THE PROBABLE IMPACT OF THE ST. LAWRENCE SEAWAY ON THE PORT OF BALTIMORE, MARYLAND

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CHAPTER I

INTRODUCTION

Overseas trade via the Great Lakes-St. Lawrence Seaway began on April 25, 1959, when the Prins Wilhelm Frederick sailed beneath the Jacques Cartier Bridge at Montreal.[1] Most people in this country and in Canada looked upon the new waterway, which reaches into the heart of the North American continent, as an instrument that would bring the Midwest greater prosperity than that region had ever known. While Midwesterners were proclaiming the benefits they would reap from having a direct water connection with the rest of the world, others regarded the opening less enthusiastically. These onlookers included the eastern railroads and the Atlantic and Gulf ports, groups which viewed the Seaway as a competitor, not as an ally. The ports saw the Seaway carrying cargoes which previously had moved through coastal cities from Maine to Texas, creating income as they passed through. The railroads, which connected these ports with the Midwest, would lose this same traffic. Each port and each railroad looked at the opening of the Seaway and asked itself, how much traffic will we lose?

For many years these interests had been concerned over the threat of a new waterway into the Great Lakes, and repeatedly they had expressed their fears before Congressional committees. What sort of

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[1] New York Times, April 25, 1959, p. 42.

an outlook did they present? Representatives of various port interests testified that the Seaway would take away 30 percent of Boston's foreign trade, New Orleans would lose almost one-fourth of its traffic, New York would lose one-sixth of its traffic, and Philadelphia would lose 10 percent of its foreign tonnage.[1] Spokesmen for Baltimore did not estimate the volume of traffic which would probably be diverted to the Seaway, but Mr. Joseph L. Stanton of the Baltimore Association of Commerce stated the belief that an estimate made by the Department of Commerce which set Baltimore's loss at 10 percent of its foreign traffic was conservative.[2] In support of this belief he went on to say:

> The types of cargo in which this port specializes are extremely well adopted [sic] to a water haul such as would be possible through the seaway. Baltimore has long been known as a bulk-cargo port. Such commodities as iron ore, grain, coffee, bulk rubber, chemicals, fertilizers, and sugar compose the greatest portion of our commerce. All of these commodities would be subject to diversion through the seaway. We, of course, realize that a completed seaway would not close the port of Baltimore. We would still enjoy the traffic destined for immediate areas in the State and adjacent sections of West Virginia and southern Pennsylvania. However, a large portion of Baltimore's commerce is destined to or originates at points in western Pennsylvania, Ohio, Indiana,

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[1]U. S., House of Representatives, Committee on Public Works, Hearings on the St. Lawrence Seaway and Power Project, 1953, (Washington: U. S. Government Printing Office, 1953), John J. Halloran, Port of Boston Authority, p. 391. U. S., House of Representatives, Committee on Public Works, Hearings on the St. Lawrence Seaway and Power Project, 1951, (Washington: U. S. Government Printing Office, 1951), Louis I. Bourgeois, Board of Commissioners of the Port of New Orleans, p. 978; Walter P. Hedden, The Port of New York Authority, p. 1224; George Hardenstine, The Port Agency of the City of Philadelphia, p. 1422.

[2]U. S., Senate, Committee on Foreign Relations, Hearings on the St. Lawrence Seaway and Power Project, 1952, (Washington: U. S. Government Printing Office, 1952), p. 729. At that time Mr. Stanton was the Director of the Export and Import Bureau of the Baltimore Association of Commerce; he is currently the Executive Director of the Maryland Port Authority.

> Illinois, Michigan, and Wisconsin. With an all-water or a longer water routing possible from major points along the Lakes, it can be seen that Baltimore would stand little chance of holding the inland business we now enjoy.

Mr. Stanton's comments indicate two reasons why the Seaway is likely to divert a greater relative volume of traffic from Baltimore than from any other major port. Those reasons are the type of cargo handled and the area served by Baltimore. The fraction of foreign traffic represented by bulk cargoes is larger at Baltimore than at any other major American port, with the exception of Hampton Roads. This fact coupled with the predominant place of bulk cargoes in Seaway traffic shows the threat to Baltimore on the basis of type of cargo. Baltimore is located nearer to the midwestern states than are other seaports; hence a larger fraction of its traffic originates or terminates in the Midwest. Since the Seaway extends into the heart of the Midwest, Baltimore faces a more serious threat than do other ports.

In addition to fearing a general loss of business, the port interests also were concerned with the development of an unwanted seasonal pattern in port activities, resulting from the fact that the new route would be icebound during the winter months. Facilities of all sorts would have to be maintained at a level capable of handling the heavier traffic flow of the winter months, but the traffic volume of other months would be insufficient to fully utilize those facilities. Mr. August Idzik, Vice-President of the International Longshoremen's Association in Baltimore directed attention to this problem when he said, "The prospect of a 7-month slowdown in our operations with the resulting laying off of our men is of very serious concern to us. . . ."[1]

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[1]U. S., Senate, Committee on Foreign Relations, Hearings on the St. Lawrence Seaway and Power Project, 1953, (Washington: U. S. Government Printing Office, 1953), p. 392.

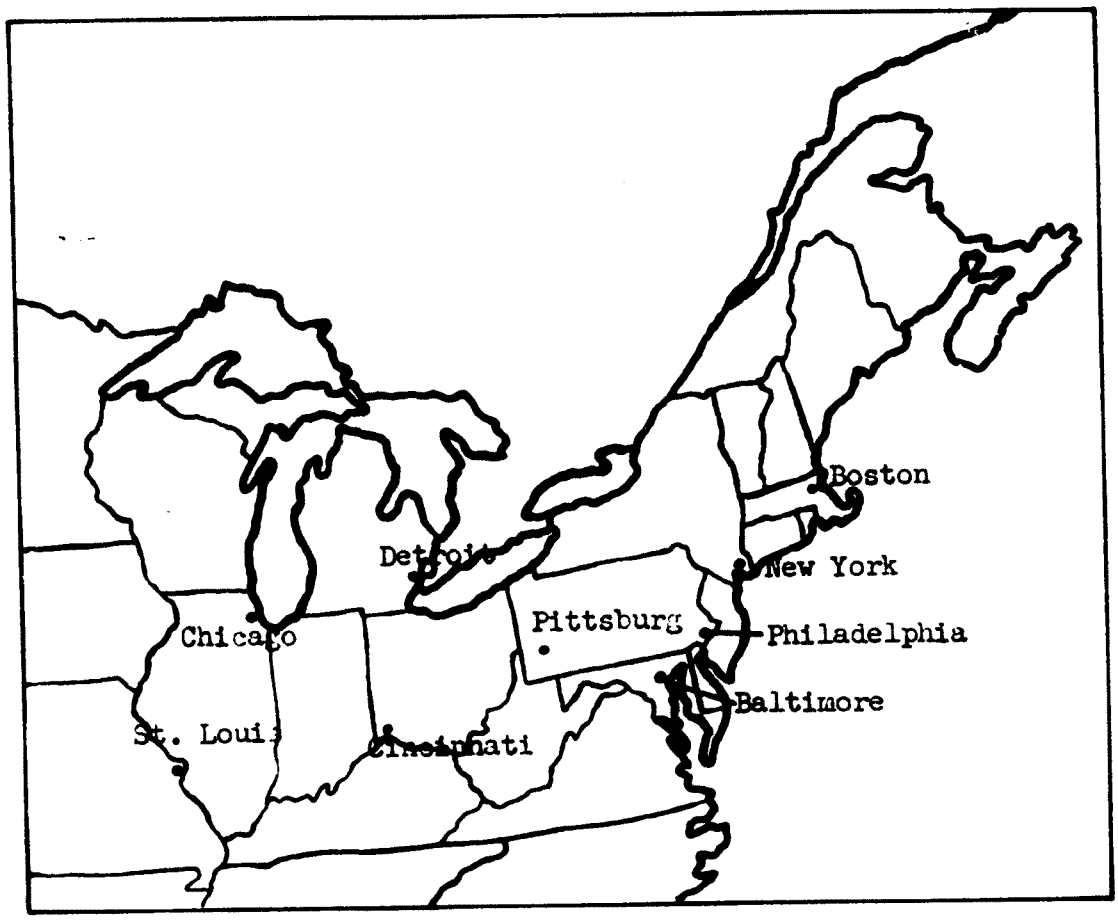


Fig. 1-Position of North Atlantic Ports Relative to the Midwest

While the Atlantic and Gulf ports opposed this country's participation in the Seaway's construction, some Seaway proponents contended that their fears were unfounded. Senator Alexander Wiley, a co-sponsor of the Seaway bill, wrote: "The completion of the 2,347-mile, deep-water, 27-foot channel will not in the slightest harm any other economic interest in this Nation, whether it be port, railroad, utility, or any other group."[1] Perhaps a more

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[1]U. S., House of Representatives, Seaway Hearings, 1951, p. 58. Letter addressed to the Honorable Charles Buckley, Chairman, Public Works Committee, House of Representatives.

representative viewpoint of the Seaway's supporters was one that recognized the diversion losses which the seaports would suffer, but which saw the increased traffic of a growing economy counter-balancing such losses.[1]

The different positions of the proponents and opponents certainly reflect the self-interests of each, but they also reflect the general lack of information of the sort necessary to arrive at a commonly acceptable motion of the impact of the Seaway upon ocean ports. Representative Franklin D. Roosevelt, Jr. disagreed with the fears expressed by the Port of New York Authority, but he could not refute their diversion estimate because "no statistical data is [sic] currently available which reports the amount of foreign trade moving through New York which originates or terminates in the region tributary to the Seaway."[2] As recently as 1958 Professor Patton wrote, "Although increasingly quantitative work did begin to appear for European hinterlands well before the Second World War, attempts at quantitative delineation of North American port hinterlands have been few."[3]

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[1]U. S., Senate, The St. Lawrence Seaway: Report of the Committee on Foreign Relations, (Washington, U. S. Government Printing Office, 1953), p. 24.

[2]U. S., House of Representatives, Seaway Hearings, 1951, p. 590.

[3]Donald J. Patton, "General Cargo Hinterlands of New York, Philadelphia, Baltimore, and New Orleans," Annals of the Association of American Geographers, December, 1958, p. 436.

The results of one attempt to measure the probable effect of the Seaway were published by the Department of Commerce in 1941.[1] The procedure followed in that study consisted of four steps.[2] First, the Department of Commerce estimated the total traffic capacity of the proposed facilities and allocated it between American and Canadian movements. Second, by comparing American capacity traffic with the volume of our past movements through the 14-foot canals, the Department concluded that American Seaway traffic would increase by ten million tons. Third, this new traffic was divided into foreign and domestic (coastwise and intercoastal) portions in the same ratio as had prevailed at Atlantic and Gulf ports over the sixteen year period from 1923 to 1938. The result was that an estimated increase of four million tons of foreign commerce would flow through the Seaway to and from American ports. Fourth, it was assumed that such new Seaway traffic would have been handled previously at Boston, New York, Philadelphia, Baltimore, Hampton Roads, and New Orleans, and the estimated traffic loss at any one port was determined by its share of the total foreign traffic of the six ports. As 45 percent of the foreign commerce of the six ports moved through New York, the Department estimated that 45 percent of the new Seaway traffic would be diverted from New York, a loss at that port of 1,800,000 tons.

The procedure adopted by the Department of Commerce has three basic weaknesses. The first is its failure to allow for the possible expansion of the Midwest's foreign trade as a result of the Seaway's

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[1]U. S., Department of Commerce, The St. Lawrence Survey, (Washington: U. S. Government Printing Office, 1941), Part IV.

[2]Ibid., Part IV, pp. 3-6.

construction. Transportation costs are a barrier to international trade, and their reduction by the Seaway should be responsible for moving goods which previously were not traded. The movement of this sort of traffic means that diversion is only one source of new Seaway tonnage. The second and third weaknesses are concerned with the practice of basing diversion upon each port's share of total foreign traffic. One is that such a procedure does not account for any possible differences in the extent to which the six ports handled traffic of the Seaway area. The reason for the omission of this factor is simple; the necessary data were not readily available. Finally, the method makes no allowance for any possible differences in the ports' relative abilities to retain traffic in the face of Seaway competition. If frequency of sailings is an important factor to some potential Seaway users, New York with more sailings than any other United States port is less likely to lose traffic than is Boston which has many fewer sailings. Accounting for these three considerations would have been difficult, or perhaps impossible, but their omission reduces the accuracy of the estimates.

The procedure used in estimating that New Orleans would lose 24 percent of its foreign trade takes somewhat better account of these factors.[1] The method does not preclude the possibility of the Seaway generating new foreign trade. In a general way the estimating procedure deals with the problem of where imports terminate and exports originate, but only to the extent of indicating the major points of origin or destination for various products. Finally the diversion

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[1]Based upon the statement of Louis I. Bourgeois before the Senate Committee on Foreign Relation. U. S., Senate, Seaway Hearings, 1952, pp. 480 and 481.

estimate implicitly assumes that if the Seaway offers lower transportation rates than New Orleans, traffic will be diverted. Service factors are not considered.

The Seaway is no longer a proposal which is being debated, but is a reality, yet its effect upon competing ports remains unknown. Our aim is to estimate how this new transportation route will affect Baltimore, an established seaport. We seek the answer to two questions. (1) How much traffic will Baltimore lose to the Seaway? (2) How will the Seaway affect the level of economic activity in the Baltimore area? Another aim is to increase the available quantitative data pertaining to port hinterlands in the United States by carefully summarizing traffic movements to and from the port of Baltimore.

In estimating how the Seaway will affect Baltimore, we shall incorporate into our analysis two considerations which have not entered past estimates. These are first, quantitative information about the port's hinterland, and second, shippers' attitudes toward service factors. After briefly describing both the Seaway and Baltimore and the transportation network serving the latter, we shall describe quantitatively the pre-Seaway traffic pattern of the port of Baltimore so that we know where the port's cargoes came from and where they went. Next we shall analyze and compare transportation rates via Baltimore and via the Seaway, and on the basis of these rates and the traffic pattern we shall estimate the volume of traffic for which the Seaway offers the lower rate, traffic subject to diversion. Then by taking the several service factors into consideration, we shall measure the probable volume of traffic diversion, how much of the potential loss (based upon rates alone) probably will be realized. Finally we

shall estimate the effect of the diversion on the Baltimore area, by converting the probable tonnage diversion into employment figures comparable with the area's total employment.

CHAPTER II

BACKGROUND AND DESCRIPTION OF THE GREAT LAKES-ST. LAWRENCE RIVER AREA AND OF THE PORT OF BALTIMORE

Transportation routes are determined largely by geographic features, but the importance of various routes stems from other conditions. Engineering techniques, which define the mode of transportation that can traverse a particular route, and the level of population and of economic activity found along the route are basic conditions governing the significance of a transportation artery. Our concern is with the relationship between two routes of world trade, one a well-established artery and the second a new route, new at least in its highly increased capacity for moving goods.

Great Lakes-St. Lawrence River Area

We begin by briefly relating the discovery and development of the waterway itself, and then we shall look at the area surrounding it.

Discovery and description of the waterway. Following the discovery of the New World by Columbus in 1492, several of the reigning monarchs of Europe commissioned explorers to find and claim lands in the Western Hemisphere and to search for a water route to the Orient. Commissioned by Francis I of France, Jacques Cartier made three voyages to the New World between 1534 and 1541. In 1535, on his second voyage, Cartier and his men discovered the St. Lawrence River. The group sailed up the river which the

Indians referred to as "a river without end"[1] until their progress was blocked by "the most violent rapid it is possible to see."[2] These Lachine Rapids are located just above the present city of Montreal.

More than a century was to pass before the full extent of this newly discovered water system became known. Lake Huron and Lake Ontario were discovered in 1615, Lake Superior in 1619, Lake Michigan in 1634, and Lake Erie in 1669.

The Great Lakes-St. Lawrence River system extends for more than two thousand miles from the Atlantic Ocean into the heart of the North American continent. Figure 2 illustrates the various parts of the system.[3] Lake Superior is more than six hundred feet above sea level and the descent to the Atlantic Ocean presents several barriers to navigation. In a short stretch of the St. Mary's River the water falls 22 feet. The water level drops 326 feet in the Niagara River. There are three sections of the St. Lawrence River which hinder navigation. In the International Rapids Section between Prescott and Cornwall, Ontario the water falls 73 feet through four rapids; in the Soulanges Section between Lake St. Francis and Lake St. Louis four rapids lower the water level 78 feet; and at the Lachine Rapids, just above the city of Montreal, the water drops 37 feet. The route leads to the heart of the continent, but to enjoy the full benefit which such

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[1]George W. Browne, The St. Lawrence River, (New York: G. P. Putnam's Sons, 1905), p. 19.

[2]Sir Percy Sykes, A History of Exploration, (London: Routledge & Kegan Paul, Ltd., 1949), p. 147.

[3]Figure 2 and the following description of the system are based upon: U. S., Department of Commerce, St. Lawrence Survey, Part II, pp. 4 and 51; and Joint Board of Engineers, St. Lawrence Waterway, (Washington: U. S. Government Printing Office, 1927), maps following p. 46.

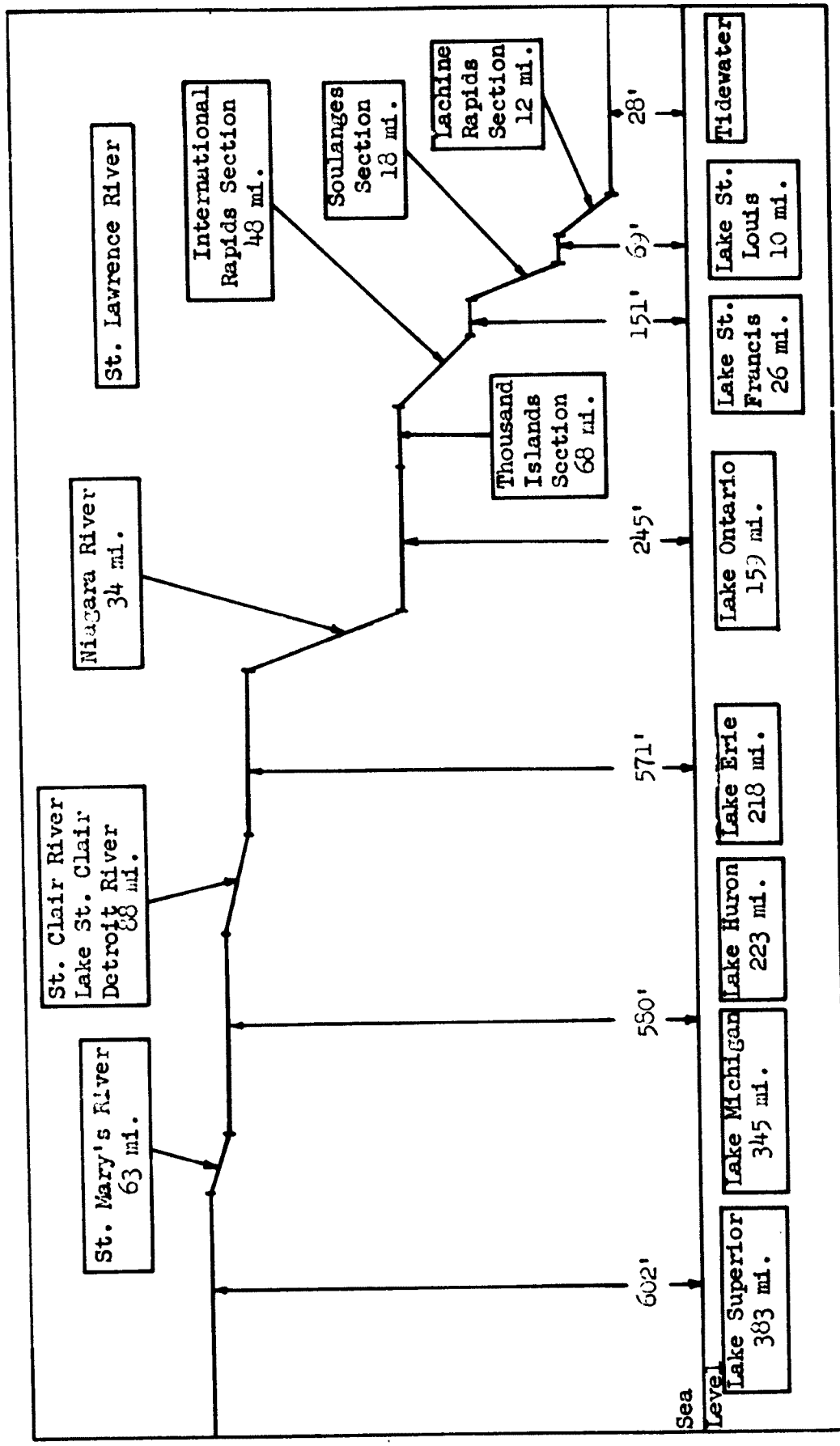


Fig. 2-The Great Lakes-St. Lawrence River System

a potential waterway affords man had to surmount the obstacles imposed by nature.

The task of overcoming these hindrances began unpretentiously in 1698.[1] The initial project had two objectives, transportation around the Lachine Rapids and water power to operate a flour mill. These twin purposes have influenced man's efforts to control the River for more than two-and-a-half centuries, but our interest lies only in the development of the navigational facilities.

A lack of funds prevented the completion of the project begun in 1698. In the late eighteenth century the English succeeded in building a canal joining lakes St. Francis and St. Louis, and in 1833 the Assembly of Upper Canada authorized the construction of a standardized and enlarged canal system between Montreal and Prescott. With the completion of this project in 1847 there was a nine foot canal by-passing the several rapids in the St. Lawrence River. Between 1871 and 1901 the Canadian government enlarged the canal system, providing a rourteen foot channel for navigation. This canal system contained twenty-one locks measuring 270 feet long and 45 feet wide. Five locks were located in the Lachine Section, four in the Soulanges Section and twelve in the International Rapids Section.

No further changes were made in the St. Lawrence canals until August 10, 1954, when officials of both the United States and Canada broke ground to initiate work on the present facilities. The present

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[1]This description of the construction of the St. Lawrence canals is based upon George Cuthbertson, Freshwater, (New York: The MacMillan Company, 1931); St. Lawrence River and Power Project, (Montreal: Reid and Boulton Publishing Company, 1958); and U. S., Hydrographic Office, St. Lawrence Pilot, (Washington: U. S. Government Printing Office, 1917), pp. 506 and 507.

Seaway contains seven locks (see Figure 3) which measure 800 feet long by 80 feet wide by 30 feet deep. The channel from Montreal to Lake Ontario is a minimum of 27 feet deep.

A Canadian, William Hamilton, first set about mastering the barrier at Niagara.[1] Begun in 1821, the Welland Canal was opened in 1829, using forty locks to lift vessels over the Niagara Escarpment. The canal underwent three major improvements and enlargements, the last being completed in 1932. Seven of the present eight locks are 859 feet long by 80 feet wide by 30 feet deep, and the eighth is 1380 feet long. In conjunction with the recent work along the St. Lawrence River, the Welland Canal was dredged to 27 feet.

The first step in the conquest of the rapids of the St. Mary's River was the construction in 1797 of a small canal which allowed canoes to by-pass the rapids.[2] In 1855 the first ship canal was completed. New canals were dug and new locks were built, until today three canals and five locks carry ships around the rapids.

As a result of man's ingenuity and effort, in April, 1959 vessels with a draft of 25 feet could sail as far inland as Toledo. By 1963, when the dredging of the connecting channels is to be finished, such ships will be able to reach Chicago and Duluth.[3] Smaller vessels have long connected Great Lakes and overseas ports. The first, successful,

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[1]This description of the development of the Welland Canal is based upon George Cuthbertson, Freshwater, and F. N. Menefee, The St. Lawrence Seaway, (Ann Arbor: Edward Brothers, Inc., 1940).

[2]This description of the Sault Ste. Marie canals is based upon George Cuthbertson, Freshwater, and U.S., Army, Corps of Engineers, St. Mary's Falls Canals, (Washington, U. S. Government Printing Office, 1945.

[3]The connecting channels link Lake Erie to Lake Huron, and Lake Huron to Lake Superior.

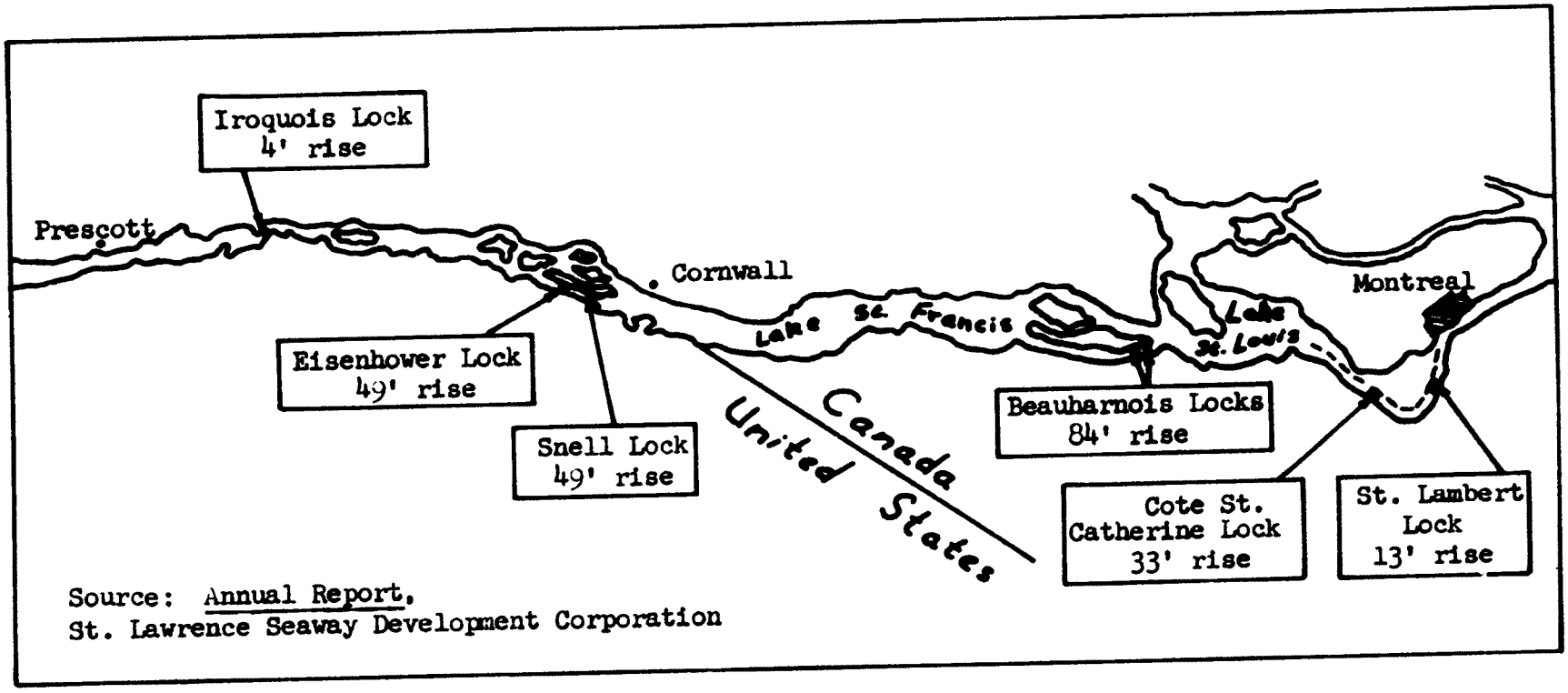


Fig. 3-The St. Lawrence River, Montreal to Prescott

regularly scheduled service between the Great Lakes and overseas ports began in 1935, when the Fjell Line put six vessels, each capable of carrying about 2,400 tons of cargo, into service. The present facilities allow ocean vessels with cargoes of close to 10,000 tons to enter the Great Lakes.

Geographical and commercial features of the Great Lakes-St. Lawrence River System. Man has overcome nature's obstacles and opened a new transportation route, but the significance of that route lies in the characteristics of the area which it serves. The area surrounding the Seaway is richly endowed with natural resources.[1] North of the lakes are rich mineral deposits, especially iron ore and nickle, and extensive coniferous forests. South of the lakes are rich coal deposits, and both to the south and west soil and climate are well-suited to varied agricultural pursuits.

Upon this rich natural base, the area served by the Seaway has developed into a populous, prosperous economy.[2] The Canadian provinces of Quebec and Ontario border the St. Lawrence system. Almost two-thirds of Canada's sixteen million people live in these two provinces, 80 percent of the country's manufacturing employees work there, and one-half of the value of her mineral output is produced there. In agricultural

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[1]This discussion of the natural characteristics of the region is based upon Griffith Taylor, Canada, (New York: E. P. Dutton and Company, 1950), and Wallace A. Atwood, The Physiographic Provinces of North America, (New York: Ginn and Company, 1940).

[2]This section is based upon Dominion Bureau of Statistics, Canada Yearbook, 1957-1958, (Ottawa: Edmond Cloutier, Queen's Printer and Controller of Stationery, 1958); and the following publications of the U. S. Bureau of the Census, Census of Agriculture, 1954, (Washington: U. S. Government Printing Office, 1956); Census of Manufactures, 1954, (Washington: U. S. Government Printing Office, 1957); and Statistical Abstract, 1958, (Washington: U. S. Government Printing Office, 1958).

output these two provinces rank behind the prairie provinces of Manitoba, Saskatchewan, and Alberta.

In this country the waters of the Great Lakes wash the shores of eight states: New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, and Minnesota. Like Quebec and Ontario these states are of great commercial importance, far more important absolutely, although relatively not as significant in the nation's economy. The fact that our climate is more temperate has caused population and industry to disperse more widely than in Canada. The states bordering the Great Lakes contain almost 40 percent of our population, and they employ slightly over one-half of our manufacturing employees.[1] Value added by manufactures in these states is over 50 percent of the national total, and these eight states raise somewhat less than 50 percent of the country's grain.

The Great Lakes-St. Lawrence River region, on both sides of the international boundary, is important as a concentration of people, consumers. As a region of agricultural surplus, it is a source of export trade; and as the location of an industrial concentration it is both a big consumer of raw materials (imports) and producer of manufactured products (exports). The nature of the region encourages a large volume of trading activity.

The Port of Baltimore

We turn now to the second of the two trade routes, the one which converges upon the port of Baltimore, a point of transfer of goods between ocean and land carriers.

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[1]Inasmuch as the whole of New York and Pennsylvania is included in these figures and the eastern portion of both states is not part of the area surrounding the Seaway, the figures are somewhat exaggerated.

Founding and growth. Credit for the discovery of the Chesapeake Bay has been given by historians to John Cabot, who, commissioned by Henry VII of England, sailed to the New World in 1497 and 1498.[1] The Patapsco River was discovered in 1608 by Captain John Smith during the first extensive exploration of the Bay.[2] In 1729 the Maryland Assembly passed a law to establish a town near the falls of the Patapsco River.

The town of Baltimore grew slowly. Trade with the surrounding countryside, a stimulus to urban growth, was slight because of the predominance of tobacco in the colony's economy and the practices followed in exporting that staple. Tobacco was raised where it easily could be delivered to ships that plied the colony's many bays, inlets, and rivers; and the large planters often had their own docks. The ships which loaded tobacco for England brought manufactures and other articles from England so that the farmers and planters directly exchanged their tobacco for the necessities and comforts which they could not provide for themselves. There was no need for a trading center.

During the second half of the eighteenth century, colonists settled farther west in the Piedmont region of Maryland and Pennsylvania. The area was less favorably suited to raising tobacco than was the tidewater region. This factor coupled with a falling export price of tobacco and a rising export price of wheat led to extensive wheat cultivation in the Piedmont. The shift in the location of the production of export crops meant that ships no longer were able to reach their outbound cargoes directly. In addition farmers could not carry their crops to tidewater

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[1]J. N. L. Baker, A History of Geographical Discovery and Exploration, (London: George G. Harrap & Company, 1931), p. 83.

[2]J. T. Scarf, The Chronicles of Baltimore, (Baltimore: Turnbull Brothers, 1874), p. 6.

in the hope that a ship would be waiting. The old trading arrangements were obsolete. The wheat trade required a commercial center. To meet the new situation warehouses were built in Baltimore to store grain while awaiting the arrival of a ship, and retail stores opened to sell manufactured goods and other articles in which the farmers were not self-sufficient.

Concurrent with the growth of the town's trading facilities was the development of a hinterland. By 1770 roads led north and west from Baltimore connecting the city with the area of Pennsylvania to the southwest of the Susquehanna River and with the Monocacy Valley in central Maryland. Both were areas of increasing population and wheat production.

As the town grew, industrial activity developed. Flour ground from wheat grown near Baltimore stood up well in the damp, hot climate of the West Indies, and the city became a milling center. A small iron industry developed, based upon deposits of bog iron found on the north side of the Patapsco River. With the city's activity tied to its waterborne commerce, it was natural for shipbuilding facilities to appear.

A depression followed the Revolutionary War, but independence specifically created problems in the field of foreign trade. English laws which required that imports and exports of the Empire be carried in British bottoms suddenly operated against American shipping interests, and American exports no longer could be sold in the British Empire free of duty.

Conditions improved for Baltimore with the outbreak of the Napoleonic Wars, which led to an increased demand for American wheat and flour. The forces that had spurred the port's earlier growth had

returned. Although this country remained neutral, our shipping was not free from interference by the European powers. Baltimore had grain to export, but her prosperity required that it be delivered. The transportation problem was temporary. The local shipbuilding industry built a newly designed type of vessel, the Baltimore Clipper, which could sail closer to the wind than any other type of ship on the high seas. If a clipper could maneuver upwind of an adversary, she could outsail it. With wheat, which was in demand on the European continent, and ships capable of delivering it, Baltimore grew.

During the first two decades of the nineteenth century, Baltimore usually ranked fourth, or higher, among American ports on the basis of the value of exports. Her trade leveled off about 1820 and did not show any sustained growth until after the War between the States. Over this period Baltimore's relative position declined as King Cotton boosted the position of the southern ports of Charleston, Savannah, and New Orleans. After the War, the absolute value of Baltimore's foreign trade began to rise and, except for cyclical fluctuations, has continued rising. The port's relative position also improved, for the War greatly reduced the prominence of cotton in this country's export trade.

Development of the rail network. Baltimore's growth was related to the more densely populated and more extensive hinterland which the port served. As settlers moved westward across the Appalachians, the eastern port cities found themselves competing with one another for trade. We noted above that by 1770 Baltimore handled traffic with the area from the western side of the lower Susquehanna River to the Monocacy Valley. The opening of the Cumberland Road, which connected Cumberland, Maryland and the Ohio River at Wheeling, in 1818 gave

Baltimore a more direct tie with the growing West than her rival ports enjoyed; but the opening of the Erie Canal in 1825 gave New York the key to the West. Water was, and is, a cheaper means of transportation than roads. Philadelphia sought a route to the West, and in 1826 began the construction of the Main Line, a series of canals, turnpikes, and an inclined plane, between the port and Pittsburg at the head of the Ohio River. The project was finished in 1834. Success of the northern routes, which had the advantage of water transportation, would reduce the position of Baltimore.

Topography made a water route from Baltimore impractical. Late in 1826 Evan Thomas, brother of the president of the Merchants' Bank of Baltimore, returned from England where he had seen the Stockton and Darlington Railroad in operation, and he suggested a rail route to the West. After discussing the proposal for several weeks, Baltimore's business leaders petitioned the Maryland Assembly for a charter incorporating a railroad company. Legislation passed on February 28, 1827 created the Baltimore and Ohio Railroad Company, and gave the company ". . . all the rights and powers necessary to the construction and repair of a Rail Road from the City of Baltimore to some suitable point on the Ohio River . . ."[1] Construction began in Baltimore that summer, and the first operation of a railroad as a means of public transportation occurred on January 7, 1830.

Knowledge about railroad construction was slight and the route passed through the mountains; hence progress was slow. In 1853 traffic began to move between the Patapsco and Ohio Rivers. The tracks led to Wheeling, but Cincinnati and St. Louis were emerging as major commercial

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[1]Maryland Assembly, "An Act to Incorporate the Baltimore and Ohio Rail Road Company," December Session, 1826, Section 14.

centers and Wheeling was not on a direct line from Baltimore to those cities. Recognizing the prominent position of those cities, the Baltimore and Ohio built a second line farther south at the same time that two other railroads were under construction. One joined Cincinnati and Marietta, Ohio and the second ran from Cincinnati to St. Louis. All three lines opened in 1857, giving Baltimore a direct rail connection with the Mississippi River. In 1871 the railroad achieved a connection with Pittsburg and three years later with Chicago.

While laying its tracks westward, the company was also expanding to the east. In 1849 the rails reached the Baltimore waterfront and freight terminals were built at Locust Point so that the railroad had a direct connection with seagoing vessels. Under the guidance of President Garrett (1858 - 1884), the company turned its Locust Point terminals into a major harbor development.

The Western Maryland Railway, formed in 1852, provided the city of Baltimore with its second rail route to the interior. One section of the road began operation in 1861, and in 1873 the rails extended to Williamsport on the Potomac River. The company had hoped that profitable coal traffic would be generated from Cumberland, moving down the Chesapeake and Ohio Canal to Williamsport and proceeding by rail to Baltimore. Since such traffic was not forthcoming, a line was extended to Cumberland in 1906, and on to Connellsville, Pennsylvania in 1912. Via connecting roads, the Western Maryland had access to traffic of the Great Lakes region. In 1904 the company opened its Port Covington terminals, giving it direct rail-to-vessel service in Baltimore.

The Pennsylvania Railroad Company was formed to help the port of Philadelphia compete against Baltimore, but the railroad became Baltimore's

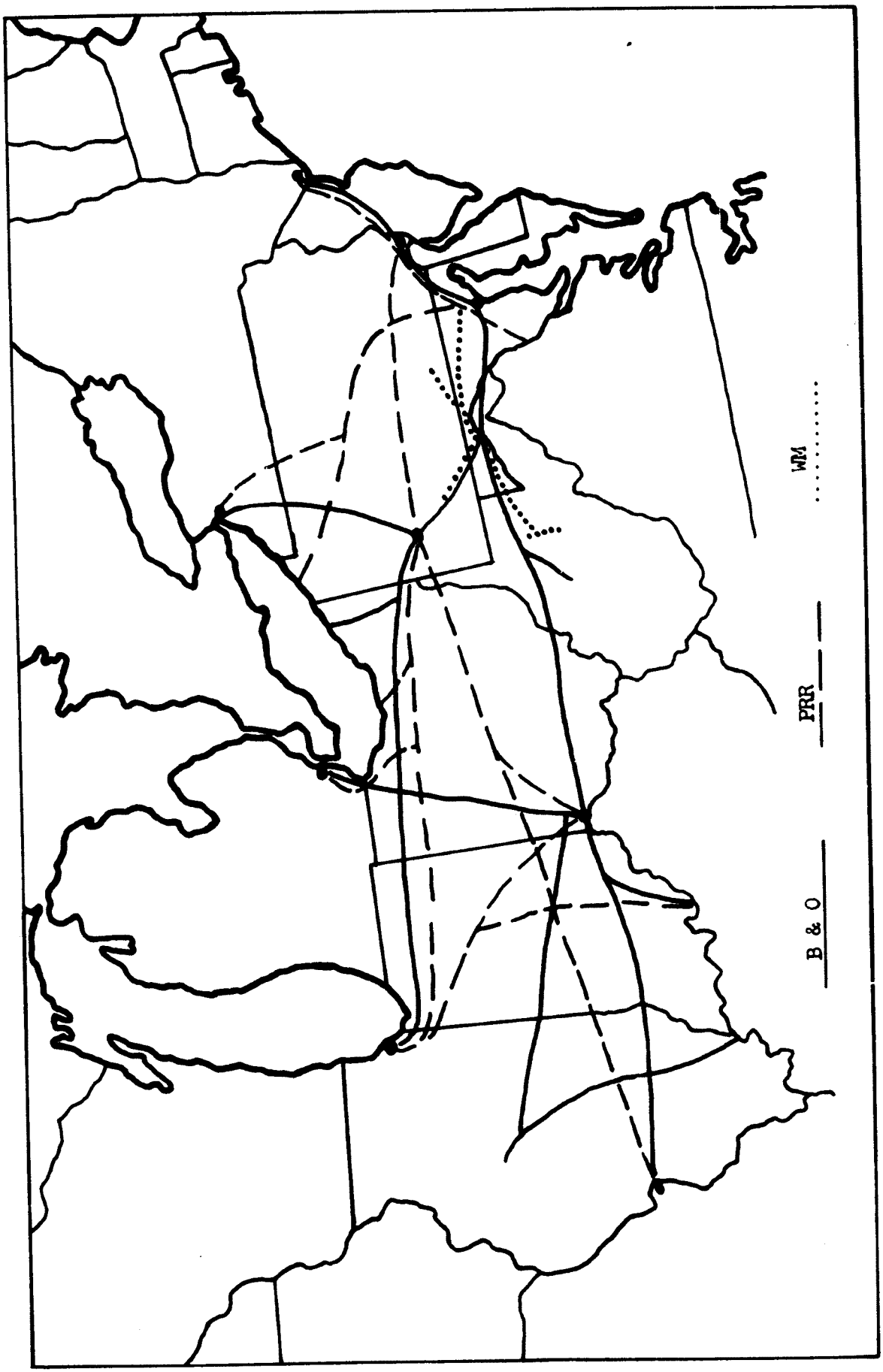


Fig. 4-Baltimore's Rail Network

third route toward the west. Attempts by the Baltimore and Ohio Railroad to obtain the r_ght to extend its tracks to Pittsburg rallied the port interests of Philadelphia behind a proposal to substitute an all-rail route for the Pennsylvania Main Line. The Pennsylvania Railroad Company was organized in 1846 to undertake the project, and in 1852, using the Portage Road of the Main Line, Philadelphia and Pittsburg were linked by rail. Service was extended westward, reaching Chicago and St. Louis in 1869. As a result of purchasing a controlling interest in the Northern Central Railway in 1861, the Pennsylvania obtained a connection with Baltimore via Harrisburg, and in 1873 the company achieved access to the waterfront.

All three roads reached westward from the port of Baltimore, and the extent of the port's hinterland moved with them. The Baltimore and Ohio and the Pennsylvania today extend into the agricultural and industrial heart of the nation, and by its rail connections the Western Maryland also links Baltimore with this productive area. Although railroads do not have the dominant place in American transportation which they had half a century ago, the routes of these three roads give a first impression of the hinterland of the port of Baltimore.

Position relative to other ports. It is well known that Baltimore is not alone in serving the region lying between the Appalachians and the Mississippi, and therefore we must consider its position vis a vis other ports. In terms of foreign trade Baltimore recently has been the nation's second or third ranking port. New York has consistently handled the largest volume of traffic with Baltimore, Philadelphia, or Norfolk being second.[1]

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[1]In the nine years 1949-1957, Baltimore ranked second seven times and third twice.

TABLE 1

FOREIGN TRAFFIC HANDLED AT SELECTED PORTS
(ANNUAL AVERAGE 1949-1957)

Port	Short Tons
New York	35,287,920
Baltimore	22,430,980
Philadelphia	19,538,660
Norfolk	15,630,830
Newport News	12,682,100
New Orleans	10,010,440
San Francisco	5,720,260
Boston	5,251,660

Source: Monthly Summary Reports FT 985, Waterborne Foreign Trade Statistics, Bureau of the Census

New York, Philadelphia, Baltimore, and New Orleans all handle a considerable volume of foreign traffic for the rich area between the Ohio and Mississippi Rivers. In certain respects Baltimore possesses advantages over her rivals in handling such traffic, and in other respects she is at a disadvantage. On the basis of rates the Chesapeake Bay port generally enjoys an advantage over her northern rivals throughout the area, and over New Orleans in part of the area. In the second half of the nineteenth century ocean freight rates varied among Atlantic ports, being lowest in New York and getting higher to the south. Philadelphia, and especially Baltimore, were located nearer to the fast-growing interior area (see Table 2) and sought to eliminate New York's advantage by reducing rates on domestic rail transportation. A series of rate wars followed. The situation was settled in 1877, when four railroads[1] agreed to a system of rate differentials for foreign traffic. The differentials applied to all import and export traffic moving between New York, Philadelphia, or Baltimore and the area bounded by a line roughly

[1]The roads were the New York Central, the Erie, the Pennsylvania, and the Baltimore and Ohio.

TABLE 2

RAIL DISTANCE TO VARIOUS NORTH ATLANTIC PORTS FROM SELECTED POINTS

From	Baltimore	Philadelphia	New York
Buffalo	404	406	400
Chicago	767	814	890
Cincinnati	560	664	724
Indianapolis	650	723	799
Pittsburg	313	360	436
St. Louis	891	964	1040

Source: The Port of Baltimore Handbook, Maryland Port Authority

extending from Buffalo to Pittsburg, down the Ohio River, and up the Mississippi River.[1] Although the rationale for the differentials - differences in ocean freight rates - ceased in 1935, the port differentials remain. Export class rates to Baltimore are 3¢ per hundredweight below New York, and import rates are 3¢ to 8¢ per hundredweight below New York, depending upon the particular class. Baltimore enjoys a 1¢

TABLE 3

CLASS I EXPORT RATES TO VARIOUS NORTH ATLANTIC PORTS (IN CENTS PER HUNDREDWEIGHT)

From	Baltimore	Philadelphia	New York
Chicago	276	277	279
Cincinnati	229	230	232
Indianapolis	252	253	255
St. Louis	300	301	303

Source: The Port of Baltimore, Maryland, Corps of Engineers and Maritime Administration

[1]The discussion of rate differentials is based upon U. S. Army, Corps of Engineers, and Maritime Administration, The Port of Baltimore, Maryland, Port Series, No. 10, (Washington: U. S. Government Printing Office, 1956), pp. 241-264.

per hundredweight advantage over Philadelphia in export trade, and a 1¢ or 2¢ advantage with regard to import movements. Since 1907 New Orleans has had import differentials below the North Atlantic ports on traffic coming from Europe, Africa, and Asia; and while the railroads were operated by the Federal Government in World War I, New Orleans obtained similar rate differentials on export traffic. Figure 5 illustrates the pattern of Baltimore's rail rates in comparison with New York, Philadelphia, and New Orleans.

TABLE 4

CLASS I IMPORT RATES FROM VARIOUS NORTH ATLANTIC PORTS (IN CENTS PER HUNDREDWEIGHT)

To	Baltimore	Philadelphia	New York
Chicago	276	278	284
Cincinnati	229	231	237
Indianapolis	252	254	260
St. Louis	300	302	308

Source: The Port of Baltimore, Maryland, Corps of Engineers and Maritime Administration

Import iron ore and export grain rates do not follow this general pattern. Since 1903 rates on iron ore traffic to the Pittsburg region have been the same from Baltimore and Philadelphia. In 1954 that rate equality was extended to cover movements from each port to Wheeling, Steubenville, and Youngstown. Export grain rates to Baltimore are generally ½¢ per hundredweight below those to Philadelphia and 1½¢ per hundredweight below New York. The exception is that ex-lake grain from Buffalo has moved to all three ports at equal rates since 1952.

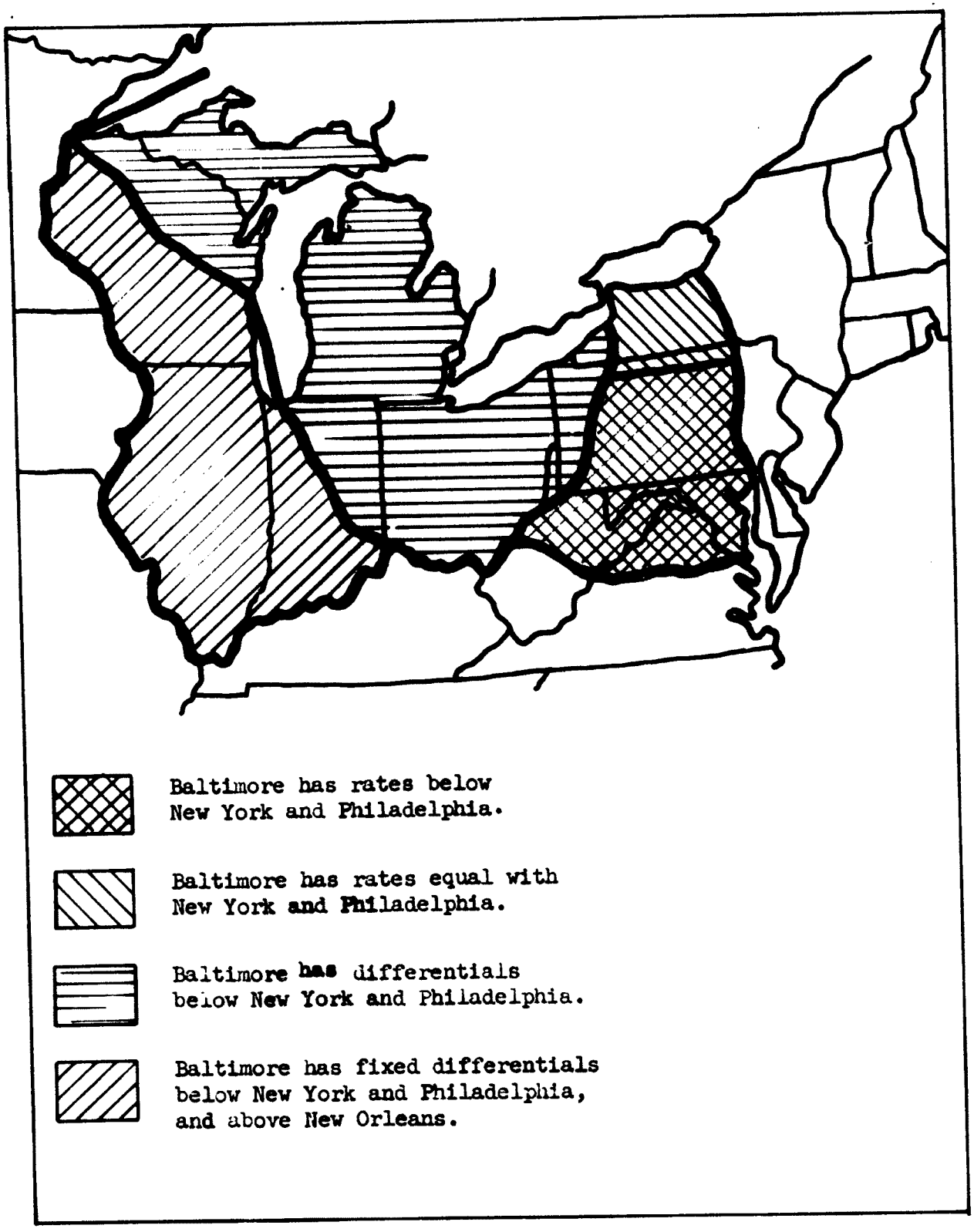


Fig. 5-Rate Relationships between Baltimore and New York, Philadelphia, and New Orleans

TABLE 5

EXPORT GRAIN RATES TO VARIOUS
NORTH ATLANTIC PORTS
(IN CENTS PER HUNDREDWEIGHT)

From	Baltimore	Philadelphia	New York
Chicago	25.5	26	27
Columbus	35	35.5	36.5
Indianapolis	35	35.5	36.5
St. Louis	31	31.5	32.5
Detroit-Toledo-Cleveland[a]	18	18.5	19.5
Buffalo[a]	21.7	21.7	21.7

[a]These are ex-lake rates which apply to wheat.

Source: The Port of Baltimore, Maryland, Corps of Engineers and Maritime Administration

In addition to her generally favorable rate structure Baltimore's physical facilities attract the traffic of the interior. Excellent facilities exist to handle the trans-shipment of ores, grains, and coal, and the Baltimore and Ohio's new banana pier was the prototype for other facilities which are operated by the United Fruit Company in other Atlantic and Pacific ports.[1]

In some respects Baltimore is at a disadvantage in comparison with competing ports. New York offers shippers a considerably larger number of sailings than does Baltimore, thereby reducing the likelihood of delay waiting for transportation to any particular overseas area. Many liners[2] call at several Atlantic ports, and usually in such an order as to give

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[1]Personal interview with W. Gregory Halpin, Head, Communications Department, Maryland Port Authority, Baltimore, Maryland, August 24, 1960.

[2]A liner is a ship which sails a particular route on a pre-arranged schedule.

New York, and to a lesser extent Philadelphia, an advantage over Baltimore. Upon arrival in this country, such ships generally make their first call at New York, followed by Philadelphia and Baltimore. At Baltimore they unload and load before sailing to the two northern ports for additional overseas cargoes. Baltimore, the last port of unloading and the first port of loading, is a poor port for handling rush cargoes.

With several rivals up and down the Atlantic seaboard, the port of Baltimore has looked to the west for its business rather than to the north or south. The development of the port's transportation network was aimed at securing for Baltimore the traffic of the interior region lying west of the city and beyond the Appalachian Mountains. The area west of the Mountains was settled rapidly and quickly became the country's major producer of agricultural crops. Later a vigorous industrial economy grew there, so that today the region possesses, side by side, the industrial and agricultural heart of the United States. For years that region has looked to Atlantic or Gulf ports to handle its foreign trade, but recently a spectacular engineering accomplishment opened the Midwest to ocean transportation. The area no longer must depend upon the old lines of transportation. Geography and the technology of transportation have placed the St. Lawrence Seaway and the port of Baltimore in direct competition with one another for the foreign commerce of the region surrounding the Great Lakes.

CHAPTER III

THE DOMESTIC TRAFFIC PATTERN OF BALTIMORE'S FOREIGN COMMERCE

In the previous chapter we saw that before the Seaway opened Baltimore's hinterland included the area bordering the Great Lakes-St. Lawrence River system, resulting in direct competition between the Seaway and the port of Baltimore. Since our aim is to estimate how large an effect the competition will have upon Baltimore, how much it will affect the level of economic activity in the port, a general picture of the port's hinterland is insufficient. We need to know in some detail the domestic origin and destination of the port's overseas trade. This chapter will build the necessary foundation by describing Baltimore's traffic pattern as it existed before the opening of the Seaway, and will point out the logical basis of that pattern.

We shall continue to use the word "hinterland" in a general sense to mean the area - comprising American states and Canadian provinces - served by the port. The term "traffic pattern" will designate a more detailed concept: the volume of goods which move between the port and each particular part, state or province, of the hinterland. The phrase "traffic flow" will be used interchangeably with traffic pattern.

Sources and Description of Data

Each year Baltimore handles foreign traffic for some forty states, the District of Columbia, and parts of Canada;[1] however statistics which

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[1]Maryland Port Authority, Port of Baltimore Handbook, 1957, p. 10.

show the volume of traffic handled for each area and are not compiled and published.[1] In 1958 Professor Patton of the University of Maryland published a partial description of Baltimore's traffic pattern.[2] He obtained his information by taking a one-month sample of general cargo delivered to or carried from the port by rail. The exclusion of bulk cargoes, which in 1956 made up more than 75 percent of Baltimore's foreign trade by volume, and the failure to show seasonality in traffic movements mean that Patton's study cannot be fitted to our needs. It is necessary, then, to trace the traffic pattern from basic data. We must know three things about shipments of foreign traffic through the port: (1) the type of good, (2) the volume moved, and (3) the domestic origin or destination.

Sources of data. There are two sources of such traffic-flow information. One is the Bureau of Customs which requires that exporters must file a Shipper's Export Declaration (Customs Form 3175) for every shipment. This document contains each piece of necessary information. Customs records do not allow a complete description of the flow of import traffic, because a record of the point of destination is generally lacking. Most imports are cleared through customs at Baltimore, and for these goods no destination is recorded except that city, the port of entry. Destination information exists only for goods which are not released by the Bureau of Customs at the port of entry and for goods which are imported for subsequent re-export.

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[1]The lack of detailed traffic-flow information is noted in U. S., Bureau of the Census, Domestic Movement of Selected Commodities in United States Waterborne Foreign Trade, (Washington: U. S. Government Printing Office, 1959), p. 1; and Maryland, State Planning Commission, The Economic Importance of Port-Linked Manufacturing Industries, (Baltimore: 1953), pp. 47 and 53.

[2]Patton, Annals of the Association of American Geographers, December, 1958.

The records of the Bureau of Customs, while inadequate for tracing a port's import traffic pattern, contain the necessary data for a complete description of the export traffic pattern. A request to use the Shipper's Export Declarations which are on file at the Customs House in Baltimore was denied because their contents may not be disclosed except for official purposes of the Federal Government.[1]

The second source of information about the domestic flow of traffic is the records of the carriers which move export and import goods to and from the port. Of the five basic means of transportation, rail, highway, water, pipeline, and air, we easily can indentify three that are not pertinent to our study. If goods move by air between Baltimore and their domestic origin or destination, they probably move overseas by air too. The Seaway and Baltimore compete for waterborne commerce; hence we can set aside the possibility of the diversion of air traffic. The pipelines that serve Baltimore carry only one product, natural gas, which is consumed locally. This transportation medium is not linked with the port's foreign trade. We may also neglect traffic movements on inland waterways, for such movements are limited to the Chesapeake Bay region, which is not tributary to the Seaway.

Railroads carry most of Baltimore's foreign traffic. Inquiry at the foreign traffic departments in the Baltimore offices of the port's three trunk-line railroads indicated that each has records containing the necessary information, and each cooperated in making available records for the year 1956.

Detailed information concerning the movement of goods by motor truck, while in existence, is not readily accessible. The large number

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[1]Letter from J. Edward Ely, Chief, Foreign Trade Division, Bureau of the Census, July 9, 1958.

of trucking firms which serve Baltimore is one reason.[1] Gathering data is complicated further by the fact that often the records of the movement of import and export traffic are not separated from those pertaining to purely domestic movements. In some cases the records are not on file at Baltimore, but are kept in the firm's main office. The combined result of these three factors is to render the task of collecting traffic-flow data about truck movements impractical, if not impossible.

The lack of data regarding truck operations does not seriously damage our results. In the first place the volume of traffic which is not accounted for is small. Baltimore is primarily a bulk commodity port, as shown by the fact that in 1956 four products, iron ore, petroleum, coal, and grains, accounted for over three-quarters of the port's foreign traffic by volume,[2] a smaller fraction on the basis of value. Since trucks tend to carry low-bulk, high-value products, the role of truck transportation in moving Baltimore's foreign commerce should be a minor one. In 1956 trucks carried only 598,105 tons of general cargo across the railroad piers.[3] While not all of the port's foreign trade moves across the railroad piers, that which does not consists mainly of the traffic of local waterfront firms and moves over their own piers. Considering the magnitude of truck traffic at the

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[1]In 1957 there were over 150 certified motor truck common carriers with terminals or offices in Baltimore. Maryland Port Authority, Handbook, 1957, p. 16.

[2]U. S., Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, 1956, (Washington: U. S. Government Printing Office, 1957), pp. 247-249.

[3]Maryland Port Authority, "Statement of Tonnage of Waterborne Freight Handled by Trucks at Baltimore Piers," 1959.

railroad piers and the unlikelihood of a large volume of truck traffic being generated at other piers, it follows that only a small portion of Baltimore's seven million tons of general cargo trade moved by truck in 1956.

A more important reason why the lack of data on truck traffic causes little harm is that most of such traffic is too short-haul to be threatened by the Seaway. It has been estimated that truck movements of Baltimore's import and export traffic average about one hundred fifty miles.[1] A Bureau of the Census study on the movement of selected general cargoes through all United States ports shows that in 1956, 64 percent of export shipments originating outside of the port area and carried by truck moved less than one hundred miles; and 49 percent of import shipments destined outside of the port area and carried by truck moved less than one hundred miles.[2] Although not directly applicable to Baltimore, these percentage figures tell more about the length of truck movements than does the average length-of-haul figure. Recalling the fact that Buffalo, the large Seaway port nearest to Baltimore, is over four hundred miles distant, only a small portion of truck traffic is threatened with diversion. Both the comparatively small volume of traffic and the short-haul nature of such traffic minimize the seriousness

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[1]Knappen-Tippetts-Abbott-McCarthy Engineers, The Port of Baltimore, (New York: December, 1957), p. IV - 13. A comparison of the destinations of rail movements of banana and sugar imports with truck movements of the same two products also points out the short-haul nature of trucking operations.

[2]Bureau of the Census, Domestic Movements of Selected Commodities in United States Waterborne Foreign Trade, p. 20.

of the lack of traffic-flow information for truck movements.[1]

In view of the availability and pertinence of various types of data, we relied on the records of three railroads, the Baltimore and Ohio, the Western Maryland, and the Pennsylvania, to obtain most of the information used to describe the 1956 traffic pattern of Baltimore's import and export trade. Data concerning the movements of certain products is supplemented from various other sources, which will be noted and described later.

Description of data. The records of the three railroads are similar in form, but not identical. All contain monthly figures which show for each imported or exported commodity the volume carried to or from each location. Two railroads record volume in tons, while the third uses carloads. The latter measure can be converted into tons by applying an average tons-per-carload factor. The conversion factor is found by using data, which the railroad has, that shows, by commodity, the total number of tons and the number of carloads moved in 1956. The factor for iron ore cannot be found in this way because that commodity is not included in the data, but it is found by using similar information in Carload Waybill Statistics.[2]

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[1]Although indications are that the lack of traffic-flow information about truck movements is not serious as far as describing Baltimore's 1956 traffic pattern is concerned, the omission of trucking data may be serious in the future. There is a trend for trucks to carry a greater share of general cargo traffic and for trucks to carry goods over longer distances. Improvements in our national highway system, which are continuing, are part of the explanation of this trend. If the trend continues, trucks will account for a significant fraction of the port's commerce and they will be carrying a sizeable volume of traffic for which Baltimore is in direct competition with the Seaway.

[2]U. S., Interstate Commerce Commission, Carload Waybill Statistics, 1956, State-to-State Distribution, Products of Mines, (Washington: U. S. Government Printing Office, 1957), p. 23.

All three railroads maintain separate records of grain movements. The records of daily or monthly arrivals show (1) the type of grain, (2) the point of origin, and (3) the volume received. One railroad keeps grain arrivals on file for twelve months only, and since the traffic-flow information was collected in 1958, the 1956 traffic pattern of that road's grain movements must be estimated. From data contained in the records covering the twelve months from July, 1957 through June, 1958 the percentage of the total movement which originated in each state during each month is calculated, and these percentages are applied to the known total number of tons of each type of grain carried in 1956 by the railroad.[1]

In some cases the records contain origin points for grain shipments that include more than one state. As far as possible such grain movements have been included in the export traffic generated by the various states by apportioning those movements among the states in the same proportion as the states' output of each type of grain.[2] While facilitating the discussion of the traffic pattern, this arbitrary manner of attributing grain exports to states will not alter our results

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[1]In a personal interview on August 28, 1958, the elevator agent of the railroad concerned said that during the twelve months for which records were available the volume of grain movements was below the 1956 volume, but that there was no noticeable change in the distribution of origin points.

[2]For example, points designated "Illinois-Minnesota" originated 20,625 tons of wheat in 1956. Since Illinois produced 82 percent and Minnesota 18 percent of the total wheat output of these two states, 82 percent, 16,912 tons, of the movement is allocated to Illinois, and 18 percent, 3,713 tons is allocated to Minnesota. Wheat production figures are based upon U. S. Bureau of the Census, Census of Agriculture, 1954, p. 632.

significantly, because the states involved are all located adjacent to the Seaway. Two origin designations, "Midwest" and "Western," are not defined rigidly enough to show exactly what states are included; hence these designations are retained.

Monthly reports of the Tidewater Bituminous Coal Association show the movements of export coal by area or railroad of origin.[1] Since these origin classifications do not fit easily into a state-by-state system, the allocation of coal exports is handled in a manner similar to that used for grain exports.

The data obtained from the three railroads were aggregated to show by commodity the volume of traffic which had moved between Baltimore and origins or destinations in each state and province during 1956. From these figures we determine the total tonnage of each commodity which moved to or from Baltimore by rail. A commodity-by-commodity comparison of rail traffic and of import and export traffic of the port[2] indicated four commodities for which a relatively large fraction of the traffic pattern was still unknown: iron ore, petroleum, sugar, and bananas. The traffic which was not accounted for probably was delivered directly to local users or was shipped out of the port by truck.

The railroad reports show no movement of iron ore to any location in Maryland, although almost within the city of Baltimore is the Sparrows Point plant of Bethlehem Steel, the largest steel mill in the world.[3] Iron ore from Canada, South America, Europe, and Africa is unloaded at

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[1]Tidewater Bituminous Coal Statistics Bureau, "Tidewater Bituminous Coal Tonnage Dumped," New York, 1956.

[2]U. S., Corps of Engineers, Waterborne Commerce, 1956, pp. 247-249.

[3]This plant has an annual ingot capacity of 8,200,000 tons. Maryland Port Authority, Handbook, 1957, p. 77.

the company's ore dock. We can estimate the volume of iron ore consumed at Sparrows Point by subtracting the amount of ore carried to the company's interior blast furnace locations from Bethlehem's total iron ore imports.[1]

Petroleum and its products were conspicuous by their almost complete absence from the railroad records. M. Culler of the Maryland Port Authority said that most of the imported petroleum is used locally, primarily in the city's refineries and as fuel oil.[2] Local use of petroleum was found by subtracting inland movements from total imports as shown by the Import Bulletin.

The United Fruit Company, which operates Baltimore's banana pier, provided a distribution of the volume of truck movements of bananas by state of destination, and these figures have been added to those pertaining to rail movements.[3] The Canton Railroad, a terminal road, furnished information on the volume of refined sugar which moved out of the port by truck, but could give only a general description of the terminal points of such movements.[4] Raw sugar is delivered directly to the American Sugar Refining Company's plant for refining. The volume of this import movement was estimated from the Import Bulletin. Additional

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[1]The company's total imports are obtained from the Maritime Exchange of Baltimore, Import Bulletin, a monthly publication which is arranged chronologically and shows for each vessel the tonnage and consignee of each commodity carried.

[2]Interview with J. Victor Culler, Foreign Trade Representative, Maryland Port Authority, January 30, 1959.

[3]Letter from L. T. Pedler, Traffic Manager, Fruit Dispatch Company, February 26, 1959. (The Fruit Dispatch Company is a fully-controlled subsidiary of the United Fruit Company).

[4]Letter from Robert W. Dale, Jr., Foreign Freight Agent, Canton Railroad Company, April 13, 1959.

information concerning chrome and gypsum imports which were consumed in Baltimore came from the Armco Steel Corporation and the National Gypsum Company.[1]

The total amount of traffic for which these many sources provide traffic-flow information is 26,539,197 tons, approximately three and one-half million tons less than the port's 30,030,367 tons of foreign commerce. Our information covers 9,126,005 tons out of 9,664,650 tons of exports and 17,413,192 tons out of 20,365,717 tons of imports. Included in the missing traffic are slightly more than five hundred thousand tons of truck movements of general cargo, which are generally short-haul movements, and about two million tons of imported ore movements.

1956 Traffic Pattern

We shall break the description of Baltimore's 1956 traffic pattern into two steps, one covering imports, the other exports. The import tonnage, as indicated above, is about twice that of exports.[2]

Imports. Although forty-six American states and Canadian provinces received imported goods from Baltimore in 1956, the flow of traffic was heavily concentrated, as indicated by the fact that nine areas took 99 percent of the port's import traffic.[3] Maryland received over ten million tons of imports, while more than two million tons moved both into Pennsylvania and into Ohio. Metallic ores were the primary components

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[1]Letter from W. F. Marks, Purchasing Agent, Armco Steel Corporation, January 26, 1960; and letter from J. W. Shea, Production Control Manager, National Gypsum Company, January 28, 1960.

[2]Appendix A gives a detailed picture of the import traffic pattern by commodity and by state. Appendix B gives a similar picture of the export traffic pattern.

[3]This percentage figure and those which follow in the discussion of the traffic pattern are based upon the tonnage for which the point of destination or origin is known, and not upon total imports and exports.

of each of these three large-scale movements; in addition, petroleum made up a large share of Maryland's receipts. To indicate that these three states form the core of the traffic flow we shall label them the primary destinations of the import traffic pattern.[1]

Six other areas, which we shall call the secondary destinations of the traffic pattern,[2] were important termini for Baltimore's imports. In decreasing order of the volume of traffic received, they were New York, West Virginia, Indiana, Michigan, Ontario, and Illinois. Metallic ores accounted for more than three-quarters of the import movements to each area except Michigan, where they were the largest single type of traffic, but less than 50 percent of the total movement.

The remaining traffic, less than 150,000 tons, moved to thirty-seven states and provinces which form the tertiary destinations in the traffic pattern.[3] Twenty-three areas received less than one thousand tons each. The composition of the traffic flow to these less important areas was not similar to that of the larger movements. Manufactures and miscellaneous products dominated the movements rather than metallic ores. In only four instances was more than one-half of a movement metallic ore.

In summary, over one-half of Baltimore's import traffic remained in

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[1]This term should not be confused with the concept of the primary hinterland of a port which means the area which ships a larger fraction of its foreign commerce through the particular port than through any other port. To designate such an area we would need traffic-flow information on many ports, but such information is not currently available. The concept of a primary destination fits our need because we are attempting to measure the importance of various areas to the port of Baltimore, not the importance of the port to the various areas. The primary destinations are states which received over 1,000,000 tons of traffic.

[2]The secondary destinations are states which received between 50,000 and 1,000,000 tons of traffic.

[3]The tertiary destinations are areas which received less than 50,000 tons of traffic.

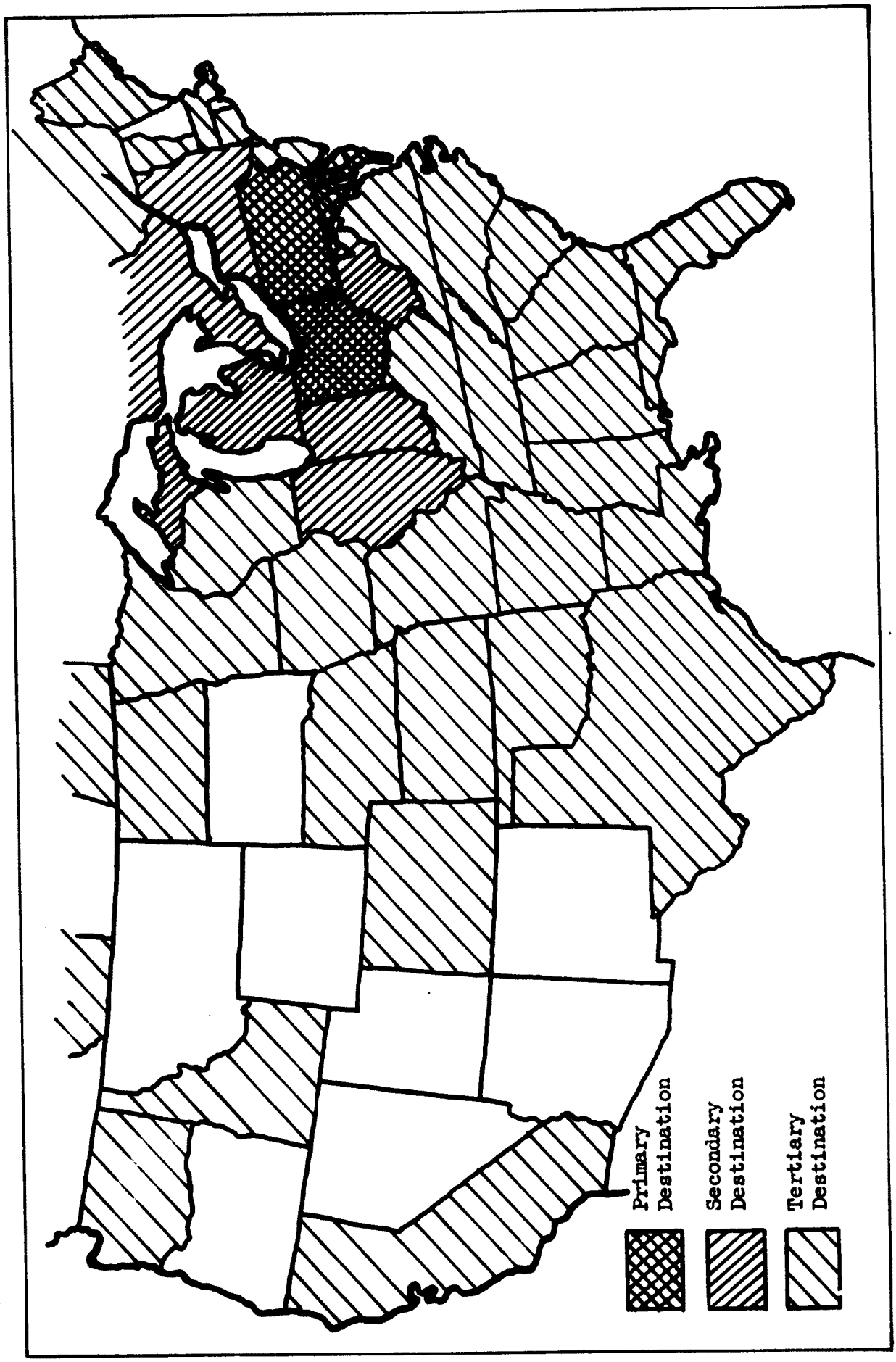


Fig. 6-Destinations of Imports, 1956

the port area,[1] but there also was a heavy movement to the Great Lakes region. A much smaller volume of goods moved north and south to states along the coast, and some traffic reached across the Mississippi River to as far west as the Pacific coast. The composition of traffic generally was a reliable guide in determining the relative importance of states in the traffic pattern. Metallic ores constituted over three-fourths of the movement to eight of the nine states in the primary and secondary destinations, but they represented a like proportion of the traffic of only four of the thirty-seven areas in the tertiary destinations.

Exports. Fewer areas (forty-one) originated Baltimore's exports than received imports, but the outbound flow of traffic was less heavily concentrated than the inbound movement. Only two states, Pennsylvania and West Virginia, originated more than one million tons of traffic, and hence can be classified as primary origins.[2] Bituminous coal, the largest single commodity to move out of Baltimore, represented 80 and 96 percent, respectively, of the exports of the two states.

Baltimore's leading export determined the primary origins, and similarly its second-ranking export, grains, set the pattern for the secondary origins.[3] In decreasing order of traffic volume originated they were: New York, Illinois, Ohio, Maryland, Minnesota, Indiana, Nebraska, Wisconsin, Michigan, Kentucky, Iowa, and Kansas. More than 50 percent of the traffic from ten of these states consisted of grain; Ohio and Michigan were the exceptions.

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[1]Local use of iron ore and petroleum represented over 90 percent of the total traffic of the state of Maryland.

[2]The primary origins are those states which received over 1,000,000 tons of traffic.

[3]The secondary origins are states which originated between 50,000 and 1,000,000 tons of export traffic.

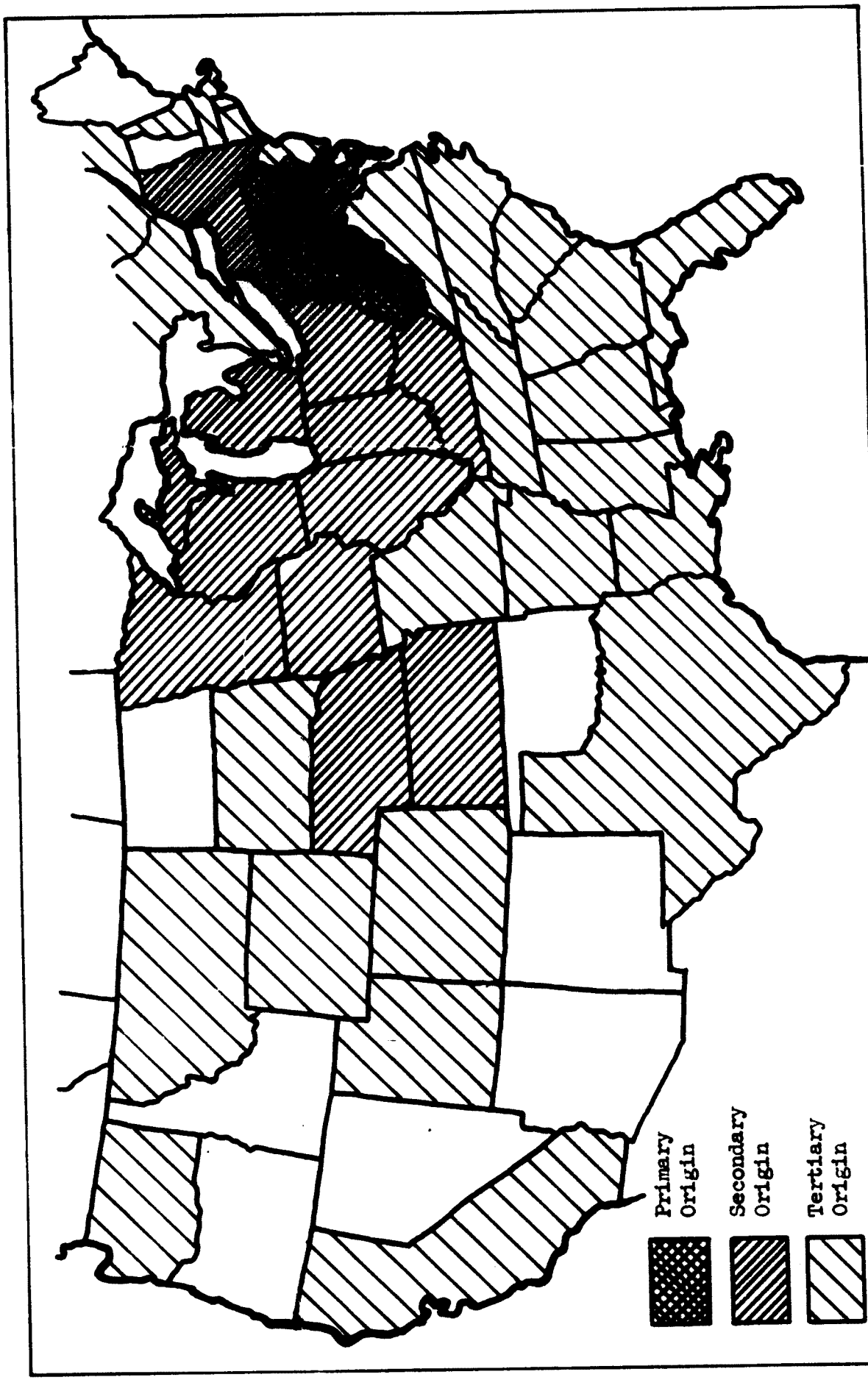


Fig. 7-Origins of Exports, 1956

The remaining 5 percent of Baltimore's export trade originated in twenty-seven states and provinces, the tertiary origins of the traffic pattern.[1] Although movements of bulk commodities, coal and grain, set the pattern for the primary and secondary origins, such commodities made up more than one-half of the traffic movement from only four tertiary-origin states. Manufactures and miscellaneous products were the largest category of exports from most of the remaining states.

Baltimore's export traffic pattern was similar to the import pattern. The outbound flow was concentrated in its origin points, the heavy movements having come from areas west and northwest of the port. Indicative of the different general locations of producers of agricultural crops and of users of industrial raw materials, important export origins lay farther west than large import destinations.

Presumptive 1956 Hinterland

We have described the pre-Seaway traffic pattern of the port of Baltimore, but our aim is to find the change in this pattern which will result from the opening of the Seaway. The probable change in Baltimore's traffic pattern must be analyzed on the basis of some theory of the relationship between the new waterway and the port. Presumably the impact will result from the Seaway's lowering the cost of bringing imports to some locations now served by Baltimore and of carrying exports from some locations which now ship via Baltimore. An analysis on this basis will be more convincing if it appears that the traffic flow which we have already described conformed to the hypothesis that goods move via the port which minimizes transportation costs. To test this proposition we shall study the movement of three commodities, iron ore, bituminous coal, and dairy products.

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[1]The tertiary origins are areas which originated fewer than 50,000 tons of export traffic.

Iron ore imports. Since the basic steel industry is the predominant user of iron ore, the flow of iron ore imported via Baltimore depends upon the location of that industry and the relative cost of using ore imported through Baltimore compared with ore imported at Philadelphia and with ore mined in the upper Great Lakes region. Locational forces in the steel industry, primarily the goal of minimizing transportation costs,[1] have caused 85 percent of the nation's capacity to produce steel ingots to be located north and east of the confluence of the Ohio and Mississippi rivers.[2] Plants are not spread evenly throughout this area, but are clustered along the Atlantic seaboard, in the Pittsburg-Wheeling-Youngstown triangle, and along the Great Lakes at Chicago, Gary, Detroit, Cleveland, and Buffalo. These are the destinations of iron ore. Our question is whether or not ore moves to these locations over the route which minimizes costs.

In 1956 the average value per ton of iron ore landed on our Atlantic coast was $7.35[3] as compared with $10.85 per ton for Minnesota ore at the lower lake ports.[4] To these prices we must add the transportation costs to the various plant locations, and then compare the totals. The cost comparison between Baltimore and Philadelphia depends upon transportation costs. In eastern Pennsylvania, Philadelphia holds a cost advantage, in the Pittsburg-Wheeling-Youngstown triangle iron ore costs are the same from

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[1]Walter Isard, Location and Space Economy, (New York: John Wiley & Sons, 1956), p. 211.

[2]U. S. Bureau of the Census, Census of Manufactures, 1954, Vol. II, p. 33A-26.

[3]U. S. Department of the Interior, Minerals Yearbook, 1956, (Washington: U. S. Government Printing Office, 1957), Vol. I, p. 598.

[4]Annual Report of the Lake Carriers Association, (Cleveland, 1957), p. 171.

both ports, and at other locations Baltimore has a cost advantage. In comparing Baltimore and lake ports, we find that Bethlehem Steel's Sparrows Point plant requires no rail movement in using imported ore, and that blast furnace operations in Illinois, Indiana, Michigan, and New York which mainly are located adjacent to Lake shipping facilities use ex-lake ore without incurring any charge for rail transportation.[1]

TABLE 6

THE RELATIVE COST OF IRON ORE IMPORTED THROUGH BALTIMORE AND EX-LAKE IRON ORE AT SELECTED STEEL-PRODUCING LOCATIONS (DOLLARS PER TON)

Location	Imported Ore		Ex-lake Ore		Saving[a] from Baltimore
	Rail Freight from Baltimore[b]	Total Cost[c]	Rail Freight from nearest Lake Port[b]	Total Cost[d]	
Baltimore	0.00	7.35	3.80	14.65	7.30
Pittsburg	3.26	10.61	2.51	13.36	2.75
Wheeling	3.44	10.79	2.51	13.36	2.57
Youngstown	3.50	10.85	1.93	12.78	1.93
Hamilton	3.94	11.29	1.90	12.75	1.46
Buffalo	3.50	10.85	0.00	10.85	0.00
Detroit	4.46	11.81	0.00	10.85	-0.96
Gary	5.62	12.98	0.00	10.85	-2.13

[a]The minus sign denotes a lower cost of using ex-lake ore.

[b]Rail rates are based upon letters from J. A. Wilson, General Coal Freight Agent, Baltimore and Ohio Railroad, December 28, 1959; and M. S. Hall, Coal Freight Agent, Baltimore and Ohio Railroad, July 22, 1960.

[c]Sum of rail freight plus $7.35, the average value of iron ore at Baltimore.

[d]Sum of rail freight plus $10.85, the average value of iron ore at lower lake ports.

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[1]Waterfront locations include Chicago and Gary on Lake Michigan, Detroit and Ecorse on the Detroit River, and Buffalo and Lackawana on Lake Erie. Lakefront furnaces are also located at Cleveland, but most of Ohio's steel capacity is situated away from Lake Erie.

On the basis of these costs our hypothesis indicates that iron ore should flow from Baltimore to western Pennsylvania, West Virginia, and eastern and southern Ohio, in addition to remaining in the port itself, and that it should not move to eastern Pennsylvania, northern Ohio, Michigan, Indiana, and Illinois. The Buffalo area should obtain its ore both from Baltimore and from the upper Great Lakes deposits. A comparison with the actual movement of iron ore shows that each of the predicted destinations received imported ore via Baltimore; however, those steel producing areas which the hypothesis indicated should not be part of Baltimore's hinterland also were actual destinations, but of a much smaller volume of traffic. It is also true that the areas included in Baltimore's presumptive hinterland, with the exception of the port itself, used domestic ore delivered from lake ports.

The fact that iron ore movements do not match perfectly our predictions indicates that cost is not the sole criterion, although the small size of movements to areas outside the presumptive hinterland supports the conclusion that costs are the major criterion. The use of domestic ores at furnaces in Baltimore's presumptive hinterland may be explained by the fact that many firms which own such plants have large investments in facilities for using domestic ores. Having sunk capital into mining properties, railroads, and steamship lines before foreign sources of ore came into use, these firms find it advantageous to continue using such existing facilities. Iron ore movements from Baltimore to eastern Pennsylvania may be explained on the basis of the operations of a multi-plant firm, the Bethlehem Steel Company. Ore extracted from the company's Venezuelan deposits is carried to its Sparrows Point plant in Bethlehem's own ore carriers. Sparrows Point, capable of producing over eight million tons of steel annually, is a huge consumer of iron ore, and consequently

the logical terminal for such traffic from South America. This integrated operation explains why the company delivers ore to its plant in Bethlehem, Pennsylvania from Baltimore rather than from the much closer port of Philadelphia. A possible reason for the movement of iron ore from Baltimore to steel centers on the Great Lakes is the need for a particular type of ore. Iron ores are not homogeneous; they are iron oxides together with various other chemicals. Different steels have different chemical make-ups, and hence there is a need for various types of iron ores. The actual movement to these areas shows clearly that the movement is not one which is coordinated with the seasonal pattern of iron ore traffic on the Great Lakes. Imports are not alternative sources during the winter months only.[1]

Bituminous coal exports. Baltimore's export coal hinterland depends primarily upon the location of coal mining activity and the relative cost of transportation via various ports. West Virginia, Pennsylvania, and Kentucky ranked one-two-three in the production of bituminous coal in 1956. Ohio was fifth and Virginia, with coal deposits in the southwestern part of the state, was sixth. Maryland mined less than 1 percent of the country's output.[2]

When we look at the cost of rail transportation, we see that the dividing line between Baltimore and Hampton Roads runs east and west, passing through Hinton and Charleston, West Virginia.[3] This division

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[1]See Table 2 of Appendix A.

[2]U. S. Department of the Interior, Minerals Yearbook, 1956, pp. 91-97. Coal production figures pertain to coal shipped from the mine via rail or water.

[3]Virginia Ports Authority, The Ports of Hampton Roads, (Richmond, 1958), p. 8; and letter from J. K. Thorney, General Coal Freight Agent, Baltimore and Ohio Railroad, January 13, 1960.

conforms closely to the routes of the Baltimore and Ohio Railroad which leads to Baltimore and the Chesapeake and Ohio Railroad which leads to Newport News. The bituminous coal fields of Pennsylvania are concentrated in the western part of the state, the eastern deposits being anthracite. As Baltimore is located closer to western Pennsylvania than is Philadelphia,[1] coal rates favor Philadelphia in the eastern fields and Baltimore in the western fields. Considering that the cost of transporting coal is high in relation to the value of the product, we would expect the coal hinterlands of the three ports to follow closely the pattern of transportation rates.[2] Baltimore should export coal mined in northern West Virginia and in western Pennsylvania. Maryland exports should move through Baltimore. If the foreign price of coal is high enough, it may pay to export coal from Ohio, and coal from the eastern Ohio fields should move through Baltimore too. Baltimore should not handle export traffic from southern West Virginia, Kentucky, Virginia, or eastern Pennsylvania.

Turning to the 1956 pattern of coal exports, we find that actual movements closely followed the presumptive hinterland. Most of Baltimore's coal exports originated in one of three coal-producing districts: (1) Clearfield, (2) West Virginia - Westmoreland, and (3) Cumberland-Piedmont-Somerset.[3] As Figure 8 shows, these lie in the presumptive

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[1]See Table 2 on page 26.

[2]The average price of bituminous coal, f.o.b. mine, in West Virginia in 1956 was $5.29 per ton, and the export rail rate from central West Virgini was $4.01 per ton. U. S. Department of the Interior, Minerals Yearbook, 1956 Vol. II, p. 107; and letter from J. A. Martin, General Freight Agent, Baltimo and Ohio Railroad, January 13, 1960.

[3]See Table 5 of Appendix B. Traffic originated in Pennsylvania, Maryland, and West Virginia was reported by the Tidewater Bituminous Coal Association as originating in one of the three districts named above, or on a railroad which operates in one of those districts.

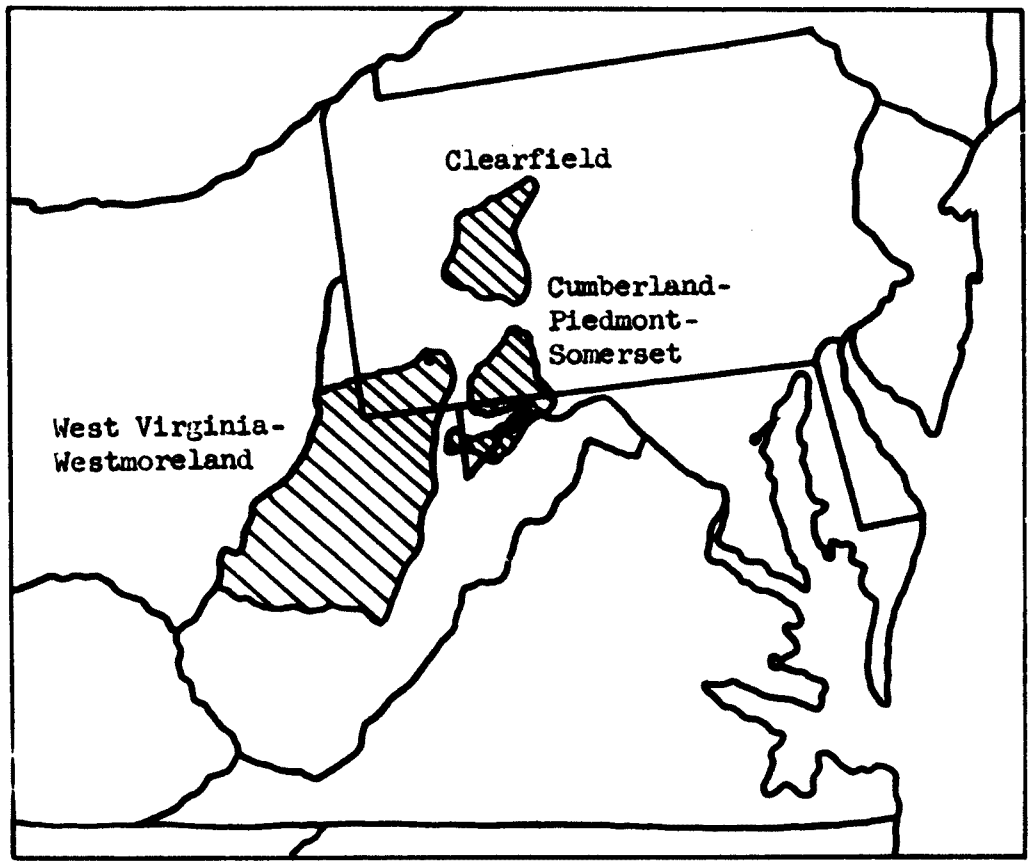


Fig. 8-Coal-Producing Regions

hinterland. A small volume of coal exports came from eastern Ohio. No coal that originated in eastern Pennsylvania or in southern West Virginia moved through the port of Baltimore.

Dairy product exports. Although the production of dairy products[1] is widespread, it is concentrated in the Midwest, particularly in Wisconsin and Minnesota, and exports do originate as far west as Iowa and Nebraska. These products move by rail under class rates and we already have seen that Baltimore has lower class rates than do New York and Philadelphia.

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[1]Our discussion of dairy products is limited to butter, cheese, and milk concentrates, the normal export products.

If dairy products move in accordance with our hypothesis, Baltimore should have a much more extensive hinterland than her rivals. Traffic originating west of the Ohio River should move to Baltimore exclusively, and that port should receive a share of the traffic of Pennsylvania and New York.

The lack of traffic-flow information about the dairy product exports of New York and Philadelphia hinders our ability to test the hypothesis, but we can make some general observations. In 1956 Baltimore exported over sixty thousand tons of dairy products. Philadelphia close to fifteen thousand tons, and New York almost seventy-five thousand tons.[1] The relative size of shipments from Baltimore and Philadelphia indicates that the latter port did not effectively attract traffic from origins in Baltimore's presumptive hinterland. Comparing exports from New York and Baltimore, we reach a different conclusion. It is doubtful that New York's large volume of dairy product exports primarily originated in areas where she faced no rate disadvantage. Traffic movements probably did not conform closely to the lower-cost route. Since general cargoes have a higher value per ton than do bulk cargoes such as iron ore and coal, transportation costs tend to represent a smaller fraction of the value of general cargoes, and this fact weakens the role of transportation costs in determining a transport route. If traffic does not move in accordance with our hypothesis, we would expect the exception to be a movement of general cargo, not of bulk cargo.

We have not yet explained why dairy products flowed in considerable volume through the port involving the higher transportation rate. Since dairy products are perishable, two factors likely influence this choice of route. New York's greater frequency of sailings reduces possible delays

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[1]U. S., Corps of Engineers, Waterborne Commerce, 1956, pp. 150, 222, and 247.

waiting for a vessel. The fact that most ships sail to overseas destinations directly from New York tends to reduce time in transit. Speed is desirable in shipping perishable goods, and New York offers faster service than Baltimore.

Our three examples show that transportation costs have a strong, but not exclusive, influence in determining the hinterland of a port. The higher such costs are in relation to the value of the product, the greater their influence. As a first approximation we can say that goods tend to move through that port which involves the lowest transportation rates, but that there are non-rate factors which must also be taken into consideration.

CHAPTER IV

ESTIMATED TRAFFIC DIVERSION FROM THE PORT OF BALTIMORE TO THE ST. LAWRENCE SEAWAY

When the Erie Canal opened in 1825, Baltimore faced competition from cheap water transportation, and again in 1959 a similar challenge arose. The St. Lawrence Seaway reaches directly into the area which Baltimore has tapped through its extensive rail network. How will the new competitive force affect Baltimore; how much traffic will be diverted? Time will tell, but we should not wait for the answer. The problems which inevitably will accompany changes in the level of economic activity, higher in the Seaway ports and possibly lower in Baltimore can be attacked more realistically if we can anticipate their magnitude and prepare for them in advance. The amount of traffic diversion will depend upon shippers' decisions, which, in turn, will be based upon comparative cost of transportation, climatic conditions, and several service factors. We shall examine each of these, and then use them as the basis for estimating how many tons of traffic which has moved through Baltimore will move via the Seaway in the future.

Factors Influencing Diversion

In the last chapter we saw that transport cost plays an important role in directing commodity movements, but we also recognized that it is not the only consideration. Service factors also exert influence. The Seaway presents still another factor which affects the flow of traffic, namely, the climatic conditions which impose seasonal limitations on the accessibility of that route.

Transport rates. When we compare the cost of shipping goods via Baltimore with the cost of moving them through the Seaway, we must consider two sets of costs, the cost of water transportation and of land transportation over each route. Since goods tend to follow the cheaper route, we are more interested in differences in costs than in their absolute level.

Looking first at the overseas portion of commodity movements, Sydney Vincent has presented the most thorough study available on the cost of Seaway transportation.[1] His article compares the cost of transporting one ton[2] of general cargo between Detroit and Antwerp in a ship designed to transit the limited-draft Seaway with the cost of carrying one ton of general cargo between Baltimore and Antwerp in the same vessel. To make the comparison he assumes that the ship operates between Baltimore and Antwerp during the months the Seaway is frozen. This is not the typical schedule of a vessel which serves Baltimore, and so to be more realistic we shall base the cost of transportation from Baltimore upon a ship which serves that port all year, not upon one which serves Baltimore only when ice prevents passage through the Seaway. Vincent offers cost estimates on the basis of both subsidized and non-subsidized operation, but we shall confine ourselves to estimates based upon subsidies. We make this choice because subsidized costs more nearly measure the actual cost considerations of steamship lines. American vessels operate under subsidies to enable them to compete with foreign vessels. Although Vincent estimates costs

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[1]Sydney A. Vincent, "The Economics of Future European-Great Lakes Freighter Service," Transactions, Society of Naval Architects and Marine Engineers, Vol. 64, (New York, 1957), pp. 162-182. The author is Consulting Naval Architect, Newport News Shipbuilding and Drydock Company, Newport News, Virginia.

[2]Since the tonnage figures used in Chapter III are measured in short tons (2000 pounds), we shall convert all cost figures in long tons (2240 pounds) to short tons in order to preserve continuity.

for vessels of two different lengths operating at various speeds, we shall limit our analysis to a 440-foot ship steaming at 14 knots, the type and speed of vessel which provide both the lowest cost of service and the smallest cost differential between Detroit and Baltimore. The ship can carry over 9000 tons of cargo.

The Great Lakes season as defined by Vincent has 214 days of ice-free operation and 4 days of maintenance, a total of 218 days. The ship serving Baltimore operates 357 days, allowing 8 days annually for maintenance. Sailing distances to Antwerp are 4,023 nautical miles from Detroit and 3,713 from Baltimore. Scheduling allows 4 round trips per year from Detroit and 7.3 from Baltimore. The schedule from Detroit allows 30 days sailing time and 24 days in port, a total of 54 days per round trip.[1] Round trip sailing time from Baltimore requires 24 days (including allowance for bad weather), and cargo handling requires 25 days for a total of 49 days.

Several costs such as wages, depreciation, maintenance, stores, subsistence, and insurance are based upon time. Baltimore service must cover full annual costs, while Seaway operations must cover 60 percent of annual costs.[2] Fuel costs depend upon the number of days enroute, the number of days in port, and the cost per ton of fuel. Cargo handling costs are $5.76 per long ton. Port charges depend upon the number of vessel stops in each port. Tolls, which apply only to Seaway cargoes, are a

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[1]Sailing time includes a one-day allowance each way for bad weather and a two-day allowance each way for slow speeds in the restricted waters of the Seaway. Time in port must be sufficient to allow for loading and unloading a full cargo, even though less is usually carried. Cargo is handled at the rate of 1500 tons per day.

[2]The Seaway season of 218 days is 60 percent of a year, 365 days. We assume that the ship is engaged in a different trade during the winter.

function of the registered tonnage of the vessel and the number of tons and type of cargo. Vessels are charged $.06 per gross registered ton plus $.95 per ton of general cargo and $.42 per ton of bulk cargo.[1] Vincent estimates overhead as 15 percent of all other costs for non-subsidized operation. We assume that on an average cargo carried is 75 percent of capacity. The cost calculations of Table 1 in Appendix C show that to ship goods to Western Europe via the Seaway costs $2.19 more per ton than shipping from Baltimore.

Not all of the trade of Baltimore and the Seaway has been with Western Europe, and so other cost comparisons are desirable. Geography has given Baltimore a large advantage over Detroit in the sailing distance to the northern coast of South America, because the Seaway route forces ships to sail out of their way to the north and east. Using the same technique as above, we can estimate the cost of carrying general cargo to and from La Guaira, Venezuela, a port 1,813 miles from Baltimore and 3,466 miles from Detroit.[2] The cost calculations, which are shown in Table 2 of Appendix C, indicate that in trading with this area Baltimore has an advantage over Detroit of $3.33 per ton. Since in terms of sailing distance Baltimore's greatest advantage exists in trade with the northern coast of South America and her smallest advantage lies in Western European trade, we can say that the cost of carrying general cargo from Baltimore to overseas points is roughly $2.00 to $3.50 per ton cheaper than from Detroit.

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[1]Report on Audit of the St. Lawrence Seaway Development Corporation, Fiscal Year 1959, (Washington: U. S. Government Printing Office, 1960), p. 16.

[2]U. S., Hydrographic Office, Table of Distances between Ports, (Washington: U. S. Government Printing Office, 1943); and Vincent, Transactions, Vol. 64, p. 163.

Turning to bulk cargoes, differences in cargo handling techniques and in ship design require separate cost estimates from those made for general cargo. The cost of shipping iron ore is reduced considerably by the more efficient means of loading and unloading. In 1956 the charge for loading and unloading iron ore on the Great Lakes was $.48 per long ton between the ships' rail and hold,[1] while Vincent's estimate of handling costs for general cargo was $5.76 per long ton.[2] Since cargo handling savings are available both at Baltimore and at Seaway ports, shipping costs to both locations fall by the same amount, so that the differential remains the same. A second difference in the ore trade is the existence of specially designed ocean ore-carriers whose large cargo-carrying capacity generates large cost savings.[3] Their size prevents these vessels from entering the Great Lakes, but as they serve the Atlantic coast ports they will be a factor in the competition between Baltimore and the Seaway.

We can get an idea of the cost relationship between the two routes by comparing Seaway cost estimates based upon Vincent's analysis with suggested ocean rates given by Benford.[4] Since Vincent's study pertains to general cargo, we must make several changes to estimate the cost of carrying iron ore. We assume that ore movements will either be captive

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[1]U. S., Department of the Interior, Minerals Yearbook, 1956, p. 598.

[2]Vincent, Transactions, Vol. 64, p. 168.

[3]Professor Harry Benford discusses the economies of large scale in the movement of bulk cargoes in "Ocean Ore-carrier Economics and Preliminary Design," Transactions, The Society of Naval Architects and Marine Engineers, Vol. 68, (New York, 1959).

[4]Ibid., p. 411

movements - in ships owned by an American steel company - or charter movements for a similar company. This assumption means that a full cargo of ore will be carried from foreign deposits to this country, but the return trip will be in ballast. Such an arrangement reduces time in port, increases the number of voyages per season, increases the volume of cargo carried, and reduces the cost of transportation. Since we are dealing with a bulk commodity, loading and unloading time declines to one day for each operation.[1] While faster cargo-handling techniques reduce costs from both Seaway ports and Baltimore, the lower toll charged against bulk cargoes further tends to lower costs of the Seaway route.

The estimated cost of carrying iron ore from Venezuela, Baltimore's largest single supplier, to Ashtabula, Ohio is $6.74 per ton.[2] Comparing this figure with Benford's suggested rate of $2.54 per ton on traffic between Venezuela and Sparrows Point, we find that Baltimore enjoys a $4.20 saving. To deliver iron ore to Ashtabula from Liberia or Norway (distance is about equal from the two locations) costs an estimated $8.09 per ton. Benford gives no rate from either of these sources of iron ore, yet we can estimate that his suggested rate would not be above $4.39, and would probably be closer to $4.00 per ton.[3] Using the latter figure, Baltimore's saving over the Seaway is $4.09.

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[1]Baltimore's ore piers can unload 2,000 tons per hour, allowing for a 1-day turnaround. Maryland Port Authority, Port of Baltimore Handbook, 1959, p. 64.

[2]Calculations appear in Table 3 of Appendix C.

[3]The estimated rate is in the same proportion to Benford's suggested rate from San Juan, Peru to Morrisville, Pennsylvania ($3.75) as the distance between Monrovia and Baltimore (4151) is to the distance between San Juan and Morrisville (3626). This proportional relationship over-estimates the rate from Liberia, as transportation costs generally increase less than proportionally with distance.

Baltimore enjoys a distinct advantage over Ashtabula as the terminal point for iron ore received from overseas, but that advantage largely disappears in the movement of iron ore from Seven Islands, Quebec, the outlet for ore mined in the Quebec-Labrador fields. Great Lakes ore-carriers, which are designed for limited-draft operation, can transit the Seaway and haul the Canadian ore in large volume, taking advantage of economies of scale. Although Ashtabula is closer to Seven Islands than is Baltimore, time delays at the Locks and in restricted channels make transit time approximately the same to either port. With similar cargo-carrying ability and similar time in transit over both routes, costs must be similar too, except for the toll charged on the Seaway. On Labrador ore Baltimore's advantage is 42¢ per ton, the amount of the Seaway toll.

Another important type of cargo for which cost comparisons are needed is grain. Hartley has estimated cost differentials between Seaway ports and Baltimore in carrying export grain to several overseas ports.[1] His calculations are based upon a foreign-flag tramp steamer carrying a full cargo of 8,000 long tons. He allows one day for delay in the Seaway, but recognizes that congestion may cause a two-day delay. To preserve continuity we shall assume a two-day allowance for slow-speeds, which Hartley estimates will raise the cost differentials by 18¢ per ton. Since his toll estimate is 3¢ below the actual toll being charged on the Seaway, we shall increase his cost estimates by a total of 21¢ per ton. The resulting cost differentials are given in Table 7.

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[1]Joseph R. Hartley, The Effect of the St. Lawrence Seaway on Grain Movements, (Bloomington: Bureau of Business Research, Indiana University, 1957), Chapter 5.

TABLE 7

ESTIMATED COST DIFFERENTIALS FOR CARRYING GRAIN TO SELECTED FOREIGN PORTS (IN CENTS PER TON)

Foreign Port	Chicago over Baltimore	Cleveland over Baltimore
Antwerp, Belgium	113	75
Bombay, India	123	85
Naples, Italy	123	85
Rio de Janeiro, Brazil	181	143

Coal is another of Baltimore's major foreign cargoes whose origin locations make it possibly subject to diversion. Like iron ore and grain, coal moves in bulk form. Unlike iron ore, it is not carried in vessels specially designed to achieve economies of large scale, and coal movements differ from the grain trade in that colliers often carry cargo on just one leg of their voyage. Many ships which carry coal from Baltimore to Western Europe or the Mediterranean - Baltimore's largest markets - return in ballast. Since waterborne movements of coal and grain are similar, and since Hartley gives some estimates of cost differentials for grain when no return cargo is carried, we shall use his estimates. A comparison of Hartley's differentials with and without a return cargo shows that the Seaway's disadvantage vis a vis Baltimore is two-thirds greater without a return cargo than with one. To find the cost difference for carrying coal over the two routes we multiply the grain differentials by one and two-thirds. The result shows that Baltimore has an advantage of approximately $1.25 per ton.

Because Seaway ports are located farther from overseas ports than is Baltimore and because ships face delays in transiting the Seaway, sailing time and costs are less from Baltimore for all types of cargo. Baltimore's advantage is greatest in carrying iron ore, indicative of the inability of

large, economical ocean ore-carriers to navigate the Seaway's shallow channel; her advantage is least in carrying grain, showing the influence of carrying a capacity cargo to spread fixed costs. Table 8 summarizes the differences in the cost of water transportation via the two routes. The tapering principle, which ocean transportation costs follow, has led to the equalization of freight rates among several ports. The probable structure of rates to and from Great Lakes ports will continue to be one of equal rates among ports below the Detroit River and higher rates for ports above the Detroit River.[1]

Now that we have studied the cost of the waterborne portion of foreign trade via the two routes, we introduce rail rates into the analysis in order to compare total transportation costs over the competing routes. From any location we find the rail plus water rates for each route and compare the sums, and whichever route involves the lower over-all cost will tend to carry the traffic of that locality. By identifying a series of places from which the two sums are equal, we find those locations from which neither route has an advantage. They are equal-cost points. We can then make the general statement that locations nearer to the Seaway than the equal-cost points find the Seaway the cheaper route and places situated nearer to Baltimore find it cheaper to ship through that port. Since Baltimore enjoys a lower cost of water transportation, the equal-cost line, which joins the equal-cost locations, must lie closer to the Seaway ports than to Baltimore, indicating that rail rates are lower to Seaway ports.

Using this technique, we find equal-cost lines for general cargo, ores, grain, and coal. In locating the equal-cost line for general cargo,

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[1]United States Great Lakes Bordeaux-Hamburg Range, Eastbound Conference Tariff No. 1, effective April 15, 1957.

TABLE 8

ESTIMATED COST DIFFERENTIALS FOR CARRYING SELECTED CARGOES TO SELECTED FOREIGN PORTS

Cargo	Cost	
	¢/ton	¢/cwt.
General Cargo		
Detroit over Baltimore		
to or from Antwerp, Belgium	219	11.0
to or from La Guaira, Venezuela	333	16.7
Iron Ore		
Ashtabula over Baltimore		
from La Guaira, Venezuela	420	21.0
from Monrovia, Liberia	409	20.5
from Seven Islands, Canada	42	2.1
Grain		
Cleveland over Baltimore		
to Antwerp, Belgium	75	3.8
to Bombay, India	85	4.2
to Naples, Italy	85	4.2
to Rio de Janeiro, Brazil	143	7.2
Chicago over Baltimore		
to Antwerp, Belgium	113	5.6
to Bombay, India	123	6.2
to Naples, Italy	123	6.2
to Rio de Janeiro, Brazil	181	9.0
Coal		
Cleveland over Baltimore		
to Antwerp, Belgium	125	6.2
to Naples, Italy	142	7.1

we use class rates.[1] Since a large share of Baltimore's foreign traffic falls in classes 35, 40, and 45, we use class 40 in determining rail rates.[2]

[1]For rate-making purposes every good is classified as belonging in one of several classes. Between any two points all goods in the same class move at the same rate, while goods in different classes move at different rates. The higher the class number, the higher the rate.

[2]Some of the goods included in these classes are canned fruit, dry milk concentrates, and steel bars.

For general cargo traffic with Western Europe the equal-cost line runs from Binghamton, New York to Connellsville, Pennsylvania, Clarksburg, West Virginia, Bristol, Virginia, and across Tennessee to the Mississippi River south of Memphis.[1] Transportation costs tend to channel the Western European general cargo trade of all points situated north and west of this line via the Seaway, and the traffic of points located south and east of this line through Baltimore. As Baltimore has a greater cost advantage in trade with the northern coast of South America, the equal-cost line for such traffic lies even closer to the Seaway. The line crosses the New York-Pennsylvania border near Elmira, New York and passes near Punxsutawney, Pennsylvania, Charleston, West Virginia, Elkhorn City, Kentucky and across southern Tennessee.

Turning to iron ore imports, we use commodity rates, which apply to individual commodities and differ among commodities. To find the equal-cost line for iron ore imports we consider ore coming from Labrador, because the large water rate disadvantage of the Seaway in carrying ore from South America, Africa, and Europe (about $4.00 per ton) lets Baltimore serve almost all ore-consuming centers. Even Buffalo, located on Lake Erie, can get overseas iron ore cheaper by rail from Baltimore than via the Seaway.[2] From Seven Islands, Quebec the water rate to Ashtabula is only 42¢ above Baltimore. The break-even point on this movement is Johnstown, Pennsylvania. The rail rate from Ashtabula is $2.60, while from Baltimore it is $3.03; thus the total cost of transporting iron ore

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[1]For example, Baltimore enjoys an 11¢ per hundredweight advantage over Seaway ports. The rail rate from Clarksburg, West Virginia to Baltimore is 100¢, and to Cleveland, the nearest Seaway port, it is 89¢. Baltimore's 11¢ advantage on the waterborne portion of the movement is offset by her 11¢ disadvantage on the rail portion.

[2]From Venezuela, the cost via Baltimore is $2.54 (water) plus $3.50 (rail), or a total cost of $6.04. Via the Seaway, the cost is almost $6.74.

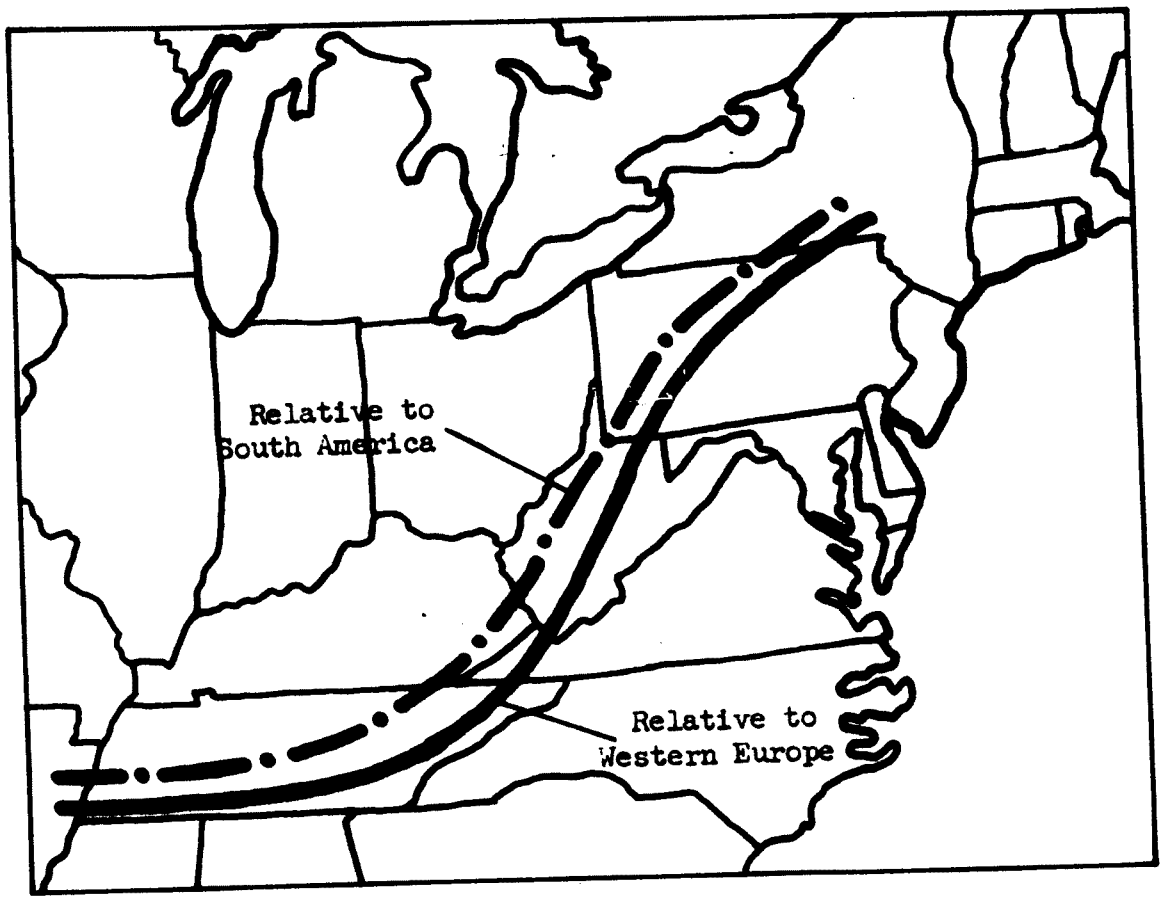


Fig. 9-Equal-cost Lines for General Cargo

to Johnstown is almost the same (within 1¢) via each route. By drawing a line north and south through Johnstown, we separate points for which the Seaway is the cheaper route from those for which Baltimore is less expensive. Over-all rates make the Seaway the cheaper route for carrying Canadian ore to all steel-producing locations in Baltimore's pre-Seaway hinterland, except those in central and eastern Pennsylvania and, of course, Sparrows Point.

The equal-cost line for coal exports to Europe is located where rail rates to Lake Erie ports are about $1.30 per ton below rail rates to Baltimore. From the Pittsburg district of western Pennsylvania the difference is only 90¢;[1] hence the equal-cost line lies west of the Ohio

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[1]Letter from J. A. Martin, January 13, 1960.

River.

The equal-cost line pertinent to grain exports must show either a 4¢ per hundredweight advantage in comparing rail rates to Lake Erie ports with rates to Baltimore, or an advantage of 6¢ per hundredweight to Chicago as compared with Baltimore. Using export wheat rates, we locate the equal-cost line as lying southeast of Columbus and Cincinnati, and then running westward to St. Louis.[1]

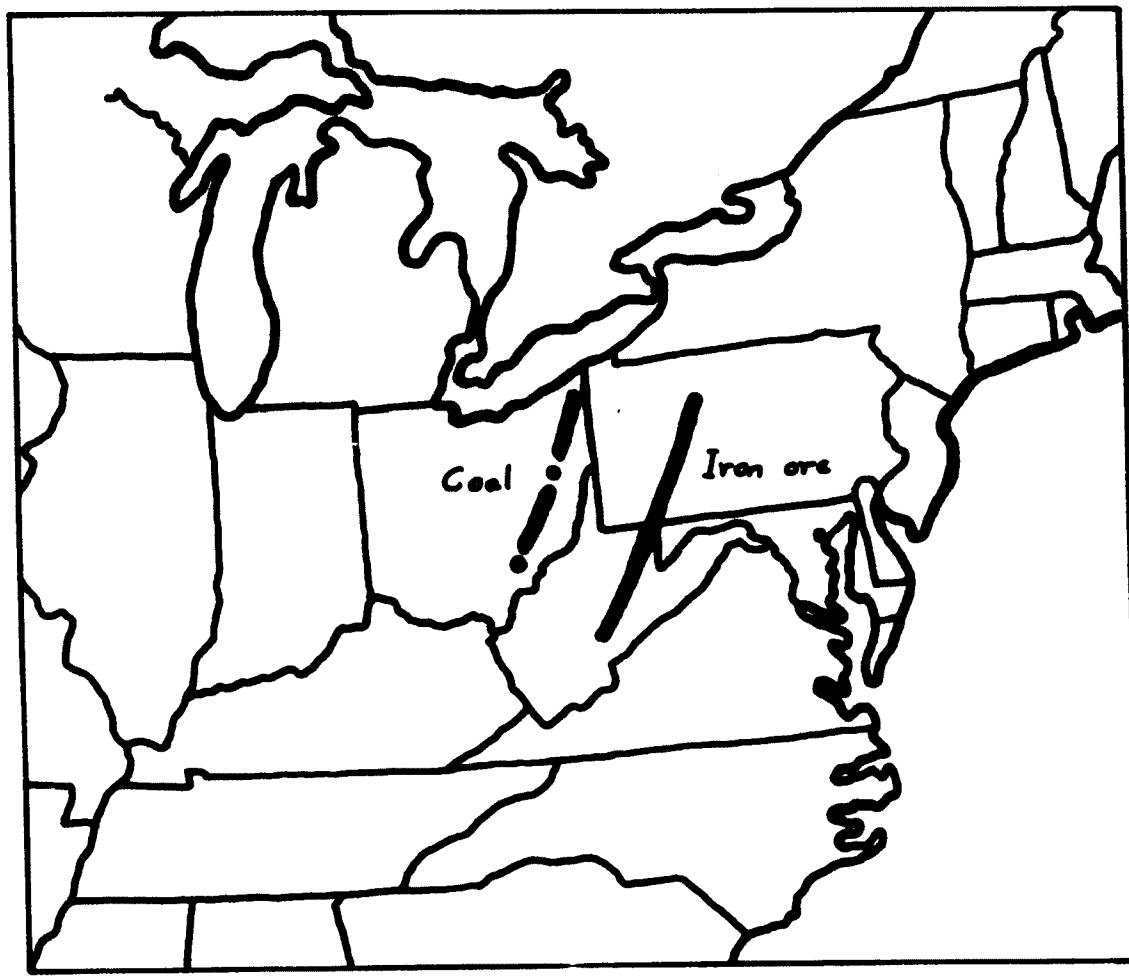


Fig. 10-Equal-cost Lines for Export Coal and Import Iron Ore

[1]Letters from J. A. Martin, April 19, 1960 and May 3, 1960.

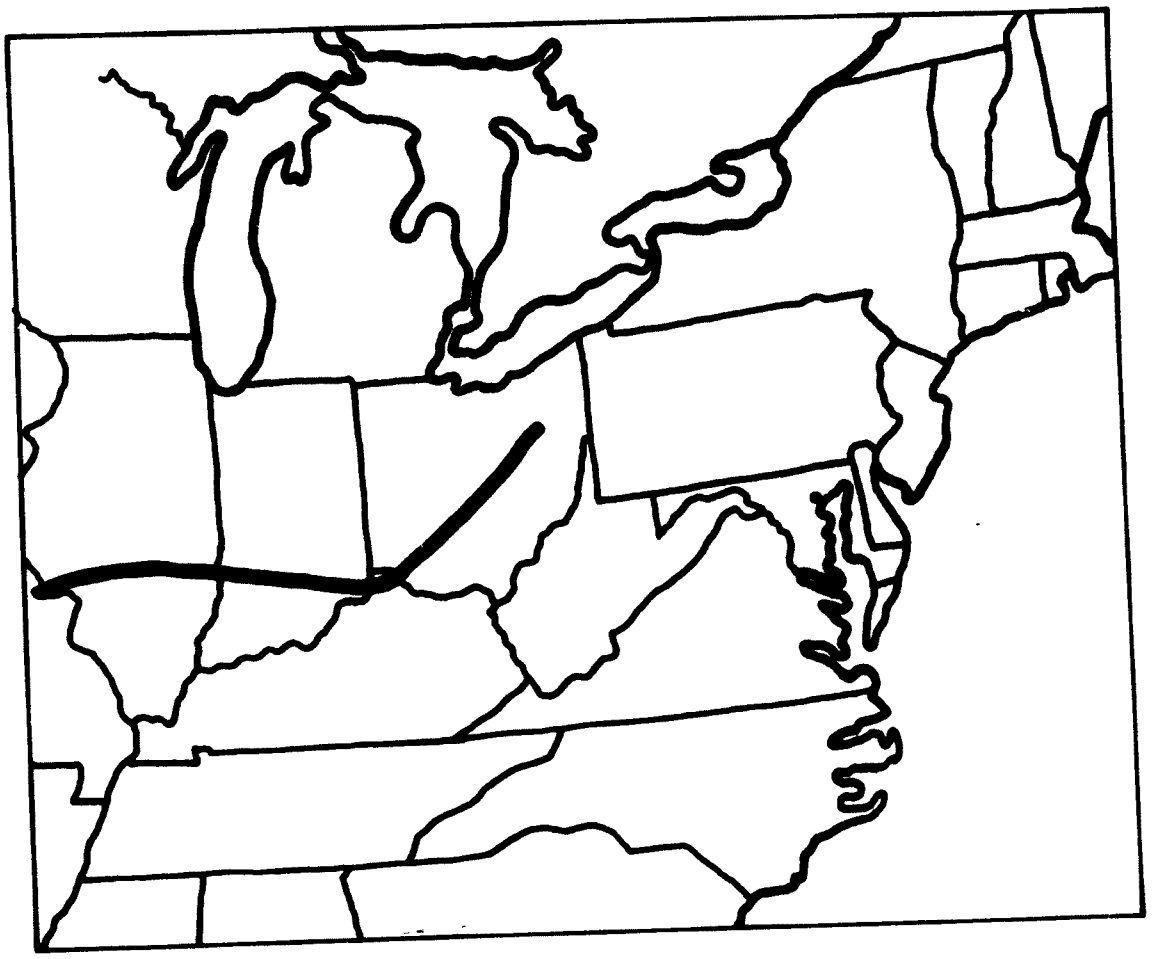


Fig. 11-Equal-cost Line for Export Grain

Seasonality. In addition to differences in transportation costs, differences in climatic conditions influence the competitive positions of Baltimore and the Seaway. The port of Baltimore is generally ice-free and can be kept open to traffic twelve months of the year, but the Seaway is not ice-free. Part of the year it is frozen and closed to traffic.

Several estimates, ranging from seven to nine months, have been made of the length of time that ships will be able to engage in the Great Lakes-overseas trade.[1] For the purpose of this study, we shall define the

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[1]U. S., House of Representatives, Seaway Hearings, 1951. Mr. Stanton of the Baltimore Association of Commerce stated that the Seaway would be " ... usable only about 7 months out of each year." (p. 1555), while Mr. Norman W. Foy of the Republic Steel Corporation said "... between the months of January, February, and part of December and part of March, why, there is no possibility of getting ore through (the Seaway)." (p. 438).

navigation season as extending from April 22nd through November 30th. These are the average opening and closing dates of foreign traffic through the 14-foot St. Lawrence canals over the nine years from 1949 through 1957.[1] The 1956 traffic pattern is divided into two parts to reflect this seasonal pattern. Traffic which moved during December, January, February, March, and 73 percent of April is classified as having moved during the Seaway's closed season. Open season traffic is that which moved through Baltimore during May through November plus 27 percent of April's traffic.

It is possible that users of the Seaway will adjust their traffic movements to fit the seasonal pattern, just as steel companies currently stockpile iron ore during the summer months to meet their winter requirements. Such a policy would do much to increase the Seaway's competitive power. There is a strong likelihood that imports of iron ore, especially from Seven Islands, will adjust to the seasonal character of the Seaway. Grain movements might also adjust if adequate storage facilities are available. However, Adam Keller of the Louis Dreyfus Corporation, a large grain exporter, feels that a lack of overseas storage facilities will do much to continue year-round shipments of grain.[2] Because storage costs are higher and the need for inventory capital is greater, general cargoes are much less likely to be stockpiled in anticipation of the Seaway's freezing. The seasonal nature of Seaway operations will reduce the pull of that route on foreign cargoes, although it may be possible to ship a year's supply of iron ore in the little more than seven months that the Seaway is open.

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[1] Annual Report of the Lake Carriers Association, 1949 to 1957.

[2] Donald Zylstra, "The St. Lawrence Seaway: A Threat to Baltimore?" Baltimore American, January 18, 1959.

Service factors. There are several cost considerations which are not included in transportation rates, but which also are factors influencing the choice of route. These factors are responsible for the routing of part of the foreign trade of such states as Ohio, Indiana, and Illinois through the port of New York, even though import and export rail rates are lower from and to Baltimore. Some ports have better cargo handling records than others; damage and pilferage are less. One problem facing the lake ports when the Seaway opened in 1959 was the general lack of a sufficient number of experienced longshoremen to handle the increased traffic.[1] Although probably not permanent, such a condition leads to delays and damaged cargoes while it continues. Lake ports are experienced in handling bulk cargoes, especially grain and ore. For these products they offer service comparable to Baltimore.

Frequency of sailing is another factor with a bearing on the choice of route. More frequent sailings mean faster transportation service. New York has more sailings than any other American port, an advantage partially responsible for its position as our leading port.[2] In its early stages of operation the Seaway will be hampered considerably by its less frequent service. As time passes the number of sailings from the Great Lakes will probably increase; however, it will be a long time, if ever, before the Seaway ports match Baltimore in frequency of sailings.

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[1] "Seaway Made a Slow Start," Business Week, January 23, 1960, p. 129. In Buffalo, off-hour firemen and policemen constituted the longshoreman force. R. H. Benton, "Report on the Great Lakes-St. Lawrence Seaway," submitted to Farrell Lines, Inc., 1956.

[2] In 1958 New York had 39,333 sailings, Philadelphia had 11,413, and Baltimore had 9,281. U. S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, 1958, (Washington: U. S. Government Printing Office, 1959).

In addition to delays resulting from less frequent sailings, Seaway traffic will be longer enroute than will goods which move to or from Baltimore. Differences in sailing time stem from differences in distances between ports and from the additional time required to pass through the locks and restricted channels of the Seaway. Little can be done to reduce the Seaway's disadvantage in this respect, although there has been talk of "twinning" the locks in the Welland Canal to allow two-way traffic through that bottleneck.[1]

Many firms have established offices on the Atlantic coast to handle their import and export traffic, and other multi-plant firms channel their foreign trade through eastern plants. Proximity to the port allows closer control over import and export movements. Such arrangements will tend to continue the routing of goods through eastern ports, even in the face of lower transportation rates via the Seaway.

The seasonal factor also has a service aspect. Most Seaway users will want to move goods during the winter when ocean ports offer the only available routes. To maintain contacts and to insure good service in the winter months, such firms may send at least part of their summer traffic via coastal ports.

All of the factors we have discussed, rates, climate, and service, form the basis upon which each shipper must decide whether to move his goods via the Seaway or through the port of Baltimore. Using rates and the seasonal pattern, we can find the maximum potential loss of traffic from Baltimore to the Seaway; but to estimate the probable volume of traffic diversion we must include all three factors.

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[1] "Seaway Sufferers," Wall Street Journal, November 8, 1959, p. 6.

Maximum Potential Diversion

As a first approximation, we can say that traffic will follow whichever route involves the lower total freight rates, rail plus water. The maximum potential diversion is a measure of the number of tons of traffic for which the Seaway offers lower transportation rates. It is the traffic which moves to and from locations north and west of the equal-cost lines.[1] In view of the fact that the service factors tend to favor Baltimore as opposed to the Seaway, it is unlikely that any traffic for which Baltimore offers lower rates will move through the Seaway. Baltimore stands to lose no more than the traffic which the Seaway can carry at lower rates.

To find the maximum potential diversion we measure the volume of traffic which moved through Baltimore to or from the Seaway's rate area in 1956. For movements between Baltimore and New York, Pennsylvania, West Virginia, and Ohio we have information from the railroads showing the city of origin or destination, and the traffic of these four states is apportioned to the Seaway's rate area on the basis of the location of the city of origin or destination. Since we do not have information on the city originating grain exports from Indiana, Illinois, and Missouri, we must estimate the volume of such traffic which originated north of the equal-cost line. County statistics from the Census of Agriculture provide the basis for the estimate.[2] For each type of grain the Census shows the number of bushels sold in each county. We estimate that grain

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[1]Henceforth we shall refer to this area as the "Seaway's rate area," and similarly the phrase "Baltimore's rate area" will refer to the area south and east of the equal-cost lines, the area for which Baltimore offers lower rates.

[2]U. S. Bureau of the Census, Census of Agriculture, 1954, Vol. I, Parts 4, 5, and 10.

origins from the Seaway's rate area were in the same proportion to each state's total origins as grain sales in that area were to total grain sales in each state. Although most of Baltimore's 1956 iron ore imports came from overseas deposits (from which Baltimore has a large rate advantage over the Seaway), the output of the Quebec-Labrador mines is large enough to supply all of the iron ore which moved from Baltimore to points west of Johnstown (the area to which Canadian ore moves more cheaply via the Seaway). For this reason we shall base the maximum potential diversion of iron ore imports upon the equal-cost line which pertains to movements from Seven Islands. Because the Seaway is closed during the winter, potential diversion includes only that traffic which moved to or from the Seaway's rate watershed during the navigation season. We noted earlier, however, that there is a strong presumption that steel company's will import sufficient ore during the open season to supply their needs for the entire year; therefore the potential diversion of iron ore includes traffic of both the open and closed seasons.

In 1956 well over four million tons of cargo moved between the port of Baltimore and the Seaway's rate area during the open season and close to one million tons of iron ore moved to that area during the closed season (see Table 9). If the 27-foot Seaway had been open in 1956, the maximum potential diversion would have amounted to over five and one-half million tons, almost one-fifth of Baltimore's total foreign commerce. Two of the port's four largest cargoes, petroleum and coal, would not have been subject to diversion. Petroleum imports had a very localized market, and Baltimore's coal origins lay east of the equal-cost line.[1]

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[1]In support of the conclusion that Baltimore's coal traffic is not subject to diversion we may note that no steamship company serving the Seaway publishes a rate for carrying coal from the Great Lakes to overseas destinations. Letter from J. A. Jarosi, Export Manager, Great Lakes Overseas, Inc., February 17, 1960.

TABLE 9

THE VOLUME OF TRAFFIC MOVED BETWEEN THE
PORT OF BALTIMORE AND THE SEAWAY'S RATE AREA
1956
(IN TONS)

Type of Traffic	Imports		Exports		Maximum Potential Diversion
	Open Season	Closed Season	Open Season	Closed Season	
Iron Ore	2,128,351	936,640	1,380,395	838,710	3,064,991
Grain			28,352	22,848	1,380,395
Products of Agriculture	52,531	23,444	50,686	30,136	81,483
Products of Animals	187	417	8,713	7,019	50,873
Products of Mines	357,621	248,331	948	814	366,334
Products of Forests	869	1,769	469,016	426,190	1,817
Manufactures and Miscellaneous	160,126	109,660			629,142
Total	2,699,685	1,319,942	1,938,710	1,325,717	5,575,035

Iron ore imports and grain exports would have constituted a large part of the potential diversion. Somewhat over 10 percent of the potential diversion would have consisted of general cargoes.

The port of Baltimore faces a potential loss of close to 20 percent of its international trade to the competitive route. How much of that potential actually will be diverted we cannot estimate without considering all of the factors which influence the selection of a transportation route. The inclusion of service considerations should keep actual diversion below the maximum potential.

Estimated Traffic Diversion

Starting with the traffic which the Seaway attracts by lower rates and which moves at the time of year that the Seaway route is accessible, we can now introduce the influence of the service factors and estimate the probable amount of traffic diversion. We have listed the pertinent service considerations and have indicated the direction of their influence, but no line of reasoning can tell us how strong these influences will be, to what extent they will counterbalance the pull of rates in the opposite direction.

Survey of importers and exporters. In order to estimate the role of service factors and to ascertain shippers' feeling about their own use of the Seaway, a survey was conducted among importers and exporters who had used the port of Baltimore prior to the Seaway's opening. On the assumption that traffic for which Baltimore remains the cheaper route will continue to use that route, the survey was limited to shippers who moved traffic to or from the Seaway rate area.

The general aim and content of the proposed survey questionnaire were discussed with several firms in Chicago. From these personal

interviews it seemed that importers and exporters would generally be able and willing to provide information about their foreign trade activities, the non-rate factors to which they give weight, and their attitude toward their future use of the Seaway. A sample questionnaire was prepared and was discussed with some firms in Pittsburg, and comments, criticisms, and suggestions made by traffic personnel of these firms formed the basis for revising the questionnaire. Several foreign traders in Detroit looked over the revised set of questions which with minor changes became the final questionnaire.[1]

The sample of importing and exporting firms to which the questionnaire was mailed was taken at random from the 1956 records of the Baltimore and Ohio and the Pennsylvania railroads. Since the major aim of the survey has been to estimate the number of tons of cargo which will probably be diverted from Baltimore to the Seaway, the sample was taken of traffic tonnage, not of firms directly. The sampling procedure picked every 1,800th ton of cargo, and the firm which imported or exported that ton of cargo was included in the group to which a questionnaire was sent. The weighting factor assigned to each firm was the number of tons moved between the Seaway's rate area and the port of Baltimore by that firm in 1956.[2]

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[1]Interviews were held in Chicago on December 30, 1958 with traffic personnel of United States Steel Corporation, Armour and Company, and Joseph Gies Import, Incorporated; in Pittsburg on February 3, 1959 with representatives of Pittsburg Bolt and Screw Corporation and Federal Cold Storage Company; in Detroit on April 15, 1959 with Goebel Brewing Company, Hancock Steel Company, and Feldman Brothers. A copy of the questionnaire may be found in Appendix D.

[2]The weighting factor is based upon the volume of traffic carried by the two railroads from whose records the sample was taken, not upon all three Class I railroads which serve the port of Baltimore.

Questionnaires were sent to one hundred forty firms. One month later a follow-up letter and a copy of the questionnaire were sent to those firms which had not answered. A total of fifty-three firms responded, a rate of 38 percent. The weighted response rate was 47 percent. A breakdown of the responses by industry is shown in Table 10. The relative importance of grain in the replies is far greater than grain's relative importance in the flow of traffic between Baltimore and the Seaway's rate area. Replies from two offices of the Commodity Credit

TABLE 10

QUESTIONNAIRE REPLIES BY INDUSTRY

Industry	Number of Firms	Percent of Traffic
Grain and grain products	12	85.2
Food	8	2.5
Basic metals	5	7.6
Metal fabricators	5	0.9
Machinery and vehicles	5	0.2
Chemicals	5	0.4
Rubber	3	1.2
Other	10	2.0
Total	53	100.0

Corporation, the governmental agency which administers grain exports, account for the dominant position of grain. The importance of basic metal producers in the response is smaller than their role in traffic movements. Only one of the top ten steel producers returned the questionnaire. The deficiency of replies from this group reduces our ability to anticipate the probable diversion of metallic ore imports, but we can base such an estimate upon replies from smaller steel manufacturers and from users of non-ferrous ores.

The results of any survey are subject to bias in that the respondents may not be representative of the entire group that was contacted, and hence their answers may not be representative of the entire group. If answers only came from firms which had a history of using the shallow-draft canals, we would not expect the survey results to present an accurate picture of the impact of the Seaway upon trade routes. To check the presence of any such bias in the survey, several firms which did not return the questionnaire were asked why they failed to do so. The most common reason given was that the time and effort required to compile the information requested was more than they were willing to devote. The amount of work was not great merely because the firm was large rather than small, but stemmed from the form of their records which made it difficult to extract the information. (A similar situation was found among many firms which did reply; their records sometimes were inadequate or made it impractical to answer every question.) One firm indicated that it was not its policy to give out such information. The reasons given for non-response did not indicate any bias due to answers coming only from firms with a special interest in the Seaway or from generally large or generally small firms.

The number of answers to the questionnaire is too small to allow any sophisticated statistical analysis, and the general applicability of the answers is limited by the exaggerated influence of the Commodity Credit Corporation and by the under-emphasized position of the large steel firms. Due to the span of time involved answers to questions about the firms' probable behavior in 1965 obviously are not an infallible guide to their future action, but they are a guide. The answers represent the firms' current anticipation of their future behavior. Keeping these

limitations in mind, we turn to an analysis of the survey results.[1]

We shall analyze the results of the survey in three steps: (1) the reasons for increased use of the Seaway, (2) the reasons for this increase occurring at the expense of Baltimore, and (3) the magnitude of the probable traffic diversion from Baltimore to the Seaway. The increase in Seaway traffic can come from firms which had not used the old shallow-draft canals or from increased patronage by firms that had used them.[2] Of twenty firms (6 percent)[3] which had used the 14-foot canals, eight (2 percent) planned to increase the volume of traffic they would ship through the Seaway by 1965. Six firms (65 percent) replied that they would become new users of the Seaway route, and an additional seven firms (20 percent) indicated that they might use it, giving a total of twenty-one companies from which the Seaway might attract larger cargoes. The gain in Seaway traffic will cause diversion from Baltimore in twelve cases (84 percent); will not cause diversion in four instances (less than 1 percent); and may or may not adversely affect that port in five cases (less than 1 percent).[4] The Seaway definitely will affect the volume of overseas cargo which will move through the port of Baltimore.

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[1]An aggregate summary of the replies to the questionnaire appears in Appendix E.

[2]The following is based upon each firm's answers to questions 6, 8, 10 and 14. See Appendix E.

[3]The number in parentheses is the weight of the twenty firms, expressed as a percentage of the total weight of the fifty-three firms which responded.

[4]These five firms gave no indication of how the greater use of the Seaway will influence traffic volume at ocean ports.

Let us consider what factors account for the increase in Seaway use. Of the six new Seaway users, five stressed the role of transport costs in selecting a route. Cargo handling facilities influenced the decisions of four firms. Two of these were grain exporters, and since waterfront grain elevators and efficient grain handling already exist at lake ports, their needs can be served adequately; and another firm gave the impression that it looked for cargo handling efficiency to improve to its satisfaction with time. One firm noted that the proximity of its plant to the Seaway will allow it to use its own trucks on the overland portion of the route, thus providing closer control over shipments.

Turning to the seven firms which are probable new users of the Seaway, we find that three emphasized the importance of transportation rates in their choice of route; however, two of these also gave consideration to transit time. Since both firms trade mainly with South America, the Seaway's rate advantage is small and sailing time is a disadvantage. These firms may be waiting for rates and sailing time via the Seaway to settle down before deciding whether to use that route. One of the government grain exporters gave an uncertain answer because it was not sure of the role the government would be playing in 1965. At present there is no evidence that the Federal Government will abandon its farm support program, from which stems its position as a grain exporter; hence there is a strong presumption that this CCC office will become a new Seaway user. Two firms indicated that they have eastern plants (one located in Baltimore itself) through which most of their foreign business is handled. Evidently, these firms have not decided whether the rate advantage of the Seaway will offset the benefits of centralized handling of foreign traffic. The seventh firm did not give sufficient information to interpret its reasons for possibly shifting to the Seaway.

Five of the eight firms which answered that they will increase the volume of their Seaway shipments emphasized low rates; and two of these indicated that their proximity to Seaway ports will improve their control over cargo movements. The remaining three companies gave no answers explaining their increased use of the Seaway.

Although we have anticipated increased use of the Seaway, three firms answered that they used the 14-foot canals in 1958, but they did not indicate that they planned on using the improved waterway in 1965. One said it will not use the Seaway; one said it possibly will use it; and one did not answer whether it will or will not use it. The first firm has two plants located in southeastern Pennsylvania, within approximately fifty miles of Baltimore. Since most of the company's imports have come through Baltimore, regardless of their destination, these eastern plants may be responsible for handling the firm's import activities. Although its answers did not so state, the firm may plan to channel all of its foreign trade through one or both of these plants. The company which may possibly use the Seaway in 1965 has operations scattered widely throughout the country. The volume of its foreign trade to and from the Seaway's rate area is large, yet its past use of the 14-foot canals was small. Frequency of service and sailing time are important factors in the firm's choice of routes; however these considerations might better explain an unchanged volume of Seaway traffic than a possible decrease in it. The firm which did not indicate its plans for 1965 probably will continue to use the Seaway. Its objection was that vessels do not adhere to established schedules so that transit time becomes uncertain. The firm anticipated better service in this respect in the future, and it will resume its use of the Seaway when such improvement occurs.

The Seaway's rate advantage is its basic attraction for increasing its traffic volume. Its facilities for handling grain do not attract traffic, since they are comparable not superior to Baltimore's, but they are important in the decisions of grain exporters. The nearness of the waterway to some plants allows close control over traffic which draws traffic to it. The Seaway will find it difficult to attract the traffic of firms which place considerable importance upon either frequency of service or sailing time.

To discover why some of the increased Seaway traffic will be diverted from Baltimore we turn to the service provided there and compare it to Seaway service. Twenty-two (92 percent) of the fifty-three firms answered that Baltimore possessed special advantages in moving their goods.[1] Sixteen recognized its inland rail rate advantage over other Atlantic ports. Six specified the port's efficiency in cargo handling, and of these two were grain exporters and two were importers of metallic ores, cargoes in which the port of Baltimore specializes. Two firms indicated that plants located near Baltimore helped in moving goods through the port.

The port's advantages serve to channel through Baltimore the traffic of firms which stress those points. Six of the seven firms which shipped over 90 percent of their traffic via Baltimore cited advantages of that port. The seventh shipped goods for export under instructions from another firm and therefore could not answer. Five of the six firms which shipped between 46 and 90 percent of their overseas trade through Baltimore also cited particular advantages. The sixth could not answer because it exported under outside instructions. Of thirteen companies that used Baltimore for 1 to 15 percent of their foreign traffic, only three listed

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[1]See answers to question 8 in Appendix E.

special advantages, and only seven out of twenty-seven firms which moved from 16-45 percent of their business through that port indicated specific advantages.

The advantages which attract traffic to Baltimore are similar to those which the Seaway offers, low transportation rates and efficient handling of bulk cargoes. If a firm decides to make increased use of the Seaway, and if one or both of these factors influenced its earlier decision to trade via Baltimore, then it is very likely that that firm's greater use of the Seaway will be at the expense of the port of Baltimore. Twelve companies answered that their increased use of the Seaway would divert traffic from Baltimore, and ten of these cited specific advantages of Baltimore, either rates or bulk cargo handling. Of the nine firms which indicated greater Seaway traffic without any diversion from Baltimore, only two pointed out advantages of the eastern port.

Summarizing the survey response, we find that in addition to transportation rates five factors influence firms' selection of shipping routes: (1) frequency of service, (2) sailing time, (3) cargo handling facilities, (4) location relative to ports, and (5) customers' orders.[1] The factors are listed in the same order as the number of firms which take them into account. Briefly considering each, we note that infrequent sailings may mean that goods must be stored at the port while awaiting a vessel, adding to the cost of transportation. In two respects infrequent sailings and long sailing time produce similar problems. The longer the time

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[1]The last factor did not enter our discussion of the expected future use of the Seaway and of Baltimore because it is not a general advantage or disadvantage of any port. It certainly will be responsible for some increase in Seaway traffic, partially at the expense of Baltimore; but it is not a factor which shippers control, and hence they cannot use it as a basis for estimating what route they will use in the future.

consumed by transportation, the farther ahead firms must plan, increasing the uncertainty of their operations; and if an exporter is not to receive payment until delivery of the goods, delays are costly. Ports must be capable of handling large volumes of bulk cargoes quickly and easily, or congestion will develop rapidly and cause delays. Pilferage and damage to general cargoes increase transportation costs. Being close to a port allows shippers to exercise close control over their import and export activities with a possible reduction in costs. Firms may use a high-cost port to meet customers' wishes, believing that having the business is worth the increased transportation cost. Each of these factors affects costs, but costs which cannot be determined as easily nor compared as readily as transportation rates; however, firms also consider these factors in the process of choosing a shipping route.

Probable traffic diversion. Earlier in this chapter we analyzed transport rates to determine the territory potentially tributary to the Seaway, and we used the Seaway rate area and climatic conditions to estimate the maximum traffic diversion from the port of Baltimore. Now, on the basis of the questionnaire results, we have developed an idea of the non-rate as well as the rate factors that affect diversion. Continuing to use material from the questionnaires, we are able to estimate the probable diversion, in the light of all factors, and compare it with the maximum arrived at earlier.

In making our diversion estimates, we separate Baltimore's traffic into three categories, export grain, import ore, and general cargo, both import and export. (Coal is not included on the basis of the earlier discussion which located coal origins in Baltimore's rate area, so that such traffic is not threatened with diversion.) For each commodity

classification we carry out the following procedure for the firms which answered the questionnaire. (1) We estimate the tonnage moved in 1956 between the Seaway's rate area and the port of Baltimore. (2) We determine the portion of this traffic which belonged to firms that plan to use the Seaway and express it as a percent of (1). (3) We state the estimated diversion of the traffic of these firms as a percent of their total traffic; and (4) we multiply step (2) by step (3) to obtain the diversion coefficient, the fraction of traffic originating or terminating in the Seaway's rate area which will probably shift from Baltimore to the Seaway. The estimated diversion coefficients (d) are given in Table 11.

TABLE 11

DIVERSION COEFFICIENTS AS ESTIMATED FROM SURVEY REPLIES

Coefficient	1959		1965	
	low	high	low	high
d_w	.37	.38	.43	.44
d_o	.00	.01	.02	.05
d_g	.02	.03	.06	.08

The low figures are based upon replies in which the changes in the share of traffic shipped through the two ports is quite certain, while the high estimates include losses of Baltimore which are not explicitly

shown in the questionnaires, but are implied.[1] The subscripts indicate the commodity classification: $\underline{w}$ for grain, $\underline{o}$ for ore, and $\underline{g}$ for general cargo. The grain coefficient shows so little relative variation between the low and high estimates because of the large influence of the CCC; the implicit diversion by small exporters is almost lost from sight. The figures upon which these coefficients are based (basically the answers to question 13 as shown in Appendix E) are approximations. In order to take into consideration the necessary inexactness of the respondents' answers, it seems appropriate arbitrarily to increase the spread between the low and high estimates. Because of the small absolute difference between the high and low figures, the arbitrary adjustment factor should be small, and so we decrease each "low" coefficient by one percentage point and increase each "high" coefficient by one percentage point. We must keep in mind that the adjusted diversion coefficients given in Table 12, are arbitrary, but that they are based upon the behavior which firms expect to follow.

By applying the adjusted diversion coefficients to the total volume of traffic which moved through Baltimore to or from the Seaway's rate area, we can estimate the amount of traffic diversion from Baltimore on the basis of the volume and pattern of 1956 traffic. The estimating equation is

$$(1) \quad D = dT$$

in which $\underline{D}$ is the number of tons of cargo diverted, $\underline{d}$ is the diversion

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[1]For example, two firms indicate that 100 percent of their 1958 traffic moved through Baltimore and that they will use the Seaway in 1965, but they do not indicate what fraction of their 1965 traffic will probably move via Baltimore. Their intention to use the Seaway implies that a portion of their traffic will cease to move via Baltimore.

TABLE 12

ADJUSTED DIVERSION COEFFICIENTS

Coefficient	1959		1965	
	low	high	low	high
d_w	.36	.39	.42	.45
d_o	.00	.02	.01	.06
dg	.01	.04	.05	.09

coefficient, and T is the number of tons of traffic which moved between Baltimore and the Seaway's rate area in 1956. The equation must be solved three times, once each in terms of grain, ore, and general cargo. The estimates, shown in Table 13, indicate that traffic flows are subject to considerable influence by non-rate factors. On the basis of transport

TABLE 13

ESTIMATED TRAFFIC DIVERSION FROM THE PORT OF BALTIMORE TO THE ST. LAWRENCE SEAWAY, BASED UPON 1956 TRAFFIC (TONS)

Type of Traffic	1959		1965	
	low	high	low	high
Grain	798,878	865,451	932,024	998,597
Ore	0	95,128	47,564	285,386
General	12,011	48,044	60,054	108,098
Total	810,889	1,008,623	1,039,642	1,392,081

rates alone, over 5.5 million tons of cargo were expected to shift from Baltimore to the Seaway,[1] while the inclusion of non-rate considerations reduces the maximum diversion estimate to 1.4 million tons.

The survey results indicate that probably only one-fourth of the traffic potentially subject to diversion will actually be rerouted. Comparing Tables 9 and 13, we find that ore movements make up most of the difference between the two diversion estimates. Although a large part of Baltimore's iron ore imports have come from Canada,[2] the one source from which the Seaway has a sizable rate area, most of Baltimore's receipts of Canadian ore have been consumed within the port and part of the remainder moved to blast furnaces located within Baltimore's rate area.[3] From these points we conclude that Baltimore's past Canadian ore traffic is subject to little diversion. From a cost basis, however, it is possible that Canadian ore could replace overseas sources of ore in blast furnaces west of the Appalachian mountains, but the survey does not indicate a large shift of this source. One explanation may be that the rich Labrador ore will replace the poorer grades of Mesabi iron ore, rather than the high quality ore from Venezuela, Liberia, etc. We must recognize, however, that our estimated diversion of ore may be low because of the small response from the major steel producers, especially from those interested in the Labrador ore fields.

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[1]See Table 9 on page 73.

[2]In 1958 Canada was Baltimore's third largest source of iron ore, originating 18 percent of the port's total receipts. Maryland Port Authority, Handbook, 1959, p. 59.

[3]In 1957 less than one-third of the inbound movement of Canadian iron ore moved out of the port area. Letter from J. V. Guthrie, Vice-President, The Cottman Company, October 23, 1958.

The probable diversion of general cargoes is also much smaller than the potential loss. This result may be indicative of the greater importance of time in the transportation of such cargoes as compared to bulk commodities. Frequency of service and sailing time were often cited as factors influencing the choice of route, but they did not appear among the factors considered by shippers who planned to increase their use of the Seaway. In addition, shippers indicated that they felt the Seaway offers adequate cargo handling for bulk commodities, but that the handling of general cargoes does not match the Atlantic ports. The probable and potential losses of grain are much closer to each other than they are for either ore or general cargo. Grain shippers emphasized the influence of rates and of efficient handling of bulk commodities. As these are the strong points of the Seaway, we expect the Seaway to gain this type of traffic.

The estimated traffic diversion shown in Table 13 is based upon the volume of traffic which moved through Baltimore in 1956. A more realistic approach to measuring probable future diversion is to assume that in the absence of the Seaway the flow of traffic through Baltimore would grow over time, causing the number of tons of diversion to the Seaway to be larger. Mr. Stanton of the Baltimore Association of Commerce told the House Subcommittee on Public Works that the volume of goods handled at the port of Baltimore is closely related to the level of economic activity in the nation.[1] Since past experience has shown a continuing growth of gross national product, the level of national output and the volume of Baltimore's overseas commerce should rise as the

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[1]U. S., House of Representatives, Seaway Hearings, 1951, p. 1555.

years pass. In the absence of any reason for believing that the pattern of Baltimore's traffic flow will change as the volume of the port's commerce increases, we assume that as the level of port activity rises over time the proportion of its traffic originating or terminating in the Seaway's rate area will remain constant. This means that T in equation (1) will rise over time, but that it will remain in a fixed proportion to Baltimore's total traffic. The fixed proportions, those that existed in 1956, are shown in Table 14.

TABLE 14

TRAFFIC MOVING BETWEEN BALTIMORE AND THE SEAWAY'S RATE AREA AS A PERCENT OF THE TOTAL FOREIGN TRAFFIC OF THE PORT OF BALTIMORE

Type of Traffic	Percent of Total Traffic
Grain	8.4
Ore	17.9
General	4.5

Our final estimate of the probable future shift of traffic from Baltimore to the Seaway depends upon the projected volume of Baltimore's foreign commerce which, in turn, depends upon the projected level of gross national product. We obtain the latter by a time series analysis and the former by a correlation analysis, which yield the following equations:

(2) $GNP = 252.6 + 13.38Y$

(3) $B = .1034GNP - 10,656$

In these equations GNP is gross national product measured in billions of 1947-49 dollars, Y stands for the year (numbered consecutively from 1948 = 0), and B is the number of tons (in millions) of foreign traffic which moves through Baltimore. The standard errors of estimate show that

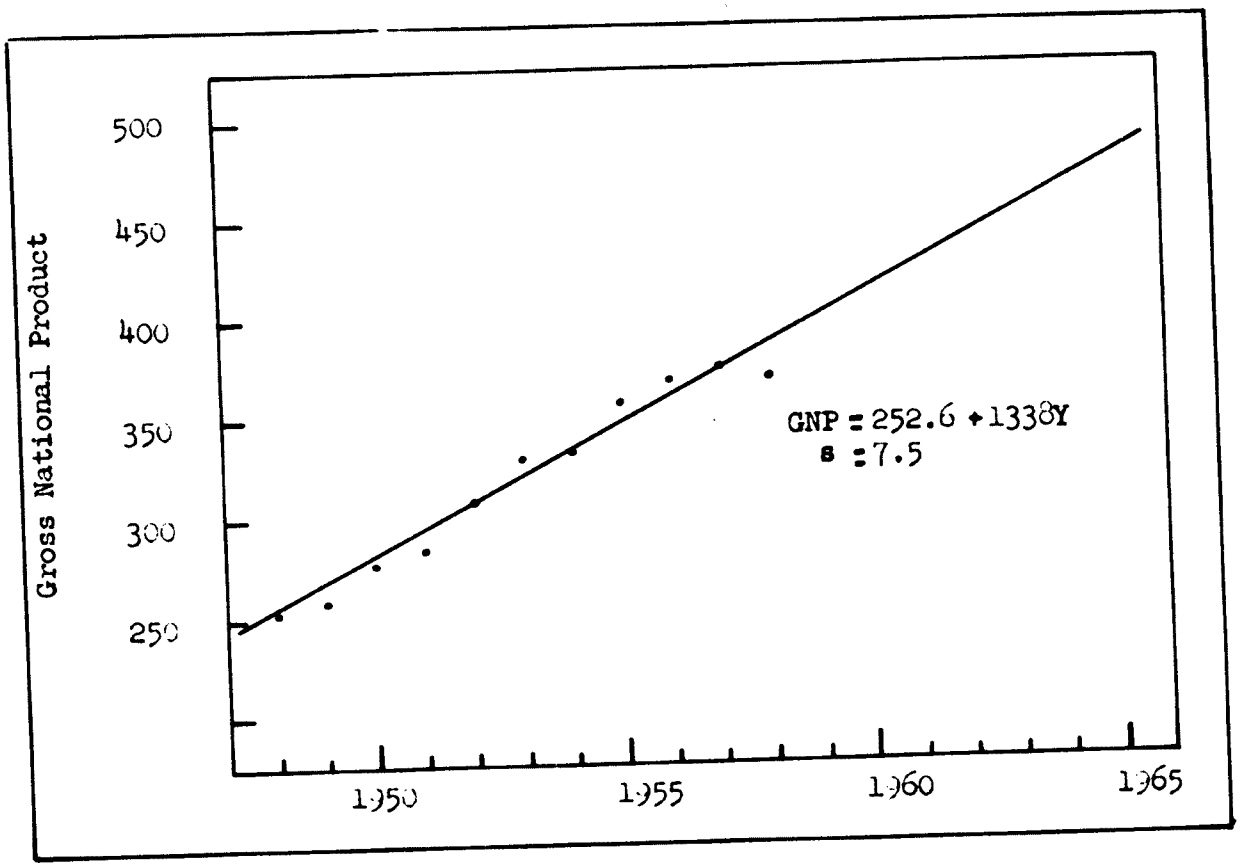


Fig. 12-Gross National Product (billions of 1947-49 dollars), 1948-1950.

two-thirds of the time gross national product will be within $7.5 billion of the estimated value and the level of traffic will be within 2.8 million tons of the estimated value. The actual values of GNP and of B are plotted in relation to the trend line and the regression line in Figures 12 and 13. By relating GNP to time and then relating traffic to GNP, we find that the relationship between traffic and time is one in which traffic increases by approximately 1,385,560 tons per year (13.38 x 103,400).

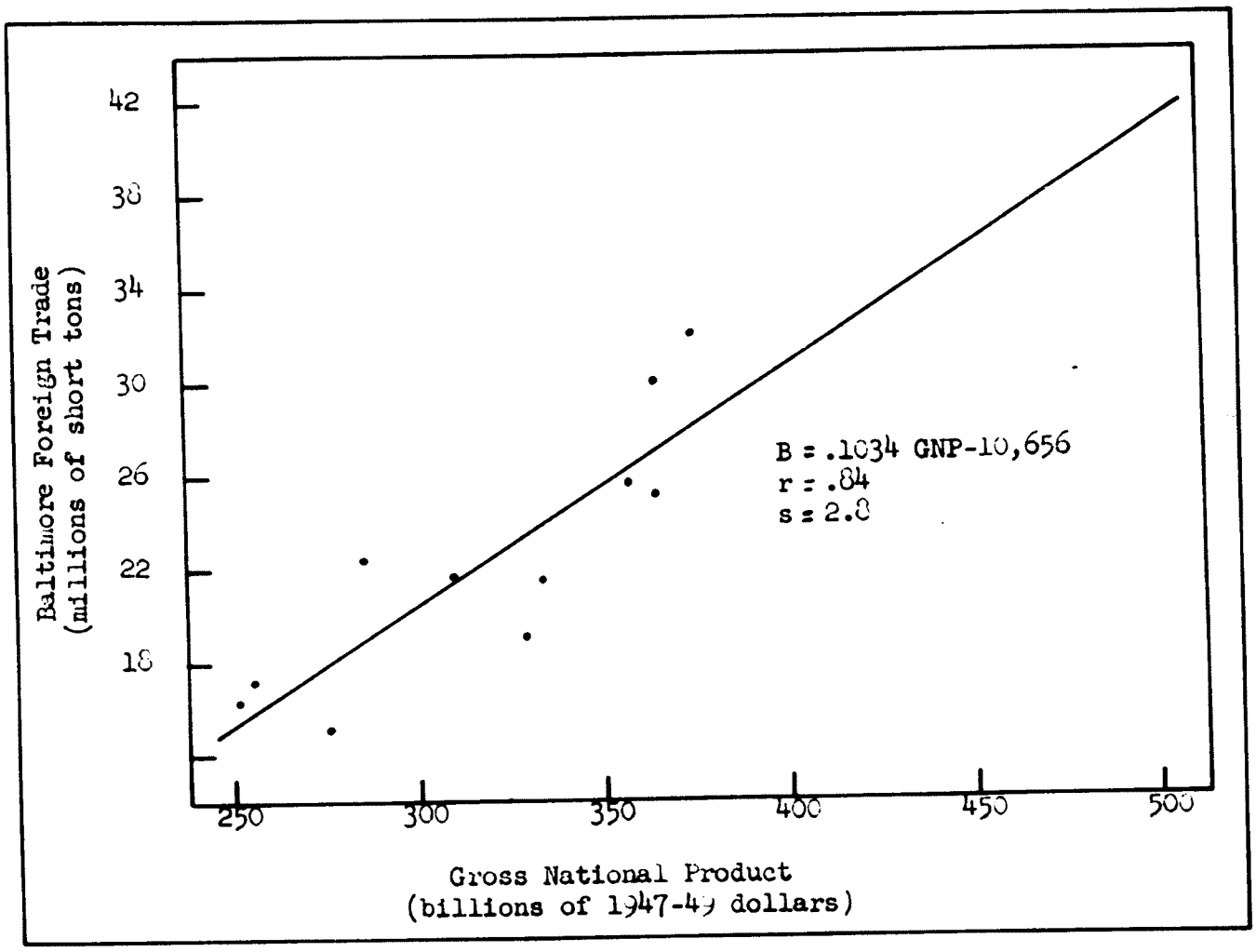


Fig. 13-Correlation between Gross National Product and the Volume of Foreign Trade at the Port of Baltimore, 1948-1958

Solving equation (2), we estimate gross national product to be $400 billion in 1959 and $480 billion in 1965, both in 1947-49 dollars. Using these values in equation (3), the projected volume of Baltimore's foreign trade in 1959 is 30,683,000 tons, and in 1965 it is 38,976,000 tons. From these figures we find the amount of traffic which in the absence of the Seaway would move to or from the Seaway's rate area; and by applying the diversion coefficients, we estimate Baltimore's probable loss of traffic as shown in Table 15. The estimated diversion to the Seaway in 1959 is approximately one million tons or 3½ percent of Baltimore's

TABLE 15

ESTIMATED TRAFFIC DIVERSION FROM THE PORT OF BALTIMORE TO THE ST. LAWRENCE SEAWAY

Type of Traffic	1959		1965	
	low	high	low	high
Grain	927,854	1,005,175	1,375,073	1,473,293
Ore	0	109,845	69,767	418,602
General	13,807	55,229	87,696	157,853
Total	941,661	1,170,249	1,532,536	2,049,748

projected total foreign trade. For 1965 the loss is estimated between 1.5 and 2.1 million tons, or from 4 to 5 1/4 percent of the port's projected traffic.[1]

Baltimore's 1959 experience. To the extent that available statistics allow, we shall look at what actually happened to the volume of traffic which moved through Baltimore during 1959. In the absence of the Seaway our projections indicate that traffic volume would increase by about 1.4 million tons per year, of which roughly one-half would be ore and one-tenth grains. Since we estimate a diversion of traffic as large as 1.2 million tons in 1959, Baltimore's foreign traffic that year should have been only two hundred thousand tons above its 1958 level. The actual quantity of traffic which moved through Baltimore in 1959 was approximately

[1]As a means of comparison in 1958 the volume of foreign trade which was handled at Charleston, South Carolina was 1.6 million tons and at Savannah, Georgia it was 2.3 million tons. U. S., Corps of Engineers, Waterborne Commerce, 1958, pp. 332 and 339.

two million tons below the previous year's level.[1]

The decline in traffic was largely the result of a fall in the volume of coal exports by 1.8 million tons. Since there were no overseas coal exports via the Seaway from the United States,[2] diversion cannot be responsible for this drop, which is in accord with our analysis that shows Baltimore to be the cheaper route for export coal. Ore imports should have risen by roughly six hundred thousand tons, one-half of the total projected increase in traffic less one hundred thousand tons of diversion. This increase was not realized as ore movements grew by only ten thousand tons. Chrome imports rose by nearly two hundred thousand tons, while iron and manganese receipts fell, the former by over one hundred thousand tons and the latter by fifty thousand.[3] The decline in iron and managanese imports was probably due to the steel strike. Grain exports through Baltimore declined in the late summer and fall, but exceptionally large movements in the last two months of the year resulted in a slight rise in the volume of grain exports over the 1958 figure.[4] Our projected estimate shows grain exports falling by over eight hundred thousand tons, rather than the realized increase of fifty

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[1]"Maryland Port Authority Reports on 1959 Maritime Traffic," Port of Baltimore Bulletin, (Baltimore, January, 1960), p. 1.

[2]The St. Lawrence Seaway Authority and St. Lawrence Seaway Development Corporation, Traffic Report of the St. Lawrence Seaway, 1959, (Ottawa: The Queen's Printer and Controller of Stationery, 1960), p. 28.

[3]"Ore Imports Show Slight Gain in 1959," Port of Baltimore Bulletin, April-May, 1960, p. 12.

[4]"December Grain Loadings Top All Months of the Year," Port of Baltimore Bulletin, February, 1960, p. 6.

thousand. The expected seasonal drop in grain shipments did occur, but movements during the Seaway's closed season offset the summer decline. Another factor to consider was that in 1959 soybeans represented a larger fraction of the total grain movement than in 1958, and the states near to Baltimore are relatively large originators of soybean traffic.

Without having a detailed traffic pattern for 1959 it is difficult to assess the impact which the Seaway had in its first year of operation, but certain observations seem in order. Coal seems to be safe from diversion, although subject to other vicissitudes. The great ore-consuming centers in the Seaway's rate area will continue to draw large quantities of imports from Baltimore. And finally Baltimore will be faced with a problem of serious seasonal variations in export grain movements, if not by losses in grain traffic.

There is a factor which may tend to counter this loss of traffic. Not all of the goods which move through the Seaway will represent diverted traffic; some traffic will be new movements. To the extent that the Seaway increases the volume of foreign trade of its contiguous area, it is likely to generate closed season traffic through ocean ports. How much new traffic will develop is unknown, just as what fraction of the closed season share of such traffic Baltimore will handle is unknown; but any effect of this sort will tend to offset the fall in Baltimore's port activity due to the Seaway. While mitigating the total decline in traffic volume, such new traffic will augment the seasonal variation in the flow of foreign trade through Baltimore, increasing the size of winter movements relative to warm weather movements.

CHAPTER V

EMPLOYMENT EFFECT OF TRAFFIC DIVERSION

Up to this point our analysis provides an estimate of the number of tons of cargo which will be routed via the St. Lawrence Seaway rather than through the port of Baltimore. This estimate measures the impact on merely one sector of Baltimore's economy. We might well ask how the presence of the new trade route will affect Baltimore's overall economic position. Tonnage of commodity shipments is not a measure which is pertinent to all types of economic activity, and hence it does not form a common basis for measuring the Seaway's impact upon Baltimore as a whole. Two common denominators which apply equally to port activity and to other forms of business activity are value added and employment. What is the value of port services rendered in Baltimore; by how much will the estimated traffic diversion alter the value of port services; and how large is this change in comparison with value added by all industries in Baltimore? Similarly, using employment, we ask how many workers are employed in providing port services; by how much will such employment change as a result of traffic diversion; and what is the size of that change relative to Baltimore's total employment. These are both ways in which we might be able to show the broader economic effect of the Seaway. Information on value added, however, is not available in sufficient detail to allow the use of that measure as an indicator of the Seaway's impact; but employment data can be used. The steps followed in estimating the employment effect are the same as those which would be used to measure

the Seaway's impact in terms of value added, so that if adequate value-added data should become available, it would be possible to measure the effect in those terms.

The Relationship between Port Traffic and Employment in Local Industries

Before seeking to estimate the effect of traffic diversion upon the level of employment in the Baltimore area,[1] we shall identify those industries which are subject to employment changes and those which are free from any such influence.

Industries subject to change. There are two types of industries in which employment will be affected by the diversion of traffic, port-dependent industries and consumer-service industries. Included in the former are all port-located industries which provide a service that is used in moving goods through the port: bringing products to the port, loading them into or unloading them from ocean-going vessels, and carrying them from the port. The services rendered are those of pilots, tugboats, stevedores, steamship operators, steamship agents, foreign freight forwarders and custom house brokers, international finance, domestic transportation, ship repair, and customs clearance (U. S. Bureau of Customs.)

As the level of traffic in the port varies, employment in these industries will change, but the sensitivity of employment to changes in traffic volume differs among them. Some industries do nothing but handle foreign trade. Foreign freight forwarders, custom house brokers, and steamship agents (unless they represent lines engaged in coastwise or intercoastal traffic) are examples. Other industries rely on waterborne

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[1] We define the Baltimore area to include the city of Baltimore, Baltimore County, and Anne Arundel County, the Baltimore Metropolital Area as defined by the Bureau of the Census before 1958. In that year two counties, Carroll and Hanover, were added to the Area. Since past employment statistics are not available for the currently defined Baltimore Metropolital Area, we shall estimate the employment effect in the smaller area.

commerce for employment, but handle foreign as just one sort of waterborne movement. Stevedores load and unload cargoes regardless of the point of origin or destination, and tugs assist ocean-going vessels of any sort and also handle local movements in their towing operations. For some industries, serving foreign commerce is only one part of a wider range of business activity. The foreign departments of Baltimore's banks account for a relatively small fraction of the banks' operations. Rail and highway carriers move freight of all types, both domestic and foreign. Ship-repair facilities are often integrated with shipbuilding operations. The latter are quite independent of port traffic. Minor repair work is related to the number of vessels which visit the port; and even though ship owners shop around before deciding where to have major repairs made, such jobs are related - perhaps loosely - to the number of vessel arrivals.[1] All of the port-dependent activities are in some degree sensitive to traffic diversion and accordingly all affect total employment in the area. We shall call the impact of traffic diversion on employment in port-dependent industries the direct employment effect.

Consumer-service industries will also feel the influence of the Seaway.

These industries serve the local population. Retailing is probably the one which comes to mind first, and directly tied to it are wholesale operations. Professional, financial, and personal services, entertainment, local transportation, local government, and residential and commercial construction all fit this classification.[2]

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[1]Letter from Philip Myers, Assistant to the President, Maryland Shipbuilding & Drydock Company, March 24, 1960.

[2]Construction strictly cannot be called a service industry, but it does cater to the needs of a growing population in much the same way as the other activities, which are services.

Since port-dependent activities provide employment that supports a share of the area's population, changes in such activities will influence employment in the consumer-service industries appreciably. The Seaway competition will reduce the normal increase in jobs in port-dependent industries and thus will also reduce the expansion of jobs available in the consumer-service industries. Even though they play no direct role in the movement of goods through the port, these industries also will feel the effect of the Seaway. This change in employment we shall call the indirect effect.

Industries not subject to change. There are two groups of industries upon which the Seaway will have no appreciable effect, even though one of them is closely tied to port activities. Those industries whose location in Baltimore results from the advantages that a port offers are port-oriented industries. Economical water transportation is a basic attractive factor. The Bethlehem Steel Company and the American Sugar Refining Company rely heavily on waterborne imports of raw materials, and Bendix Radio exports close to 40 percent of its products through the port.[1] While changes in the shipping needs of these industries influence the level of port traffic, changes in port traffic resulting from Seaway competition are unlikely to affect port-oriented industries. The traffic which will be diverted will not curtail local operations of port-oriented plants, except in the possible case of a shift in the location of a port-oriented plant to a place near the Seaway. Industries which process imported materials for distribution in the area contiguous to the Seaway, or which process the products of the Midwest for subsequent export, might possibly

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[1]Maryland State Planning Commission, The Economic Importance of Port-Linked Manufacturing Industries in the Baltimore Metropolitan Area, Baltimore, 1953.

shift their location so as to perform their processing operations nearer to the point of distribution or the source of raw materials. Estimating the extent of such a shift in location requires detailed information on the origin and destination of raw materials and finished products of port-located manufacturing firms, and this information is not available. In the absence of detailed data it seems best to assume that there will be no change in the location of port-oriented industries and hence no employment effect in such industries as a result of Seaway competition.

Port-independent industries include those in which income and employment are essentially unrelated to port activity. Although they may use the port, they are not regular users. While they may sell some of their output in the local market, their primary function is not to serve that market. Clothing manufacturers are an example of such an industry. Income and employment in port-independent industries are not subject to any significant change as the volume of port traffic varies.

In estimating how the traffic diversion to the Seaway will affect the level of employment in the Baltimore area, we are interested in two types of industries. The direct employment effect will occur in port-dependent industries, which move goods through the port, and the indirect effect will take place in consumer-service industries, which cater to the needs of the local community.

Probable Employment Effect

We concluded in Chapter IV that the Seaway probably will divert about two million tons of traffic from the port of Baltimore in 1965, in the neighborhood of 5 percent of the port's foreign commerce. This loss of traffic will affect employment opportunities in both the actual handling of traffic movements and the serving of local consumers' needs. The

employment effect in port-dependent industries is the link between changes in the number of tons of traffic passing through the port and the employment effect in consumer-service industries.

Direct employment effect. As a basis for measuring the direct effect of the Seaway competition, we use a correlation analysis between the number of tons of foreign commerce which pass through the port and the level of employment in port-dependent industries. Data on the latter, which were furnished by the Employment Service Division of the Maryland Department of Employment Security, relate to employment throughout the state of Maryland, but employment in such industries is so heavily concentrated in the Baltimore area that the wider coverage is negligible in its effect upon the figures.[1] Six different sub-groups of the Standard Industrial Classification System make up what we call port-dependent industries: (1) ocean-borne foreign trade, (2) local water transportation, (3) freight forwarding, packing, and crating, (4) arrangement for transportation, (5) services auxiliary to water transportation, and (6) ship and boat building and repair. The first group includes steamship operators, the second consists of tugs and pilots, and the third foreign freight forwarders and custom house brokers. The fourth group is made up of steamship agents, the fifth includes stevedores, and the last is self-explanatory. Employment in domestic transportation, finance, and the U. S. Bureau of Customs is reported in other industrial classifications and cannot be separated from other types of employment.[2]

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[1]Letter from D. L. B. Fringer, Director, Employment Service Division, Department of Employment Security, State of Maryland, March 31, 1960.

[2]An estimate of the employment effect upon the port's railroads is made on pages 102 and 103. According to a vice-president of one of Baltimore's leading banks, changes in the level of port activity have very little influence upon employment in international finance activities.

The relationship between traffic volume and employment in these six port-dependent industries is estimated by the equation

(4) $E = 10{,}596 + 333\ B$

in which E is port-dependent employment and B is foreign traffic in millions of tons. The regression coefficient estimates that jobs increase by 333

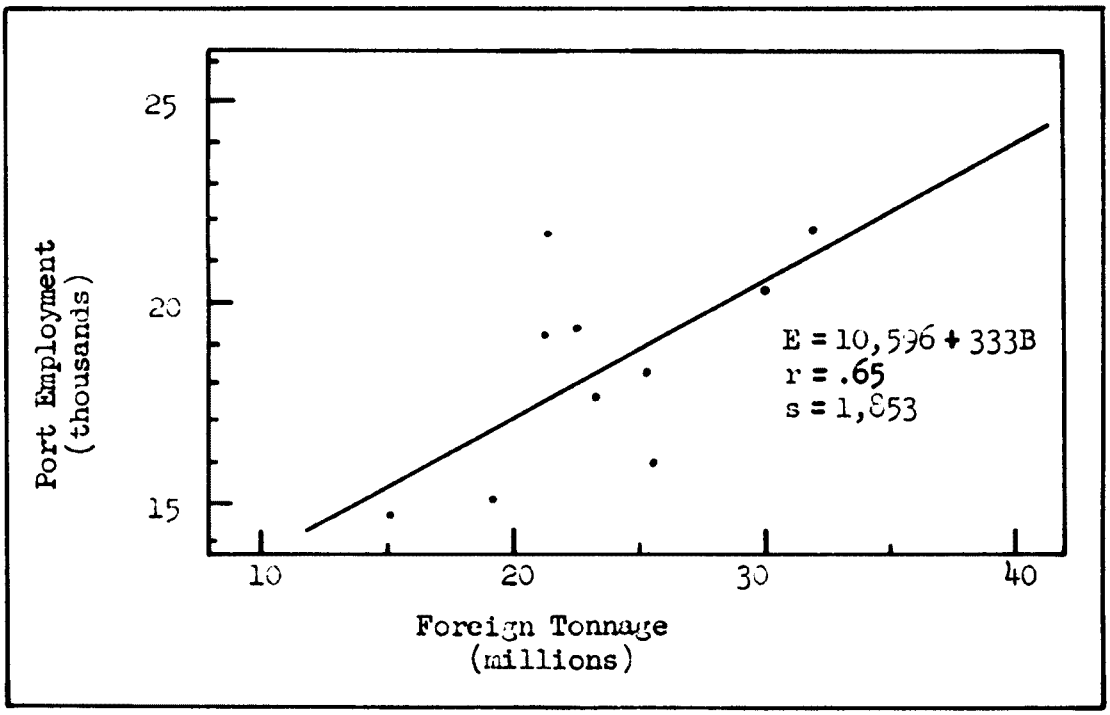


Fig. 14-Correlation between Foreign Tonnage and Port Employment, 1950-1959

for every one-million-ton increase in traffic. Like equations (2) and (3) this regression equation is found by the least squares method. A relationship certainly exists between these two variables, but it is not a close one as shown by the small size of the coefficient of correlation, which is .65. The lack of a high degree of correlation results from the fact that not all of the jobs in the six industries depend upon waterborne foreign trade, and so changes in the level of such trade cannot explain all changes in the level of employment in these six industries. Grouping

of the data does not allow the separation of those jobs which are dependent upon foreign trade from those which are not. The standard error of estimate shows that in about two cases out of three employment will be within 1,850 jobs of the estimated number. Recalling that traffic diversion probably will be close to two million tons, we estimate that in 1965 employment in these six industries will be about six hundred sixty below what it would have been in the absence of the Seaway.

The direct employment effect will be greater than this estimate, because not all port-dependent employment is included in the six industries upon which the estimate is based. Domestic transportation is conspicuous by its absence. We shall try to measure the employment effect in railroad transportation by using employment data of the Canton Railroad, a switching company serving the port of Baltimore. Waterborne commerce accounts for about 75 percent of the road's total traffic.[1] Because it is a local switching road, all of the company's employees work in the Baltimore area, and figures for annual employment are available.[2] If we assume that the number of workers engaged in moving waterborne traffic is in the same proportion to total employment as is waterborne tonnage to total tonnage, we can relate port-dependent employment of the Canton Railroad to port traffic.[3] For the nine year period 1950-1958 such employment changed at

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[1]Letter from Melton Shreck, Vice President, Canton Railroad Company, May 2, 1960.

[2]U. S., Interstate Commerce Commission, Statistics of Railroads of the United States, (Washington: U. S. Government Printing Office).

[3]This assumption was used in estimating port-dependent railroad employment in a study prepared for the Virginia State Ports Authority. University of Virginia, Bureau of Population and Economic Research, The Impact of Virginia Ports on the Economy of Virginia, (Charlottesville, 1954).

the rate of about four jobs for every one-million-ton change in port traffic.[1]

One of Baltimore's three trunk-line railroads provided information showing that employment in its port operations is about 25 percent above that of the Canton Railroad. The 1956 traffic-flow information shows that this major road carried roughly one-third of the port's total rail traffic. Again using traffic as an indicator of employment, we estimate that port-dependent employment of three trunk-line railroads varies by about fifteen jobs per million tons of cargo, or that all railroad employment varies some twenty jobs per million tons of traffic. The effect of the Seaway will be to reduce the growth of railroad employment by about forty jobs by 1965.

There is no way to estimate the possible change in trucking employment, however it is likely to be small. We saw in Chapter III that it is unlikely that much truck traffic will be diverted to the Seaway. Furthermore, our estimate of diversion shows only a small probable loss of general cargo, the type of traffic most likely to move by truck.

Our estimates show that the Seaway's direct employment effect will be to hold port-dependent employment approximately seven hundred jobs below what it otherwise would have been in 1965. Since we expect Baltimore's foreign traffic to continue increasing, but at a slower rate due to the Seaway's competition, there will not be a fall in port-dependent employment, just a slower rate of increase. On the basis of the projected level of 1965 port traffic of about thirty-nine million tons, we would expect that employment in the six port-dependent industries would be

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[1]The estimating equation is:

$$E_{(Canton)} = 198 + 3.8B$$
$$r = .65$$
$$s = 22$$

approximately twenty-three thousand. The Seaway will hold port-dependent job opportunities only about 3 percent below that level.

The direct impact upon employment is relatively smaller than the effect upon traffic, which we estimated at 5 percent of the total. There are two reasons for this. First, as we noted earlier, part of the employment in these industries is not dependent upon waterborne foreign trade. As the employment data included all employment, we are comparing the direct employment effect with an exaggerated level of total port-dependent employment. Second, the indivisibility of some jobs makes them quite insensitive to changes in the level of port activity. Such indivisibility is more evident in short-run variations in traffic, but it does not disappear entirely in the long-run.

Indirect effect. The relative slowing down of the growth of port-dependent employment will tend to dampen the rate of growth of the Baltimore area, both in terms of employment and population. Since the area will not grow as fast, the growth of those industries which serve the community will be retarded. We now turn to the estimation of the indirect employment effect of the St. Lawrence Seaway, the employment effect in consumer-service industries.

We are seeking to find the relationship between non-consumer-service employment, or primary employment, and consumer-service employment. The Maryland Department of Employment Security furnished data on non-agricultural employment for the nine years 1949 to 1957.[1] As far as possible we separate the employment figures into two classifications, primary

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[1]State of Maryland, Department of Employment Security, Non-farm Wage Earners and Salaried Workers, Baltimore Metropolitan Area, Baltimore.

employment and consumer-service employment. The nature of the grouping of the data supplied causes some difficulties. Construction employment is a total figure including residential, commercial, and manufacturing construction. The last is a form of primary employment, while the first two are part of consumer-service employment. Government employees are not reported in a manner that allows the separation of employees of local governments from others. Land transportation only indicates interstate railroads as a separate category, while all other forms are lumped together. Public utility employment does not distinguish between consumer and industrial service. In addition the data do not include professional people. These limitations mean that we can make only a rough estimate of the relationship which exists between primary and consumer-service employment.

The figures are grouped in such a way that we cannot accurately distinguish between the two types of employment. If we include in consumer-service employment only those industrial classifications which definitely belong, retailing, wholesaling, finance and real estate, and services, we under-estimate the true relationship. On the other hand, if we also include those mixed industrial classifications, construction, government, transportation, and public utilities, the relationship is exaggerated. The real relationship between the level of primary employment and of consumer-service employment lies somewhere between these two estimates.

The low estimate, which uses the four industrial classifications that included only consumer-service jobs, is given by the following equation:

$$(5) \quad E_{cs} = 33{,}000 + .47\, E_p$$

The regression equation shows that if primary employment (E_p) rises by one hundred jobs, employment in consumer-service industries (E_{cs}) will increase by forty-seven. There is a high degree of correlation between these two variables as shown by the fact that the coefficient of correlation is .96. The standard error of estimate shows that the actual level of

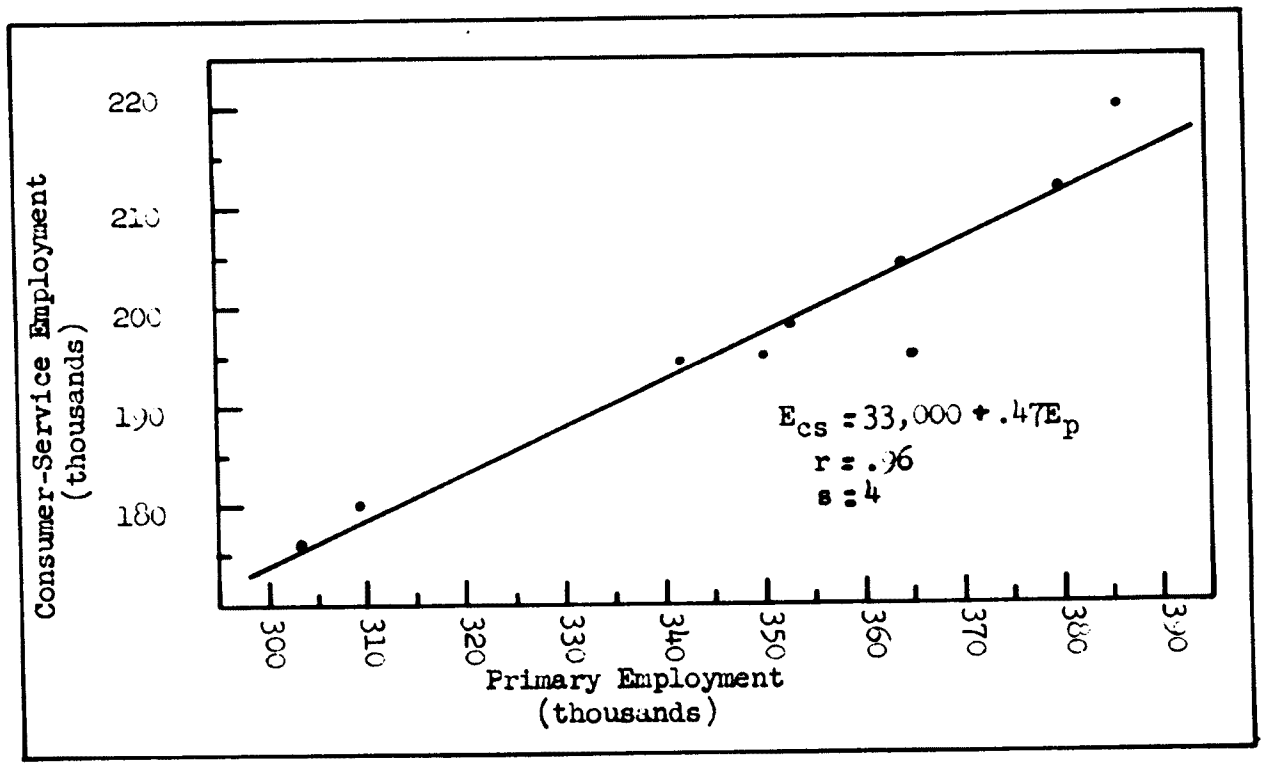


Fig. 15-Correlation between Consumer-Service Employment and Primary Employment (low estimate), 1949-1957.

of employment in these four consumer-service industries will be within three thousand jobs of the estimated level in two cases out of three.

The high estimate, which includes the four purely consumer-service industries plus four industries that include both consumer-service and primary activities, is shown by equation (6).

(6) $E'_{cs} = 1.71\ E'_p - 6,200$

In this case the equation indicates that if primary employment (E'_p) rises by one hundred, employment in the eight consumer-service industries (E'_{cs})

will rise by 171. There is still a high degree of correlation between the variables, although not as high as was found in equation (5). The coefficient of correlation is .92, and the standard error of estimate is 10,723. Consumer-service employment will fall within about eleven thousand

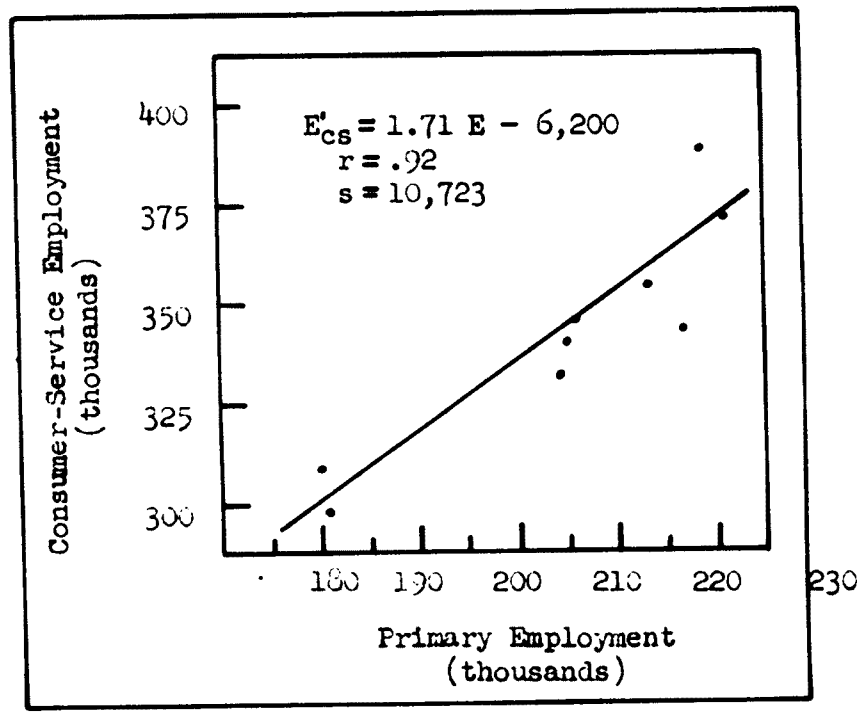


Fig. 16-Correlation between consumer-service employment and primary employment (high estimate), 1949-1957.

jobs of its estimated level 68 percent of the time.

The actual change in consumer-service employment as primary employment changes by one lies somewhere between .47 jobs and 1.71 jobs.[1]

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[1]The Bureau of Population and Economics Research of the University of Virginia used a relationship of a change of one job in consumer-service industries for every change of one job in port activities. Bureau of Population and Economic Research, Measuring the Impact of the Waterborne Commerce of the Ports of Virginia on Employment, Wages, and Other Key Indices of the Virginia Economy, (Charlottesville, May, 1959), p. 3. A relationship of 1.248 additional consumer-service jobs for an increase of 1 in primary employment was found in a study of employment in Los Angeles County. George H. Hildebrand and Arthur Mace, Jr., "The Employment Multiplier in an Expanding Industrial Market: Los Angeles County, 1940-1947," The Review of Economics and Statistics, August, 1950, p. 247.

We have already estimated that traffic diversion will cause port-dependent employment, a type of primary employment, to be lower than it would have been in 1965 by about seven hundred jobs. This change will be responsible for the level of consumer-service employment being somewhere between three hundred thirty and twelve hundred jobs below what it otherwise would have been. The nature of the data indicates that the lower estimate should definitely under-estimate the change and the higher estimate should exaggerate the change. Adding the direct and indirect effects, we estimate that the St. Lawrence Seaway, by carrying some of the traffic which normally has moved through the port of Baltimore, will cause total employment in the Baltimore area in 1965 to be from one thousand to one thousand nine hundred less than it would have been if there were no Seaway. Projecting non-agricultural employment by a straight-line trend, this estimated employment effect represents between 0.2 and 0.3 percent of employment in the Baltimore area.

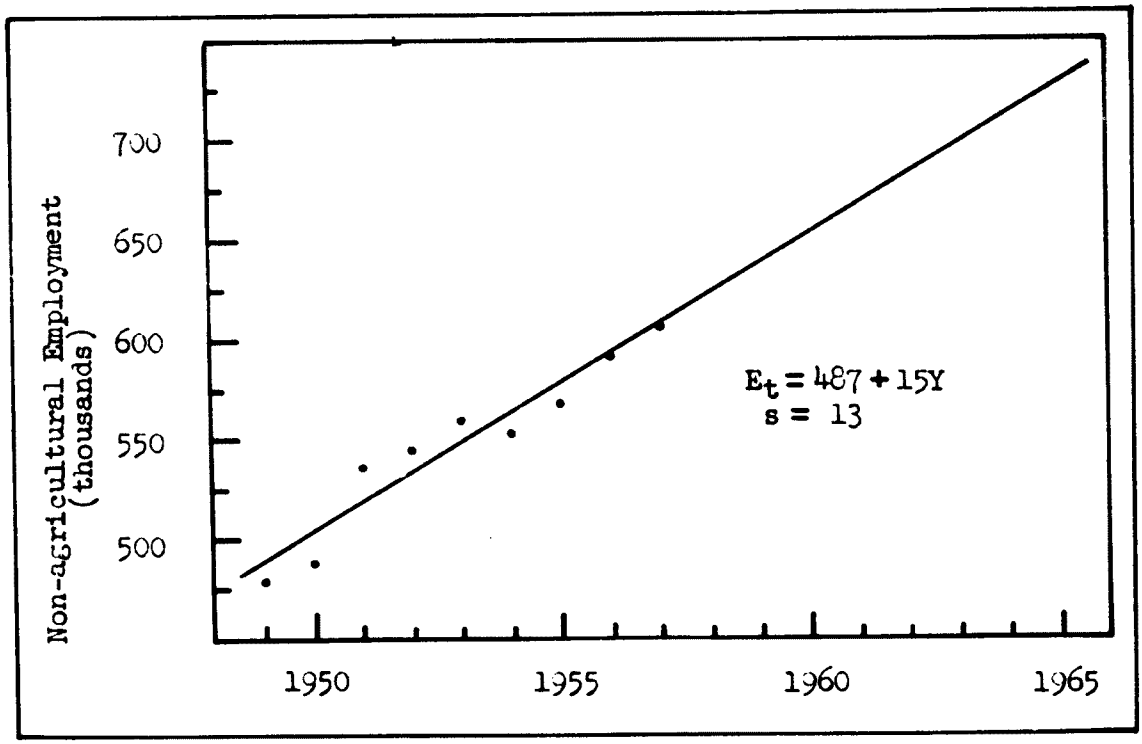


Fig. 17-Non-agricultural Employment in the Baltimore Area

CHAPTER VI

CONCLUSION

For centuries the waters of the Great Lakes have drained into the Atlantic Ocean through the St. Lawrence River, but it has been just in the last two years that average-sized ocean vessels have been able to sail to and from these inland seas. The 27-foot Great Lakes-St. Lawrence Seaway is the most recent result of man's efforts, which span more than two-and-a-half centuries, to make the waterway a safe and efficient transportation artery. The Seaway serves a rich agricultural and industrial area, an area which historically has depended upon ocean ports to handle its foreign trade. As a result of the Seaway's opening, this dependence upon coastal ports will be weakened, and we have attempted to learn how the new route will affect Baltimore, a port which historically has served the area contiguous to the Seaway.

Our study of the flow of traffic into and out of the port of Baltimore shows that the port has a hinterland which stretches the length and breadth of the United States and reaches into Canada. Although similar, the port's export hinterland is not quite as extensive as its import hinterland; while the import hinterland is broad, a few states stand out as major destinations of inbound cargoes. Maryland, Pennsylvania and Ohio received about seven-eighths of the port's 1956 import traffic, and West Virginia and the states on the southern shores of the Great Lakes received most of the remaining traffic. Two key industries, steel and petroleum,

make the port its own best customer for imported goods. The reverse flow of traffic from the hinterland to the port is also concentrated, but not as heavily as import traffic movements. The important role of grain increases the significance of the Middle West, where important originators of export traffic are over one thousand miles from Baltimore.

Several factors cause the cost of carrying goods between a given overseas port and Seaway ports to be higher than the cost to or from Baltimore. Sailing distances are longer through the Seaway, except between western Europe and lake ports east of Toledo. Delays in passing through the locks and the restricted waters of the Seaway further increase sailing time. Draft restrictions prevent the use of the Seaway by large vessels, forcing costs up relative to Baltimore for certain types of cargoes. In spite of these disadvantages in the cost of water transportation, the Seaway ports realize sufficient savings in the cost of rail transportation to offer shippers over a large area lower overall transportation rates than Baltimore offers.

The seasonal nature of the Seaway affects its ability to divert traffic from Baltimore. Closed by ice for over four months of the year, the Seaway cannot serve Midwestern shippers throughout the year. Considering only the traffic which previously moved through Baltimore during the Seaway's navigation season, lower transportation rates subject about one-fifth of Baltimore's foreign trade to potential diversion to the Seaway.

Rates, however, are not the only basis upon which the selection of shipping routes rests. In addition to inertia, continuing to use one route because it is easier than changing routes, shippers find that infrequency of service and longer sailing time reduce the attractiveness

of the Seaway. By analyzing questionnaire replies from importers and exporters, answers which weigh both rate and service considerations, we estimate that the extent of traffic diversion from Baltimore in 1965 is more likely to be in the neighborhood of 5 percent rather than 20 percent. In judging the accuracy of the estimate, we must keep in mind two things. First, the estimate is based upon shippers' statements about their probable behavior six years in the future. Circumstances may alter their actions significantly; but shippers' expectations are the best basis we have for looking toward the future. Second, the influence of iron ore importers in determining the diversion estimate is much smaller than their share of total traffic, because most of the large steel firms did not answer the questionnaire. It is possible that they may make greater use of the Seaway than the smaller importers of iron ore and the importers of other metallic ores, and hence increase the volume of traffic diversion. The effect of the Seaway will be to reduce the rate of growth of Baltimore's traffic, not to cause an absolute decline in the volume of trade.

The reduced growth of port traffic will hold down the level of employment in port activities and indirectly will restrain the expansion of consumer-service employment. Because port-dependent employees are only one sort of primary employment, upon which consumer-service employment depends, for the whole Baltimore area the impact of the St. Lawrence Seaway by 1965 will be slight. There will merely be a small dampening of the rate of growth. If the Seaway causes job opportunities to grow at a slower rate than the local labor force grows, there will be people in specific industries for whom the Seaway competition will cause severe hardship.

The structure of railroad rates and the composition of traffic lead us to expect that Baltimore has played a major role in serving the area contiguous to the Seaway, and hence that Baltimore is likely to suffer more than other ocean ports from Seaway competition. Our analysis of the probable effect upon Baltimore, then, provides some basis for judging the predictions upon which the opposition to the Seaway rested. Several Atlantic and Gulf ports predicted the loss of traffic they would suffer in the face of Seaway competition. Their diversion estimates ranged from 10 to 30 percent of their foreign trade, with Baltimore considering a loss of 10 percent to be a conservative estimate. In light of our analysis, which places Baltimore's probable loss at 5 percent of her projected 1965 traffic, it appears that the Seaway will cause less injury to ocean ports than they feared. The Seaway definitely will attract traffic which hitherto moved through ocean ports, but the extent of such diversion from any single port will tend to be small, resulting in a slower growth of the port, not in an absolute fall in the level of economic activity. The ports' concern, however, over the need for year-round maintenance of sufficient facilities to handle a heavy volume of traffic during less than five months out of the year is substantiated by the analysis, especially for grain.

In addition to pointing out the probable traffic and employment effects of the Seaway upon the port of Baltimore and its environs, the study indicates that it would be possible to have better traffic-flow information than is currently available. Depending upon the intended use of the information, it could be compiled by either of two agencies, individual port authorities or the Interstate Commerce Commission. If the information is to be used as we have used it in this study, to

measure the importance of various parts of a port's hinterland, then it does not seem that the Federal Government should assume the responsibility, but that each port should collect its own information. For the broader problem of learning how important various ports are in handling the foreign trade of the various states, or other geographic units, the Interstate Commerce Commission is the logical agency to collect and process the data.

The more information a port has on the pattern of the movement of traffic through it, the better equipped it is to sell itself to importers and exporters. Any success in selling the port to shippers will increase the traffic of the railroads and truck lines which serve the port. It follows, then, that it would be to these carriers' benefit to allow access to their records for traffic-flow information. It would not be necessary to cover all traffic movements. A sampling procedure would suffice. Professor Patton used a one-month sample in his study of four ports; but in light of the opening of the Seaway a seasonal pattern is likely to develop in some ports (those using and those competing with the Seaway), indicating the desirability of at least a two-month sample, one during the Seaway's open season and one during its closed season. To compile, organize, and aggregate the data on two months of rail traffic at the port of Baltimore should take one person about four weeks. The time for other ports would vary with the volume of traffic and the number of carriers involved.

By using a sampling procedure, it should be possible to include truck movements in a traffic pattern. A sample of one day per month ought to yield an accurate description of the traffic flow. On that one day it should not be difficult for trucking firms to report traffic-flow data (commodity, point of origin or destination, and volume) pertinent

to that day's movements of overseas trade.

In this manner any port could quite easily depict the traffic pattern of goods which move through it. Since some ports may not choose to collect such information, our traffic-flow data may remain incomplete, although more adequate than at the present time. Furthermore it is possible that the use of the data compiled by the separate ports would be restricted. Without arrangements for the reciprocal use of traffic patterns, any one port may be reluctant to allow a detailed picture of its traffic pattern to be used in a way that would make the pattern known to other ports. Unless we can put together the traffic patterns of several ports, we cannot say much about the share of, say, Ohio's foreign traffic that each handles.

To achieve a more thorough coverage of traffic movements and to provide data for a broader scope of analysis, the Federal Government would be better suited than the individual port authorities. The Interstate Commerce Commission currently receives data from the country's railroads which sample traffic movements and from which the Commission publishes a description of the national traffic pattern.[1] By commodity, the report shows the number of carloads and of tons which move from each state to each other state. It should be a relatively simple matter to collect and compile similar data on import and export traffic. If the railroads were to report movements of import and export goods separately from purely domestic traffic, the data could be assembled to show two things currently not included in the Carload Waybill Analysis. First the

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[1]U. S., Interstate Commerce Commission, Carload Waybill Analysis, (Washington: U. S. Government Printing Office).

traffic pattern of each port could be extracted from the data, showing the relative importance of various states in generating traffic for each port. Second, the data could be used to describe the foreign traffic pattern of each state, disclosing the relative importance of various ports in handling each state's import and export trade. The administrative burden on the railroads would be increased only slightly by requiring them to include separate information on foreign traffic movements in the report they currently submit, while such information would increase greatly our knowledge of port hinterlands.

It appears that the Interstate Commerce Commission quite easily could provide a pattern of the domestic rail movements of import and export traffic. If traffic-flow information is not made available through this agency, any port authority which wants traffic-flow data pertaining to its port could assemble such information at a low cost, if it could obtain the cooperation of the rail and motor carriers which serve the port.

APPENDIX A

TRAFFIC PATTERN OF THE IMPORT TRADE OF THE PORT OF BALTIMORE, 1956[1]

TABLE 1

DESTINATIONS OF IMPORTS THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
New England States			
Maine	56	21	77
Vermont	8	3	11
Massachusetts	298	516	814
Rhode Island	8	58	56
Connecticut	407	377	784
Middle Atlantic States			
New York	229,616	288,672	518,288
New Jersey	1,619	3,059	4,678
Pennsylvania	1,009,260	1,548,381	2,577,641
Southern States			
Delaware	1,145	2,967	4,112
Maryland	3,771,398	6,955,372	10,726,770
Dist. of Col.	3,209	5,036	8,245
Virginia	11,894	23,102	34,996
West Virginia	99,852	161,687	261,539
North Carolina	3,469	4,967	8,436
South Carolina	146	1,287	1,433
Georgia	1,958	2,616	4,574
Florida	48	282	330
Kentucky	25,400	7,343	32,743

[1]The data in Appendix A were compiled from the records of the Baltimore and Ohio Railroad, the Western Maryland Railway, and the Pennsylvania Railroad; the Import Bulletin; and letters from the Canton Railroad, the Fruit Dispatch Company, the Armco Steel Corporation, and the National Gypsum Company.

TABLE 1 - Continued

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Tennessee	2,004	4,108	6,112
Alabama	142	458	600
Mississippi	0	6	6
Arkansas	295	347	642
Louisiana	0	86	86
Oklahoma	18	165	183
Texas	110	189	299
North Central States			
Ohio	733,910	2,106,105	2,840,015
Indiana	52,497	69,225	121,722
Illinois	18,284	51,028	69,312
Michigan	43,774	50,413	94,187
Wisconsin	1,497	2,597	4,094
Minnesota	830	702	1,532
Iowa	3,943	5,398	9,341
Missouri	736	534	1,270
North Dakota	0	68	68
Nebraska	186	39	225
Kansas	155	300	455
Mountain States			
Idaho	0	7	7
Colorado	17	182	199
Western States			
Washington	50	4	54
California	155	487	642
Canada			
New Brunswick	0	47	47
Nova Scotia	0	27	27
Quebec	539	12,238	12,777
Ontario	21,999	61,658	83,657
Manitoba	0	19	19
Alberta	0	77	77
Total	6,040,932	11,372,260	17,413,192

TABLE 2

DESTINATIONS OF IMPORTS OF IRON ORE
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Middle Atlantic States			
New York	136,564	113,580	250,144
Pennsylvania	511,452	833,826	1,345,278
Southern States			
Maryland	2,143,027	4,437,906	6,580,933
Virginia	280	0	280
West Virginia	65,031	76,350	141,381
Kentucky	23,737	5,946	29,683
North Central States			
Ohio	383,444	1,549,629	1,933,073
Indiana	31,471	27,122	58,593
Illinois	9,940	40,902	50,842
Michigan	9,042	13,314	22,356
Total	3,313,988	7,098,575	10,412,563

TABLE 3

DESTINATIONS OF IMPORTS OF MANGANESE ORE
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Middle Atlantic States			
New York	1,140	12,096	13,236
Pennsylvania	362,406	553,948	916,354
Southern States			
Maryland	1,228	1,062	2,290
Virginia	3,326	11,433	14,759
West Virginia	4,429	22,208	26,637
North Carolina	0	52	52
North Central States			
Ohio	167,752	260,657	438,409
Indiana	18,100	36,409	54,509
Illinois	0	108	108
Michigan	9,401	13,447	22,848
Iowa	720	1,870	2,590
Canada			
Quebec	100	55	155
Ontario	18,221	50,601	68,822
Total	586,823	963,946	1,550,769

TABLE 4

DESTINATIONS OF IMPORTS OF CHROME ORE
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Middle Atlantic States			
New York	38,065	80,289	118,354
Pennsylvania	5,667	6,369	12,036
Southern States			
Delaware	68	95	163
Maryland	22,753	13,356	36,109
West Virginia	13,079	40,197	53,276
South Carolina	0	1,125	1,125
Kentucky	1,029	0	1,029
Tennessee	225	538	763
North Central States			
Ohio	121,605	201,434	323,039
Iowa	2,674	2,957	5,631
Canada			
Quebec	226	10,913	11,139
Ontario	0	2,796	2,796
Total	205,391	360,069	565,460

TABLE 5

DESTINATION OF IMPORTS OF PRODUCTS OF AGRICULTURE
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
New England States			
Maine	56	21	77
Vermont	8	3	11
Massachusetts	171	78	249
Rhode Island	8	58	66
Connecticut	0	42	42
Middle Atlantic States			
New York	3,207	7,332	10,539
New Jersey	652	795	1,447
Pennsylvania	19,944	30,647	50,591
Southern States			
Delaware	570	828	1,398
Maryland	33,657	43,329	76,986
Dist. of Col.	336	688	1,024
Virginia	345	428	773
West Virginia	8,096	5,003	13,099
North Carolina	653	438	1,091
South Carolina	58	134	192
Georgia	298	144	442
Florida	34	142	176
Kentucky	56	39	95
Tennessee	74	114	188
Arkansas	21	21	42
Louisiana	0	21	21
Texas	0	26	26
North Central States			
Ohio	7,068	13,719	20,787
Indiana	89	38	127
Illinois	1,226	2,686	3,912
Michigan	4,373	7,852	12,225
Wisconsin	367	255	622
Minnesota	158	0	158
Missouri	112	76	188
Mountain States			
Colorado	17	39	56

TABLE 5 - Continued

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Western States			
Washington	11	4	15
California	52	0	52
Canada			
Quebec	33	349	382
Ontario	2,069	6,002	8,071
Manitoba	0	19	19
Total	83,819	121,370	205,189

TABLE 6

DESTINATION OF IMPORTS OF PRODUCTS OF ANIMALS THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Middle Atlantic States			
New Jersey	0	16	16
Pennsylvania	24	40	64
Southern States			
Delaware	0	15	15
Maryland	18	27	45
North Central States			
Ohio	18	21	39
Indiana	20	0	20
Illinois	128	5	133
Michigan	149	71	220
Wisconsin	80	60	140
Total	437	255	692

TABLE 7

DESTINATION OF IMPORTS OF PRODUCTS OF MINES THROUGH THE PORT OF BALTIMORE, 1956[1]

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Middle Atlantic States			
New York	44,983	38,101	83,084
New Jersey	89	8	97
Pennsylvania	60,193	48,481	108,674
Southern States			
Delaware	0	447	447
Maryland	1,431,237	2,183,915	3,615,152
Dist. of Col.	23	0	23
Virginia	71	22	93
West Virginia	3,652	8,737	12,389
South Carolina	13	0	13
Georgia	0	41	41
Tennessee	0	18	18
North Central States			
Ohio	2,621	16,744	19,365
Illinois	298	522	820
Michigan	317	106	423
Wisconsin	70	30	100
Missouri	143	0	143
Canada			
Quebec	33	0	33
Total	1,543,743	2,297,172	3,840,915

[1]Excluding iron, manganese, and chrome ores.

TABLE 8

DESTINATION OF IMPORTS OF PRODUCTS OF FORESTS
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
New England States			
Massachusetts	0	65	65
Middle Atlantic States			
New York	41	0	41
Pennsylvania	500	654	1,154
Southern States			
Maryland	957	3,006	3,963
Virginia	640	787	1,427
West Virginia	127	128	255
North Carolina	590	779	1,369
Georgia	0	26	26
Florida	0	42	42
Alabama	0	39	39
Texas	0	36	36
North Central States			
Ohio	573	343	916
Indiana	82	41	123
Illinois	491	258	749
Michigan	113	19	132
Total	4,114	6,223	10,337

TABLE 9

DESTINATION OF IMPORTS OF MANUFACTURES AND MISCELLANEOUS PRODUCTS THROUGH THE PORT OF BALTIMORE, 1956

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
New England States			
Massachusetts	127	373	500
Connecticut	407	335	742
Middle Atlantic States			
New York	5,616	37,274	42,890
New Jersey	878	2,240	3,118
Pennsylvania	49,074	74,416	123,480
Southern States			
Delaware	507	1,582	2,089
Maryland	138,521	272,771	411,292
Dist. of Col.	2,850	4,348	7,198
Virginia	7,232	10,432	17,664
West Virginia	5,438	9,064	14,502
North Carolina	2,226	3,698	5,924
South Carolina	75	28	103
Georgia	1,660	2,405	4,065
Florida	14	98	112
Kentucky	578	1,358	1,936
Tennessee	1,705	3,438	5,143
Alabama	142	419	561
Mississippi	0	6	6
Arkansas	274	326	600
Louisiana	0	65	65
Oklahoma	18	165	183
Texas	110	127	237
North Central States			
Ohio	50,829	63,558	114,387
Indiana	2,735	5,615	8,350
Illinois	6,201	6,547	12,748
Michigan	20,379	15,604	35,983
Wisconsin	980	2,252	3,323
Minnesota	672	702	1,374
Iowa	549	571	1,120
Missouri	481	458	939
North Dakota	0	68	68
Nebraska	186	39	225
Kansas	155	300	455

TABLE 9 - Continued

State	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Mountain States			
Idaho	0	7	7
Colorado	0	143	143
Western States			
Washington	39	0	39
California	103	487	590
Canada			
New Brunswick	0	47	47
Nova Scotia	0	27	27
Quebec	147	921	1,068
Ontario	1,709	2,259	3,968
Alberta	77	0	77
Total	302,694	524,573	827,267

TABLE 10

PORT OF BALTIMORE IMPORTS, 1956
BY COMMODITY

Commodity	Tons terminated during Seaway's closed season	Tons terminated during Seaway's open season	Total tons terminated
Iron Ore	3,313,988	7,098,575	10,412,563
Manganese Ore	586,823	963,946	1,550,769
Chrome Ore	205,391	360,069	565,460
Products of Agriculture	83,819	121,370	205,189
Products of Animals	437	255	692
Products of Mines	1,543,743	2,297,172	3,840,915
Products of Forests	4,114	6,223	10,337
Manufactures and Miscellaneous	302,694	524,573	827,267
Total	6,041,009	11,372,183	17,413,192

APPENDIX B

TRAFFIC PATTERN OF THE EXPORT TRADE OF THE PORT OF BALTIMORE, 1956[1]

TABLE 1

ORIGINS OF EXPORTS THROUGH THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
New England States			
New Hampshire	37	4	41
Massachusetts	33	60	93
Connecticut	1,268	1,013	2,281
Middle Atlantic States			
New York	126,639	616,655	743,294
New Jersey	1,698	3,126	4,824
Pennsylvania	953,606	1,795,006	2,748,612
Southern States			
Delaware	2,403	21,178	23,581
Maryland	171,585	287,748	459,333
Dist. of Col.	1,457	2,142	3,599
Virginia	17,991	18,682	36,673
West Virginia	864,532	1,781,002	2,645,534
North Carolina	2,651	2,515	5,166
South Carolina	38	163	201
Georgia	846	347	1,193
Florida	283	234	517
Kentucky	36,831	39,291	76,122
Tennessee	220	329	549
Alabama	44	705	749

[1]The data in Appendix B were compiled from the records of the Baltimore and Ohio Railroad, the Western Maryland Railway, and the Pennsylvania Railroad; and from "Tidewater Bituminous Coal Tonnage Dumped."

TABLE 1 - Continued

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Mississippi	0	176	176
Arkansas	20	296	316
Louisiana	0	357	357
Texas	0	142	142
North Central States			
Ohio	254,562	335,253	589,815
Indiana	63,642	85,103	148,745
Illinois	311,067	360,681	671,748
Michigan	38,540	41,662	80,202
Wisconsin	45,117	35,701	80,818
Minnesota	184,744	56,684	241,428
Iowa	35,382	31,992	67,374
Missouri	12,306	9,219	21,525
South Dakota	499	903	1,402
Nebraska	23,642	73,499	97,141
Kansas	11,259	40,706	51,965
Mountain States			
Montana	0	234	234
Wyoming	216	93	309
Colorado	0	85	85
Utah	0	220	220
Western States			
Washington	0	12	12
California	112	81	193
Canada			
Quebec	112	30	142
Ontario	14,144	255	14,399
Midwest	81,613	213,717	295,330
West	554	6,961	7,515
Railroads			
C & P	1,199	0	1,199
N & W	0	851	851
Total	3,260,892	5,865,113	9,126,005

TABLE 2

ORIGINS OF EXPORTS OF WHEAT THROUGH
THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	30,019	411,369	441,388
New Jersey	118	0	118
Pennsylvania	212	32,283	32,495
Southern States			
Delaware	0	2,945	2,945
Maryland	1,169	67,892	69,061
Dist. of Col.	0	176	176
Virginia	1,347	3,051	4,398
West Virginia	144	86	230
Kentucky	28,933	25,178	54,111
North Central States			
Ohio	29,593	81,105	110,698
Indiana	13,607	33,302	46,909
Illinois	114,299	235,293	349,592
Michigan	5,015	10,229	15,244
Wisconsin	0	11,316	11,316
Minnesota	4,162	19,000	23,162
Iowa	1,416	13,107	14,523
Missouri	11,963	7,942	19,905
Nebraska	23,380	72,442	94,822
Kansas	10,012	36,516	46,528
Midwestern	19,205	106,985	126,190
Total	294,594	1,170,217	1,463,811

TABLE 3

ORIGINS OF EXPORTS OF CORN THROUGH
THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	19,191	23,771	42,962
Pennsylvania	5,433	17,683	23,116
Southern States			
Maryland	555	3,876	4,431
West Virginia	0	103	103
Kentucky	2,340	7,254	9,594
North Central States			
Ohio	48,604	22,434	71,038
Indiana	37,132	37,682	74,814
Illinois	169,091	91,162	260,253
Michigan	9,217	1,874	11,091
Wisconsin	617	3,045	3,662
Minnesota	82,461	18,215	100,676
Iowa	28,703	15,420	44,123
Missouri	309	0	309
Nebraska	93	524	617
Kansas	216	2,927	3,143
Mountain States			
Wyoming	216	93	309
Midwestern States	59,020	104,391	163,411
Western States	554	6,345	6,899
Total	463,752	356,799	820,551

TABLE 4

ORIGINS OF EXPORTS OF OTHER GRAINS THROUGH THE PORT OF BALTIMORE, 1956[1]

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	19,752	122,638	142,390
New Jersey	0	97	97
Pennsylvania	0	463	463
Southern States			
Delaware	1,946	17,509	19,455
Maryland	47,546	52,376	99,922
Virginia	13,184	9,426	22,610
North Carolina	629	553	1,182
North Central States			
Ohio	4,588	4,695	9,283
Indiana	87	172	259
Illinois	10,260	208	10,468
Michigan	246	6,039	6,285
Wisconsin	29,227	1,828	31,055
Minnesota	92,809	9,441	102,250
Iowa	3,094	526	3,620
Midwestern States	3,388	2,341	5,729
Western States	0	616	616
Total	226,756	228,928	455,684

[1] "Other grains" include oats, barley, rye and soybeans.

TABLE 5

ORIGINS OF EXPORTS OF DAIRY PRODUCTS THROUGH THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
New England States			
Massacushetts	48	0	48
Middle Atlantic States			
New York	2,150	1,806	3,956
Pennsylvania	327	1,272	1,599
Southern States			
Maryland	467	1,583	2,050
District of Columbia	120	1,248	1,368
South Carolina	0	34	34
Kentucky	49	51	100
North Central States			
Ohio	1,897	6,301	8,198
Indiana	150	445	595
Illinois	529	706	1,235
Michigan	236	711	947
Wisconsin	10,382	17,584	27,966
Minnesota	4,458	8,708	13,166
Iowa	345	16	361
Missouri	17	663	680
Nebraska	29	484	513
Total	21,204	41,612	62,816

TABLE 6

ORIGINS OF EXPORTS OF COAL THROUGH
THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
Pennsylvania	690,624	1,517,448	2,208,072
Southern States			
Maryland	17,894	50,840	68,734
West Virginia	808,765	1,713,553	2,522,318
North Central States			
Ohio	15,940	26,817	42,757
Railroads			
Cleveland and Pittsburg	1,199	0	1,199
Norfolk and Western	0	851	851
Total	1,534,422	3,309,509	4,843,931

TABLE 7

ORIGIN OF EXPORTS OF IRON AND STEEL PRODUCTS
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
New England States			
Connecticut	0	41	41
Middle Atlantic States			
New York	41,475	40,918	82,393
New Jersey	100	128	228
Pennsylvania	95,173	99,587	194,760
Southern States			
Delaware	457	641	1,098
Maryland	71,599	65,425	137,024
Dist. of Col.	156	0	156
Virginia	65	38	103
West Virginia	30,474	43,553	74,027
North Carolina	696	68	764
Kentucky	2,546	3,850	6,396
Tennessee	0	36	36
Alabama	44	705	749
North Central States			
Ohio	104,765	134,812	239,577
Indiana	4,381	3,837	8,218
Illinois	2,938	4,161	7,099
Michigan	7,096	5,570	12,666
Wisconsin	3,608	44	3,652
Canada			
Ontario	3,179	170	3,349
Total	368,752	403,584	772,336

TABLE 8

ORIGIN OF EXPORTS OF PRODUCTS OF AGRICULTURE
THROUGH THE PORT OF BALTIMORE, 1956[1]

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	407	740	1,147
Pennsylvania	407	1,060	1,467
Southern States			
Dist. of Col.	91	419	510
Virginia	193	458	651
West Virginia	24	25	49
North Carolina	608	650	1,258
Florida	0	88	88
Kentucky	0	54	54
Arkansas	0	296	296
North Central States			
Ohio	37	816	853
Indiana	53	1,060	1,113
Illinois	1,819	8,169	9,988
Wisconsin	0	37	37
Minnesota	226	826	1,052
Missouri	0	518	518
Kansas	0	665	665
Mountain States			
Colorado	0	85	85
Western States			
California	112	81	193
Canada			
Ontario	0	50	50
Total	3,977	16,097	20,074

[1]Excluding grains.

TABLE 9

ORIGIN OF EXPORTS OF PRODUCTS OF ANIMALS
THROUGH THE PORT OF BALTIMORE, 1956[1]

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	0	23	23
Pennsylvania	371	148	519
Southern States			
Maryland	179	249	428
District of Columbia	0	87	87
Virginia	215	86	301
West Virginia	27	11	38
Georgia	30	11	41
Kentucky	22	0	22
North Central States			
Ohio	4,010	5,124	9,134
Indiana	1,308	743	2,051
Illinois	2,938	3,131	6,069
Michigan	94	16	110
Wisconsin	0	602	602
Minnesota	426	54	480
Iowa	1,426	1,957	3,383
South Dakota	499	903	1,402
Nebraska	140	49	189
Kansas	1,017	498	1,515
Western States			
Washington	0	12	12
Total	12,702	13,704	26,406

[1]Excluding dairy products.

TABLE 10

ORIGIN OF EXPORTS OF PRODUCTS OF MINES
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New Jersey	39	9	48
Pennsylvania	2,558	3,209	6,767
Southern States			
Maryland	20	391	411
Virginia	184	572	756
West Virginia	336	1,379	1,715
North Carolina	214	293	507
South Carolina	0	34	34
Georgia	0	30	30
Mississippi	0	176	176
North Central States			
Ohio	1,437	2,985	4,422
Indiana	4	129	133
Illinois	1,392	3,299	4,691
Michigan	314	561	875
Minnesota	0	34	34
Iowa	0	27	27
Missouri	0	58	58
Mountain States			
Utah	0	220	220
Total	7,498	13,406	20,904

TABLE 11

ORIGIN OF EXPORTS OF PRODUCTS OF FORESTS
THROUGH THE PORT OF BALTIMORE, 1956

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Middle Atlantic States			
New York	59	11	70
Pennsylvania	254	189	443
Southern States			
Maryland	691	619	1,310
Virginia	534	360	894
West Virginia	66	20	86
Florida	0	146	146
Kentucky	0	262	262
North Central States			
Ohio	581	421	1,002
Indiana	16	0	16
Michigan	87	200	287
Wisconsin	54	0	54
Iowa	23	0	23
Total	2,365	2,228	4,593

TABLE 12

ORIGIN OF EXPORTS OF MANUFACTURES AND MISCELLANEOUS PRODUCTS THROUGH THE PORT OF BALTIMORE, 1956[1]

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
New England States			
New Hampshire	37	4	41
Massachusetts	33	12	45
Connecticut	1,268	972	2,240
Middle Atlantic States			
New York	13,586	15,379	28,965
New Jersey	1,441	2,892	4,333
Pennsylvania	157,247	121,664	278,911
Southern States			
Delaware	0	83	83
Maryland	31,465	44,497	75,962
Dist. Of Col.	1,090	212	1,302
Virginia	2,269	4,691	6,960
West Virginia	24,696	22,272	46,968
North Carolina	504	951	1,455
South Carolina	38	95	133
Georgia	816	306	816
Florida	283	0	283
Kentucky	2,941	2,642	5,583
Tennessee	220	293	513
Arkansas	20	0	20
Louisiana	0	357	357
Texas	0	142	142
North Central States			
Ohio	43,110	49,743	92,853
Indiana	6,904	7,733	14,637
Illinois	7,801	14,552	22,353
Michigan	16,235	16,462	32,697
Wisconsin	1,374	1,100	2,474
Minnesota	202	406	608
Iowa	375	939	1,314
Missouri	17	38	55
Kansas	14	100	114
Mountain States			
Montana	0	234	234

[1]Excluding iron and steel products

TABLE 12 - Continued

State	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Canada			
Quebec	112	30	142
Ontario	10,965	35	11,000
Total	325,063	308,836	633,899

TABLE 13

PORT OF BALTIMORE EXPORTS, 1956
BY COMMODITY

Commodity	Tons originated during Seaway's closed season	Tons originated during Seaway's open season	Total tons originated
Wheat	294,594	1,170,217	1,464,811
Corn	463,752	356,799	820,551
Other grains	226,756	228,928	455,684
Dairy products	21,204	41,612	62,816
Coal	1,534,422	3,309,509	4,843,931
Iron and Steel	368,752	403,584	772,336
Products of Agriculture	3,977	16,097	20,074
Products of Animals	12,702	13,704	26,406
Products of Mines	7,498	13,406	20,904
Products of Forests	2,365	2,228	4,593
Manufacturing and Miscellaneous	325,063	308,836	633,899
Total	3,261,892	5,865,113	9,126,005

APPENDIX C

CALCULATIONS OF THE COST OF OCEAN TRANSPORTATION

TABLE 1

ESTIMATES OF THE COST OF WATER TRANSPORTATION OF GENERAL CARGO BETWEEN ANTWERP AND DETROIT AND BETWEEN ANTWERP AND BALTIMORE

	Antwerp-Detroit	Antwerp-Baltimore
(1) Distance in nautical miles	4,023	3,713
(2) Days enroute per round trip	30	24
(3) Days in port per round trip	24	25
(4) Round trips per season	4.0	7.3
(5) Maximum total deadweight, tons	10,650	10,650
(6) Fuel carried per voyage, tons	1,267	1,138
(7) Fresh water, stores, etc. per voyage	250	250
(8) Maximum cargo per voyage	9,133	9,262
(9) Cargo carried per voyage	6,850	6,946
(10) Crew wages	$63,063	$105,087
(11) Depreciation	91,914	153,190
(12) Maintenance and repairs	18,000	30,000
(13) Stores	29,315	48,859
(14) Subsistence	17,250	29,200
(15) Insurance	13,288	22,147
(16) Port charges	5,200	9,490
(17) Fuel cost	79,076	122,728
(18) Cargo handling cost	315,648	584,133
(19) Tolls	57,172	0
(20) Sub Total	$690,196	$1,104,834
(21) Overhead	147,439	194,998
(22) Total cost of operation	$837,635	$1,299,832
(23) Cargo carried per season, tons	54,800	101,412
(24) Cost per long ton	$15.28	$12.82
(25) Cost per short ton	13.64	11.45

TABLE 1 - Continued

Explanation of Table 1.

(1) From Table of Distances between Ports and Vincent, Transactions.
(2) Line (1) divided by (14 x 24).
(3) 4 [line (8) divided by 1500]. Vincent uses 1500 tons per day as the average rate of loading and unloading general cargo.
(4) Detroit: 214 days divided by the sum of lines (2) and (3).
Baltimore: 357 days divided by the sum of lines (2) and (3).

(5) Given by Vincent on the basis of the design of the vessel.
(6) Detroit: (1.2 [28.2 x line (2) + 50] + 192) x line (4).
Baltimore: (1.2 [30.5 x line (2) + 50] + 200) x line (4).
Fuel consumption from Detroit is 28.2 tons per day at sea, and 30.5 tons per day at sea from Baltimore, and a 20 percent reserve is carried. Fuel consumption in port is 8 tons per day.
(7) Given by Vincent.
(8) Line (5) - [line (6) + line (7)].
(9) 0.75 x line (8).
(10) $35,025 per month with 75 percent subsidy.
(11) Annual rate of depreciation is 5 percent. The cost to be charged to depreciation is total cost of construction less 40 percent subsidy less salvage value of $100,000. Initial cost, $5,273,000.
(12) $60,000 per year with 50 percent subsidy.
(13) $138 per day with 3 percent subsidy.
(14) $2 per man (50 man crew) per day with 20 percent subsidy.
(15) 0.07 percent of total construction cost with 40 percent subsidy.
(16) $1300 x line (4). Port charges at Antwerp are assumed by Vincent to be $550 per visit, and at United States' ports, $750 per visit.
(17) Detroit: $18.17 [28.2 x line (2) + 242] x line (4).
Baltimore: $17.11 [30.5 x line (2) + 250] x line (4).
(18) $5.76 x line (23).
(19) [$639 x 2 x line (4)] + $.95 x line (23).
(20) Sum of lines (10) through (19).
(21) Detroit: 0.15 [line (20) + $292,731*].
Baltimore: 0.15 [line (20) + $195,153*].
*These figures represent the difference between subsidized and non-subsidized cost.
(22) Sum of lines (20) and (21).

(23) 2 [line (4) x line (9)].
(24) Line (22) divided by line (23).
(25) Line (24) divided by 1.12.

TABLE 2

ESTIMATES OF THE COST OF WATER TRANSPORTATION OF GENERAL CARGO BETWEEN LA GUAIRA, VENEZUELA AND DETROIT AND BETWEEN LA GUAIRA, VENEZUELA AND BALTIMORE

	La Guaira-Detroit	La Guaira-Baltimore
(1) Distance in nautical miles	3,466	1,813
(2) Days enroute per round trip	27	13
(3) Days in port per round trip	25	26
(4) Round trips per season	4.1	9.1
(5) Maximum total deadweight, tons	10,650	10,650
(6) Fuel carried per voyage, tons	1,165	735
(7) Fresh water, stores, etc. per voyage	250	250
(8) Maximum cargo per voyage	9,235	9,665
(9) Cargo carried per voyage	6,926	7,249
(10) Crew wages	$63,063	$105,087
(11) Depreciation	91,914	153,190
(12) Maintenance and repairs	18,000	30,000
(13) Stores	29,315	48,859
(14) Subsistence	17,250	29,200
(15) Insurance	13,288	22,147
(16) Port charges	5,330	11,830
(17) Fuel cost	74,720	100,583
(18) Cargo handling cost	327,128	759,928
(19) Tolls	59,193	0
(20) Sub total	$699,472	$1,260,824
(21) Overhead	148,830	218,397
(22) Total cost of operation	$848,302	$1,479,221
(23) Cargo carried per season, tons	56,793	131,932
(24) Cost per long ton	$14.94	$11.21
(25) Cost per short ton	13.34	10.01

TABLE 3

ESTIMATES OF THE COST OF WATER TRANSPORTATION OF ORE BETWEEN LA GUAIRA, VENEZUELA AND ASHTABULA AND BETWEEN MONROVIA, LIBERIA AND ASHTABULA

	La Guaira-Ashtabula	Monrovia-Ashtabula
(1) Distance in nautical miles	3,250	4,151
(2) Days enroute per round trip	27	33
(3) Days in port per round trip	2	2
(4) Round trips per season	7.4	6.1
(5) Maximum total deadweight, tons	10,650	10,650
(6) Fuel carried per voyage, tons	989	1,193
(7) Fresh water, stores, etc. per voyage	250	250
(8) Maximum cargo per voyage	9,411	9,207
(9) Cargo carried per voyage	9,411	9,207
(10) Crew's wages	$63,063	$63,063
(11) Depreciation	91,914	91,914
(12) Maintenance and repairs	18,000	18,000
(13) Stores	29,315	29,315
(14) Subsistence	17,250	17,250
(15) Insurance	13,288	13,288
(16) Port charges	9,620	7,930
(17) Fuel cost	104,474	104,963
(18) Cargo handling cost	33,428	26,958
(19) Tolls	38,706	31,384
(20) Sub total	$419,328	$404,335
(21) Overhead	106,809	104,560
(22) Total cost of operation	$526,137	$508,895
(23) Cargo carried per season, tons	69,641	56,163
(24) Cost per long ton	$7.55	$9.06
(25) Cost per short ton	6.74	8.09

Explanation of Table 3.

(9) Same as line (8) because ships carry a full cargo.
(19) [$639 x 2 x line (4)] + $.42 x line (23).
(23) Line (4) x line (9).

THE UNIVERSITY OF MICHIGAN
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DEPARTMENT OF ECONOMICS

RESEARCH SEMINAR IN
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APPENDIX D

SURVEY OF FOREIGN COMMERCE ON THE GREAT LAKES - ST. LAWRENCE SEAWAY

The opening of the Great Lakes - St. Lawrence Seaway in April, 1959, provided the Midwest with a new route to its overseas customers and suppliers. Under the direction of the Department of Economics and the Research Seminar in Quantitative Economics a study is being made to determine what effect the new water route will have on the port of Baltimore, Maryland. The port of Baltimore was selected for two reasons: (1) it handles large volumes of those commodities which are expected to move through the seaway; and (2) of our North Atlantic ports it is the nearest to the Midwest.

Much material on the volume and composition of traffic, transportation costs, port facilities, etc. has been gathered and analyzed. This material provides a foundation for explaining the effect of the seaway on Baltimore. The impact will be large or small, however, depending on the decisions of importers and exporters to use or not to use the seaway. This survey is being made to obtain information directly from the people who will be making these decisions. It is planned to publish a complete report of the study in one of the academic journals interested in transportation economics.

All answers will be kept strictly confidential. They will be used only in combination with responses from other firms.

Your cooperation in promptly filling out and returning the questionnaire will be appreciated. As soon as it is possible a summary of the results will be sent to you upon request.

Sincerely,

Donald C. Darnton

Donald C. Darnton
Program Director in
Transportation Economics

SURVEY OF FOREIGN COMMERCE ON THE
GREAT LAKES - ST. LAWRENCE SEAWAY

Please answer the first ten questions on the basis of your firm's experience during 1958.

1. Did your firm use the seaway for either importing or exporting during 1958? _____

2. How many tons of your firm's imports terminated in the inland area? _____

3. How many tons of your firm's exports originated in the inland area? _____

4. How many tons of your firm's foreign commerce moved to or from ocean ports by the following types of domestic carriers?

   Railroads _____
   Trucks _____
   Other _____



Note: The "inland area" is that area shown in white.

5. Through what ocean ports did your firm's foreign trade move?

   _____ _____
   _____ _____
   _____ _____

6. For any given shipment, has your firm ever used a port other than the one through which transportation costs for that shipment were the lowest? _____

   If "yes", what reasons caused the use of the high-cost port?

   _____
   _____
   _____
   _____
   _____
   _____

SURVEY OF FOREIGN COMMERCE ON THE
GREAT LAKES - ST. LAWRENCE SEAWAY

7. Who determined through what port your firm's traffic moved?

Your Traffic Department _____
Foreign Freight Forewarder or
Custom House Broker _____
Consignee _____
Other (please specify) _____ _____

8. Does the port of Baltimore offer any special advantages in the handling of your firm's goods relative to other ports? _____

If "yes", what are those advantages?

_____
_____
_____
_____

If yours is a multi-plant firm, please answer questions 9 through 14 on the basis of those plants located in the inland area only. If such answers are not possible, answer relative to all plants and put a check before the question number.

9. What percent of your firm's foreign traffic moved through the port of Baltimore in 1958? _____

10. How many tons of your firm's foreign commerce were with the following areas?

Western Europe _____
Mediterranean and North Africa _____
Other Africa _____
South America and Caribbean _____
Far East and Pacific Ocean _____

Investigation indicates that total transportation costs will probably be lower via the seaway for points located in the white area shown on the map. Total transportation costs will probably be lower via Baltimore for points located in the shaded area on the map.

11. Given the above information, do you expect that your firm will use the seaway in 1959? _____, in 1965? _____

SURVEY OF FOREIGN COMMERCE ON THE
GREAT LAKES - ST. LAWRENCE SEAWAY

12. If either answer to question 11 is "yes",

a. Will your firm ship goods via ocean ports during the seaway's closed season in 1959? _____, in 1965? _____

b. Will your firm ship goods via ocean ports during the seaway's open season in 1959? _____, in 1965? _____

Note: The seaway's closed season is approximately from December 1st through mid-April. The open season is from mid-April through November.

13. What percent of your firm's total foreign commerce will move via the following routes?

	in 1959	in 1965
Seaway	_____%	_____%
Baltimore	_____%	_____%
Other	_____%	_____%

14. What factors other than transportation costs is your firm considering in deciding whether to use the seaway?

_____
_____
_____
_____
_____
_____

15. What was the value of your firm's sales in 1958?

less than $1,000,000 _____
$1,000,000 to $50,000,000 _____
more than $50,000,000 _____

If you wish to receive a summary of the results of the survey as soon as they are tabulated, please fill in the following for mailing purposes.

Name _____

Title _____

Firm _____

Address _____

Form

APPENDIX E

SUMMARY OF REPLIES TO SURVEY QUESTIONNAIRE

1. Did your firm use the Seaway for either importing or exporting during 1958?

	Number of firms answering	Weight of firms answering[a]
Yes	20	67,535
No	28	1,009,610[b]
No answer	5	6,870
Total	53	1,084,015

2. How many tons of your firm's imports terminated in the inland area?

Tons	Number of firms answering	Weight of firms answering
351,418	12	66,855

3. How many tons of your firm's exports originated in the inland area?

Tons	Number of firms answering	Weight of firms answering
1,612,441	33	1,027,320[b]

4. How many tons of your firm's foreign commerce moved to or from ocean ports by the following types of domestic carriers?

	Tons	Number of firms answering
Railroads	598,497	38
Trucks	33,790	19[c]
Other	790,800	3[d]
Total	1,423,087	60[f]

5. Through what ocean ports did your firm's foreign trade move?

	Number of firms answering	Weighted proportion of firms
North Atlantic	43	1,008,655[a]
South Atlantic	7	6,211
Gulf of Mexico	16	27,456
Pacific	9	6,283
Canadian	5	4,989
No answer	10	30,421
Total	90[f]	1,084,015

6. For any given shipment, has your firm ever used a port other than the one through which transportation costs were the lowest?

	Number of firms answering	Weight of firms answering
Yes	33	1,008,350[a]
No	9	44,157
No answer	11	31,508
Total	53	1,084,015

If "yes", what reasons caused the use of the high-cost port?

	Number of firms answering	Weighted proportion of firms
Frequency of service	11	13,258
Transit time	5	40,431
Ancillary services	6	803,915
Customers' order	9	136,320
Other	7	14,426
Total	38[e]	1,008,350

7. Who determined through what port your firm's traffic moved?

	Number of firms answering	Weighted proportion of firms
Traffic department	36	1,019,368[a]
Foreign freight forewarder	7	18,288
Consignee	19	27,737
Total	62[f]	1,065,393

8. Does the port of Baltimore offer any special advantages in the handling of your firm's goods relative to other ports?

	Number of firms answering	Weight of firms answering
Yes	22	995,559[a]
No	20	74,298
No answer	11	14,158
Total	53	1,084,015

If "yes", what are those advantages?

	Number of firms answering	Weighted proportion of firms
Lower rail rates	16	409,333
Cargo handling efficiency	6	573,209
Nearness to plant	2	13,017
Total	24[e]	995,559

9. What percent of your firm's foreign traffic moved through the port of Baltimore in 1958?

Percent	Number of firms answering	Weight of firms answering
0	4	25,966
1 - 15	13	24,251
16 - 30	6	11,370
31 - 45	4	35,191
46 - 60	1	200,000
61 - 75	2	716,800
76 - 90	3	5,547
91 - 100	7	24,552
No answer	13	39,978
Total	53	1,084,015

10. How many tons of your firm's foreign commerce were with the following areas?

	Tons	Number of firms answering	Additional firms answering[g]
Western Europe	161,470	19	5
Mediterranean	133,392	12	2
Africa	237,758	8	2
South America	338,428	24	4
Far East	98,762	17	3
No answer	0	22	0
Total	969,810	102[f]	16

11. Given the above information, do you expect that your firm will use the Seaway in

	1959		1965	
	Number of firms answering	Weight of firms answering	Number of firms answering	Weight of firms answering
Yes	22	857,673	23	762,874
No	12	86,313	7	49,201
Possible	4	202,287	8	220,858
No answer	15	37,742	15	51,082
Total	53	1,084,015	53	1,084,015

12a. Will you ship goods via ocean ports during the Seaway's closed season in

	1959		1965	
	Number of firms answering	Weight of firms answering	Number of firms answering	Weight of firms answering
Yes	30	1,004,892[a]	29	1,003,715[a]
No	3	8,660	1	80
Possible	1	1,718	3	20,298
No answer	19	58,745	20	59,922
Total	53	1,084,015	53	1,084,015

12b. Will your firm ship goods via ocean ports during the Seaway's open season in

	1959		1965	
	Number of firms answering	Weight of firms answering	Number of firms answering	Weight of firms answering
Yes	26	972,887[a]	24	971,661[a]
No	3	18,660	1	80
Possible	3	13,392	7	32,553
No answer	21	79,076	21	79,721
Total	53	1,084,015	53	1,084,015

13. What percent of your firm's foreign commerce will move via the following routes?

	1959		1965	
	Number of firms answering	Weight of firms answering	Number of firms answering	Weight of firms answering
Seaway				
0	10	37,915	2	13,203
1 - 15	8	228,050	5	24,080
16 - 30	5	13,597	3	202,234
31 - 45	2	700,049	3	700,506
No answer	28	104,404	40	143,992
Total	53	1,084,015	53	1,084,015
Baltimore				
0	2	1,748	2	2,411
1 - 15	8	34,019	6	24,586
16 - 30	5	4,624	2	1,541
31 - 45	3	712,020	3	911,435[a]
46 - 60	1	200,000	0	0
61 - 75	2	21,293	0	0
76 - 90	0	0	0	0
91 - 100	4	5,907	0	0
No answer	28	104,404	40	143,992
Total	53	1,084,015	53	1,084,015
Other				
0	0	0	0	0
1 - 15	2	8,236	0	0
16 - 30	2	716,800	1	700,000
31 - 45	1	200,000	2	200,457
46 - 60	6	20,638	4	13,075
61 - 75	4	3,819	1	693
76 - 90	4	22,594	5	24,117
91 - 100	4	5,397	2	3,844
No answer	30	106,531	38	141,829
Total	53	1,084,015	53	1,084,015

14. What factors other than transportation costs is your firm considering in deciding whether to use the Seaway?

	Number of firms answering	Weighted proportion of firms
Frequency of service	12	715,486
Transit time	13	103,539
Ancillary services	10	74,400
Other	8	100,416
None	7	47,341
No answer	20	42,833
Total	70[f]	1,084,015

15. What was the value of your firm's sales in 1958?

	Number of firms answering	Weight of firms answering
below $1 million	4	6,387
$1 to $50 million	20	258,296
above $50 million	18	790,154
No answer	11	29,178
Total	53	1,084,015

Footnotes:

[a]The response of each firm has been weighted by the number of tons of traffic which that firm moved between the inland area and the port of Baltimore in 1956.

[b]This figure includes 900,000 tons of goods shipped by the Commodity Credit Corporation's district offices at Minneapolis, Minnesota and at Evanston, Illinois.

[c]Of the total, 18 responses indicated that both railroads and trucks were used.

[d]Lake-rail, 750,000 tons; air, 800 tons; unspecified, 40,000 tons.

[e]This total is greater than the number of "yes" answers because some firms indicated that more than one category applied to them. The weighting factor has been divided equally among the various categories mentioned by any firm.

[f]This total is greater than the number of responses received because some firms indicated that more than one category applied to them. The weighting factor has been divided equally among the various categories mentioned by any firm.

[g]These firms indicated that they trade with these overseas areas, but furnished no figures on the volume of their trade with them.

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