad technology improved, as tracks were made heavier, cars larger, locomotives more powerful, signals and dispatching more effective, and switching more efficient, the cost of moving goods from one part of the nation to another was reduced. The effect of this was to break down further the isolation of small local markets and expose producers to the competition of goods produced in other regions. As this took place in industry after industry and in region after region what was emerging was a nation-wide market. Goods produced in any part of the nation could compete effectively with goods produced anywhere else. Inevitably the pressure of competition forced industries to gravitate toward their most efficient locations and to abandon areas where they no longer received the protection of high-cost transportation. The movement toward regional concentration of industry was under way. This concentration of production in a relatively few centers gave rise to opportunities for mass production on a scale hitherto undreamed of. This, in turn, reinforced the trend toward greater and greater concentration.

The emergence of the national market fostered by the railroad affected the economy of New Jersey. Under the relentless pressure of competition the primary iron and steel industry moved west to take advantage of the lower cost bituminous coal in the Pittsburgh region and the more abundant and more easily mined iron ore of the Mesabi Range, which could be moved cheaply by water down the Great Lakes. New Jersey producers, using the anthracite of the eastern Pennsylvania fields and the local

rock ores, were hard pressed by the lower cost iron and steel from Pittsburgh and the Great Lakes region.

New Jersey's share of the Nation's iron output declined to a very small fraction of the whole. The railroads exposed New Jersey iron and steel makers to the competition of lower-cost producers, which resulted in the virtual elimination of the primary iron and steel industry from the State.

Although the coming of the railroad had a devastating effect upon the iron and steel industry in New Jersey, on balance, its advent was enormously beneficial to the economy of the State. For, if the raw steel of the Pittsburgh mills came at lower cost, this was a boon to the iron- and steel-using industries. And thus New Jersey's industrial pattern shifted away from primary metals to the metalworking industry. Perhaps most dramatic in this transformation is the emergence of the city of Paterson as a maker of railroad locomotives.

The New Jersey farmer, too, was hard hit by the competition brought by the railroad. The products of the vast, fertile, mechanized, western farms could now be sold in eastern markets at prices far below those at which he could recover his costs. Working small plots of land, on soil that had been farmed for one hundred years without benefit of fertilizer, drainage, or rotation of crops, the New Jersey farmer could not efficiently employ the mechanical equipment being used so profitably by his western competitor. The major grain crops of wheat, corn, and oats which he had once raised were fast becoming unprofitable. And many Jersey farmers abandoned their land to seek employment in the rising industrial cities.

It was indeed the needs of the industrial cities that provided the solution for the New Jersey farmer. And it was the railroad which aided in the solution. As the urban population grew in numbers and in income, its demand for agricultural products increased. As the diets of city dwellers shifted from the basics of bread, meat, and potatoes toward fresh fruits and vegetables, fresh

milk, and the like, tremendous demand for such products arose. Because these foods were perishable, the demands could be met only by farms nearby and then only if the foods could be gotten quickly to the market. Thus the railroad which had destroyed the eastern farmer's market for agricultural staples provided the means for his recovery by enabling him to supply instead perishable fruits and vegetables and, of greatest significance for North Jersey farmers, for dairy products, primarily fresh milk. What the iron horse had taken away with the box-car and cattlecar it replaced with the refrigerated tank car.

The centripetal effect of the mass transportation provided by the canal and, more importantly, by the railroad is manifest in the layout and design of industrial plants. The larger the steam plant, the more efficient steam generation is. Full utilization of the energy generated by a large steam plant called for a larger and larger manufacturing plant—assembling many machines and many workers under one roof. A constraint on the size of the factory was exerted by the difficulty of distributing the motion generated by the steam power plant to the machines in the factory. This was usually accomplished by a system of overhead shafting with leather drive belts to conduct the motion of the shafts to the machines on the floor. To minimize the loss of energy through friction and to minimize the cost of the heavy construction and expensive shafting required, it was necessary to concentrate machines and workers in a small area adjacent to the steam plant. This led to the multi-story, massive factory building so characteristic of older industrial communities. This intensive land use was reinforced by increasing costs of land as the area surrounding the railyards and terminals filled up. Thus, in order to minimize cartage of fuel, materials, and products, plants tended to concentrate around rail terminals and yards, and in order to minimize friction loss and land costs, the facilities of individual plants tended to cluster around the power source. Other things being equal, firms ig-

noring these considerations found themselves at a competitive disadvantage.

Another force leading to the concentration of economic activity in particular regions and in urban centers was the emergence of relatively few large ports from among the large number of small ports of the colonial period. As late as the 1830's, the Atlantic coastline was dotted with small ports which served international trade. The decentralized character of international shipping was perhaps most evident in the Chesapeake Bay area where ocean-going vessels could push up the Potomac, or York, or the James River to plantation wharfs, dropping off their cargoes of luxury goods for the plantation owner and taking on hogsheads of tobacco for European smokers. In New Jersey, Elizabethtown, the Amboys, New Brunswick, Salem, and Burlington served as ports of exit or entry for goods moving in foreign trade.

As with the dispersal of manufacturing activity, this decentralization of foreign trade grew out of the high cost of overland transportation and the small size of seagoing vessels. With the cost of moving goods by wagon so high, transport costs were minimized when the ocean voyage began or ended as close to the origin or final destination of the goods as possible. The typical brig of one hundred tons or less could poke its way into shallow bays and up small rivers and did not require a large flow of traffic to make its visit profitable. Once again, however, the small scale of operations prevented specialization and rendered impractical any significant investment in cargo-handling facilities.

The advent of the canal and the railroad sharply altered this dispersed pattern of seaport trade. The effect of the improvements in overland transportation was reinforced by increases in the size of ocean-going vessels with the use of steam and iron. The flow of imports and exports came increasingly to be channeled through a relatively few large ports. As with the small forge or furnace in the countryside, the small ports along the coastline were abandoned. No longer would English

ships put into New Jersey's bays and inlets; New York and Philadelphia would handle her foreign trade.

While the growing capacity of ocean-going vessels favored a concentration of the flow of international freight by requiring greater tonnages for economical operation, it was the reduction in the cost of overland transportation which made such a concentration possible. The canal and the railway provided the shipper with alternatives to the local port facility. His choice among these alternatives would depend upon the advantages offered by each for the conduct of his foreign trade. These advantages came increasingly to rest with the larger ports. As their flow of traffic increased, the large ports could provide more frequent and regular sailings, thus reducing the time required for completing a shipment. It became feasible to invest in more efficient cargo-handling equipment. Specialized services grew up to facilitate the international shipment of goods. Specialists in importing and exporting, in banking, in marine insurance, and in customs clearance could perform these functions more efficiently than could the producer himself, as he would have had to do if he continued to ship his products through a small, local port.

It was the port of New York which most dramatically reflected this transformation. At the end of the eighteenth century, New York handled only 6 per cent of the value of all United States foreign trade; by 1870 her share had risen to over one-half. Historians are agreed that New York's dominant position in international trade grew out of her superior access to the agricultural products of the west, via the Erie Canal and the railroad network. Although Philadelphia had taken the lead in the eighteenth century, her more limited access to the west insured her commercial and financial eclipse in the nineteenth century.

The rise of New York to dominance of the Nation's foreign trade had important consequences for New Jersey. Since New York was the major port for the shipment of goods, it also became the major port of entry for

immigrants. And while many of these people passed through on their way to the west, others settled in the New York area, thus providing a source of labor for the emerging industries of northeastern New Jersey. The port also provided the principal entrepôt for many imported raw materials, which led to the establishment of processing industries in New Jersey, such as sugar refining and coffee roasting. The fact that the transportation system's principal justification had been to speed the flow of goods in foreign trade did not deny its usefulness to New Jersey manufacturers to move materials in and finished products out, whether this involved movements in international trade or was confined to purely domestic traffic. Easy access to the Nation's wholesale and financial center served the New Jersey economy also. Ready access to the growing New York market stimulated New Jersey's agriculture as well as its industry. Similar stimulus, though on a much smaller scale, was provided to the portion of New Jersey facing the port of Philadelphia. The concentration of port activity in the nineteenth century profoundly affected New Jersey's economic development, speeding its growth as an industrial as well as a garden state.

The concentration of industrial plants in proximity to the railroad terminals in downtown centers brought with it huge numbers of workers. As their numbers grew, the residential area of the city pushed out into the surrounding country. Soon, however, its limits had pushed beyond reasonable walking distance from the plant. A worker no longer could walk to work. It was necessary not only to transport the materials and fuel; it now became necessary to transport the labor. When travel to work was by trolley car or commuter train, population tended to settle within walking distance of the lines of public transit. Fingers of settlement pushed out along these avenues of travel, radiating spokelike from the central city. However, the intervening territory, which was not within walking distance of a trolley or railroad line tended to remain open farmland. Mean-

while the central city became increasingly concentrated as business firms sought locations most readily accessible for their labor force.

Public transportation moved not only workers but also customers. The intersections of transit routes provided locations giving access to masses of shoppers. The tremendous sales potential of these downtown locations provided opportunities for large scale operations in retailing. These stores could offer a greater variety, lower price, and could make use of the city newspapers to advertise their wares. The familiar urban department store came in response to these opportunities.

The centripetal force exerted by developments in transportation in the nineteenth century has been reversed by developments in transportation in the twentieth. Where the canal and the railroad acted to concentrate economic activity and population in regions, in urban centers, and in particular plants, the effect of the automobile and motor truck has been to liberate economic activity and population from these centers and to disperse it once again over the countryside. No longer are plants tied to railroad centers or people to commuter or trolley lines. This centrifugal force has been reinforced by developments in energy use and transmission and has resulted in a refashioning of the manufacturing plant and the industrial community. Though underway for several decades earlier, these developments have been most dramatic in the period since the First World War. Imprecise as any specific dating of economic change is likely to be, we may take World War I as the watershed between the two ages of transportation: the nineteenth-century age of the railroad which saw ever increased concentration of business and population and the twentieth-century age of the automobile which has worked toward their dispersal. The latter age has by no means come to an end, and we may anticipate further dispersal of economic activity and population over the open countryside in the future.

The automobile and the motor truck have served both to pull and to push industry and people out of the cities. By providing inexpensive movement of relatively small shipments, the truck has enabled the manufacturer to cut himself loose from the railroad center, thus pulling him away from the downtown location. By jamming downtown streets both trucks and automobiles have accentuated the disadvantages of traffic congestion in the cities, thus pushing industry into the countryside. By providing convenient and inexpensive individual transport facilities, the automobile has enabled the worker to free himself from dependence on the mass transit facilities.

The impact of the truck has grown out of certain advantages which it holds over the railroad as a means of moving freight. While the railroad continues to hold an advantage in the movement of large-volume shipments over long distances, the truck enjoys clear superiority for small shipments, where distances are short and where speed of movement is important. The provision of public streets and highways has traditionally been accepted as the responsibility of government and thus the truck owner is required to furnish only the relatively small fixed investment involved in the vehicles themselves. The greater flexibility and cheaper construction of the highway as compared to the railroad enabled a much wider network of connections allowing the truck to reach any location of economic significance. By contrast, the railroad is limited to routes that will provide a heavy volume of traffic. Large shipments being less important, the advantage of concentration of production in large plants or adjacent to rail terminals disappears when trucks are used. With trucks, frequent stops can be made along any one route without delaying other shipments as would be the case with a one-hundred-car railroad train. The motor truck, by providing a much more flexible and extensive system of transport connections and by reducing the advantage of large plants and location near rail terminals, has enabled manufacturing plants

to become more widely dispersed, thus exerting a centrifugal force on industrial location.

The opportunity to move to the country afforded by the motor truck does not present itself with equal appeal to all types of business. Those operations which are dependent upon large volumes of raw materials or fuel or whose products are shipped long distances in carload lots continue to be tied to the railroad line or terminal—the coking plant, the electric generating station, and the heavy chemical plant. Those which depend upon water-borne materials such as the sugar refining industry are restricted to deep-water locations. The petroleum industry is limited through its dependence upon pipelines or water transportation, and its satellite, the petrochemical industry, is tied also to these facilities. It is to light manufactures, pharmaceuticals, electronic gear, plastics, and light chemicals that the opportunity beckons most invitingly. Their relatively small shipments of high-value products are better served by the door-to-door service, frequent pickup and delivery, faster movement, and general flexibility of the motor truck. The same advantages appeal to wholesale and distribution activities which now find a location on the fringe of the city advantageous in order to avoid the traffic congestion in the downtown area.

Important as the truck has been for the liberation of industry, it has probably been the passenger automobile which has had the greatest impact on the pattern of our cities, affecting as it has the habits of both workers and shoppers. No longer is the worker restricted in his choice of a home to a spot within walking distance of public transportation. The automobile and an extensive net of highways and roads allow him to range as much as twenty or thirty miles from his place of work. Where he uses his car as a means of getting to the commuter train, he may be willing to drive ten miles or more. The highway network has enabled the motor bus to extend the system of public transportation between existing transit lines. The consequence has been a filling-in of the

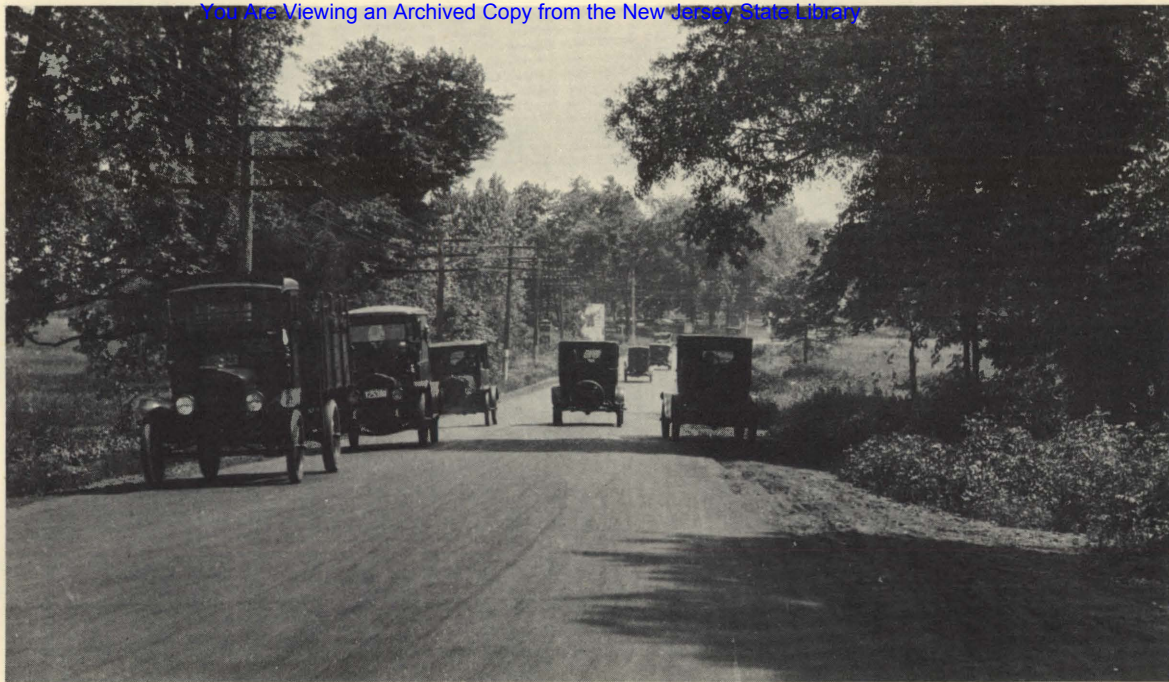
vacant areas between the fingers of settlement, so that the figure of the spoked wheel for the metropolitan area is no longer apt. It is now better regarded as a series of concentric circles.

The greater mobility provided the labor force by the automobile has acted to reinforce the outward shift of industry. No longer is an industrial plant restricted to mass transit centers or lines for its labor force. Any location within driving distance of population centers now becomes possible. Firms considering moving to suburban or even rural locations are no longer restrained by a lack of labor. Indeed, as people have filled in the countryside, companies have moved in pursuit, seeking to tap the unused labor potential of the suburban regions. Through its effect on population location, the automobile has tended to pull industry away from the central city into suburban or exurban regions.

The use of the automobile by the consumer as well as the producer has reshaped the pattern of secondary industries. Where the population abandoned the city for the suburbs, and particularly where it spread away from the mass transit lines, it was accompanied by retail and service trade. Shopping by car rather than train, suburban housewives, repelled by downtown congestion and unable to park their cars, shifted their custom from the department store to the local shop. This transformation in shopping habits is manifest in the burgeoning of the supermarket and the suburban shopping center. Outward migration of population and business has left many areas of the central city subject to urban blight and has produced the "grey areas" through which one travels on the way to and from the city.

Also contributing to the migration of industry out from the central city has been the transition in energy sources and its consequent change in plant layout and design. Crucial here has been the substitution of electricity for steam in powering industrial machinery. This might better be regarded as the intervention of electricity in the process of converting coal into motion, since most

You Are Viewing an Archived Copy from the New Jersey State Library



The Beginning of the Automobile Age in New Jersey
Courtesy of New Jersey State Highway Department

electricity is generated by coal-fired steam. Conversion to electric power has shifted the steam plant out of the factory to the central generating station. More important, however, is the flexibility of location and design which the use of electricity has afforded. The industrial plant can plug in to the transmission grid at any location; it is no longer tied to the railroad for coal for its boilers. The firm can tap the grid for as much or as little energy as it may need; no longer is power a determinant of plant size. It is perhaps in the flexibility of its use that electricity has most affected industrial layout. Power is now transmitted through a cable rather than through the expensive system of shafting and belts of the steam era. This has removed the need to locate machines and workers close to the power source. Factory buildings and factory layout can now be designed to fit the process rather than the power needs. The consequence has been the modern single-story plant spread extensively over a wide area, providing ample working and storage space, and emphasizing a continuous flow process. This development has hastened the exodus of manufacturing from the central city since the space needs for such a design are far greater than could be met in the high-cost, congested downtown area. The provision of energy in the form of electricity rather than in the form of coal has provided both the opportunity and some of the motivation for the relocation of industrial plants in the suburban or rural portions of the country. The space needs of the modern plant have been further enlarged by the use of the automobile in the journey to work. The parking space necessary to accommodate a large working force becomes prohibitively costly downtown.

In addition to exerting a centrifugal force on urban centers, the automobile has also radically altered the rural economic landscape. Substitution of the gasoline engine for the horse has greatly increased the farmer's mobility, enabling him to bypass the tiny farming village in both his selling and his buying. The marketing

of farm produce and the commercial and financial activities serving the farmer have consequently gravitated to the larger towns where operations could be conducted on a larger scale. The ramifications of this change are illustrated by its effect on the mail-order houses. Established originally to serve the farmer in his comparative isolation, such companies saw a sharp decline in their business as the farmer became mobile. Their response was to open retail stores in the market towns in order to recapture their lost trade. In recent years sales through their retail stores have overshadowed their mail-order business. Similarly, small country banks tended to concentrate in the large towns. The crossroads general store, so characteristic of retailing in the nineteenth century, has virtually disappeared.

II

THE RAILROAD

THE ELEVEN MAJOR RAILROADS in New Jersey operate nearly two thousand miles of line, making the State the national leader in rail density. For the most part, the roads originate in the New York metropolitan area and fan out across the State to the north, west, and south. The heaviest traffic volume is, as it has been for over a hundred years, across the State between New York City and Philadelphia. The busiest stretch of railroad in the world is the Pennsylvania's main line at Rahway—about one train every three minutes. It is this heavy flow of traffic across New Jersey which has given rise to the name, "the corridor State."

From the point of view of miles of line operated within the State, the leading road is the Central Railroad of New Jersey. Originating at Jersey City, the Jersey Central runs south to Bayonne and then crosses Newark Bay to Elizabeth. There it separates, with one line running west through Plainfield and Somerville to Phillipsburg and the valley of the Lehigh. The other line runs south across the Raritan at Perth Amboy, serving the Jersey shore and the southern part of the State. Numerous branches push out from these two main lines.* The main line of the Jersey Central was designed primarily to tap the anthracite traffic of the Lehigh Valley. The road is one of the major commuter carriers in the State.

* See maps on pages 26-28 for details of New Jersey railroad routes.

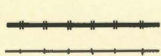
The main line of the Pennsylvania enters New Jersey via a tunnel under the Hudson River, loops across the Meadows to Newark and then extends south, crossing the Raritan at New Brunswick and the Delaware at Trenton. The company operates numerous branch lines, particularly in the western and central parts of the State. However, its nearly 400 miles of line in New Jersey represent less than 4 per cent of its entire system.

By contrast, the slightly more than 350 miles of the Pennsylvania-Reading Seashore Lines are all located within the State. This network originates in Camden and radiates out across the southern part of the State, serving the Jersey Shore from Atlantic City to Cape May as well as South Jersey communities such as Vineland, Millville, Bridgeton, and Salem.

About one-fifth of the Delaware, Lackawanna and Western Railroad's line is located in New Jersey. From its eastern terminal in Hoboken, the Lackawanna runs west across the State to the Delaware Water Gap. The Boonton Line of the Lackawanna follows the valleys of the Passaic and Rockaway rivers. The Morristown Line crosses the Meadows to Newark then swings west through the Oranges via Summit and Morristown, joining the main line at Denville. The major source of traffic for the "Route of Phoebe Snow" was coal from the Scranton mines which was moved to tidewater over its tracks. The Lackawanna is one of New Jersey's principal commuter railroads.

The Lehigh Valley Railroad has its eastern terminal on the Upper New York Bay on the Bayonne peninsula. It crosses Newark Bay and swings south through Hillside and Bound Brook. Its route to the west roughly parallels the main line of the Jersey Central crossing the Delaware at Phillipsburg. Like the Jersey Central, its major traffic was the moving of anthracite from the Lehigh Valley coal fields to the New York market.

Of the more than two thousand miles of Erie Railroad line only 129 are located in New Jersey. From its terminal in Jersey City the main line follows the Passaic



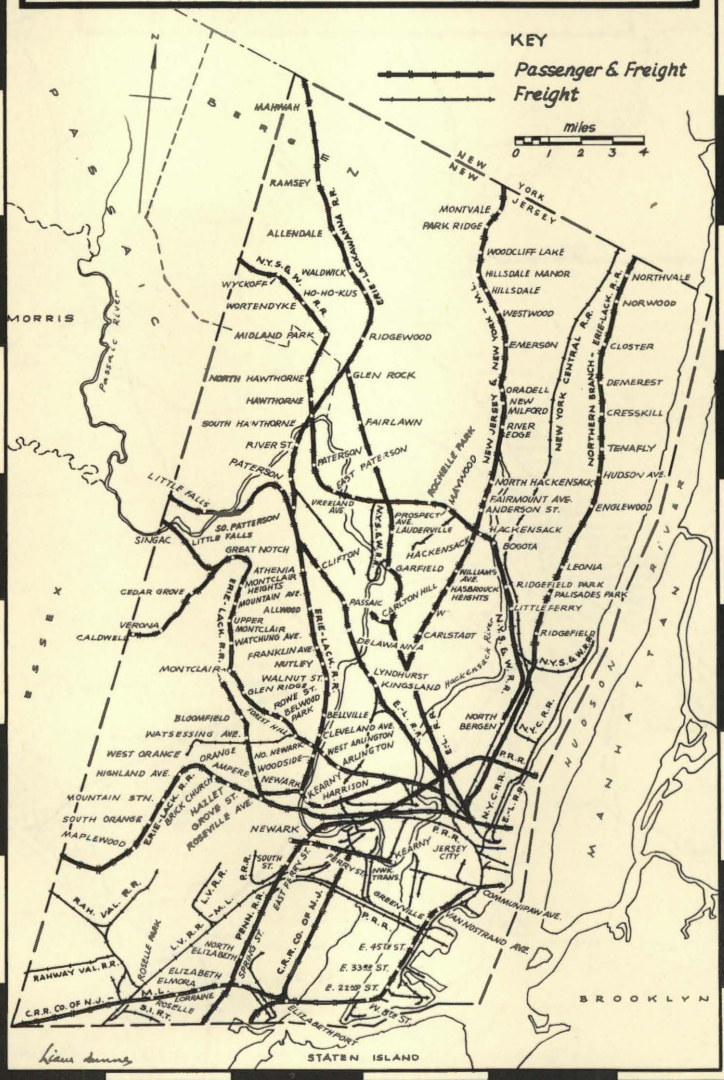
miles

0 5 10 15 20

RAILROAD MAP of NEW JERSEY *Southern Portion*



RAILROAD MAP OF METROPOLITAN NEW JERSEY



River to Paterson and then runs north to the State line at Suffern. The system penetrates the Southern Tier of New York State on its way to Buffalo and the west. It provides a major channel for the manufactured goods of the middle west to flow to the New York port. Its operations in New Jersey include the provision of commuter passenger service on the many branch lines which it operates in the Bergen County region.

The other major railroad which is completely contained within the State is the New York, Susquehanna and Western. This, too, starts on the west bank of the Hudson at Jersey City and runs north and west through Paterson and Pompton Lakes, up the valley of the Pequannock into Sussex County.

The New York Central Railroad is one of the major railroad systems of the Nation with over ten thousand miles of line. In New Jersey, however, there are only the 23 miles of its West Shore division, originating on the Hudson at Weehawken and running north through Teaneck to the State line at Tappan. The division then parallels the west side of the Hudson River, joining the main line of the system at Albany. The West Shore has been a major participant in port traffic and has provided commuter service to Bergen County communities.

A small portion of the line of the Reading Company extends from the Delaware River west of Trenton northeast across the State via Bound Brook to the Arthur Kill at Woodbridge. This line gives the Reading direct access to the New York market.

The list of New Jersey's major railroads is complete with the Lehigh and Hudson River and the Lehigh and New England. Both of these roads cut diagonally across the northwest corner of the State and provide a route by which traffic, such as coal and cement, bound from the Lehigh Valley for New England can by-pass New York congestion. In recent years the Lehigh and New England abandoned this service; a portion of its road was acquired by the Jersey Central.

Minor railroads in the State include such doughty little

lines as the Morristown and Erie, the Rahway Valley, the New York and Long Branch, and others.

The dominant position established in America by the railroads during the nineteenth century continued through the first two decades of the twentieth. At the end of the First World War, the railroads were the principal carriers of both freight and passengers. In the movement of goods and people from city to city, over 75 per cent of the freight and 80 per cent of the passengers went by rail.* This position was fairly well sustained during the 1920's regarding the movement of goods. However, with the phenomenal upsurge of private automobile and bus travel, the railroads' share of passenger traffic declined abruptly.

In 1920 American railroads carried over 410 billion ton-miles of freight. This traffic grew gradually through the 1920's to just under 450 billion in 1929. It plummeted during the years of the Great Depression, but the onset of the Second World War put immense pressure on the railroads, forcing 747 billion ton-miles of freight over their tracks in 1944. From that all-time peak, rail freight traffic declined to 563 billion ton-miles in 1961.

The deterioration in the railroads' competitive position is clearly illustrated by the decline in their share of freight traffic. As late as 1929 they carried over 75 per cent of all the freight moved; today little more than 40 per cent goes by rail. In contrast, both the motor truck and the pipeline have increased their share of such traffic.

The inroads of competing forms of transportation have been even more severe in the movement of passengers. In 1920 revenue passenger-miles carried by the railroads

* The most comprehensive and practical measures of traffic volume are intercity revenue ton-miles and intercity revenue passenger-miles. Revenue ton-miles are computed by multiplying the number of tons of freight someone paid to have transported by the distance each ton was carried. Similarly, revenue passenger-miles are computed by multiplying the number of paying passengers by the distance each passenger traveled.

reached an all-time high of 47 billion. In 1962, for the first time in the twentieth century, rail passenger-miles fell below 20 billion. Today 90 per cent of all intercity passenger traffic is by private automobile. Of the remaining 10 per cent by commercial carriers, less than one-third goes by rail.

Generally speaking, the declines in traffic have been more severe for railroads serving New Jersey than for companies in other parts of the Nation. Indeed, most of the loss of freight traffic since World War II has taken place on the eastern roads. Where revenue ton-miles dropped some 28 per cent on railroads in the east, railroads elsewhere in the United States show a decline of only 4 per cent. The disparity is less striking but nonetheless apparent in passenger traffic. Thus in both freight and passenger traffic the railroads serving New Jersey have suffered greater loss than have other American railroads.

The decline in traffic has been reflected in lower profits for both American railroads as a whole and for the eastern railroads. Once again, these reductions have been particularly striking in the postwar period and have been greater for the eastern railroads than for the others. Despite declining volumes of traffic, higher freight rates and passenger fares raised revenues for all United States railroads by about 10 per cent. For the eastern roads revenues declined 3 per cent. Meanwhile, with wage rates, rents, state and local taxes, costs of fuel, all participating in a rapid rise, the pressure on the railroads' financial position increased. When allowance is made for the decline in purchasing power due to inflation, the drop in revenues for the eastern railroads becomes much more severe. In 1962, these companies incurred a net loss of \$3 million.

It has been popular to condemn, depending upon one's prejudices, the managements of these companies for their supposedly supine posture in the face of these events; the railway unions for their intransigence in seeking for their members the benefits of rising income

and increased economic security afforded to employees in other industries; or the Interstate Commerce Commission for its insistence on implementing the legislation which constitutes its basic directive. There has, however, been little attempt to determine and set forth for the general public the economic forces which have been operating in the market for rail transportation services.

The decline in the railroads' fortunes is attributable to changes in their competitive posture vis à vis other means of transportation, and to changes in their economic environment. It is clear that the railroads' near-monopoly of intercity freight and passenger traffic in the nineteenth century has been undercut by competing forms of transportation. The truck and the pipeline have cut into its freight carriage, and the automobile, the bus, and the airplane have taken over its passengers. Much of the strength of the new forms, however, has derived from massive subsidies at all levels of government—federal, state, and local. Indeed, the pipeline is the only form of transportation that may be regarded as a privately financed entity competing with the railroads. Since 1920, governments have spent over \$150 billion on construction, maintenance, policing, and interest for the Nation's streets and highways. These expenditures are currently exceeding \$10 billion a year, of which some \$3 billion are provided out of general tax funds. Governments at all levels have devoted over \$9 billion to support the construction of airports, maintain air traffic control, and provide airline subsidies. The federal government has committed over \$3 billion to inland waterway improvements. In recent years, on the other hand, tax *payments* by railroads have average a billion dollars per year.

A factor which has been responsible in part for the more rapid decline of the eastern railroads is the greater density of population and industry in the east as compared with the south and west. Since it is in the short haul that the truck enjoys its greatest advantage, the shorter distances between cities have enabled the truck

to take over a larger proportion of traffic than in the more sparsely settled parts of the country where journeys between population and industry centers involve greater distances.

A major determinant of the volume of freight traffic is provided by the size of the population in the region served. A rapidly increasing population will require additional transportation for final products and will, through increased employment and production, give rise to increased transportation for industry. Although the population of the region served by the eastern railroads has been increasing, its growth lags behind that of the rest of the Nation; the Far West and the Gulf Coast have been experiencing much more rapid growth. This has been due to shifts of population in response to greater employment opportunities, particularly in the defense and space-age industries, a condition which shows little sign of abating in the foreseeable future.

The volume of freight traffic depends also upon the level of economic activity in the region served. Whether measured by personal income or by manufacturing employment, economic growth in the East has lagged behind that of the rest of the Nation. Indeed, in the last decade, manufacturing employment in New Jersey has declined by more than one-fourth. It may be argued that employment is not an accurate indicator of production and that due to automation of production processes, relatively few workers produce a far greater output. However, the regions in which employment is growing most rapidly are the regions where new plants are being built. It is these new plants that are likely to embody the most modern, efficient techniques of production. Hence, employment data tends, if anything, to understate the extent to which actual production has shifted away from the older, less efficient plants of the east to the rapidly growing areas with their highly automated production facilities in the south and west.

A recent study by the United States Department of Defense casts further light on what has been happening

to the railroads and particularly to those serving New Jersey. It reveals a shift away from the East in allocating defense contracts and a shift in composition of the remaining defense industry which is adverse to rail freight traffic. During World War II, the Middle Atlantic and East North Central states received 56 per cent of military prime contracts; the Mountain and Pacific Coast less than 14 per cent. By fiscal 1961 the East was receiving less than 32 per cent. The Mountain and Pacific states, meanwhile, had leaped to nearly 33 per cent. The significance of this for railroads such as the Pennsylvania, the Erie-Lackawanna, and the New York Central is obvious. Moreover, shifts in the composition of defense purchasing have further disadvantaged these roads. Procurement of hardware such as tanks, military vehicles, guns and ammunition which amounted to about 50 per cent of total defense buying in 1950-1951, had dropped to 12 per cent in 1961. These, of course, are the mass produced, heavy goods characteristic of the industry of the East. Since the Korean War, however, missiles and electronic gear have accounted for rapidly increasing shares of the defense dollar. Missiles have grown from less than one per cent to over 33 per cent; electronics from less than 12 per cent to over 18 per cent. Not surprisingly, the most rapid gains in defense contracting have taken place in the states that lead in the production of missiles and electronics. Of greatest importance, however, is the fact that light, compact, high-value electronic products are precisely the type of product which has been slipping away from the rails to trucks and, in all likelihood, air freight. This shift in the composition of defense procurement from the more familiar types of military hardware such as tanks and guns to the exotic products of the space age has affected all rail traffic adversely and has been particularly adverse for the railroads serving New Jersey.

Traditionally, for New Jersey railroads the most important single commodity has been coal—anthracite and bituminous. Bituminous coal has generally represented

more than one-third of all tonnage carried. Since World War II, however, production of bituminous coal has fallen off by about one-third; it has fallen off even more rapidly in the mining areas served by these railroads than in other areas. Thus these companies have seen their loadings of bituminous coal drop by nearly 40 per cent since 1947. The Pennsylvania, for example, has lost over 60 per cent of its bituminous coal traffic. The major markets for bituminous coal have been electric utilities for steam generation of electric power, the railroads themselves for motive power, the steel industry for coking, home and industrial heating, and exports. The use of coal for electric generation has increased rapidly during the postwar period, although along the east coast sharp competition has been felt from imported residual oil.* Consumption of bituminous coal by steel-makers for coking has followed the vagaries of the steel industry. The other major markets have experienced sharp decline. The use of bituminous coal as a source of energy has dropped from two-thirds of the Nation's total energy in 1920 to about one-fourth in 1960. Petroleum and natural gas have increased their share from less than 20 per cent to almost 70 per cent over the same period.

Anthracite carriers such as the Lackawanna have witnessed an even more dramatic fall in production and carriage. Since 1947, production of anthracite has plummeted from 57 million tons a year to just over 15 million tons—a drop of over 70 per cent. Conversion to gas and oil for home heating has removed a principal source of revenue for these railroads. Where most hard coal was

* Although the use of soft coal is expected to increase in the future, there are several threats to the railroads' dominance of the hauling of it. One is the generation of electricity at the mine and the transmission of electricity rather than coal. Another is the coal pipeline in which coal is powdered, mixed with water to form a "slurry" and pumped to its destination. A more distant but nevertheless major threat is the use of atomic energy for the generation of electricity.

previously moved by rail, its carriage has come increasingly to be by truck so that the railroads' share has fallen to no more than half. Thus rail movements of anthracite coal have dropped by 80 per cent since 1947.

The consequence of these forces has been the decline in rail traffic which has placed the railroads and particularly those of the East in a precarious financial position.

The drastic fall of passenger traffic on the New Jersey railroads has been almost entirely a consequence of loss to competing forms of travel. The number of passengers crossing the Hudson River each day has increased over the last four decades, yet the numbers using the railroads and ferries has been cut in half. Bus and automobile crossings have increased enormously—buses by perhaps twenty times, private cars by as much as ten times. These shifts have been possible only as a result of the bridge, tunnel, and terminal facilities of the New York Port Authority. The effects of these alternative routes for commuting varied with the location. The commuter railroads operating south and southwest of Manhattan Island have enjoyed relatively stable or moderately increasing commuter patronage during rush hours. On balance, railroads pushing to the west have seen a sharp decline. Those running to the north and northwest have seen their patronage decline disastrously. Off-peak daily traffic and weekend traffic has declined continually for virtually all roads.

The portion of the commuter belt to the south along the Jersey shore and along the Trenton-New Brunswick line is served by branches of the Jersey Central and the Pennsylvania railroads. As a result of the dramatic increases in population in the area, rail commuting has held up despite diversion to the automobile and bus. It is clear that these railroads are moving a declining share of a rapidly increasing total. On the main line of the Pennsylvania, average weekday travel has increased

and the sharp postwar declines in weekend travel have tended to level off in recent years.

The main line of the Jersey Central and the Dover and Gladstone branches of the Lackawanna serve the area lying to the west and southwest. Prior to its abandonment of passenger service in 1961, the Lehigh Valley also aided in the daily commuter migration. In this region, despite the fact that commuting to New York City continues to be predominantly by rail, the declines in passenger traffic have been great. For example, the Lackawanna has seen its passenger traffic slide from over 23 million in 1929 to less than 10 million per year at present. The drop has been particularly severe in the postwar period. In 1947 some 25 thousand commuter passengers rode the Lackawanna during the morning rush hour each day; by 1959 only about 15 thousand commuters boarded these trains. The Jersey Central has experienced similar declines, and the drop in its own traffic forced the Lehigh Valley to abandon passenger service entirely.

In the northern portion of the New Jersey commuter belt, patronage continues to decline. The principal carrier is the Erie which serves the region with its main line and various branches. The Erie system has seen its commutation traffic fall from 23 million to less than 5 million over the last thirty years. The precipitate drop was characteristic of other commuter roads in the region such as the Susquehanna and the New Jersey and New York Railroad. So severely hit was the West Shore line of the New York Central that it, too, gave up passenger service entirely.

It is most important to emphasize the decline in the off-peak and weekend passenger traffic on these commuter lines. This deterioration has been so extensive that in recent years most roads were carrying more than three-fourths of their passengers in the peak period. This was particularly apparent for the northern lines. The Erie system saw only 12 per cent of its passengers

outside of the rush hour. The Susquehanna, the Northern, and the New Jersey and New York had virtually no passengers other than at peak hours. The Lackawanna's 35 per cent non-rush-hour traffic was the highest for New Jersey roads. The peak periods amount to no more than two hours in the morning and again in the evening, five days each week. Thus the railroads operate at capacity for perhaps 20 hours each week, but equipment and train crews to handle this huge load must be hired on a full-time basis. Reductions in non-rush-hour traffic have cut unusually deeply into passenger earnings; such business is highly profitable since the equipment and crews are already available to handle the rush-hour levels of traffic. On some roads, over half of the payroll for suburban passenger train crews represents payment for off-duty time, usually between 10:00 A.M. and 4:00 P.M. The Jersey Central reports that passenger locomotives stand idle 65 per cent of the time, passenger cars 83 per cent of the time, ferry boats 60 per cent and that 59 per cent of payments to passenger train crewmen represent payment for idle time.

Probably the line most seriously afflicted by these problems was the Hudson and Manhattan Railroad Company. When in 1908 President Theodore Roosevelt pushed the button inaugurating passenger service on the Hudson Tubes, he remarked, characteristically, that he was most impressed by the company's pluck in overcoming extraordinary difficulties. In recent years, the road has needed all of that quality it could muster as, indeed, have its passengers. The Hudson Tubes consist of some eight miles of electric transit lines in two tunnels under the river. The 6-thousand-foot north tunnel connects Hoboken with Manhattan at Christopher Street; the line continues uptown to 33rd Street. The south tunnel extends 6600 feet and links downtown Manhattan with Jersey City. A connecting line on the Jersey side enables trains originating at the Jersey terminals to reach either of the New York terminals. A through connection is provided for Newark travelers over the Penn-

sylvania railroad tracks to Jersey City. Because of the small size of the tunnel and the extremely sharp curves of the track, Hudson and Manhattan cars are small. Thirty years of weak financial condition has prevented acquisition of new rolling stock and precluded adequate maintenance of existing cars. Riding the tubes can be an exasperating experience; doors refuse to close properly, despite the exertions both physical and vocal of the attendants, and so the train cannot start. Once under way brakes lock, become overheated and fill the tunnel with smoke, ceiling fans flail the immobile air—and the Jersey commuter daily resolves to move to Westchester or Long Island.

When the Hudson Tubes opened the time was cut for crossing the Hudson to ten minutes. By providing New Jersey commuter railroads with rapid connections to New York City, the Tubes played a major role in developing northern New Jersey as a residential area. In 1927, the year the Holland Tunnel opened, traffic reached a peak of 113 million passengers each year. From that high point, patronage fell precipitously. World War II breathed some renewed vigor into the Hudson and Manhattan, but in the postwar period traffic has fallen away steadily. Currently the Tubes have only about 30 million passengers each year. Jersey commuters, subjected to the daily crush, will find incredible the fact that the Hudson Tubes are carrying only little more than one-quarter of the passengers they handled in 1927. It is the solitary non-rush-hour traveler who gets a more accurate impression of the road's business. The massive decline has been in off-peak traffic; the Tubes carry nearly half of all their daily passengers in just two hours each day.

The Hudson and Manhattan Railroad Company paid its last dividend in 1932. For a number of years earnings on real estate offset its operating losses. Rental income from the Hudson Terminal Buildings amounted to \$1.3 million in 1957, offsetting a loss of some \$500 thousand in railroad operations. The age of the buildings coupled

with the movement of corporate headquarters from downtown to midtown New York caused a decline in rentals in the late 1950's. The company went into bankruptcy in 1954. Its finances, patronage, and physical condition continued to deteriorate despite fare increases. In 1961, combined losses of real estate and railroad operations exceeded two million dollars.

Like the Hudson and Manhattan, the New Jersey commuter railroads are saddled with old equipment and outmoded structures. Three-quarters of the passenger cars used in commuter service are over twenty-five years old; one-third are over thirty-five years old. Most of the Diesel locomotives are relatively new, but the passengers ride in the cars, not in the cabs. On most lines, stations, located in an age when commuters walked to the train, are too close together, resulting in frequent stops and inefficient and slow operation. Most lines have been pushed too far out from the urban centers into sparsely settled country. While this is the region in which population growth has been, and is likely to be, most rapid, it is not yet capable of generating the heavy volume of traffic needed for profitable operations.

The consequence of these declines in passenger traffic, coupled with rising costs, have been deficits in passenger operations. In 1959, for example, New Jersey suburban railroads incurred operating and other costs growing out of their suburban passenger service of over \$63 million. Against this they took in less than \$36 million in revenues from fares and other sources. Thus their loss in that year amounted to over \$27 million. Though railroad accounting procedures and allocation of costs are spelled out minutely by the Interstate Commerce Commission, some concern has been expressed regarding the usefulness of such data for economic analysis. Reviews of railroad accounting procedures have produced a wide diversity of conclusions. So long as profits on freight operations were sufficient to offset losses in passenger traffic, the argument over accounting methods had con-

siderable point; with losses on both freight and passenger operations, the controversy loses much of its relevance.

These deficits on passenger operation have deterred the railroads from making the capital investments necessary to improve their competitive posture. Their shaky financial condition in the postwar period has made them a poor credit risk and thus denied them access to capital even where they might have wished to refurbish their passenger service. It has been estimated that the complete overhaul of equipment and facilities necessary for the seven commuter railroads of the New York metropolitan area, including the Hudson and Manhattan, would cost between \$650 and \$800 million. Clearly the railroads, in their present impoverished condition, cannot raise anywhere near such a sum.

The railroads have not sat idly by, watching their competitive position deteriorate and their markets disappear. Efforts to counter these developments have been made in a variety of directions. The New Jersey railroads have been in the forefront of many of these efforts to reduce costs, improve competitive position, and eliminate unprofitable service. One of the earliest of such steps was the electrification of heavily traveled passenger routes to speed up service. Another has been the virtually complete substitution of the Diesel for the steam locomotive. Efforts toward the automation of yards and the central control of line have been designed to speed service and reduce costs. The development of trailer-on-flat-car, or "piggy-back," service has been an attempt to combine the advantages of the truck and the railroad. In order to improve their financial position railroads have sought to abandon lines and service which became unprofitable as traffic volumes declined. Railroads have designed and adopted specialized types of cars in order to reduce costs and improve service in the handling of particular types of commodities. Rather than continuing to raise rates as traffic declined, the railroads have begun to strive for

rate reductions in order to retain or recapture freight traffic. And in recent years, in order to eliminate duplicate facilities and service and obtain the advantages of large-scale operation, railroads have sought to merge individual companies into large systems.

One of the earliest steps taken was shifting from steam to electricity on the suburban passenger runs. Electrification had been considered periodically for a number of years. A short transit line from Mount Holly to Burlington had been electrified in 1895. However, the Long Island Railroad was the first major railroad in America to be electrified when it made the transition in 1905. Early experiments on that road had employed the device of the third rail for carrying the electric current. Later, the successful experience of the New Haven with an overhead catenary system led the Long Island to change to an overhead system also.

Communities along the Lackawanna, longing for relief from the noise, smoke, and soot of steam operation, had urged the company to electrify. They cited the advantages of speed and convenience which would accompany electrification. Management of the company had felt that the costs of installation ruled out adoption of electricity, particularly in view of the inroads being made into passenger traffic by motorized competition. In these circumstances, a program of heavy capital expenditure seemed unwise. However, early in 1928 a joint committee representing most of the interested communities demanded electrification and indicated its willingness to accept a fare increase to cover the higher costs and thus speed the transition. The management of the Lackawanna, impressed by the need for improving service to cope with growing competition, authorized the project in March, 1928.

Specifications for the new materials, equipment, and rolling stock were drawn up and contracts were let in August of 1929—hardly an auspicious date for inaugurating a major capital expenditure program.

Acquisition of the new equipment and construction

of the electrical system proceeded rapidly. Just one year later, the first of the new cars was put on display in the Hoboken terminal. Meanwhile, the steel pillars and crossarms were being put in place and the cables and their supporting gear rigged. In order that passenger service not be interrupted, tracks were electrified one at a time so that if anything should go wrong the entire line would not be tied up. The first new, electrified passenger train was run between Hoboken and Montclair in September, 1930. Within a month electrification had been completed to South Orange and by December had been completed as far as Morristown. The Gladstone branch was brought in, in January of 1931, and within the month the project was completed to Dover.

As the electrified portion was pushed west from Hoboken, communities along the line vied with one another in their celebration of its arrival. To the delight of the children, schools were let out; stations and platforms were decorated; bands, speeches, and parades entertained the jubilant crowds, freed at last from the pall of soot.

Having in mind the possible future extension of electrification to the Delaware River and ultimately over the Pocono Mountains, the management chose 3,000-volt direct current since it seemed most suitable for both suburban and long haul operations. Power was supplied by electric utility companies along the line, and the railroad operated five substations to transform the alternating current to direct current with the proper voltage. These substations were equipped with what were, at the time, the largest rectifiers ever used in any power station in America. In all, some 70 miles of road, involving 160 miles of track, were electrified. The old semaphor signal system was replaced by a new automatic block signal system.

The new equipment afforded a 20 per cent reduction in scheduled time on most runs. The electric coaches, seating 78 to 84 passengers, could accelerate at a rate of $1\frac{1}{2}$ miles per hour per second on level track—four times as fast as the old steam trains. To match the greater

acceleration, the cars were equipped with a system of electro-pneumatic brakes which, while providing a more comfortable ride for passengers, also afforded more rapid deceleration. On suburban runs involving frequent station stops, rapid speeding up and slowing down reduces the running time required between stations. The controls were fitted with a "dead-man" switch which supplies power only so long as the engineer holds the power lever on; should he let go, the power is automatically shut off and the train comes to a halt.

Hopes to electrify the entire road did not come to fruition and only local passenger runs were electrified. Through passenger runs and all freight continued to employ steam until the advent of the Diesel.

Electrification may be said to have begun on the Pennsylvania Railroad since it controlled the Long Island at the time of its transition from steam. The Pennsy had experimented with electricity on the Main Line from Philadelphia to Paoli in 1915. The satisfactory results of these tests led to further adoption. By 1935 the main line from New York to Washington had been completely electrified. This included the portion across New Jersey from Trenton to the Hudson River.

Electrification of through passenger service coincided with the opening of the Pennsylvania's new station in Newark and completion of its new lift bridge across the Passaic. The program leading to these improvements had been begun in 1929. The costs were estimated to be \$42 million of which the railroad would contribute \$20 million and the city of Newark \$22 million. The new Pennsylvania Station was designed to be the most modern and attractive in the world. Replacing the old passenger station, it provided Newark's principal access via rapid transit to New York City and for through trains to the south and west; it provided a terminal for buses, taxicabs, and private automobiles, and constituted the terminus of the new city subway. To help ensure that no passenger would miss his train, the station's system of electric clocks was controlled by two master instruments

which are synchronized with the clocks in the Pennsylvania Station in New York City.

While electrification served to facilitate passenger traffic, freight, in general, continued to be moved by steam. It was not until the introduction of the Diesel that more efficient motive power became available for the movement of freight. Rudolph Diesel developed the internal-combustion engine which bears his name in Germany in the late nineteenth century. Experiments conducted in Germany and Switzerland in the early twentieth century for application to rail service produced the Diesel locomotive, more accurately described as the Diesel-electric locomotive. The Diesel engine is used to drive an electric generator which in turn supplies power to electric motors attached to the drive wheels. This eliminates the need for complicated clutch and gear box to transfer power from Diesel to wheels. The first successful American Diesel-electric locomotives were built by the combined efforts of Ingersoll Rand, General Electric, and the American Locomotive Company in the middle of the 1920's. These early locomotives were designed for switching operations. The first of these was put in service by the Jersey Central in 1925. Historic engine number 1000, built by Ingersoll Rand in Phillipsburg, ended its career in 1957 and now rests in the Baltimore and Ohio Railroad Transportation Museum. Its retirement came not because it was worn out but because its 300-horsepower was not enough in a day when locomotives measure their horsepower by the thousands.

Although the Diesel was introduced to American railroads in the 1920's, its adoption was slow and it was not until the great demands on rail service during World War II that it was introduced in great numbers. In the postwar period it has replaced steam and halted the growth of electric power on the rails. In the 1920's, the railroads' 59 thousand steam locomotives performed the overwhelming bulk of work in both passenger and freight service. The eastern railroads burned bituminous coal

and the western railroads tended more toward fuel oil to get up steam. The abrupt drop in traffic during the 1930's caused abandonment of many old steam locomotives, but these locomotives were not replaced. During the war years, Diesels were added as rapidly as defense priorities allowed, and by 1946 there were over 4 thousand in service. The trend to Diesels accelerated rapidly and by the late 1950's Dieselization was virtually complete. Today there are fewer than a hundred steam locomotives in service, while over 28 thousand Diesels are at work. The Birmingham Southern in 1936 became the first American railroad exclusively Diesel powered. For the roads in New Jersey somewhat higher proportions of traffic are moved by electricity than for the Nation as a whole, but this still amounts to less than 4 per cent of freight and about 16 per cent of passenger traffic.

While the railroads in New Jersey had acquired a few Diesels in the 1920's and 1930's, it was not until the postwar period that steam disappeared completely. The Lehigh Valley had acquired its first Diesel early in the 1930's and added another 15 by 1940, but it was probably the Erie that adopted the Diesel most rapidly. By 1951 its 396 Diesels represented the highest proportion of Diesels to steam locomotives of any of the main trunk lines through the State. In 1946 the Jersey Central had begun to take delivery on a series of new locomotives from the Baldwin Locomotive Works in Philadelphia. The first of these was a 2000-horsepower monster, 80 feet long, capable of 90 miles per hour, and costing almost twice as much as a coal-burning locomotive. The Lackawanna dispatched the last steam engine in commuter service on its Boonton line in July of 1953. In 1954, after one hundred twenty years of smoke and cinders, the entire stretch of track between Jersey City and Hampton on the Jersey Central was converted to Diesel. The doom of the steam locomotive was sealed on April 28, 1952, when the Morristown and Erie put into service its first new locomotive in thirty-five years—a Diesel.

Another response to competition from other public

carriers which the railroads have made was "TOFC" (trailer-on-flat-car), or "piggyback" service. Designed to combine the lower line-haul cost of the railroad with the door-to-door convenience of the truck, it also eliminates the loading and unloading required for a conventional truck-rail move. Trailers can be loaded at the shipper's door and hauled to rail terminal by truck-tractor, where they are loaded onto a rail flatcar for shipment. Arriving at the destination, trailers are removed from the railroad flatcar and hauled to the destination by tractor. By operating fast, through-service TOFC trains, railroads are able to offer overnight delivery in direct competition with highway truckers.

Piggyback operations represent one of the fastest growing rail services. Since 1955 TOFC loadings have tripled. In the early years single trailers were mounted on one standard flatcar; today specially designed 85-foot trailer flats carry two trailers at one time. There are a variety of plans by which the piggyback operation is conducted. The plan which involves the railroad most is that by which the railroad owns both the trailer and the flatcar and provides pickup and delivery service door-to-door for the shipper. The least rail contribution occurs when the trailer and flatcar are both owned by the shipper, and the railroad provides only the locomotive to move the loaded trailer flat. Various combinations of rail, trucker, forwarder, and shipper ownership operations have been offered. Growth of piggyback service has been retarded by trucker opposition and by the Interstate Commerce Commission's grudging pace in accepting new combinations and plans for TOFC operations.

New Jersey railroads have been quick to adopt the piggyback technique. The Tructrain terminal of the Pennsylvania Railroad in Kearney is the busiest TOFC facility in the Nation. Daily service is provided to major distribution centers throughout the country, enabling the company to match the convenience of pickup and delivery service at rates competitive with other carriers. The Erie-Lackawanna in cooperation with six highway

carriers has opened special piggyback terminals in Jersey City and Chicago to handle all types of TOFC operations. Equipment in the terminals includes electronic weighing devices and a photoelectric mechanism which checks the clearance dimensions of incoming trailers.

There seems little question that TOFC operations have contributed to the very recent recovery in rail freight traffic. Since piggyback costs are competitive with highway truckers over distances of 600 miles or more, TOFC has caught on more rapidly in the west and has been limited to long-haul operations. The working out of satisfactory TOFC arrangements offers great promise for a renaissance of rail freight traffic.

A potential transportation breakthrough is promised by "containerization." This is by no means anything new; containers were used on the Camden and Amboy to speed the transfer of passengers' baggage from train to ferry in the 1840's. Common on European railways for years, the idea of providing standardized containers for the movement of goods, though it has excited railroad imaginations, has failed to catch on in the United States. Certainly it offers great advantages, among which reduction of loss from damage or pilferage, quicker handling, and reduction of transportation costs are but a few. Adoption has been retarded by a failure to agree on a standard size, the relatively large investment required, and the as yet unsolved problem of the return of the used container.

Adoption of specially designed cars to meet particular types of traffic needs has served to retard the loss of railroad traffic in some commodities and to prompt a return of traffic to the rails in others. Probably the outstanding illustration has been the auto rack. So long as automobiles were being carried in ordinary boxcars—four to the car—it was cheaper in many cases for the manufacturer to ship by an automobile trailer carrying four automobiles. During the postwar period the railroads had lost nearly 70 per cent of their automobile business. However, in recent years specially designed

racks which enable a single railroad car to carry as many as a dozen automobiles have allowed the railroads to reduce their costs and rates and recapture a large proportion of this traffic.

More expeditious yard operations have provided another means of reducing costs and speeding service. A freight car spends 22 hours a day waiting for something to move it. The average car on a New Jersey railroad travels about 35 miles per day and is moving no more than 2 hours each day. Much of this time is spent on sidings waiting to be loaded or picked up, but some is spent in railroad yards. To reduce the time required for switching and classification the railroads have constantly sought ways to make their yard operations more efficient. A train of cars arriving at a yard is classified by means of a "hump." A hump consists of a single track passing over the crest of a small hill from which a maze of switches fan out into a number of tracks. The cars in a string are slowly pushed over the hill, uncoupled, and allowed to roll down hill. Switches are set to guide each car onto the desired track. During the 1920's this was entirely a hand operation. Switches were set on hand signals from the hump. Brakemen rode each car down the grade to control its speed so that it would couple onto the other cars but would not crash into them. A large number of men was required to operate the switches and ride the cars. Occasionally cars would be misassigned, brakes would fail, or brakemen would miss their footing altogether, and suffer serious injury or even death. Gradually this operation has become automated. Switches are controlled from a tower at the top of the hump, eliminating the need for switchmen. Electronically controlled "car-retarders" have been installed which operate like disc brakes on an automobile, pinching the car's wheels between the retarder and the rail thus slowing its motion. The car is weighed and the required amount of retardation determined before it starts down the hump. Thus the brakeman is eliminated and the likelihood of damage greatly reduced. Automation speeds the flow of

cars through the yard and reduces the hazards associated with switching.

The Erie-Lackawanna and its connecting road, the Nickel Plate, have recently completed a new electronic classification yard at East Buffalo at a cost of over \$13 million. Designed to accommodate 3000 cars per day, the yard will facilitate the interchange of cars between the two roads as well as with some nine connecting roads. In 1962 over half a million cars were exchanged. The new yard will reduce interchange time, thus producing savings for the owning lines, the connecting roads, and shippers. The yard employs electric snow-melters to keep switches clear, uses closed circuit television to check cars coming into the yard, uses ultra-sonic presence detectors to identify piggyback or other special type cars. Car retarders and switches are controlled by an electronic computer which determines the correct amount of braking to be applied, taking into account speed, weight, and distance to coupling. For this it must keep account of the number of cars already on each track. Not all switching and classification yards carry enough traffic to justify automation. In its Port Morris yard, the Erie-Lackawanna employs hand braking and switching entirely.

Another step the New Jersey railroads have taken to improve their competitive position has been to rid themselves of unprofitable passenger traffic. Abandonment of passenger service has been complete on the West Shore, the Lehigh Valley, and the Baltimore and Ohio, as well as on many of New Jersey's short-line roads. One of the State's earliest experiences with abandonment of unprofitable passenger service came in 1915, when the Lehigh Valley dropped passenger service on its Irvington line. In 1919 the Rahway Valley, a 15-mile road from Roselle Park to Summit, gave up passenger service, as did the Morristown and Erie in 1928. It has been in the postwar period, however, that abandonment has involved the major New Jersey railroads.

The peak in applications for abandonment of passen-

ger service came in the late 1950's. From July of 1958 to August, 1959, the Public Utility Commission acted on 27 applications for discontinuance of passenger service on 10 railroads. These cases involved termination of 245 scheduled runs of which the board approved 127. The rash of applications was precipitated by the Transportation Act of 1958, which empowered the Interstate Commerce Commission to authorize abandonment of service over the objection of State utility and railroad commissions. The most drastic reduction of service was involved in the request by the Lackawanna to discontinue 91 trains, of which 45 were approved. The Jersey Central sought the elimination of 30; the West Shore, 28; the Pennsylvania, 16. Virtually every major New Jersey railroad was involved. This was the "crisis in New Jersey transportation" which called forth State action in the creation of the Division of Rail Transportation in the State Highway Department.

Government regulation encompasses more phases of railroad activities probably than phases of any other form of business. The responsibility of the federal government for interstate commerce was set forth in the famous *Gibbons vs. Ogden* decision; its exclusive responsibility for interstate transportation was established by the Supreme Court in 1886. In response Congress enacted the Interstate Commerce Act based upon the principle that the railroads enjoyed a monopoly of transportation services and that they were charged with a public duty in the exercise of that monopoly power. The original purpose of the act was simply to prevent unreasonable charges and discriminatory practices. From this limited intention to prevent abuses, regulation has expanded its aim to insure the provision of adequate transportation service under the "fostering guardianship" of the Interstate Commerce Commission. The scope of regulation has been extended to virtually every railroad function. Regulation of intrastate transportation by state public utility commissions has tended to follow federal practice. Of

particular interest to New Jersey in recent years has been governmental control of specific freight rates, of mergers, and of withdrawal or reduction of service.

Another means to which railroads have resorted in their effort to reduce costs has been the merger. Mergers have been of two sorts: the end-to-end merger and the merger of parallel roads. The end-to-end merger may be regarded as primarily a competitive device as a means of securing traffic from connecting roads at the expense of competing lines. By joining connecting roads into a system, traffic originating on any line which belongs to the system is forwarded for through haul to other system members. Such a merger provides only scant opportunities for cost reduction. The merger of parallel lines, however, is a device to eliminate duplicate facilities and service and thus reduce costs. The effect may be also to reduce competition. It is the task of the regulatory authority to determine whether reduction of competition is sufficient to place shippers at a disadvantage. However, it must also have concern for the economic viability of the railroads involved.

The biggest railroad merger accomplished thus far was that of the Erie and the Lackawanna. The two railroads had total assets of over \$700 million. They operated 3179 miles of main track. Both were among the Nation's weakest roads financially, having consistently incurred losses in recent years. The merger is expected to save some \$13 million per year over a five-year period through more efficient use of motive power and equipment, consolidation of freight and passenger service, elimination of duplicate track and facilities, and combination of administrative operations. Capital improvement plans include the new electronic classification yard in East Buffalo, expanded freight yards at Hornell, New York, and at Jersey City, improved signaling and communications along the line, and construction of the necessary connecting track and bridges. Illustrations of passenger consolidation have been seen in the concentration of commuter operations in the Lackawanna passenger ter-

minal at Hoboken. Duplicate track has been eliminated by routing Boonton-line traffic over Erie's Greenwood Lake Division. A future connection with the Lackawanna's Montclair line would enable Erie trains to serve Newark. Similarly, routing Erie trains over Boonton-line track east of Paterson has allowed elimination of Erie grade-level track through Passaic.

A major development in railroading in the postwar period has been the emergence of Centralized Traffic Control (CTC). With this system of electronically regulated track, dispatchers seated before a control panel in a railroad headquarters can direct traffic over hundreds of miles of line. Two major benefits result from CTC: reduction in track required to handle a given volume of traffic and increased speed of operation of both passenger and freight trains. By more efficient use of track, roads have found that they can reduce four-track lines to two-track or double track to single, thus accomplishing major savings in track maintenance and property taxes. By speeding train operations they can get more service out of their rolling stock and can offer more rapid transportation service to shippers. The dispatcher's control panel takes the form of a diagram of the section of line under his control. Lights indicate the precise location and progress of each train traveling the section. Buttons and levers operate the switches and signals which are interlocked to prevent admitting two trains to the same track. By remote control of switches, signals, and train operations, dispatchers can shunt fast expresses around trundling freights on crossover switches. No longer must slow moving freights pull onto a siding and wait for the fast passenger train to go by. The essence of CTC is that the individual tracks of a double-track stretch no longer need be regarded as primarily eastbound or westbound. Fast passenger and slow freight trains may be operating in both directions on the same track at the same time. By shifting them from one track to another CTC substantially increases track capacity. Since written train orders and the manual operation of the switches and signals are

eliminated, CTC also has enabled railroads to close down telegraph and signal stations along its line and further reduce costs.

A number of other innovations have been introduced in recent years in the railroads' efforts to reduce costs and improve service. To combat the threat of the coal pipeline the railroads have adopted the integrated train for handling coal. Since these trains are bound for a single destination they are composed entirely of hopper cars loaded with bituminous coal, and can move as a unit, by-passing switching yards and justifying reduced rates. On most roads the familiar clickety-clack of wheels on rails is fading out. In the future tracks will be made of quarter-mile lengths of welded rail with no joints, providing a quieter, smoother ride, in this way reducing maintenance and wear on rolling stock. The familiar "gandy dancer," the track-walker, too, is disappearing; track work formerly performed by hand labor is now done by complicated machines which pull and drive rail spikes, tamp ballast, and re-lay track automatically. The life of railroad ties has been greatly extended by the use of new preservatives; the tie that once lasted ten years is now good for more than thirty. When brakes lock and a car is dragged along the track, a flat spot is worn on the wheel. Grinding the wheel to remove the flat spot once required that the entire assembly—truck, axle and wheel—be pulled apart. The task is now performed by a grinding machine set at track level which smooths the wheel in a single operation without requiring its removal from the car.

Railroads have sought to eliminate unprofitable, little used branches. The regulatory authorities, aware that many spurs and lines carry little traffic and might well be eliminated to reduce costs, nonetheless are reluctant to allow discontinuance of service because such lines might be needed as standby service when weather makes air or auto travel impossible. This has led one railroader to remark: "What we are is foul weather friends."

The greatest problem faced by the rails is the archaic

system of regulation under the Interstate Commerce Commission. Originally the task of regulation was to act in lieu of competition to keep rates down; now, however, regulation is seen as keeping rates up to prevent competition in transportation services. Established at a time when the railroads enjoyed and in many cases exploited a monopoly position in intercity freight and passenger transportation, the ICC continues to regard the roads in the same light, ignoring the enormous changes in the roads' competitive posture since 1887. On the one hand, the ICC has only grudgingly allowed rate increases to cover the inflated costs of the postwar period. Rate increases have augmented ton-mile revenues about 45 per cent while wages have risen 130 per cent and material costs have risen 80 per cent. On the other hand, the regulatory agency has been reluctant to grant rate cuts which would enable the railroads significantly to recapture traffic lost to truck and barge lines. The 1963 decision in the wheat-rate case proposed by the Southern Railroad confirms the impression that, despite the Transportation Act of 1958, the ICC continues to frown on penetration of the markets of competing forms of transportation.

The Southern had introduced a reduction of 60 per cent in the tariff on wheat shipped to points in the southeast. The lower rate was justified by cost reductions growing out of the use of a new type of jumbo hopper car which it had developed. The ICC rejected the rate cut but indicated that a reduction of 53.5 per cent might be acceptable. The majority indicated that it felt that barge lines would be able to compete at the modified rate, but would be driven out of competition by the more drastic cut. This suggests that the ICC is still determined to protect barge lines and truckers from really significant rail rate reduction. If cost reductions afforded by new equipment are not to be translated into rate reductions, railroads are likely to be deterred from engaging in research and development of cost-cutting equipment and methods.

III

THE AUTOMOBILE

THE FORCES making for the twentieth-century transformation of the American transportation scene had been gathering prior to the First World War. Spurred by the public's craving for speed and by special interest groups' craving for profit, the movement for improved highways got underway after the turn of the century. The first automobile show was held in the old Madison Square Garden in 1900. Local automobile clubs created the American Automobile Association in 1902. At a time when automobile use was confined to city streets, *Outing* magazine urged a "rediscovery of America" by automobile tours of the open countryside. Agitation for highway improvement sought to get the United States "out of the mud!"

The concern of the public was augmented by the pressure of a wide variety of interest groups. Automobile and tire manufacturers, petroleum refiners, makers of road-building machinery, all urged action by government to facilitate highway construction. A most significant force in mobilizing public interest was the Lincoln Highway Association which publicized the idea of a hard-surfaced, all-weather highway across the Nation.

A major obstacle to a significant road program lay in the absence of any agency for planning and undertaking it. Rural roads were the responsibility of the community which they served. Local property owners often met their tax obligation by contributing labor. It was the county

which had supervision; few states had highway departments or programs; and since Andrew Jackson's Maysville Road veto, the federal government had had a small role to play.

A breakthrough was accomplished with the Federal Aid Act in 1916 which provided \$75 million in aid for states having highway departments. Though the amount of aid was minute, and though the program was tied to the provision of post roads, the principle of federal responsibility had been established. Implementation of the act was retarded by the First World War, but with the Armistice attention was focused on the highway program once again. A most dramatic event, which added the argument of national defense to the persuasions of economic interest, was the movement of a convoy of army vehicles from coast to coast; it took 62 days.

Pressure upon Congress finally culminated in 1921 in the passage of the Federal Highway Act. Under the direction of the Bureau of Public Roads some 200 thousand miles of roads were incorporated into a federal system of numbered highways. In order to take advantage of federal assistance, states created highway departments and committed themselves to the necessary financial arrangements in order to match federal grants. Driven by the public demand for improved highways, government at both the state and national level came increasingly to participate in highway planning and construction.

The extent of the response to this breakthrough is indicated by the great upsurge of road mileage, numbers of automobiles, and use of the roads. There were 369 thousand miles of surfaced roads in 1920. By 1930 this figure had nearly doubled. During the years of the Great Depression, in response to the need for creating employment as well as the need for roads, it came near to doubling again. During the war years, progress was slowed, but in the postwar period over 600 thousand additional miles had been added so that today there are over two and one half million miles of surfaced roads, of which nearly one million are part of the federal sys-

tem. Numbers and use of automobiles have skyrocketed in response. From 9 million cars, trucks, and buses in 1920, registrations have leaped to over 70 million. In 1920 American cars and trucks traveled about 50 million vehicle miles. Today we clock over 500 million miles in cars alone with more than another 100 million miles traveled by trucks.

Eager to use the public highways, Americans have been more restrained in their willingness to pay for them. Avid acceptance of aid forced states to raise funds to match federal grants. Expenditures by state highway departments marched steadily upward from \$358 million in 1920 to over a billion dollars in 1930. As a result of constant expansion in mileage and quality, coupled with postwar inflation of construction costs, state highway departments spent over \$7 billion in 1957. Provision of through roads revealed bottlenecks in local and county roads. Local taxpayers could not carry the burden and states sought additional revenue sources. In the 1920's recourse was had to gasoline taxes which offered the intriguing promise of shifting the burden from the property owner to the user of the highway. Presumably dedicated to highway construction, these revenues provided a temptation to the legislators to divert them to other purposes. Although automobile associations and other groups sought to prevent diversion, all too frequently the temptation was too great, particularly during periods of business depression. In several states constitutional provisions were adopted to prohibit such raids upon what were regarded as highway funds.

Another aspect of the highway program which has contributed to the need for ever increasing expenditure has been the incessant need for improvement in the quality of the roads. When vehicles were slow, light, and few in number, highways could be lightly constructed, narrow, and, by current standards, unsafe. Improvement in the highways, however, allowed higher speeds and greater weight, particularly for trucks. This in turn called for improvement in highway construction. This has led to

the familiar pattern of highway improvements creating a need for more highway improvement, just as more highway mileage, by attracting more traffic, has led to the need for more highway construction to relieve the bottlenecks created by past construction.

These national developments were reflected in New Jersey as early as 1917 when, in response to the Federal Aid Act and the urging of Governor Walter E. Edge, the Legislature created the New Jersey Highway Department. The Department was to be governed by a State Highway Commission whose eight members were to be appointed by the governor with the advice and consent of the Senate. Two of the commissioners were required to be qualified and competent engineers. The governor served *ex officio*. At the same time, the Legislature spelled out the basic highway system of today by designating 15 routes as the primary concern of the new department. It allowed existing roads to be incorporated into the system, but authorized the Commission to create new highways to implement the basic system and also gave the Commission authority to establish such additional routes as it might see fit. Little action could be taken to implement these plans due to the onset of the First World War.

Organizational changes have been made in the State Highway Department from time to time as the need became apparent. In 1923 the unwieldy eight-man Commission was replaced by a group of four. In 1935, the commission form was abandoned and a single highway commissioner was appointed to serve under the governor as administrative and executive head of the Department. The major innovation in the postwar period has been the creation of a Division of Railroad Transportation within the Highway Department in March of 1959.

Under the leadership of the Highway Department New Jersey pushed forward in roadbuilding programs. The late 1920's saw the advent of the three-lane highway and the pressure of increased traffic forced attention to the problem of intersections. New Jersey built the Nation's first traffic circle in Camden; later the now-

You Are Viewing an Archived Copy from the New Jersey State Library



Route U. S. 1 in the early 1920's, Adams Station
Courtesy of New Jersey State Highway Department

familiar cloverleaf took its place. The first divided-lane highways were built during this period. Construction and expenditures on highways reached a peak in the early 1930's when many new roads were completed and the dual highway became standard for heavily traveled roads. The design of bridges underwent a change. From the draw- or swing bridge, so subject to traffic interruption, plans shifted to the high-level span. An illustration of these new trends in both highways and bridges was completed across the Jersey Meadows in 1932.

Begun in the late 1920's, the Pulaski Skyway was completed at a cost of \$21 million. By vaulting over the Hackensack and Passaic rivers and the intervening Jersey Meadows it cut the travel time from Jersey City to Newark from 25 to 5 minutes. In addition to escaping traffic on the old Lincoln Highway, it avoided two busy drawbridges and many traffic lights. The Skyway contributed to the early success of the Newark Airport. In conjunction with the Holland Tunnel it allowed air passengers landing at Newark to be in New York City in a matter of minutes. Today the four lanes of traffic carry an average of 45 thousand cars each day; on particularly busy days 60 thousand cars may use it. In its first year of operation, 14 fatalities occurred. Steps have since been taken to improve its safety. In 1933 trucks were excluded, and the death toll fell to an average of 6 per year. Experiments have been conducted with various types of surface material to minimize skidding on wet pavement. Recently a center barrier has been erected to prevent the head-on collisions that were the chief cause of death.

The Highway Department submitted a plan in 1927 for a comprehensive State highway system. This proposal called for a total expenditure of some \$175 million to be financed through bond issues and user taxes. Forty-five new routes were designated which constituted the main arteries linking New York, New Jersey, and Pennsylvania, as well as the Jersey shore. The program was approved by the Legislature and plans were begun for the new construction. Some projects were inaugurated and brought

to completion. However, the onset of the Depression prevented the program from being carried through as State revenues plummeted. Construction languished for lack of funds until the federal government, in an effort to promote economic recovery, inaugurated a vast program of aid to state and local public works. With the financial constraint removed, highway construction began again and by the early 1940's most of the proposed network had been completed.

During the Second World War there was again a virtual cessation of new construction. With the war's end, however, the rapid expansion in automobile ownership and use and the exodus of population and industry to the suburbs called attention to the inadequacies of a highway system designed to meet the needs of the 1920's. Many New Jersey State highways were carrying nearly twice their planned capacity. Designed to carry 32 thousand cars per day, portions of Route 46 were carrying 56 thousand; sections of Route 4 were jamming through 64 thousand cars per day; Route 22 enjoyed a daily-double traffic jam of 69 thousand; and Route 1 was clogged with over 65 thousand. New Jersey's State highways enjoyed the distinction of having the highest traffic density in the world, some seven times the national average.

Despite the large increase in automobile and truck traffic after World War II, only some 80 miles of new highway had been added to the State system by the 1950's. This was supplemented, however, by 304 miles of toll roads provided by the New Jersey Turnpike and the Garden State Parkway.

A comprehensive survey of the State's minimum highway requirements in 1946 disclosed a need for \$600 million of construction to relieve postwar traffic congestion. Several plans were put forward for financing this work, including increases in gasoline taxes and bond issues. All such plans were found to be impracticable, and in 1948 Governor Alfred E. Driscoll offered a proposal to the Legislature to finance the necessary roads by means of

a bond issue by a quasi-governmental authority. This was adopted by the Legislature in October, 1948, when it created the New Jersey Turnpike Authority.

Preliminary studies indicated that potential traffic volumes would justify making the proposed 118-mile Turnpike self-supporting. Cost was estimated at \$230 million. The route suggested was from the Delaware Memorial Bridge, then under construction by the State of Delaware, to U. S. Route 46 near the George Washington Bridge. This route was divided into seven sections and construction was begun in September, 1949.

A unique feature of the financing of the project was the adoption of a "forward commitment basis" for the provision of the funds. Financing was completed in mid-February, 1950, with a group of 52 investment organizations, most of them insurance companies; more than half the funds originated within the State. These investors made commitments for the \$220 million involved. These funds were drawn upon as needed and $3\frac{1}{4}$ per cent bonds issued. When the bonds have been fully amortized the law requires that the highway be turned over to the State for operation by the Highway Department. Inflation and changes in design boosted costs and forced the issuance of another \$35 million of bonds in 1951. Another \$30-million issue was required to provide for improvements to handle the unexpectedly large volume of traffic that developed immediately upon the opening of the Turnpike. Further issues amounting to over \$200 million were made to finance the Newark Bay-Hudson County extension, the connection with the Pennsylvania Turnpike, and a widening of 61 miles of road from four lanes to six lanes. As of December, 1962, over \$130 million of bonds had been retired.

The Turnpike with its extensions totals 131 miles of divided highway without crossings at grade. There are no stoplights and no left turns. It is a controlled access highway with 21 interchanges. Acceleration and deceleration lanes are 1200 feet long at interchanges and service areas to allow vehicles to merge or disengage at turnpike

speeds. Fourteen service areas and a charter bus stop are provided. Areas offer service stations and lunchroom and restaurant facilities. The Authority is currently engaged in rebuilding the northern interchanges. When completed there will be two plazas instead of the present five. There was great pressure to complete this work in time to speed the flow of traffic to and from the New York World's Fair.

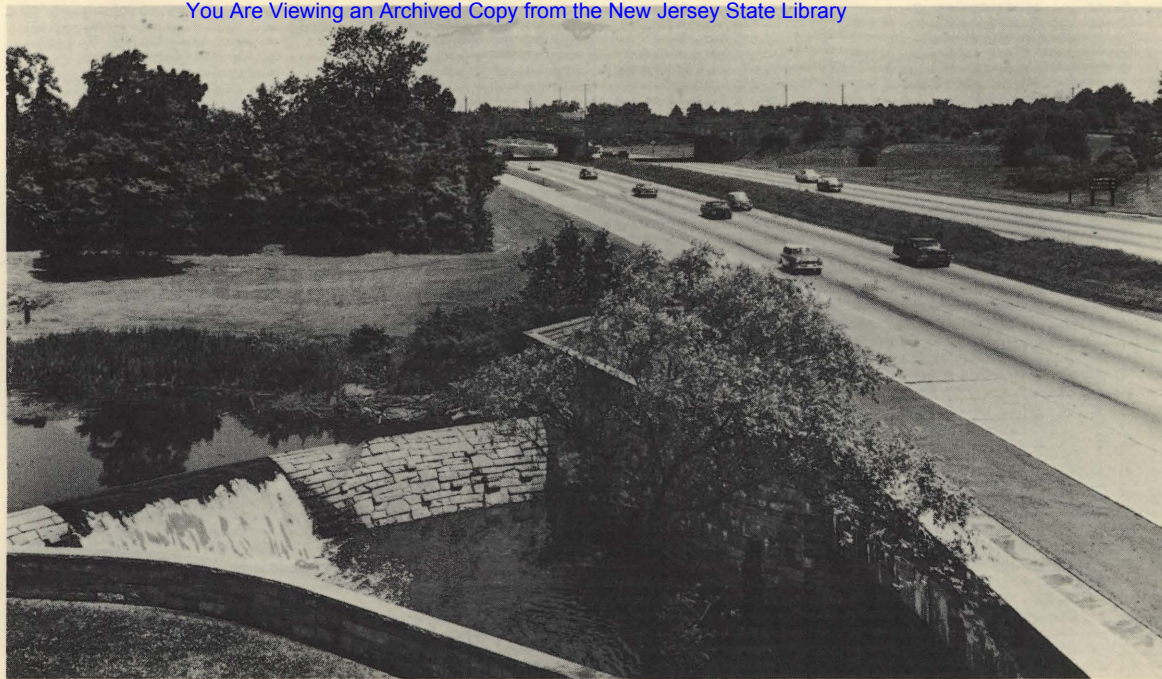
As of December, 1962, total cost of the Turnpike and its extensions amounted to nearly \$450 million. Construction involved moving over 60 million cubic yards of dirt and fill. There are over 5 million square yards of asphalt paving, and almost 12 million square yards of topsoiling and seeding were required to provide the greenery in the median strip and along the right of way.

From the day of its opening in 1951 to the present, traffic volumes have far exceeded expectations. In the first complete year of operation nearly 18 million vehicles used the Turnpike, clocking over three-quarters of a billion vehicle-miles and paying over \$16 million in tolls. In 1962 traffic had grown to just under 55 million vehicles traveling one and a half billion vehicle-miles and contributing \$39 million in tolls. Of these travelers nearly 10 thousand ran out of gas, 14 thousand had flat tires, and just under 18 thousand were arrested for speeding.

The Turnpike has compiled a commendable safety record with an accident rate about one-quarter that for all New Jersey streets and highways. In 1962, 22 fatal accidents brought death to 34 people. This was a fatality rate of 2.17 per 100 million miles and compares with an average of 5.40 for the Nation as a whole. Inattentive driving accounted for half of all accidents on the Turnpike in 1962.

The success of the authority form of organization on the New Jersey Turnpike suggested its adoption for other needed projects. One such project was the Garden State Parkway, a 173-mile superhighway to span the State from its northern boundary to Cape May. Although enabling legislation for the Parkway had been adopted some years

You Are Viewing an Archived Copy from the New Jersey State Library



The Garden State Parkway
Courtesy of New Jersey State Highway Department

before, lack of funds limited construction to only 20 miles in six years. In 1952 in order to speed completion by removing the financial constraint, the Legislature created an authority to construct and operate the Parkway. The act, creating the New Jersey Highway Authority, provided for the financing of the project by the issuance of bonds to be repaid out of revenues produced by tolls. As outlined in the original legislation the project was to extend from Route 17 in Paramus 164 miles to Cape May.

Provision of the necessary funds through bond issues enabled the Authority to complete the basic project and to provide additional facilities which made the Parkway more useful to Jersey motorists. The 164 miles of the original project were opened in 1955. A crossing of Great Egg Harbor Bay was completed in the following year. Portions of the road which had only two lanes to serve both directions of traffic were provided with a second roadway, A 9-mile extension to connect with the New York Thruway was completed in 1957. As its traffic volume built up over the years, the original two-lane separated roadways became increasingly congested, and in recent years substantial portions of the Parkway have been widened to three lanes each way.

Toll revenues have marched steadily upward from the \$9 million reported in 1955. In 1961 they exceeded \$22 million. Together with other revenues they have enabled the Authority to meet its debt service obligations and to build up reserves against future requirements.

The Garden State Parkway, too, established an enviable safety record during its first decade of operation. Despite an ever-increasing traffic volume, the number of fatal accidents has continued to decline in relation to usage as a result of constant improvement in safety features. In 1961 the fatality rate of 0.66 per 100 million miles was the lowest in Parkway history and established the Garden State as the safest superhighway in the country that year. This distinction results in part from the careful engineering of the highway. However, also of

great importance has been the exclusion of commercial vehicles from the heavily traveled northern section. Even in the southern portion the virtual absence of industry in the shore region means that truck traffic is minimal and is limited to delivery vehicles.

Concern was expressed regarding the economic effect which the Parkway would exert on the regions which it traverses. Specifically it was alleged that the project absorbed so much land as to remove a significant number of tax ratables and thus reduce the tax revenues of the communities through which it passed. Doubt was expressed that the promised economic growth would be sufficient to offset this loss. In 1958 the Authority commissioned a study of the economic effects of the highway. The report concluded that retail sales, population, tax ratables, home construction, and other measures of economic growth had increased more rapidly in the region contiguous to the Parkway than in other parts of the State. Whether all of this growth may be directly attributable to the Parkway is open to serious question. However, it seems probable that a significant portion is due to the influence of the improved highway transportation made available by the Garden State Parkway.

Sandwiched between the Delaware River on the west and the Hudson on the east, New Jersey is almost entirely surrounded by water. This, plus the fact that most traffic moves across the State and thus must pass these water barriers, has been responsible for the attention given to river crossings throughout New Jersey's experience. Today the traffic crossing the border between New Jersey and Pennsylvania is greater than that crossing any other state boundary in the country; that crossing the New Jersey-New York barrier ranks second. Thus river crossings provide major bottlenecks for the heavy volumes of traffic crossing the corridor state.

Although the Hudson River provides a magnificent deep-water harbor which has made possible the growth of the port of New York, it also introduces a barrier,

denying the eastern portion of the metropolis land access to the west. The consequence of this blockage has been constant and repeated effort to accomplish a crossing. More than a century ago the imaginative John Stevens, vexed by the delays of ferry service, proposed a stone tube to carry a road for wagons and coaches under the river. Most speculation about a crossing for private vehicles, however, had concerned the building of a bridge. In 1906 New Jersey and New York named a joint commission to investigate the feasibility of such a bridge. The commission found the cost prohibitive and recommended a tunnel instead. Action on the proposal was interrupted by the First World War, but in 1919 construction of a vehicular tunnel was authorized. Engineering responsibility was vested in Clifford M. Holland, whose experience in building the subway tunnels under the East River made him the logical candidate for the post of chief engineer.

Holland's plan for the tunnel called for two cast-iron tubes lined with concrete, each providing a roadbed for two lanes of vehicular traffic and an elevated pedestrian walk. Unlike present techniques such as are being employed on the Chesapeake Bay crossing, which string prefabricated links of tunnel in a trench like a line of pipe, the Holland Tunnel was to be bored. Starting at either end, the cutting face, or shield, would be inched forward through the silt and sand of the river bed with the protective segments installed behind it. The principal problem lay in the pressure of 70 feet of water which threatened constantly to burst into the working chamber. The Hudson River was held back by generating an equal pressure within the working chamber by means of compressed air. At times this required a force of over 45 pounds per square inch above normal atmospheric pressure. This pressure and the associated heat made conditions extremely difficult for the men working at the face. Decompression chambers (air locks) gave access to the working chambers and allowed the silt, sand, and rock to be removed without releasing the pressure. More

important, the air locks allowed for gradual adjustment to outside pressures; rapid adjustment produced a condition called caisson disease or "the bends." Although some five hundred cases of caisson disease were recorded, no fatalities occurred from this cause. The two borings under the river met in October, 1924.

The first Hudson River vehicular tunnel, built by the combined efforts of the States of New York and New Jersey, represents an initial investment of some \$54 million. It lies 72 feet below mean high water; the maximum depth of the roadway is 93 feet. The four lanes of traffic, two in each of the separate east and west bound tubes, can handle nearly 4 thousand vehicles per hour.

The tunnel, named after its chief engineer, was dedicated and opened to traffic in November, 1927. On its first day 51 thousand cars moved through its twin tubes. In 1928, the first complete year of its operation, more than 8 million vehicles used the tunnel. Just after World War II this had increased to over 15 million, of which three-quarters were passenger cars. Tolls amounted to over \$9 million. By 1960 over 20 million vehicles were using the tunnel each year, of which one-quarter were trucks. Despite the construction of other facilities, the Holland Tunnel remains the most heavily traveled artery for trucks entering New York City from the south and west.

Having demonstrated the engineering and economic feasibility of a vehicular tunnel under the Hudson River, the States of New York and New Jersey withdrew from the management of the Holland Tunnel in 1931, turning it over to the Port of New York Authority. They had agreed the previous year that the Port Authority was to have responsibility for the construction and operation of all interstate vehicular bridges and tunnels. Under the Authority's management the Holland Tunnel has continued to justify the faith of its creators. By 1961 total net revenues since its opening in 1927 had amounted to \$174 million. Total investment aggregated \$58 million. Over the thirty-five years of its existence, this represents

an average return of nearly 10 per cent per year. This income has enabled the Port Authority to undertake construction of other projects without recourse to new bond issues.

Financial success may be regarded as the least important criterion by which the Holland Tunnel is to be judged. Of far greater significance here has been its effect upon the economy of New Jersey. As a major strand in the network of highway connections by which the State has been drawn together, it represents one of the principal contributors to the automobile age.

While work was going forward on a breach in the barrier to the east, efforts were under way to provide a major crossing of the lower Delaware. The project had been held up by the adamant opposition of New Jersey's northern counties. However, approval of the Holland Tunnel had provided a *quid pro quo* and they quickly fell in line. The Benjamin Franklin Bridge, or Delaware River Bridge as it was formerly called, was completed in 1926. The longest suspension span in the world at the time of its completion, it afforded a 1750-foot main span over the Delaware. Overall, the bridge was just under 3200 feet long. In order to allow ocean-going vessels to pass under it, there was channel clearance of 135 feet at the center. Six lanes of vehicular traffic, with additional space reserved for trolley tracks, were carried over the river. The bridge cost \$37 million. In 1950 two more lanes of automobile traffic were added in the space reserved for trolleys. Tracks of the Bridge-Line of the Philadelphia Transportation Company are carried over the river to connect Philadelphia with downtown Camden.

While construction of the Holland Tunnel was still under way, the vision of a bridge across the Hudson had been revived. Prior to World War I, the Interstate Bridge and Tunnel Commission had recommended that such a bridge be built from Fort Lee on the New Jersey side to 178th Street in Manhattan. However, traffic studies based on population densities argued for a loca-

tion at 59th Street, closer to the center of population. The war had diverted attention from the project. However, in 1923, a joint proclamation of the governors of the two states recalled it to public attention. The governors recommended that the project be undertaken by the Port of New York Authority and urged legislative endorsement. Both legislatures complied in 1925 and appropriated funds for preliminary studies. These studies indicated feasibility of the project and the following year both states appropriated \$5 million each for loans to aid in financing.

The Hudson River Bridge, as it was then called, was to be the longest and most massive suspension bridge yet constructed, with a main span of 3500 feet from tower to tower and end spans of over 600 feet each. Although initial construction was to be of a single deck only, the design called for the addition of a second deck when traffic should justify it. The upper deck was to be for vehicular traffic and the lower deck for four rapid transit tracks and additional highway lanes. This huge structure would hang from four cables suspended from steel towers. The towers were to be faced with granite and would rise above the river to a height about equal to that of the Washington Monument, 555 feet.

Preliminary engineering studies confirmed the selection of the Fort Lee-178th Street site where natural conditions seemed ideal for a suspension bridge. High ground at both ends minimized the approach construction required and the hard basaltic rock of the Palisades formed an ideal anchorage for the suspension cables on the Jersey side. On the New York side an anchorage would have to be built. Traffic and economic studies indicated that revenues would be adequate to justify the costs and that, while the region at the Jersey end was comparatively undeveloped, completion of the span could be expected to trigger rapid economic growth. Construction began in 1927.

Once the piers had been put in place the next step was the erection of the towers. Each of these is composed

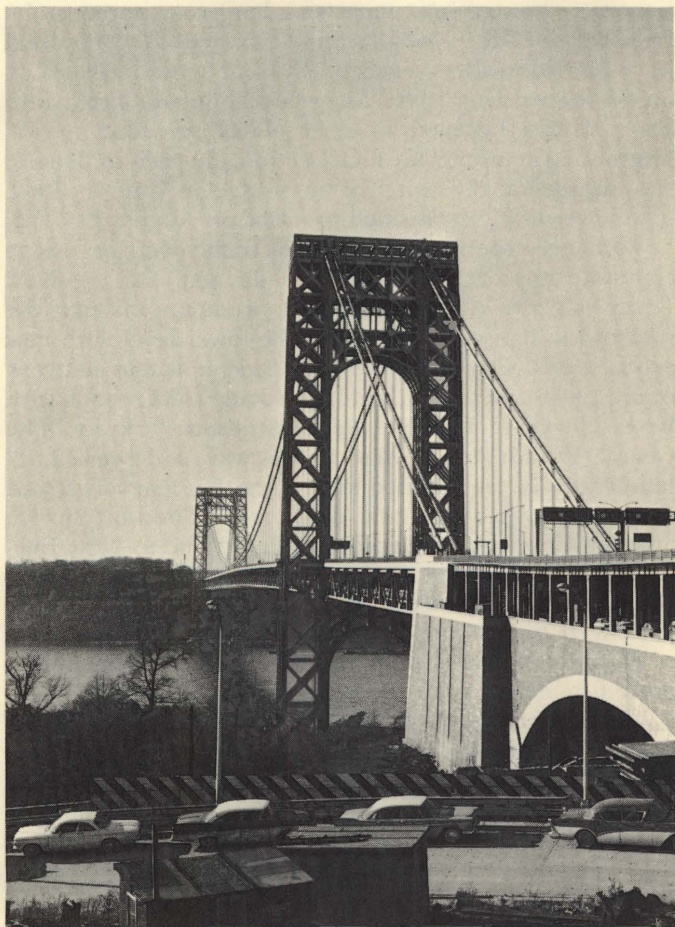
of 20 thousand tons of steel erected in single-story sections for 12 successive stories. As the towers soared upward the functional beauty of their structure led to the abandonment of the granite facing originally planned. After the 180-ton steel saddles on which the suspension cables would rest had been placed atop the towers, the bridge was ready for its cables.

The cables of a suspension bridge support the roadbed and carry the weight of the traffic on it. Temporary cables were carried across the river and hung from the tops of the towers. From these temporary footbridges or catwalks were suspended. It was along these catwalks that the suspension cables were spun—wire by wire, strand by strand. One end of each pencil-sized wire was tied in to the anchorage, the other end looped over a spinning wheel which drew the loop up the catwalk to the saddle at the top of the near tower, down to the middle of the span, then up across the saddle on the far tower and down to the anchorage at the other end. In an hour, working on all four cables, 100 miles of wire were spun. Four hundred and thirty-four wires formed a strand; 61 strands, or 26,474 wires, formed a cable. Each wire must be in its proper place and doing its share of the work of supporting the weight of the bridge. Upon completion of the cables, the hanging of the suspenders, the lighter cables that support the bridge deck, could begin. To these were attached the giant steel trusses upon which the roadway was built.

Four years after construction was begun, in 1931, the George Washington Bridge was dedicated and opened to traffic—a full year ahead of schedule. The total cost of the project was just under \$55 million, of which the bridge itself came to \$31 million, the approaches \$9 million, and real estate and interest during construction \$15 million.

During the first year of its operation the bridge carried a total of $5\frac{1}{2}$ million vehicles. By 1938 it was carrying nearly 8 million vehicles each year and by 1947 the total exceeded 14 million of which over 12 million were private automobiles.

The unprecedented expansion in vehicular traffic since the end of World War II increased traffic congestion on both sides of the river. Studies of traffic conditions indicated that one means by which it might be relieved was an enlargement of the George Washington Bridge.



Port Authority's George Washington Bridge
Courtesy of New Jersey State Highway Department

Accordingly, the Port Authority determined to complete the span in compliance with the original plan by adding the lower deck.

Construction of the second deck began in September of 1958. In order that work go forward without interruption of the normal flow of traffic, prefabricated sections were hoisted into place from barges anchored in the river below. The 75 two-hundred-ton sections were raised by powerful trolleys, suspended from temporary tracks under the existing span. As each section was fitted into place it was fastened to steel plates provided in the original structure. The final section, 60 feet in length, was installed at the center of the bridge on June 16, 1960. The lower level was opened to traffic on August 29, 1962.

To handle the increased flow of traffic over the bridge elaborate approach systems were devised. On the New Jersey side two three-lane tunnels were cut through the rock of the Palisades to connect the lower level with new access roads. On the New York side a whole network of approach ramps was built to provide connections with Riverside Drive and the Henry Hudson Parkway. The George Washington Bridge Expressway, a depressed 12-lane highway, was pushed east to the Harlem River and connections with the new Alexander Hamilton Bridge and the Cross-Bronx Expressway for traffic to New England. An uptown bus station was built over the expressway to accommodate a peak load of 200 buses and 10,000 passengers per hour. The new terminal replaces scattered individual terminals and is connected by an underground passageway to the Independent Subway.

The six-lane lower level increases the capacity of the George Washington Bridge by 70 per cent. In the three months of operation in 1962 a considerable increase in bridge traffic was discernible. The Authority expected 43 million vehicles in the first full year of two-level operation. Opening of the World's Fair in 1964 pushed the traffic levels even higher.

While the original construction of the George Washington Bridge was under way Port Authority planners had been considering the possibility of a midtown tunnel

to connect Manhattan with northern New Jersey. Then, however, traffic requirements did not seem to justify it, particularly in view of the other crossings being undertaken. Moreover, the expense seemed to put it out of the realm of possibility. Conditions had changed by the early 1930's. Population had grown and traffic increased. But, more importantly, the Great Depression was at its depth and unemployment at its height. To help put people back to work the Public Works Administration in Washington was making loans and grants for public projects. The Port Authority put in a bid for funds to build the midtown tunnel, and a federal loan of \$37 million was awarded to finance the project. Work was started promptly although ground breaking ceremonies were not held until May 17, 1934.

As with the Holland Tunnel a decade before, the single tube was bored by the shield method using compressed air to keep the water out. Operations were begun simultaneously from both the New York and the New Jersey sides. On August 2, 1935, the "holing through" process, the meeting and joining of the two portions under the river, was completed. The remaining work of lining the tube and installing the roadbed, ventilation system, tiling, lights, etc., took two more years.

Early in 1935 general business conditions had improved to the extent that it became practicable for the Port Authority to repay the federal advances made to that date and finance the further construction costs of the first tube. The federal government contributed nearly \$5 million in the form of a grant. The Authority took advantage of further improvements in business conditions to go forward with construction of the second tube.

The south tube, the first completed, was 8215 feet in length, of which about 4600 feet were under the river. Like the Holland Tunnel, its maximum depth was over 70 feet and the roadway dropped to a maximum depth of 97 feet below mean high water. The single tube consisted of two lanes which carried two-way traffic pending completion of the second tube.

Delayed by the Second World War, the second, or

north, tube was not completed until 1945. It was opened just in time to meet the increased demand for additional crossing facilities resulting from the elimination of gas rationing and increased automobile production. The new two-lane roadway would handle westbound traffic, relieving the two-way pressure on the older tunnel and affording two lanes for westbound traffic. The second tube added some \$80 million to the total cost of the tunnel and required the building of new approaches on both sides of the river.

In response to the ever-increasing traffic, construction was begun for a third tube in September of 1952. Opened in May, 1957, the newest tube, which lies south of the original tunnel, provides the permanent eastbound lanes. Westbound traffic is routed through the north tube. The original center tube is reversible. This enables tunnel authorities to shift the lanes to meet the flow of traffic, permitting the use of four lanes in the peak direction or three lanes in each direction. The third tube added \$95 million to the cost of the Lincoln Tunnel, raising the total cost of the three tubes to over \$187 million. In order to handle the increased volume of traffic it was necessary to expand the New Jersey connections at a cost of some \$11 million. Manhattan's connections also were improved; new approaches were provided and the Lincoln Tunnel Expressway to West 30th Street was opened.

Nineteen hundred and sixty-two marked the 25th anniversary of the opening of the Lincoln Tunnel. In 1938, the first year of its operation, just under 2 million vehicles had used its facilities. During 1962 nearly 30 million cars, trucks, and buses passed through to make it the world's busiest vehicular tunnel.

These new vehicular crossings served to speed traffic across the Hudson, but they spelled the virtual doom of the ferryboat. During the 1920's a number of ferry lines were in operation in and about New York Harbor. The principal ones in terms of significance to New Jersey's economy were those operated by railroads to provide service to New York City from their terminals on the

Jersey side. Farther north were a series of independent lines at Edgewater, Englewood, and Alpine. Traffic on these was more seasonal than on the commuter-oriented railroad ferries. Many of these lines closed down during the winter months when operations were complicated by river ice and by rock falls on the switchback roads winding down the face of the Palisades.

Regular ferry passengers found riding the boats anything but a routine experience. In heavy fog they might crash into other ferries, tugs, other harbor craft, or ocean liners; occasionally they banged into pilings, landing bridges, and piers; now and then they strayed from their course, ran aground, became stuck in ice jams, and drifted from their moorings. Drivers of automobiles, seeing the landing slip approaching, might start their engines in gear, pushing cars and passengers ahead of them into the river. Absent-minded commuters have left their locked cars and walked off with their fellows for the train. Probably the most eventful odyssey was the cruise of the *Catskill* of the West Shore line. Nosing out from her Weehawken pier at 6:50 A.M. one fogbound morning, she began her trip to Cortland Street. After almost being run down by an ocean liner, she found herself off Pier 7 in the East River on the opposite side of Manhattan from her destination. There a Navy vessel gave her her bearings. Going into reverse, she ran onto a mud flat off Governor's Island. Getting cleared again, she was struck on her port side by a tug which carried away a portion of her drainpipe. It was not quite 9:00 A.M. when she eased into her Cortland Street slip—backwards—after a two-hour trip that usually took 25 minutes.

Operators of ferry boats across the Hudson attempted a variety of responses to the competition offered by new vehicular crossings. Their first resort was to fight back by cutting rates below those charged by their new competitors, hoping to attract sufficient additional customers to recover their lost revenues. This failing, they were forced to seek rate increases to keep out of the red. Others

attempted to consolidate operations in order to reduce costs and increase efficiency. Efforts were made to shift the burden to public agencies such as the City of New York or the Port Authority. Ultimately, abandonment of service was seen as the only recourse, and under the Transportation Act of 1958 all but a very few were eliminated.

While these bridge and tunnel projects were surmounting the barrier provided by the Hudson River to the east, similar endeavors were being undertaken on the Delaware River in the west. It is below Trenton that the Delaware widens and becomes a more formidable obstacle to traffic. Hence, crossings below Trenton have provided greater challenge to the civil engineers. At present there are six such bridges across the Delaware. The Delaware River Turnpike Bridge, built in 1954, provides a crossing for the connection between the Pennsylvania Turnpike and the New Jersey Turnpike. The Burlington-Bristol and Tacony-Palmyra bridges provide local crossings and are under the jurisdiction of the Burlington County Bridge Commission. The Benjamin Franklin and Walt Whitman bridges link Camden and Philadelphia. The Delaware Memorial Bridge extends the New Jersey Turnpike across the river to just below Wilmington.

Prior to the opening of the Delaware Memorial Bridge in 1951 the only crossing below Philadelphia was provided by ferries. As traffic volume increased, serious congestion resulted. In 1941 the Delaware Highway Department recommended construction of either a bridge or a tunnel and urged creation of a bi-state authority to undertake the task. Once again, action was stalled by the war. In 1945 the Delaware Legislature resolved to go ahead with the project on its own. Meanwhile, New Jersey had undertaken the Jersey Turnpike which it planned to terminate at the bridge and the necessary arrangements for linking the bridge approaches to the turnpike were completed.

The Delaware Memorial Bridge is the seventh-largest

suspension bridge in the world, with a center span of 2150 feet. It carries four lanes of traffic over the river. From just over 4 million vehicles in the fiscal year 1951 to 1952, traffic has increased to nearly 12 million in 1961 to 1962. This was expected to be greatly increased when the Chesapeake Bay Bridge-Tunnel was opened. Because the present volume of traffic has exceeded the bridge's capacity on peak days, plans are underway to construct a sister span just north of the present bridge. This will double the capacity of the present crossing.

The pride of possessing the largest and most massive suspension bridge in the world will return to the East with the completion of the new bridge over the Narrows. To be called the Verrazano-Narrows Bridge, the span will provide the first direct connection between Staten Island and the rest of New York City. Like the George Washington Bridge, it has been designed for a double deck, although only one deck will be installed at first. Including approaches, the bridge will be just under three miles long. The length of the main span will exceed that of the Golden Gate Bridge by some 60 feet.

The new span is expected to benefit both local and through traffic. It will end the isolation which has hindered the development of Staten Island, and a boom in population, industry, and land values has already begun. Of greater interest to New Jersey residents is the alternate route it will offer to through traffic bound for New England from the south and west. When linked up with the freeways on Long Island, with the Throgs Neck and Whitestone Bay bridges, and with similar highways and crossings in New Jersey, it will enable through traffic to by-pass the congested river crossings farther north, thus taking pressure off the Holland and Lincoln tunnels and the George Washington Bridge. It will reduce the traffic jamming the Jersey approaches to those crossings and benefit the Jersey driver even though he may never use the bridge himself.

The proposal for a bridge over the Narrows was first seriously put forward in 1888. It quickly encountered

the hostility of the War Department as a possible threat to New York Harbor in time of war and also because there were army bases at both ends of the most likely site. In the 1920's efforts were made to tunnel under the Narrows but the expense involved prevented the project from being completed. In 1956 final clearance for a bridge was obtained, and the \$325-million project got under way.

Each of the towers of the bridge rises 690 feet above water level and is big enough to contain the Washington Monument with space left over. Although perfectly perpendicular to the earth's surface, because of the curvature of the earth between them, the towers are about five inches farther apart at the top than at the bottom. The four steel cables will support a weight of 4 thousand tons in the main span of the bridge plus their own weight of 39 thousand tons plus a potential weight of traffic of another 10 thousand tons. Due to the expansion and contraction of the steel wires in the cables, the floor of the bridge will rise and fall as much as 12 feet from winter to summer. The weight of peak levels of traffic also will cause the cables to stretch enough for the bridge floor to rise and fall. The pull of these tremendous weights is resisted by huge anchorages at the ends of the bridge. Each of these monoliths of concrete and steel weighs 410 thousand tons—heavier than the Empire State Building.

The bridge is being named after a sixteenth-century Florentine navigator who is believed to have explored the lower bay of the Hudson. It is expected that 12 million vehicles will use the bridge in its first year. By 1980 some 50 million are expected to cross it. The bridge is being built by the Triborough Bridge and Tunnel Authority.

The provision of highways and river crossings has played a major part in the emergence of the bus and the truck in New Jersey in the automobile age. Unlike the automobile and the truck, the services of the motor bus

were not entirely unique in comparison with its chief competitors, the streetcar and the commuter railway. Hence, it was somewhat slower to appear in the State. "Jitney" lines began to appear on the streets of Newark and other Jersey towns as early as 1914. Original operations were conducted with five- or seven-passenger touring cars. Early attempts to increase carrying capacity of vehicles included mounting crude bus bodies on truck chassis. Such a vehicle did not afford a particularly luxurious ride. Constant experiments with body design and spring mounting led to a more comfortable ride and greater carrying capacity, allowing an increase in passengers carried to as many as twenty.

As an illustration of the rapid development of bus travel, Public Service of New Jersey provides a notable case. During 1917 the Public Service Railway Company organized a subsidiary, the New Jersey Transportation Company, to operate buses. In 1918 the company used buses to extend a street railway line at Tenaflly to Camp Merritt. It also operated buses in Newark and East Orange. In 1923 the first substitution of buses for streetcars in New Jersey took place on Kaighn Avenue in Camden. During the 1920's the company embarked on a program of purchasing buses operated by competitors along the streetcar lines, coordinating the operation of buses with their trolley service. In 1928 the subsidiary was merged with the parent organization to form Public Service Coordinated Transport. The company engaged in extensive engineering and design studies to improve the breed of crudely constructed, poorly ventilated, uncomfortable buses then available. An early innovation was the all-service vehicle which was operated either as a trolley-bus from overhead wires, or as a regular bus.

By 1962 Public Service Coordinated Transport had emerged as the largest supplier of local transportation in the United States, operating 198 regular bus routes, numerous race track and other special routes, and the Newark City Subway. Its lines serve 369 municipalities in New Jersey, penetrating 20 of the State's 21 counties

and such widely scattered interstate locations as New York, Philadelphia, and Wilmington. Its 2500 buses traveled over 90 million miles, carrying over a quarter of a billion passengers.

As more and more Jersey commuters and interstate travelers came to depend upon buses, they increased pressure upon existing streets and facilities and contributed to traffic snarls at rush hours. By the end of World War II the Lincoln Tunnel was funneling nearly a million buses a year on to the already crowded New York City streets. These vehicles operated out of eight widely scattered bus terminals owned or leased by the operating companies. Removal of the buses from the city streets would not only lessen rush-hour congestion, but would also benefit the bus companies themselves by reducing the time spent in fighting city traffic, thus cutting down on gasoline consumption, wear on tires and vehicles, and the accident rates of city traffic. The Port Authority had been planning for a central midtown bus terminal for a number of years. Finally construction was begun in 1949. Located just one block from Times Square, the original terminal was designed to serve 60 thousand passengers and to accommodate some 144 long-haul buses and over 500 short-haul buses in each day. To remove these vehicles from the city streets, direct access was provided by ramps from the Lincoln Tunnel portals. The roof of the building was fitted with an access ramp and devoted to parking for 450 cars, further relieving congestion on the city streets.

By 1958 the average weekday traffic had far exceeded the planned capacity of the terminal. Over 150 thousand passengers were using the terminal every day. The increased traffic forced expansion of the facilities. The enlarged terminal provides 104 loading positions for commuter buses and 65 positions for long-distance arrivals and departures. In 1962 over a million buses departed from the terminal and nearly 60 million travelers passed through the facility.

The rapid growth of the motor bus spelled the doom

of one of New Jersey's most picturesque forms of travel: the trolley car. The trolley had made its debut in the 1880's, replacing horse-drawn streetcars. The convenience and flexibility of service offered gave it great popularity. As with many new transportation facilities, there had been much fear and opposition on the part of the public of the clanking monsters "run by lightning." However, when competing horse and cable car companies discovered the economic advantages of electric propulsion, opposition melted away and the boom in electric railways was on.

From 1890 to the First World War was the golden age of the trolley. In addition to the workaday needs of the commuter and the shopper, the trolley car played a major role in the recreational and social life of the times. Breezy, open cars offered the closest thing to air conditioning on a sweltering summer evening, but it was the amusement park and the ocean beach that gave the trolley its principal recreational role. In addition, trolley companies, eager to increase their traffic, pushed into subsidiary operations such as real estate development, promotion of cemeteries, establishment of picnic parks, vaudeville theaters, and zoos. Longer vacation trips could be taken by trolley. A favorite was the 267-mile run from New York to Boston. Total fare was \$3.75. It took over 18 hours of actual running time; additional time was spent waiting for connections and for meals. By 1902, American trolleys were carrying nearly 6 billion riders each year.

A ride on a trolley was not always an uneventful trip. Accidents, though rare in relation to the volume of traffic, did happen. Sometimes a wagon or automobile got jammed between two passing streetcars or a horse shied at some imagined threat offered by the clanging monsters. An occasional derailment or collision or bridge collapse might cause injury or death to the riders of a car, but it was far more frequently the individual pedestrian who was the victim. In 1902 the number of pedestrians killed by streetcars in the United States was 831 as compared

with 265 passengers and 122 employees. The major safety innovation was the introduction of air brakes in the early 1900's. Even air brakes were not always enough to bring a car to a halt when tracks were wet or greasy, and motormen frequently adopted the resort of a Newark operator in the 1920's who, seeing that his brakes were not going to prevent his car from crashing into an automobile ahead, reversed his motors and dumped sand on the rails to increase friction. Even this was not enough and his car crunched slowly into the rear of the automobile. After surveying the damage and filling out the necessary reports, the motorman climbed back into his car, released the brake, and started up again—only to smash into an automobile behind him. He had forgotten that the controls were reversed.

During the 1920's it was becoming clear that trolleys were on the downhill grade. At the start of the period few autobuses were in operation, but just as reduced costs had argued for the substitution of electricity for the horse-drawn streetcar, as transit companies became aware of the savings to be had by a shift to gasoline, the bus began to replace the electric streetcar. Passenger traffic, however, continued to rise, reaching a peak in 1923 of 14 billion riders per year, but from that year on the inroads of the automobile and the bus became increasingly severe and traffic declined sharply. Buses usually were introduced as feeders to trolley lines in outlying areas where traffic was relatively light. Trolleys tended to be retained longer on the heavily traveled main lines. The pressure of costs forced increased reliance on buses. A modest recovery was experienced as a result of the gasoline and tire shortages of the Second World War, but the postwar period finished the trolley in all but a very few cities.

By the end of the First World War, New Jersey had an elaborate system of electric railways. Public Service Corporation operated a dense network of street railways in Newark, Jersey City, and throughout northern New Jersey and extended their lines south to Trenton and

Camden. Many of these lines were interurban in the sense that they connected separate cities, but are best regarded as streetcar lines since they served primarily local traffic. Two of the company's lines were primarily interurban, however. The Riverside line connected Trenton and Camden, while the "Fast Line" ran from northern New Jersey to Trenton. The Trenton-Camden line was one of New Jersey's earliest interurban transit routes. Public Service had built the "Fast Line," offering through service from Jersey City to Trenton, since a through trip from Jersey City to Camden by means of the ordinary connections took nearly nine hours. A change of cars was required in Trenton because of a difference in track gauge on the Riverside line. Declining revenues forced abandonment of through service between Camden and points beyond New Brunswick in 1924. After unsuccessful experiments during the early 1920's with combination gas-electric streetcars and with buses designed to run on either rail or road, the entire line was replaced by standard motorbuses in 1927.

Among other companies operating trolley service in New Jersey was the Morris County Traction Company. This line ran west from Elizabeth through Morristown to Lake Hopatcong with numerous branch lines. It abandoned service in 1928. The Atlantic City and Shore Railroad, which ran from Atlantic City to Ocean City, was also abandoned in 1929. One of the State's earliest lines, the Bridgeton and Millville, opened in the period 1892 to 1895, and survived until 1931. In the western part of the State, the Easton and Washington Traction Company, running from Phillipsburg through Washington to Port Murray, disappeared in 1925.

For the most part, local streetcar service tended to survive longer than the harder-hit interurban lines in New Jersey. The local lines enjoyed the patronage of commuters and shopping passengers along heavily traveled routes. Their replacement by buses was more a matter of decision by transit company management for reasons of efficiency and less a matter of declining revenues as

travelers shifted to other means of transportation. Today, apart from a trace influence in the architecture of the roadside diner, the trolley car is no more in New Jersey.

While the trolley car was suffering eclipse during the 1920's, the motor truck was emerging into prominence. The growth of motor trucking in New Jersey is illustrated by truck registrations. In 1920 there were fewer than 25 thousand trucks registered in the State. By the end of the "Roaring Twenties" registrations had increased to over 130 thousand. A moderate decline in the early 1930's and again during the war years left the State with about the same number in early 1946. The postwar period may be characterized as one of virtual explosion in truck usage; by the 1960's there were over 250 thousand trucks registered in New Jersey.* The rapid postwar rise in truck travel in New Jersey is also reflected in trucking employment. The industry employs over 225 thousand men and provides more than one billion dollars in payrolls annually. State highway-user taxes have grown from just under \$10 million in 1939 to over \$44 million in 1961. This rapid growth is in part traceable to favorable tax treatment of motor vehicles in New Jersey. In 1956, for example, New Jersey ranked 48th among the states in charges on a three-axle tractor-trailer combination, having 40 thousand pounds gross weight, and 48th on a Diesel-powered, four-axle tractor-trailer of 50 thousand pounds weight.

A sample traffic count made by the State Highway Department indicates that in addition to the trucks registered in New Jersey, a great number of vehicles registered in other states use New Jersey highways. It is estimated that 20 per cent of vehicles on New Jersey highways come from other states.

The truck has seen increased use in New Jersey agriculture in recent years. In 1953, 488 million pounds of fresh fruit and vegetables were shipped by truck from

* Because of multiple registration of interstate trucks, registrations cannot be considered identical with trucks owned or operated in the State.

New Jersey to 14 major United States markets. During 1961 these same markets received more than 714 million pounds of New Jersey's fresh fruits and vegetables by truck.

The most efficient operations for over-the-road carriers arise when trucks are fully loaded. Contract carriers hauling bulk door-to-door are not so greatly dependent upon volume as the common carrier which must provide frequent service, yet cannot be sure of a full pay load. Small shipments originating in a metropolitan area are consolidated in warehouses and at terminals by local truckers in small pickup trucks and are then transferred to large tractor-trailer combinations for over-the-road shipment. It would be uneconomical, obviously, for huge rigs to travel through the city to pick up and deliver individual shipments. Hence truckers establish terminals for storage and interchange of freight from small local trucks to the line-haul vehicles. Location in downtown areas would require the over-the-road vehicles to fight traffic jams in and out and would slow local delivery. Location on the edge of the city where arteries provide access to the downtown metropolitan region for local vehicles and to interstate highways for over-the-road combinations are preferable. Many are located along Route 1 in the Jersey Meadows, adjacent to the exits from the Holland and the Lincoln tunnels.

In order to eliminate the need for multiple handling and to speed the flow of truck freight for the region, the Port of New York Authority built a union truck terminal in Newark. Located just north of Newark Airport near Port Newark Marine Terminal and adjacent to Route 1 and the New Jersey Turnpike, the Newark Union Motor Truck Terminal was completed in May, 1950. It is a consolidating terminal at which less-than-truckload, common-carrier mixed merchandise shipments are received and sorted for interchange between line-haul and local carriers. Designed to reduce street congestion, to provide modern facilities and equipment for the clearing of cargoes, and to reduce handling costs and thus provide

better truck service for the New York metropolitan region, the terminal serves eight counties of northern New Jersey and Staten Island.

New Jersey's efforts to facilitate automobile transportation, great as they have been, must be considered in the light of the growth of the demands placed upon the system. The State's highways carry a density of traffic unmatched by any other state's system—some 11 thousand vehicles per mile per day. This is five times the national average, three times the average volume for Pennsylvania, and nearly four times the average for New York. This density of traffic is not surprising, however, in view of New Jersey's role as a corridor and the density of her population. Eighth largest in population but fourth smallest in land area, New Jersey ranks second only to Rhode Island in population density. Massive as present traffic demands are, there is little likelihood of relief in the future. The State Highway Department projects registrations of nearly 3.7 million vehicles in 1975 and estimates that highway usage will more than double present levels. To accommodate this enormous increase in the volume of traffic the Department's estimates call for construction of additional freeways, conversion of much of the present two-lane or three-lane road into dual highways, and a heavy program of rehabilitation of existing roads.* This, of course, says nothing of the need for additional county or municipal roads. Completing the State portion alone is expected to cost nearly \$3 billion at current price levels.

* These plans are set forth in greater detail in Chapter V.

IV

PLANES, PIPES, AND PORTS

IN ADDITION TO RAILS AND HIGHWAYS three other transportation media have played significant roles in New Jersey's transportation history in the period since the First World War. The phenomenal growth of air travel has wrought changes in the life of virtually every New Jersey resident. Though far less dramatic in effect, the pipeline has brought petroleum products for our automobiles and natural gas to our furnaces. And the port facilities on the Hudson and the Delaware rivers have made signal contributions to the State's economy.

Commercial aviation has been a product of the last three decades; not until the 1930's did the airplane begin to play a significant role in transportation in the United States. Until World War I, the story of aviation was largely concerned with engineering and technical developments—experiments with balloons, airships, and airplanes of many kinds. The first commercial applications were a product of the joint efforts of the Post Office Department and the Army in the establishment of air mail routes. By 1924 these routes had become transcontinental. This sparked an upsurge in production of civil aircraft and in 1929 over 5 thousand planes were built. It was only after 1928 that significant private commercial applications were made.

A rapid increase in public interest in flying was due to many spectacular flights, such as the *Bremen's* crossing of the Atlantic, George Wilkins' polar expedition,

and the flight of the *Graf Zeppelin*. The most dramatic and most significant for Americans, of course, was Charles Lindbergh's flight to Paris. Bolstered by the subsidies provided by government airmail contracts, commercial airlines, in contrast to other forms of transportation, saw their business grow rapidly through the years of the Great Depression. Retarded during World War II, it has been in the last fifteen years that the growth of commercial aviation has been most rapid and extensive. From 85 *million* passenger-miles in 1930, air travel has grown to more than 35 *billion* passenger-miles in 1962. Due largely to the increasing speed and safety of air travel, the airlines' share of commercial passenger traffic has leaped from 0.2 per cent in 1930 to over 45 per cent in 1962. Air freight has grown from less than 60 thousand ton-miles flown in 1928 to 671 million ton-miles in 1961.

The impact of the rapid development of aviation on New Jersey is best indicated by the experience of the city of Newark with its airport. There had been interest in a municipally owned flying field in Newark as early as the middle of the 1920's. Led by the Aeronautical Club of New Jersey, many organizations and groups had urged construction of an airport, but neither the general public nor Newark city officials had paid much heed. Newark's rivalry with New York City as a port provided a rallying point for airport enthusiasts. Lacking New York City's deep water harbor and miles of shoreline, Newark could not hope to usurp its seaborne transport. Air transportation might well be another story, however. The Port Newark area seemed to provide an ideal location for an airport. Flying time from Cleveland to Hadley Field, New Brunswick, the airmail terminal for New York City at that time, was a little more than three hours. It took another three hours for a truckload of mail to get from the terminal to New York City. With the Holland Tunnel and the Pulaski Skyway, truck time from Newark to downtown New York would be less than 20 minutes. Moreover, at Port Newark open land owned by the city was readily available and access to alternate transporta-

tion facilities was handy. In 1927 Newark officials announced the start of construction of Newark Airport.

The airport was opened in October, 1928. It occupied 100 acres of hard, level surface with another 500 acres reserved for future development. Though primitive by modern standards, Newark Airport was one of the best equipped in the Nation at the time. It had paved runways, an unheard-of luxury, and boasted 22 one-million-candlepower lights to aid in night landings. A single hangar was constructed to house 25 planes. The hangar was fitted with a hot air heating system to provide the constant temperature and humidity necessary to prevent warping of the wooden airplane parts.

The Post Office Department quickly shifted its airmail operations to Newark. When the Department insisted that airmail contractors offer more diversified services in order to spread the costs, passenger and air freight service were instituted. Newark's traffic increased rapidly during the 1930's; passengers carried rose from 90 thousand in 1931 to over 200 thousand in 1935. Unfortunately, passenger accommodations did not grow with traffic. Each airline provided its own terminal and passengers floundered through mud or dust to change flights.

By 1935 traffic had outgrown the airport's facilities and a program of enlargement was begun. With \$3 million from the Works Progress Administration and another million from the city of Newark, additional marsh was drained and filled and the field enlarged to 420 acres. New runways were built and the old, cramped hangars were replaced. By 1938 the airport was handling over 300 thousand passengers and nearly 3 million pounds of express each year.

In the late 1930's Newark Airport faced its greatest challenge. The campaign had begun in 1935 when New York City made a bid to take over Newark's airmail service by proposing Floyd Bennett Field. In 1937 a dispute arose between Newark and the airlines over facilities at the airport, particularly regarding passenger comfort. Meanwhile, under the energetic leadership of Mayor

Fiorello LaGuardia, New York City had been building a new airport at North Beach. By 1939 this project was completed and the Civil Aeronautics Authority certified it the equivalent of Newark. Three airlines shifted to the new airport immediately. Within a year traffic had fallen off at Newark to such an extent that authorities were considering closing it down. LaGuardia Airport dominated New York air travel.

Newark Airport did not emerge from the doldrums until World War II. Because of its access to rail and water connections, the airport provided an ideal site for an Air Force staging area for overseas shipment of aircraft. Military planes and urgently needed war materials were flown from production plants to Newark to be prepared for movement to combat theaters and loaded aboard ships at Port Newark.

In 1945 the airport was reopened to commercial flight, but it was apparent that its facilities were inadequate to sustain a profitable volume of traffic. Costing the citizens of Newark nearly half a million dollars a year, it could become a major air terminal again only if many millions of dollars were invested in it. At that time the Port of New York Authority had undertaken a program to lease and integrate the activities of all the airport facilities in the port region. An agreement was reached by which the Authority would assume responsibility for both Newark Airport and Port Newark and would commit over \$75 million to their improvement. The properties were to be leased for a period of fifty years; net revenues would be divided on a three-to-one basis. At the end of the fifty-year lease the properties would revert to the city.

Under the Port Authority the facilities of the airport have been improved and its traffic capacity expanded. Additional land has been added, bringing the total acreage to approximately 2300—four times that of LaGuardia. In 1947 an elaborate system of lights was installed to aid pilots in locating the runways in bad weather and a completely automatic instrument landing system was installed to make Newark one of the finest

all-weather airports. From the point of view of passenger comfort and convenience, the most obvious improvement was the construction of a new passenger terminal building providing a glass-enclosed observation deck, restaurant, and shops. In 1953 a new control tower was built which looms 150 feet above the field. By 1961 nearly \$40 million had been invested in the airport; it employed over 4 thousand persons and generated a payroll of over \$30 million each year. Currently, nearly 3 million passengers, over 120 million pounds of air cargo, and nearly 24 million pounds of air mail pass through the terminal in a year. These require more than 168 thousand aircraft landings and take-offs.

The dramatic upsurge in air passenger traffic has been accompanied by an equally dramatic increase in the safety of air travel. Passenger fatalities per 100 million passenger-miles fell from 28 in 1930 to 0.1 in 1960.

Despite this record of reduced air fatalities, the increased numbers of planes and the ever-increasing speeds at which they fly have raised serious problems of air-lane congestion and air safety. It is clear that the systems used to control air traffic in the United States are inadequate. This is underscored by the more than 400 near-misses reported each year by pilots who have been forced to get out of each other's way. Currently about 2.5 million flights each year are controlled, but more than 22 million are uncontrolled—that is, not subject to instrument flight rules. Flight control seeks to isolate each plane in its own envelope of air space. However, as planes become faster the air space required to protect them effectively becomes larger. Moreover, with more planes in the air more air space is taken up. With present speed and traffic there simply is not enough space on many routes to accommodate all flights safely. In addition, at today's jet speeds planes cannot be seen soon enough to avoid collision.

These considerations have led the Federal Aviation Agency (FAA) to undertake a program of research to develop new systems of air traffic control. It seeks a com-

pletely integrated system covering weather, communications, air traffic control, and airport operations. To accomplish this aim it has established an aviation-facilities experiment center near Atlantic City. Major effort at the center is devoted to an improved traffic control system. The problem is very similar to that being met by Centralized Traffic Control on the railroads—improved efficiency through centralized control of traffic. However, the air traffic controllers' task is complicated by the additional variable of altitude. Currently, ground control must depend upon word from the pilot as to his altitude; a new device called a transponder is being developed to report the altitude of flights automatically. This, together with radar systems which will give all needed information about a flight—speed, rate of climb or descent, even the type of plane—will greatly facilitate ground control. Development of an all-weather landing system which will enable planes to land “blind” would eliminate the need for rerouting planes to open airports and for “stacking” planes awaiting their turn to land in bad weather.

In contrast to the massive penetration by airplanes into the market for passenger travel, their impact on the handling of freight has been relatively minor. Less than 0.1 per cent of intercity freight ton-miles are moved by air. This tiny portion represents great growth but is still insignificant in relation to total freight movements.

Hauling freight by air was largely a sideline of passenger and airmail service prior to World War II, and it received its major impetus during the war. After the war, hundreds of military pilots, eager to put their flying skills to use, sought to establish air freight businesses. By late 1946 some 300 air freight companies had been established. Few of these pioneer companies have survived. High cost of operations demanded high freight rates which deterred customers. The only advantage which air freight could claim was speed over long distances. Apart from rush shipments of antibiotics, orchids, experimental monkeys, and atomic isotopes, few products could stand the high cost of air freight transportation. Thus freight

volumes were low and traffic was largely a one-way business; return cargoes were almost non-existent.

In order to attract bulk cargoes lower rates were needed, but lower rates awaited the cost reduction which only bulk cargoes would provide. Cost reduction depended upon development of specialized cargo aircraft. The plane designed for air freight service must embody certain distinctive features. It needs a stronger floor than either military or passenger craft to support the weight of the cargo. It requires greater wingspan to get the necessary lift for the weight of the cargo. It must be able to operate out of small airports having short runways. It cannot, however, be a lumbering behemoth; speed means more ton-miles per day, and this represents the difference between profit and loss in operation. Above all, it must be designed for speedy cargo handling; a plane earns no revenues on the ground.

Development and adoption of specialized cargo planes was long delayed by the great number of war surplus planes which were available at low prices and later by the availability of old passenger planes replaced by modern craft or jets. Converted military or passenger planes, not possessing the features necessary for a cargo plane, were inefficient and hence high in cost.

The future course of air freight development probably lies in the swing-tail jet operating on frequent schedules and with containerization and mechanized cargo handling. The capital required for such equipment in the volume needed is probably beyond the capability of many of the firms engaged in air freight to marshal.

While the airplane was providing improved means of moving New Jersey's citizens through the air, the pipeline was expanding its facilities for moving their goods underground. The earliest pipeline is reported to have been a bamboo tube used in China to conduct natural gas used for the evaporation of salt brine. The first iron pipeline in the United States was a 5-mile-long, 2-inch gathering line used in the early oil fields around Titus-

ville, Pennsylvania. The vast growth of the petroleum industry has provided the impetus for the rapid expansion of pipelines. The first interstate pipeline, used to transport crude petroleum from an oil field in Pennsylvania to Bayonne, was built across New Jersey in 1888. Today pipelines are used to transport a variety of products. Their most prominent use in the United States is for the overland transportation of petroleum, refined petroleum products, and natural gas. In 1930 oil pipelines accounted for nearly 28 billion ton-miles or about 5 per cent of all freight transportation. By the 1960's this had grown to more than 230 billion ton-miles and amounted to nearly 18 per cent of all intercity freight. As pipelines have grown in volume and coverage, they have replaced the tank car as the primary means of moving crude and refined petroleum products. Petroleum pipeline mileage has grown from 55 thousand miles in 1921 to over 150 thousand miles today.

Like the railroads and the airlines, pipelines have been moving toward greater centralized control of traffic flow. Automatic sensing and control devices guide liquids through the pipes from hundreds of miles away. This facilitates the task of the dispatcher and eliminates manual regulation of pumping and control stations. Control centers are kept in constant and instantaneous communication by means of microwave radio, teletype, and telephone. Automation speeds the flow of liquids through the system, affords closer control over that flow, and reduces the operating costs incurred.

The large-diameter pipeline was inaugurated with the construction of the famous Big Inch, and Little Big Inch lines during World War II. With Hitler's U-boats harrying East Coast shipping, an alternative was sought to the ocean tanker for moving petroleum from the East Texas fields to the New York port. Both the Big Inch and Little Big Inch were built by the federal government through the Defense Plant Corporation. Big Inch extended 1340 miles from Longview, Texas, to Linden, New Jersey. Its 24-inch pipe weighs 250 tons to the mile.

Its 27 pumping stations could push a barrel of crude oil from Longview to Linden in about twelve days. The Little Big Inch carried refined petroleum products from Texas refineries to tank farms in Linden. Boasting 30 pumping stations and stretching 1475 miles, it carried a variety of products such as aviation gasoline, automobile gasoline, and fuel oil. Dispatchers guided the flow of these products during their twelve-day trip through the line.

With the end of the war, movement of petroleum and products returned to the sea lanes once again, and the government put the two pipelines up for sale, occasioning a fierce rivalry for the rapidly developing natural gas market in the East. A newly formed company, Texas-Eastern Transmission Company, submitted the highest bid, \$143 million, and began pushing natural gas through. The postwar demand for natural gas was so great, however, that most of the gas was sold before it reached New Jersey. Transcontinental Gas Pipeline Corporation stepped into the gap with a line linking the furnaces of the eastern seaboard with the gas wells of the deep south. Completed in 1950, Transcontinental's more than 3 thousand miles of line supply the major part of the gas sold in New Jersey. More than 180 miles of the company's line lie within the State. Its pipes cross the Delaware near Washington's Crossing and below Camden and push on to New York under the Hudson at 134th Street and under the Narrows at Staten Island. Tennessee Gas Transmission Company and Algonquin Transmission Company supply gas, not only to New Jersey, but to parts of New England as well.

In recent years the flow of petroleum products has been reversed. Where the 1888 line from Pennsylvania and the Big Inch brought crude petroleum east across New Jersey, today the sprawling system of the Buckeye Pipe Company picks up petroleum products at Linden and moves them west to Pennsylvania. Output is gathered from the refineries of several major oil companies and some 90 thousand barrels of gasoline an hour can be pushed across

the State, under the Delaware River to a network of lines through Pennsylvania and into New York State. The system also ties in with the refineries in the Camden-Philadelphia area via a link from Woodbury to Linden. These lines pump a variety of products in minimum lots of 25 thousand barrels. Since Buckeye is a common carrier, it carries the products of a number of different companies. Constant pressure retards the mixing of adjacent lots; kerosene is used as a buffer between gasoline and fuel oils. Brilliantly colored dyes mark the beginning and end of a particular shipment. A similar pipeline is about to be completed by Colonial Pipeline Company to deliver refined products 1600 miles from the Texas Gulf coast to a New Jersey station.

Where international trade was carried on in New Jersey through a multitude of little ports in the early nineteenth century; today port activity focuses on two areas: the ports of the Hudson and the Delaware. The New Jersey side of the Hudson began to assume significance in 1831 with the completion of the Morris Canal and the establishment of terminal facilities at Jersey City. This was accelerated in 1847 when Cunard Lines shifted from Boston to New York and built wharves at Jersey City. It was the coming of the railroad which established the character of New Jersey's port development, however. During the second half of the nineteenth century, railroads coming from the west and south established terminals in New Jersey; only the New York Central railroad had direct access to Manhattan.

A unique feature of the New York port is that piers serving ocean-going vessels are separated from the railroads supplying them by the wide Hudson. Though ocean-shipping facilities have developed on the Jersey side, particularly for handling bulk cargoes such as wheat, petroleum, bananas, ores, etc., as the port developed most general cargo vessels berthed on the New York side of the river. The physical characteristics of the piers grow out of the fact that in the early years most cargoes

came down the Hudson by barge from the Erie Canal or across the Hudson by car-ferries and lighters from railroad terminals on the Jersey side. Lighters and car floats were shifted to the ocean piers by tug. Tied up alongside piers, cargoes were shifted to the pier to await loading into the ship or were loaded directly into the hold. This produced an immense amount of harbor traffic and the waterfront was engineered to facilitate the transfer of cargo from barges and lighters to ships. Essentially, the movement of cargo was across the piers or from lighters to ships directly; little freight touched the land. Thus it was most efficient to build the piers out into the river to maximize waterfront exposure rather than to build wharves where a ship ties up alongside to load directly from overland vehicles. There was little need for parking or access from the land end of the pier; the piers could almost have been anchored in the middle of the river. With the transformation of overland freight traffic from rail to truck, New York pier designs became outmoded. It would be difficult to imagine a design more admirably suited to the generation of a traffic jam at the base of the pier.

In recent years some innovations have taken place in the loading of general cargo. Prior to World War II this was done almost entirely by hand. Bales, crates, and boxes stacked by hand, moved to loading spots by hand, were hoisted into the hold in slings by ships' winches, and were shifted in the hold by hand. The major innovation has been in the use of the "pallet" or "skid" and the fork-lift truck. Boxes stacked on wooden platforms are moved from place to place by the lift truck, thus eliminating much human handling of cargo. The most promising innovations are offered by the sea-train in which loaded railroad boxcars and trailer flats are hoisted aboard ships which are fitted with railroad tracks. The savings in cargo handling and turn-around time for the vessels are partly offset by the less efficient use of space in the ship's hold. A sea-train loaded with cargo in railroad cars can carry perhaps half the volume of cargo of

a conventionally loaded vessel. Piggyback operations on the railroads have suggested "fishyback" operations at sea. Loaded trailers, delivered to the pier by tractor truck or flatcars, may be hoisted aboard ship, thus eliminating cargo-handling and greatly reducing loss through damage and pilferage. Container shipments, too, move by ship; the containers are often trailer bodies which can be demounted from their chassis. Startling reductions in loading costs can be accomplished by these means. However, the additional capital investment in trailers or containers as well as in cranes and other gear to handle them partially offset the savings.

The cost of handling cargoes is only one aspect of the cost of moving goods overseas. Overland rates to the port plus ocean rates to the port of destination obviously influence a shipper's choice of port. In general, as a result of ocean shippers' conference agreements, ocean freight rates for a journey of a given distance do not vary from port to port. Hence they do not influence a shipper's choice. This is by no means the case regarding overland freight rates. Rail and truck costs generally make up a large portion of the total cost of a shipment. It is far more costly to ship from Chicago to New York by rail than from New York to London by water. Of major importance to the New York port have been the differentials among railroad freight rates. Differential rates for different ports were established by agreement among the major eastern railroads in 1877 in order to compensate for differences in ocean rates which then existed between ports. In order that Norfolk, Baltimore, and Philadelphia might compete for traffic with the lower ocean rates enjoyed by New York and Boston, they were allowed rail rates from two cents to three cents lower per 100 pounds than New York and Boston. Despite the establishment of uniform ocean rates in 1935, these rate differentials were retained. Efforts on the part of the railroads serving the New York Port primarily, together with the Port Authority and the City of New York, to eliminate them came to naught. A very recent decision by the

United States Supreme Court has invalidated the differential, but there can be no question that growth of port activity in New Jersey in the past was slowed by these differentials.

Another rail-rate anomaly which may have been of even greater significance for New Jersey's economic development has been the absorption of lighterage costs by the New Jersey railroads. Free movement of goods from terminals in Hoboken, Jersey City, etc., throughout the port is designed to offset the advantage enjoyed by railroads such as the New York Central, having direct access to New York City. However, a charge for lighterage would give the west side of the Hudson a transport cost advantage over New York City and would tend to induce port activity to shift to the New Jersey side, thus speeding its economic development. Put another way, the natural advantages for location of industry which New Jersey's geography affords have been offset by free lighterage, thus slowing growth.

In contrast to general cargo, piers and equipment for handling bulk cargo have long been located on the Jersey side of the Hudson. From the George Washington Bridge on the north to Raritan Bay on the south, the western side of the New York harbor is lined with such facilities. The terminal of sea-train lines, served by the Susquehanna Railroad, and a number of industrial plants occupy the riverside at Edgewater. At West New York the West Shore Railroad has built a two-million-bushel grain elevator, the largest grain-handling facility in the port. The West Shore also provides an extensive facility to move bananas from the holds of the United Fruit Company's vessels to trucks and railroad cars for distribution. With a west wind, the coffee roasters on the Jersey side make their aromatic presence known to New Yorkers. South to Bayonne the waterfront is devoted very largely to railroad terminals and facilities. Here are the ferry-boat and railroad car-float slips, general cargo gear for loading and unloading of barges and lighters, dumpers for transferring coal from rail to barges of the Erie-

Lackawanna, Jersey Central, Lehigh Valley, and Pennsylvania railroads. They are interspersed with piers of the Port Authority and the Harborside Terminal and the supply facilities of the Army and Navy. Bayonne and the Arthur Kill area are devoted to unloading facilities serving the petroleum refineries and other heavy industrial plants located there. Kill van Kull, between Staten Island and Bayonne, serves three-quarters of the ocean tankers using the New York port. The only significant ocean terminal facilities in Newark Bay are those of the Port Authority at Port Newark and the development being built at Elizabeth Port.

As part of the 1948 agreement with the City of Newark, the Port of New York Authority accepted responsibility for the further development of Port Newark. The marine terminal had already been begun by the City as part of its effort to compete with the City of New York. The major advantages seen for the port were an abundance of space, access to the harbor via Newark Bay, and abundant rail and highway transportation. The shallow waters of the Bay and the marshy nature of the ground required dredging the channel and filling in much of the land. Funds were appropriated by the city, and Port Newark opened in October of 1915. Two years later 300 acres of meadow land had been reclaimed. Further development by the city was halted during World War I and depressed business conditions dampened its growth during the 1930's. In 1942 the federal government took over the 136 acres north of the channel, and also acquired by lease and purchase additional acres in the south portion. Federal operation was a further deterrent to the development of the port. Thus, despite Newark's having invested over 17 million dollars by 1948, the port never had developed as rapidly as expected.

As Newark looked forward to the end of World War II and reacquisition of the property, it recognized that considerable rehabilitation and improvement would be necessary if an economically viable port were to be developed. More importantly, additional improvements

would be required. Unable to accomplish these tasks itself, Newark negotiated the 1948 agreement, already mentioned, with the Port of New York Authority. By 1963 the Authority had spent more than \$73 million for necessary repairs and major improvements of the terminal. The channel has been dredged to a depth of 35 feet. Additional berths, storage warehouses, and other facilities have been provided. Of particular interest to thirsty Jerseymen was the construction of a bulk wine terminal in 1956; the next year the *Angelo Petri*, a wine tanker, inaugurated regular ocean service from California.

Port Newark and Elizabeth Port handle a wide variety of cargoes. They provide the leading point of entry for foreign automobiles, and they are the principal handlers of lumber on the east coast. They also provide the facilities for Sea-Land Services, which has established its east coast container-shipment terminal at Port Elizabeth.

While the Port of New York handles the greatest volume of ocean traffic in dollar terms, the Delaware River Port is the chief importing center in terms of tonnage, accounting for more than one-fourth of the total for the Nation. Petroleum, iron ore, sugar and molasses, lumber, and wood pulp make up the major commodities handled. Exports include coal, grain, petroleum products, and manufactured goods of all kinds.

From the head of navigation at Trenton to the Delaware capes, the Delaware River and Bay provide 135 miles of water highway. The river has an authorized channel of 40 feet in depth from Deepwater, at the Delaware Memorial Bridge, to the Fairless Steel Works and a 35-foot depth from there to Trenton. It is navigable throughout the year and tidal as far up as Trenton, although the tides average only five feet in range.

The many communities lining the river's banks form the Delaware Port. Of these the city of Philadelphia is the largest, providing over 30 miles of waterfront and handling the largest share of the general cargo traffic. New Jersey's Delaware ports include Camden, Gloucester,

Paulsboro, Trenton, Deepwater, and Burlington. The Delaware Port is located at the center of a major concentration of commerce, industry, and population on the Atlantic seaboard. It is served by a complete range of transportation facilities—railroad lines, truck services, airlines, and highways. The area is the largest petroleum refining center on the East coast and ranks second only to the Gulf Coast nationally. Seven major oil companies operate eight refineries in the area. Crude petroleum for these refineries at Paulsboro, Marcus Hook, and Delaware City is brought up the Delaware River by tanker. The major steel centers, the Fairless Works and those at Chester and Marcus Hook, depend upon iron ore brought from Venezuela. The chemical plants of Paulsboro, Wilmington, and Deepwater provide a variety of major waterfront industries. Sugar refining is associated with imported raw materials as is the papermaking industry. One job in ten in manufacturing and in wholesale and retail trade depends upon materials received through the port. In manufacturing alone, one job in five depends upon materials flowing through the port. Nearly 100 thousand workers in the area derive their income either directly or indirectly from port activity. These port-related jobs generate over half a billion dollars in wage and salary incomes each year.

Traffic of the Delaware River Port has shown rapid increase since the Second World War. In 1948 the port handled 57 million short tons of cargo; by 1960 the total exceeded 100 million tons. Foreign trade has shown the greatest increase. From less than 17 million short tons in 1948, the total of imports and exports has grown to over 47 million tons in 1960. The bulk of the increase has been contributed by crude petroleum, iron and other ores.

Both the Delaware and New York ports make significant direct and indirect contributions to the economy of the State. Cargo-handling, shipping, and associated activities provide important sources of employment and income to New Jersey residents. By attracting industries de-

pendent upon water-borne raw materials they make a further contribution. However, their major effects may well be less obvious. By calling forth transportation facilities that otherwise might not be available, they create a more favorable economic environment for all kinds of industry, thereby generating additional employment and income. It may well be in this indirect way that New Jersey's ports make their greatest contribution to the economic well-being of the State.

V

THE ROLE OF GOVERNMENT

THE PROVISION of transportation facilities was early recognized as central to American economic development, and the economic history of the nineteenth century is largely the story of the growth and impact of transportation facilities. A conspicuous feature of the internal-improvements movement in the ante-bellum period was the extent of government activity involved. Interstate rivalries and supposed constitutional limitation prevented the federal government from taking a part; hence the task fell largely to state and local governments. In the first half of the nineteenth century the vast majority of projects were carried out either by state governments directly or by private companies enjoying very considerable public aid. The most dramatic illustration is the case of New York State and the construction of the Erie Canal. This dependence upon state enterprise was a consequence of capital conditions in the underdeveloped economy of the United States at that time. Desperately short of capital, the United States nonetheless offered extremely attractive investment opportunities. Just as the underdeveloped nations today look to the United States for funds for their economic growth, so the United States in the early nineteenth century looked to Europe. However, since individual American entrepreneurs were unknown to European investors, only the securities of state governments or those backed by the credit of state governments were sure of finding a sale in European capital

markets. To tap the European capital markets government support was required. Hence most canals were built or financed by state governments.

This wave of canal construction, often called a "canal mania," resulted in overbuilding, overburdened state treasuries, and ultimately financial collapse of both private companies and state systems. Several states were forced to repudiate their internal improvements debt. Pennsylvania, Maryland, Indiana, and Illinois were all in default on their obligations at one time or another. Michigan repudiated part of its \$5-million loan. One consequence of this experience was a "revulsion" of public opinion against state and local participation in transportation enterprises. Henceforth throughout the nineteenth century initiative was to come from private rather than public sources, as in the case of the railroads. However, again as shown in the history of the railroads, this was not to deny public support for the projects. Another consequence was a wave of constitutional prohibitions of or severe restrictions against the incurring of state or local debt for the improvement of transportation facilities. These archaic limitations handicapped state and local governments later, when highway departments were denied access to the capital markets and thus forced to limit annual expenditures to current tax revenues. Piece-meal progress and construction of facilities was an inevitable result. The restrictions also forced resort to federal aid for support of highway construction. Of greatest importance, however, constitutional limitations on debt have forced state and local governments to resort to the subterfuge of the "authority" for the construction and operation of public transportation facilities.

The adoption of the authority device was not without precedent in New Jersey's experience. As early as the 1820's a quasi-governmental organization had been supported as the proper agency to build the Delaware & Raritan Canal. In order to secure the benefits of the canal to the State and yet avoid involving the State treasury directly, a bill brought before the Legislature called for the crea-

tion of a canal commission to undertake the work for the State. Funds for construction were to be provided through the sale of one million dollars of 5 per cent bonds secured by the property of the canal. Toll revenues over and above maintenance and operating costs were to be dedicated to the payment of interest and principal as were the proceeds of the State's tax on bank stock. Thus the canal was to be built by the State without recourse to taxation, other than the bank-stock tax already in effect, and without involving the credit of the State treasury.

The proposal had the endorsement of the governor and was approved by the Assembly with a comfortable margin, but failed passage by the upper house where the vote was seven to seven. Since a majority was lacking, the bill was not passed. Thus New Jersey failed to establish a Delaware & Raritan Canal "Authority" by only a single vote in the 1820's. It was not until one hundred years later that the authority became a significant instrument in New Jersey.

The principal authorities concerned with New Jersey transportation are the Port of New York Authority and the Delaware River Port Authority. The Port of New York Authority came as an outgrowth of years of friction between New Jersey and New York over control of New York Harbor, and the transportation jam which developed in the port during the First World War. The origins of the friction between the states reached back into the earliest years of American history. In the period after the Revolution, tensions erupted again when New York attempted to tax vessels from New Jersey as though they had sailed from a foreign market. New Jersey retaliated by seeking to tax a lighthouse on Sandy Hook owned by New York. Jersey tempers were not soothed by the claim of New York City to ownership of all waters of the Hudson River right up to the Jersey shoreline. The famous case of *Gibbons vs. Ogden* grew out of a grant of a steamboat monopoly by New York which denied New Jersey ferries access to New York City and

added further fuel to the fires. These incidents led to the formation of a compact between the states in 1834 which set forth the rights and obligations of each regarding the harbor. Hostilities were renewed in the early twentieth century with New Jersey's charge that the structure of railroad rates was discriminatory since the railroads absorbed lighterage charges. Denial of the claim by the Interstate Commerce Commission did not placate ruffled Jersey tempers.

During World War I, the Port of New York was the main staging area for personnel and materials en route to Britain and the European theater. The volume of freight and passenger traffic overwhelmed the facilities of the port. One of the principal bottlenecks was inadequate lighterage. The result was that shipments were delayed, freight was stacked up on the Jersey piers, and railroad cars jammed the railroad yards waiting to be unloaded. Responding to the crisis, the legislatures established the New York, New Jersey Port and Harbor Development Commission to make recommendations for solving the rail congestion problem. The report of the Commission, which was presented in 1920, constituted a most detailed study of the port and its operations and made recommendations which led to the formation of the Port of New York Authority.

In this report the Port and Harbor Development Commission urged creation of a permanent interstate agency responsible for the improvement of the port. The agency proposed was patterned after the Port of London Authority, which had been created in 1909 to deal with similar problems in that port. Creation of such an agency required a compact between the states and approval by the United States Congress. These requirements were met, and the Port of New York Authority came into existence on April 30, 1921. The Port District was established as the area within a 25-mile radius of the Statue of Liberty. Direction of the Authority was vested in six commissioners, three from each state, appointed by each governor and subject to confirmation by

each senate. Later the number of commissioners was increased to twelve. The commissioners serve without compensation.

The original draft of the compact gave the Authority regulatory powers as well as responsibility for the development of physical facilities and plans. The New York City Board of Estimate objected to the draft of the compact, holding that creation of the Authority should await adoption of a definitive plan and arguing also that the Board itself should constitute the New York membership. As a result of the Board's adamant opposition, the original compact was amended to remove the regulatory powers of the proposed Authority. This evisceration produced a much weaker Authority than the one envisioned by the Port Development Commission. The Authority was not to be the owner of the harbor facilities, nor could it enforce compliance of private or municipal interests with its plans. This became evident in 1928 when the Authority sought to force the New York Connecting Railroad to allow the New York Central to use the Hell Gate Bridge for the interchange of cars. The United States Supreme Court denied the Authority's case. Similarly, when the Jersey Central Railroad planned to replace its lift span at the lower end of Newark Bay, which would interfere with traffic on the Bay, the Supreme Court denied the Authority any jurisdiction in the case. The Authority was given responsibility for the development of the port but was denied the powers necessary to carry out that responsibility fully. This has restricted the operations of the Port of New York Authority to the provision of transportation facilities rather than the overall planning of port development originally envisioned for it.

Preparation of a comprehensive plan for port development was the first major task undertaken by the Authority. A plan submitted in 1922 was essentially that of the Harbor Development Commission and was primarily concerned with improvement of rail services to the port. The Commission had seen the fragmentation of terminal

facilities as the principal obstacle to more efficient operation. Each road maintained its own terminals for both freight and passenger service, provided its own lighterage service, and refused to cooperate with other roads. The Commission had regarded the unification of rail facilities as its major task. The central feature of the comprehensive plan was the creation of a beltline railroad to tie together the railroad facilities. Much of the track for the belt was already in existence. The principal new ingredient was a 5-mile, double-track tunnel under New York Bay, which would link the extensive yards and terminals in Jersey City with the Long Island Railway in Brooklyn. The belt line would describe a huge U. Starting on the Hudson River at Spuyten Duyvil and following the Harlem River, it would cross the East River to Long Island via the Hell Gate Bridge. The tracks of the Long Island Railroad would carry the line to Bay Ridge where it would enter the proposed tunnel to Jersey City. Extensions over existing tracks would carry it north and south to connections with all New Jersey railroads and into Staten Island. This would have provided an all-rail connection between the railroads serving the port and would have provided an alternative to lighterage and car-ferry operations. The beltline tunnel was opposed by the City of New York which had its own project for a rail tunnel under the Narrows. When the roads themselves refused to cooperate, the beltline project was abandoned, since the Authority could not enforce its plan.

Frustrated by the refusal of the railroad companies to cooperate in the comprehensive plan, the Authority turned its attention to the improvement of vehicular transportation facilities. This emphasis upon non-rail facilities was reinforced by the profitable operation of its river crossings.

Financially the Port Authority was on its own. It was given no taxing powers, nor could it rely on the credit of the state treasuries. Thus the Authority had to compete in the marketplace for whatever capital funds it

needed to undertake its projects. In the early years, each project was regarded as a separate entity. Bond issues were individually secured by a pledge of the revenues to be anticipated from the project. In 1931 the Authority was allowed to pool surplus revenues in a general reserve. This enabled it to refund its varied issues into a single consolidated obligation.

The ability to borrow against the security of its overall revenues removed the constraint of undertaking only those projects which were financially viable. Allowing for risk, an investor will invest in those projects which offer the best profit prospects and will avoid projects which do not provide the prospect of profitable operations. However, this choice does not apply where the revenues of existing projects are used to secure the bonds of new projects, and hence these new projects do not have to meet the test of the market. Thus the evaluation of the desirability of particular projects is shifted from the impersonal forces of the marketplace to the personal opinions of the management of the Authority. The Authority may resist pressure to assist commuter railroads because in its judgment such facilities can never become self-supporting. However, it may continue to subsidize air terminals in the expectation that these may at some future time become profitable facilities. Serious misallocations of scarce capital may result thereby.

Under the provisions of the compact, control of the actions of the Authority is vested in the governors of the two states. This control is regarded as ineffective at best. Either governor has the right to veto the minutes of the Commission's meetings, but this veto must be exercised within ten days. An action which may have been under study by the Authority for several years must be reviewed and acted upon by the governors in a matter of days. In fact, both governors have established liaison with the Authority in an attempt to keep informed on the Commissioners' proposals. However, much of the work of the Commission is accomplished in subcommittees over which the governors have no review. The result has been

that no major action has been vetoed by a governor. Of course the basic compact is subject to legislative review, but, short of this, the Authority is virtually free to take whatever action it wishes.*

The Delaware River Port Authority had its origins over a hundred years ago in plans to build a bridge across the lower Delaware River. The Trenton-Delaware Bridge farther north, completed in 1806, had stimulated repeated attempts during the nineteenth century to construct a bridge from Camden to Philadelphia. The goal appeared in sight when New Jersey formed the Delaware River Bridge and Tunnel Commission in 1916. As a result of pressure generated by advocates of a bridge, Pennsylvania formed a commission in 1917 to work on the project. Later New Jersey created a new body to serve as an extension of the State Highway Department: the Interstate Bridge and Tunnel Commission. Finally, in 1919, both states adopted uniform laws establishing the Delaware River Bridge Joint Commission. This was the agency which built and operated the Delaware River Bridge, completed in 1926.

The Commission's only concern for a quarter-century was the Delaware River Bridge. In 1931, the states reorganized the Joint Commission. The new compacts gave the Commission greater freedom of financing and greater responsibilities. Under this enlarged mandate railroad lines were added to the bridge, and rapid-transit lines connecting Camden with downtown Philadelphia were constructed. As a response to increased traffic demands, the bridge was widened, but after World War II it became apparent that additional crossing facilities were required. It was also obvious that the commission form of organization was inadequate to cope with the increasing problems of commerce in the Delaware Port

* A recent study by Robert G. Smith of Drew University examines the function and proliferation of the authority device in the United States with particular reference to New Jersey. See *Public Authorities, Special Districts, and Local Governments*, Washington, D. C., National Association of Counties, 1964.

area. Accordingly, recourse to an authority was urged to build a second bridge and to aid in the development of the port.

The Delaware River Port Authority was formed to succeed the Delaware River Joint Commission in July, 1952. Where the Commission's purpose had been to co-ordinate transportation on and over the river in the Philadelphia-Camden area, the Authority's powers and responsibilities were greatly expanded. The port district was increased to encompass the counties of Philadelphia and Delaware in Pennsylvania and the counties of Camden, Burlington, Gloucester, Salem, Cumberland, Cape May, Atlantic, and Ocean in New Jersey. Organized very much like the Port of New York Authority, the Delaware River Port Authority is composed of sixteen members—eight from each state. It has no powers of taxation, but is permitted to employ the revenues from its river crossings in the construction or the development and improvement of port facilities and for the promotion of the Delaware River Port.

The Authority's principal construction projects have been the Walt Whitman Bridge completed in 1957 and a program of improvement in conjunction with the Pennsylvania Railroad at the Broadway Terminal in Camden to facilitate transfer of passengers to and from rapid transit lines and the railroad. In 1954 the Authority initiated an extensive survey of the needs for mass transportation systems in the Camden area and for connections with central Philadelphia. This study resulted in proposals for a Southern New Jersey Rapid Transit System from downtown Philadelphia to Kirkwood, New Jersey, and for two new bridges: one from Chester, Pennsylvania, to Bridgeport, New Jersey, and another from northern Philadelphia to Delair, New Jersey.

Unlike the Port of New York Authority, the Delaware River Authority does not own or operate terminal facilities in its port activities. However, through its port development division it seeks to promote the commerce of the port. It is active in studying and making recom-

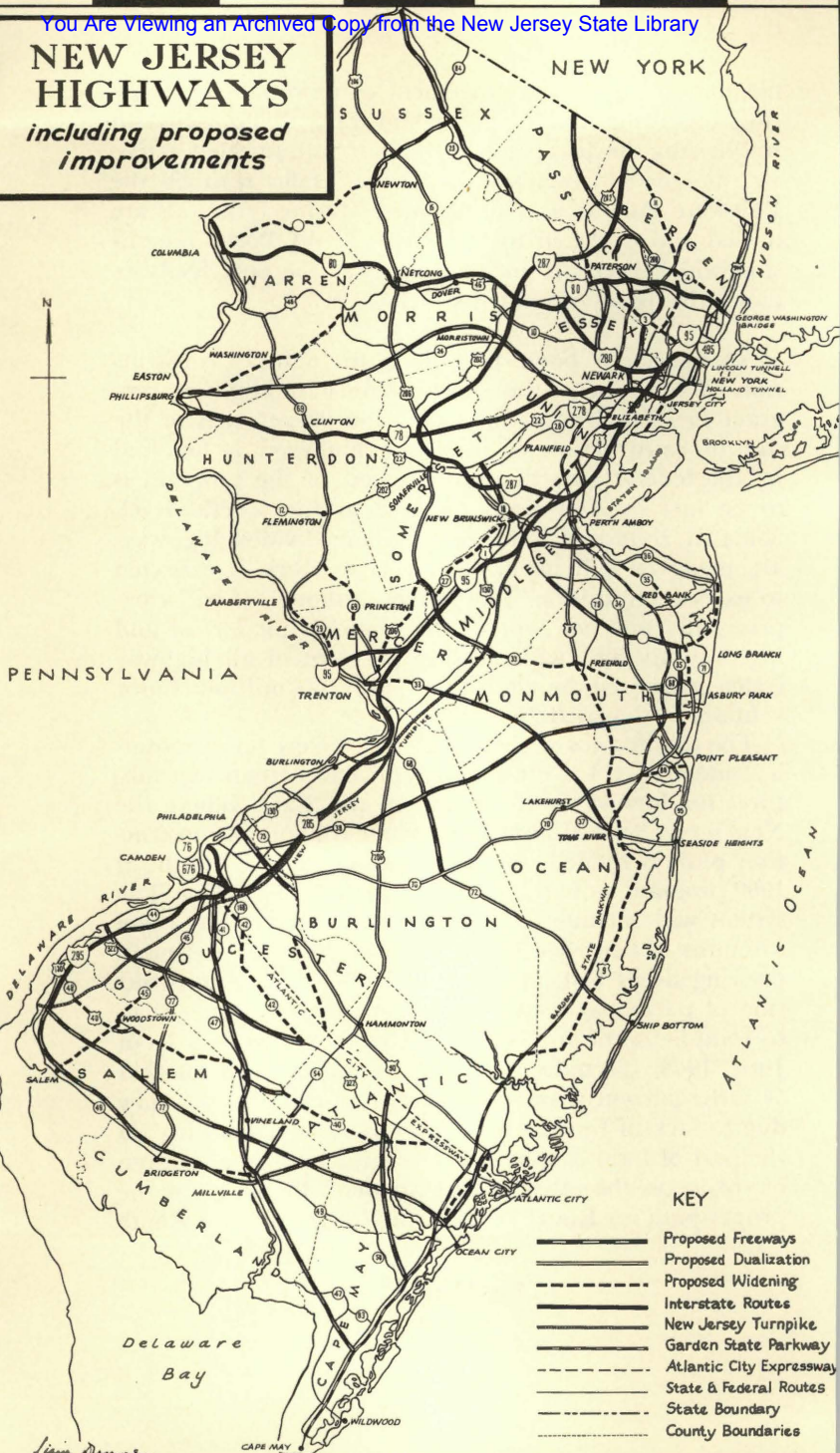
mendations for the improvement of terminals, in litigation regarding freight rates and rate differentials, in publicizing the advantage of the port, and in other activities designed to increase the flow of traffic through the Delaware Port area. The Camden Marine terminals are owned and operated by the South Jersey Port Commission which exercises jurisdiction over the port facilities along the Jersey side of the Delaware.

An enormous boost was given to highway construction by adoption of the Federal Interstate Highway program in 1956. Under this legislation 90 per cent of the cost of construction of interstate highways is financed by the federal government. The cost of the program is to be met by user taxes imposed at the federal level. Some 41 thousand miles of four-lane divided highways are being or will be built at a cost which is expected to exceed \$40 billion. The system, although it will comprise only one per cent of the Nation's total road and highway mileage, will carry 20 per cent of all highway traffic generated by the more than 100 million motor vehicles anticipated by 1965.

The significance of this program for New Jersey motorists and truckers is indicated by its effect upon expenditures for highway construction in the State. Where the New Jersey State Highway Department's annual construction outlays totaled only \$25 million in 1955, its fiscal 1960 program amounted to more than \$144 million. The system will include eight major freeways totaling some 376 miles of new road in the State. In order to meet more pressing needs first, priority has been given to construction of particular sections of these freeways rather than to completion of any single road from end to end. As of June, 1963, 128 miles had been completed with another 34 miles currently under construction. Progress was slow due to lack of funds, on the one hand, and inability on the part of local communities to agree upon the location of roads, on the other. The extended discussions of the proper path for Route 78 through Newark and for Route

NEW JERSEY HIGHWAYS

*including proposed
improvements*



287 through Morristown are cases in point. It is expected that the interstate system will be completed by 1970.

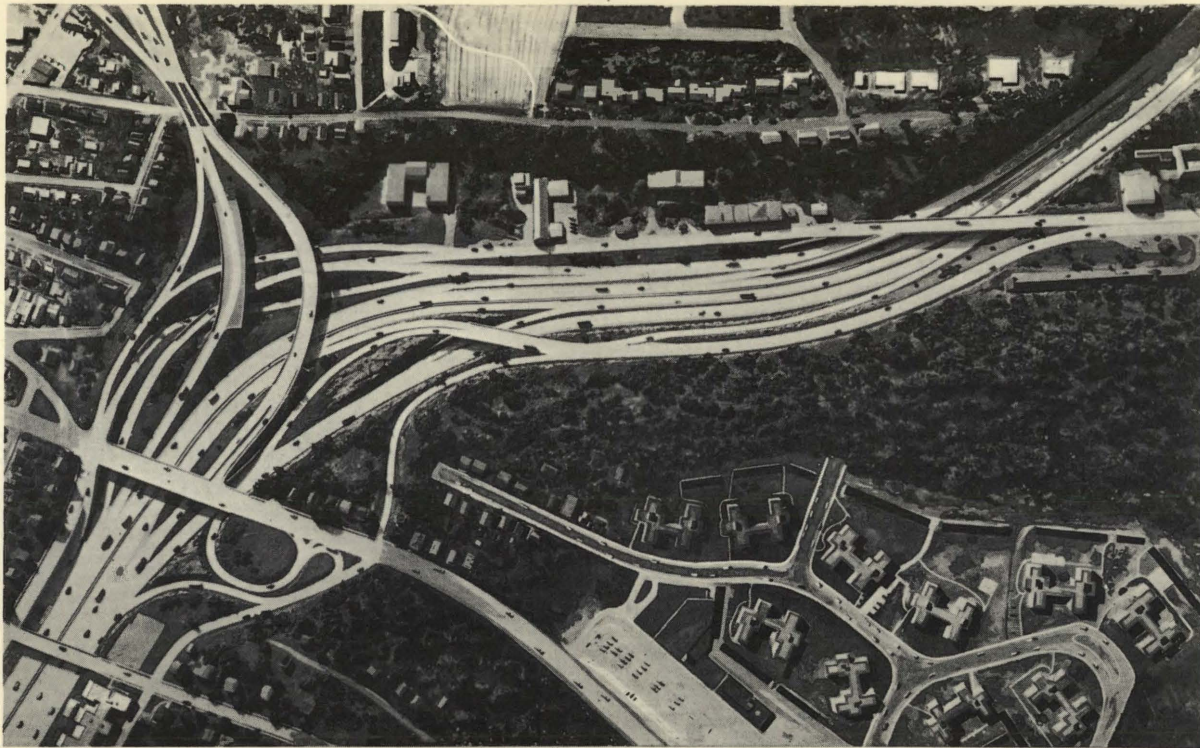
Five of the interstate routes will extend for 20 miles or more.* Route 78 will run 66 miles from the Holland Tunnel via the Newark Bay Extension of the Jersey Turnpike to Phillipsburg using a portion of present Route 22 in rural areas, but bringing it up to interstate standards. Route 80 will extend 68 miles across the State from the New Jersey Turnpike at Ridgefield Park to the Delaware Water Gap. The portion in Bergen and Essex counties is referred to as the Bergen-Passaic Expressway. Route 95 will utilize a portion of the present Jersey Turnpike in extending 71 miles from the George Washington Bridge to the Delaware River just above Trenton. Route 287 will describe a loop from the Jersey Turnpike west into Somerset County and then north, roughly paralleling the present Route 202 to the New York State line near Mahwah. The portion of this road within Middlesex County is to be called the Middlesex East-West Freeway. Route 295 will parallel the New Jersey Turnpike from the Delaware Memorial Bridge 68 miles north to the proposed Route 95 in Lawrence Township, north of Trenton.

In addition to the 376 miles of interstate highway, the State plans another 530 miles of major highway construction. The principal roads are: the Route 24 Freeway running west from the proposed Interstate 78 in Springfield to the Delaware River at Phillipsburg; Route 60 from Deepwater to Somers Point in Salem, Cumberland, and Atlantic counties; Route 56 from Deepwater to Mays Landing; and Route 55 from Westville to Swainton in Gloucester, Cumberland, and Cape May counties.** Since the maximum share of the federal government in non-interstate highways is 50 per cent, a mile of such construction imposes a greater cost on the State than does the interstate program. In addition, an extensive pro-

* See map on page 116 for the location of these routes.

** See map on page 116 for the details of these routes.

You Are Viewing an Archived Copy from the New Jersey State Library



Proposed Interstate 95 Interchange with Routes 4, 1, 9, 46
Courtesy of New Jersey State Highway Department

gram of widening, dualization, resurfacing, installation of overpasses, ramps, jug handles, barrier curbs, etc., is planned.

A third highway authority was created in February, 1962, with the establishment of the New Jersey Expressway Authority. This legislation authorized the construction of two turnpikes: the Atlantic City Expressway and the Cape May Expressway. The first will extend from the southern end of the North-South Freeway in Camden County some 39 miles east to Atlantic City. The Cape May Expressway will provide a spur from the proposed Atlantic City Expressway at Hammonton south to the Garden State Parkway at Seaville in Cape May County. Both of these highways will be financed by bond issues to be repaid by tolls charged users of the roads.

It was expected that the federal highway program would sound the death knell for turnpike construction and, indeed, turnpike bonds appear to have declined in price with the adoption of the program, particularly where an existing turnpike was faced with the prospect of a parallel federal highway. Since 1956 few new turnpikes have been authorized. In recent years, however, the toll road has returned to favor and plans are under way for the construction of a number of such highways. The Atlantic City Expressway provides an example in the State of New Jersey.

The federal program reflects a transformation in the philosophy of highway planning and location. In the past, the aim of the highway planner was to so locate the road that it would by-pass urban centers, thus taking the through traffic off the busy city streets. Links between downtown traffic centers and the highway in the open country were provided over local roads or by separate highway projects. Streets designed to handle local suburban traffic found themselves engulfed by cars, trucks, and buses seeking passage between the downtown center and the open highway. Moreover, unless meticulously zoned, the margins of those streets quickly degenerated into a hodgepodge of used car lots, roadhouses, diners,

and junkyards. As with the familiar complaint about air travel, that it takes longer to drive to the airport than it does to fly to the destination, it took longer to get out to the highway along the jammed city streets than it did to get to the destination. To mitigate this congestion it was necessary to build access highways from traffic centers to the peripheral highways.

The current philosophy favors building the highway through the heart of the city or town, relying upon grade separation and infrequent access ramps to isolate the highway from local traffic. Although this increases the cost, particularly of land acquisition, it removes the need of providing linking highways, minimizes the time spent getting to the highways, and, with limited access, eliminates the honky-tonk growth along the right of way.

Passage of the Federal Transportation Act of 1958 precipitated a crisis in New Jersey's commuter situation. The new law gave the Interstate Commerce Commission greater freedom in allowing railroads to abandon passenger service. Citing their heavy losses on commuter service, a number of New Jersey railroads petitioned for elimination of or massive reductions in commuter service. These threatened cuts in rail service would have placed an intolerable burden on alternative commutation facilities. In response to the crisis, the Legislature created the Division of Railroad Transportation in the State Highway Department. Its immediate task was to insure the continuance of commuter service. Its longer-range objectives are to seek a permanent solution to the commuter problem. To preserve essential rail service, the Division contracted with the commuter railroads to continue passenger operations on a year-to-year basis. Annual payments amounted to \$6 million and came out of Highway Department funds. This, however, is rightly regarded as a stopgap measure; a permanent solution to the commuter problem is yet to be reached.

The Highway Department's plans for meeting the rail commuter problem involve the elimination of some por-

tions of line, consolidation of others, and rehabilitation of the remaining lines. It has laid out a program for the rehabilitation of two of New Jersey's major commuter systems, the Central Railroad of New Jersey and the Erie-Lackawanna.

The major innovation recommended for the Jersey Central was that mainline passenger service be operated into Newark rather than to the present terminal in Jersey City. Under this plan trains are to be routed over Lehigh Valley and Pennsylvania Railroad tracks to Pennsylvania Station in Newark. From Newark, passengers could continue on to midtown New York on the main line of the Pennsylvania or take Hudson and Manhattan trains to the downtown or 33rd street terminals. Also, passenger service from the Jersey Shore currently provided by both the Jersey Central and the Pennsylvania is to be consolidated under the Pennsylvania. These changes would involve little new construction, but would afford improved service for passengers and would allow reduction of the Jersey Central's passenger deficit. Implementation would depend upon the rehabilitation of the Hudson and Manhattan service.

These changes are to be combined with a general improvement of rolling stock, stations, and schedules. The entire fleet of obsolete passenger cars is to be replaced with new, air-conditioned coaches of modern design. Stations on the Jersey Central are too close together for efficient scheduling of trains, so some stations are to be eliminated; those remaining will be provided with adequate parking facilities. New equipment and fewer stops will cut running time and allow for more frequent service during the peak hours as well as during non-rush hours. These programs for the improvement of the Jersey Central are expected to require less than three million dollars, excluding the cost of new rolling stock.

Consolidation of shore service under the Pennsylvania calls for the extension of electrification to Bay Head Terminal and elimination and relocation of some stations. At present, time is lost due to the changeover from

Diesel to electric locomotives. Electric service allows faster schedules and greater flexibility in equipment use. It is hoped that the relocation of passenger stations from congested downtown areas to locations affording ample parking space would make the new service more attractive to commuters who use their automobiles to reach the station. Accomplishing these changes will cost about \$14 million.

Changes proposed for the Erie-Lackawanna involve the elimination of parallel service primarily. Electrification of heavily traveled portions of the system would improve efficiency and service. Provision of additional parking facilities and the closing of little-used stations will, it is hoped, make the service more attractive. These innovations are expected to cost \$25 million. The cost of the entire program, together with the purchase of modern air-conditioned cars, will amount to \$126 million.

The rehabilitation and expansion of the Hudson and Manhattan Tubes are necessary conditions for the accomplishment of the Highway Department's program for the renaissance of the New Jersey commuter railroads. Terminating Jersey Central commuter runs in Newark will throw an increased burden on the Tube's facilities, as will re-routing shore service into Newark. The success of these innovations depends upon greater capacity and improved service by the Hudson Tubes.

If the Hudson and Manhattan were to provide improved transportation service to commuters, some financial assistance would be essential. Unfortunately, the road did not qualify for assistance from the program of financial aid of either state. New Jersey State Highway Commissioner Dwight Palmer urged that the Port of New York Authority take it over. The Authority, however, was reluctant to become involved in a deficit operation, which offered little prospect of paying its way even after massive investment in facilities and rolling stock and which might compromise the Authority's credit position and restrict its borrowing capacity for future projects. The Authority was interested, though, in plans for a World

Trade Center in downtown New York. An accommodation worked out by the governors of the states of New York and New Jersey allowed the Authority to proceed with the World Trade Center and to undertake the reconstruction of the Hudson and Manhattan Tubes without impairing Authority credit. The Authority set up a subsidiary corporation, the Port Authority Trans-Hudson Corporation (PATH) which took title to the railroad in September, 1962.

The Authority proposed a three-stage plan for the rehabilitation of the Hudson Tubes. The first stage was an immediate housecleaning of cars and properties. Then would come a virtually complete reconstruction of the road—new rolling stock, renovation of stations, new track, roadbed, and signal system. Over a period of three to four years 250 new air-conditioned, high-speed cars will replace the 1908 rolling stock. New maintenance facilities and car shops will be built to assure improved maintenance for the new equipment. Although these intentions have been delayed by law suits, a few Hudson Tube commuters are considering staying in Jersey after all. Finally, the Authority plans a long-term program of extension and improvement, involving new terminal facilities and improved connections with New Jersey commuter railroads.

Under the plans for the development of a World Trade Center on the site of the present Hudson Terminal in downtown New York, the fifty-three-year-old buildings would be removed. This would provide an opportunity for a complete reconstruction of the terminal. The present terminal cramps the operations of the railroad. Extremely sharp curves and short loading platforms limit capacity. Elimination of these bottlenecks and the provision of additional loading platforms would greatly improve tube service, particularly at rush hours.

PATH also proposes to develop a new transportation center in Journal Square that will encompass not only a new Tube station, but also a bus terminal and parking facilities. By straightening tracks and lengthening plat-

forms, longer trains can be accommodated and more efficient operations performed. A bus terminal would remove many of the buses now clogging the streets in the area.

A major transfer station is proposed at Harrison to provide interchange between the Erie-Lackawanna, the main line of the Pennsylvania, and an extension of the Tube. The transfer station would take advantage of the adjacent location of Erie-Lackawanna and Pennsylvania tracks and would require little relocation or connection of track. Passengers approaching New York on the Erie-Lackawanna would be able to transfer to either the Hudson and Manhattan to the downtown area or 33rd Street, or to the Pennsylvania's mainline service to Penn Station in New York. The latter would be particularly advantageous for the Jersey commuter bound for midtown. The transfer station would be the terminus for all suburban service on the Morris and Essex Division, the Montclair line, and the Greenwood Lake line of the Erie-Lackawanna. Through trains would continue on to the present Hoboken terminal.

A similar transfer station is proposed for the point in Secaucus where the tracks of the Boonton line of the Erie-Lackawanna pass under the main line of the Pennsylvania. An extension of the Hudson and Manhattan would be pushed out along the existing tracks of the Erie-Lackawanna to that point. This would require the junction of the Tube with the tracks of the Erie-Lackawanna in Hoboken and use of the present tunnel through the Palisades.

Adoption of these plans would improve the flexibility and convenience of commuter service to New York. Virtually all New Jersey rail commuters would have the option of transferring to high-speed service on the Pennsylvania main line to midtown or of taking the air-conditioned up-to-date PATH trains to the downtown or 33rd Street stations. Significant reductions in commuter time are envisioned. The opportunity to transfer to the Pennsylvania at Newark would lop 20 minutes off the

Westfield commuters' trip to midtown New York. The Madison commuter could save 10 minutes on his trip by transferring to the Pennsylvania at Harrison. Hopefully, the increased speed, convenience, and comfort would attract present automobile commuters back to the rails and, of greater importance, stimulate rail travel in off-peak hours as well.

It had been obvious for a number of years that the public transit facilities between the Camden suburbs and downtown Philadelphia were inadequate to meet current needs, quite apart from being able to serve the volume of traffic anticipated for the future. Since 1947 although total Delaware River passenger crossings had increased by 20 per cent, use of rail and bus service had declined. The result was that the bridges were dumping a constantly increasing number of automobiles on Philadelphia streets. Numerous studies were undertaken which recommended creation of a transit system which would provide rapid, convenient, and comfortable alternatives to highway travel. In 1956 consultants to the Delaware River Port Authority recommended construction of a rail system which would pass under the Delaware River by means of a tunnel. The costs of this project appeared prohibitive. Another study reduced these costs by taking advantage of the existing tracks on the Benjamin Franklin Bridge and the present subway connections in Philadelphia.

The proposed rapid transit line would connect downtown Philadelphia and Kirkwood, New Jersey, following the existing Bridge-Line to Camden and then using the right-of-way of the Pennsylvania-Reading Seashore Lines to Kirkwood. The area to be served by the proposed line has a high population density as far as Haddonfield and the prospect of rapid growth to the south and east of that town. Without improved public transportation connections to Philadelphia, it appears that the potential of this area cannot be realized.

The plan calls for high-speed cars with seats for from 80 to 85 passengers, modern lighting, air conditioning,

power for quick acceleration and deceleration, and a top speed of 65 miles per hour. Incorporation of the most up-to-date signaling and communication equipment would insure maximum operating safety. Stations would be designed to be both attractive and functional with escalators for all upward movements. Spacious free parking areas would be provided to encourage commuter usage. The scheduled time from Kirkwood to downtown Philadelphia would be 22 minutes. The system would cost about \$50 million, or the equivalent of about eight miles of superhighway. The Kirkwood line is expected to be the first in a system which would fan out across South Jersey. Hopefully, such a system would reverse the trend toward increased auto use and relieve the traffic strangulation of downtown Philadelphia.

Possibly the most important development in New Jersey transportation since the formation of the Port of New York Authority in 1921 was the creation of the Tri-state Transportation Committee by New Jersey, New York, and Connecticut in 1961. The temporary committee is now in the process of being converted into a permanent commission. Its membership includes officials drawn from the three states, from New York City, and from interested federal agencies. The tri-state organization would not be just another committee whose recommendations would follow those of its many predecessors into the inactive files; it would have responsibility, control of funds, and authority to act. Unlike the Port of New York Authority, the committee would have the power to enforce its planning decisions. Enabling legislation would permit it, with specific approval of each legislature, to lease, purchase, or take by condemnation any transportation facilities it deems necessary. However, it would not have the power to finance its acquisitions with bond issues. Its finances would be derived from pooling public funds for highway construction, railroad assistance, and transportation planning. Currently, these would provide about \$12 million a year.

The temporary committee sees its first task as one of

gathering data upon which plans can be based. A detailed aerial-photo map has been completed, showing every building in the region surveyed and providing a basis for land-use planning. An inventory of rail passenger cars represented the first stage in a survey of all transportation facilities in the region. An analysis of traffic patterns is currently underway to develop a statistical picture of the millions of movements of people and vehicles taking place on a typical working day. These data would be used as a basis for projecting traffic volumes over the coming decade. These projections would in turn determine the basic development plan for the region's transportation facilities of the future.

The tri-state committee accepted responsibility for the various state efforts to aid the commuter railroads and has undertaken projects to improve commuter service. One project already underway will seek to determine whether a modern passenger station with adequate parking facilities will generate increased rail usage. A new station has been built on the main line of the Pennsylvania Railroad just outside of New Brunswick, supplementing the present station. Another experiment will increase express train service on the New York Central's Harlem Division in Westchester and Putnam counties and will provide additional parking and coordinated bus service in an effort to demonstrate that fast, frequent service backed by parking facilities and bus connections can recover off-peak and commuter traffic. Other experiments will seek to determine the value of feeder and express bus service in the Rockland County area.

The committee's concern has not been exclusively for the movement of people, however. Its initial recommendations for the solution of the rail freight problem in the New York Port area revert to the beltline principle first suggested by the Harbor Commission in 1922. Lighterage and car-ferry operations would be consolidated into one or more terminals. In terms of the handling of rail freight, the New York Port is about where it was forty years ago.

Promising though the many plans appear to be, it must be acknowledged that no significant progress has been made in dealing with either of the two major transportation problems facing New Jersey: no real long-term solution to the problem of the commuter railroads has yet been achieved, and the movement of rail freight within the New York Port continues to employ the costly lighterage method.

In recent years there appears to be increasing recognition that the solution to the State's transportation problems rests with mass transit rather than with the endless expansion of highway, river crossing, and parking facilities. This awareness is more apparent in the treatment of the problem of moving people than in the case of moving freight. Efforts to restore rail transit systems are under way in both the New York and Philadelphia metropolitan areas. Similar efforts must be undertaken to restore the rail handling of freight. The present railroad system suffers from excess capacity; the highway system is choked to the point of strangulation. Diversion of freight traffic from over-crowded roads to under-utilized rails would provide the least expensive solution to New Jersey's transportation problem in the automobile age.

BIBLIOGRAPHICAL NOTE

This note is confined to materials treating transportation in New Jersey in the period following the First World War. No comprehensive study of transportation or of major segments of the transportation industries in the State has been published as yet. Thus the would-be transportation history researcher is very much at the mercy of the *New York Times Index* and the files of the *Newark Evening News* and, indeed, these were the principal sources for this volume.

The definitive study of the forces determining industrial and demographic location is that of Edgar M. Hoover, *The Location of Economic Activity* (New York, 1948). Of particular interest to New Jerseymen are Benjamin Chinitz, *Freight and the Metropolis* (Cambridge, 1960) which discusses the role of freight movements in location, and John I. Griffin, *Industrial Location in the New York Area* (New York, 1956). An overall view of the transportation industries in the State may be obtained from Salomon J. Flink, *The Economy of New Jersey* (New Brunswick, 1958), and from the "Transportation Issue" (XIV, 1) of *Jersey Plans*, the quarterly publication of the State Department of Conservation and Economic Development. The significance of New Jersey's role as a "corridor state" for the economy of the New York metropolitan area is detailed in D. Alfred Jenney, *Report on the Acute Transportation Problem Existing Between Northeastern New Jersey and the City of New York* (Trenton, 1951).

A quantitative view of the railroads' role in both freight and passenger transportation is presented in the Association of American Railroads, Bureau of Railroad Economics, *Railroad Transportation: a Statistical Record* (Washington, issued biennially) and in the Eastern Railroad Presidents' Conference, *Yearbook of Railroad Information* (Jersey City, issued annually). The economic situation of the railroads in the northeastern part of the United States is set forth in the Eastern Railroad Presidents' Conference, *Eastern Railroad Problems: The Serious Situation and its Causes* (Jersey City, 1962). The commuter problem is concisely summarized in *Commuter Transportation: A Study of Passenger Transportation in the New Jersey-New York-Connecticut Metropolitan Region with Particular Reference to Railroad Commutation*, a report of the Committee on Interstate and Foreign Commerce, United States Senate (Washington, 1961). Two publications of the Division of Railroad Transportation of the New Jersey State Highway Department highlight the commuter problem in New Jersey: *Will We Emerge?* (Trenton, 1962) and *New Jersey's Rail Transportation Problem*, (Trenton, 1960). No discussion of railroads in the Garden State would be complete without mention of John T. Cunningham's delightful *Railroading in New Jersey*, a series of 17 articles written for the magazine of the *Newark Sunday News* in 1951 and published by the Associated Railroads of New Jersey.

A brief history of New Jersey's highways is presented in *Development of the State Highway System* of the Bureau of Public Information, New Jersey State Highway Department (Trenton, 1960) and in *Highways: a Review of the New Jersey State Highway Department* (Trenton, 1961). The role of the State government in the highway system is set forth by Sidney Goldman and Thomas J. Groves, *The Organization and Administration of the New Jersey State Highway Department* (Trenton, 1942). The New Jersey Turnpike is thoroughly described in "New Jersey Turnpike: Tomorrow's Highway Built Today," a series of 13 articles on a variety of aspects of

the toll road in *Civil Engineering*, XXII, No. 1. The annual reports of the New Jersey Turnpike Authority and of the New Jersey Highway Authority provide further information on New Jersey's two major toll roads. The annual reports and other publications of the Port of New York Authority and of the other responsible agencies are helpful regarding the various river crossings.

The story of the airplane in New Jersey remains to be told as does that of the pipeline. Here the researcher is very much dependent upon newspaper and periodical files. John I. Griffin's *The Port of New York* (New York, 1959) provides an excellent description and analysis of New Jersey's Hudson River Port. No comparable study has been made of the Delaware Port. An account of the development of both can be pieced together from the reports of the Authorities concerned.

The Port of New York Authority is described in Erwin W. Bard's book of that title (New York, 1942) and in Frederick L. Bird, *A Study of the Port of New York Authority* (New York, 1949). The student should also consult the very detailed *A Selected Bibliography of the Port of New York Authority, 1921-1962*, published by the Port Authority, as well as the annual reports of the Authority itself.

INDEX

- Aeronautical Club of New Jersey, 90
Air freight, 94-95
Alexander Hamilton Bridge, 74
Algonquin Transmission Company, 97
Alpine, 77
American Automobile Association, 56
American Locomotive Co., 45
Angelo Petri, 103
Appalachian Mountains, 4
Arthur Kill, 29, 102
Atlantic City, 25, 85, 94, 119
Atlantic City and Shore Railroad, 85
Atlantic City Expressway, 119
Atlantic County, 114, 116

Baldwin Locomotive Works, 46
Baltimore and Ohio Railroad, 50
Bayonne, 24, 25, 96, 101, 102
Beltline railroad, 111, 127
Benjamin Franklin Bridge, 70, 78, 113, 125
Bergen County, 29, 116
Bergen-Passaic Expressway, 116

Big Inch, 96
Birmingham Southern Railroad, 46
Boonton, 9
Bound Brook, 25, 29
Bremen, 89
Bridge-Line, *see* Philadelphia Transportation Company
Bridgeport, 114
Bridgeton, 25
Bridgeton and Millville Railroad, 85
Buckeye Pipe Company, 97, 98
Bureau of Public Roads, 57
Burlington, 14, 42, 104
Burlington-Bristol Bridge, 78
Burlington County, 114
Burlington County Bridge Commission, 78

Camden, 6, 25, 59, 70, 78, 81, 85, 97, 103, 113, 114, 125
Camden and Amboy Railroad, 48
Camden County, 114, 119
Camden Marine Terminals, 115
Camp Merritt, 81
"Canal Mania," 107
Cape May, 25, 64, 66

- Cape May County, 114, 116, 119
 Cape May Expressway, 119
Catskill, 77
 Central Railroad of New Jersey, 24, 25, 36, 37, 45, 46, 51, 102, 110, 121, 122
 Chesapeake Bay Bridge-Tunnel, 79
 Chester, Penna., 104, 114
 Civil Aeronautics Authority, 92
 Colonial Pipeline Company, 98
 "Corridor State," 24
 Cross-Bronx Expressway, 74
 Cumberland County, 114, 116

 Deepwater, 104, 116
 Delair, 114
 Delaware and Raritan Canal, 7, 107
 Delaware City, 104
 Delaware, Lackawanna and Western Railroad, 25, 35, 37, 38, 42, 46, 51, 52
 Delaware Memorial Bridge, 63, 78-79, 116
 Delaware Port, 103-105, 114
 Delaware River, 4, 25, 29, 43, 67, 70, 78, 89, 97, 98, 104, 113, 115, 116, 125
 Delaware River Bridge, *see* Benjamin Franklin Bridge
 Delaware River Bridge and Tunnel Commission, 113
 Delaware River Bridge Joint Commission, 113, 114
 Delaware River Port Authority, 108, 113-115, 125
 Delaware River Turnpike Bridge, 78
 Delaware Water Gap, 25, 116
 Denville, 25
 Division of Railroad Transportation, *see* N. J. Highway Dept.
 Dover, 6, 9, 43
 Driscoll, Alfred E., 62

 East Orange, 81
 East River, 77, 111
 Easton and Washington Traction Company, 85
 Edge, Walter E., 59
 Edgewater, 77, 101
 Elizabeth, 24, 85
 Elizabeth Port, 102, 103
 Elizabethtown, 14
 Englewood, 76
 Erie Canal, 15, 99, 106
 Erie-Lackawanna Railroad, 34, 47, 50, 102, 121, 122, 124
 Erie Railroad, 25, 37, 52
 Essex County, 116

 Fairless Works of United States Steel, 9, 104
 "Fast Line," *see* Public Service Coordinated Transport
 Federal Aviation Agency, 93
 Federal [Highway] Aid Act, 57, 59
 Federal Highway Act, 57
 Federal Interstate Highway Program, 115-120
 Floyd Bennett Field, 91
 Fort Lee, 70, 71

 "Garden State," 10
 Garden State Parkway, 62, 64-67, 119
 General Electric Co., 45
 George Washington Bridge, 63, 71-74, 79, 101, 116
 Gibbons vs. Ogden, 51, 108

- Gloucester, 103
 Gloucester County, 114, 116
 Governor's Island, 77
Graf Zeppelin, 90
 Great Egg Harbor Bay, 66

 Hackensack River, 61
 Haddonfield, 125
 Hadley Field, 90
 Hammonton, 119
 Hampton, 46
 Harborside Terminal, 102
 Harlem River, 74, 111
 Harrison, 124, 125
 Hell Gate Bridge, 110, 111
 Henry Hudson Parkway, 74
 Hillside, 25
 Hoboken, 25, 43, 101, 124
 Holland, Clifford M., 68
 Holland Tunnel, 39, 61, 68-70, 75, 79, 87, 90, 116
 Hudson and Manhattan Railroad Company, 38-40, 41, 121, 122, 123, 124
 Hudson County, 63
 Hudson River, 25, 29, 36, 44, 67, 68, 69, 76, 77, 78, 89, 97, 98, 99, 101, 108, 111
 Hudson River Bridge, *see* George Washington Bridge
 Hudson Terminal, 123

 Ingersoll Rand Co., 45
 Interstate Commerce Act, 51
 Interstate Commerce Commission, 40, 47, 51, 55, 109, 120
 Irvington, 50

 Jackson, Andrew, 57
 Jersey City, 7, 10, 24, 29, 38, 39, 46, 48, 52, 61, 84, 85, 101, 111, 121

 "Jersey Lightning," 10
 Jersey Meadows, 25, 61
 "Jitney" buses, 81
 Journal Square, 123

 Kearney, 47
 Kill van Kull, 102
 Kirkwood, 114, 125, 126

 LaGuardia, Fiorello, 92
 LaGuardia Airport, 92
 Lake Hopatcong, 85
 Lawrence Township, 116
 Lehigh and Hudson River Railroad, 29
 Lehigh and New England Railroad, 29
 Lehigh Valley, 7, 24, 25, 29
 Lehigh Valley Railroad, 25, 37, 46, 50, 102, 121
 Lincoln Highway, 61
 Lincoln Tunnel, 74-76, 79, 82, 87
 Lincoln Tunnel Expressway, 76
 Lindbergh, Charles A., 90
 Linden, 96, 97, 98
 Little Big Inch, 96, 97
 Little Falls, 9
 Long Island Railroad, 42, 44, 111

 Madison, 125
 Madison Square Garden, 56
 Mahwah, 116
 Manhattan Island, 36, 38, 70, 75, 76, 77
 Marcus Hook, 104
 Mays Landing, 116
 Maysville Road veto, 57
 Middlesex County, 116
 Middlesex East-West Freeway, 116
 Millville, 25

- Montclair, 5, 43
 Morris Canal, 7, 8, 9, 10, 98
 Morris County, 7, 9
 Morris County Traction Company, 85
 Morristown, 3, 25, 43, 85, 116
 Morristown and Erie Railroad, 30, 46, 50
 Mount Holly, 42

 Narrows, The, 79, 80, 97, 111
 New Brunswick, 7, 14, 25, 36, 85, 90, 127
 New Haven Railroad, 42
 New Jersey and New York Railroad, 37, 38
 New Jersey Expressway Authority, 119
 New Jersey Highway Authority, *see* Garden State Parkway
 New Jersey State Highway Department, 59, 61, 63, 86, 88, 113, 115, 122; Division of Railroad Transportation, 51, 59, 120
 New Jersey State Public Utility Commission, 51
 New Jersey Transportation Company, *see* Public Service Coordinated Transport
 New Jersey Turnpike, 62-64, 78, 87, 116
 New Jersey Turnpike Authority, *see* New Jersey Turnpike
 New York and Long Branch Railroad, 30
 New York Bay, 111
 New York Central Railroad, 2, 34, 37, 38, 98, 101, 110, 127
 New York City, 7, 10, 15, 16, 24, 37, 39, 44, 61, 69, 76, 78, 79, 82, 83, 90, 97, 98, 101, 102, 108, 111, 126, 128
 New York City Board of Estimate 110
 New York Connecting Railroad, 110
 New York, New Jersey Port and Harbor Development Commission, 109, 110, 111, 127
 New York Port, 7, 15, 29, 67, 76, 80, 96, 100, 103, 105, 109, 127, 128
 New York, Susquehanna and Western Railroad, 29, 37, 38, 101
 New York Thruway, 66
 Newark, 7, 9, 10, 25, 38, 61, 81, 84, 87, 90, 91, 92, 102, 103, 115, 121, 122, 124
 Newark Airport, 61, 87, 90-93
 Newark Bay, 24, 25, 63, 102, 110
 Newark City Subway, 81
 Newark Union Motor Truck Terminal, 87
 Nickel Plate Railroad, 50
 Northern Railroad, 38

 Ocean City, 85
 Ocean County, 114
 Oranges, the, 25
Outing magazine, 56
 Oxford Furnace, 9

 Palisades, 71, 74, 77, 124
 Palmer, Comm. Dwight H., 122
 Paramus, 65
 Passaic River, 25, 61

- Paterson, 6, 7, 9, 12, 29
 Paulsboro, 104
 Pennsylvania Railroad 25, 34,
 35, 36, 39, 44, 51, 102,
 114, 121, 124, 125, 127
 Pennsylvania-Reading Sea-
 shore Lines 25, 125
 Pennsylvania Turnpike, 63, 78
 Pequannock River, 29
 Perth Amboy, 24
 Philadelphia, 3, 15, 24, 44, 46,
 82, 103, 113, 114, 125, 126,
 128
 Philadelphia Port 7, 16
 Philadelphia Transportation
 Company, 70
 Phillipsburg, 7, 24, 25, 45, 85,
 116
 Plainfield, 24
 Pocono Mountains, 43
 Pompton Lakes, 29
 Port Authority Trans-Hudson
 Corporation, 123
 Port Morris, 50
 Port Murray, 85
 Port Newark, 87, 90, 92, 102-
 103
 Port of New York Authority,
 36, 69, 71, 74, 75, 78, 82,
 87, 92, 100, 102, 103, 108-
 113, 114, 122, 123, 126
 Public Service Coordinated
 Transport, 81, 84, 85
 Public Service Railway Com-
 pany, *see* Public Service
 Coordinated Transport
 Public Works Administration,
 75
 Pulaski Skyway, 61-62, 90
 Rahway, 24
 Rahway Valley Railroad, 30,
 50
 Railroads: loss of traffic, 30-
 41; electrification, 41-44;
 Newark Penn Station, 44;
 conversion to Diesel, 41,
 45-46; TOFC or piggy-
 back, 41, 46-48, 100; auto-
 mation of yards, 41, 49-50;
 abandonment of service,
 41, 50-52; rate reduction,
 41, 55; mergers, 41, 52-53;
 containerization, 48, 100;
 Centralized Traffic Con-
 trol, 53-54, 94
 Raritan Bay, 101
 Raritan River, 24, 25
 Reading Company, 29
 Ridgefield Park, 116
 Riverside Line, *see* Public
 Service Coordinated
 Transport
 Rockaway, 9
 Rockaway River, 25
 Roselle Park, 50
 "Route of Phoebe Snow," 25
 Salem, 3, 14, 25
 Salem County, 114, 116
 Sandy Hook, 108
 Sea-Land Services, 103
 Seaville, 119
 Secaucus, 124
 Somers Point, 116
 Somerset County, 116
 Somerville, 24
 Southern New Jersey Rapid
 Transit System, 114
 South Jersey Port Commission,
 115
 South Orange, 43
 Southern Railway, 55
 Springfield, 116
 Staten Island, 79, 88, 97, 102,
 111

Stevens, John, 68
Suffern, 29
Summit, 25, 50
Sussex County, 29
Swainton, 116

Tacony-Palmyra Bridge, 78
Tappan, 29
Teaneck, 29
Tenafly, 81
Tennessee Gas Transmission
Company, 97
Texas-Eastern Transmission
Company, 97
Throgs Neck Bridge, 79
Transcontinental Gas Pipeline
Corporation, 97
Transportation Act of 1958,
51, 78, 120
Trenton, 7, 25, 29, 36, 44, 78,
84, 85, 104, 116
Trenton-Delaware Bridge, 113
Triborough Bridge and Tun-
nel Authority, 80

Tri-State Transportation
Committee, 126-127
Tructrain Service, 47
United Fruit Company, 101
Verrazano-Narrows Bridge,
79-80
Vineland, 25
Walt Whitman Bridge, 78, 114
Washington, 44, 85
Weehawken, 29, 77
West New York, 101
West Shore Division of the
New York Central, 29, 37,
50, 51, 77, 101
Westfield, 125
Westville, 116
Whitestone Bay-Bridge, 79
Wilkins, George, 89
Woodbridge, 29
Woodbury, 98
Works Progress Administra-
tion, 91
World Trade Center, 122-123

THE NEW JERSEY HISTORICAL SERIES

Published Under the Auspices of

STATE OF NEW JERSEY TRICENTENARY COMMISSION

Paul L. Troast, *Chairman*

Charles E. Farrington, *Vice-Chairman*

David S. Davies, *Executive Director*

Roger H. McDonough, *Secretary*

Kenneth Chorley

Marion West Higgins

Mrs. A. R. Green

Clifford L. Lord

Frederick H. Groel

John T. Soja

Anthony J. Grossi

Richard R. Stout

William A. Wachenfeld

MODERN transport of both people and products efficiently and conveniently is one of today's most vital needs: vital to a region's economic development, to its population growth, to its very survival. More than any other state, New Jersey has reason to be concerned with problems of the automobile age.

The amount of traffic crossing the New Jersey—Pennsylvania border is more than that crossing any other state in the nation, while the traffic crossing the New Jersey—New York border ranks second! This study shows how this situation developed, what it has meant in terms of state expansion, and how grave are the problems it has created.

Beginning with the rise of canals and steamboats, into the great age of the railroad and the start of air and motorized travel, Dr. Cranmer traces the impact of transportation innovations upon the state. He describes the role they played in relocating commercial markets, in urban centralization and the subsequent return to the suburbs, and in the replacing of primary industries with secondary ones.

Because New Jersey is the nation's leader in rail density, the current plight of the railroads is given detailed treatment, with each side of the controversy fairly evaluated. The steady loss in freight and passenger revenue is viewed in light of the rise of the trucking and airplane industries and the increased purchase of automobiles. The author presents his own suggestions for giving the railroads new life, at the same time helping to alleviate our congested streets and highways.

Much research has been conducted for this report, and the results show clearly

(Continued from front flap)

why New Jersey deserves to be called the corridor state. Bridges and tunnels abound—from the soaring George Washington, Delaware Memorial, Benjamin Franklin, and Walt Whitman bridges to the deep, cavernous Holland and Lincoln tunnels.

Within the state are found such transportation facilities as the Newark Airport, Port Newark, various railroad terminals, and those superhighways—the New Jersey Turnpike and the Garden State Parkway. Examined here are the financial difficulties and seemingly insurmountable engineering problems connected with this construction.







It is evident that New Jersey faces many crucial and pressing problems with regard to her transportation network. Dr. Cranmer's book intelligently brings forth both problems *and* prospects for solution.

A native of Mountain Lakes, New Jersey, H. JEROME CRANMER is Chairman of the Department of Economics at Drew University, and Director of its Institute for Economic Research. He has taught at Drew since 1949, two years after receiving his A.B. there. He also holds A.M. and Ph.D. degrees from Columbia University.

Dr. Cranmer's specialties include American economic history, economic research and business forecasting. He has acted as consultant to the Bankers Trust Company and the American Bankers Association, and he is currently consulting economist for the New Jersey Bell Telephone Company and for the Board of Governors of the Federal Reserve System in Washington.

NEW JERSEY TODAY

With selected historic sites

- State Capital *
- County Seats ●
- County Boundaries - - - - -
- Toll Highways 
- Other Important Highways 
- Interstate Route Numbers 
- Federal Route Numbers 
- State Route Numbers 
- Selected Railroads 
- Abandoned Canals 