Hart, Schaffner & Marx Prize Essays

XIII

WATERWAYS VERSUS RAILWAYS

WATERWAYS VERSUS RAILWAYS

BY

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BOSTON AND NEW YORK
HOUGHTON MIFFLIN COMPANY
The Riverside Press Cambridge

Published June 1912

TO

MY MOTHER

PREFACE

This series of books owes its existence to the generosity of Messrs. Hart, Schaffner & Marx, of Chicago, who have shown a special interest in trying to draw the attention of American youth to the study of economic and commercial subjects. For this purpose they have delegated to the undersigned committee the task of selecting or approving of topics, making announcements, and awarding prizes annually for those who wish to compete.

For the year ending June 1, 1911, there were offered: —

In Class A, which included any American without restriction, a first prize of $1000, and a second prize of $500.

In Class B, which included any who were at the time undergraduates of an American college, a first prize of $300, and a second prize of $200.

Any essay submitted in Class B, if deemed of sufficient merit, could receive a prize in Class A.

The present volume, submitted in Class A, was awarded the first prize in that class.

J. Laurence Laughlin, *Chairman,*
University of Chicago.
J. B. Clark,
Columbia University.
Henry C. Adams,
University of Michigan.
Horace White,
New York City.
Edwin F. Gay,
Harvard University.

AUTHOR'S PREFACE

When this investigation was undertaken the writer shared in the common belief that traffic of certain kinds can be carried at substantially less cost by water than by rail. He inclined to the view, however, that in the case of many of the waterway projects before the country the traffic available was not sufficient to warrant the contemplated expenditures, and it was thought that the chief contribution to be made would lie in an investigation of the traffic possibilities of certain proposed water routes.

A reading of the literature of the subject, however, soon made it evident that no adequate analysis of the cost of transportation by water had ever been made; that it was merely tacitly assumed that water transportation is cheaper than that by rail; and that the rate comparisons sometimes presented in support of this assumption were virtually meaningless. This discovery led to a shifting of emphasis to the cost aspect of the problem, the question of traffic assuming a secondary place.

The constant reference by writers on the subject to the apparently successful experience of European countries in maintaining harmony and mutual coöperation between waterways and railways made an investigation of European transportation conditions imperative to a comprehensive treatment of the subject. When the author went to Europe he shared, again, in the general belief that water transportation on the Continent was of undoubted economic advantage, and it was believed that the chief contribution to be made from a study of foreign transportation would lie in contrasting the geographical, industrial, and governmental conditions of Europe and the United

States. It was doubted, in other words, if conditions abroad were sufficiently similar to those in this country to warrant the conclusions commonly drawn from European experience. But to the surprise of the author it soon became apparent that in Europe, as in the United States, little consideration had ever been given to the *inclusive* cost of transportation by water, as compared with that by rail, and that the rate comparisons usually made proved nothing whatsoever. Consequently, here again, the question of *cost* assumed the foremost place; and the comparison of conditions became incidental.

Because the writer's own views were thus constantly undergoing revision in the course of the investigation, and because of a growing consciousness that he was becoming more and more at outright loggerheads with the advocates of waterway development, the arrangement of the subject-matter, the method of attack, and even the style is not all that he could wish. It has seemed preferable, on the whole, however, to leave it in its present form rather than to undertake a thoroughgoing revision. It may be, indeed, that the conclusions will be more readily accepted if the reader goes through the same stages of evolution that the writer passed through.

The waterway question is closely related to the whole movement for the conservation of natural resources; and it is foreseen that this work will probably be attacked by conservationists on the ground that it has not given sufficient attention to, or made adequate allowance for, allied benefits of waterway development, such as the prevention of floods, the reclamation of riparian lands, the development of water power, etc. It is true that the main emphasis has been placed upon the transportation aspect of the case, and the author recognizes that he has not adequately treated the other phases of the subject. He would point out here, however, that so far as *canal* transportation is concerned these allied benefits do not figure largely in the case. And it is believed, moreover, that as regards river improvement the burden of proof has been placed upon the conservationists. It has been generally assumed that, since the cost of river improvement will be more than paid for by transportation advantages alone, the allied benefits will constitute a net gain to society. But if the conclusions reached in this volume be sound, it becomes necessary (in most cases) to establish the value of river improvement on these incidental grounds alone. If this can be done, well and good. There is no objection to conservation, provided the thing conserved is worth what it costs to conserve it. It should be observed further, however, that river improvement for the sole purposes of reclaiming flooded lands, developing water power, etc., may well take an altogether different form than when transportation is a primary consideration. Independent investigations of these aspects of the waterway question are badly needed.

This opportunity is taken to express appreciation of the kindness shown the writer by the various consulates of Europe in giving him access to all their data on the subject, and to the Department of Public Works of Germany, who extended every courtesy, even to the use of the department library. Especial acknowledgment of thanks is also due to M. Colson, Director of Roads and Bridges, and Minister of State of France. Mr. A. C. Goodrich rendered valuable assistance in the preparation of maps and charts. I am under great obligation to Messrs. Hart, Schaffner & Marx, whose financial assistance made the European investigation possible. Above all, I am deeply grateful to Professor J. Laurence Laughlin, who inspired the work, and who gave his searching criticism at every stage of the writing.

HAROLD G. MOULTON.

CHICAGO, February, 1912.

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WATERWAYS VERSUS RAILWAYS

CHAPTER I

INTRODUCTION: THE REVIVAL OF THE AGITATION FOR WATERWAYS

1. Not since the great period of internal improvements following the close of the second war with Great Britain, when our attention was first earnestly directed toward the West, have we witnessed such an agitation for national development as exists at present. And now, as then, the central programme in the movement is the improvement of rivers and harbors and the construction of canals as connecting links in a great chain of inland waterways. The early movement was marked with all the enthusiasm of a young people just becoming cognizant of a national unity. The present movement is regarded as a great awakening to the need of national economy, and the conservation as well as the development of our natural resources. In the extent of interest and in the intensity of agitation the present equals if it does not exceed the early movement.

The great revival may be said to have begun about fifteen years ago. In 1895 there was held in Cleveland an International Waterways Convention composed of over three hundred delegates, representing Canada and all sections of the United States. In 1901 the first National Rivers and Harbors Congress met in Baltimore. The assembling of these two conventions, together with the work of various commercial associations, greatly stimulated and widened interest in the subject; and in 1903 the people of New York voted $101,000,000 for the improvement of the Erie Canal. But the real revival dates from 1906. In that year two history-making meetings were held, — the St. Louis Convention and the Washington Session of the Rivers and Harbors Congress. Out of the former grew the organization known as the Lakes-to-Gulf Deep Waterway Association; while the latter led directly to the appointment by President Roosevelt on March 14, 1907, of the Inland Waterways Commission.

The movement then began in earnest. During the summer of 1907 members of the new commission studied the possibilities of water transportation on the Atlantic Coast, in the Mississippi Valley, in the Southwest, and in the valley of the Columbia. In the early fall, accompanied by the President, the commission floated down the Mississippi from Keokuk to Memphis in one long celebration. Wrote Secretary McGee of the commission: "Nearly all the water craft of the river system were assembled; railways abandoned schedules and stopped freight traffic to accommodate specials; entire towns were evacuated that the inhabitants might gather on the river front. On the average each river town from Keokuk to Memphis showed more spectators standing out to salute the presidential party than its entire population; while day and night the air was rent with acclamations of voices, steam whistle, shrieking siren, salvo of guns, and roar and rattle of fireworks."[1]

The autumn of 1907 saw a veritable harvest of conventions and congresses;[2] and in the next two years there was

[1] *Popular Science Monthly*, April, 1908.

[2] They were: —

The Lakes-to-Gulf Meeting at Memphis, Tennessee.

The Upper Mississippi Improvement Convention at Moline, Illinois.

The Interstate Waterways Convention at Victoria, Texas.

The Irrigation Congress at Sacramento, California.

The Celebration of the Opening of the Hennepin Canal at Sterling, Illinois.

The Trans-Mississippi Congress at Muskogee, Oklahoma.

The Atlantic Deeper Waterways Conference at Philadelphia.

The Drainage Congress at Baltimore.

no cessation of activity. Rather the agitation became progressively enthusiastic, almost violent, especially in the Middle West, — culminating in the Deep Waterways Convention at New Orleans late in October of 1909. Another holiday party, led by St. Louis business men, floated down the Mississippi, with President Taft and Speaker Cannon the honored guests in place of Mr. Roosevelt. Tremendous enthusiasm marked the daily sessions of the meeting. Five thousand delegates at the greatest popular convention ever assembled in America were there to declare their unchangeable conviction that construction should be begun at once on a channel "fourteen feet through the valley." Impatient criticism of opposition and dogmatic assertion of feasibility characterized the addresses. The telegram of Governor Ansell of South Carolina to the convention seemed to sound the keynote: "We want water, more water, and deeper water." The issue of the convention was a long series of resolutions, drawn up in Jeffersonian phraseology, demanding of Congress financial aid for the immediate construction of the waterway. "To the enforcement of this demand" — the resolutions concluded — "we pledge our individual effort and our united support, and we hereby publicly pledge our personal honor, each for himself, and to each other, to support no candidate for public office who will not unqualifiedly indorse and maintain that policy."

The Rivers and Harbors Congress, which met at Washington in December, 1909, for the purpose of demanding enormous appropriations, or bond issues, for waterway development, met with a decided rebuff. Influenced by the unfavorable Engineers' Report on the Lakes-to-Gulf proposition, and confronted with a delicate political situa-

The Gulf States Waterway Convention at Birmingham, Alabama.
The Ohio Improvement Association Meeting at Wheeling, West Virginia.
The National Rivers and Harbors Congress at Washington.

tion, President Taft announced that he would veto any waterway measures that might then be presented. In the summer of 1909 the National Waterways Commission, appointed by President Taft, visited Europe and investigated transportation conditions on the Continent. A preliminary report was submitted to Congress by Chairman Burton in January, 1910. This report placed somewhat of a damper upon the enthusiasm, or at least checked the possibility of the immediate Government appropriations that were demanded. The Lakes-to-Gulf Association meeting in St. Louis in October, 1910, resulted in a fierce factional fight over the question whether the State of Illinois or the National Government should assume the lead in making appropriations for the waterway; while at the Chicago meeting a year later the chief bone of contention was whether resolutions should be drawn up in criticism of the President's apparent apathy in regard to waterway improvement. All factions were, however, united in depicting the benefits to come from the carrying-out of the great project.

The year 1911, however, was in general more encouraging to the advocates of waterway improvement. Congress gave sanction to a scheme for improving the Ohio River at a cost of approximately $60,000,000, and made appropriations for the commencement of the work. And in a message to Congress late in the year President Taft expressed himself as favorable to an early undertaking of the Lakes-to-Gulf project. While there may be now and then a lull in the storm, the waterways movement is nevertheless firmly rooted, and will command attention for years to come. A large number of waterway associations[1] are active propagandists and supporters of water-

[1] They are: —

The Western Waterways Association — embracing the entire Mississippi Valley.

The Lake Carriers Association — for the furthering of all shipping interests connected with the Great Lakes.

way development. These may be relied upon to keep up a constant agitation; and they give an aspect of permanency to the movement which would not exist in the absence of organization.

2. The projects that are talked of, written of, and dreamed of are well-nigh too many for enumeration. It is quite impossible to give an accurate description of all the waterway schemes before the country for the reason that many of them are ill-defined and more or less chimerical. There are, however, a large number of projects which have taken definite shape and which may be grouped to show the tremendous extent of the movement. These are given below with sufficient data to indicate their nature and importance: [1] —

1. Lakes-to-Gulf Deep Waterway.

   A channel fourteen feet deep, connecting Lake Michigan with the Gulf of Mexico *via* the Chicago Drainage Canal, the Illinois and the Mississippi Rivers. Already $55,000,000 has been expended in the State of Illinois. The estimated further expenditure is $159,000,000.

   A ship canal twenty-four feet deep is the ultimate goal, but no engineering estimates of the probable cost have yet been

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The Lakes-to-Gulf Deep Waterways Association — for the connecting of the Great Lakes with the Gulf of Mexico.

The Atlantic Deeper Waterways Association — devoted to the waterways of the Atlantic Coast.

The Interstate Inland Waterways Association — embracing mainly Texas and Louisiana.

The Upper Mississippi River Improvement Association.

The Ohio Valley Improvement Association.

The Interstate Mississippi River Levee Association — covering the territory from Cairo to the Gulf.

The Columbia River Improvement Association.

A host of other smaller river improvement associations in the South and West.

[1] While all of these are by no means new projects, they are being pushed now as never before with the cry, "We have waited long enough; it is time to act."

made. The Government engineers, however, urge that a depth of eight feet is preferable to either of the deeper channels.

2. Upper Mississippi River Improvement.

Canalization of the Mississippi River from St. Paul to St. Louis, there to connect with the Lakes-to-Gulf waterway. The estimated cost is $53,000,000 for a depth of six feet.

3. Missouri River Improvement.

Canalization of the Missouri River from Kansas City to Sioux City. The estimated cost of the improvement is $43,500,000. From Sioux City to Fort Benton, $40,000,000 more.

4. Ohio River Improvement.

Canalization of the Ohio River for its entire length. The estimated expenditure is $63,000,000 for a depth of nine feet. The project was authorized by Congress in 1911.

5. Lake Michigan to Lake Erie.

A canal connecting the southern end of Lake Michigan with Lake Erie in order to avoid the long lake route *via* the Straits of Mackinac. The estimated cost is $100,000,000.

6. The Grand and Saginaw Valleys' Waterway.

A canal across central Michigan, connecting Lake Michigan with Lake Huron *via* Grand and Saginaw Rivers. The estimated cost is $20,000,000.

7. Erie Barge Canal.

Deepening of the present Erie Canal from seven to twelve feet. The State of New York in 1903 voted an expenditure of $101,000,000 for the project. The work of construction is well under way. It is expected to be completed by the end of 1914.

8. Lakes-to-Atlantic Deep Waterway.

A ship canal from the Great Lakes to the Atlantic Ocean, probably by the present Erie route. The estimated cost is in round numbers $200,000,000. This has probably been abandoned for all time now that the barge canal project has been decided upon.

9. Lake Erie and Ohio River Ship Canal.

A canal fourteen feet deep from the mouth of Beaver River, twenty-six miles below Pittsburg, to Indian Creek on Lake Erie, a distance of 103 miles. The estimated cost is $53,000,000. A private company has been chartered for this purpose, but the work of construction has never been started.

10. New York, Brockton, and Boston Waterway.

A canal twenty-five feet deep from Boston through Brockton and Fall River to Narragansett Bay. The estimated cost is $50,000,000, and no Government aid is asked. A private corporation has been chartered for the purpose, but no work has been done.

11. Boston to the Gulf of Mexico.

An Atlantic Coast inland waterway which will cost more than $100,000,000. It has the following divisions: —

a. Cape Cod Canal.

A ship canal twenty-five feet deep across Cape Cod, a distance of eight miles. The estimated cost is $12,000,000. Construction work has been begun by the Cape Cod and New York Canal Company, a private corporation.

b. Rhode Island Canal.

A canal connecting Narragansett Bay with Long Island Sound, a distance of thirty-one miles, of which twenty-four miles is now flowed by tide water.

c. Delaware and Raritan Canal.

Deepening and widening of the present Delaware and Raritan Canal, connecting New York with the Delaware River, a distance of thirty-one miles. It is estimated that a channel twenty feet deep will cost $15,000,000.

d. Delaware and Chesapeake Canal.

An enlargement of the old Delaware and Chesapeake Canal, connecting Delaware and Chesapeake Bays. The estimated cost for a ship canal thirty feet deep is $17,312,000.

e. Norfolk and Beaufort Inlet Waterway.

A canal connecting Chesapeake Bay and Beaufort Inlet, North Carolina, a distance of 204 miles. It would avoid the dangers off Capes Hatteras and Lookout. The estimated cost for a depth of ten feet is $2,500,000, and for a ship canal, $35,000,000. Congress appropriated $550,000 for the project in 1907 and construction is now under way.

f. Beaufort Inlet to Jacksonville, Florida.

A protected waterway for more than three hundred miles along the Carolina and Georgia coasts. A small amount of dredging will give a depth of six feet for the entire distance.

g. Jacksonville to the Gulf of Mexico.

A waterway five hundred miles long across Florida, utilizing the St. Johns and Oklawaha Rivers. It is already open for a distance of 326 miles at a depth of six feet.

12. Interstate Inland Waterway.

A waterway nine feet deep connecting the numerous bays, passes, and lakes along the Gulf Coast, and extending from near the mouth of the Rio Grande River to the Mississippi at Donaldsonville, Louisiana. The estimated cost is $4,000,000. It is already under construction.

13. Trinity River Improvement.

Canalization of the Trinity River in Texas from Dallas to the Gulf of Mexico, a distance of fifty-one miles. The estimated cost for a depth of six feet is $6,000,000.

14. Sabine Lake Ship Canal.

A canal ten feet deep, with a hope of twenty-five feet eventually, from Sabine Lake in eastern Texas to the Gulf of Mexico. Congress appropriated $536,500 in 1904, and the work of construction has been commenced.

15. Black Warrior and Tombigbee Rivers' Improvement.

Canalization of these rivers to obtain navigation from the Alabama coal-fields to Mobile Bay. The estimated cost is $6,000,000.

16. The Atlantic and Great Western Waterway.

A waterway connecting St. Louis, Missouri, with Brunswick, Georgia, *via* the Mississippi, Ohio, Tennessee, Ocmulgee, and Altamaha Rivers, through the heart of the South, a distance of 1508 miles, of which 265 miles would consist of canal and of slack-water navigation. It is estimated that a depth of five feet would cost $40,000,000.

17. Columbia River Improvement.

Canalization of the Columbia River above, and a canal with locks around, the Dalles.

The above cost estimates are merely tentative, and in most part are not based on careful engineering investigations. They may possibly be excessive; but the history of public expenditures would rather lead one to believe that they are much too low. It is a part of political wisdom for those who seek government subsidies to have their demands appear moderate. At any rate, the amounts are staggering enough. In addition, almost every little stream and creek in the land perennially asks modestly for its handful of aid from the "pork barrel" appropriation for waterway development. And besides all of these projects, which are mainly in the nature of special and sectional interests, comprehensive plans for the systematic nationalization of our waterways, for the connection of all our lakes and rivers, forming one grand system of standard depth, are here and there outlined. Any estimate of the cost of such an undertaking cannot be given. It belongs to the field of speculation.

The sudden recurrence of the movement for the development of internal waterways in this country, the remarkable extent and earnestness of the agitation, and the tremendous money outlays contemplated, may well bid us pause before taking up the question of feasibility, to inquire what are the causes that have precipitated so remarkable a movement.

CHAPTER II

CAUSES OF THE REVIVAL

1. It is always difficult, at the time of a great popular agitation, to assign accurate values to the many causes underlying it. Consequently, no attempt will be made here to weigh the forces in this movement for the resuscitation of our waterways. There has been a conjunction of influences, however, which should be understood before we can hope to discuss intelligently the feasibility of waterway development. No attempt will be made in this chapter to pass judgment upon any phase of the movement. The effort will be merely to analyze the present situation in the hope that it may help to clarify subsequent discussion.

The revival of the agitation for waterways is a part of the general movement for the conservation of our national resources. Until the last decade American orators and writers have almost universally regarded our resources as unlimited in extent. But we have recently been forced to face the cold fact that there is a limit to the prodigality of nature, even in America, that we are not a country of "inexhaustible resources," and that out of regard to posterity extravagant waste must be checked. The nation has paused at last to reflect, and to lament the waste and wreckage strewn along the pathway of its progress. Our waterways are conspicuous reminders of our improvident past. "At Cincinnati and Pittsburg hundreds of boats have given place to tens. Where once on the Missouri there were sixty, there now remains but one to remind us of the departed glory of our waterways. Along our wharves — old gang-planks, anchors, and broken machinery are tangled in the grass growing in the crevices between the cobblestones."[1] Railways parallel the banks of great rivers, deserted save for a few small boats of uncertain schedule, or run in the very channels of abandoned canals. Such spectacles compel reflection, and they recall the early days of water transportation in this country. There is a lingering glory about our great navigable rivers and inland seas that is not easy to dissipate. The waters which led Marquette and La Salle to the heart of an unexplored continent, the rivers which carried the American pioneer beyond the Alleghanies to the great Middle West, and on whose banks he built his home and reared his family, are associated with a most romantic history.

Furthermore, a vast amount of money has already been expended upon our rivers and upon artificial canals. At present this is largely wasted investment; and it will prove almost a total loss unless more be added to it, and our waterways fully developed. Then, it is believed, the whole will yield large financial returns. Consequently, we should conserve the work already done.

2. Associated with the development of our waterways for transportation purposes, and for consequent rapid industrial development, are various by-effects which play an important part in the current thought and agitation.

The deepening and improving of our rivers would purify our water supply. This is of great importance for industrial and sanitary purposes. Many lines of manufacture, such as paper, woolens, distilleries, creameries, etc., are greatly benefited by a supply of pure water; while the importance of pure water for public health is inestimable.

The building of canals and the improving of rivers, it is thought, would make possible the development of large amounts of water power, the sale of which would in a few years cover the entire cost of the water routes. Governor

[1] *Moody's Magazine*, December, 1907.

Deneen and the supporters of the Lockport-to-Utica division of the Lakes-to-Gulf Deep Waterway estimate that the $20,000,000 bond issue voted by the people of Illinois can be paid off in the short space of fourteen years from a sinking fund derived from the sale of water power along the canal.[1] The chief hydrographer of the United States has estimated that the power developed along the Ohio River alone, if his reservoir system be established,[2] would yield a three per cent income on $73,000,000.[3]

The improvement of our waterways is further urged as a preventive of floods, and the consequent annual loss of property and life, especially in the valley of the Mississippi. With this would come the reclamation of great areas of riparian lands, at present valueless because of the periodic overflows and inundations, but of incomparable richness for agricultural purposes.

3. There is a well-nigh universal belief that water transportation is very much cheaper than transportation by land. The argument for cheap transportation seems to be, indeed, the chief of reasons advanced in favor of waterways. And it may well be argued that the fundamental consideration should be that of cost. Various estimates of the great reduction in transportation charges to be effected by means of waterways have been made. The following quotation will illustrate the general belief: "From the best information I can get, after a careful study of the subject, I am convinced that waterway transportation in this country, under favorable conditions, costs about one sixth as much as the average cost by rail."[4] The estimated cost of

[1] Prospectus of the Plan proposed by the Internal Improvement Commission of Illinois. For a criticism thereof, see chapter XIV.

[2] *Preliminary Report of the Inland Waterways Commission*, pp. 451–87.

[3] *Ibid.*, p. 490.

[4] U. S. Representative Joseph E. Ransdell, President of the National Rivers and Harbors Congress. *Annals of the American Academy of Political and Social Science*, vol. 31, p. 39.

carrying upon the Erie Barge Canal, now being constructed, is .52 mills per ton-mile. Statistics of the Interstate Commerce Commission for 1903 show that the average freight rate per ton-mile received by the railroads was 7.5 mills. Transportation by rail, therefore, it is urged, is some fourteen times more costly than by water.[1] If this be true, national economy would certainly justify the development of water transportation facilities.

4. Accompanying the belief that water transportation is inherently more economical than railway transportation is the conviction that the railroads, having monopolized the transportation of the country, are charging extortionate rates, which an unwilling but helpless public must pay. It is pointed out that wherever railroads are subjected to water competition the rates are substantially lower than elsewhere; that the winter rates on grain from Buffalo to New York are about one cent a bushel higher than when the Erie Canal is open. The railways should therefore be subjected to competition from Government waterways. Whether the waterways carry the traffic or not, the potential water competition will force the railroads to carry at a low rate, to the benefit of American shippers. Waterways are, consequently, a means of railroad rate regulation. President Roosevelt said, in his Memphis address in October of 1907, — "Wherever a navigable river runs beside railroads, the problem of regulating the rates on the railroads becomes far easier, because river regulation is rate regulation."[2] President Taft, in a message to Congress,[3] reëmphasized this feature. Speaking of the rivers and canals of Europe, he said that "it is certain that the existence of such methods of traffic materially affects the

[1] *Moody's Magazine*, August, 1907.

[2] *Annals of the American Academy of Political and Social Science*, vol. 31, p. 3.

[3] January 14, 1910.

rates which the railroads charge, and it is the best regulator of those rates that we have, not even excepting the governmental regulation through the Interstate Commerce Commission."

5. Again, it is often maintained that waterways and railways, rather than compete for the same traffic, should complement each other, to their mutual advantage, and of course to the benefit of the shipping public. That is, the waterways should carry the heavy, bulky, and slow-moving traffic, and the railroads should specialize on the higher grades of commodities. Thus relieved of the heavy traffic, which, it is said, they must carry at small profit, the railways would be given the opportunity of devoting their efforts to the developing of the better paying classes of freight. The railroads should accordingly favor the construction of waterways. And, in fact, some railroad men are not opposed to the movement. In a speech which has been everywhere quoted and which has given great impetus to the movement for waterways, James J. Hill said that he was glad to emphasize the fact that the relation of the railways to waterways "is one of harmony, of helpfulness, and of coöperation." [1]

This idea of a harmony of interests in transportation agencies had its beginning in this country in the congestion of traffic preceding the panic of 1907. The railways at that time were unable to meet the demands made upon them, and their operations, along with those of the entire industrial machinery of the country, were seriously hampered. It was easy under such conditions to draw the conclusion that water transportation facilities would be an aid, rather than a hindrance, to the railroads. The belief has spread generally that the railway service of the country has broken down, and has failed to keep apace of

[1] Address before the Lakes-to-Gulf Deep Waterway Association at the Chicago Convention, October 8, 1908.

expanding business. Unquestionably there was gross inadequacy of service at the height of the prosperity period. Cars were not to be had at any cost, produce could not be marketed, and everywhere industries suffered for want of transportation means. Mr. Hill concretely stated the situation, when he called attention to the fact that, "in the ten years between 1895 and 1905, the railroad mileage of the country had increased but 21 per cent, while the passenger business had grown 95 per cent and the freight business 118 per cent. By the decade ending in 1907 the increase of mileage as compared with 1897 had crept up to 24.7 per cent; but in the same time the increase in passenger business had leaped to 126.1 per cent, and that of freight traffic to 148.7 per cent."[1] There would seem, then, to be an imperative need for increased means of transportation.

6. Finally, the example of foreign waterways has had a great influence upon the movement in this country. It is well known that in Germany, France, and Belgium waterways have continually served as public carriers. They exist along with the railroads, complements one of the other. The Manchester Ship Canal is said to have solved the great transportation problem of that city, and throughout England there has been for some time a movement for the resuscitation of inland waterways. Vast sums of money have been spent upon these European waterways, with success apparently sufficient to warrant the present increasing appropriations in nearly every country on the Continent. Nearer home, Canada is bestirring herself, and planning a great ship canal to the Lakes. If waterways are successful abroad, it is reasoned that they should prove likewise successful in America. It is accordingly urged that we should no longer lag far behind other countries; we should not continue the suicidal policy of permitting our great natural highways to lie neglected. Efficient

[1] Hill, *Address*, *ibid.*

transportation facilities mean much in the race for industrial supremacy. The United States must, therefore, awake and utilize her twenty-five thousand miles of navigable waters.

7. Again, the very great part waterways have played in the development of our own country is used as a strong argument for their continued support. In our early history they long served as the chief unifying agencies in our national life as well as the great avenues of commerce. Where canals were built, villages and cities sprang up as by magic, wealth poured into the contiguous territory, and industry thrived in the entire region. To-day, the inhabitants along proposed water routes again see visions of reviving industries, of booming towns and cities, of fleets of barges laden with the commodities of commerce borne swiftly along upon the surface of the waters. It is an alluring picture; and it is widely believed that all that is needed to make that picture a reality is the improving and connecting of our rivers and lakes.

The benefits to accrue to all classes of society are set forth in detail in the reports of practically every waterway association. A quotation from one will serve for all: —

> To your entire business interests it means cheaper freight rates. To the manufacturer it means direct touch with the great markets of the South and Southwest, by a cheap, dependable, competing, and at all times freight-regulating route for their finished output and the cheaper assembling of their raw materials.
>
> To the wholesaler and jobber it means opportunity for the extension of trade. It means that the great markets of commerce will be open to them to make of such opportunity what they will.
>
> To the retailer it means increased population, increased opportunity and an expansion in business beyond any limit now possible.
>
> To the wage-earner it means dwelling in a prosperous district under most advantageous conditions; an increase of opportunity and lower cost of living. To the man who owns a little home would

come a rise in value that would make him more independent, and, with greater security of steady and remunerative employment, he could further improve his surroundings.

To the landowner and real-estate dealer there will come a greater demand, and with greater demand greater valuation and greater sales.

It will mean that your city will be a greater and more prosperous city, a better one to live in.

Much as it will mean to all other classes throughout the entire valley of the Ohio, the farming interests will be the greatest beneficiary. Indeed, as agriculture is the foundation of all industrial and commercial growth, it is first affected. It will mean increased markets and better and surer prices; it will mean greater earning capacity; greater social and educational advantages, through increased wealth. The growth of the cities along the river will ever assure a home market for home produce and elimination of freight charges now deducted from receipts for long hauls over the railroads.[1]

8. There is still another element in this movement, to which attention should be called. Though it must be regarded as an emanation from the movement, rather than as an underlying cause, it is none the less an active force. Good statecraft requires constant feeling of the public pulse and active support of the popular will. Accordingly. whenever a movement shows evidence of coming popularity, the wise politician devotes himself immediately to the agitation of the question, and inaugurates forthwith a great campaign of education. Interested parties, contractors hoping to be permitted to build the works, and special interests directly to be benefited, join hands with the politicians in educating the public to its needs. A flood of literature is spread broadcast, and oratorical effusion, perhaps less patriotic than political and pecuniary, is heard on every hand, until the populace reaches a high state of enthusiasm. The waterways movement is no exception to the rule.

[1] *Proceedings of the Fifteenth Annual Convention of the Ohio Valley Improvement Association,* Cincinnati, Ohio, October 14 and 15, 1909, p. 9.

CHAPTER III

ANALYSIS OF CURRENT ARGUMENTS

1. In the minds of many people the feasibility of waterway development in the United States is hardly a debatable proposition. The arguments which were briefly sketched in the preceding chapter have been widely accepted by the general public as conclusive evidence of the need of restoring water transportation in this country. There has been no really scientific investigation of the subject, and, as the present chapter will show, many of the arguments that have been advanced are entirely fallacious. The reader should bear in mind that no attempt is here being made to arrive at final conclusions. The intent is merely to demonstrate the need of a scientific study of the question, and to prepare the way for the detailed discussion which is to follow.

2. As has been noted, one of the chief causes of the agitation in favor of waterways is the belief that the railway service has become inadequate to meet the transportation needs of the country. Beginning in 1898 and lasting till 1907 the United States experienced a period of the most remarkable prosperity ever known. Year after year of bountiful harvests gave a basis for extended operations in every branch of industry. Production in all lines, anticipative of growing demands, was pushed as never before, and wealth increased with amazing rapidity. In fact, the remarkable material prosperity had developed a situation which was overtaxing the machinery of the entire industrial system; and it required a financial panic and serious indus-

trial depression to restore more normal conditions. It was at the height of this period of unusual production that the railways were unable to meet the needs of traffic. The transporting facilities of the country were unquestionably overtaxed.

Furthermore, during these years there developed an agitation against the railways which led to wholesale legislation tending toward lower rates and stricter Government supervision. Whether the antagonism to the railroads was justified and whether the legislation was wise or not, is apart from the present consideration. The fact, however, that within a period of five years, from 1902 to 1907, thirty-three states enacted a total of three hundred and thirty-four laws affecting railroads, as to car service, train service and connections, maximum passenger and freight rates, and general corporate affairs, does have a direct bearing upon the situation in question. This legislation had little scientific basis, and it varied as the number of states passing regulative acts. In addition to the activity of the various states at this time, the Interstate Commerce Commission was given increased powers, and federal regulation became far more efficient than it had been hitherto. The result of all this hostile legislation was to render railway investment precarious, and at the very time when there was the greatest demand for new lines of road, double tracks, better terminal facilities, and more rolling-stock, the railways found it hardest to secure funds with which to extend their operations. And it was the large investors who were the most chary of railway investments; they feared the results of restrictive legislation upon the earning power of roads.

Thus in two ways were the railways confronted with an unusual situation. There was an abnormal amount of traffic to be handled, and it was abnormally difficult to secure the funds necessary to meet the increased needs of traffic. There can be no doubt that the congestion on the railways was rendered exceptionally severe by this coincidence of events. It will be interesting now to consider the evidence that has been brought forward in proof of the contention that we can no longer depend upon the railways; and that the breakdown is permanent.

The belief that the railways are failing to meet the transportation needs of the country in a satisfactory manner is apparently based on the well-known statement of James J. Hill [1] that, in the ten years from 1895 to 1905, population grew more rapidly than the number of miles of single track and that the growth of traffic was out of all proportion to the increase in railway mileage in this country. These statistics appear significant at first glance, but a more careful analysis of railway conditions during these years will show that they are far from proving the case. Below is presented a tabular exhibit of the railway situation in 1895 and 1905: [2] —

Elements	1895	1905	Increase	Per cent of increase
Population	69,458,470	86,128,871	16,670,401	24
Railroad Mileage:				
Single track	177,746	216,973	39,227	22
Second, third, and fourth track	12,348	19,881	6,533	53
Yards and sidings	43,181	69,941	26,760	62
Total tracks	233,275	306,796	73,521	31
Tonnage carried	755,799,883	1,435,321,748	679,521,865	90
Ton-miles	88,567,770,801	187,375,621,537	98,807,850,736	111
Tons per mile	4,362	6,681	2,418	57
Rolling-stock:				
Locomotives	36,610	49,616	13,006	35
Freight cars	1,230,798	1,757,105	526,307	43
Tractive power	13,700	28,700	15,000	109
Tons per capita	10	15	5	50
Ton-miles per capita	1,160	2,000	840	72

[1] See quotation, p. 15.

[2] These statements were compiled from the reports of the Interstate Commerce Commission.

It appears from this table that while the increase in miles of single track did not quite keep pace with the increase of population, 22 per cent, as against 24 per cent, the total trackage increased 31 per cent. But the increase in miles of track is not the sole criterion of the growth in efficiency of a railway system. Notice that the number of freight cars increased by 43 per cent (at the same time their carrying capacity increased by 120 per cent); that the number of locomotives increased 35 per cent, and the tractive power 109 per cent. Surely, in determining whether the railway service is breaking down, these fundamentally important factors ought to be given consideration.

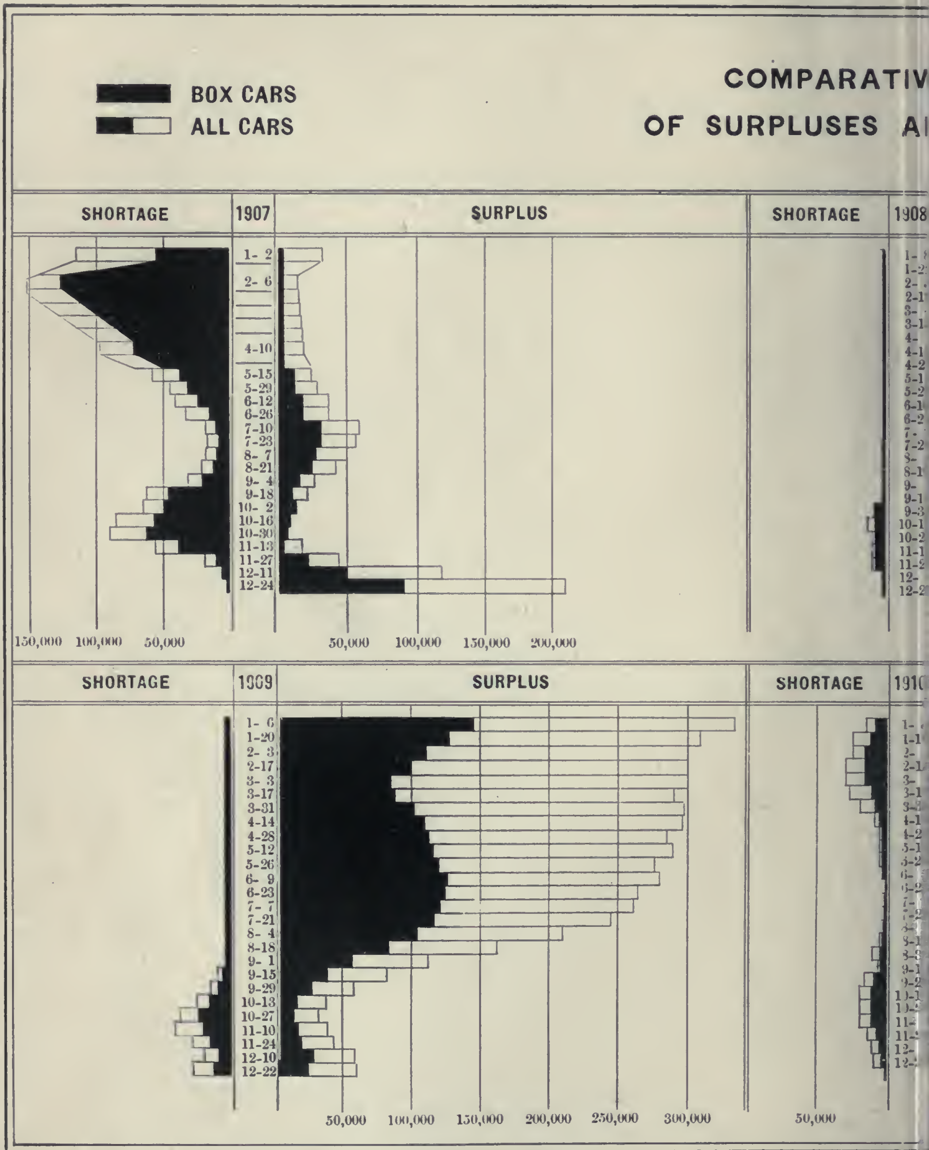
To argue that the number of miles of single track must keep pace with the growth of population and with the increase of ton-mileage on the roads is wholly to ignore the nature of the railway industry. The argument proceeds upon the assumption that in 1895 the railways were carrying at their full capacity. A railroad, by its nature, hopes to increase its profits when once the main line is constructed, not mainly by building more miles of trackage, which always involves tremendous initial outlay, but by utilizing to the full its existing tracks. Consider the history of a railway. It pushes out its tracks across a continent to connect markets; it goes into uninhabited wilds; carrying there settlers to produce the commodities for eventual traffic, so that in time the railway may run, not one, two, or four trains, but ten, twenty, or forty trains a day to carry the freight it has created. The profits in railroading come, not from the extensiveness of trackage, but from intensity of traffic. Thus, during the period of most rapid railway building in the United States, lines were spread out over the country, extending to every corner of the land. Then, when once a network of roads was secured, the need for more miles of trackage relatively declined, though admittedly still increasing at a very rapid rate. During the past ten or fifteen years the railways naturally have devoted more attention to the handling of traffic than earlier, when they were constructing the great trunk lines of their systems. They have done this by increasing the amount and capacity of their rolling-stock, by laying heavier rails, and building sidings, yards, and terminals. The more densely populated a country is, the less need be its per capita railway mileage. The very fact that with an increase in the miles of single track in this country, during the period under consideration, of only 22 per cent, the railways carried an increased ton-mileage of 111 per cent, would seem to prove the point in question. The items of most significance in the above table are those showing the large increase in facilities with which to carry the enlarged traffic.

An attempt has not been made here to show that the railways have actually at all times fully met the transportation needs of the country. It has already been noted that the carrying capacity of the roads was overtaxed at the height of the period of great prosperity. The discussion has been merely for the purpose of pointing out that the meagre statistics commonly presented to prove that the railways have fallen behind the needs of commerce, in reality throw no light whatever on the situation under consideration.

Now, let us consider the condition of the railway service during the four years that have elapsed since the panic of 1907. Have events proved that the railways have permanently fallen behind the times, or do they indicate that their condition in 1906 and 1907 was rather an abnormal and temporary one? The situation is illustrated in the chart on the accompanying page. The year 1907 is also given in order to show the extent of the congestion at that time, and for purposes of comparison with the years following.

The apparent contradiction of both a shortage and surplus should be explained.[1] At any given moment one road may have a shortage of cars, while another may have a

[1] See chart opposite p. 22.



BOX CARS
ALL CARS
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SHORTAGE
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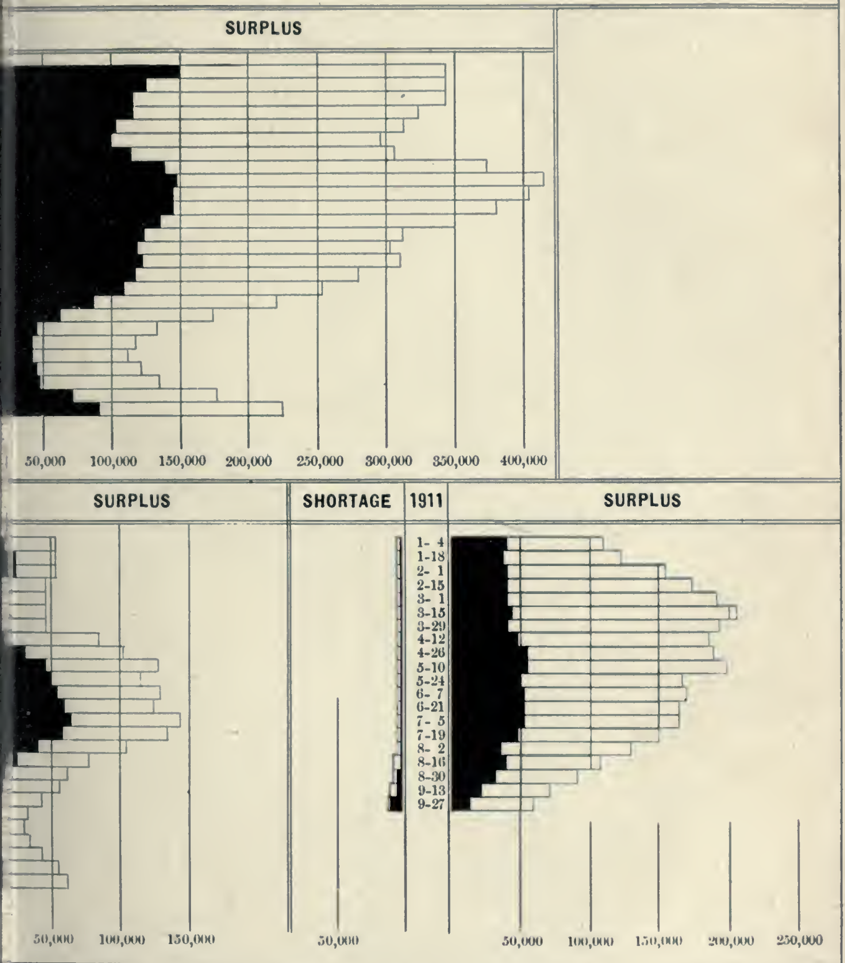
CHART
SHORTAGES



surplus. In other words, cars cannot always be properly distributed to meet the needs of shippers. Consequently, we have both shortages and surpluses at the same time. To find the net shortage or surplus, it is only necessary to subtract the one from the other, as the case may be.

The chart for 1907 shows a very great shortage of cars for the greater part of the year. Observe, however, the immediate effect of the panic in causing a surplus of over 200,000 cars at the end of the year. The extraordinary surplus throughout 1908 is doubtless due largely to the industrial depression which followed the panic. But conditions during the three following years may fairly be regarded as normal. In 1909 we find a surplus of cars in the country as a whole during the entire year, except for a brief period in October. The variations in seasonal demands is clearly shown on the chart. It is of course as impossible for the railways to forecast exactly how many cars are to be needed to move the fall crops as it is for them always to have their cars distributed exactly according to traffic needs. The rather small surplus at the very end of the year is explained by the severe weather conditions that prevailed at that time, blocking up the traffic of the roads for many days in some sections. Below are given the net totals for 1909:[1] —

Period	Number of roads reporting	Surplus	Shortage
1–20	162	311,318	
2–17	159	300,971	
3–31	158	296,201	
4–28	161	281,831	
5–26	158	272,470	
6–23	166	262,117	
7–21	165	243,015	
8–18	169	157,415	
9–29	174	38,806	
10–27	174		5,740
11–24	163	12,032	
12–22	177	34,300	

[1] *Statistical Bulletin of the American Railway Association*, no. 103 A.

The severe weather conditions in the early part of 1910 account for the relatively small net surplus indicated on the chart. Trains were snowbound to such a degree that in the great Northwest there was serious difficulty in obtaining cars when desired. Throughout the year, however, there was a net surplus of *all* cars. Only during the crop-moving of September and October was there a net shortage of *box* cars. At no time during the year was there a serious congestion, and the general situation during the months of heaviest traffic was perceptibly better than in 1909. The year 1911 shows an even better record than 1910. In the four years since the panic, therefore, it must be said that the railway service has been reasonably satisfactory.

3. If what has been indicated above be true,—that is, if the congestion of the railway traffic was but temporary, and if the fact that the railway mileage is not keeping pace with the growth of population is no evidence that the railways are becoming unable to meet the needs of commerce,—the question may well be asked, Why is it, then, that railway men are themselves advocates of waterway development? In the first place, not all railway men are in favor of wholesale waterway improvement. Probably the great majority are apathetic in regard to the whole question. Some, at least, are opposed to the idea. At any rate, Mr. James J. Hill is the one railway man who has openly championed the movement, and his attitude is easily explained. Just at present there is a very perceptible tendency on the part of railway men to curry favor with the public, whereas a dozen years ago they were prone almost wholly to disregard popular opinion. They have been forced to recognize that the public is in earnest in this matter of railway regulation, and that it is indeed possible to restrict very seriously the operations of the railroads. Such men as Mr. Hill and Mr. Ripley have accordingly taken to conciliating the public, to meeting us more than halfway

in frank discussion of railway matters, in the hope of discouraging the hostile legislation that has been so common in recent years.[1] Railway men fear the Interstate Commerce Commission more than they fear waterways.

Mr. Hill gave the address from which we have quoted[2] before a Deep Waterway Convention, before an audience that did not care to listen to an address unfavorable to the Lakes-to-Gulf project. Besides, he saw an opportunity to create sympathy for the railways, thereby perhaps checking the hostile legislation which was rampant at the time. Accordingly, while skillfully winning the favor of his audience by indorsing the plan of a deep waterway from Chicago to the Gulf of Mexico, he found opportunity to dwell at length upon the legislation inimical to the railways, and upon the consequent inability of the railroads to develop with sufficient rapidity to meet the growing needs of commerce. Now no one knows better than Mr. Hill himself that the number of miles of track is not the measure of a railroad's efficiency and ability to earn profits. And no one knows better than he that the railway industry is peculiarly susceptible to the law of increasing returns with increasing traffic, because of the extraordinarily large amount of fixed capital involved. Mr. Hill, himself, was doubtless as little deceived as any one by the comparative statistics which were presented. Mr. Hill also urged, in an address before the Merchant's Club of Chicago,[3] that, if the rails and money were available, it would be impossible to procure the labor necessary to lay the additional trackage, said to be necessary; and that consequently the need of constructing the Lakes-to-Gulf and other waterways is imperative, and the sooner they are built the better it will be for the country. Again, he knew that it would require more money and more labor, if not more structural materials, to construct

[1] See Ripley, *Atlantic Monthly*, January, 1911.

[2] See chapter II, p. 15.

[3] November 10, 1906.

waterways adequate to meet the country's needs than to build the necessary railways.[1] But as he is not in the waterway business, how to secure the means with which to build the waterways is not a part of his problem.[2] There would seem to be little doubt that Mr. Hill's advocacy of waterways has been primarily for the purpose of inducing his hearers to regard the railways with less disfavor, if not to leave them alone entirely. Again, it should be remembered that a Lakes-to-Gulf waterway, were it successful, would not affect the Hill lines unfavorably. Anything that would develop Chicago and the Upper Mississippi territory would rather work out as an aid to the lines leading from this region to the Northwest. Hence, personal interest may explain Mr. Hill's attitude.

4. In enumerating the causes of the waterway movement in the preceding chapter, emphasis was laid upon the idea of railway regulation by means of water competition, and quotations were given from the addresses of Mr. Roosevelt and President Taft on this phase of the transportation problem. They do not stand alone in this position. In the minds of many people the waterways will have done enough if only they force the railways to lower transportation charges. That is, even though no freight whatever should actually travel over the waterways, the potential competition secured, forcing down the rates charged by the railways, would make the construction of waterways advisable.

In connection with this idea it should be noted that the

[1] Mr. Hill advocates a depth of at least twenty feet, holding that it would require boats of at least 10,000 tons capacity to meet the competition of modern railroads.

[2] It is interesting to recall that only a few years ago Mr. Hill is reported to have said that he could make railway rates to the Pacific Coast so low that the Panama Canal would grow up to pond lilies; and that, before the Mississippi River could compete for traffic with the railways, its sides and bottom would have to be lathed and plastered.

monopolistic rates of American railways are not on through traffic. Competition with each other and with existing water routes, and attention to trade conditions have forced our railways to offer much lower rates on long-distance traffic than exist anywhere else in the world. On the other hand, for short hauls, where competition is absent, our railway charges are unquestionably in many cases extremely high, and it is here that complaints are most often heard. In so far as complaints are made on through rates, they are usually on grounds of discrimination, rather than on grounds of exorbitance. But with local traffic, charges are sometimes complained of as being excessively high. It is on local traffic, therefore, that we should wish to secure lower freight rates by means of water competition. But it is obviously altogether impossible for canals to reach every local point; and it is also recognized the world over that it is only on long-distance traffic that waterways can hope to compete with the railroads. Unless savings in hauling by water can be extended over a considerable distance — and a considerable part of this distance must be on a natural waterway, rather than a canal, — the *total cost* of transportation, including charges on the investment in the waterway itself, will be greater than that by rail.[1] This is a cardinal principle in transportation in Germany and France. At precisely the place, therefore, where railway rate regulation is most necessary, namely, on local traffic, the waterways are wholly unable to perform the service.

But granted that the waterways would be able to force lower rates on local traffic: concretely stated, the proposition means that the Government should spend hundreds of millions of dollars in order to secure an artificial means of regulating the business of a public service corporation. Such a method of control might with reason be resorted to were the need drastic enough and were there no other means of regulation available, but so long as we possess a

[1] This point will be brought out more fully in succeeding chapters.

constitutional method of direct regulation in the Interstate Commerce Commission and the federal judiciary, waterways can justify themselves only as actual carriers of traffic. A much less expensive means of railway regulation is to extend Government control as it is needed, and we should at least first thoroughly test the possibilities of such control before resorting to artificial means of regulation.

In case we fail to control our railways by means of legislation, there remains another alternative to the competition of Government waterways, namely, the competition of Government railways. Without advocating Government ownership of railroads, the point may nevertheless be raised, that if the Government is eventually forced to resort to direct competition as a means of restraining the railroads of the country, it would be well to consider whether the more economical method of securing the desired results would be by means of constructing waterways or by means of constructing railways. The idea of competition by means of Government railways has received very little attention in this country, though it may contain possibilities worthy of very serious consideration.

Another phase of this competitive idea remains to be considered. Government ownership of the boats is not a part of the present waterway plan. The idea is to make our rivers and canals public highways. Might it not be easily possible for the railways to prevent damaging competition by securing control of the boat lines? That this would be done is not only within the realm of possibility, but altogether probable. While they do not find it profitable to incur the enormous expense of building great canals, the railways might very conceivably find it of advantage to appropriate such highways after they have been constructed at public expense. Their monopolistic tendencies would hardly be checked in this manner. It is well known that most of the boats on the Great Lakes are owned by the railways; and as early as 1881 it was found that competition between the Ohio River boats and the railroads was practically nil.[1]

It might not be difficult for the railways to secure control of the traffic on the waterways.[2] While the public, having constructed these highways, was calmly resting on the assumption that the problem of low freight rates was solved for all time, the railway men might either be building boats, or else quietly buying up the stock of independent boat companies and assuming control of the situation, just as they have purchased the stock of competing electric railways and gained control of their operations. By gaining control of new waterway terminal sites and facilities in the same manner that they have acquired many of the present ones, or by refusing to prorate and coöperate with the waterways, the railroads might easily defeat the ends sought by the construction of water lines. The problem of railroad regulation would by no means be solved the moment the waterways were equipped for traffic.

[1] "The understanding between the railroads and the steamboat lines has not amounted to a pooling arrangement, or a mutual participation in profits, but has sought to effect a certain distribution of freight, and has virtually removed competition as to rates between the two methods of transportation." (*Report on Internal Commerce*, 1881, Appendix, p. 56.)

[2] Indeed, we already have evidence that the railroads are planning to control transportation on the proposed Lakes-to-Gulf Waterway. The Mississippi Valley Transportation Company was organized on September 19, 1909, with a capital stock of $10,000,000. Its prospectus states: "We expect to combine with a number of railroads to issue through rates, and some of the railroads have already agreed to this. We expect to receive a fair differential of 25 to 30 per cent under railroad rates." Having this agreement with the railroads and a monopoly control of the river traffic, the company promises to pay dividends of 39 per cent on its entire capitalization. (Gross, *A Discussion of the Proposed Deep Waterway*, Chicago, p. 7.) It is worthy of attention that W. K. Kavanaugh, who is president of the Mississippi Valley Transportation Company, and of the Lakes-to-Gulf Waterway Association as well, is also president of the Wiggins Ferry Company of St. Louis, the stock of which is controlled by an association of railroads centring in that city. (*Report of the Inland Waterways Commission*, p. 129.)

5. Two arguments for the improvement of our waterways, which appear somewhat inconsistent, have been advanced side by side. One is that the waterways will check the railroads and cut down their monopolistic earnings; and the other that they will serve as auxiliaries to the railways, and prove a blessing in disguise by leaving the roads free to devote all their attention to the carrying of high-class profitable freight. The contradiction may perhaps be explained on the ground that the one argument has been advanced by the enemies, the other by the friends, of the railways. But if it should work out that waterways would complement the railways and prove a blessing in disguise, it is apparent that it could not then well be maintained that they were an effective means of regulating the railways and destroying their monopoly profits.

Nor is there much ground for a belief that the railways would in general welcome the waterways as auxiliaries in the movement of freight. The very fact that they continue to charge discriminating rates for the purpose of securing potential water traffic contradicts such an idea. Moreover, the lack of congestion at present does not argue a change of attitude in the near future. Indeed, it is contended by some prominent railway men that, contrary to the general belief, the so-called low-grade traffic is about the most profitable class of freight, because of the fact that it is usually handled in trainload lots. This argument, that the railways and waterways of the United States would work together in harmony, has been borrowed from Europe. It will be shown, in the portion of this work devoted to European transportation, that the railways of Europe do not coöperate with the waterways from choice, but only from compulsion.

6. No less a personage than the president of the National Rivers and Harbors Congress has advanced the theory that traffic moves much more speedily by water

than by rail. Arguing from the premise that "the best authorities say that the average movement of freight by rail in our country is only twenty-five miles a day," he attempts to show that boats move much faster than this. "When freight is loaded in boats, on lakes, canals, or rivers, it moves promptly at a speed of from five to ten miles an hour to its destination, where it is quickly discharged and the boat started on another trip. Boats on the Great Lakes make the round trip from Buffalo to Duluth — two thousand miles — every eight to nine days, a distance of considerably over two hundred miles a day. It is the old story of the race between the tortoise and the hare. The former won in spite of his slow movements because he kept going. And the boats win for the same reason. They do not slumber on side-tracks as the hare and the railroad car, but keep moving like the patient tortoise and win every time." [1]

The method employed in computing the average distance that freight moves a day by rail cannot give a result that pretends to mean anything definite. The total number of miles traveled by all freight cars, of whatever kind, is divided by the product of the total number of freight cars in the country and the number of days in a year. The general result derived has no real meaning. In the computation are included the hundreds of thousands of cars necessarily idle [2] during a large portion of the year. Short and long hauls are not differentiated. No allowance is made for the very large number of cars used mainly for warehousing purposes, and in yard business, or for those in shops undergoing repairs. It should be remembered, also, that railway cars serve as developers as well as carriers of traffic. For the accommodation of shippers they are left on side-tracks for two days at a time without de-

[1] Joseph E. Ransdell, *Annals of American Academy of Political and Social Science*, vol. 31, p. 38.

[2] See chart opposite p. 22.

murrage charged.[1] To take a concrete case, a gondola car placed on a side-track in the lumbering town of Cadillac, Michigan, requires two days for loading with cord-wood. It then travels a hundred miles overnight to Grand Rapids, is switched to the designated siding during the forenoon, is unloaded by the next afternoon, and on the following night is returned empty to Cadillac for another load. Approximately four days are thus consumed in moving this freight a distance of one hundred miles. But the service to the shipper at the time of loading and unloading fully compensated for the apparent lack of speed. Take another case, where a local freight train carries small freight, and sorts out of broken lots the various commodities to be dropped off at each way station on the route. Here, again, the distance covered per day is not the important consideration.

Strictly, there are no average conditions in either line of transportation, much less comparable average conditions. Even if there were average conditions, this so-called twenty-five miles per day average movement by rail cannot fairly be regarded as a basis for comparison with waterways under the most favorable conditions that exist. If a comparison be attempted, the waterway side of the equation should consider not merely the unusually favorable conditions existing on special lines on the open lakes in the summer season, but all the boats on all the lakes, rivers, and canals should be counted. It should consider the low speed

[1] A demurrage charge is a daily tax for the use of cars longer than two days while loading or unloading. In the past the two days' exemption period was very commonly extended. Roads hired each others' cars and paid according to the number of miles they traveled. It made little difference then to the hiring road how long the cars lay on sidings. The railways have now, however, adopted the custom of requiring payment for the use of their cars from other roads by the day instead of on a mileage basis, and extensions of the time of free use are accordingly infrequent. Shippers, however, often pay the demurrage for the privilege of a longer use of the cars.

necessitated on narrow canals and tortuous rivers, which, especially with the dense traffic hoped for, present almost unlimited possibilities for collision.[1] At night movement would be next to impossible. Again, the tedious delays encountered in the passage of locks, with the attendant danger of mishaps, tying up perchance for hours or days the traffic of an entire canal, should be included: and, finally, all the days in the year should be counted, not excluding the months when transportation must wholly cease on account of ice, floods, or low water. The average daily speed by water thus computed would appear much less than that by rail. The idea of the greater swiftness of water transportation is indeed a novel one, and must have been presented primarily because of its originality.

7. More important than any of the foregoing arguments for internal waterways is the contention that transportation by water is much cheaper than by rail. Hardly an article has appeared in the press, hardly a public speech has been delivered that has not emphasized this phase of the subject. Obviously, that transportation system which can serve the country efficiently at the least cost is the system which should be established. The cost consideration is of primary importance and merits the share of attention it has received. But in support of the contention that traffic moves more cheaply by water than by rail there has been unfortunately only the loosest sort of reasoning. There has been not only an utter lack of proof, but also a general disposition to discuss it in an *ex parte* manner. A few comparisons have indeed been drawn, but in no case have the conditions compared been fairly comparable. From mere assumptions of the inherent cheapness of water transportation, supported by rate comparisons drawn from dissimilar

[1] It is not true that boats can travel on *canals*, as Mr. Ransdell says, at a speed of from five to ten miles an hour. In Europe it averages only two or three miles an hour.

conditions, conclusions have been deduced, purporting virtually to prove the entire case for water transportation.

The argument that water transportation is incomparably cheaper than transportation by rail runs somewhat as follows: The average price received by all the railways of the country for the calendar year 1907 was 7.82 mills per ton-mile; on the Great Lakes the charge was .8 mills per ton-mile; and on the Erie Canal, about 3 mills per ton-mile. A dollar, then, will carry a ton of freight the following distances: by rail, 127 miles; on the Erie Canal, 333 miles; and on the Great Lakes, 1250 miles.[1] It is estimated that the cost of carrying upon the Erie Barge Canal, now under construction, will be but .52 mills per ton-mile.[2] A dollar will carry a ton of goods at that rate nearly 2000 miles. President Ransdell, of the National Rivers and Harbors Congress, conservatively estimates water traffic to be about one sixth as costly as rail.[3] It has been pointed out that "the expenditure of coal necessary to drive a train carrying 1000 tons eighteen miles per hour on the Michigan Southern Railway would drive, on the Great Lakes, a steamboat at the same speed with a load of 5000 tons."[4] This is said to mean that water transportation is only one fifth as expensive as transportation by rail.

Let us analyze these comparisons of the cost of transportation by water and by rail. The average cost of carrying freight on the Great Lakes or on the Erie Canal is compared with the average freight charge on all the railways in the country. All that was said about the impossibility of obtaining an average speed which was accurate or of definite meaning is equally appliable to average cost. The computation makes no distinction between high-class, expensive freight and bulky commodities traveling

[1] S. A. Thompson, *Outlook*, vol. 92, p. 746.

[2] Franklin Wood, *Moody's Magazine*, August, 1907.

[3] See quotations, *supra*, p. 12.

[4] Franklin Wood, *supra*. Taken from a statement of Major Townsend, of the United States Engineering Board.

at low rates. It makes no allowance for the length of haul, severity of gradients, or expensiveness of terminals. It does not consider whether the consignment be in trainload, carload, or broken lots. Speed, kinds of cars, degree of care, refrigeration, — none of the varying conditions under which freight traffic moves are distinguished. All factors go in on a parity in determining the average rate charged by the railways. It ought to be readily apparent that, unless the average waterway rate is determined in the same way, unless it is derived from a similar complexity of conditions, the comparison is imperfect. No one would regard it fair to prove, by a comparison of the rates on a railroad that carried only coal with those of a road that carried all classes of freight under all manner of conditions, that the former road was the more efficient or the more economical. The lower rates on the coal road would be held to prove nothing. In like manner, the low water rates quoted ought to be regarded as evidence of little, if anything. The waterways carry practically only low-grade freight, which must travel at low rates if it travels at all. These rates, however, are compared, not with the railway rates on similar freight, but with the so-called average rate on all freight of whatever kind. It is from such a comparison that the conclusion has been reached that transportation by water is cheaper than by rail.

Even if the comparisons of cost given above had been based upon similar classes of goods moving under comparable conditions, it would still be necessary to ask if the term "cost" had the same meaning in both cases. Unless the same elements are included in "cost" as applied to water transportation as are included in transportation by rail, conclusions drawn from a comparison of these costs are worthless. Now, "cost," as used in railway parlance, has several meanings. Sometimes it denotes the direct cost of moving a certain commodity a given distance, that is, merely the added expense of handling that particular commodity. In another sense it means both the direct and indirect cost of handling the commodity, that is, the haulage or carrying charges, together with an indirect charge to meet a portion of the cost of building and maintaining the railway. Finally, cost may include, in addition to the above, whatever is necessary to insure a reasonable profit upon the total capital of the road. The average freight rate which we have been considering was obviously meant to secure at least a reasonable profit upon the entire capitalization of the railways of the country. Cost of building the roads, cost of equipment, of maintenance, and of operation, — all were considered in the fixing of the rates on the railways. We shall now consider what cost concept is used in connection with water transportation.

It is said that a dollar will carry a ton of traffic on the Great Lakes a distance of 1250 miles, as against 127 miles on the railways. Obviously, since the Great Lakes are a highway readymade by nature, the rates charged there need be merely sufficient to yield a reasonable profit on the investment in the ships, in addition to meeting the expenses of operation. Naturally, the rates under such conditions would be much lower than if they had to earn a profit on a tremendous investment in the highway itself. A comparison of railroad rates with the charges on canals, which, like the railways, are artificial highways, clearly affords a fairer basis upon which to make comparisons.

It is contended that one dollar will move a ton of traffic on the railways a distance of 127 miles, as against 333 miles on the present Erie Canal, and that, with the opening of the new barge canal, this distance will be extended to about 2000 miles. What is meant by "cost" as applied to the Erie Canal? It was built by the State of New York, and since 1882 has been free of tolls. Any one who desires can build a boat and engage in the carrying-trade free of charge, on the state's highway. If he can earn, in addition to the operating expenses, a reasonable profit on the cost of a small boat, as is the case on the Great Lakes, he is satisfied. Thus, whereas the railway rate is fixed to earn a profit upon the total cost of the road, upon equipment, upkeep, and operation, the rate on the Erie Canal covers no part of the enormous expenditures involved in the construction and maintenance of the waterway. In a comparative study of waterways and railways, to leave out of the computation of cost the enormous construction and maintenance expenditures in the one case, and to include them in the other, is totally to invalidate the conclusion drawn therefrom. Yet this is the method that has been commonly employed in proving water transportation less costly than transportation by rail.

Transportation must be paid for by some one. If the State builds and keeps in repair a transportation system, donating its use to the public, the cost of construction and maintenance is paid for by the inhabitants of the State in the form of taxes. The remaining cost — of equipment and operation, plus a reasonable profit on this investment — is paid by the shippers of traffic to the carriers thereof. On the other hand, if the means of transportation are privately constructed, the entire cost is paid by the shippers who make use of the transportation agencies. In the former case, a large part of the cost is borne by the general public, the apportionment being dependent, not upon the benefits derived from transportation, but upon whatever system of taxation chances to be in use. In the latter case, the cost is borne by the shippers according to the use made of transportation. It was shown, in the introductory chapter, that there are waterway schemes before this country involving an initial expenditure of many hundred millions of dollars. This amount, plus the interest which would accrue from a long period of bonded indebtedness, would constitute no inconsiderable taxation burden for the country to bear. If the National Government subsidizes the waterways, the greater part of the cost must be borne by the consumers of tariff-protected commodities, regardless of benefits derived from transportation, inasmuch as customs duties are the chief source of federal revenue. If the State Governments finance the schemes, the owners of real property will in most cases bear the brunt of the expense, because such is the incidence of the general property tax so largely employed in raising state revenue. We should not be deceived, and be led to believe that merely because the cost is divided, part going to the Government in tax payments, and part to the traffic carriers in transportation charges, that the total cost is thereby lessened. It may be added, also, that we should not overlook from whom is to come the greater part of the cost, and to whom are to accrue the chief benefits.

8. We come now to a consideration of the remarkable benefits which it is thought the resuscitation of the waterways would confer upon all classes of society. It will be recalled [1] that the manufacturer, the wholesaler, the retailer, the wage-earner, the landowner, the real-estate dealer, and, above all, the farmer, are promised vastly greater possibilities of gain and better opportunities for development than ever before. Now, it should go without saying that the conferring of such benefits is dependent upon the cheapness of water as compared with railway transportation. The foregoing discussion of the question of cost showed that it is by no means established that traffic does move, all things considered, more cheaply on canals and canalized rivers than on railroads. In the event that it be subsequently shown that, save under exceptional conditions, the railways are the more economical carriers of the two, it will be obvious that these promised benefits of water transportation are a delusion. Granting, however, for the time being, that water transportation is the cheaper, even when all factors are included, but granting it only for the sake

[1] See chapter II, pp. 16–17.

of the argument, it will still be worth our while to analyze some of the promised rewards. As in many of the other arguments for waterways, we may find here, also, no small amount of fallacious reasoning.

The construction of the Erie Canal through the State of New York from the Hudson River to Lake Erie in 1825 led to a period of remarkable prosperity along the entire route, and it undoubtedly made New York City the metropolis of America. The opening-up of the Ohio canals shortly afterwards, in a similar way gave a great impetus to industry west of the Alleghanies.[1] It secured a wider market and better prices for commodities. Land advanced rapidly in value, work became plentiful, and wages greatly increased. Beyond any question the opening-up of these waterways was of unusual benefit to the inhabitants of all the contiguous territory. "Previous to the construction of the [Erie] canal, the cost of transportation from Buffalo to New York City was $100 a ton and the ordinary length of passage twenty days. . . . On the opening of the Erie Canal, the cost of freight fell, according to its class, to between $15 and $25 a ton, and the time of transit was reduced to eight days. Rates from Ohio to the seaboard were steadily lessened until they were only about one tenth of the former figures."[2] Charges by wagon and stage were prohibitive, except for local traffic, and a region without waterway connection was utterly unable to carry on trade with the rest of the world. Upon such sections canals conferred unnumbered benefits.

To-day the situation is very different. Freight rates have now become so small, in proportion to the value of the commodities of traffic, that in most cases nothing short of a tremendous cheapening of transportation would be reflected in the price of the articles, and rate reductions now usually

[1] *Ohio State Archæological and Historical Society Publications;* C. P. McCleland and C. C. Huntingdon, *History of Ohio Canals*, 1905.

[2] Bogart, *Economic History of the United States*, pp. 191–92.

accrue almost wholly to the benefit of middlemen. "The transportation charge on the material entering into a pair of shoes made in a St. Louis factory averages one and one fourth cents. The transportation charge required to place that pair of shoes in the hands of a consumer in any part of the United States averages between two and three cents."[1] This makes a total charge of approximately four cents. Suppose our waterways should effect even a fifty per cent reduction of freight charges, we should have a saving of only two cents on a pair of shoes. It is hardly probable that such a saving would cause shoes to retail at two cents less than formerly. The saving would be absorbed by the shippers and middlemen, and the consumer would be benefited not at all.[2]

"The freight rates on cantaloups to New York range from less than a cent for a melon from the Carolinas to about two and one half cents for that from California." [3] A fifty per cent reduction would not cause melons to be sold in New York at 34 instead of 35 cents, since they sell at 25, 30, 35, and 40 cents, and not at odd figures. Again the saving would be absorbed in marketing. A bullock that weighs 1200 pounds, retailing in New York at 15 cents a pound, would bring $105. The freight charge for transporting this beef alive to Chicago, then (dressed) to New York, is between $3.50 and $4.[4] A fifty per cent reduction would mean a saving of less than $2 on $105, or about 1.8 per cent. This per cent reduction on a selling price of 15 cents a pound is about one fourth of a cent. "The transportation charges on a man's suit of clothes is from 2 to 8 cents; on calicos and ginghams from one fiftieth of a cent to one fifth of a cent a yard. The freight charge paid on the entire

[1] McPherson, *Railroad Freight Rates*, p. 51.

[2] These charges do not include the cost of shipping to market the original cattle from which the hides came, but the result would not be affected in the least were these included.

[3] *Ibid.*, p. 50.

[4] *Ibid.*, p. 49.

apparel of a fully dressed man or woman would range from perhaps 6 or 7 to 16 or 18 cents." [1]

Even with the more bulky, low-class freight, the case is not greatly different. The railways which carry coal to Chicago were recently permitted to make a flat raise of 7 cents a ton on coal. The result was a 25-cent increase in the price of coal, 18 cents of which represents the increased profits of middlemen. Is it reasonable to believe that under reversed conditions a reduction of 7 cents a ton in the railway charge on coal would lead the coal dealers to lower their price 25 cents a ton, or indeed at all? It is too well known that dealers are always looking for opportunities and excuses to raise prices, and always resisting any reductions, to warrant a belief that a slight lowering of transportation charges would benefit the consumer. This is fast coming to be an age of monopolized retail trade.

Enough illustrations have been given to indicate how little the selling price of most commodities is affected, even by cutting the transportation charges in two. Even in the event of so large a reduction in rates as fifty per cent, the consumers would benefit scarcely at all; the shippers and middlemen would only increase their margin of profit.

9. Attention is now directed to the current reasoning from analogy in support of inland waterways. It is argued that, since the traffic carried on the Great Lakes is tremendous in amount, we have there ample proof of the practicability of transportation by water. But a little reflection will show that no conclusions in support of river and canal transportation ought fairly to be drawn from the Great Lakes. They are great natural highways similar to the ocean itself. They are of ample depth, free from current, and of great width. Moreover, they stretch in a general east-and-west direction through the heart of the continent, and in the very pathway of our greatest commerce. Vast

[1] McPherson, *Railroad Freight Rates*, p. 52.

forests and wondrously rich ore deposits on their very shores have always furnished a traffic peculiarly favorable to movement by water. These factors combined have given rise to an enormous lake traffic, in a few particular commodities. On the other hand, many of the proposed canals have no advantages in common with these of the Great Lakes. They extend crosswise to the prevailing trend of traffic; they do not tap rich ore or forest regions; they are narrow and tortuous; they require locks at frequent intervals, and constant dredging and repair. Under such diversity of conditions analogy is clearly worthless.

about 35 miles improved channels in navig. by River

It is argued further, however, that the St. Mary's Falls Canal and the Suez Canal have demonstrated the feasibility of canals beyond any doubt whatsoever, and that the Panama Canal gives promise of more than rivaling these in importance. Here again, however, conditions are very exceptional. The St. Mary's Falls Canal is a short channel, but little more than a mile in length, connecting Lake Superior and Lake Michigan, and making possible the tremendous traffic between the upper and the lower lakes. The Suez Canal, connecting the deep waters of the Mediterranean and the Red Seas, makes it possible to avoid the great ocean voyage of thousands of miles around the southern end of Africa. The Panama Canal, to connect the Gulf of Mexico with the Pacific Ocean, will obviate the present necessity of the long journey around South America. In every case they are short channels connecting deep water, and in the line of great traffic. Such undertakings can hardly prove the feasibility of a great inland canal like the Lakes-to-Gulf Waterway, which would be over sixteen hundred miles in length, not in the line of greatest commerce, of insufficient depth to permit the passage of deep-water vessels, and perennially subject to floods and shifting bottoms. One would be regarded as of questionable sanity were he to argue that, since the Brooklyn and London Bridges have proved of great value, bridges should, therefore, be constructed across the Strait of Florida and the English Channel. Such reasoning, nevertheless, is akin to that heard in support of canals.

Similarly, there is folly in concluding that, since canals have apparently been satisfactory in one country, they will prove successful everywhere. Topography, commercial conditions, and Government policy, both as to railways and waterways, must all be carefully considered before analogies may safely be drawn. Such factors, however, have been almost wholly ignored by waterway advocates in this country. It was not until the preliminary report of the National Waterways Commission sharply called attention to the many differences in conditions at home and abroad that it was generally realized that our transportation problem is somewhat different from that of the countries of continental Europe. There is much to be learned from a study of foreign transportation development; but conclusions based on inadequate study of foreign conditions are fraught with no little danger.[1]

10. The discussion of the preceding pages has shown that most of the arguments advanced in favor of the development of water transportation in the United States have not been based on a thorough study of the subject; and that many of the contentions are supported by statistics which are wholly misleading. This has been seen to be particularly true in connection with the fundamentally important question of the "cost" of transportation by rail and by water. It should be emphasized again that the cost comparisons that are commonly made are wholly erroneous. Usually they do not compare like kinds of freight traveling under comparable conditions, and they always leave out of the computation of cost, on the waterway side of the equation, the tremendous initial expenditures and the mainten-

[1] A full discussion of the waterways of Europe is given in subsequent chapters.

ance charges, that is, the cost of construction and upkeep of the highway itself; while on the railway side of the equation these are always included. The unnumbered benefits of waterways vanish into thin air unless it be proved that, all factors considered, water transportation is cheaper than transportation by rail. More than that, it must be proved substantially cheaper, because transportation charges have become so small a part of the value of articles of commerce that nothing short of a remarkable reduction of charges will usually be reflected in the prices of commodities. Wholesale benefits to all classes, like those conferred by canals before the days of railways, can come only by reductions corresponding to those of that period. If canal transportation is as much cheaper than railway transportation as it was cheaper than transportation by wagon and stage, proportional benefits will flow from their rebuilding, but not otherwise. It is believed that the present chapter has demonstrated the need of a scientific investigation as a prerequisite to possible appropriations for waterway development.

CHAPTER IV

A NATION-WIDE SYSTEM OF WATERWAYS

1. THERE are occasional individuals who hope ultimately to see in the United States, a great ramifying system of internal waterways, of uniform depth and of standard gauge, a system so perfected that it would be possible for a canal boat, like a box car, to travel without impediment to the farthest ends of the country, from Maine to Oregon and from Montana to Florida. In general, however, the advocates of waterway development would be reasonably satisfied if all or even the greater part of the numerous independent canal projects and river improvement schemes, which were enumerated in the introductory chapter of this study, were speedily carried to completion. It is obvious that even such a development would give the United States nothing short of a remarkable system of inland navigable waterways. The question now before us is, whether waterway development on such an extensive scale is feasible. The present chapter will, therefore, be devoted to certain important *general* considerations which affect the water transportation possibilities of any country whatsoever, in the hope of throwing light upon the problem before us. The considerations to be advanced may be divided into geographical and non-geographical classes.

2. The recent progress that has been made in what may now be called the science of geography has been of much importance in leading to a better understanding of the development of peoples and of institutions. The union of geography and history, on the one hand, and of geography and economics, on the other, has been perhaps the most fruitful development of recent years in this general field of practical

study. In no branch of industrial development have geographic conditions exercised a more determining influence than in that of transportation. And as transportation is a basic industry, these influences have indirectly determined the distribution of population and of industrial enterprise.

The early history of American development reflects on almost every page the influence of the topography of the country as affecting transportation. Considerations of transportation confined the early settlements along the Atlantic Ocean to the banks of the coastal rivers. Considerations of transportation directly affected every phase of the Western movement. The three great routes to the land beyond the Alleghanies — by way of the Hudson and Mohawk depression to the Great Lakes; up and down the transverse valleys of Pennsylvania, utilizing the Susquehanna, the Juniata, and the Allegheny Rivers to the Ohio gateway; and the Cumberland gap opening in the South through the mountains of Tennessee — were, for reasons of transportation, necessarily the lines of first settlement and development. In the great Middle West, in turn, population always kept close to the banks of rivers, and it followed their winding courses as the frontier moved out across the prairies. And, finally, the old Santa Fé and Oregon Trails followed the natural depressions across the Western mountains to the Pacific.

Since this development occurred before the era of railways, the lines of advancement and of development were everywhere conditioned by the possibilities of water transport. The location of every city of importance in the eastern part of this country, save one,[1] and hence the distribution of practically all our industries, was in this earlier period determined by possibilities of water transportation.

The development of the railways naturally followed, in

[1] Indianapolis owes its position to its central location within the state. Its subsequent rapid development has been due to the centering of railways there.

the main, the banks of the old water routes, partly because they offered the lines of least resistance, but more because the traffic which the railways were seeking was almost wholly confined, in these early days, to the river lines. It was not until the possibilities of the Great West became fully realized that our railroads left the old beaten paths of travel along the watercourses and covered the prairies, and even the mountains, with a very network of lines of communication. It is this development which has constituted the revolution in transportation of which we so frequently hear, and it is likewise, as we shall see, mainly this development which has spelled the fate of water transport. With this brief historical survey, we may now direct attention to a consideration of the various geographic conditions which limit the possibility of successful water transportation in competition with fully developed railways.

3. In the first place, transportation by water is necessarily mainly confined to natural valleys. It is possible to construct canals across territory of considerable elevation, but it is impracticable, for the reason that the cost of construction is much more than proportionally increased, as the elevation to be overcome increases. Since the course of an artificial waterway must be maintained in a series of levels, canal construction across a rough country involves enormous outlays in making deep cuts and huge fills for the purpose of securing a dead level; and at frequent intervals (and the higher the elevation to be overcome, the more frequent) locks for the control of the water; and either sluice gates, lifts, or sharp inclined planes, for the purpose of raising or lowering vessels from one level to another, must be constructed. On the other hand, the cost of railway construction in overcoming elevations is increased at nothing like the rate prevailing in the case of canals. The railway track need not be at a dead level. It can be constructed across long undulations without seri-

ous impediment; it can wind around and up a mountain-side, and by merely increasing its distance, by doubling on its tracks, as it were, often almost entirely avoid any considerable excavation. Or, if a devious surface route is beset with extraordinary difficulties, the railway has the alternative of tunneling directly through the mountain. In view of these considerations, it is apparent, and it probably is not generally doubted, that for mountain or inter-valley traffic canals cannot hope to compete on even terms with railroads.

4. The second geographic consideration is that of territorial extent. The greater the distance freight must travel to its destination the fewer are the commodities which can make use of waterways. Speedy delivery has become so important to modern business that the greater dispatch afforded by railways is a decided advantage, and in a country of broad extent canals must rely upon a comparatively few commodities. Even coal, especially coal for household consumption, is, under present conditions, to a surprising extent delivered in small quantities, in order to save the cost of storage in urban centres, awaiting delivery to customers. Hence it must be delivered at more frequent intervals, which introduces the element of speed as an important factor. Even where it has to travel, at most, only a few hundred miles, as to London, it is carried largely by rail, even though waterway facilities exist, because by rail it can be shipped in quickly and in quantities as desired.[1] It is obvious that the greater the distance that coal must travel to market, the greater need there is for speed, and hence the greater is the railway advantage.

Canals are at another disadvantage, also, in a country where long distances have to be reckoned with. The competitive strength of a canal decreases as the distance between important centres of traffic increases, because the cost of the highway, the mere road-bed, if you please, is

[1] See chapter VI, p. 114.

much greater in the case of a canal than in the case of a railway. This is true even where the intervening territory to be traversed between the source and destination of traffic is perfectly flat, and hence relatively favorable to canal building. The laying of a railway track across a level stretch of country is comparatively inexpensive. The heavy costs of railway construction are those involved in the tunneling of mountains, in the crossing of rivers, in the elevating or laying of tracks within urban centres, and in the acquirement of expensive terminal sites. The capitalization of the railways of the entire country averages only about sixty thousand dollars a mile, much of which is commonly regarded as a fictitious valuation. In the five states in which physical valuations of railways have been made, namely, Washington, South Dakota, Michigan, Minnesota, and Wisconsin, the cost of reproduction new, as estimated, varies from $25,946 per mile of single track in Michigan to $64,343 in Washington, and averages but little more than $40,000.[1] The method employed in assigning these values varied with the states, and they were not as scientific as one could wish, but they doubtless approximate the correct figures. On the other hand, the estimated cost of enlarging the Erie Canal is about $300,000 per mile. Since there is this enormous disparity in the construction costs of railways and canals, it is evident that the greater the distance between important traffic centres the less is the probability of successful canal competition. It is only where such distances are short, or where relatively short canals connect naturally navigable waters that canals can hope to compete on even terms.[2]

[1] Bureau of Railway Economics, Washington, 1911. *A Comparative Statement of Physical Valuation and Capitalization*, p. 13.

[2] On page 27 we remarked that it was only with long distance that water transportation could be economically successful. This may at first appear contradictory to what has just been said; but the former statement contained the important qualification that a part of the long distance must be on a *natural* water route, rather than on a canal.

5. In the third place, it is necessary to consider the influence of geographic conditions upon the supply and the control of water for transportation purposes. The influences in this connection, of course, make themselves directly felt upon rivers; the effect upon canals, whose water is supplied from river sources, being only indirect in this case. The present considerations will, therefore, have reference to river transportation only.

The geographic considerations here referred to are the character of river currents and the alternating periods of high and low water. The short, rapid rivers breaking over the Atlantic "fall line" were never successfully navigated very far inland. Again, streams with narrow gorges here and there, or with shifting channels, present constant menaces to navigation, while the silting or choking-up of the courses of many rivers with sediment necessitates incessant dredging at enormous expenditure. For example, on the Mississippi River between St. Louis and Cairo, a distance of only 190 miles, the surveys of a special Board of Engineers show that "there existed in 1908 as many as 68 localities that would require dredging to obtain a 14-foot channel, and that to dredge a channel 500 feet wide and 14 feet deep at low water would necessitate the removal of 35,000,000 cubic yards of material. Channels thus formed would have a tendency to refill, not only on every rise of the river, but on any change in the regimen, such as would be produced by an ice gorge, so that extensive dredging operations would be required, not only on a falling river, but every spring at the opening of navigation."[1] The estimated cost of opening such a channel is $6,000,000, and the cost of maintenance is $2,000,000 per year.[2] The cost here for dredging alone would in ten years amount to $135,000 per mile. From such statistics it seems abundantly evident

[1] *Report by a Special Board of Engineers on Survey of the Mississippi River*, 1909, p. 13.

[2] *Ibid.*

that the amount of dredging required is a very important consideration in estimating the feasibility of any given project.

But perhaps of even more consequence than silting are the considerations of alternating floods and low water in river courses. In a country where the annual rainfall is evenly distributed throughout the year, or where the rivers are fed by the gradual melting of glacial ice, and where the river banks are well protected and the descent of the stream not precipitous, there may be comparatively little impediment to river navigation at any portion of the year. On the other hand, where rivers are at times inordinately swollen by the sudden melting of vast accumulations of winter snows, or by the rapid run-off from a naked territory following tremendous occasional rains, and at other times are of scant depth on account of protracted droughts, they are proportionately handicapped as transporting agents. While reforestation, levees, revetments, or great reservoirs may lessen, they cannot wholly remove, the risks attending navigation on rivers subjected to periodic floods and droughts; and, indeed, the necessary regulative works may themselves prove so costly as altogether to counterbalance the advantages otherwise offered by river transit. At any rate, the risks connected therewith are a constant deterrent to shipping. No less than speed, the business man requires certainty of delivery. A delay of even a few hours in the arrival of a cargo of fuel, of building-materials, or what-not, is almost sure to involve heavy losses. Hence, where water navigation is attended with considerable risks, other things being equal, the shippers are naturally inclined to give the preference to the railways.

6. The closing of navigation for considerable periods of time on account of cold weather also has an important bearing upon the question under consideration. If a waterway, either canal or river, is closed to navigation because of ice

for one, three, or six months during the year, its chance of success is obviously proportionally less than if it suffers from no such interruption of traffic movement. Other things being equal, the construction expenditures are the same in a cold as in a warm land. Moreover, almost as much equipment is required for a half or three quarters of a year as for an entire year. It is a plain mathematical proposition, then, that when the capital invested in an enterprise must lie idle for one half or one fourth of each year, it should yield during its period of activity proportionately higher rates of return than would otherwise be necessary.

Moreover, if a waterway is annually closed for several months on account of ice (and the same holds true of any interruption to traffic), the proportion of the traffic that it can hope to carry, even during the months of navigation, is usually greatly lessened. Shippers do not readily change from one mode of transport to another. If they cannot ship by water except during a part of the year, in many cases they may choose to make no use of the waterways at all, preferring to forego any slight advantages that might come from their use when opened, rather than change back and forth from one agent to the other. Where industries locate themselves so as to possess certain and convenient means of transport, this consideration is of vital importance; for it would be sheer folly to build a factory where the sole reliance for transportation was a waterway open to navigation for only a portion of each year. Where factories are built along waterways, except in warm countries, they must also be convenient to railway transportation. On the other hand, the railways afford almost uninterrupted service, and are hence sufficient in themselves to meet the constant needs of traffic. The importance of the above consideration can hardly be overestimated. The existence or non-existence of ice for several months in the year may alone largely determine the feasibility of constructing a water route.

7. The next question to be considered is that of traffic. It is passing strange that, in the discussion of waterway projects in the United States, this most important of all considerations has been largely disregarded. While here and there estimates of the amount of traffic in sight have been made, there has nevertheless been comparatively little investigation for the purpose of ascertaining whether there is a reasonable expectation of a sufficient traffic development to warrant the expenditures involved in the various projects, and that geographic conditions may be in this connection of the greatest consequence is an idea which seems scarcely to have been entertained. We shall find, however, that they are of decisive importance.

By its nature a canal of consequence requires a very heavy traffic if it is to prove remunerative. Owing to the smaller construction cost per given distance a railway may earn dividends when carrying a much smaller quantity of traffic than can a canal of equal length. The advantage of the railway in this connection is further increased by the fact that it is not compelled to rely upon a limited number of commodities as a means of revenue. A railway can carry all kinds of freight, and those kinds able to bear a large transport charge are especially important from a revenue standpoint. Again, a railway may defray a very large part of its permanent or fixed charges by means of passenger traffic. On the other hand, the success of a canal is almost wholly dependent upon a certain few bulky commodities, chief of which are coal, building-materials, timber, ores, and, to a much less extent, grain, for reasons which will soon appear. This is the case on European waterways no less than on those of this country. Now, since canals require an exceptionally heavy traffic, because of the unusual amount of fixed capital involved in their construction, and since they must rely upon a limited number of commodities, it is evident that the quantity of these particular commodities and their geographical distribution in relation to the waterways of the country are of fundamental importance.

If the geography of a country is such that a waterway cannot extend in the direction which the raw materials constituting its possible traffic must take in order to reach the centres of manufacture or consumption, that is, if it runs crosswise to the general direction of such traffic, its chances of success must be regarded as almost nil. And, moreover, if waterways would be successful, they must lie not only in the general direction that bulky traffic must move, but they must also actually tap the sources of the traffic which they would handle, and reach the actual destination thereof. This brings us to one of the most decisive considerations in the entire transportation problem, namely, that of transshipment.

If a navigable river, or a canal, is not so situated in relation to coal, building-materials, and other waterway commodities that it can receive them direct without transshipment from railways, the chances are that it will not receive them at all in any considerable degree. For if the traffic must first be loaded into railway cars, then hauled to the waterways, and there transshipped to barges or canal boats, this transshipment adds a heavy item to the cost of transport. If, in addition, the destination of the traffic be not immediately upon the waterway or within very convenient trucking distance, a second transshipment is necessary when the combined rail and water route is used, this time from the waterway to the railway. The importance of this consideration is usually overlooked and scarcely ever fully appreciated.[1] A shipper is not primarily con-

[1] It is only recently that any attention has been given to the transshipment phase of the waterway question. When the waterway movement first started, the idea that terminal and transshipping facilities were an absolute necessity was apparently not thought of. Later, since learning how much has been expended in Europe upon terminal equipment, much emphasis has been laid upon the need of such facilities. But as yet no attention has been given to the question whether these additional costs may not destroy the supposed economy of water transportation.

cerned with the relative freight charges on waterways and railways for given distances. He is concerned rather with the total charge of moving his goods from source to destination, including handling expenses at both ends, and at intermediate points, where necessary. So far as he is concerned, the waterway rate may be only one seventh as great for a given distance as that by rail, yet he will not use the waterway if the added costs of extra handling, transshipments, etc., more than counterbalance the haulage advantage of the water route. Unless waterways can effect a cheaper moving of goods, from the very source of the traffic to its ultimate destination, including handling and transshipping expenses en route, they cannot be said to have reduced the cost of transportation.

It has been said that the total cost of hauling coal on the Great Lakes from Buffalo to Duluth is no greater than the cost of shoveling it from a sidewalk into a consumer's cellar, and the statement may very likely be true. In England, meat arriving at Southampton and destined for London is unloaded from the importing vessels into road wagons which have been placed upon railway cars. The advantage of this is that it saves in London the cost of unloading from railway cars to road wagons for delivery about the city. The wagons are merely removed from the cars as they stand and an extra handling is thus avoided. In this case but one transshipment is eliminated, but the saving is obviously sufficient to cover the cost of carrying the heavy truck wagons from Southampton to London and return. Moreover, on the return voyage there is no cargo.[1] To take another illustration, nearer home: huge ferries carry loaded freight trains for a distance of ninety-six miles across Lake Michigan from Ludington to Milwaukee, in order to save the cost of transshipment. It is evidently cheaper to carry the tremendous tonnage of a complete train of cars than to

[1] Chisholm, "Inland Waterways," *Annual Report of the Smithsonian Institution*, 1907, p. 350.

transfer the cargo. Again, it is said that "the terminal charges against railroad freight between Philadelphia and New York were about fourteen times the cost of transportation alone, and that the terminal charges at Chicago and New York about equaled the cost of transportation between these cities."[1]

In the light of such facts, it is evident that the handicaps to water transportation, where either the source or the destination, or both, of the traffic are not immediately adjacent to the waterway, are very great. Unless the waterway saving from the standpoint of haulage costs alone are exceptionally large, the costs of transshipment under such conditions are almost certain to be prohibitive of water transport.[2] More efficient loading and unloading machinery would substantially reduce these costs, but they remain in any case a very important handicap to water transportation.

The question naturally arises at this point, May not the obstacles of transshipment be overcome by the development of lateral waterways? In answer to this, it should be recalled that the main lines of waterways, as has been shown, are usually limited to natural depressions or valleys, and the construction of branch lines, therefore, except in a perfectly flat territory, or where they do not extend outside the limits of the valley, will prove perhaps even more costly than the main lines themselves. It must be borne in mind that such branch canals must be of the same size as the

[1] Harts, "Governmental Policies for River Improvements," *Bulletin of American Economic Association*, Fourth Series, no. 2, p. 163.

[2] It may be argued in contradiction of the above that the ores from the mines of Lake Superior are transshipped from railway cars to Lake vessels. Conditions here, however, are very exceptional. Not only is the Lake route much shorter for all the ore going to the Pittsburg region, but the capacity of the Lake vessels is such that the ore can be handled in enormous quantities. This permits specially constructed ore boats to be used and labor-saving machinery to be extensively employed. It is altogether an exceptional situation, and general conclusions may not safely be drawn therefrom.

main line, if they would serve the purpose for which they are constructed. If the capacity of a branch is sufficient for boats of only one hundred tons' burden and that of the main line large enough for boats of six hundred tons, the cargo must be transshipped from the smaller to the larger boats and back again. Otherwise all the advantages of the large capacity of the main line, so far as all traffic not originating immediately upon its banks is concerned, are dissipated; the same thing obviously holds true, in like manner, for the traffic not destined for consumption on the banks of the main route. Now, the reason that branch lines, of equal capacity with the main lines, would cost perhaps more than the main lines themselves, is that as a rule they must be constructed across rougher country. It is to be considered, also, that a great number of branches would be required. A characteristic feature of modern industry is the existence of a large number of important collecting and distributing centres, from which the lines of transportation radiate out, like spokes from the hub of a wheel. Under almost any condition branch canals would needs be numerous, thus greatly swelling the total cost of the whole waterway system; and where a country is of broad extent, the length of the branch lines would have oftentimes to be very great, thereby still further lessening the practicability of economical water transportation.[1]

In contrast to the expensiveness of branch waterway lines, railway branches can be constructed at comparatively small cost. While the width of the track must needs be the same as that of the main line, in no other regard need a branch be the equal of a main railway line. There is, comparatively, much less wear on the roadbed, because of the relatively small amount of traffic, and the engines may be, and usually are, second-hand ones passed down from the main lines.

[1] This is due, as already seen, to the greater cost per mile of a canal than a railway. When the distances between industrial centres are great canals are therefore under a heavy handicap.

The practical advantages possessed by the railways may readily be seen in connection with the carrying of such commodities as coal, ore, and building-materials. The tremendous scale on which these raw materials are now extracted from the earth involves very frequent shifting of the sources of supply. Nothing is more simple than continually to extend spur lines of railway to the very mouths of the mines. It is obvious that ramifying waterways throughout a mining district are altogether impracticable.

The advantages of the railways in this regard are even more strikingly to be seen in connection with agricultural products. By the nature of the industry, agricultural produce is necessarily scattered over a wide area. Hence — and herein lies the reason that agricultural produce seldom travels extensively by water — the lines of communication with the collecting centres must be very numerous and of unusual length. Accordingly, the cost of extending a great ramifying system of canals, large enough to avoid transshipment to the main line, throughout a great agricultural region, even in a level country, is altogether prohibitive. The same consideration is obviously involved in the delivery of supplies to rural communities.

The above considerations relating to branch canals seem conclusively to indicate the impracticability of their extensive development. Only under exceptionally favoring conditions could they hope to be remunerative. The railways possess decisive advantages in this regard. Hence we must conclude that transshipment is not to be overcome by means of branch lines.

Much has been written about the harmony of interest between waterways and railways. It has been contended that not only should the two modes of transport aid each other by means of a mutually advantageous division of traffic, but that they should serve each other as feeders, discharging their traffic back and forth, from railway to canal and from canal to railway. This idea has been introduced into the United States from Europe. Where it is practiced in Europe, however, it is made possible only by a resort to artificial means, and in most cases, as we shall later see, it is a barrier to industrial development.[1] It is only under unusually favoring conditions that transshipment can be economically made. The standard gauge of railways makes it possible, on the other hand, to send a loaded freight car to any part of the country where railways extend, without transshipment of the cargo. At collecting and distributing centres, except in the case of broken lots, it is merely necessary to switch cars from one train and track to another. No handling of the goods whatever is required. It should be recalled, moreover, that the cost of sending a car, when once it is loaded, a somewhat longer distance is inconsiderable if not insignificant. Hence, under all ordinary conditions, an expectation that shippers will prefer the risks, inconveniences, delays, and heavy cost of transshipment to a through routing by rail is the height of improbability.

It is not alone in the case of transshipping from rail to water, moreover, that this handling charge manifests itself in water transportation. In comparatively few cases is it practicable to maintain river channels of uniform depth. The Upper Mississippi, the Missouri, and the Ohio cannot be given a depth equal to that of the Lower Mississippi, except at a cost which would be prohibitive. In the absence of a uniform depth, transshipments are necessary unless the draught of boats carrying through traffic over the entire system is to be regulated by the depth of the shallowest portions of these rivers.

It is not expected that the above discussion will be accepted as conclusive proof of the impracticability of trans-

[1] In France, transshipments from rail to water lines is almost unknown. In Germany, they are more common, but the expense thereof is largely borne by the Government rather than by the shipper. For a full discussion of the German methods of artificial stimulation of transshipments, see chapter x.

shipping from one agent of transport to another under all circumstances. It may be that under especially favoring conditions it can be done. The point will be more fully considered in the discussion of specific projects in later chapters.

8. Attention may now be directed to a discussion of the second class of considerations which affect the chances of economical water transportation in any country. For want of a better name, these considerations may be designated as non-geographic in nature. The first to be taken up is that of the quantity of traffic within the country in question, in conjunction with the extent of railway development.

The degree to which the capacity of railways can be extended is not usually fully recognized. The installation of double tracks has made it possible to run trains in both directions at the same time and at intervals of only a few minutes. The chief interruption to freight traffic is the running of passenger trains on the same tracks that are used for freight. But when the need becomes imperative enough, as it already has on a few lines, separate double tracks for freight and passenger service can be installed. And it is to be borne in mind that the laying of additional tracks costs much less than the construction of the original ones. Little or no surveying is required, grading is usually much less difficult, and the existing tracks can be utilized to great advantage in the distributing of materials or the laying of the roadbed, the ties, and the rails.

In view of these considerations it is evident, providing the necessary funds and materials are available, that the carrying capacity of the railways can be very greatly if not indefinitely extended. It is perhaps well to remind the reader that the statement of James J. Hill, of which so much capital has been made by waterway advocates, was not that railways had reached the limit of their development, but merely that they were unable to secure the necessary capital with which to increase their rolling-stock and equipment, and with which to extend their tracking, and that sufficient structural materials and labor force were not immediately available for the making of the necessary improvements in traffic facilities. The almost constant large surplus of cars since 1907 [1] shows, moreover, that the railways are not in normal times by any manner of means extended to the limit of their present carrying capacity. Much less have they reached the limit of their possibilities.[2]

We are now in position to understand how the density of traffic within any given country and the extent of the railway development may affect the question of extensive waterway development. If there is not sufficient traffic to be handled to tax fully the capacity of the railways alone, if the railways are constantly seeking to develop and secure more traffic, it is evident that waterway development, even though it be furthered by the Government, is greatly handicapped in the securing of a tonnage sufficient to make it remunerative. But if, on the other hand, there chances to be a very dense traffic within a country, it might then be comparatively easy for both railways and canals to earn returns upon the capital invested. Even in this case, however, it should be observed that there would still remain the all-important question of determining whether it would be economically advisable to develop both agents of transport at the same time. This consideration will be dwelt upon at length in later chapters.

9. If the railway freight service of a country is excellently cared for at the time of the beginning of waterway

[1] See chart opposite p. 22.

[2] American railways are no exception in this regard. The dense traffic of England is almost wholly handled by the railways, and there has been no contention there that the service is inadequate. On the Continent canals are extensively used, but, as we shall see, not for the reason that the railways are overburdened.

development, the railways possess the enormous advantage of an established trade. Industries will have located themselves, so long as their sole dependence for transportation is the railways, without regard to the location of possible canal routes. The heavy losses involved in rebuilding their plants on new sites along waterways would usually far outweigh any possible advantages afforded by water transit. Hence, in the main, only new industries could be expected to choose the waterway sites in preference to those of the railways. Even if the waterways could secure the traffic of all new industrial concerns whose products are adapted to water transport, the development of traffic could not be expected to be very rapid.[1]

Again, the waterways may have to face certain well-known competitive methods of the railways. Whether it is fair or unfair, railways are able, in the absence of restrictive legislation, to reduce freight rates to such a point that would-be competitors find it almost impossible to gain headway. The ability of the railways to do this arises from the fact that they do not have to rely, as already pointed out, upon merely a few bulky commodities for their income. If a railway can defray a part of its expenditures by means of high-class freight and passenger traffic, it can afford, when necessary, to carry low-class freight at very low rates. So long as the charges are more than enough to cover the mere haulage expenses, the railway obtains some revenue therefrom which it can apply in payment of constant charges. While the same thing is true of a canal, in a way, the latter must nevertheless secure a much larger margin above the mere haulage cost on low-class goods, since such freight constitutes practically its sole source of revenue. Railways may, for a time, carry bulky goods even at a loss, for the purpose of crushing competition, but such a policy is sui-

[1] A reversal of this situation is well illustrated in Holland, where the industries are largely centred around the old-time waterways of the country. Railway development there has been hampered accordingly.

cidal to a waterway, which has no source of revenue other than these same bulky commodities. Again, by refusing to coöperate with water lines, by prorating on terms fatal to the waterways, or by gaining control of water terminal sites or equipment, the railways can seriously cripple water routes. Unless competition is checked by means of legislation in countries whose railways are strong and vigorous, the development of water transportation must follow a thorny pathway.

10. There remains to be touched upon a final consideration affecting the successful development of water transportation. It is what may be termed sectionalism. In a country which is divided into a large number of political subdivisions, sovereign states, kingdoms, or principalities, it very frequently happens that the interests of the different divisions are not in harmony with the interests of the whole, and hence the situation is not conducive to the most efficient development of a transportation system. This becomes of greatest importance in connection with the question with which we are dealing, when the railways of a country are privately owned and thus largely removed from the influence of sectionalism, and when, on the other hand, waterway development must rely upon a "pork-barrel" method of appropriation from the Federal Treasury. To illustrate, throughout the history of the United States, whenever public funds have been appropriated for general internal development, whether for roads, canals, rivers, or harbors, the different sections of the country have always vied with each other in making the most of their needs. Indeed, even the minor political districts usually have to be considered in the distribution. The political representatives are everywhere expected to obtain as large a portion of the public fund as possible for their particular districts, and the amount secured usually depends less upon the needs of the district than upon the skill or "pull" of its representa-

tive.[1] The result of such a method obviously cannot be a systematic development of the waterways of the country.

In a similar manner, the part played by local governments in the improvement of waterways may prove a handicap to systematic development. For instance, in Germany, before the Imperial Government assumed supervision of transportation, the various Kingdoms and Grand Duchies were accustomed to compel transshipment at their borders, whether necessary or not, in order to furnish labor to their inhabitants; and some of them constructed indirect routes across their territory, in order that through traffic would have to travel the further within their borders.[2] The custom of taxing traffic passing across their borders was a well-recognized prerogative of the German States. The various states of the United States have spent several hundred millions of dollars upon waterway development, and they have naturally done it without regard to the interests of the country as a whole. Under such conditions a standard gauge and a comprehensive system of waterways is practically impossible. Unless both the waterways and the railways of a country are similarly unsystematically developed along lines which seek to further sectional rather than national ends, or unless, when the railways are in private hands, the waterways are systematically developed by a strongly centralized national government, it is obvious that the chances of the latter, from the standpoint of a competitive system, are comparatively small.

11. Having discussed in some detail the many considerations which may affect the extensive development of the waterways of a country, it only remains now to consider to what extent the possible handicaps that have been enu-

[1] It is stated on good authority that the United States Government has been very liberal in appropriations for the waterways in the South, for the reason that the South does not share in the distribution of pension funds.

[2] Schramm, *Grundzüge Deutscher Eisenbahnpolitik*, pp. 5–7.

merated apply to the United States. In general, the applications are so apparent that only a brief statement is necessary.

Obviously, in the United States, as everywhere else, the waterways must be confined to natural valleys and to the comparatively level portions of the country. In the matter of territorial expanse we are subject to the full extent of the handicap therein contained. Our river currents are notoriously unruly, and the annual floods and droughts work unusual havoc with navigation. The interruption to traffic on account of ice lasts from three to five months a year on all our Northern rivers and lakes. While no general statement can be made as to the location of traffic in relation to waterways (this being a matter which must be considered separately in connection with particular projects), it may be said that the density of traffic in the United States is much less than in most European countries. On the other hand, it is generally recognized that our railways are more efficient carriers than those of any other country. At the same time they have not as yet been subjected to sufficient control to safeguard the waterways from a ruinous competition. It remains to be seen how efficient will prove the new law which prevents the charging of more for a shorter than a longer haul where waterway competition is present, except by consent of the Interstate Commerce Commission. Finally, the United States is subject to sectionalism to an unusual degree on account of our dual form of government and the nature of our present political methods. In the light of these considerations, the conclusion is unavoidable that a vast system of ramifying waterways in this country, of standard gauge and uniform depth, is impossible.

Waterway development in the United States must at best be confined to a few particular projects where conditions combine in a very favorable manner. From what has been said of the disproportionately heavy expense of canal construction, and of the consequent handicap of great distances, between important centres of traffic, it is evident that the chances of success are greatest where the distances to be traversed are shortest. If, moreover, a short canal connects naturally navigable waters, and makes possible a continuous water route of many times its own length, thereby offering the advantages of the low haulage rates for great distances, it may well prove very successful. Such, for example, is the St. Mary's Falls Canal, connecting Lakes Superior and Huron. A canal a little more than a mile in length makes possible an uninterrupted water route of more than a thousand miles. To some extent the Lakes-to-Gulf Waterway and the Erie Canal are supposed to be projects of this type. They will constitute the subjects of later chapters.

CHAPTER V

BRIEF HISTORY OF WATER TRANSPORTATION IN THE UNITED STATES

1. As a preliminary to the discussion of the future of American inland waterways it will be profitable to devote some attention to the history of water transportation in this country. The present chapter will accordingly have to do with the expenditures which have been made on internal waterways in the United States; the amount and the character of the present water-borne tonnage; and, finally, of the causes which have been operative in the decline of water traffic in recent years.

The construction of canals and the improvement of rivers in the United States has involved an outlay of large sums of money, the total amount of which is not generally appreciated. Indeed, the opinion is rather prevalent that in this country we have been on the whole unmindful of the possibilities of water transportation. It will be seen, however, that the facts do not bear out such a belief.

Owing to the fact that three different agents have participated in the building of canals in the United States, namely, the Federal Government, the various State Governments, and private corporations, and that unsatisfactory records of the cost of building canals have been kept, it is impossible to set down with absolute accuracy the total expenditures that have been made. The approximate amounts, however, are given in the following table. For the National Government they are precise.

Expenditures on Canals in the United States

Federal	$ 40,905,877.31*
State and private	288,628,072.00
Total	$329,533,949.31

* *Preliminary Report of Inland Waterways Commission*, pp. 193–95.

Federal expenditures on rivers from 1790 to 1909 amounted to $258,378,432.[1] The inadequate records of state expenditures on river improvement render it impossible to give an accurate statement of their amount. Omitting river improvements by the states, there has been expended upon canal and river development in the United States the sum of $587,912,381.31. This is more than four times the amount that has been spent upon waterways in Prussia during the same period of time, and more than a half more than has been spent in France. It is worthy of mention, also, that the expenditures upon river improvement in this country have been increasing heavily in the last twenty years.

Of the original 4633.31 miles of canals in the entire country, 2444.26 miles, representing a cost of $81,171,374,[2] have been abandoned. The statement below shows the mileage and cost of canals now in operation:[3] —

	Length	Cost
Government canals	194.49	$ 40,905,877.31
State canals	1358.98	156,983,538.00
Private canals	635.58	50,573,160.00
Total	2189.05	$248,462,575.31

As compared with the canal mileage of 2189 miles in this country, France has 1073 miles of canals, and Germany, 895 miles. In relation to territorial area, however, France and Germany have the greater mileage.

The number and mileage of navigable streams in the United States, as distinguished from canals, is shown by groups in the following table:[4] —

[1] *Report of National Waterways Commission*, Doc. 15, p. 4.

[2] *Report of the Commissioner of Corporations on Water Transportation*, vol. I, p. 44.

[3] *Ibid.*, pp. 36–44; and *Preliminary Report of Inland Waterways Commission*, pp. 195–202.

[4] *Report of the Commissioner of Corporations on Water Transportation*, vol. I, p. 28.

Streams	Number	Navigable length (miles)
Tributary to Atlantic	148	5365
Tributary to Gulf (exclusive of Mississippi)..........	53	5212
Mississippi and tributaries	54	13912
Flowing into Canada...............	2	315
Tributary to Pacific	38	1606
Total	295	26410

The majority of the streams included in this table are, however, navigable only for light draft boats. Forty streams, with a total of about 2600 miles of navigation, have a depth of 10 feet, and seventy streams, with about 3200 additional miles, have a navigable depth of from 6 to 10 feet. This gives a total of about 5800 miles of river navigation at a depth of more than 6 feet.

2. The era of greatest canal building in the United States was between 1825 and 1840, and the thirty years following this latter date was the period of great canal and river prosperity. The amount of water-borne traffic steadily increased for several decades, but with the development of railways, especially in the last quarter of the nine-

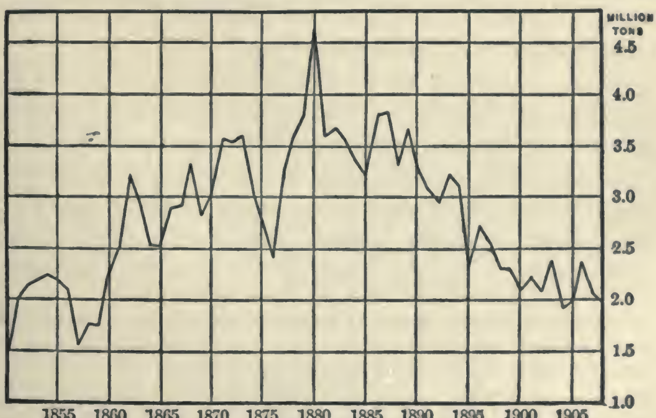


Chart I
Total Tonnage on Erie Canal (1850-1908)

teenth century, further growth of water traffic was arrested. In all cases the traffic on the waterways failed to keep pace with that on the railroads, and in nearly every case the tonnage on the water routes declined absolutely.

Chart I shows the movement of freight on the Erie Canal from 1850 to 1908. There is seen to have been a general

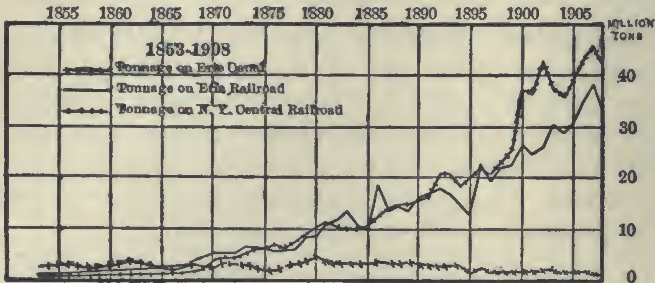


Chart II

Railway and Canal Tonnage in the State of New York

growth of tonnage on the Erie, with numerous ups and downs, until the year 1880, when 4,500,000 tons were carried. Although tolls were abolished in 1882, the entire expense of maintenance having since been borne by the state, traffic has steadily declined since 1880, until it is now little more than it was a half-century ago.

Chart II tells the story of railway competition with the Erie Canal.[1] The line at the bottom represents the tonnage on the Erie, being the line in the preceding chart on a reduced scale, which gives a flattened appearance, it being necessary to reduce the scale in order to get the lines representing the railway tonnage on a chart of convenient size. A line representing the tonnage of all canals

[1] A chart of this sort is always somewhat misleading. The increase in branch railway lines, while the canal system remained unchanged, would naturally cause a more rapid development of traffic on the railways. Since the canal traffic has actually declined in this case, however, the chart substantially represents the true situation. This comment applies also to Chart V.

of the state would closely parallel that of the Erie alone. In 1853 the canal system of the state was carrying 81.1 per cent of the total traffic. In 1873, the year that the lines representing the traffic on the railways cross the line of canal traffic, the canals of the state were carrying only 34.9 per cent of the total. In both 1907 and

Chart III
Shipments and Receipts in Tons on the Upper Mississippi at St. Louis

1908, the percentage carried by the canals was only 3.9 per cent of the total. It should be remembered that the railways have accomplished this wholesale diversion of traffic without any aid whatever from the state in the building or maintaining of the roads, while the canals have been constructed and, since 1882, maintained entirely at public expense. While the railway men have been obliged to make rates calculated to earn dividends on the total capitalization of the roads, the canal operators have had to attempt to make returns only on the cost of canal boats and the mules which draw them.

Charts III and IV indicate the traffic movement on the Mississippi River both above and below St. Louis. Beginning with 1871 there was an uninterrupted decline in the traffic above St. Louis until 1905. In 1906 and 1907 a slight increase is shown, doubtless a result of the railway car shortage of these years. Below St. Louis the high mark

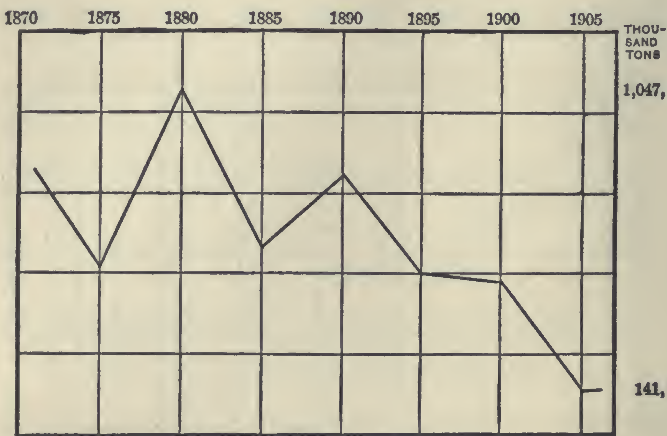


Chart IV
Shipments and Receipts in Tons on the Lower Mississippi at St. Louis

was reached in 1880, since which time the decline has been continuous to the present day.

The cotton trade was once of considerable importance on the Lower Mississippi, but the railways have succeeded in diverting a large portion of this traffic to themselves. The receipts of cotton at New Orleans by rail and by river since 1873 are shown in Chart V. Since 1881 the railways have carried an ever-increasing proportion of this tonnage. The condition of this cotton traffic is typical; in every class of commodities, except coal coming down from the Ohio, the railways have almost driven the traffic off the river.

When we come to the Ohio River system, however, the condition of water traffic is found to be much better. Chart VI shows the movement of coal through the locks on the Monongahela River in western Pennsylvania. Since a large portion of this coal is sent down the Ohio, a plot of the Ohio River coal trade would closely parallel the line in the present chart.[1] There is seen to have been a continuous rapid increase here. Statistics of all the traffic on the

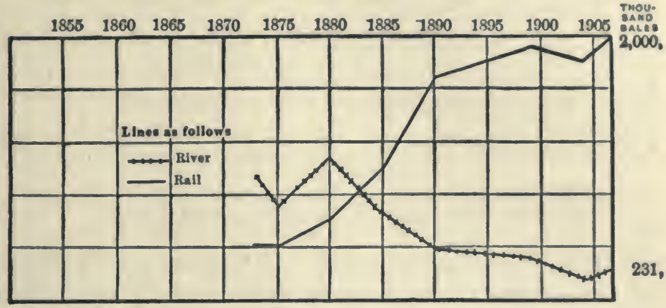


Chart V
Receipts of Cotton at New Orleans

Ohio would, however, not appear to such good advantage. The increase in coal has been offset, to a large extent, by the decrease in miscellaneous traffic and in lumber. Though there has been a slight absolute increase in the total traffic on the Ohio, there has nevertheless been a heavy relative decline compared with the railways. The reason for the comparatively good showing of the Ohio River system will appear elsewhere.

3. It is generally recognized that water traffic now consists, for the most part, of what is called bulky or low-class freight. Precisely what percentage of the traffic on existing waterways is of a distinctly bulky nature, and what particular commodities predominate, are, however, not so well known. It is the purpose of the succeeding paragraphs to show the character of present traffic by means of statis-

[1] Statistics of traffic on the Ohio are usually unreliable for the reason that the receipts and shipments at all the river ports are added together, and no allowance is made for duplication. Most of the coal traffic is thus counted several times.

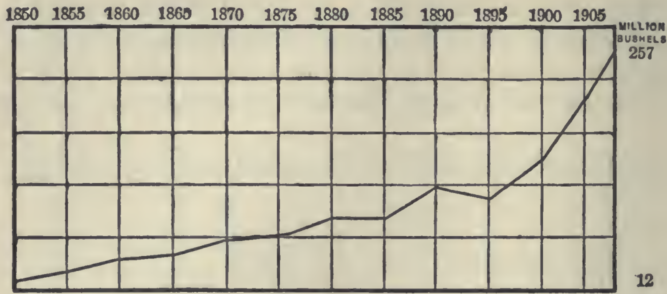


Chart VI
Movement of Coal through Monongahela River Locks, destined for Pittsburgh and points along the Ohio River

tical data. The first table gives the total tonnage of different commodities through the St. Mary's Falls Canal for a series of years, and the percentage each bears to the grand total: —

	1881	Per cent	1891	Per cent	1901	Per cent	1903	Per cent	1905	Per cent	1908	Per cent
Coal	296	18.2	2507	28.2	4593	16.2	6938	20.0	6509	14.7	9902	23.9
Flour	61		378	4.2	763	2.7	709	2.0	577	1.3	573	1.4
Wheat	104	6.6	1164	13.1	1584	5.6	1841	5.2	2050	4.6	3184	7.7
Other grain	9	.6	25	.3	594	2.1	770	2.2	941	2.5	1042	1.8
Manufactured and pig iron	88	5.6	70	.8	206	.7	193	.6	238	.5	289	.7
Salt	9	.9	33	.8	62	.2	64	.2	59	.1	77	.2
Copper	29	1.8	69	.8	99	.3	113	.3	106	.3	102	.2
Iron ore	748	47.7	3560	40.0	18061	63.7	21655	62.5	31333	70.8	24650	59.6
Lumber	94	6.0	619	6.9	1806	6.5	1710	4.9	1610	3.7	782	1.8
Unclassified freight	129	8.2	417	4.7	605	2.1	681	2.0	848	1.9	843	2.0

The three commodities, iron ore, coal, and grain, including flour, made up the following percentages of the total: —

Year	Percentage	Year	Percentage
1881	77.6	1904	91.5
1891	85.8	1905	93.5
1901	90.3	1906	93.9
1902	91.7	1907	95.6
1903	92.0	1908	95.4

The above statistics do not indicate accurately the total amount of bulky freight passing through the canal; for while all except the unclassified freight is of a bulky kind, it does not follow that all of the unclassified is of high grade. In fact, it is probably for the most part of a distinctly low class. It must include such commodities as cement and stone, sand and clay, sugar, crockery, and tiling. It is therefore likely that the distinctly high-class freight bears only a very small ratio to the total tonnage passing between Lake Huron and Lake Superior.

From the standpoint of value the showing of high-grade commodities would be somewhat better, but it would still be relatively unimportant. There is a considerable traffic in package freight on the Lakes, but the conditions under which this is carried are exceptional, in that the packet lines are almost wholly under the control of the railways. There is thus no real competition in operation. The railways fix the rates in such a way as to send this traffic by water or rail as best suits their convenience. At best, however, this package freight is unimportant.[1] It is included under the unclassified freight listed in the above table.

The next table shows the tonnage on the canals of New York and the percentages of the leading classes of commodities for a series of years:[2] —

Year	Product of the forest	Per cent	Agriculture	Per cent	Manufactures	Merchandise	Other articles	Total
1840	587,647	41	393,780	28	100,367	112,021	222,231	1,416,046
1850	1,261,991	41	965,619	31	200,218	269,370	379,419	3,076,617
1860	1,509,977	32	1,682,754	37	268,759	250,360	938,364	4,650,214
1870	1,916,511	34	1,309,153	18	352,497	271,856	2,323,752	6,174,869
1880	1,566,764	24	2,408,358	38	278,114	355,165	1,849,255	6,457,656
1890	1,397,862	27	1,201,916	22	139,310	769,672	1,737,342	5,246,102
1900	726,984	22	511,518	16	142,784	250,436	1,714,219	3,345,941
1906	854,610	24	648,715	18	170,584	202,285	1,164,711	3,540,907

[1] For a statement of the package freight business on the Lakes, see *Preliminary Report of the National Waterways Commission*, pp. 48–52.

[2] *Report of the Inland Waterways Commission*, p. 224.

This table indicates a considerable falling-off in the percentage of products of the farm and the forest in recent years, but shows these two sources still to furnish over 42 per cent of the entire tonnage.

In the year 1908, "Manufactures" included the following commodities: —

Commodity	Tons
Domestic spirits	93
Furniture	50
Pig Iron	19,171
Bloom and bar iron	944
Castings and ironware	230
Domestic woolens	68
Salt	85,812

Under the heading "Merchandise" were included the following: —

Commodity	Tons
Sugar	40,056
Molasses	1,116
Coffee	2,114
Iron and steel	829
Flint, enamel, crockery, and glassware	58
Ice	122,675
All other merchandise	121,833

"Other articles" included the following kinds of freight:

Commodity	Tons
Stone, lime, and clay	1,053,759
Phosphate	20,414
Anthracite coal	358,572
Bituminous coal	140,209
Iron ore	29,114
Petroleum	123
Sundries	39,223

These tables show that practically all the traffic on the canals of New York is of low grade. "Furniture," "Domestic spirits," "Domestic woolens," "Coffee," and "All other mechandise" may alone fairly be considered as of high grade, and in 1908 these constituted only about four per cent of the total tonnage.

The same general situation exists on the Mississippi River system. Without giving a detailed statement of the tonnage of different commodities, it should be stated that "of the total freight movement, exclusive of harbor traffic and car ferries, . . . more than 56 per cent was coal and 20 per cent stone and sand. This was an increase of coal traffic since 1889 of 29.4 per cent, and in stone and sand of 1147 per cent."[1] On the Lower Mississippi, from Memphis southward, considerable quantities of general merchandise and plantation supplies are still shipped, but they now constitute only a small proportion of the total traffic.[2]

Between the years 1886 and 1902, 75 per cent of the entire traffic on the Ohio River was coal, and at the present time it is nearly all coal.[3] On the Monongahela River 84 per cent of the traffic is coal and 15 per cent sand and gravel, and on the Allegheny almost the entire tonnage is made up of lumber, coal, gravel, sand, and stone.[4] On the Kanawha, coal constitutes 90 per cent of the total, and timber and ties most of the remainder, while on the Big Sandy, timber and ties make up 94 per cent of the total traffic. On the Chesapeake and Ohio Canal, in 1906, coal constituted 88 per cent of the entire tonnage.[5]

4. Having considered the character of present waterborne freight in the United States, and the decline in traffic that has taken place on the majority of American rivers and canals during the last thirty or forty years, we may now inquire into the causes of this condition. The tendency has been to assign the practical failure of water transportation in recent years to two main reasons: first, to physical defects in the waterways, and second, to the unfair competition of the railroads. Let us, therefore, inquire in what degree

[1] Dixon, *Traffic History of the Mississippi River System*, p. 64 (*National Waterways Commission*, Doc. 10).

[2] *Ibid.*, p. 60. [3] *Ibid.*, p. 44. [4] *Ibid.*, p. 47.

[5] *Report of Inland Waterways Commission*, p. 1157.

these causes have been operative, and at the same time endeavor to ascertain whether there may not also have been other causes contributing to produce the decline in water-borne freight which has been observed.

a. It cannot be denied that one of the reasons for the failure of water traffic to increase in the United States of late has been the inadequate development of water lines. Many of the old canals are of insufficient depth to be of any importance in modern transportation. Other canals have been neglected and allowed to fill up with silt, while the wharves have rotted away for want of repair. Again, some of our canals are poorly located, "beginning nowhere and ending nowhere," as has been well said. These cannot play an important part as carriers of traffic. It is an absolute essential that water lines should connect with the important routes of traffic.

Many of our rivers are ill adapted to navigation on account of the existence of snags, sandbars, shifting channels, and alternating high and low water. The nonuniformity of depth, and the absence of connecting links between important water routes, have likewise been serious handicaps to the development of water traffic.

But, on the other hand, it must be stated that even where there are no barriers of the kind mentioned, the condition of water traffic in this country is little better. The Hudson River, for instance, is capable of carrying a most extensive traffic, yet statistics show the tonnage movement to be insignificant in quantity. The Erie Canal, which connects the Hudson with the Great Lakes, has a present depth of seven feet, as much as any of Germany's great inland water ways, except the Rhine River. On the Mississippi River below Cairo there is a channel nine feet in depth which is seldom obstructed by either ice or low water, and as far up as St. Louis there has been for many years a depth of eight feet during the greater part of each season. The extensive water traffic of Europe is carried on waterways which, with few exceptions, have depths less than this. We must, then, look to other causes than the inadequacy of present water routes for a complete explanation of the decline of water traffic.

b. In considering the part played by the railways in the decline of water-borne freight, it may be said at once that the waterways are unable to compete for freight which is of considerable value or which requires a speedy delivery. The superiority of the railways in handling high-class freight is universally admitted. As it was not until after the Civil War that the railways of the United States really came into their own, this diversion of high-class freight from the waterways is to a considerable extent reflected in the charts shown above. This obviously accounts, however, for only a small part of the decline which has taken place.

c. When we take up the case of the diversion of the low-class freight from its supposedly natural avenue, the waterway, it becomes necessary to inquire more closely into the situation. It is not sufficient to say that superior advantages offered by the railways for the carrying of low-grade commodities accounts for the wholesale diversion of such freight that has occurred. In order to get at the causes we must give careful attention to the history of this decline.

First, let us consider the competitive methods employed by the railways. The most obvious method at the command of the railroads for attracting traffic away from the waterways is by the cutting of rates on competitive freight. That the railways have lowered their rates in order to meet the competition of water lines is admitted even by railway men. Case after case has come before the Interstate Commerce Commission involving this point. This cutting of rates is oftentimes not so great as to eliminate all profit from the handling of the traffic; that is, something is still obtained above the direct cost of carrying the goods in question. It is undoubtedly true, however, that the railroads have not infrequently cut rates to a point so low that the returns were insufficient to cover the mere haulage costs, to say nothing of affording anything to apply in the payment of fixed charges. They have done this in the knowledge that, after the competing boat lines had been driven from the waterways, the rates by rail could be substantially increased. This latter practice may be regarded as an unfair means of competition, but the former not necessarily so. For it must be remembered that the operators of boat lines do not have to fix rates which cover the cost of the highway itself. Fixed charges do not concern them, for the waterways are constructed and maintained by the state. Consequently, when the railways lower their rates to a point where the returns yield little if anything to be applied in payment of fixed charges, where they only cover the haulage cost proper, they are simply competing with waterways on even terms. That the railways resort to this practice is no indication, then, that the waterways are inherently the cheaper means of transport. To settle that point, as we have elsewhere pointed out, the charges on fixed capital, as well as the haulage costs proper, must be included. But when the railways cut rates below the actual haulage charges for a time, in order to crush out competition, the case is somewhat different. We generally regard such practices, when employed by a railway or an industrial corporation, as unfair, and legislation attempts to prevent such means of destroying competition.

d. It is by other means, however, that the railways have most seriously damaged the waterways. A much more effective method of competition than the cutting of rates has been the refusal to coöperate with water lines in the handling of through freight. Inasmuch as a great proportion of traffic does not originate or find its destination immediately along water routes, it is imperative that they should have the coöperation of the railroads. The railways have possessed here a controlling advantage.

Testimony before the Cullom Committee of 1885 brought out the fact that the New York Central Railway practically forbade roads connecting with itself to accept any traffic that might come to them from the Erie Canal, by the threat of severing their own connections with such roads as refused to obey.[1] Further testimony stated that "the railroads west of the Mississippi River, running to the river and crossing the river, — unless they could be compelled to do so by law, — will not discharge their cargoes on the west bank of the river, but will carry them through to the Lake ports."[2] It is obviously to the advantage of the railways to carry this traffic through to Chicago, on account of the larger return from the longer haul. And so long as the total rate to final destination is not greater than it would be by a broken route, the shippers will seldom raise any serious complaint.

Wherever goods must travel a part of the distance by rail, the railway is in a position to adjust rates in such a way that the traffic will prefer to make the entire journey by rail instead of using the water route for a part of the distance. It can do this by refusing to prorate with the waterways on terms which will allow a broken route, the railway rate for the short haul to the waterway being placed so high that the combination rail and water charge is in excess of the all-rail charge. The railways thus hold the whip hand and the waterways must forego the traffic.

e. It is through the control of terminal and transfer facilities, however, that the railways have perhaps intrenched

[1] *Report of Cullom Committee on an Investigation of Interstate Commerce*, 1885, p. 367.

[2] *Ibid.*, p. 1297.

themselves most strongly. In nearly all the cities having important waterway terminals, the railroads control the situation in no small degree. In Philadelphia "the attitude of the railroads as to their frontage holdings has been highly exclusive and adverse to general water traffic. Railroads, as a rule, refuse any use of their piers for freight not going over their particular lines and oppose independent lighterage. Thus lighters cannot come to a pier to get freight for independent water or rail lines." [1] In Chicago the situation is, however, somewhat better. Although on the south branch of the Chicago River the city owns only street ends and about twenty-five hundred feet of wharves, the rest being owned by railroads and industrial concerns, nearly all of the Sanitary Canal is under public control. About seventy miles of frontage is reserved here, with a view to providing industrial sites.[2] The city of Milwaukee, on the other hand, owns no frontage of commercial importance. The larger portion is held by the railways, with some under the control of industrial companies.[3] In Buffalo "about half of the active river frontage is owned by the railroads, with some small holdings by water lines. Of the five miles on the two sides of the City Ship Canal, four miles are owned by railroads. On the Lake front the total frontage protected by breakwaters is about four miles, of which railroads own about three, subject to some dispute as to title. The city owns about three fourths of a mile, but, with the exception of two blocks, practically none of its frontage can be reached without crossing railroad property. The city owns and controls nine small docks at street ends." [4] Again, the railroads at Buffalo control much of the transshipping equipment, and the so-called "Elevator Pool" has often prevented the shipment of grain by canal.[5]

"At the terminals on the Mississippi system there is a

[1] *Report of Commissioner of Corporations*, vol. I, p. 10.
[2] *Ibid.*, p. 23.
[3] *Ibid.*
[4] *Ibid.*, p. 25.
[5] *Ibid.*, p. 33.

conspicuous lack of coördination between railroads and water lines, which has undoubtedly contributed with other causes to reduce the volume of Mississippi River traffic."[1] "In many cases all satisfactory terminal property has been acquired by the railways. For example, portions of the river front at Pittsburg, New Orleans, St. Louis, and Vicksburg are owned by railway corporations. The primary purpose of the railways is not to check the development of water transportation, but to secure desirable land for switch tracks and yards, yet its effect on the development of steamboat traffic is disastrous."[2]

f. Again, the railways have in many cases eliminated water competition by the outright purchase of canals, or by the control of boat lines. The cases of direct purchase of canals by railway companies are not numerous. The Ohio and Pennsylvania Canal of Ohio was purchased many years ago by the Mahoning Railroad Company, which raised the tolls so high that boating was not profitable.[3] The James River and Kanawha Canal in Virginia was purchased in 1880 by the Richmond and Alleghany Railroad, which assumed, also, outstanding obligations to the amount of $1,546,020.[4] In 1871 the Delaware and Raritan Canal was leased by the Pennsylvania Railroad Company for 999 years, and since that date it has been operated by that road. The Pennsylvania Railroad Company engages to pay ten per cent per annum on the total stock. Since 1894 there has been a considerable annual deficit from operation.[5]

The railways have more effectively eliminated water competition, however, through gaining control of boat lines on the waterways. Attention has been called, in another place, to the fact that as early as 1881 competition

[1] *Report of Commissioner of Corporations*, p. 33.

[2] *Report of National Waterways Commission*, Doc. 11, p. 68.

[3] *United States Census*, 1880, vol. IV, p. 30.

[4] Whitford, *History of New York Canals*, vol. II, p. 1376.

[5] *United States Census*, 1880, vol. IV, p. 31.

between the Ohio River boats and the railroads was almost nil. "The understanding between the railroads and the steamboat lines has not amounted to a pooling arrangement or a mutual participation in profits, but has sought to effect a certain distribution of freight, and has virtually removed competition as to rates between the two methods of transportation." [1] The Cullom Committee of 1885 found that "all of the canals of the United States, except the Erie, are now controlled by the railroads." [2] The majority of the boat lines on the Great Lakes are owned by the railways,[3] and even on the Erie Canal the railways exercise no little control over Canal rates on certain kinds of freight. The through Canal and Lake service for package freight is supplied by Lake lines, which charter boats and make rates for the through service. Since the railways own the Lake lines, and these in turn control the Canal shipments, the railways may be said to determine the rates that Canal boats may charge on this package freight. This does not apply, however, to the grain trade, and other Canal traffic.[4]

In various ways, then, the railroads have succeeded in restricting the growth of water traffic. By the cutting of rates on competitive freight to a point below the actual haulage costs until the boats are forced to suspend operations; by refusal to coöperate with the waterways in the carriage of through freight; by control of terminal sites and equipment; and by ownership or control of canals and boat lines, the railroads have come to dominate the situation almost completely. The knowledge that the railways have adopted such methods as these to defeat the waterways

[1] *Report on Internal Commerce*, 1881, Appendix, p. 56.

[2] *Report of Cullom Committee*, p. 507. "Control" is here meant in the sense that the boat lines are in the hands of the railways.

[3] For a complete list of the boat lines on the Great Lakes which are controlled by the railways, see *United States Census Publication on Transportation by Water*, 1906, p. 149.

[4] *Report of the Chicago Harbor Commission*, 1909, p. 188.

has raised a storm of protest, and developed the contention that, if the waterways were afforded protection from such crushing competition, they would speedily regain their former position in the transportation of the country. Such, indeed, might prove the case were there no other causes for the decline of water traffic than the unfair competition of the railways. We shall find, however, that the competitive methods in question by no means tell the whole story.

g. Until the time of the Civil War the Mississippi River enjoyed a large traffic, especially in grain for export by way of New Orleans. Directly after the war, however, this traffic began to go to New York as the port of shipment. "In 1872 the railways carried to market 83 per cent of the grain and provisions of the West."[1] It would seem that this extensive diversion of traffic to the Atlantic seaboard may be partially accounted for without reference to the unfair methods of competition discussed above.

Until the development of the through railway lines to the Mississippi in the sixties, the only outlet for the produce of the Mississippi Valley was by way of the river through New Orleans. The railway lines to the east gave a new, a much shorter, and at the same time a much safer route to the markets of the world. The advantage from the standpoint of distance is especially marked in the Upper Mississippi Valley, and it is here that the diversion to the east-and-west route was most rapid and complete. "The building of railroads west of the Mississippi River brought that vast territory almost completely into subjection to rail transportation. By 1879, seven eighths of the surplus products of the trans-Mississippi States north of Arkansas crossed the Mississippi River on railways at St. Louis, or between that city and St. Paul, and were transported east to local or foreign markets. Only 608,555 tons were carried

[1] *Report of National Waterways Commission*, Doc. 11, p. 38.

south by river in 1878, as compared with 4,583,844 tons moved east by rail by way of St. Louis and points north, from the territory west of the Mississippi."[1]

Again, the development of Chicago as the great primary grain market of the country would doubtless have resulted in sending grain eastward rather than to the south, even had the railways offered no differential rate advantage over the water route by way of New Orleans. And as a matter of fact, although at times the through charge from St. Louis to Liverpool by way of New York has been greater than that by way of New Orleans (when the railways to the Atlantic seaboard have been in agreement to maintain rates), much the greater portion of this grain has nevertheless gone by way of Chicago and New York.[2] The development of these east-and-west railroad facilities, and of primary markets like Chicago, obviously do not entirely account for the diversion of traffic from the Mississippi. The railway practices referred to above played no small part, as did also other causes soon to be discussed. No one influence alone can be said to have been decisive, and we must give each its due credit. With this in mind we may now consider another factor instrumental in the defeat of the waterways.

h. In striking contrast to the lack of organization everywhere present on the water lines, the railways of the country have developed very systematic methods, both in the carrying of traffic and in the attracting of it to their lines. "The freight lines have their agents in nearly all the local markets of the West who solicit traffic for them. The Erie Canal has no such agencies. It receives only such traffic as seeks it in consequence of lower rates."[3] The Cullom Committee in 1885 reported that "the last twenty years

[1] *Report of National Waterways Commission*, Doc. 11, p. 48.

[2] *Ibid.*, p. 56.

[3] *Report of the Cullom Committee on Investigation of Interstate Commerce*, 1885–86, p. 59.

have constituted a period of railway improvements in which the inventive genius and business talent of the country have been devoted to the newer and more rapid means of transport, while the artificial waterways have been comparatively neglected. But by far the most efficient cause of the relative increase of railway tonnage is to be found in the administrative organization of the railway companies."[1]

The contention is frequently made, however, that while it is true that the railways are far better organized than the neglected waterways at present, if the latter were now systematically developed and given an efficient administration, they would be able to more than hold their own against the railways. It is pertinent to inquire at this point, therefore, Why is it that the possibilities of water transportation have been neglected, if they are so full of promise? Why is it that we are confronted with the sorry spectacle of broken-down gang-planks, of deserted wharves, and boatless rivers and canals? Why has not private capital been lured into this unusually profitable field of investment? If a great waterway from the Great Lakes to the Atlantic Ocean or to the Gulf of Mexico could drive competing railways from the field, as is said, why have not our great business men seized the golden opportunity? Why did such men as Daniel Drew, Commodore Vanderbilt, and James J. Hill forsake the waterway business, in which they had been engaged, for the railway? The reason that practically everywhere in this country private capital shuns investments in waterways can hardly be because they are exceedingly profitable. In spite of the hundreds of millions of dollars that have been donated by our State and National Governments to the cause of water transportation, the water traffic of the country has steadily declined for many years. Private capital has not been willing

[1] *Report of the Cullom Committee on Investigation of Interstate Commerce*, 1885–86, p. 59.

even to build the boats and other equipment to make use of waterways, even where they are broad and deep enough to carry vast quantities of freight. If it be answered, perchance, that the reason private capital has been chary of investment in waterways is because of the cut-throat competition to which the railways subject them, it may still be asked why the railway men themselves have not extensively used the waterways as aids to the railroads if they offer great economies in the carriage of freight.

Even were private capital induced to develop water transportation, and were the inventive genius of the country now directed to that field of activity, it would seem still that it would be impossible to develop a waterway system comparable with that which exists on the railways, for the reason that waterways are inherently not so well adapted to efficient systematization as are the railroads. It is admittedly impossible to secure a uniform depth of waterways throughout the country; and even if we could secure a standard gauge on all our rivers and canals, there would still remain comparative disadvantages which the water routes could not overcome. The ability of the railways to extend their lines to every point of the compass, to develop a very network of branch and spur lines which can carry traffic from the most out-of-the-way source to any destination whatsoever, cannot be matched by any system of waterways that could be developed. Considerable attention will be devoted to these considerations elsewhere; hence they may be dismissed at present without further comment. It is sufficient to note at this place that the lack of systematization must always remain a handicap to successful competition with the railroads. Waterways are inherently not adapted to efficient organization. In the United States, moreover, the play of sectional interests and the influence of politics tend greatly to increase the disadvantages suffered by the water routes in this regard. While our railways are privately owned and have been developed on truly national lines, our waterway development has been spasmodic, in pursuance of no plan, and dependent upon the ability of sectional interests to secure appropriations for waterway construction in their particular districts.

i. Still other reasons for the diversion of traffic from the waterways are to be found in certain advantages offered by the railroads in the way of speed and protection of the cargo from injury during transit. Grain is at times required to be delivered at New York, in order to meet contracts for ocean shipments, sooner than it can be transported there by way of the Great Lakes and the Erie Canal.[1] Again, "railway transportation is preferred for grain in bad condition, since it sustains less injury when shipped in that way than by canal."[2] Unless the grain is perfectly dry, it is always liable to heat when carried for long distances in so large mass as is necessary when it is loaded into the holds of ships or barges. The same consideration prevents the extensive shipping of grain by boat in France, even though the distances there are much shorter than in the United States.[3]

In the case of flour, these considerations are still more important. Expeditious delivery of flour is a very frequent demand of shippers; and barrels of flour are often broken open if rough weather is encountered on the Lakes. It is worthy of attention, while we are considering this question of damage to cargoes in transit, that when a cargo is delivered to a railway company, the company assumes the responsibility and guarantees a safe and reasonably speedy delivery. It issues the shipper a bill of lading, which is a merchantable and bankable paper, and almost absolutely protects him against loss of any kind. On the

[1] *Report of Windom Select Committee*, p. 69.

[2] *Ibid.*, p. 59.

[3] *Bulletin de l'Association du Congrès International des Chemins de Fer*, 1910, xxiii, p. 1425.

contrary, if he ships by water he receives a mere receipt for his goods, and must go to the expense and trouble of having his cargo insured. This point of itself is very often sufficient to lead the shipper to choose the rail route without further consideration.

j. Inquiring still further, we find that another cause of the falling-off in water traffic in recent years has been the exhaustion of the supply of certain commodities which formerly traveled extensively by water. For instance, great quantities of timber were once found along the Wisconsin, St. Croix, and Chippewa Rivers, which in the form of logs was floated down these streams every spring. Every town of any size on the Mississippi between St. Louis and St. Paul was either a lumbering, manufacturing, or distributing point for logs, or a mere distributing centre for the rafts of laths, shingles, and various forms of manufactured lumber brought down from the upper river and tributaries. "The most important cause of decline in this lumber traffic has been the exhaustion of the lumber supply along the water courses, making it more feasible either to ship logs by rail to the mills, or to move the mills into the forest and ship out by rail the manufactured lumber."[1] "The New York forests have long since been denuded; and in recent years the Michigan supply has fallen off, and with it the Lake lumber business."[2] The results of this are seen in the decreased tonnage of forest products both on the Lakes and on the Erie Canal, as shown by the traffic statistics given above. In fact, all over the great Northwest the supply of lumber has been rapidly decreasing, and with its exhaustion has come an inevitable decline in water traffic.

Iron ore was once an important traffic on New York canals, but the relatively small output of the Lake Cham-

[1] *Report of National Waterways Commission*, Doc. 11, p. 51.

[2] Fairlie, "New York Canals," *Quarterly Journal of Economics*, 1900, pp. 219–20.

plain mines since the development of the vast deposits of ore along Lake Superior has resulted in a great falling-off in such traffic on the canals of New York.[1] There are many such cases as this. Some canals were early built for the exploitation of some particular source of traffic, but the subsequent shifting of industrial centres has completely changed conditions, and necessitated the abandonment of canals, or at least has destroyed their prosperity.

k. A final and very important cause of the decline in water traffic in recent years has been the decrease of traffic which originates near enough to water lines to avoid the necessity of transshipment. So long as industry was confined almost entirely to the river valleys, the problem of transshipment did not present itself. But with the extension of business to points off the river courses, the situation was greatly changed. When it became necessary to carry the produce a part of the way to destination by rail, whether it would go the remaining distance by water depended upon whether the cost of transshipping to the water route were greater or less than the saving in haulage by water for the remainder of the journey. And it seems to have been often true, even at an early day, that the cost of transshipment was prohibitive. The National Waterways Commission states that grain shipments on the Upper Mississippi River have now ceased almost entirely.[2] "When grain began to be produced away from the waterways, it had to be loaded first into railroad cars, and once in the cars it remained there until it reached its market. The movement of the wheat area northwestward to a region west of Lake Superior, and the advance of the corn area westward, enhanced this tendency."[3] This same tendency of the

[1] Fairlie, "New York Canals," *Quarterly Journal of Economics*, 1900, p. 220.

[2] *Report of National Waterways Commission*, Doc. 11, p. 39. What little grain is still produced near the rivers is almost wholly consumed by local mills.

[3] *Ibid.*, p. 68.

grain trade to make use of the railroads for the entire distance to market, inasmuch as it must in any case make use of them for a part of the distance, is true also in Germany. It is there recognized that agricultural produce, except that which is imported to be consumed in cities on the banks of water routes, cannot advantageously travel by water on account of the cost of transshipment.[1]

In the United States, on account of the very long haul afforded by the water route from Chicago or Duluth to the Atlantic by way of the Great Lakes and the Erie Canal or the St. Lawrence River, it has been often possible to make the transshipment from the railways at these primary grain markets. The saving in the long water haul is here sufficient to outweigh the cost of the transshipment. The considerations noted above, however, relative to grain in bad condition, and the frequent demand for speedy delivery in New York in order to meet foreign contracts, should not be forgotten. Grain in good condition, where speed is not demanded, can, however, usually travel by the Great Lakes and the Erie Canal, so long as tolls are not charged on the latter, at an advantage sufficient to offset the cost of transshipment at Western markets.

But in the case of grain which is not destined for export, the advantage is wholly in favor of the railroads. In this case there is an extra transshipment to be reckoned. In addition to that from rail to water at the Western markets, it must again be transshipped from water to rail in order to reach all those towns which are not located immediately upon the banks of waterways. "The increase in the transportation of wheat and corn by rail is due chiefly to the organization of through freight lines from all the principal points in the West to the interior points in the New England States, and the states of the Atlantic seaboard, such transport being practicable, notwithstanding the greater cost of movement per mile by rail, from the fact that grain thus

[1] See chapter IX, pp. 212–13.

carried is distributed directly to the consumers, and also because it thus avoids the terminal charges at Buffalo and at New York, formerly the chief distributing point of Western wheat and corn consumed in New England."[1] Even though the waterways are maintained entirely at Government expense, they have no chance to compete for the domestic grain trade.

In the case of the cotton traffic in the Southwest, we find the same transshipping considerations playing a decisive rôle in the fate of water transportation. "With the development of railways in the South after 1865, with the establishment of cotton manufacturing plants at various points in the South, the extension of cotton culture westward beyond the Mississippi into territory not served by waterways, and the change in method of purchasing, compressing, and shipping cotton, the waterways became of decreasing importance. The immense cotton territory extending up the Mississippi and along the Red, Ouachita, Arkansas, and White Rivers, which had sent its cotton to New Orleans wholly by water, began to ship its products by rail. . . . By 1880 shipments of cotton from the Arkansas and White Rivers had practically ceased."[2] So long as the agricultural and industrial development of the South was confined to the very banks of rivers, water transportation was profitable. But as soon as the development of railways made it possible to extend the culture and manufacture of cotton to outlying districts, the waterways were unable to hold their own. When the transshipping charges are included, the cost by rail is less than that by river.

There has been a great falling-off in the amount of coal handled by the canals of the State of New York. "The construction of railroads from the mines in eastern Pennsylvania to Lake Erie, which provided a shorter and more direct route than that *via* the Hudson River and the canals,

[1] *Report of the Windom Select Committee*, p. 54.

[2] *Report of National Waterways Commission*, Doc. 11, p. 58.

and without transfer en route, and the extensive use of bituminous coal, which is mined in regions not directly accessible for a canal movement, either east or west,"[1] have been set down as the causes of this decline. "The development of coal traffic has been one of the most important items in the expansion of railroad traffic; and the geographic situation of mines and markets explains why the canals, in their present condition, have not shared in this development."[2]

In the case of the Ohio River, "with the exception of coal, and to a slight extent lumber, commerce is now confined to short-distance movements between local points. In spite of the fact that along the Ohio River between Pittsburg and Cairo there are forty railway crossings, or terminals, this traffic reaches but a few miles from the river bank. Traffic requiring transfer and a rail haul for any considerable distance no longer makes any use of the river, but is handled the entire distance by rail."[3]

The only waterway in this country that has had a respectable increase in business in recent years, aside from the Great Lakes, is the Ohio River. And as we have seen, this increase has been due entirely to the movement of coal from western Pennsylvania to points on the Ohio and the Mississippi. It is a fact to be particularly noted, however, that this coal traffic requires no transshipment whatever. "Coal can be loaded direct from the mines into the barges and can then be transported without any rehandling to its destination, which is the river steamboat, the ocean-going steamship, the sugar plantation on the bay, or the railway coal yards on the river bank. In other words, the Mississippi system can at present handle traffic successfully which begins and ends within its banks, but traffic requiring transfer to the railways at any point on its course will have a tendency to resort to the railways for the entire distance."[4]

[1] Fairlie, "New York Canals," *Quarterly Journal of Economics*, 1900, p. 220. [2] *Ibid.*

[3] *Report of National Waterways Commission*, Doc. 11, p. 48.

[4] *Ibid.*, p. 69.

In the light of these considerations, it is evident that the failure of through traffic to develop on our waterways is to be attributed, in the main, to the inability of waterways to carry traffic the entire distance from source to destination. In other words, there is a real question as to whether it is possible for a broken rail and water route to carry traffic, even when the waterway is supported at public expense, as cheaply as a railroad can move the traffic for the entire distance. We shall have much more to say on this point in following chapters; and it may be dismissed for the present with the mere recognition of the fact that the various Government investigating commissions on water transportation, and independent students of the question, unite in attributing a considerable part of the failure of water transportation to expand in this country to the prohibitive costs of transshipments from rail to water, and *vice versa*.

It should be added that it is not alone in the case of a broken rail and water route that transshipment is a serious problem. Transshipment must often be made from small to large boats, and *vice versa*, on account of different depths of channel; and where this is necessary, the railways possess the usual advantage. For instance, it is said that "the diversion of commerce from the river to rail at St. Louis was aided by the fact that in river traffic transfers at this point were necessary. Because of the shallowness of the upper river, vessels of much less draft operate above the city than below. Because of this break in shipment, the railways found their opportunity to step in and take the business."[1] When to the river rate proper was added the cost of this transshipment from the smaller to the larger barges, the balance of advantage passed from the waterway to the railroads. Too much weight cannot be given to this point. Here was a case where the necessity of transshipment from one section of the river to another spelled the fate of water traffic. The Lower Mississippi was not dependent in this

[1] *Report of National Waterways Commission*, p. 39.

connection on coöperation with the railways. There were no unfair practices of any sort present. The necessity of transshipment simply prevented through traffic on the river.

5. The results of the above inquiry have indicated that the decline of transportation by water in the United States has been due to a large number of factors. In addition to the physical imperfections of the waterways, and what have been defined as unfair competitive methods of the railroads, we have found that many other influences have been equally important in producing the decline of water tonnage that has taken place. The development of the primary grain markets and the great trunk-line railroads from the Middle West to the Atlantic seaboard; the inherently inefficient organization of the waterways in contrast to the excellent systematization of the railroads; the considerations of speed, and of damage to grain in bad condition when carried by water; and, finally, the cost of breaking bulk, of transshipping en route, — these various factors have been of at least equal importance with the physical handicaps of the waterways and the unfair practices of the railroads in causing the decadence of water transportation. It cannot fairly be said, therefore, that, if the waterways of the country were improved and guaranteed protection from the railroads, their successful future would be assured. The other considerations mentioned above might still be found to be of sufficient weight in themselves to prevent any extensive development of water traffic. Before deciding to expend millions in the development of water routes, we should give careful attention, not only to the unfair practices of the railways, but to the many other factors that have been operative in the defeat of our present waterways.

Thus far our discussion has brought us to a twofold conclusion: first, that a large number of causes have conspired to produce the decline in water traffic that has taken place in the United States, that no one alone can be regarded as of determining importance; and, second, that the question of the feasibility of further waterway development can be decided only on the basis of a thorough-going scientific study of particular projects. It seems advisable, however, to postpone the consideration of such projects until we have taken up the study of water transportation in foreign countries. This will be found to clear up so many points of importance to our investigation that the subsequent discussion of specific projects will be greatly facilitated.

CHAPTER VI

THE BARGE CANALS OF GREAT BRITAIN

1. When discussing the causes of the movement for the rehabilitation of the waterways of the United States, mention was made of the part played by the apparent success of foreign canal and river transportation. Attention was also called to the current popular argument that if waterways are successful in Europe, then assuredly they can be made successful in the United States, with its unrivaled system of naturally navigable rivers. A second contention is also frequently made, to the effect that, if the United States would keep pace with other nations in the great struggle for industrial supremacy which is going on, she has no alternative other than to develop her waterways as European nations are doing.

Now, while it is unquestionably true that nations have in general much to learn from one another and that foreign example is frequently instructive, it is equally true, on the other hand, that where conditions are not substantially similar, it may be the worst of folly for a nation to follow in the footsteps of other countries. It has already been seen [1] that a large number of influences may condition the transportation development of any country, and it should be apparent that conclusions concerning the feasibility of waterways, when drawn from a foreign experience, are of little if any value, unless they are formed after a careful weighing of all the considerations which may affect the situation. It has seemed necessary, therefore, to devote considerable attention to a careful study of transport-

[1] Chapter IV.

ation in the principal countries of Europe. In so doing, two main questions have been kept constantly in mind: First, to what extent have the waterways of the different European countries been successful under the conditions there existing? And second, what conclusions, if any, may be drawn therefrom relative to the feasibility of waterway development in the United States? The first country to be considered is Great Britain.

No other country furnishes so favorable an opportunity for a comparative study of rail and water transportation as England, because there alone have both railways and waterways been from the beginning privately owned and privately operated. In contrast to the Continental method of strict governmental supervision or ownership of the agencies of transportation, England has consistently left the development of her transportation system in the hands of private companies. Rather than arbitrarily establishing freight rates which force certain classes of commodities to travel on the waterways, as has France; rather than building up a national system of canals and railways to serve national purposes, — commercial, military, and political, — as has Germany; rather than granting subsidies, — money for the building of canals; land, for the most part, for the construction of railways, — as has the United States, England has chosen to permit entire freedom of competition, and has aided neither canals nor railways, directly or indirectly. In this unhindered struggle for supremacy, the relative merits of the two systems of transport were put to the test of efficiency. The history of English canals and railways is consequently full of interest and suggestion to the student of transportation.

2. Similarly to the United States, England passed through an early mania for canal building, a period of great canal prosperity, followed by a gradual decadence, and, finally, a great wave of agitation for the resuscitation

of the languishing waterways. The chief steps in this history may be briefly traced.

The impetus to canal building in England was given by the Duke of Bridgewater about the middle of the eighteenth century. In order to secure an outlet for his valuable coal mines at Worsley, in Lancashire, in the northern part of England, he undertook the then tremendous task of building a canal from his mines to the city of Manchester. The waterway was opened in 1761. Encouraged by the rewards of the enterprise, the route was soon extended and by 1772 was opened for traffic all the way to Liverpool.[1] So great an improvement was this canal upon the previous means of transportation, and so large were the profits, that it brought canals into great favor and led to a veritable mania for canal building. In the year 1792 no less than eighteen canal schemes were promoted, and in the four years ending in 1794 as many as eighty-one canal acts were passed by Parliament. Many of the schemes were wholly speculative, and thousands of innocent investors suffered the losses which usually occur on date of settlement.

But such of the projects as were carefully considered and favorably located, proved unusually remunerative. They soon obtained a monopoly of all the traffic that had to travel any considerable distance. The ancient method of trucking was altogether unable to compete with the barges, and consequently all, except the speculative waterways, earned handsome dividends for their owners.[2] A vast system of canals was thus developed, connecting all the principal cities of England. By 1830 there were as many as sixty-nine canals and seventy-one canalized rivers in England and Wales, with a total length of 3669 miles.[3]

[1] *Report of the Royal Commission on Canals and Inland Navigations*, 1906, vol. VII, p. 3.

[2] Pratt, *British Canals; Is their Resuscitation Practicable*, 1906, pp. 16–17.

[3] Forbes and Ashford, *Our Waterways*, p. 295.

From Liverpool, Manchester, Birmingham, and London they radiated in all directions; while through connections enabled goods to travel the entire length of the country by boat.[1] As it was another twenty years before the railways were fairly established, the canals enjoyed practically a half-century of undisturbed prosperity.

3. But since about 1850, as in the United States, the water-borne traffic has steadily declined, coincidently with the development of railways. Many formerly prosperous canals have been entirely abandoned, others have been converted into railways, and a still larger number have been purchased by railway companies and are now used by them in conjunction with the railroads. "On a few waterways or sections of waterways, favored by special conditions, combined in two or three places with enterprising management, traffic has been maintained and even increased. On other waterways it has declined; on some it has virtually disappeared. Everywhere the proportion of long-distance traffic to local traffic has become small. Considered as a whole, the waterways have had no share in the enormous increase of internal transport business which has taken place between the middle of the nineteenth century and the present time."[2]

4. An agitation for the revival of canal transportation in Great Britain began about a decade ago, and culminated in 1906. Scores of resolutions appeared from boards of trade and chambers of commerce. Government select committees investigated the question, canal bills were presented in Parliament, and the public press was prolific

[1] "The largest part of the existing canal system had been completed by the end of the eighteenth century, and the whole of it, with the exception of the Manchester Ship Canal and a few short cuts or arms, was completed before 1830, the year of the opening of the Manchester and Liverpool Railway." (*Report of Royal Commission*, p. 3.)

[2] *Report of Royal Commission*, vol. VII, p. 5.

in articles showing the imperative necessity of rebuilding the waterways of the country. Literally dozens of projects were advocated and widely discussed, including a ship canal from Birmingham to Liverpool, and even a large steam barge canal from Liverpool to London. It was urged that the waterways should be nationalized, that the Imperial Government should purchase the present canals, deepen and widen them, and systematize the waterways of the entire kingdom.[1]

As in the United States, again, there were a number of causes leading to this agitation for waterway reconstruction. It was generally believed that the railways, having strangled the competition of the barge canals by purchase and control, and by unfair methods of competition, such as the wholesale cutting of rates at competitive points, had monopolized the transportation of the country and were charging exorbitant rates, to the injury of British industry. The magazines, feeling the public pulse, took up the cry, and article after article was published, showing how the railway companies were destroying the canals of the country. The conviction grew that it was absolutely imperative to subject the railways to competition, thereby forcing them to lower their extortionate tariffs; and it was believed that an efficient waterway system would achieve the desired result.

Then, second, there was a class of people, directly interested in canals, who hoped to benefit by their rehabilitation. If constructed at the expense of the state, the cost being distributed among all the taxpayers of the country, those shippers, favorably located and dealing in commodities adapted to canal transportation, would doubtless be benefited, though at the expense of the many taxpayers not directly interested in water transportation.

[1] Forbes and Ashford, *op. cit.* Chapter XII gives a very good description of the agitation. For an article indicating the character of the popular arguments, see Lee, "British Canal Problems," *Journal of Society of Arts*, December, 1904.

Then, too, the fact that vast sums of money were being expended upon canals and rivers on the Continent led many persons to believe that canals would be advantageous to England in its industrial competition with other countries, and that they should, therefore, by all means be reconstructed.

Finally, the movement was apparently given much support by the opinions of engineers. When once the agitation for a systematic development of the waterways of the country was aroused, the question of engineering practicability necessarily had to be decided; and constructing engineers soon pronounced the rehabilitation of the waterways as fraught with no insurmountable engineering difficulties. Immediately, thereupon, many people regarded the question as settled, failing to reflect that the proof of practicability from an engineering standpoint is not a demonstration of commercial feasibility.[1]

The contention was not advanced in England, as it is in the United States, that the railways were in need of relief from superabundant traffic. In other respects, however, the agitation for waterways in England rests upon the same general grounds as the waterways movement in this country.

5. The agitation resulted in the appointment, on March 5, 1906, of a royal commission on waterways. This commission was instructed to —

inquire into the canals and inland navigations of the United Kingdom and to report on: —

(1) Their present condition and financial position.
(2) The causes which have operated to prevent the carrying-out of improvements by private enterprise, and whether such causes are removable by legislation.

[1] For a good analysis of the causes of the British canal movement, see Pratt, *British Canals*, introductory chapter.

(3) Facilities, improvements, and extensions desirable in order to complete a great system of water communication.

(4) The prospect of benefit to the trade of the country compatible with a reasonable return upon the probable cost.

(5) The expediency of canals being made or acquired by public bodies or trusts and the methods by which funds for the purpose could be obtained and secured; and what should be the system of control and management of such bodies and trusts.[1]

The commission collected evidence from representatives of canal companies, of railway companies owning or controlling waterways, from traders, merchants, manufacturers, mine-owners, agriculturalists, waterway carriers, chambers of commerce, and county and city councils. Two hundred and sixty-six witnesses submitted testimony.[2] The report fills eleven large English Blue Books, and is of great importance because it furnishes us with practically the only reliable data on British waterways. The conclusions set forth below are consequently based largely upon a study of the evidence collected by the Royal Commission.

If the conclusions reached in the following pages be found to differ in some respects from those set forth in the "Majority Report" of the Royal Commission,[3] the reasons therefor will be stated in every case, and where data are necessary for the support of conclusions presented here, they will be drawn from those furnished by the commission itself. But before entering upon an analysis of the recom-

[1] *Report of Royal Commission*, vol. I, p. 11.

[2] *Ibid.*, vol. VII, p. 1.

[3] The Royal Commission was composed of nineteen members, only sixteen of whom signed the Majority Report. Five of these affixed their signatures, not because they agreed with the recommendations, but on account of the historical and other useful data that the report contained. Four of these five members submitted a series of twenty-eight reservations, stating wherein they disagreed with the Majority Report. Each of the three members who refused to sign submitted a Minority Report, stating the grounds of dissent.

mendations of the commission, it will be necessary to describe the present status of English waterways.

6. The condition of canals in England is almost as hopeless as in the United States. Unfortunately no early statistics of English canal traffic were ever kept, and it is accordingly impossible to show the precise extent of the decline of water-borne traffic which every one is aware has taken place. The only statistics that exist for the period before 1888 are those collected by the Select Committee on Canals (1881–83); and these are woefully incomplete and unreliable. But Sir James Allport submitted evidence to this committee, showing that the amount of coal brought into London from the Midlands and North of England by canals and railways respectively in the years 1852 and 1882 was as follows:[1] —

	1852	1882
Carried by canals	33,000 tons	7,900 tons.
Carried by railways . . .	317,000	6,546,000

Since coal has always comprised a large percentage of all the canal traffic of the country, this decline may be regarded as unusually significant. It should be observed that there was an absolute falling-off in canal tonnage, during these thirty years, of more than seventy-five per cent; and that, on the other hand, the tonnage carried by the railways increased more than twenty fold. Doubtless not all the canals of the country would show so large a diminished tonnage during this period, but unquestionably all of them would reveal a very heavy relative decline, even in coal, the commodity generally regarded as best adapted to water transport. The reasons for the decline of coal traffic on canals will be given presently.

While there are no statistics of the traffic in manufactures and general merchandise for this period up to 1882, it is a matter of common knowledge that such traffic has

[1] Pratt, p. 81.

now almost wholly disappeared from the waterways. The commission finds that by far the larger part of the total traffic at present consists of coal, iron ore, and pig iron; building-materials, — such as stone, brick, timber, cement, tile, and slate; road materials, — sand, gravel, and clay; manures and refuse; and some grain and food stuff; while in Lancashire and Yorkshire a considerable amount of wool and cotton still travels by water.[1]

For the past twenty years statistics of total tonnage for the principal waterways of England and Wales are somewhat more accurate. The commission has formulated a table, giving the tonnage and revenue for all the waterways of England and Wales on which full returns were obtainable, as follows: [2] —

	Miles	Year	Total tonnage	Total gross revenue	Total expenditures	Total net revenue
England and Wales	2416	1888	33,123,666	$9,122,965	$5,840,925	$3,282,040
		1898	34,022,493	9,275,530	6,845,950	2,429,580
		1905	32,340,264	9,553,560	7,237,975	2,315,585

This table shows a slight reduction in the amount of freight carried by water, even since 1888, when already the railways had become the dominant agent of transportation. In contrast with this continuing decline in waterborne traffic during this period, we find that the tonnage carried by the railways of the entire United Kingdom has increased by sixty-four per cent; from 281,747,439 tons in 1888 to 461,139,023 tons in 1905.[3] The total waterway tonnage for the entire United Kingdom in 1905 was 43,161,927 tons;[4] or a little more than one eleventh of the total freight tonnage of Great Britain. Were the *ton-miles* of traffic computed, the proportion carried by rail would be

[1] *Report of Royal Commission*, vol. VII, p. 61.

[2] *Ibid.*, p. 49. For the years 1888 and 1898 statistics for all the canals could not be secured. The above table comprises about three fifths of the total. In this table the year 1905 includes only those canals on which data for the previous years were available.

[3] *Ibid.*, p. 52.

[4] *Ibid.*, vol. IV, p. 3.

found to be even very much greater still, since by far the larger part of the water tonnage is, according to the commission, local traffic. Whereas, once boats commonly traveled all the way from Lancashire and Yorkshire to London, to-day practically all of the through traffic goes either by rail, or around by sea.

As regards revenue, it is to be seen from the above table that the total net revenue on these canals has decreased from $3,282,040 to $2,315,585, a falling-off of twenty-nine per cent.

The commission has also compiled a table for all the waterways of the United Kingdom, which gives some additional items of interest. The statistics for 1905 are reliable, but those for the earlier dates are incomplete as before. The table includes all of the canals and canalized rivers of the British Isles, whether independent, railway owned, or railway controlled:[1] —

Year	Total share and loan capital paid up	Total tonnage	Revenue				Expenditures				Net profit	Net profit per mile
			Tolls	Freight as carriers	Other sources	Total revenue	Management and maintenance	Transit expenses	Other expenses	Total expenses		
	$ 000	000	$ 000	$ 000	$ 000	$ 000	$ 000	$ 000	$ 000	$ 000	$ 000	
1888	155,030	182,305	4,485	2,180	1,500	10,145	4,135	235	5	6,515	3,630	
1898	220,255	208,000	5,675	3,975	2,180	11,930	3,625	3,210	1,865	8,710	3,220	
1905	237,750	215,805	6,595	4,140	2,665	13,400	4,000	3,305	2,145	9,455	3,945	$ 845

From this table it would seem that for the entire United Kingdom, the net revenue from waterway investments is increasing. This is not actually the fact, however, because the amounts for 1888 and 1898 are far too low, due to incomplete returns. An important fact brought out by the table is that about one fourth of the total revenue comes from "Other sources." Most of this increased revenue is derived from the increase in rents of property be-

[1] *Report of Royal Commission*, vol. IV, p. 3.

longing to the canal companies, and from the supply of water, cranage, haulage, etc.[1] Since the expenses connected with these other sources are practically nil, the net income from "Other sources" is by far the largest item of profit. In fact, the total net profits are but little more than the amount of this outside revenue.

The amount of the annual revenue in comparison with the total paid-up capital is interesting. In 1905 the paid-up capitalization was $237,753,840, or $50,880 per mile. While these figures include the Manchester Ship Canal, which considerably swells the average capitalization per mile, they include, also, 812 miles of open river, needing no improvement whatever, and 1312 miles of rivers requiring only a small amount of canalization to make them navigable.[2] This is more than sufficient to counterbalance the effect of the Manchester Ship Canal on the average construction cost per mile. Taking the average cost given above, therefore, as approximately that of the small canals, we find that there has been expended upon the narrow barge canals, with an average depth of only four or five feet on the sills at the locks, over $50,000 a mile, giving a capitalization about one fifth that of the great railway system of England, and almost as great per mile as that of the railways of the United States. The total net revenue per mile on these waterways in 1905 was $845. If the entire amount were applied in the payment of dividends, the rate on the total capitalization would equal .0166. The fact is that only in rare instances are earnings distributed to shareholders; the scanty profits being usually devoted to improvements. This net revenue, it should be recalled, includes the revenue from "Other sources," without which the net earnings would be practically negligible.

It has thus been seen that the traffic on the waterways of Great Britain has steadily declined since about the middle of the last century; that practically the only traffic

[1] *Report of Royal Commission*, vol. VII, p. 52. [2] *Ibid.*, p. 20.

now carried by the waterways is of a bulky nature and of small value; and that this sort of traffic is on the wane and altogether insufficient in amount to make canal transportation profitable. It will be of interest now to ascertain the causes responsible for this condition.

7. Since the palmy days of canal transportation, before the railways had appeared as competitive carriers, there has taken place a complete transformation in the methods employed in practically every branch of industry. The introduction of the telegraph, the telephone, and, be it said, the railway itself, has completely revolutionized commercial conditions, rendering almost the entire internal trade of such a country as England retail in character. The primary demand on the part of shippers is for speedy and certain delivery. It has come to be recognized, in these days of small margins of profit, that the most successful business man is he who allows the least portion of his capital to lie idle. The frequency of the turn-over of the stock of goods is the test of efficiency. Capital tied up in stock which lies idle for a considerable period of time is capital wasted. Hence, business men have now taken to ordering in smaller quantities, but at more frequent intervals, than they formerly did. In order, however, to keep but a small stock on hand, and yet never fail their customers, they require a rapid and certain means of transportation. For quick and dependable service, the railways are much superior to any inland waterways which could be constructed. Some of their chief advantages were well stated before the commission by Mr. Fay, the general manager of the Great Western Railway Company. Asked why he thought the railways were able to divert traffic from the waterways, he replied, "Firstly, the canals only carry from one point to another, from A to B or C, as a rule, whereas railways can carry from A to the rest of the alphabet, and *vice versa*. Traders naturally prefer to deal with the carrier which can

take their traffic to all points, and can accept from all places. Secondly, a manufacturer who has a siding to his works can himself run railway wagons to any part of his manufactory, and has neither to lay out nor build his works to suit a fixed spot for the receipt and dispatch of goods, as in the case of a canal. Thirdly, there are more privately owned railway wagons in the country than there are railway-owned, and it is to the interest of owners to keep their wagons continuously moving. That is more particularly the case in connection with the colliery business, and tells very much against the canals."[1] In regard to this statement the commission says that "there is a considerable degree of truth in the argument for certain classes of goods," but adds that " it does not follow that waterways, if they are given a stronger administration and an improved carrying capacity, will not, as in other countries, be extensively used for that class of traffic which is, by its nature, most suitable for water carriage."[2] The commission thus acknowledges, and, in fact, it is now almost universally recognized, that canals are adapted only to slow-moving, bulky traffic of small value. It will be our purpose accordingly to devote all of our attention henceforth to the question of bulky freight. It will be advisable to consider first the present condition of such traffic, for it will be found that this study will throw much light upon the possibility of an increased tonnage in case the waterways were enlarged and systematized.

8. By far the most important waterway traffic, wherever waterways exist, is coal. In fact, so important is the coal traffic in water transportation that it can almost, if not quite, be said that the deciding factor in the canal question is whether coal will travel extensively by water. In the year 1905, on the fifteen most important waterways of the United Kingdom, the coal tonnage was 9,727,972,

[1] *Report of Royal Commission*, vol. VII, p. 80, footnote. [2] *Ibid.*, p. 82.

out of a total waterway traffic of 21,494,631 tons; or forty-five per cent of the entire amount.[1]

By far the most important coal traffic in the Kingdom is that between the Yorkshire and Midland region and the metropolis of London. The commission has collected much valuable data as to the present state of this traffic, and has summarized in the following table the amount of coal coming to London by rail, by sea, and by canal:[2] —

Year	By rail	Per cent	By sea	Per cent	By canal	Per cent	Total
1880	6,200,780	62.5	3,714,708	37.4	4,079	0.045	9,919,567
1888	7,619,223	60.9	4,887,583	39.0	12,541	0.098	12,519,347
1898	6,954,206	48.6	7,337,062	51.3	13,808	0.097	14,305,076
1900	7,742,269	49.2	7,988,250	50.7	15,484	0.098	15,746,003
1901	7,399,908	49.1	7,652,137	50.8	13,489	0.090	15,065,534
1902	7,360,890	47.7	8,069,898	52.2	16,686	0.108	15,447,474
1903	7,101,903	47.1	7,969,903	52.8	15,981	0.106	15,087,787
1904	7,141,567	46.3	8,285,409	53.6	18,870	0.122	15,445,846
1905	7,137,473	45.6	8,494,234	54.3	18,681	0.119	15,650,388
Totals	64,658,219	50.1	64,399,184	49.8	129,619	0.100	129,187,022

It should be recalled that in 1852 the amount of coal traffic carried to London by canal was 33,000 tons.[3] It is at present but little more than half that amount, though it has been increasing slightly during the past few years. The totals in the tables show that since 1880 only one tenth of one per cent of this very important traffic traveled on the canals, even though they connect directly with all the great colliery districts. On the other hand, 49.8 per cent of the coal coming to London is brought by sea. It is to be noted also that the percentage of that carried by sea has steadily increased. The reason for this is that it can be brought in large boats in tremendous quantities and unloaded directly to the holds of ships bunkering for long ocean voyages. It can also be unloaded conveniently at the great wharves along the Thames, whence it can be carted directly, or carried in railway cars, to its destination.

Between 1852 and 1880 the amount carried by the rail-

[1] *Report of Royal Commission*, vol. VII, p. 61. [2] *Ibid.*, p. 66. [3] See p. 105.

ways increased from 317,000 to 6,546,000 tons, since which time it has averaged 50.1 per cent of the total.[1] This is five hundred times the amount brought by canals during the same period of time. Is this surprising condition due to the insufficient size of the present waterways and to the lack of organization, or is it because the railways are inherently better adapted to the needs of coal shippers?

Coal is shipped to London for three chief purposes: for fuel in ocean-going vessels, for fuel in manufacturing and industrial establishments, and for household consumption. It has already been seen that in supplying the ships there is every advantage in bringing it by sea to London and unloading directly to the ocean vessels. Neither the canals nor the railways can hope to secure this traffic in face of the open-sea competition. Hence we may omit this from consideration, and direct attention to the coal needed by factories and manufacturing concerns of whatever kind.

It comes somewhat as a surprise at first to learn that the railways have a tremendous advantage over the canals in supplying factories with fuel. It would seem that coal might be sent down to London by canal in large quantities and unloaded to suit the needs of the various plants in a very satisfactory and economical manner. The fact is, however, that it can be much more economically and more satisfactorily carried by the railroads. A prominent railroad man, Mr. A. C. Briggs, testified before the commission that, in the case of coal for large establishments, "the railway can very often take it in the sidings actually to his boilers, if he be a manufacturer; if not, it takes it to a wharf where carts can be actually backed against the truck; the coal is at a higher level and it takes very much less labor to lift the coal, or shovel the coal into the consumer's cart out of the truck, than it would out of the barge."[2] Or, the trucks may be emptied by tipping directly into carts, effecting a very great saving.

[1] See p. 105. [2] *Report of Royal Commission*, vol. VII, p. 224.

Still another consideration, of the first importance in counting the cost, is that of loading at the colliery. If it is to be shipped by canal, the coal has either to be carted or carried by rail for a considerable distance from the mine to the banks of the waterway; for it is of course utterly out of the question to be continually extending lateral canals as the source of the coal moves from place to place. On the other hand, a railway side-track can with little difficulty be run almost anywhere to the very mouth of a mine. The cars can accordingly be loaded directly at the colliery and sent to any destination, without delay, and without the extra costs of transshipments. When once it is loaded on the cars, it becomes a sheer waste of money to haul it a short distance, then transfer it to a waterway, from which again it must be laboriously unloaded, and more than likely carried to its final destination in railway cars. This question of transshipment is ever protruding itself. We have seen how the same consideration was fundamentally important in our own country. Everywhere it is one of the most important aspects of the problem. It is in the standard gauge and inexpensive siding, making it possible to send a railway car to any point of the compass, that one of the greatest advantages of the railway lies.

Finally, in London there is the very important traffic in house coal. Here, again, the railways possess a great advantage, and for various reasons. It is of course immediately apparent that the cost of transshipment from railway to canal and back again is to the disadvantage of the waterways as before. That argument need not be reiterated. In the second place, much the greater part of this coal is handled in London by small dealers. With these men, as with retailers generally, a small stock and a rapid turn-over is essential if the business is to be made profitable. Consequently their orders are for small quantities at a time, and for prompt delivery. Mr. Bury stated before the commission that the Great Northern Railway

Company, with which he is connected, built some large railway cars which were able to carry from thirty to thirty-five tons of coal each, but the traders, to use his own words, "would not look at them. The ordinary order for house coal is from a householder whose cellar does not hold more than eight or ten or twelve tons and he wishes it in these amounts."[1] Consequently, the small railway truck is of very convenient size to meet the needs of these shippers. On the contrary, the capacity of the barges on the present waterways is as a rule from thirty to fifty tons. The same objection evidently applies to their use as to the large railway cars. The reason for the predominance of small shipments is to be found in the prohibitive cost to small dealers of providing warehouses or storage place in London. Without attempting to push the point too far, it must be considered as a strong argument against the use of canal barges.

A more important point for the coal dealer to consider, however, is that if he orders by boat, he must accept delivery at the boat's side, transfer the cargo to carts, and haul it perhaps for miles across the city to customers; whereas, if he orders by rail, the cargo will be delivered on the siding in whatever part of the city he desires. The advantage of the railways in this connection is decisive.

Finally, breakage of coal is much more serious in barges than in small railway cars. Mr. A. C. Briggs, before quoted, stated before the commission that there is not half the breakage by rail that there is by canal barges.[2] He explained that while the broken fragments can be disposed of for various purposes, it must be at a price reduction of from \$.40 to \$1.80 a ton.

9. Turning now to building-materials, it appears again that certain railway advantages have combined to divert from the waterways a large share of their "natural" traffic.

[1] *Report of Royal Commission*, vol. VII, p. 223. [2] *Ibid.*, p. 224.

Such commodities as brick, stone, timber, tiles, drain-pipes, and road materials are frequently handled more expeditiously and more conveniently by rail than by canal, considerations which more than counterbalance the less cost of actual haulage on the canal. For instance, a London builder in the heart of the city, who secures his materials from Yorkshire, must, if they are shipped by canal, have them carted several miles across the city from the terminus of the Grand Junction Canal at Limehouse, where they are unloaded, to the site of the building operations. Since, on the other hand, he can secure them quicker by rail and have them delivered near at hand, he is practically never disposed to make use of the waterways.[1]

Again, as in the case of coal, the size of the shipment of building-materials is often an important factor. An instance of this in the brick traffic between Peterborough and London was cited to the commission by Mr. Bury. "The traffic amounted to about 1,000,000 tons a year, and formed a suitable material for large [railway] wagons; but the consignees would not accept large consignments on the site where the bricks were required, and neither would they agree to the bricks being unloaded and stacked at the station, inasmuch as double handling would be necessary, the cost of which the consignees were not prepared to bear."[2] It is apparent, therefore, that the barge-load of thirty or forty tons is not adapted to the needs of these shippers. A small carload of eight or ten tons is convenient, hence the railways secure the traffic.

10. The northern counties of England constitute the greatest cotton manufacturing district in the world. The raw cotton which supplies the mills is imported from abroad. One might naturally expect that, since practic-

[1] Pratt, *Railways and their Rates*, p. 343.

[2] *Report of Royal Commission*, vol. VII, p. 225. (Minority Report.)

ally all of the inland manufacturing towns have waterway communication with the great *entrepôt* of Liverpool, the bulky raw cotton would be distributed to the manufacturing districts by means of canal barges. The fact is, however, that nearly all of the cotton is carried inland by rail. Again, the size of the cargo preferred by the shippers seems to be a determining factor. The spinners do their business on a comparatively small scale, and they prefer to telegraph or telephone to Liverpool for the amount of raw cotton required from time to time. If it were brought in barges, warehousing space would be required for the surplus which could not be immediately used. Rather than incur this expenditure, and at the same time tie up capital in stored cotton, the cotton men naturally prefer to use the small railway car, which can promptly deliver the goods in the quantities desired.

11. Agricultural commodities are among those commonly regarded as adapted to water transportation. The commission, however, reports that the agricultural produce carried by English canals is insignificant in quantity. "The Grand Junction Canal, for instance, passes across nearly one hundred miles of farm lands in order to reach London. In 1905, it carried but 5812 tons of agricultural produce, out of a total canal traffic of 1,794,233 tons."[1] The reasons presented by the commission in explanation of this condition are as follows: First, the farmers buy and sell their commodities in small quantities, and they find the railways more convenient. Second, the farm roads lead to the railway stations and loading-places, and do not connect with the canals. Third, canal transportation is too slow for the daily deliveries of the products of the dairy, in which there is a large traffic in England. Finally, the warehousing facilities along the canals are hopelessly inadequate to meet the farmers' needs.[2]

[1] *Report of Royal Commission*, vol. VII, p. 62. [2] *Ibid.*

12. Small as is the traffic on British inland waterways at present it would be even less than it is, in the absence of certain exceptional conditions. It is, of course, true that the general conditions governing the transportation of bulky commodities which we have been discussing are not applicable to every ton of such traffic. Under especially favoring circumstances some coal and building-materials may still advantageously travel to London by canals, and some cotton and agricultural produce may continue to be economically shipped on the waterways. But this can account for but a small part of the canal traffic that still remains.

A large amount of the existing tonnage is to be explained by the fact that factories were constructed on the banks of canals long before the days of railways, and that an industrial inertia operates to prevent their removal, or the giving-up of the accustomed means of transport. In some cases, it must be said that there would, indeed, be little advantage in a change. For example, in the north of England many flour mills are located along canals. Barges bring the wheat to these mills directly from unloading vessels in Liverpool. They can tie up alongside the large boats at the dock, be loaded directly, and again unloaded readily from the barges to the mills on the banks of the canals. The conditions are here rather favorable for water transport. The cost of transshipment is small, the size of the barge cargo convenient for the millers, and the question of speed not important. Hence the traffic is not inconsiderable.

Again, we find that London is decentralizing. Many factories are moving out from the heart of the city because of the high rents which must be paid in the metropolitan district. They locate on the banks of the canals, but conveniently also to railways. When they have large orders of certain classes of freight, — biscuits, for example, on which the London cost of cartage is not heavy, — they often make use of the waterways. Since the distance is short, the question of speed hardly enters. Nevertheless, practically all of the smaller orders are sent by train, and the total of such waterway tonnage is by no means great. It should be borne in mind, also, that in all these cases, if the canals were not already constructed, no private capital could be found to build them for the sake of the small traffic which the present waterways still retain.

There is still another important reason for the continued use of these old canals. The commission reports that "the survival of the existing traffic in England is probably due, to a considerable extent, to the character of the labor employed. Just as in many parts of the country, farming is most successfully carried on by a small farmer and his family, so inland navigation is mainly worked by families of small means living day and night in the barges."[1] The motive power is generally a horse, which the husband, with usually a lad to spell him when he becomes weary, leads along the towpath on the banks of the canal. The wife, meanwhile, rides on the barge and holds the tiller. There has been practically no improvement in this primitive method in generations. The bargemen are of course opposed to any innovation which might imperil their means of livelihood. When recently a Londoner traveled over many of the canals of England in a motor boat, with the view to the introduction of electric traction on the waterways, he was rudely received by the canal bargemen. Learning his purpose, they assailed him from the banks and bridges with all manner of missiles. Were it not for the character of this labor, for inertia, and for the few special conditions enumerated, practically all of what little waterway traffic remains would be diverted to the railways.

13. In the foregoing paragraphs the present status of British canals and inland navigation, as detailed in the

[1] *Report of Royal Commission*, vol. VII, p. 57.

report[1] of the commission, has been described; and reasons have been presented which it is believed account for the failure of the waterways to retain their former position in the transportation business of the country. The commission, however, designates three main causes for the decline of waterway traffic in Great Britain, as follows: the lack of warehousing and terminal facilities; the lack of organization and systematization; and the control of a considerable portion of the waterways by railway companies.[2] As regards the first two of these causes, the commission states that the canal owners have failed to provide loading facilities, terminals, and storage accommodations for the convenience of shippers, and that the canals are controlled by a large number of small owners, which has militated against their systematization. Accordingly they are of varying width and depth; thus preventing the use of large boats for through traffic, — this, because the capacity of the smallest link in the chain of waterways determines the size of the barge that can travel over the entire route. Contrasting this lack of system and equipment with the excellent terminals and commodious warehousing facilities of the great railways, with their standard gauge, and rapid through service, the commission thinks it is easy to understand why the canal owners have become doubtful of the future of waterways. Let us see if these causes are not more apparent than real.

It has been seen that in the earlier part of the nineteenth century canals had a virtual monopoly of the transportation business of England. They possessed, therefore, the tremendous competitive advantage of a well-established trade. On the other hand, the railways, new and experimental, possessed nothing except inherent possibilities. Overcoming the tremendous handicap of the long lead

[1] When the report of the commission is referred to, the majority report is always meant. Whenever a minority report is referred to, it will be specifically named.

[2] *Report of Royal Commission*, vol. VII, p. 82.

obtained by the canals during the half-century of their uninterrupted prosperity, the railroads succeeded, in a surprisingly short space of time, in diverting from the canals the greater part of their traffic and in gaining a complete ascendancy. Since English canals were privately owned, there was unquestionably every incentive to keep them in a condition to compete successfully with the railways. The canal owners, facing the possibility of a destruction of their vested interests, cannot reasonably be considered as having been apathetic in regard to the future of the waterways. The canal companies lacked a systematic organization, it is true, but it must be remembered that in 1850 the railways were equally unorganized. The railway men had to build the great systems which to-day exist. They had to provide themselves with expensive warehousing facilities and costly terminals. With the same incentive and the same free opportunity, why did not the canal men at least keep pace with the railway men in these improvements?

We may now consider the third factor to which the commission assigns the decline of water transportation, namely, that the railways have purchased many of the canals of the country and have contrived to strangle competition. Mr. Inglis, in his minority report, contributed some interesting information as to the reasons for the purchase of canals by the railway companies. He says, "The scared canal companies themselves thought to safeguard their own interests, as far as they could, at the expense of the railways. In some cases such pressure was brought to bear on the railway companies that they were compelled to take over certain canals as a condition of getting authority to construct their proposed lines. In other cases the canal companies obtained Parliamentary powers to build railways, with the express design of compelling the railway companies to buy them out. In still other cases the railways deemed it prudent to purchase, to take over, or to guarantee the interests of canal companies without being actually forced so to do. But whatever the precise reason, the canals were not, in the great majority of cases, voluntarily acquired by the railway companies." [1]

Even if it could be shown that the railways dealt unfairly with the canals, this fact would furnish no argument that the canals should be reconstructed. In the case of neglected governmental waterways there might possibly be some occasion for contending that the fight for supremacy had not been won by the naturally most efficient agent of transportation. Where, however, perfect freedom of competition has existed, as in England, such a contention cannot fairly be made. One would rather have expected to see the canals purchase and cripple the newly developing railways than the reverse. It is usually the industry that is strongly intrenched that buys up and destroys struggling would-be competitors, instead of potential competitors purchasing the old established interests. That the railways were able to enter an already appropriated field, and in a few short years entirely dominate the transportation business, would seem to be strong circumstantial evidence of their superiority over canals, rather than the reverse. At any rate, the burden of proof would seem to lie with those who contend that it is the superior agent that has succumbed in the struggle for supremacy.

14. Now, as to the specific recommendations of the commission. The report states that if the waterways of Eng-

[1] *Report of Royal Commission* (*Minority Report of Mr. J. C. Inglis*), p. 207. Mr. E. A. Pratt, in his book on *British Canals*, has made the same contention, and he quotes from the general manager of the Great Western Railway, which owns more canals than any other railway company, to the effect that " his company owned about 216 miles of canal, not a mile of which had been acquired voluntarily. Many of these canals had been forced upon the railway as the price of securing acts, and some had been obtained by negotiation with the canal companies. The others had been acquired in incidental ways, arising from the fact that the traffic had absolutely disappeared." (Pratt, *British Canals*, p. 38.)

land were improved and systematized, as they are on the continent of Europe, a large traffic would undoubtedly develop, and that the trade of the country would undergo a decided stimulus. To use the words of the report, "There can be no question that trade would be largely increased upon waterways, or at any rate certain main routes of waterway, if they were placed under a uniform administration; if they were so far improved as to enable horse traction to be more largely replaced by steam or electric traction, to allow of economies of time and labor in the transport of goods; if arrangements existed for the running of regular services and for the supply of ordinary facilities for loading, unloading, and protecting goods, and for collection and delivery; and if transit upon them were cheaper to a substantial degree than transport by railway." [1] Accordingly, the commission has recommended the improvement of four main waterway routes as a start in the programme of reconstruction. From the present radiating canal centres of Birmingham, in the Midlands of England, it is proposed to construct, as trunk lines in the new system, four chief routes leading to the four corners of the country, as it were, and connecting with the estuaries of the Thames, Mersey, Severn, and Humber Rivers.[2] (See the map on the opposite page.)

Route I is the present principal water route between London and Birmingham, *via* Norton Junction and Warwick.

Route II extends from Hull *via* Trent Junction and Leicester, to Route I at Norton Junction.

Route III is the principal route from the Mersey River and the Manchester Ship Canal to Birmingham, *via* the Haywood and Fradley Jnnctions.

Route IV connects Birmingham with the estuary of the Severn River *via* Worcester.

It is the opinion of the commission that these four routes

[1] *Report of Royal Commission*, vol. VII, p. 84. [2] *Ibid.*, pp. 93–94.

SCOTLAND
NORTH SEA
IRISH SEA
Liverpool
Mersey R.
Manchester
Manchester Ship Canal
Hull
Humber R.
Route No. II
Br. Route No. III
Nottingham
Trent Jc.
Haywood Jc.
Fradley Jc.
Leicester
Wolverhampton
Br. Route No. IV. a
Birmingham
Worcester
Warwick
Norton Jc.
Br. Route No. I
London
Thames R.
Bristol
Severn R.
ENGLISH CHANNEL
FRANCE

might be so improved as to permit the cheap transport of minerals and goods which do not require the highest speed, such as import raw materials, and coal, building-materials, hardware, explosives, and other commodities of large bulk.[1] These water routes would unite practically all of the great coal and mineral regions of England, and at the same time connect directly with the four great seaports of London, Liverpool, Bristol, and Hull, and with the Manchester Ship Canal, extending from Liverpool to the great inland port of Manchester. There can be no question that these routes are well chosen, and that these, if any, are the ones which should be reconstructed.

15. The commission was instructed to ascertain "the prospective benefit to the trade of the country, compatible with a reasonable return on the probable cost." Consequently, an attempt was made to secure an approximate estimate of the cost of carrying out the improvements recommended above. The following table gives the derived estimates for a 100-ton and a 300-ton barge capacity:[2] —

TOTAL COST OF THE ROUTES

Route	100-Ton Scheme			300-Ton Scheme		
	Distance	Cost	per mile	Distance	Cost	per mile
	Miles	$	$	Miles	$	$
Route I, and Branch I . .	150+	26,385,770	175,085	150+	49,794,185	330,550
Route II	144+	11,171,650	77,340	142+	18,795,830	132,170
Route III, and branches from Wolverhampton to Trent Junction	141+	18,554,320	131,145	141+	35,297,185	249,485
Route IV, and branch to Wolverhampton . . .	108+	10,855,675	100,460	108+	18,681,915	172,965
Total	544+	66,967,415	122,945	542+	122,569,115	225,975

While the commission did not definitely commit itself as to which barge capacity it deemed preferable, the 300-ton boat was evidently favored, all the estimates of traffic

[1] *Report of Royal Commission*, vol. VII, p. 94. [2] *Ibid.*, p. 145.

being based on the 300-ton scheme. Indeed, if water transportation is to be "cheaper to a substantial degree than transport by railway," and this is absolutely essential to the success of the enterprise, at least a 300-ton capacity must necessarily be provided. Almost the whole assumption of the inherent cheapness of water transportation is dependent upon a large cargo. It is generally considered, in the United States, that nothing less than barges of 1000 tons' capacity can reclaim the traffic from the railways. On the waterways of Germany there are few barges with a capacity of less than 600 tons, and in France the 300-ton "péniche flamande" is the prevailing boat now in use. In view of these facts, we may dismiss the 100-ton scheme from consideration.

16. In attempting "to ascertain the prospective benefit to the trade of the country compatible with a reasonable return upon the probable cost," the commission undertook an investigation of the traffic possibilities upon the proposed routes, and the savings that might be effected as compared with present transportation in England. On the basis of a total cost of $122,569,115 for the four routes of waterway, it was computed that when the canals were in operation the annual Government expenses, on account of maintenance, administrative charges, and loss of interest, would amount to $4,825,000. The next step was to ascertain the amount of traffic necessary to yield a net revenue equal to this sum; and it was found that "at 0.2 pence (4 mills) per ton-mile, the total ton-mileage of traffic required will amount to 1,158,000,000."[1] Since the existing traffic may fairly be regarded as certain to continue on the improved waterways, in order to find the increased tonnage necessary, we may subtract the present tonnage from the above estimated totals. "The existing

[1] *Report of Royal Commission*, vol. VII, p. 157. This rate of 4 mills is the government toll. To ascertain the total cost to the shipper, the haulage charge must be added to this amount.

tonnage on these waterways amounts to about 16,600,000 tons. If it is assumed that the average travel is twelve miles, the present traffic amounts to 199,200,000 ton-miles. Additional traffic would therefore be required, amounting to 958,800,000 ton-miles, to meet the total expenditure when in the course of years the whole scheme of improvements had been completed."[1] What are the probabilities of so heavy a traffic being developed?

17. In an effort to ascertain how great an increase of traffic might be expected, questions were sent out by the commission to manufacturers, mine-owners, and other traders along the main routes, asking how large an amount of traffic they would likely ship over improved waterways:

(1) At present rates of transport.

(2) If these were reduced by twenty-five per cent.

(3) If these were reduced by fifty per cent.

The replies returned in response to these queries were far from encouraging. The commission reports that "it cannot be said that these inquiries elicited very numerous or exact assurances of traffic. The most important results of these inquiries were the replies sent by the Erewash Valley coal-owners in the Nottingham District, and by the coal-owners in the South Staffordshire and Warwickshire Districts. These replies indicate a probability that if there were a reduction of fifty per cent in the total cost of transport per ton per mile, 3,000,000 tons of coal per annum might be sent to London by the inland water route from these two districts alone. If to the statements from the two colliery districts which we have mentioned are added other definite statements which were made by manufacturers in reply to our written questions, the total amount of traffic predicted on Route I amounts, in case of a fifty per cent reduction in rate, to 4,220,912 tons; in case of a twenty-five per cent, to 1,550,178 tons."[2]

[1] *Report of Royal Commission*, vol. VII, p. 157. [2] *Ibid.*, p. 160.

Since these estimates of traffic are based upon an assumption of greatly reduced freight rates, before we may draw conclusions it is pertinent to inquire into the probability of so large a reduction in freight charges. On this point the commission states: "We do not believe that any very exact estimate of the cost of transport on improved waterways can be arrived at. But upon the figures which have been placed before us, based in one case upon experiments which have been made, regard being had to figures furnished by foreign waterways, there is much reason to believe that, if on improved canals trainloads of 260 tons could be conveyed in shorter time than loads of 50 to 60 tons on the present canals, tolls remaining at their existing level, there would be a large reduction in the cost per ton-mile of conveyance."[1] This is obviously merely a profession of faith.

The only attempt to show concretely the extent of rate reduction that might be made was in a computation of the cost of carrying coal. The report states that "the total rate, including toll and haulage, at which coal can at present be conveyed by waterways from a colliery in Leicestershire to Paddington [a London station] is about \$1.60 per ton,[2] almost the same as its conveyance by rail. Of this cost, 60 cents is due to the tolls charged at the locks and \$1 is for haulage. It has been calculated that on an improved water route, allowing the passage of boat trains conveying 220 tons of coal at a time, the toll being reduced to 56 cents, by a reduction of the actual mileage, the total cost of transport could be reduced from \$1.60 to 92 cents per ton."[3] This is a reduction of 42.5 per cent from the present water, and from the present railway rates, on such traffic. These, however, are merely haulage and toll charges. To obtain the total cost by water there must be added the costs of transshipment, extra cartage, deterioration by breakage, etc. If

[1] *Report of Royal Commission*, vol. VII, p. 159.

[2] For clearness the English shillings and pence are here stated in terms of American coinage.

[3] *Ibid.*, p. 159.

these incidental charges be included, it is doubtful if there would be any advantage in shipping by water.[1] In any event it cannot be expected that more than a twenty-five per cent reduction could be effected by the proposed improvements. With such a reduction the commission received assurance that there *might* result an increased traffic on Route I, amounting to 1,550,178 tons per year.[2] There was no assurance of an increase on the other routes. Since Route I leads from the great mining and manufacturing region of central England to the metropolis, it offers far the best possibility of any of the routes for a heavy canal traffic. But to be very liberal, suppose we assume that the other routes might enjoy practically as great an increase as Route I and concede 6,000,000 tons per year for the four canals. At present the average distance traveled by each ton is something like twelve miles; but since a larger proportion of through traffic might be expected on the larger waterways, let us here extravagantly estimate that the average haul will become fifty miles. Multiplying 6,000,000 by fifty, gives a ton-mileage of 300,000,000. This is the maximum tonnage that could be expected, granting that freight rates were reduced by twenty-five per cent. It should be observed now that this is less than one third of the 958,800,000 ton-miles computed by the commission as necessary to meet the annual charges on the cost estimate of $122,000,000.

The commission reports, however, that "on the whole,

[1] Mr. Inglis, in his minority report (*Report of Royal Commission*, vol. VII, p. 224), adds to the above figures several items of importance, as follows:

Conveyance from pit to canal, and toll or haulage on Thames or Regent's Canal in London (not included above)	24 cents
Deterioration by breakage	12
Extra cost of unloading	12
Extra cost of cartage in London (average)	36
Total	84 cents

Adding 84 cents to the commission's estimate of 92 cents for haulage and toll gives a total transportation charge from mine to market of $1.76, or more than the present inclusive cost by rail.

[2] See page 126.

it is necessary to base expectations of future traffic, not upon any promises which may be made, but upon the intrinsic probabilities of the case." [1] Thereupon, the report proceeds to show how many millions of tons of coal still await transportation from the great Midland coal-fields of England. It is true that the coal is there, but it is equally true, according to testimony submitted to the commission, that the shippers prefer to send it to market by rail or by sea. The commission thus repudiated its own evidence, collected from shippers, from whose verdict there could well be no reasonable appeal. The "intrinsic probabilities" would seem to be that the shippers along Route I had good reason for saying that with a twenty-five per cent reduction in freight charges they would ship not more than 1,500,000 tons of freight each year by water.

18. In the above analysis of the commission's report on the feasibility of the routes in question, the cost estimates presented were accepted without criticism. It should be mentioned now, however, that some English writers contend that the ultimate cost of the system would in all probability reach several times the amount estimated by the commission.[2] There seem, in fact, to be the best of reasons for such a belief.

It should be recollected that public works of this kind, for some reason, almost universally cost far more than is predicted in the carefully prepared preliminary estimates. The Chicago Drainage Canal, the Panama Canal, and the Manchester Ship Canal, for examples, eventually cost two or three times the amount originally expected. It is doubtful if any canal, outside of some of the continental countries, for which public money was appropriated, was ever carried to completion within the limits of the first estimates of minimum cost.

[1] *Report of Royal Commission*, vol. VII, p. 160.

[2] For example, see J. B. Firth, *Fortnightly Review*, April, 1910, who estimates that the total cost would probably reach $500,000,000.

The above estimates, moreover, are far from being inclusive of all the items of cost. For instance, they do not include the cost of maintaining an adequate water supply, of providing wharves, warehouses, and terminal arrangements, nor any of the incidental Parliamentary, legal, and engineering expenses.[1] While it is of course impossible to ascertain how great a total outlay these items would eventually necessitate, a rough idea of the amount may nevertheless be obtained.

The commission has furnished some estimates of the probable cost of securing and maintaining at all times an adequate and reliable supply of water for the proposed canals. For the separate routes they are as follows:[2] —

Route I	$1,061,940
Route II	16,875
Route III	743,400
Route IV	587,715
Total	$2,409,930

The commission states that "these estimates include only the cost of providing the mechanical arrangements for raising water to points along the routes and of the repair of the existing reservoirs and feeders; but they do not include the cost of obtaining powers to take from the sources recommended the quantities of water required for the schemes, nor do they include any amounts for Parliamentary, legal, or engineering expenses."[3] The cost of securing the right to sources of water in the heart of a great manufacturing region would unquestionably be very great, and the incidental expenditures named are by no means inconsiderable.[4]

[1] *Report of Royal Commission*, vol. VII, p. 143.

[2] *Ibid.*, p. 155. [3] *Ibid.*, p. 150.

[4] It seems probable that if to the commission's estimate of $2,409,930, for the mere physical and mechanical costs connected with the securing of the water, be added the cost of the water itself, and of the engineering, legal, and Parliamentary proceedings incidental to the schemes, the total outlay for a water supply would reach in the neighborhood of $4,000,000.

It is necessary, also, to consider the question of shipping facilities for the improved waterways. The commission has asserted many times that a chief cause of the failure of the waterways has been the lack of warehouses, wharves, and terminal arrangements. Unquestionably the need of adequate equipment is imperative if the canals are to be placed on equal footing with the railways. To make the necessary provision for the needs of shipping involves the purchase of large amounts of land, which is everywhere costly in England, and tremendously so in the large cities.[1] Again, there would be required along the entire system of canals extensive docks and warehouses; and at every important shipping point expensive terminal equipment would have to be constructed.[2]

Finally, the estimate of the commission does not include the necessary branches and feeders of the four main lines of waterway. The report states on this point, that "we have not been able to arrive at more than an approximate estimate of what the eventual cost will be if we include the cost of improving the minor canals or 'feeders' of the main routes, a procedure essential to the success of the enterprise."[3] In order to compete successfully with the railways, whose side-tracks extend to almost every nook and cranny of the country, a vast system of branch waterways would have to be constructed. At present,

[1] It cost the Manchester Ship Canal Company, for the land it required, $7,514,250, or $211,000 a mile (*Port of Manchester Official Sailing and Shipping Guide*, April 1910, p. 97). Since this scheme involves the securing of land in a large number of the big cities of England, it is evident that the total cost on this account would be many millions of dollars.

[2] No statistics for comparative purposes are available in this connection, since the Manchester Ship Canal Company does not separate the equipment from the other construction costs, and since the old canals have furnished no statistics relative to what little equipment they possess. There cannot be the slightest question, however, that the erection of these indispensable facilities — wharves, storehouses, and terminals — would entail an outlay of many additional millions.

[3] *Report of the Royal Commission*, vol. VII, p. 155.

for instance, there is a veritable network of small barge canals about the city of Birmingham, all of which would require rehabilitation. And unless these lateral canals were constructed on the same scale as the main lines, their utility would be but slight. If they were smaller than the main waterways, one or the other of two consequences, either of which would be disastrous, would result: Either transshipments would be necessary for all freight not originating on main lines, involving expenditures which would dissipate any savings in the cost of carrying which the canals might otherwise effect; or else the size of all the barges on the main canals would have to be restricted to the capacity of the branches, which would destroy the advantages of enlarging these same main routes. The commission has recognized that adequate branch canals are "essential to the success of the enterprise," and has estimated that 574 miles of branches would be required. Since the necessary laterals should be of the same size as the main routes, since they would require very extensive docks, warehouses, etc. (practically all of them would necessitate terminals), it cannot but follow that the cost per mile would be almost, if not quite, as great for the laterals as for the main lines. The length of the main lines was 542 miles as against a minimum of 574 miles for the lateral. We may conclude, therefore, that the estimate of $122,000,000 would have to be practically doubled on this account alone.[1]

It is evident from the above discussion that it is, indeed, not improbable that the ultimate cost of the proposed improvements would be three or four times the admittedly partial and tentative estimate of the commission. This being true, it follows that three or four times as much traffic would be required to cover the cost as was estimated

[1] It does not appear from the commission's report to what extent the promised increase of traffic is contingent upon the existence of adequate branch lines. It is possible (though by no means probable) that the development of branch lines might secure a considerably larger traffic than was estimated.

above. Instead of 958,800,000 ton-miles of traffic, it would take some three or four billion ton-miles of traffic to meet the annual outlays. This raises a question as to the capacity of the proposed canals.

On this point the commission has stated that if so large an increase of traffic should result as the 3,000,000 tons of coal from the Erewash mines (which was promised contingently upon a fifty per cent reduction in charges), it would involve additional construction expenditures upon the canals, in the duplication of locks, etc. It has been seen in a preceding paragraph that 1,500,000 tons of freight for each route (the amount contingent upon a twenty-five per cent reduction in rates) would give a total ton-mileage of 300,000,000. This was less than a third of the amount necessary to cover the cost, on the basis of the partial estimate of the commission; 3,000,000 tons would be only two thirds enough. And if the system is to cost three or four times as much as estimated by the commission, it is evident that the capacity of the canals will be only one fourth or one fifth large enough to permit them to be profitable. If they were to be enlarged, moreover, it is obvious that construction expenses would then greatly exceed the estimates given above; and this in turn would necessitate a corresponding increase in the traffic over the above estimates, if again the project be made to pay.

19. It would have passed comprehension if the commission, in the face of all the contrary data which it collected, had still held out the hope of a direct return upon the capital invested. The report states that "we do not think it right to make a confident statement that there will be an adequate direct return on the probable cost."[1] The indirect results were, however, regarded as sufficiently important to more than counterbalance any direct loss which might be sustained. "There would be the reward which

[1] *Report of the Royal Commission*, vol. VII, p. 164.

we anticipate of an indirect return in the shape of benefit to the trade of the country."[1] Hence it would follow that the improvements should be made. Now there would seem to be only one way in which the trade of the country could be benefited by the waterways, namely, through reduced transportation charges. We have seen that it is very doubtful whether, even on the basis of the partial cost estimate given by the commission, there would be any reduction in the cost of transport as compared with existing railways, when all the transportation expenditures from place of origin to place of destination are included. And when it is recognized that the total cost would be, in all probability, several times the tentative estimate of the commission, it becomes a certainty that rates could not be reduced at all. On the other hand, we have found that the shippers of bulky commodities declare that even if there were a twenty-five or fifty per cent reduction from the present level of canal rates, they would nevertheless make little use of the waterways. In the face of these facts, one hesitates to accept without question the commission's statement that the general trade of the country would experience a revival, and is prompted to raise the query, — to what branches of industry are these promised indirect benefits to accrue, and in what guise may they be expected to appear? But one searches the report of the commission in vain for an answer to the question. There is to be found merely the comforting anticipation that improved waterways would confer indirect benefits upon the trade of the country.

20. One need not look far to find the reasons why the shippers should refuse to make extensive use of enlarged waterways, even though they should effect so large a reduction in rates as twenty-five or fifty per cent. To understand their attitude, it is only necessary to recall the

[1] *Report of the Royal Commission*, vol. VII, p. 164.

reasons why the present waterways are unused. In the case of coal, the canals would obviously still be unable to compete for that which now travels from the Northern coal-fields to London by sea. And as against the railways, the canals would continue under the handicap imposed by the necessity of transshipments; while barges of 300 tons' capacity would be much less adapted to the needs of small shippers than those of 30 tons'. Finally, the loss from breakage in the larger barges would be much increased.

In the case of building-materials, the cartage charges from canal to place of destination in the city were found to be frequently prohibitive, and the demand was often for small allotments in order to save space on the site where the materials were to be used, or the cost of double handling if stacked along the canal awaiting delivery. Three-hundred-ton barges would only aggravate the latter disadvantage, and they would not lessen the prohibitive cartage costs.

Cotton is ordered, as we have seen, in small amounts and shipped by rail from Liverpool to place of destination. It is not carried extensively either upon the small canals or upon the Manchester Ship Canal; no more would it be shipped on canals of 300 tons' capacity.

In the case of agricultural produce the dearth of storage facilities along the present routes might be removed, but the macadamized roads of England cannot be expected to change their present location, and 300-ton boats would be less adapted to the farmers' requirements than the present small barges.

21. In the light of the above investigation, how are we to account for the recommendations of the Royal Commission in favor of the extensive improvement of the inland waterways of Great Britain? One should doubtless show some degree of hesitancy in undertaking to criticize the work of a governmental commission. But after all, a

commission is nothing more nor less than a public servant, and its work is therefore freely open to the criticism of those it purports to serve. Accordingly, no apology is considered necessary for subjecting both the Royal Commission and its findings to a careful examination before indorsing without qualification the recommendations found in its report.

It cannot fail to become apparent to any one who reads the report of the commission that the majority of its members came to their task with an almost unalterable prejudice against the railways. Now, whatever may have been the misdeeds of the railways in the past, however deserving they may be of the opprobrium which is heaped upon them, a study of the question of transportation, for the purpose of ascertaining whether it would at present be wise economic policy for the nation to provide for the rehabilitation of its defunct waterways, can count for little if it is not undertaken with a mind open to conviction.[1]

Again, the commission appears to have been unduly influenced by the apparent success of Continental waterways. The report teems with references to the amount of public money that has been expended upon the waterways of Germany, France, Belgium, and the Netherlands, and to the increase of traffic that has resulted. But unfortunately the mere fact that money was spent in these countries and that water-borne traffic thereafter increased does not establish the economic feasibility of the systematic development of British waterways at Government expense. The commission's treatment of Continental transportation was woefully inadequate. Absolutely no effort was made to ascertain whether the increase of water traffic in these countries was sufficient to yield a reasonable return upon the expenditures involved; no attempt was made to discover if

[1] Dissenting members of the commission called attention to the predisposition of the majority to favor the development of the waterways, regardless of evidence. (*Report of Royal Commission*, vol. VII, p. 206.)

a like investment in railways would not have proved economically more profitable; no recognition was given to the fact that on the Continent most of the railways, as well as the waterways, are governmentally owned or controlled; no attention was given to the question of whether it would be advisable for England to follow the French method of preventing competition between railways and waterways by arbitrarily establishing rates which forced commodities to travel by the one or the other, according to the desire of the government; no mention was made of the military, naval, and political considerations which have shaped the transportation policy of Germany; and no consideration was given to the necessity of canals in the Low Countries for drainage purposes, and to the exceptional situation of those countries as gateways to the inland waterways of France and Germany, a situation affording a tremendous traffic in the transshipping of ocean commerce to the interior of Europe. The only question asked was, Has traffic developed? In the mind of the commission that consideration alone appeared to decide the entire question. An attempt was, indeed, made to show that topographic conditions, density of population, and the character of traffic were sufficiently alike to indicate that similar results to those on the Continent might be expected from corresponding expenditures upon a systematic development of the waterways of England; but this afforded absolutely no information concerning either the need of improving the waterways of England or the economic feasibility of their reconstruction. The study of Continental waterways was thus utterly wanting in discrimination. Whether the commission purposely avoided a discussion of the vital considerations which we have mentioned, or whether the members lacked sufficient penetration to discover their existence, matters little. In either case the value of their conclusions must be heavily discounted.

22. The future of British inland waterways appears, therefore, utterly devoid of promise. In all probability the proposed improvements would not be able to effect any reduction in freight charges, and in almost equal likelihood, even were the present water rates substantially lowered, the railways would continue to dominate the transportation business of the country as before. Even the commission can see no prospect of a direct return upon the probable cost of the improvements; and the hoped-for indirect benefits appear to be as visionary as the individuals who have expressed their anticipation thereof. It should be added that there is small chance that the improvements which have been recommended will ever be undertaken. To use the words of a writer in the "Fortnightly Review," "Another Royal Commission has expended time and labor on a forlorn hope, and has only succeeded in recommending — and that in a half-hearted way — to the public, a project for the expenditure of millions which no responsible Government would ever dare to lay before the House of Commons." [1]

The grave political problems the nation is facing, together with the tremendous naval expenditures consequent upon the mad race with Germany for maritime supremacy, preclude the possibility of any immediate development of a comprehensive scheme of internal transportation facilities. Indications are rather that the discussion of waterways will gradually diminish until it altogether ceases to agitate the British public; but, like financial crises and comets, its periodical return to the foreground of public interest may, with no little degree of confidence, be predicted.

23. It only remains to inquire what conclusions, if any, may be adduced, from this study of the barge canals of

[1] J. B. Firth, *Fortnightly Review*, April, 1910, p. 755. It was not until after the present study was completed that the writer learned of Mr. Firth's article. His conclusions confirm those here presented in practically every particular.

Great Britain, as to the advisability of developing through governmental aid a great system of internal waterways in the United States. It is always necessary to exercise the greatest caution before making conclusions, drawn from a particular set of circumstances and conditions, the basis of action in a foreign environment, where perhaps considerations of a vastly different order may serve materially to complicate or alter the nature of the problem. American advocates of waterway development, for instance, almost invariably point to the apparent success of the waterways of continental Europe as sufficient evidence of the practicability of water transportation in the United States, utterly ignoring the while the numerous points of incomparability between European and American conditions. The folly of accepting such evidence at face value will be fully laid bare in the succeeding chapters on the waterways of continental Europe. In the meanwhile, we should not fall into an error equally bad, and equally inexcusable, by assuming that the evident failure of British canals proves the case against similar undertakings on this side of the Atlantic. Before attempting any conclusions, we should first direct attention to certain conditions which may be regarded as fairly comparable in the countries in question, and then to various points of obvious dissimilarity. Not until such an analysis has been made shall we be in a position to decide what inferences of value to the United States are to be drawn from the history of British inland waterways.

In point of railway efficiency, England and the United States are far in advance of all other nations. Their railways have been systematically developed and welded into a few great systems universally regarded as among the greatest achievements of man. Moreover, in contrast with the countries of continental Europe, a distinctive feature in the railway history of English-speaking nations has been the development of facilities for the economical carriage of freight, no less than passenger traffic. The enterprise in this direction has resulted in the provision of every facility for the convenience of railway shippers. The waterways of both countries have, therefore, been subjected to a competition of a marvelously well-equipped transportation agent.

Again, the question of speed has come to be a decisive factor in transportation in England, as well as in our own country. The imperative demand of shippers is for dispatch and promptness of delivery. The state of canals in both countries has been in no small degree determined by this consideration.

In the third place, the influence of water competition (other than canal) has been of the greatest force in both these nations in the adjustment of freight tariffs. England has an abundance of good harbors, and the open sea is nowhere far distant from the most inland centre. Accordingly, a tremendous traffic travels from port to port in ocean vessels, and the railways have been forced to meet these rates. Similarly, in the United States, despite our great area, the competition of natural waterways has been a determining factor in the adjustment of freight rates. From New York and New England to the Southern States, the railways had to compete with the open Atlantic; and the rates finally established in that region affected indirectly all of the north-and-south tariff schedules of the eastern half of the country. In the Middle West, moreover, the navigable Mississippi River system formerly exerted a great influence in the adjustment of north-and-south rates. The transcontinental railways have been compelled to adjust their schedules to meet the ocean competition around South America, or by way of the Panama Railway across the Isthmus. And, finally, the east-and-west water route afforded by the Great Lakes has largely determined the level of freight rates on all points from the Northwest to the Atlantic seaboard. The existence of this natural water competition in England and the United States has forced both a lower level of rates and a more efficient transportation service than would have otherwise developed.

Two methods were open to the railroads in order to meet the competition of natural waterways, — to effect economies in construction of the roads and in moving of traffic, or to offer shippers facilities superior to those furnished by the waterways. The railway men adopted *both* plans, to the great advantage of transportation everywhere. Now, it is evident that the more ample the transportation facilities and the lower the transportation charges of a country, both on the natural water routes, and on the railways, the less need is there for, and at the same time the less profitable becomes, the development of artificial waterways. Here and in England, in fairly equal degree, natural waterways have been a conditioning factor.

Finally, in the two countries under consideration freedom of competition between waterways and railways has been the general policy adopted by the respective Governments. While the United States has not followed an identical policy with that of England in this respect, having extensively subsidized some of its railways by means of land grants, and to a less extent through direct financial aid, and having expended hundreds of millions of dollars on canals and river improvements, whereas England has left all to private enterprise, still, the fact that the United States, though contributing freely to the development of transportation systems, has interfered comparatively little with their use and management, serves to maintain the analogy with English conditions. Private companies have been as free to exploit the possibilities of water as of rail transportation. Indeed, there has been much greater freedom of enterprise in connection with the waterways from the fact that the railways have been subjected to no little restrictive legislation; and the same thing has been true in England.

We now have to present, on the other hand, certain phases of the transportation question which are far from being similar in the countries under discussion. In certain respects canal transportation in England has enjoyed advantages unknown to water transport on this side of the Atlantic; and the reverse is equally true.

The advantages possessed by English waterways arise from the topographic and climatic conditions and from the density of population. England is a small island attaining nowhere a great elevation above sea level. The construction of canals has, therefore, involved comparatively no great engineering obstacles. The problem of river control presents not a tenth part of the difficulty that it does in the United States, the streams of Great Britain being mere brooks as compared with the mighty rivers of North America. Moreover, the warm climate of the island does not permit, as in the United States, the accumulation of great quantities of winter snow, the sudden melting of which produces torrential spring floods and works havoc with river navigation for weeks every year. Equally important is the fact that ice is seldom a barrier to English water transportation, whereas our Northern rivers and lakes are totally closed by it from three to five months each season. Again, the very short distances in England have been decidedly advantageous to canal building. England and Wales together are not quite so large as the State of Indiana, and the two great ports of London and Liverpool, almost at opposite corners of the country, are only about two hundred miles apart. It is a quite different undertaking to construct canals across an intervening territory of several hundred or a thousand miles in order to join important trade centres, as would be necessary in the United States, to that of building them for short distances of from twenty to perhaps a maximum of two hundred miles, as in England. That, early in the nineteenth century, England was able to boast that no place in the country was more than twenty miles from a navigable waterway would seem to be circumstantial evidence of the comparative ease of waterway construction there. It would be hardly possible, even to-day, to develop in the United States so ramifying a system of internal waterways as is found in these old canals of Great Britain.

The population inhabiting England's small territorial expanse was, in 1901, more than 32,000,000, equal to that of the entire United States so recently as 1880. At the beginning of the railroad era, England had a dense population and a traffic correspondingly great, being in the enjoyment, even at that time, of a high state of industrial development. It is readily apparent that the greater the amount of traffic there is to be handled within a given area, the more need there is for extensive transportation accommodation; and as a consequence of this, it follows that the probability that the waterways would be able to secure a share of the traffic, and hence prove remunerative, is proportionally increased. English canals, in this respect, possessed a tremendous advantage over those of the United States, especially during the period of active competition between the canals and railways in the third quarter of the last century.

Turning our attention now more directly to the United States, we find certain peculiarly favoring conditions for water transport which tend to offset the foregoing handicaps. While canals are less easily constructed in this country than in England, there is at the same time comparatively less need for their extensive development, owing to the existence of a wonderful system of great navigable rivers and inland lakes. Canals are consequently required, primarily not as independent routes but as connecting links in a great chain of natural waterways. It is usually stated that America, on account of her immense rivers and lakes, possesses greater possibilities for inland water traffic than any other country. While this may be the case so far as traffic on the lakes and rivers themselves is concerned, it does not necessarily follow that the same is true to a like extent on canals. Nevertheless, we may regard the existence of these natural waterways as a distinct American advantage and one serving in large measure to offset the disadvantages as compared with England, to which attention has been called. Indeed, were there no other considerations than these thus far enumerated, one might possibly hold that, on the whole, the transportation conditions of England and the United States are sufficiently similar to warrant the drawing of conclusions from one for the other. Unfortunately, however, there remains to be discussed a very important consideration, which will be seen to destroy whatever balance of conditions may otherwise exist.

Attention has many times been called to the determining force of the size of the cargo in the question of water transportation. We have seen that in England the growing demand for rapid service and prompt delivery has been accompanied by a demand for smaller shipments. Now, while speed is of even greater importance in the United States than in England, the demand for quick deliveries on this side of the Atlantic has not carried with it a desire for consignments of smaller size. To a surprising degree England has remained a country of small producers and small dealers. We have seen, for instance, how factories have continued to stand on old canal sites for generations. But in America there has been much less industrial inertia. Tradition has been wanting, and regardless of apparent waste, we have torn down the old as fast as it has become antiquated, and built anew on a larger and more extensive plan. The tremendous scale on which American enterprises are conducted is proverbial. The result of all this is that the demand of the American shipper is usually for large consignments, in striking contrast to that of his British cousin. One of the first things to excite the curiosity of an

American traveling in England is the tiny English railway freight car. Compared with the huge American freight cars, it appears a mere toy or dummy. One at first has difficulty in believing that the cars he sees are not designed for some unique purpose, and he remains for some time incredulous, expecting momently to discover the box or gondola car of "regulation size." He learns, however, that they are all small, and adapted to meet the almost universal demand of English shippers for small consignments.

In our analysis of the causes of the decline of water-borne traffic in England, we found one of the chief reasons to be that barge-loads of thirty or forty tons were inconveniently large; and we concluded therefrom that the proposed 300-ton barges would only aggravate this disadvantage. But in the United States cargoes of many times this size are by no means exceptional. Now, while we found that there was grave doubt that the waterways of England having a capacity for barges of 300 tons could move traffic, all things considered, more economically than the railways, it does not *necessarily* follow that the same would hold true on canals capable of floating 600 or 1000-ton barge-loads. *Conceivably* such cargoes might be sufficient to overcome the margin of difference and tip the balance in favor of canal transportation. It is considerations such as this that usually prove the determining factors in industrial problems; and yet, strangely enough, it is, at the same time, considerations such as this that are so often overlooked or disregarded in the making of comparisons and in the drawing of conclusions. For our part, we would refrain from determining the future of American waterways by the fate of the canals of Great Britain.

CHAPTER VII

THE MANCHESTER SHIP CANAL

1. The Manchester Ship Canal, connecting the city of Manchester with the sea at Liverpool, on the northwest coast of England, has attracted much attention in the United States during the last few years of canal agitation. Though much has been written about it in this country in a descriptive way, there has been no careful study with a view to ascertaining whether it has been economically successful, and whether it affords a reliable basis for conclusions as to the feasibility of similar enterprises in the United States. In the present treatment a brief history and description of the project is given because of the light it throws upon English methods, and upon subsequent developments along the canal; but the body of the discussion is devoted to the economic aspects of the waterway.

As in the decade following 1820 the monopolistic rates charged by canal between Manchester and Liverpool started an agitation which led directly to the construction of a railway between the two cities, so, in turn, in the eighties the high railway tariffs between the same points developed an agitation which resulted in the Manchester Ship Canal. There had been occasional proposals as early as 1840, but no definite steps were taken until 1882, when a provisional committee indorsed the project, and raised a fund for the purpose of defraying the necessary expenses incident to the securing of a charter from Parliament. Three years of persistent effort on the part of the promoters of the project were required before Parliamentary sanction could be secured. England, in contrast to the United States, has never adopted the policy of passing general incorporation laws for public service corporations.

Her railways have one by one been required to secure from Parliament a special, distinct charter. Instead of having merely to conform to certain specifications laid down in a general law, each company has been rigidly required to prove the necessity for its existence, before a charter would be granted. To prove the necessity of a ship canal, adequate for ocean-going vessels, from Manchester to the sea, was no easy matter. Determined opposition developed on the part of the railways, the Mersey Docks and Harbor Board, the Liverpool corporation, and the owners of great estates. The case for the canal was submitted with a fullness of detail seldom equaled, and in startling contrast to the slipshod method prevalent in the United States. In the Parliamentary sessions of 1883–85 no less than 175 days were consumed in the discussion of the project.[1] Witnesses were cross-questioned as in a criminal trial, and their statements and statistics were subjected to the most searching criticism. As many as 326 petitions in favor of the project were presented by cities, chambers of commerce, and trading and manufacturing companies of the district interested.[2] The authorizing act was finally passed in 1885. The estimated necessary funds were secured in the following two years, the stock being subscribed for by the business people of Manchester and neighboring cities. Construction work was begun in November, 1887, and the waterway was opened for traffic on January 1, 1894.

The building of the waterway was a magnificent engineering feat. The length of the canal is 35.5 miles, and it has a depth for the entire distance of 28 feet, and a bottom width of 120 feet.[3] There are five sets of gigantic locks,

[1] Tracy, "The Manchester Ship Canal. The Story in Brief," *Journal of Manchester Geographical Society*, July, 1907.

[2] *Ibid.*

[3] A comparison of the Manchester Canal with other noted canals follows:

	Depth	Bottom width
Suez	26 feet	72 feet
Amsterdam	23	89
Manchester	28	120

necessitated by the 70 feet elevation of Manchester above the sea level. Among the engineering features are a number of tremendous swing-bridges, a huge sea wall, rising in places from a depth of 40 feet, and averaging 12 feet in thickness, and the Barton aqueduct, by means of which the Bridgewater Canal is carried over the Ship Canal and its course stopped and swung at right angles during the passage of large ships.

The cost of the waterway,[1] to January 1, 1894, the date of opening, was £14,860,000; while a deepening of two feet, together with the construction of docks, sheds, and other necessary equipment, had raised the total expenditure on capital account by December 31, 1909, to £16,790,491, or nearly $84,000,000.[2]

At Manchester magnificent docks, nine in number, have been constructed on a commodious scale, with an eye to future needs. There is a solid concrete and steel shed, half a mile long and three stories in height, and a huge grain elevator with a capacity of 1,500,000 bushels, equipped with the most modern improvements. The dock equipment includes 53 hydraulic, 61 steam, and 9 electric cranes, capable of lifting from 1 to 10 tons to a height of from 13 to 59 feet; a 30-ton steam crane; 47 locomotives; 6 floating pontoons of a dead-weight capacity of 800 tons each; and all modern appliances for giving vessels quick dispatch. There is also a pontoon sheers capable of dealing with weights up to 250 tons, with a lift of 21 feet.[3] In fact, no money has been spared to make the canal, harbor, and docks thoroughly modern and efficient.

Ocean vessels from all parts of the world now load and unload their cargoes of every description at this inland seaport, already fourth in importance in the United King-

[1] Tracy, *op. cit.*

[2] *Port of Manchester Official Sailing List and Shipping Guide*, April, 1909, p. 97.

[3] *Ibid.*, p. 94.

dom. The ships are towed up the canal by large tugs. Competition has lowered, to some extent, the rates charged by the railways, while the canal-borne traffic travels at a still lower charge. Distributing business has been built up in Manchester, and the relative decline of the city has been checked in no small degree. The transshipping business alone furnishes a large amount of employment, and, in addition, new industries have developed along the canal. All this means more business and larger opportunity for the people of Manchester, whose splendid enterprise has brought the sea inland to the very centre of their business activities.

Such, in brief, is the story of the Manchester Ship Canal as it is customarily told. The conclusion commonly drawn from such cursory sketches is that this deep waterway is an unqualified success, — that here is substantial proof of the beneficent results of ship canals. A careful, first-hand investigation of the entire project has, however, led the writer to the conclusion that the Manchester Ship Canal has fallen far short of fulfilling the expectations of its builders, and that, splendid engineering achievement as it is, its economic advantages are of very questionable importance.

2. In the first place, the canal cost more than twice the amount of the original estimate. The very carefully prepared report of the committee formed to consider the Manchester Ship Canal, which was submitted in 1886, estimated "that the Ship Canal and works can be completed ready for traffic at a cost within the estimate of £5,750,000, and that the sum of £802,936 set down for the purchase of the necessary land is a safe estimate."[1] In addition to this, it was estimated that the Bridgewater Canal property, to be purchased, would cost £1,710,000,[2]

[1] *Report of the Committee formed to consider the Manchester Ship Canal*, p. 4.

[2] *Ibid.*

making a total of £8,262,936. The contract was let for the construction of the canal at the above figure, but the chief engineer, finding himself utterly unable to complete the work under double the amount of his bid, gave up in despair,[1] and the work had to be finished by others. Expenditures kept mounting higher and higher, and it became necessary for the company to borrow an extra £5,000,000 from the city of Manchester in order to finish the work. By December 31, 1909, the expenditure on capital account stood as follows:[2] —

Construction of works (including plant and equipment)	£10,956,792
Bridgewater Canal	1,268,286
Land (purchase and compensation)	1,502,850
Engineering and surveying	194,210
Interest on share and loan capital	1,170,734
Parliamentary expenses	195,022
General expenses	448,357
Interest on debentures discharged by the issue of a like amount of preference stock to the corporation of Manchester	1,054,240
	£16,790,491

There is no question that had it been known in advance that the cost of the canal would approximate a total of nearly $75,000,000 on opening day in 1894, and nearly $9,000,000 more in the next sixteen years, the project would never have been undertaken.

In the second place, the anticipated earnings have not been realized. The committee above mentioned estimated the net revenue for the second year of operation at £479,430. "This sum, which we consider a safe estimate, would be sufficient to pay a five per cent dividend upon the whole share capital of the company [£8,000,000], and to leave a surplus of £79,430."[3] How has this prophecy, made after

[1] This engineer, Mr. Walker, died, before the completion of the work, it is said of a broken heart over his failure.

[2] *Port of Manchester Official Sailing List and Shipping Guide,* April, 1910, p. 97.

[3] *Report of the Committee,* p. 15.

a very careful investigation, been fulfilled? In the second year of canal operation the *gross* revenue was only £137,-474,[1] but little more than one fourth the estimated *net* revenue. Sixteen years have now elapsed, and never has the company been able to make ends meet. Never yet has it been possible to pay in full the interest on the £5,000,000 borrowed from the city of Manchester. At the close of the year 1909, a balance of £6990 of interest remained unpaid.[2] There is a perennial hope that the interest payments may be met in the near future, but shareholders have almost ceased even to dream of dividends.

3. There appear to be two reasons for this failure to pay dividends — excessive expenditures, and small traffic. Since the experience of the Manchester Ship Canal is typical of practically all similar enterprises, it seems advisable to set forth in some detail the situation as it developed. The expenditures will be considered first.

It had been assumed, as is usually the case in quasi-public undertakings of this kind, that once the canal was open for traffic, thereafter all would be, literally, smooth sailing. Three years after the date of completion, however, a special report on the physical and engineering features of the waterway was submitted, which showed how numerous were the points of weakness in the canal, and indicated how heavy might be the expense connected therewith. Some of the difficulties to be encountered were:[3] —

1. A crowded entrance at Liverpool.
2. A poor entrance at Eastham.
3. Only one entrance to the canal, which might cause a blockade from mishaps, such as the grounding or wrecking of boats,

[1] *Port of Manchester Official Sailing List and Shipping Guide, supra,* p. 97.

[2] Statement of accounts, general balance sheet, December 31, 1909.

[3] *Manchester Ship Canal: Physical and Engineering Features, Special Report by an Expert,* 1897, p. 8.

disablement of lock gates, or of swing-bridges, landslips in the cuttings, floods and storms, or loss of water.

4. The silting-up of the tidal portion of the canal.
5. The failure of sea embankments at Ellesmere Port.
6. Dangers of the Weaver River.
7. Dangers from cross traffic at Runcorn.
8. Dangers in the deep cuttings at Norton.
9. Encroachments by estuary floods and storms.
10. Dangers at swing-bridges.
11. The liability of the caving-in of rock cuttings.
12. Dangers from defects in locks and sluice gates.
13. The instability of lock walls.
14. Deficient dock and trade arrangements.

Obviously, not all, nor even many of the above difficulties would have to be met at once, but at any time large unexpected expenses were likely to arise. Some of the difficulties, however, such as the incessant dredging necessary to keep the channel free from silt and the maintenance of adequate dockage and trading facilities, were constant problems.

One of the most serious problems in inland water transportation, everywhere, is the filling-up of the channel with silt. "It is manifest that the difficulties of dredging in the docks and in the restricted channel of the [Manchester] Canal, simultaneously with continuous use by shipping, will be almost insuperable."[1] For the half-year ending December 31, 1909, the cost of dredging was £20,282,[2] or almost equal to the total outlay for salaries of managers and wages of all the employees of the canal company, which amounted to £24,535.[3] This half-year may be regarded as typical. Hence, approximately $200,000 a year is the cost of dredging alone, in a canal only 35.5 miles in length, — nearly $6000 per mile annually to keep the channel freely navigable.

[1] *Manchester Ship Canal, etc., ibid.*, p. 9.

[2] Statement of account, December 31, 1909.

[3] *Ibid.*

It is to the credit of the company that no expense has been spared in attempting to make the physical equipment of the best. Untiring effort and great expense have likewise been undergone in trying to better the facilities of trade. A list of questions was sent out in 1897 to shippers, asking whether they were using the canal; if so, with what success; if not, why not. Suggestions were also asked in every case. The answers returned showed that in many instances the canal was not used because of poor service in handling, etc.; very frequently it was stated that foreign shippers were averse to risking their goods upon the canal; and shipowners hesitated to send their ships thirty-five miles inland to Manchester. Such problems as these were not to be overcome without the expenditure of a deal of effort and a tremendous amount of money. Even then, as will be seen, they were by no means wholly removed.

The anticipated tremendous traffic has not yet been realized. There has been an earnest desire on the part of Manchester business men to see the canal prosperous. Having expended many millions of pounds sterling in bringing the sea to their midst they were naturally anxious to coöperate in making the canal a success. Answers to the queries which the company sent out in 1897 showed, as a rule, that the shippers were making use of the canal wherever possible, sometimes even at a loss, in the hope that service would improve and the enterprise be ultimately successful. Yet, with this unusually favorable disposition on the part of the shipping public, traffic failed to expand rapidly. There are many reasons.

We have already noted the hesitation of shipowners to risk their vessels on inland waters; the objections of foreign shippers to the transit of their goods on the canal, because of delays, ungrounded fears, or what-not; and the slow and often inefficient service rendered on the canal. Moreover, it was soon realized that the savings on freight were far from being as great as had been estimated, if they were not indeed altogether negligible. It had been contended that enormous savings would accrue, not alone to all places on the canal and to points directly east of Manchester, but to the entire surrounding country, north and south of the canal as well. But it usually did not work out that the rate from Liverpool to Manchester by canal, plus the railway charge from Manchester to some city, X, Y, or Z, was less than from Liverpool to this point direct by rail, especially when the delays and inconveniences of the canal route were considered. In consequence of these conditions, traffic did not expand with the rapidity predicted. Below is a statement of the annual tonnage during the sixteen years of the canal's existence.[1]

Year	Sea-borne traffic, tons	Barge traffic, tons	Total tons
1894	686,158	239,501	925,659
1895	1,087,443	271,432	1,358,875
1896	1,509,658	316,579	1,826,237
1897	1,700,479	365,336	2,065,815
1898	2,218,005	377,580	2,595,585
1899	2,429,168	348,940	2,778,108
1900	2,784,843	275,673	3,060,516
1901	2,684,833	257,560	2,942,393
1902	3,137,348	280,711	3,418,059
1903	3,554,636	292,259	3,846,895
1904	3,618,004	299,574	3,917,578
1905	3,993,110	260,244	4,253,354
1906	4,441,241	259,683	4,700,924
1907	4,927,784	282,975	5,210,759
1908	4,317,965	264,531	4,582,496
1909	4,290,765	272,636	4,563,401

It is to be noted that from the beginning the increase was very slow, indeed, and that 1909 showed a lower total than 1906. Nor is the outlook for the future encouraging. The semiannual shareholders' report for February 12, 1910, is decidedly gloomy. Where, if in any place, one would expect to find an expression of optimism for the future, we read in the secretary's words: —

[1] *Report of Directors*, December 31, 1909.

I do not see any present prospect of going ahead with really rapid strides.[1]

And again: —

I do not know that the repetition or frequent reiteration of our pressing need is likely to do much good, yet I cannot refrain from saying that if more patriotism could somehow or other be infused into the mercantile and manufacturing community of this district we should soon have a large expansion of traffic.[2]

In the light of such statements the case seems clear to an unbiased observer. The people who went deep into their pockets to build a canal for the salvation of their city now, from lack of patriotism, it is said, do not make use of their own waterway. Manufacturers and traders are usually business men more than patriots, and the only reasonable explanation for their not using the canal would seem to be that it is more profitable not to use it. The report referred to is almost naïve in some of its statements: —

For some reason or other they [the manufacturers and merchants] still quote the same price for delivery at various ports and take the chance of having to deliver the goods and pay the carriage to such ports, as even London and Glasgow, although they themselves are near to Manchester. It is difficult to get at the bottom of it. When you hear that works are leaving inland towns to get on the sea, it seems to me a very curious thing that when the sea is brought to the manufacturers, they are not eager to make use of it.[3]

May it not be that the constant deterrent is a something inherent in an inland ship canal itself, as a means of transportation? When it would seem to be to the direct interest of these shippers to use the waterway as much as possible, in the hope of receiving dividends on their share investments, and in order to build up Manchester and the sur-

[1] *Report of the Half-yearly Meeting of Shareholders*, February 17, 1910, p. 9.

[2] *Ibid.*, p. 8.

[3] *Ibid.*, p. 8.

rounding territory, thereby enlarging their businesses and increasing their opportunities, the fact that they employ other means of transportation seems, indeed, strong evidence against the earning capacity of this ship canal.

The amount of traffic carried in barges, as shown by the above table, is likewise very instructive. It is particularly interesting, in view of the fact that in the United States barge canals are looked upon with much favor as a solution of our transportation problem. It should be observed that the tonnage of barge traffic on the Manchester Canal has remained almost a constant quantity for sixteen years, and comprises only about one seventeenth of the total canal traffic; and this, in face of the fact that the Ship Canal has direct communication with fourteen barge canals, tapping the central manufacturing region of England, the Lancashire, Yorkshire, and Birmingham districts.

4. In another, though indirect, manner it was hoped that the great canal would reward the expenditures of its builders. It was believed that in addition to building up a huge traffic by water, and securing for all time low transportation charges, the Manchester Ship Canal would attract many new industries to the region. The Report of the Committee of 1886[1] expressed the conviction that along the entire length of the canal great manufacturing establishments would be erected, that shipbuilding would become a great industry on the banks of the waterway, and that Warrington, Runcorn, and other intermediate cities between Manchester and Liverpool would quickly become thriving commercial ports. Traveling the length of the canal sixteen years after its opening, one sees scant evidence of the fulfillment of this brilliant promise. There is some shipping at intermediate points, to be sure; naturally some new industries have been established along the canal; but shipbuilding there is none, and remarkable industrial

[1] *Op. cit.*

development has not been present, as witness only too plainly the tonnage and revenue statistics already given.

Many Manchester business men, owners of stock in the canal company, are frank to admit that the canal has been a great disappointment. "We got excited over the alluring picture of Manchester as an ocean port" is a common expression. And it is now generally believed that the chief benefits from the canal have come through the growth of population and the general expansion of business — benefits unascertainable in amount, but none the less existent, and none the less important. Attempts have been made by supporters of the waterway to claim a prodigious growth in Manchester since the canal was built. But population statistics do not bear them out. The census returns show the following statistics for a number of rival cities in northern England: —

	1891	1901	Increase, per cent
Hull	200,472	240,618	20
Leeds	367,505	428,953	16.6
Birmingham	478,113	522,182	9.2
Liverpool	629,548	684,947	8.7
Manchester	505,368	543,969	7.5

Later statistics would be better evidence, but they are not available. In 1901, however, the canal had been open eight years, and the anticipation of its beneficent results should have stimulated industry and business before the waterway was actually ready for traffic. Consequently, the above figures furnish good evidence as to the benefits of the canal. They show a less rapid growth in Manchester than in any of the other large cities in northern England. Perhaps without the canal, Manchester would have gained even less rapidly, but at all events, it can hardly be contended that a remarkable growth of the city has resulted from its water connection with the sea.

Again, it was hoped that the entire surrounding territory would receive a reviving impetus, that unemployment would cease, that unalloyed contentment would reign in all the district. Alas, however, we find to-day more unemployment than ever before. In fact, Lancashire and Yorkshire form the centre of English discontent, and a desperate effort is being made by the anti-socialist union to quell the rising tide of socialism, which is the outgrowth of low wages and unemployment. Large and increasing numbers of emigrants are leaving the country for English dominions overseas. The canal in this, as in other respects, appears to have been a failure.

But what of the potential competition which the waterway has offered? Has it not paid for itself indirectly by forcing the railways to lower their rate schedules? It is impossible to say precisely what effect, if any, the canal has had upon railway rates. In the Report of the Chicago Harbor Commission,[1] Professor Goode quotes rates on certain classes of freight which show rate reductions, as a rule, of from five to ten per cent.[2] These are slight reductions at best, and but little more than has been the case elsewhere in England during the same period. As against the contention that the canal has substantially lowered rail rates, W. M. Acworth, the well-known English authority on transportation, states that the canal has had virtually no effect on the rates charged by the railways of that section of England.[3] The relatively slow growth of population and the rather stagnant condition of industry seem also to indicate that these indirect benefits have not been very great in comparison with the outlay. In any event, it would require an enormous saving in freights, indeed, to yield interest to the people of Manchester on an expenditure of $84,000,000. A waterway, the benefits of which depend mainly upon the potential competition secured, is always of exceedingly doubtful feasibility.

If it be found necessary to resort to potential compe-

[1] Published in 1909. [2] Page 86. [3] Personal letter to the writer.

tition as a means of reducing freight rates, the result can be attained in a more economical manner than by means of a ship canal. The canal had cost, up to the beginning of 1910, about $2,400,000 per mile of length. The capitalization of English railways, on the other hand, is only about $385,000 per mile, and a cheaper means of securing potential competition would be through the building of Government railroads.[1]

5. Having seen what were the hopes for the Manchester Ship Canal, and having discovered in how small degree these have been subsequently realized, it remains to inquire what conclusions are to be drawn as to the feasibility of similar undertakings in the United States. Were not, perchance, the engineering problems of this project particularly difficult, and may not the commercial conditions have been peculiarly adverse? And, therefore, despite this failure, may not ship canals in our own country prove successful? Let us consider the conditions existing at Manchester.

In the first place, it is to be observed that Manchester lies only 35.5 miles from the open sea, and the elevation is only 70 feet above tide water. The slight elevation minimizes the number of locks needed to control the waters, thereby greatly lessening the cost of construction and maintenance.

In the second place, the builders of the canal were exceptionally fortunate in the matter of construction materials. Suitable filling-in material was plentiful along the entire route, while rock, clay, and sand for the making of the sea-wall embankments were found in abundance. For a long period of time over 450,000 bricks per week were produced, as needed, right along the works.[2] Unusually favor-

[1] A fuller consideration of this question will be found in chapters XIX and XX.

[2] Tracy, *op. cit.*, p. 9.

able were these very important phases of the engineering work; and there is no record of any exceptional difficulties encountered. The excessive expenditures have never been ascribed to unexpected engineering difficulties. They are rather due to the usual underestimates of the cost of deep waterways. It is doubtful if anywhere in the United States can be found conditions as favorable to cheap construction as were present at Manchester.

Furthermore, in the building of a ship canal which costs more than $2,000,000 per mile, the question of distance is of paramount importance. The amount of traffic on a canal seventy miles in length will, as a general rule, be not much greater than on one thirty-five miles in length, provided both reach important industrial centres; but the cost of construction will be nearly double for the longer distance. Now, in the United States, we have no inland city of half a million people which is not many hundreds of miles inland. The Erie Canal route from Buffalo to New York is over 340 miles in length. From Chicago to the Gulf of Mexico by way of the Mississippi River the distance is, roughly, 1600 miles. Canals of sufficient depth for ocean vessels, as is sometimes advocated, between these points would involve an expenditure of fabulous sums of money. From the standpoint of distance every advantage lies with the Manchester Canal.

Again, the geographical situation of Manchester could hardly be improved upon as a ship-canal port. It is the centre of the greatest manufacturing region in the United Kingdom and a distributing-point for more than one hundred and seventy industrial towns. Within a radius of twenty-five miles lives a population of 3,778,765, and within fifty miles are 8,726,267 people.[1] Bolton, the centre of the cotton-spinning district, a city of 170,000, is but nine miles away; Oldham, another great cotton centre, with 140,000 people, is but eight miles from Manchester; while

[1] Manchester *Journal of Commerce*, October 15, 1909, p. 3.

Stockport (79,000), Bury (60,000), Ashton (44,000), Eccles (35,000), and Stalybridge (28,000), are other important industrial cities near by. Manchester is at once a natural terminus and a starting-point — a centre of great activity. The enormous manufacturing of the district necessitates the importation of vast quantities of raw materials, while the dense population has to be fed on foodstuffs sent in from abroad. Cotton, wool, flax, iron ore, timber, oils, dyewoods, paper, paper-making materials, and all kinds of foodstuffs, grain, flour, meat, fruit, etc., are commodities of constant importation. For the back-haul, the export trade, we find tremendous quantities of cotton and other skilled manufactures, all kinds of hardware and machinery, and an abundance of coal from the Yorkshire fields. This traffic was already existent, apparently waiting for the canal to carry it. It did not require an influx of population and a slow growth of industries to develop it. It was ready at hand.

Especially important is the cotton trade which centres about Manchester. The city had control of all the cotton-distributing business, even before the canal was opened. Testimony before the House of Lords in 1885 showed that

> the business is done through Manchester and for many very important reasons. One above all others is that the goods require inspection, and the man who buys the goods to ship requires to know that he is getting the quality he has bought; and the goods are marketed in Manchester, and inspected in Manchester. Then a great portion of the goods require to be finished, some of them dyed, some of them bleached, some of them printed; and all those subsidiary trades are grouped around Manchester. Hence, Manchester practically directs the whole of the cotton trade, and many other trades in the district; and the buyers are all congregated there, and they have their agents abroad who are acquainted with all the requirements of every market.[1]

[1] *Manchester Ship Canal Enquiry before the House of Lords* (J. C. Fielden), 1885, p. 7.

It seemed certain that all of this traffic would go by the waterway. In fact, traffic conditions were little short of ideal. There was an abundance of traffic in commodities well adapted to water transport; there was an established trade in both directions, an all-important consideration; and finally, it should be noted that the canal was in the direct line of established routes, not crosswise to the main line of trade as are some of the proposed canals of the United States. It is not surprising in view of these facts, that M. Fleury, the French expert, visiting Manchester in 1885, asked, "In what other part of the globe are conditions so favorably combined?"[1]

From practically every standpoint, then, this English canal project was subject to unusually favoring conditions: there was comparatively easy construction, abundance of traffic in both directions in the region, and the coöperation of shippers financially interested in the success of the scheme. Conditions are far less favorable in the United States, where greater distances have to be traversed, higher elevations to be overcome, swifter streams to be controlled; and where the population is less dense, and the traffic correspondingly lighter and more uncertain.

[1] Tracy, *op. cit.*, p. 11.

CHAPTER VIII

THE FORTH AND CLYDE SHIP CANAL

1. THERE has been considerable discussion in Great Britain at various times, and especially since the beginning of the canal revival, about the year 1900, of a ship canal across the narrow isthmus-like piece of land between the estuaries of the Forth and the Clyde Rivers in Scotland. Resolutions in favor of the project have been passed by the town councils of the particularly interested cities of Glasgow, Stirling, and Greenock; and Parliamentary commissions have investigated the scheme, both from the commercial and from the naval points of view. Since the project is of tremendous size, and since it has attracted no little attention in the United States, it perhaps merits a brief discussion at this place.

There has long been a small barge canal connecting the opposite coasts of Scotland *via* the Forth and the Clyde; but it is urged that a deep channel, permitting the passage of large ocean steamers and of Dreadnought battleships, has become essential to meet the needs of both modern commerce and modern warfare.

On the commercial side, advocates of the scheme call attention, in the first place, to the fact that the canal would save, for vessels traveling between the Irish and North Seas, the long journey of over four hundred miles around the northern end of Scotland; and similarly, it would eliminate a somewhat less distance for vessels bound from Germany to the ports of North America.

In the second place, it would permit a much readier assembling of a full cargo. The once numerous small "tramp" steamers are rapidly disappearing from the sea, giving way before the demand for large vessels and through cargoes. At the present time it is difficult for a large boat to secure a full load on either Scottish coast, alone; but if the proposed ship canal were opened, it would become possible for them to load in part on the east coast and then complete their cargoes in the port of Glasgow. The present trouble and expense of having to travel all around the Scottish coast in order to collect a respectable cargo is a serious handicap to shipping interests. It is thought, also, that Continental vessels might easily be induced to stop at Glasgow or Grangemouth and pick up traffic, while en route for the United States. Much encouragement for this belief is found in the fact that there is an abundance of cheap bunker coal along the proposed canal routes, which it is thought should prove attractive to foreign shipowners.

The strategical importance of the scheme would arise from the possibility it would insure of a rapid mobilization in time of emergency, of naval vessels on either the North or the Irish Sea. The exigencies of war, moreover, often require the quick repair of damaged ships, and this canal would open up the great shipyards on the Clyde to the use of his Majesty's Navy in time of need. On the strength of these naval advantages, aid in the carrying-out of the project has been asked of the Imperial Government.

2. Two different routes have been proposed. Since the fate of the scheme has hinged largely upon a choice of routes, it seems advisable to present here a brief statement of the alternate projects: [1] —

a. The first route would follow the course of the present Forth and Clyde barge canal from Grangemouth on the east coast (Firth of Forth) to Yoker on the Clyde, below Glasgow. The total length would be 30 miles and the ele-

[1] *Report of Royal Commission on Canals and Inland Navigations*, vol. VII, pp. 180–81.

vation to be overcome 35 feet. Various estimates of the probable cost of this plan have been submitted, but none can be regarded as other than tentative. Mr. Hogg, an engineer, estimates that for a depth of 26 feet with a bottom width of 110 feet the cost would be $35,000,000; while for a depth of 30 feet the amount would probably reach $50,000,000. Other estimates have placed the cost as high as $100,000,000, and D. & C. Stevenson regard the amount needed as $135,000,000 in case deep cuttings, which seem advisable, were substituted for all of the locks except those at either entrance.

b. The second route would start at a point one and one fourth miles above Grangemouth and proceed past Bannockburn and Stirling to Loch Lomond, a distance of 35.5 miles; thence 15.5 miles to Tarbet; thence 1.75 miles to Loch Long, an arm of the sea, some 15 miles distant from the Firth of Clyde.

The advantage of this route is that it is nearly level, and would require but two locks. It is estimated that the cost would approximate $100,000,000 for a depth of 36 feet with a bottom width of 100 feet.

The Committee of Imperial Defense recently investigated the strategical side of the question, submitting a report thereon in June, 1909, in which it is stated that the minimum dimensions required by the Admiralty are as follows: [1] —

Depth	36 feet
Width of floor	148
Length of lock	850
Width of entrance	110
Depth of locks	36

It was further reported that only the second, or Loch Lomond route, would satisfy the naval requirements. For this route the estimated cost given above was $100,000,000 for a bottom width of 100 feet; since nothing short of a

[1] *Report of Royal Commission, ibid.*, p. 183.

floor width of 148 feet, almost a half greater, will satisfy the Admiralty, we must conclude that the total cost of the project would much exceed $100,000,000, granting that the estimate for the size named is in reality adequate.

3. The Royal Commission endeavored to ascertain how much financial support for the project could be relied upon from the inhabitants of the interested districts, and they found that the citizens were not prepared to make the canal themselves, and that "it seems doubtful whether they would contribute to the cost, if, for strategic reasons, . . . the Loch Lomond route were adopted in preference to the direct route, which has hitherto been favored by Glasgow opinion."[1] Since this second route alone is adapted to naval requirements it is apparent that the fate of the project rests in the hands of the Imperial Government. It is accordingly significant to note that the aforementioned Committee on Imperial Defense reported that while the canal would unquestionably possess some strategical value, "this value alone would, however, not be sufficient to warrant any considerable Government expenditure."[2] It would seem, therefore, that the project is indefinitely suspended. The Government is disposed to give no aid for the first-named route, because it is strategically valueless; the inhabitants of Glasgow and other cities are averse to contributing to the building of the second route, because it promises no substantial direct commercial returns to themselves; and neither party is willing to undertake its favored scheme without the coöperation of the other.

4. While the prospect that the project will ever be carried to completion is exceedingly remote, we may nevertheless profitably give some attention to the alleged commercial advantages. For vessels engaged in the coasting trade the distance saved would be some four hundred

[1] *Report of Royal Commission, ibid.*, p. 182. [2] *Ibid.*, p. 183

miles. Were there no counterbalancing extra costs the reductions effected here might be regarded as of some importance; but the fact is that such savings in fuel as might result from the shorter distance would be largely, if not wholly, dissipated by additional expenditures for towage and for extra labor, such as tugmen, lock-keepers, and pilots, on the canal. Furthermore, since the risks incurred by large ocean vessels in navigating the restricted channel of an inland waterway are greatly increased, the insurance charges are always proportionally higher. Again, the saving in time would be largely lost on account of the slow pace necessitated on the canal and the numerous delays, including half-hour stops at each lock.

In the case of German vessels bound for American ports the distance saved would be much less, and it requires an unusually elastic imagination to conceive that these ships could be induced to encounter the dangers and delays and extra costs of an inland waterway for the sake of a saving of some 200 or 300 miles' distance in the open ocean.

Nor can it be considered plausible that these ocean vessels would find it to their advantage to enter the canal for the sake of picking up freight at Grangemouth or Glasgow. Tramp steamers of the old type might possibly do so; but, as the advocates of this canal themselves say, these wandering vessels are becoming scarcer year by year as the demand grows for through cargoes on large steamers. To contend in the next sentence that German vessels would be likely to load partly at home, then cross the North Sea and encounter all the uncertainties of an inland waterway in order to finish out their cargoes, is, to say the least, inconsistent; and it is as improbable as it is lacking in consistency.

Still another inducement, however, was held out to these Continental vessels, namely, that of cheap bunker coal in Scotland. No evidence was submitted to show that Scotch coal is, in fact, any cheaper than German coal; but, granting that it may be slightly cheaper, there nevertheless appears scant inducement to German ships. No difficulty is experienced by these vessels in carrying sufficient coal for the entire journey to the United States; and Scotland is, at any rate, only one day's journey from the North German ports. Again, the coal which would still have to be bought in Germany for a part of the trip would doubtless cost more per ton than when larger amounts were purchased; and, moreover, the incidental loading expenses would not be decreased proportionally with the reduced amount of fuel purchased in Germany. But if a considerable portion of the coal were secured in Scotland, the loading equipment and incidental expenses would have to be duplicated, and, in addition, many hours, or days, of valuable time would perhaps be wasted during the process of loading. Vessels can be fully bunkered in the home port at the same time that the cargo is being loaded. These considerations far more than offset any slight advantages that might arise from a possibly lower cost of fuel in Scotland. Hence it is unnecessary to enumerate again the further disadvantages in the way of risks, extra canal costs, etc.

There is some point to the argument that ships experience difficulty at present in securing a full cargo on either Scottish coast, alone. Undoubtedly, the coasting trade would find the canal a convenient short cut. One may grant all the benefits that the most optimistic could look for in this respect, and yet regard the scheme as wholly impracticable. A minimum estimate of the cost is $100,000,000, or over $3,000,000 per mile. To secure adequate returns on so great an outlay as this, in incidental ways, would require an enormous length of time. If the coasting-vessels cannot profitably carry the traffic around the island, and if it becomes necessary to collect all of the shipping upon one or the other coast, this can obviously be done much more expeditiously and much more economically, even allowing for the extra cost of transshipment, by a railway, costing at most perhaps $200,000 a mile, — one fifteenth the amount of the proposed water route.

Thus, from whatever point of view one regards this much-discussed ship-canal project, it appears hopelessly visionary. It is well that the citizens of Glasgow have come to the conclusion that the commercial benefits of such a canal would not be sufficient to warrant their undertaking its construction unaided; they will not undertake the project unaided. And it is fortunate for the present state of the imperial exchequer that the Government has not been made to believe that the strategical importance of the project is of sufficient value to warrant the necessary appropriations for carrying out the scheme.

CHAPTER IX

THE WATERWAYS OF GERMANY. COST, TRAFFIC DEVELOPMENT, AND FINANCIAL SUCCESS

1. THE rivers of the German states have been used from time immemorial as agents of transport, and the construction of canals dates back for centuries. As early as the year 791, Charlemagne is said to have caused surveys to be made for a canal to connect the Danube and Main Rivers, but the work was not carried out. The Finow Canal, near Berlin, however, was opened to traffic in 1609, and the Friedrich Wilhelm Canal was completed in 1668.[1] During the next two centuries waterways continued to be the chief means of transport in Germany; and it was not until about 1850 that railways began to play an important rôle in the carrying of freight and passengers. The development of railways in Germany, however, was accompanied, as in other countries, by a decline in water transport, which remained unchecked until the inauguration of governmental supervision of water transportation in the seventies. Between 1875 and 1900 the waterway system of the country was completely reorganized. Existing waterways were improved and a number of new canals were constructed, and the whole administration thereof was placed under the control of a Waterways Department in the Ministry of Public Works. The principal new projects completed during these years were as follows: [2] —

Canalization of the Main from Mayence to Offenbach.
Canalization of the Lower Spree.
Canalization of the Fulda from Cassel to Münden.

[1] Gerhardt, *Die Woche*, June 18, 1910, p. 1027.
[2] Sympher, London *Daily Chronicle*, April 7, 1906.

Canalization of the Upper Oder.
Construction of the Dortmund-Ems Canal.
Construction of the Elbe-Trave Canal.

In addition to these the lower Weser was canalized, and the Kaiser Wilhelm and Königsberger Canals were constructed; but as these projects are for the benefit of seagoing vessels, they may not properly be classed with inland waterways.

Following the inauguration of the new policy, traffic rapidly developed, from 2,900,000,000 ton-kilometers in 1875 to 11,500,000,000 ton-kilometers in 1900.[1] Encouraged by this increase of water tonnage, the Administration passed two important laws in 1904 and 1905 for a still further extension of the waterway net of the country. These laws provide for an outlay of $116,430,200[2] upon rivers and canals, an amount almost equal to Prussia's entire expenditures upon waterways up to 1904. It is expected that all the new projects will be completed by the year 1917.

From the remarkable development of traffic upon the waterways of Germany immediately following their rehabilitation, and from the fact that the Prussian Government has deemed it advisable to appropriate an enormous amount of money for a still further development of inland navigation, it would seem perhaps that we might at once consider the question, whether the waterways of Germany have been successful under the conditions there existing, as answered in the affirmative. A careful analysis of the character and the extent of the development of waterborne freight, and of the accompanying costs of such development, will show, however, that German waterways have not uniformly enjoyed the success with which they are usually credited.

[1] Sympher, *Die neuen wasserwirtschaftlichen Gesetze in Preussen*, 1905, p. 17.

[2] *Ibid.*, pp. 50–51.

2. In the first place, the great increase in German waterborne tonnage, when taken merely by itself, is almost sure to be misleading. It should be borne in mind in this connection that during the period in question Germany has grown with astonishing rapidity. Beginning shortly after the formation of the Empire in 1871, the country underwent a transformation that has hardly been paralleled anywhere in the Old World. Between 1871 and 1905 the population increased from 41,000,000 to 60,641,298, or 47.7 per cent.[1] Far more significant, however, than the mere increase in numbers, is the increase of business done within the country. This is reflected in the amount of traffic handled on the railways and waterways combined. The development of traffic between 1875 and 1905 is shown in the following table:[2]—

Waterways				Railways			
Year	Length (miles)	Ton-mileage (000,000)	Increase per cent	Length (miles)	Ton-mileage (000,000)	Increase per cent	Year
1875	6200 *	1798		16,430	6,758		1875
1885		2976	66	22,940	10,292	52	1885
1895		4650	56	27,780	16,430	60	1895
1900		7130	53	30,750	22,878	39	1900
1905		9300	30	33,730	27,652	21	1905

* The number of miles of waterway actually increased by 185 during these years. Some new canals were built, and some old ones abandoned. The general result, however, is not materially affected by the slight inaccuracy of the table.

The total traffic moved by water and by rail was 8,556,000,000 ton-miles in 1875; in thirty years it more than quadrupled, reaching the enormous total in 1905 of 36,952,000,000 ton-miles. In the light of such an industrial expansion, it is apparent that the important point to be considered is not so much the absolute increase of waterborne freight as the relative increase, as compared with

[1] *Statistisches Jahrbuch,* 1909, p. 1.

[2] *Report of Royal Commission on Canals and Inland Navigations of Great Britain,* vol. VI, p. 211.

that on the railways. The above table gives the opportunity for such a comparison.

The percentages show that Germany's waterway traffic has increased in about the same proportion as that of her railways. While the total ton-mileage for the period increased by 323 per cent on the railways, that by water shows a growth of only 239 per cent. On the other hand, however, the waterway increase took place with but a slight increase in mileage, while the railway mileage a little more than doubled during the period; the increase in the number of ton-miles per mile is therefore more significant than the mere ton-mileage. The increase of tonnage per mile on the waterways was 417 per cent, as against an increase of 100 per cent on the railways.[1] Since, however, the base figures are in both cases much larger for the railways, a corresponding allowance must be made in the percentage columns in favor of the railways. On the whole, therefore, the waterways and railways may be said to have enjoyed fairly equal development. In no sense can the expansion of waterway traffic be considered exceptional. It has merely kept good pace with the general industrial growth of the country.

3. There is another consideration to be regarded in connection with the development of water traffic in Germany which is of the greatest importance for the purpose of our study. The differences between transportation on artificial and on natural waterways have been discussed in a previous chapter; and it has also been shown that, on account of differences of industrial and geographic conditions, some naturally navigable rivers may be of little use, while others, even within the same country, may carry enormous quantities of freight. It will therefore prove instructive to ascertain whether the development of waterway traffic in Germany has been evenly distributed.

[1] *Report of Royal Commission*, vol. VI, p. 211.

In 1902 the total number of ton-kilometers of traffic carried on all the waterways of Germany was 11,500,000,000; and of this amount the seven great canalized rivers, the Memel, Vistula, Oder, Elbe, Weser, Rhine, and Danube, carried 9,350,000,000 ton-kilometers, or 81 per cent of the total.[1] The increase, likewise, has been greatest upon these large rivers. "The great increase in water-borne traffic in Germany . . . is mainly upon her important rivers. In 1875 the seven main rivers carried 60 per cent of the total traffic, and in 1905, 80 per cent. On the Rhine, alone, between Kehl and the Dutch frontier, 43 per cent of the total traffic of the country, and on the Elbe, between Hamburg and the Austrian frontier, 24 per cent was carried."[2] The latter part of the above quotation deserves especial notice. On the two rivers, the Elbe and the Rhine, there was carried in 1905, 67 per cent of all the traffic on German waterways. The length of the Rhine within German territory is about 355 miles and of the Elbe 386 miles, making a total of 741 miles.[3] The total length of all the waterways of the country is 7582 miles, and of the actually important ones 6155.[4] These two rivers comprise, therefore, only 12 per cent of the important waterway mileage of the country; yet they carry 67 per cent of the entire water-borne traffic. The Rhine, alone, handles 43 per cent of the entire amount, and has a mileage of less than 6 per cent of the total of the important waterways. In fact, the tremendous development of the Rhine traffic is chiefly responsible for the apparently good showing indicated by the above statistics. "In 1875 the average tonnage per mile upon the river for the 355 miles above the frontier of Holland was 1560; by 1905 it had mounted to 11,400, an increase of 631 per cent."[5]

[1] Sympher, London *Daily Chronicle,* May 10, 1906.

[2] *Preliminary Report of the* (*United States*) *National Waterways Commission,* 1910, p. 28.

[3] *Report of Royal Commission,* p. 182.

[4] Sympher, London *Daily Chronicle,* April 7, 1906.

[5] *Preliminary Report of National Waterways Commission,* p. 29.

Notwithstanding the fact that the development of German waterway traffic has thus been confined mainly to two great rivers, the above statistics of total traffic are customarily presented as evidence of the success of all German waterways, whether natural or artificial, whether in an industrial or agricultural region. That such statistics, when unanalyzed, are sure to be misleading, is clearly obvious.

It is unnecessary to proceed further in this direction at present. Enough statistical data have been presented to make it apparent that if we are to ascertain whether German waterways, both natural and artificial, are successful in all sections of the country, we must leave the general and take up the particular, that is, make a separate investigation of the development that has occurred on each of the important waterways of the country. In this study we shall inquire at what cost the various water routes have been developed, the extent of traffic development that has taken place, and the financial results of each project. We shall further give attention to the various geographic and industrial conditions that have affected, either favorably or unfavorably, each particular waterway. These are the points which may serve to illuminate our own waterway question. It is to be borne in mind that in this treatment we shall be applying American tests to German conditions. In the following chapter, however, we shall discuss the general transportation policy of Germany from the German point of view.

4. Statistics of water traffic are collected at each of the important ports on the various waterways of the country. Were we to combine the totals for each port on a given route, a large portion of the tonnage would have been counted twice. In the absence of data as to the total amount of freight movement on particular waterways, we shall in each case present the statistics for the port of largest traffic. For the purposes of our discussion these will be found to be sufficiently accurate.

The most important inland waterway of Germany is the Rhine River. The extent and character of its traffic development may best be shown by the statistics of export and import for a period of years at Emmerich, on the border of Holland. They are as follows:[1] —

Year (annual average)	Imports	Exports	Total	Floating timber
1873–75	818,000	1,554,000	2,372,000	——
76–80	1,108	2,020	3,128	13,000
81–85	1,726	2,594	4,320	18
86–90	2,482	2,760	5,242	31
91–95	4,004	3,021	7,025	29
96–00	7,703	3,728	11,431	29
1901–05	9,934	6,373	16,307	22
06	13,402	7,678	21,080	14
07	16,000	7,189	23,189	21
08	14,193	7,625	21,818	17

The character of the traffic for the year 1908 was as follows:[2] —

Imports			Exports		
Commodity	Tonnage	Per cent	Commodity	Tonnage	Per cent
Iron ores . .	5,798,121	40.8	Coal . . .	4,559,149	59.7
Grain . . .	2,696,940	19.0	Iron (worked)	804,009	10.5
Wood . . .	1,409,975	9.9	Earths . . .	693,928	
Ores (other) .	894,935	6.3	Stone . . .	468,452	
Coal . . .	527,636	3.7	Cement . .	238,016	
Petroleum .	436,324		Fertilizers .	121,355	
Rape seed .	292,800				
Cement . .	271,397				
Fat oils . .	127,081				
Stone . . .	114,400				
Metal . . .	112,382				
Flour . . .	111,636				
Sugar . . .	107,517				
Total . . .	12,701,144	89.5			90.3

[1] *Statistik des deutschen Reichs*, 1909, Binnenschiffahrt, p. 14. Throughout this chapter the tonnage statistics are in metric tons. A metric ton is equal to 2105 English pounds; the difference is slight, and so long as mere increases are being shown, there is nothing gained by a change to English tonnage.

[2] *Ibid.*, p. 37.

This table shows that a comparatively small number of bulky commodities comprise nearly the whole traffic, while two or three commodities alone make up over half the entire tonnage. We shall find it instructive to inquire into the industrial conditions which have produced so large a traffic in these few particular commodities.

The first and by far the most important point to be noted is that the Rhine passes through the great Westphalian coal region, the most productive on the continent of Europe. This one fact alone accounts for 70.2 per cent of all the exports over the Dutch border. Partly manufactured iron is added to the coal in obtaining this figure, its existence being entirely due to the presence of coal. Of the imports, the ores brought in to be manufactured in the coal regions may be directly set down as a result of the location of the river near the coal-fields. These comprised 41.7 per cent of the total upstream traffic passing through Emmerich in 1908. The existence of these rich coal-fields along the Rhine, moreover, has obviously given rise indirectly to much of the remaining traffic.

The second point to be observed is that the connections and tributaries of the Rhine are exceptionally favorable to traffic development. The canalized Main River, together with the Main-Danube Canal, form a connection with the great Danube River flowing through the centre of Austria to the Black Sea. The Neckar, joining the Rhine at the large inland port of Mannheim, reaches the rich rock-salt region near Heilbronn. This salt finds a natural market in the Ruhrort industrial region, where it is used in the process of iron and steel manufacture. At Strassburg, the head of navigation on the Rhine, the river is joined by the Rhine-Rhone and Rhine-Marne Canals, which lead across the border to the waterways of France.

The utility of these excellent tributary sources, and of the Rhine itself, however, could not be fully developed were there but a scanty population. Under however favoring natural conditions, the density of traffic, by rail or by water, very closely corresponds with the density of population. Within Germany on the banks of the Rhine are ten cities of more than fifty thousand people, six of them with more than a hundred thousand. Frankfort-on-the-Main, only twenty-three miles from the Rhine, may be added to the list.[1] All of these cities are great consuming centres, especially for imported grain, a commodity constituting in 1908 nineteen per cent of the total upstream traffic.

The interior coal traffic is also very important by reason of this large population along the river. The great industrial cities of Mannheim and Frankfort, on the upper Rhine and the Main respectively, secure their coal from the Ruhr district, near the lower Rhine. At Mannheim coal and grain together comprised in 1906 nearly two thirds of the total traffic received,[2] and at Frankfort in 1908 coal alone made up 44.7 per cent of the total upstream traffic.[3]

Another factor to be noted is, that at the mouth of the Rhine in the Netherlands is the great world port of Rotterdam. The construction of what is called the Rotterdam Waterway removed practically the only impediment to navigation on the entire river. Ever-moving sandbanks near the old outlet of the river rendered navigation so dangerous that in 1866 the Government of Holland undertook the construction of a canal outlet to the sea.[4] As a result all of the German hinterland has participated in the benefits of an excellent harbor and outlet without having to share their cost.

Having now found how exceptionally favorable are the

[1] Chisholm, *Annual Report of Smithsonian Institution*, 1907, p. 354.

[2] *Ibid.*, p. 356.

[3] *Statistik des deutschen Reichs*, *supra*, p. 9. This traffic, for the most part, does not pass through Emmerich and hence the tonnage is not included in the above table. It is set forth here in explanation of traffic development on the *upper* Rhine.

[4] See chapter XIV.

commercial conditions of the Rhine territory, we may pass to a consideration of the character of the river itself.

In the first place, the Rhine is remarkably straight, the river distance between Strassburg and the Dutch frontier being only 41 miles, or about 13 per cent greater than that by rail.

Second, with the exception mentioned above, near its mouth, in Holland, the river has required comparatively little regulative work. The only section of dangerous waters has been that between Bingen and St. Goar, a distance of about 18 miles, and an expenditure of $1,712,500 was sufficient to perfect this part of the stream.[1] In all, for the 355 miles of navigable river within Germany, the canalization costs between 1866 and 1898 amounted to $4,250,000.[2] As compared with the enormous outlays necessary to control the majority of American rivers, this sum is almost insignificant in amount.

Third, the current of the Rhine is not strong, the average descent being only 1.14 feet per mile.[3] This condition alleviates the dangers of downstream navigation and at the same time lessens the cost of propulsion or towage upstream. No locks are required on any portion of the river.

Fourth, there are very few interruptions to traffic on account of floods, drought, or winter's ice. The river is fed by the melting of the glacial ice of the Alps Mountains, and hence the supply of water is comparatively uniform throughout the year. There are very few destructive spring floods, the average interruptions to traffic from that cause being but two days a year.[4] No costly bank protections, levees, or huge impounding reservoirs are required. The climate of the region is such that ice closes navigation on the average but seventeen days each year.[5]

[1] *International Ausstellung*, Mailand, 1906, Wasserbau, p. 135.

[2] *Kommissionsbericht über die Wasserstrassen Vorlage des Jahres* 1904, p. 286.

[3] *Report of Royal Commission*, vol. VI, p. 182.

[4] *Ibid.*, p. 68.

[5] *Ibid.*

Finally, the capacity of the river is amply sufficient. Barges with a carrying capacity of two thousand tons can travel as far up the river as Mannheim, 351 miles above Rotterdam, while 800-ton barges can reach Strassburg, the present head of navigation. Thus both the commercial and the geographic conditions promote to an unusual degree the successful navigation of the Rhine.

In still another manner, however, has shipping on the Rhine been favored, namely, by the administrative policy of both Germany and the Netherlands in maintaining the river free of tolls. Including Holland's expenditure upon the Rotterdam Waterway, the present outlet to the sea, about $40,000,000[1] has been spent by the two countries in regulative works. It is not attempted, however, by the Governments of these countries to recoup themselves at the expense of shippers. In Germany in the year 1905, there was a total net outlay on the part of the State, for maintenance and operation, including interest and sinking fund at 3.5 per cent, of $750,215.[2] This may be taken as approximately the average yearly outlay. Shippers are thus given outright by the State each year a sum equal to about $2000 per mile of river length.

The shipping is carried on by independent shipping companies, and it is obvious that the rates they charge need be sufficient merely to cover the cost of the boats and the haulage charges, together with a reasonable profit on this investment. Even the harbor facilities are furnished them by the various cities (Ruhrort by the State), and the rates charged for their use are very low; usually much less than would be necessary to cover the cost of maintenance plus interest on the investment.[3]

It is interesting to note, in passing, that, between Frank-

[1] Chisholm, *supra*, p. 359. [2] Peters, *Schiffahrtsabgaben*, part III, p. 260.

[3] It would seem to have a bearing upon the question of competition with the dividend-paying railways that "in 1902, eight out of nineteen shipping companies paid no dividends; and in 1903, four paid none." (Chisholm, *supra*, p. 359.) The facts as to later years are unknown to the writer.

fort-on-the-Main[1] and the Westphalian region, railways parallel the Main and the Rhine for the entire distance, and that in 1907 the amount of coal carried by rail was 128,799 tons, as against 450,788 tons by river.[2] At all times of the year the railways were able to maintain competition in spite of the natural advantages of these particular rivers, and the artificial advantages in the way of Government subsidy to the waterways.

These various commercial, geographic, and administrative advantages have combined in an exceptional manner to further the transport of goods on the Rhine. Probably on no other river in the world are conditions so conducive to the development of water traffic. The result has been that in a limited number of commodities, chiefly coal, ores, and imported grain, there has been a very great increase of tonnage during the past thirty years.

5. We have next to consider the canalized river Main, a branch of the Rhine in south central Germany. The work of thorough canalization from Mayence to Frankfort was carried out by the Prussian Government between 1883 and 1886.[3] The traffic development is shown in this table:[4]—

Year (annual average)	Received	Dispatched	Total
1873–75 . . .	28,000	2,000	30,000
76–80 . . .	10	1	11
81–85 . . .	10	2	12
86–90 . . .	290	47	337
91–95 . . .	524	96	620
96–00 . . .	811	155	966
1901–05 . . .	1,018	224	1,242
06 . . .	1,180	284	1,464
07 . . .	1,079	265	1,344
08 . . .	963	211	1,174

[1] Frankfort is only twenty-three miles up the Main, and that river has been canalized to permit the passage of the large Rhine boats, as far as Frankfort.

[2] McPherson, *Transportation in Europe*, 1910, p. 176.

[3] *Die Wasser und Hafenbauten in Frankfurt-a.-M. Statistischen Tiefbauamt*, pp. 7–8.

[4] *Statistik des deutschen Reichs, supra*, p. 15.

It is to be noted that a rapid development began immediately after the completion of the canalization works in 1886, and continued to increase uninterruptedly for about twenty years. The last two years indicate a considerable falling off in tonnage, and the total in 1908 was appreciably less than the average during the earlier years from 1901 to 1905. The years 1907 and 1908 were, however, not good traffic years in general; consequently too much importance should not be attached to the decline.

It is hoped that the completion of the fine new harbor at Frankfort in 1911 will serve to stimulate traffic, as did the canalization works in the eighties. An analysis of the character of the present traffic, however, indicates that a rapid further extension is doubtful. In 1908 the chief commodities received and dispatched were as shown in the table below:[1] —

Received			Dispatched		
Commodity	Tonnage	Per cent	Commodity	Tonnage	Per cent
Coal	430,469	44.7	Wood . . .	29,486	18.7
Earths . . .	166,400	17.3	Ores . . .	37,045	17.5
Grain . . .	72,525		Grain . . .	18,741	
Wood . . .	47,144		Earths . .	15,847	
Flour . . .	43,459		Casks . . .	15,729	
Coke	41,436		Stone . . .	15,581	
Petroleum . .	19,988		Cement . .	9,984	
Building-Stone	15,571			–	
Stone . . .	10,545			–	
Total . . .	847,717	88		150,213	71

As is shown by the table, coal makes up nearly one half the total tonnage received. This coal comes from the Ruhrort region along the lower Rhine, and is for the domestic supply of Frankfort and the surrounding territory. The coal harbor and wharves are complete, and the forwarding business is already well developed, about one third of the total amount received being now transshipped to rail and dis-

[1] *Statistik des deutschen Reichs, ibid.*, p. 9.

tributed to near-by towns.[1] It is evident that the further development of this coal traffic cannot go beyond the general industrial development of Frankfort and its environs. And the same thing is obviously true of most of the other commodities in the list. The demand for such materials is necessarily limited to the growth of the region they supply. The very rapid development following 1886 seems to have been due not so much to the growth of Frankfort as to the diversion of this traffic from the railways; and the failure to continue to expand rapidly in the last two years is unquestionably due to the fact that diversion of traffic from the railroads has ceased, and that now the development must be merely a normal one. It is not expected that the opening of the new harbor will attract manufactured commodities to the waterway. Manufactured goods do not travel extensively by water anywhere in Germany. But even though it be granted, then, that the development of traffic on the Main must be less rapid in the future than it was in the years immediately following its canalization in 1886, still, has not the net result amply rewarded the outlays made upon the river? This question will be considered in the following paragraphs.

The table below shows the expenditures that have been made in order to perfect the navigation of the river:[2] —

Items		Totals	Per mile
Original works, 1883–86	$1,375,000		
Extensions, 1891–95 . .	745,000	$2,120,000	$90,987
City harbor and facilities, 1883–87	1,625,000		
Extensions, 1890–1900 .	625,000		
New Harbor *			
Land	8,000,000		
Construction . . .	10,000,000		
Interest loss . . .	2,000,000	22,250,000	954,935
Totals. . . .		$24,370,000	$1,045,923

* These statistics were furnished by Hermann Uhlfelder.

[1] Statement of Hermann Uhlfelder, building constructor of the new harbor.

[2] *Report of Royal Commission*, vol. VI, p. 197.

It will be observed that there is included in this table the cost of the harbor as well as the cost of canalization of the river. In counting the cost of waterways in the United States, it is common to include only the cost of constructing the canal, or of canalizing the river. But a waterway without harbors and wharves is as handicapped as a railway without terminals. Well-equipped railway terminals attract traffic in the same way that an extensive industrial or commercial harbor tends to build up trade, and if we include the cost of railway terminals, we must obviously include also the cost of waterway terminals, when making a comparison of the relative cost of developing the two agents of transport. The table, then, shows that the total cost of improving this river for a distance of 23.3 miles from Frankfort to the Rhine was $24,370,000, or $1,045,923 per mile.

As a return for its share of the outlay, the Prussian Government levies small tolls upon vessels passing through the locks. These are, however, insufficient to meet the annual charges for operation and maintenance, and for interest on the capital invested, the deficit in 1905 being $82,598.[1] The city of Frankfort, on its side, levies a few nominal harbor dues, and charges something for the use of equipment, but it is not expected that after the new harbor is completed, the direct revenue therefrom will equal even one per cent of the investment.[2] This leaves, therefore, a yearly deficit of at least 2.5 per cent on the capital invested in the harbor. (Interest and sinking fund is commonly computed in Germany at 3.5 per cent.[3]) This means that Frank-

[1] Statistics of operation of Prussian waterways are not officially published yearly. For the above figures, and for those of all the waterways subsequently to be given, we are indebted to Max Peters, who, under government appointment, has prepared careful tables of the cost and expenditures on all the waterways of Prussia. His tables are complete to the close of the year 1905 only. Peters, *Schiffartsabgaben*, p. 262.

[2] Statement of Hermann Uhlfelder.

[3] The interest is computed at 3 per cent and the sinking fund at .5 per

fort must meet each year a deficit of at least $500,000. It will probably greatly exceed that amount. Adding this sum to the annual deficit incurred by the Prussian Government, as it stood in 1905, gives a total of $582,598. This represents somewhere near the amount of the annual donation of the people of Frankfort and of Prussia in general for the benefit of shipping on the Main.

Viewed from the standpoint of national economy, it should be considered whether these millions have been profitably expended. In 1907 the average capitalization per mile of the railways of Prussia was 111,687.[1] This includes terminal facilities and full equipment even to the rolling-stock, whereas, in the above waterway cost computation, the boats, tugs, etc., were not included, they being constructed and owned by private companies. These figures signify that nine or ten fully equipped railways could have been constructed for the cost of the canalization and harbor works of the water route, leaving the boats still to be supplied. Were a railroad constructed for the sole purpose of carrying bulky freight, it is obvious that the cost per mile would be much less, probably not more than half that of a road designed for both passengers and freight. As we shall have occasion later to develop this point in some detail, it may be passed by here as a mere suggestion.

Suppose, now, one railway were constructed, — as a matter of fact, none would yet be needed, even were the waterway not used, the existing railways still being adequate, — but suppose one railway had to be built for the purpose of handling the bulky traffic of the region. At the full

cent. The sinking fund is regarded as a deficit on account of water transportation by Mr. Peters; and this is quite proper, so long as in making comparisons with railway figures a similar allowance is made.

[1] *Statistisches Jahrbuch für das deutsche Reich*, 1909, p. 114. It is said that the railways of Germany have been greatly overcapitalized for the purpose of making the dividends appear moderate in amount, thus preventing a clamor for a reduction of rates.

average rate of railway construction in Prussia, for roads whose greatest use is for passenger traffic, and hence are much more costly than they would needs be did they handle only freight, a railway between Frankfort and Mayence would cost $2,602,317. The balance against the waterway, which costs $24,370,000, is $21,767,683. Suppose, moreover, that the rates on this railway were not to be fixed high enough to yield a profit; suppose, on the other hand, that it were even run at a loss; suppose, if you please, that the $582,598 which is annually donated to the waterway were presented each year to the railway in question. If a freight railway should thus receive an annual gift equal to about 23 per cent of its capitalization, it is obvious that the freight rates might be enormously reduced. Were the same amount given to the existing railways, they could doubtless carry this low-class freight for nothing; relying upon fast freight and passenger traffic for dividends.

Viewed, however, from the local standpoint of Frankfort alone, the odds against the waterway appear not quite so overwhelming. Were it not for the waterway, the city of Mayence, at the mouth of the Main, or Mannheim, a little above Mayence on the Rhine, would become the point of transshipment to the railways. The result would be that Frankfort would lose the transshipping business she now enjoys, together with the consequent general stimulus to trade such transshipment carries with it. It is impossible to compute accurately the extent and importance of this business; but we have seen that one third of the coal *received*, and some of the grain and other materials, is annually transshipped at Frankfort and forwarded to near-by cities and towns. The amount of coal that was transshipped in 1908 was in the neighborhood of 150,000 tons. The German Government estimates the cost of transshipping coal from ship to railway at ten cents per ton.[1]

[1] *Frachtvergleichungen für gewisse güter auf dem Bahn, See und Binnenwasserwege*, p. 62.

We shall later see, however, that this Government rate is merely nominal and that the actual cost is probably twice the scheduled rate. Thirty thousand dollars a year, then, is a rough computation of the amount of money expended each year in Frankfort in consequence of the forwarding of coal.

Of the other 56 per cent of the traffic *received*, comparatively small amounts were transshipped. The earths, such as clay, sand, and gravel, as well as the stone, cement, and other building-materials were doubtless practically all destined for local consumption. The same thing is largely true of the grain received, for the surrounding country raises more than sufficient grain to supply its own needs.

If we should consider that all of the traffic *dispatched* by water were transshipped from the railways, the total value would not be great, as only 211,000 tons were sent out from Frankfort by water in that year. Forty thousand dollars a year may, therefore, be set down as the very maximum value of this transshipping business at present. Adding this to the $30,000 above makes a total of $70,000 a year.[1] It will take, therefore, more than seven times the present transshipped traffic to repay Frankfort directly for the annual outlay of approximately $500,000 a year. Many generations will elapse before that region will afford seven times its present traffic.

It may be argued, however, that there are indirect benefits which accrue from the mere fact of a city's being a shipping centre. Industries are naturally attracted to a place that is possessed of good shipping facilities, and a general stimulus to the prosperity of the city is the natural result. It is not to be questioned that such benefits are of much importance, though they do not lend themselves to computation. It should be borne in mind, however, that something like a sevenfold development is necessary to

[1] 1908 was not quite a normal year, but the general result is nevertheless not materially affected.

overcome the present margin of loss. And, again, attention should be directed to the consideration that if the city of Frankfort should donate more than $500,000 to a railway each year, the very low freight rates that would doubtless result would be likely to attract far more business to the city than does the waterway.

6. The Saar River, in southwestern Germany, is another waterway which is sometimes regarded as fulfilling its mission. Tapping, as it does, the rich Saar coal-fields, it apparently should have enjoyed an extensive development of traffic. The table below shows the growth that has occurred since 1873. The statistics are for the traffic passing through the principal locks, at Güdingen:[1] —

Year (annual average)	Upstream	Downstream	Total
1873–75 . . .	520,000	95,000	615,000
76–80 . . .	582	59	641
81–85 . . .	637	91	728
86–90 . . .	609	192	801
91–95 . . .	503	245	748
96–00 . . .	566	275	841
1901–05 . . .	560	254	814
06 . . .	571	334	905
07 . . .	480	329	809
08 . . .	417	319	736

Of the traffic upstream, coal comprised 98.7 per cent of the total for 1908; and of that downstream the three commodities, iron ore, stone, and earth, made up 70 per cent of the entire amount.[2]

It is seen from the table that the tonnage has but slightly increased since 1873, and that in 1908 it was less than it was twenty years earlier. The amount of coal handled now is less than it was even thirty-five years ago.

The total expenditures by the State on the Saar up to April 1, 1906, amounted to $2,060,429; and the net deficit

[1] *Statistik des deutschen Reichs, supra*, p. 15. [2] *Ibid.*, p. 9.

in 1905 was $101,649.[1] Notwithstanding the favorable location and the heavy Government subsidies, the above statistics indicate that the waterway has failed to develop the resources of the territory it serves.

7. The Rhine-Marne Canal extends across the French border and connects the Marne River of France with the Rhine at Strassburg, the head of navigation on that river. Traffic movement since 1872 has been as follows:[2] —

Year (annual average)	Imports	Exports	Total
1872–75 . . .	124,000	284,000	408,000
76–80 . . .	91	409	500
81–85 . . .	124	442	566
86–90 . . .	246	349	595
91–95 . . .	307	253	560
96–00 . . .	348	317	665
1901–05 . . .	356	345	701
06 . . .	431	425	956
07 . . .	503	354	857
08 . . .	442	302	744

The traffic is seen to have about doubled in thirty-six years, by no means keeping pace with the general development of the country as a whole. Of the tonnage from France in 1908, 61 per cent was coal, iron ore, and coke, and of the exports, 82.7 per cent was coal alone.[3] The presence of minerals, again, is seen to be the chief cause of the waterway traffic that exists.

8. Another famous waterway of southern Germany is the Ludwigs, or Main-Danube Canal, connecting the Main and the Danube Rivers. Here the decline in water traffic presents a striking parallel with that on the Erie Canal in the United States. The statistics of traffic between 1852 and 1892 are as follows:[4] —

[1] Peters, *supra*, pp. 260–62.

[2] *Statistik des deutschen Reichs*, *supra*, p. 16. [3] *Ibid.*, p. 9.

[4] Schranz, *Main-Donau Kanal, seine Schicksale*, p. 68.

Year	Ton-kilometers	Year	Ton-kilometers
1852	462,780	1877	358,270
57	702,758	82	265,925
62	934,690	87	254,732
67	651,803	92	182,583
72	475,591		

Complete statistics later than 1892 are not available to the writer, but in 1905 the traffic at Nuremberg, the chief centre, was much under 50,000 tons both ways.[1] The average haul in 1892 was only 2.2 kilometres. The length of the haul had formerly been much greater; at present much the greater portion of the traffic is local.[2]

This rapid decline in tonnage took place in spite of the fact that a series of legislative acts after 1843 continually reduced the rates of toll until 1876.[3] The combined effect of a concurrent decline in traffic and a reduction of tolls upon the financial status of the canal is set forth in the subjoined table:[4] —

Year	Receipts	Expenses	Surplus	Deficit
1847 . . .	$43,911	$ 54,489		$10,578
52 . . .	70,154	43,422	$26,732	
57 . . .	84,252	42,715	41,538	
62 . . .	71,228	58,721	12,507	
67 . . .	49,198	109,446		60,248
72 . . .	36,389	81,311		44,922
77 . . .	33,002	78,544		45,542
82 . . .	24,534	72,827		48,293
87 . . .	28,342	64,754		36,414
92 . . .	23,010	52,257		29,157

As the number of tons moved on the canal in 1892 was 83,447, the average deficit amounted to twenty-eight cents per ton. This was for moving low-class freight, mainly sand and gravel, an average distance of 2.2 kilometres, or 1.36 miles. To this must of course be added the small tolls,

[1] Chisholm, *supra*, p. 359.
[2] Schranz, *supra*, p. 68.
[3] *Ibid.*, p. 107.
[4] *Ibid.*, pp. 111–12.

and the actual freight charges made by the owners of the boats, as well, if one is to ascertain the complete cost of handling this traffic. Were one so disposed, it would be interesting to compute whether the value of the freight was equal to its cost of transportation.

9. The Danube River, before reaching the Austrian border, is navigable for many miles in Bavaria, and, as we have seen, is connected with the Main and the Rhine by means of the Ludwigs Canal. The traffic movement at Passau, near the Austrian frontier, has been as follows:[1] —

Year (annual average)	Imports	Exports	Total
1883–85 . . .	80,000	47,000	127,000
86–90 . . .	194	37	231
91–95 . . .	170	44	214
96–00 . . .	208	39	247
1901–05 . . .	244	55	299
06 . . .	279	69	348
07 . . .	356	92	448
08 . . .	176	105	281

These statistics indicate only a very slight increase as compared with that on the Rhine and the Main; but it is of more importance to observe that the total quantity carried is insignificant in amount, only 281,000 tons in 1908, as compared with 1,174,000 at Frankfort-on-the-Main the same year. This cannot be due to the lack of capacity of the river, as the mean depth of the Danube above Vienna in Austria is 7.5 feet, while the shallowest portion of the entire river is 6.5 feet deep.[2] The depth of the Main below Frankfort is only 7.2 feet, while above that port it averages only about 4 feet.[3] The small traffic is doubtless due to the absence of a large supply of coal along the Danube.

[1] *Statistik des deutschen Reichs, supra*, p. 16.
[2] Schranz, *supra*, p. 62.
[3] *Ibid.*

10. After the Rhine River system, the most important inland waterways of Germany are those centring about Berlin, commonly known as the "Mark Waterways." The diagram below shows Berlin to have several waterway connections with the sea. The more important are the routes by way of the Havel and Elbe Rivers to Hamburg, a North Sea port; or to Lübeck on the Baltic, by way of

the Elbe River and the Elbe-Trave Canal. The lines are navigable for vessels of 600 tons' capacity. The alternative routes are by way of the Havel, the Finow Canal, and the Oder River to the Baltic port of Stettin; or by way of the Oder-Spree Canal and the Oder River to the same port; these are navigable for vessels of 400 tons' capacity.[1] In the opposite direction the Elbe and the Oder extend across the Austrian border, the Oder opening up the great Silesian coal-fields of southeastern Germany. Directly east from the Oder, a short distance from the point of junction with the Oder-Spree Canal, extends the Warthe, which, with

Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 6.

the Netze River and the Bromberger Canal, forms a direct connection with the great Vistula (Weichsel), in eastern Germany. Now, the "Mark Waterways" proper are those of the inner circle about Berlin, the Havel and Spree, together with the canals connecting these with the Elbe and Oder. But since all of the rivers mentioned above are so closely centred about the metropolis, it will prove advantageous to consider them as one system.

The only statistics showing the traffic development over a considerable period of years are those of the tonnage received at Berlin by the Spree and by canals. These do not represent the total water traffic of Berlin, as will be later seen; but for purposes of comparison, for showing the growth of traffic that has occurred, they are serviceable:[1]—

Year (annual average)	From downstream	From upstream	Total
1873–75 . . .	2,008,000	742,000	2,750,000
76–80 . . .	2,215	733	2,948
81–85 . . .	1,916	1,043	2,959
86–90 . . .	2,594	1,556	4,150
91–95 . . .	2,618	1,914	4,532
96–00 . . .	2,887	2,004	4,891
1901–05 . . .	3,531	2,619	6,150
06 . . .	3,890	3,551	7,441
07 . . .	3,058	2,827	5,985
08 . . .	2,769	2,210	4,979

It is to be noted that the traffic in recent years has been only about double what it was from 1873 to 1875; while for the same period on the Rhine, the increase was more than a thousand per cent. It is to be observed further that the amount of traffic received in 1908 was but slightly greater than was the tonnage ten years earlier, while the totals for both 1907 and 1908 are considerably less than those for 1905. The decline in 1907 and 1908 is, however, partly due to a general lethargy of industry.

During this period, when the water-borne traffic shows

[1] *Statistik des deutschen Reichs, supra,* p. 12.

an increase of about 100 per cent, the population of Berlin increased by about 200 per cent, — from 825,000 in 1871 to about 2,500,000 in 1908.

The character of the traffic is equally interesting. In 1908 it was as follows:[1] —

From Downstream			From Upstream		
Commodity	Tonnage	Per cent	Commodity	Tonnage	Per cent
Coal . . .	783,191	29	Earths . .	1,117,895	50
Building-stones . .	769,158	28	Coal . . .	403,624	18
Timber . .	200,996		Building stones . .	302,408	14
Grain . . .	179,349		Grain . .	110,906	
Earths . . .	141,981		Cement . .	110,039	
Meal . . .	82,204		Flour . . .	46,002	
Oils	72,001		Timber . .	24,632	
Sugar . . .	70,295		Sugar . .	20,399	
Raw iron . .	55,104		Metals . .	11,037	
Coke . . .	52,378				
Stone and stoneware .	45,053				
Cement . .	40,490				
Total . .	2,492,230	90		2,146,942	97

Again we find that a comparatively few commodities make up nearly the whole of the waterway traffic. A very important point to be considered here, also, is that a large proportion of this traffic is of local origin, and hence that its carriage by water, granting it to be cheaper, can be of no widespread economic importance to the country, savings for short distances obviously being relatively much less important than those across long stretches of territory. The fact is that 85 per cent of this traffic is of local origin,[2] traveling a distance of only a few miles to its destination.

The grain traffic amounted to 179,349 tons upstream, and 110,906 tons downstream, together less than six per cent of the total waterway tonnage received at the metro-

[1] *Statistik des deutschen Reichs, ibid.*, p. 5.

[2] *Weltausstellung in Brüssel*, 1910, p. 94.

polis. In contrast with this, 2,696,940 tons of grain passed through Emmerich on the Rhine in 1908, or more than nine times the amount received by water at Berlin.

Some tables are now presented which are of the first importance as showing the amount of traffic carried by rail and by water respectively to and from the metropolis:[1] —

	1906					
	RECEIVED			DISPATCHED		
	Rail	Water	Total	Rail	Water	Total
Building materials	2,147,707	6,502,796	8,650,503	157,194	208,040	365,234
Coal	3,252,893	1,952,576	4,705,469	307,152	36,952	344,110
Foodstuffs (inc. grain)	1,542,933	735,977	2,279,910	288,147	102,800	390,947
Other raw and partly manufactured stuffs	1,167,156	407,569	1,574,725	568,975	120,330	689,305
Timber	742,477	439,133,	1,181,610	90,634	20,931	111,565
Industrial manufactures	632,232	12,342	644,574	185,682	15,873	201,555
Sundry wares	548,332	99,782	648,114	1,031,279	240,907	1,272,186
Total	10,034,730	9,650,175	19,684,905	2,629,063	745,839	3,374,902
Per cent	51	49		77.9	22.1	
	1907					
Building materials	1,827,812	4,617,286	6,445,098	211,084	303,628	517,712
Coal	3,632,990	1,522,975	5,155,965	247,507	19,984	267,491
Foodstuffs (inc. grain)	1,655,403	698,749	2,354,152	312,833	83,998	396,831
Other raw and partly manufactured stuffs	1,173,393	325,708	1,499,101	627,508	86,363	713,871
Timber	624,208	343,120	967,328	91,628	14,455	106,083
Industrial manufactures	609,945	12,626	622,571	207,441	16,528	223,969
Sundry wares	502,238	98,772	601,010	1,104,814	237,018	1,341,832
Total	10,025,989	7,619,236	17,645,225	2,802,815	761,974	3,564,789
Per cent	56.8	43.2		78.6	21.4	
	1908					
Building materials	1,573,801	4,003,850	5,577,651	192,368	294,314	486,682
Coal	3,640,393	1,616,629	5,257,022	259,719	18,283	278,002
Foodstuffs (inc. grain)	1,718,259	649,251	2,367,510	314,514	105,782	420,296
Other raw and partly manufactured stuffs	961,614	307,841	1,269,455	527,895	91,751	619,646
Timber	516,580	311,589	828,169	70,728	11,107	81,835
Industrial manufactures	555,561	10,495	566,056	213,005	15,675	228,680
Sundry wares	503,867	107,630	611,497	1,177,073	164,152	1,341,225
Total	9,470,075	7,007,285	16,477,360	2,755,302	701,064	3,456,366
Per cent	57.5	42.5		79.7	20.3	

[1] *Statistische Mitteilungen*, 1909, p. 262.

Having regard first to the totals, it is to be noted that the decline in tonnage from 1906 to 1908 was much greater on the waterways than on the railroads. That *dispatched* by the railways even shows a substantial increase. It should be observed, also, that the railways are handling much more than half the traffic of the metropolitan region, and that they are constantly increasing their share of the total. Of the traffic received, the railways' share increased from 51 per cent in 1906 to 57.5 per cent in 1908, and of that dispatched, the increase was from 77.9 to 79.7 per cent in the same years. It is a point well worth considering, also, that in 1908 the dispatched traffic of the waterways was equal to only 10 per cent of that received, while on the railways the proportion was 28 per cent. This appears the more significant when one reflects that there is every inducement for the private canal companies to offer very low rates for return cargoes of some sort, rather than send their boats back empty. The railroads, on the other hand, have the alternative of return cargoes made up of manufactured goods. Yet only 20.3 per cent of the total traffic sent out from Berlin in 1908 was shipped by water.

In building-materials, alone, which include sand, gravel, bricks, cement, stone, etc., did the waterways carry a greater tonnage than was handled by rail, and although all of this is of local origin and especially adapted to water transit, the waterway percentage of the total none the less decreased from 74.3 per cent in 1906 to 70.8 per cent in 1908.

Foodstuffs, generally regarded as certain water traffic, except where perishability is a factor, do not appear to advantage on the Berlin waterways. In 1906 as much as 67 per cent of that received came into the city by rail, and 73 per cent was sent out over the railways. In 1908 these proportions had increased to 73 and 75 per cent respectively.

But the commodity deserving the most attention, because it is the most distinctively a waterway commodity, is coal. The above table shows that there was not a falling-off in the coal traffic during these years, the *total* quantity received increasing from 4,705,469 tons in 1906 to 5,257,022 tons in 1908, and the amount dispatched falling off merely from 344,110 tons to 278,000 tons. Of that received, the railways carried 67 per cent in 1906, and in 1908 they had increased their proportion to 69 per cent, while of the coal sent out from Berlin, the railways increased their share from 89.2 per cent to 93.4 per cent during the years in question.

Reference to the above table will show that the falling-off in traffic on both railways and waterways in 1907 was chiefly in building-materials. Now, since the waterways suffered most here, on account of their larger tonnage in such traffic, it would have seemed that they should have redoubled their efforts to supplement their heavy losses by capturing a larger portion of other commodities. On the other hand, the railways suffered less from the easing-up of building activities both directly and relatively, since building-materials constituted a much smaller share of their total tonnage than was the case on the waterways. Nevertheless, as we have seen, the waterways have lost in their percentages of both foodstuffs and coal, the two most fruitful fields of waterway enterprise after building-materials.

In order to appreciate the better how the waterways are failing to fulfill their mission in the carrying of coal, it is necessary to consider the sources of the coal which is shipped to Berlin. The following table indicates the total quantities brought from the various coal districts in 1907 and 1908, and the proportion which is shipped by water and by rail respectively:[1] —

[1] *Statistische Mitteilungen, ibid.*, p. 105.

Cannel Coal, Coke, and Briketts

Source	1907 Total	1907 By water	1907 Per cent water	1907 Per cent rail	1908 Total	1908 By water	1908 Per cent water	1908 Per cent rail
English	1,164,511	967,920	83.1	16.9	1,439,890	1,134,208	78.8	21.2
Westphalian . .	483,630	144,897	29.9	70.1	408,940	105,503	25.7	74.3
Saxon	15,527			100.	14,887			100.
Upper Silesian .	2,101,904	709,423	33.7	66.3	1,968,546	801,668	40.7	59.3
Lower Silesian .	303,241	249,590	82.3	17.7	39,127	36,775	94.0	6.0
Grand total* .	4,068,813	2,071,830	45.7	54.3	3,871,390	2,078,154	50.9	49.1

* These totals do not agree with those in the above table, for the reason that they do not include the so-called "Braunkohlen."

It is to be noted, first, that about four fifths of the English coal arriving at Berlin comes by water. This would be expected from the fact that it must cross the North Sea to the port of Hamburg, and that there excellent harbor facilities are afforded for transshipment to barges. The water route thence to Berlin is capacious enough for boats of 600 tons. There would be no elimination of transshipment here if this coal were brought to Berlin by rail.

Of the Westphalian coal, only 25.7 per cent travels to Berlin by water. The route here is by way of the Dortmund-Ems Canal, and the North Sea to Hamburg, and thence to the metropolis. The much greater distance of the water route as compared with that by rail doubtless has some effect upon the proportion in this case.

The largest part of the coal used in Berlin, however, is brought from the Upper Silesian coal-fields near the port of Kosel, on the Oder. Though this river is navigable for vessels of 400 tons, as far as Kosel,[1] only 40.7 per cent of the near-by coal is shipped to Berlin by water. It is a point well worth noticing, also, that about three fourths as much coal is imported from England as is brought from the Silesian district, only a short distance away. The canalization of the Oder has not yet fulfilled its mission in develop-

[1] *Report of Royal Commission,* vol. vi, p. 69.

ing the domestic coal mines of the "Fatherland." In 1908 there was an increase over the previous year of 23.6 per cent in the coal imported to Berlin from England, and a decrease of .6 per cent in the quantity drawn from the Silesian fields. "Exceptional" railway tariffs have been established for this Silesian coal; the government realizing that the water route cannot be depended upon, at least in its present condition.

Other coal received at Berlin in large quantities is that classed as Braunkohlen and Briketts. The amounts received in 1907 and 1908 were as follows:[1] —

Year	Total	By water	Per cent by water
1907	1,823,293	13,485	.008
1908	1,961,106	6,325	.003

Practically all of this comes from the Silesian district, and, as is shown by the table, the amount traveling by water is almost negligible.

Briketts are extensively used for household purposes, and the reason for their preferable shipment by rail, as well as all coal that is for household use, is that the breakage, when brought in large barges, causes a serious loss. "The best coal will not stand the rough handling it receives at the hands of coal tips and ponderous self-loading buckets. Coal resifted on coming out of the barges at Mannheim after its second transshipment, — the first being from rail to water in Duisburg-Ruhrort, — shows a loss in value of 1.40 marks per ton (33 cents)."[2] We have earlier seen how this, with other causes, prevented the shipment of coal, destined for household purposes, to London by water.[3]

Having seen the extent of traffic development on the waterways surrounding Berlin, we may now turn our

[1] *Statistische Mitteilungen, supra*, p. 105.

[2] Clapp, *The Navigable Rhine*, p. 105.

[3] See pages 112–14.

attention to a consideration of the cost of developing such traffic. It is quite impossible to compute the cost with any considerable accuracy. Some of the waterways over which the Berlin traffic passes are also used in more or less degree for other traffic, and it would be quite unfair to charge off their total cost against the Berlin commerce alone. Such is particularly the case with the rivers which form the tributaries, so to speak, of the "Mark Waterways," immediately surrounding the metropolis. In the case of the Oder, the *local* traffic is insignificant. Of the traffic downstream in 1908 from the upcountry port of Kosel, for instance, 94 per cent was coal, practically all of which was bound for Berlin.[1] This river would not have been canalized in its upper course had it not been for the possibility of furnishing Berlin with coal from the Silesian district. We may, therefore, consider that approximately three fourths of the expense of improving the Oder is fairly chargeable to the Berlin trade. The Elbe, however, enjoys a larger degree of independence from Berlin, the total traffic handled at Hamburg in 1908 being 8,778,000 tons,[2] or more than the total traffic at Berlin. The greater part of this, however, was Berlin-Hamburg traffic. Making allowance for such of this traffic as is independent of Berlin, and also for the upstream local traffic on the Elbe, we may yet safely conclude that at least half the expenditures on this river have been for the benefit of the Berlin trade. On the Warthe, the Netze, and the Bromberger Canal, which form the connection of the Oder with the Vistula, there is also a considerable local traffic, and one half the cost of this route may hence be charged to that account. The "Mark Waterways," proper, evidently serve mainly the Berlin trade. On the basis of the above allowances, we may, then, present a table which shows, roughly, the total cost of developing the Berlin waterway system. For pur-

[1] *Statistik des deutschen Reichs, supra*, p. 3.

[2] *Ibid.*, p. 4.

poses of reference verification, the complete statistics are given first, and the necessary deductions are made in a lump sum from the total:[1] —

Waterway	Length	Capital invested to April 1, 1906	Operation		Deficit, including interest and sinking fund at 3.5 per cent. 1905
			Deficit	Surplus	
Mark Waterways	715	$22,564,491		$507,667	$282,090
Elbe	253	10,239,300	$419,002		777,378
Saale and Unstrub (Elbe branches)	140	2,048,515	30,188		122,494
Oder	430	12,207,032	542,395		969,641
Warthe	215	2,009,204	109,361		197,183
Netze	65	992,082		16,521	51,244
Bromberger Canal and Lower Netze	25	636,867	1,996		24,286
Total	2,043	$50,697,491			$2,424,316
Harbor		**To April 1, 1905**	**Operation**		
			Deficit	**Surplus**	
"(Mark)"					
Berlin		$551,975		$3,256	$16,063
Charlottenburg		73,509		7,186	
Potsdam		16,975		800	
Spandau		177,577		1,054	5,162
Brandenburg		13,067		21	436
(Elbe)					
Magdeburg		1,988,923		18,942	60,615
Aken		10,120		341	64
Halle		7,500		94	381
(Oder)					
Schwedt		16,500		843	
Frankfort-a.-Oder		67,700		843	1,526
Fürstenburg		779			28
Neusalz		117,338	651		4,739
Breslau		1,804,375	2,555		65,708
Kosel*		755,000			
Posen		464,250		8,064	10,006
Bramberg		120,550		3,227	7,447
Total		$6,186,038			$172,175
Grand total		$56,883,529			$2,596,481
Less deductions		$45,867,988			$1,767,778

* *Internationalausstellung*, Mailand, 1906, p. 108.

No deductions are made in the statistics of harbors, Magdeburg being the only costly one not very closely connected with the Berlin traffic. This over-allowance is more than

[1] These statistics have been assembled from Peters, *Schiffahrtsabgaben*, pp. 260–74.

offset by omissions. Küstrin, an important harbor on the Oder at the junction with the Warthe, is not included, the statistics not being available. Mr. Peters tells us, moreover, that the statistics, both of the waterways and the harbors, are in many cases incomplete, records having either been lost or never kept. Still further, the harbor facilities for inland shipping, in the great ports of Hamburg, Lübeck, and Stettin, are not included. All in all, therefore, we may conclude that the amount shown in the column headed "Less deductions" fairly represents the approximate cost of perfecting these waterways for the purpose of carrying the Berlin traffic. It may be added that even in case this table should be considered by some as charging off too much against the Berlin traffic the general conclusion to be reached would not be materially affected. It is believed, however, that the table is duly conservative.

It appears, then, that in round numbers $45,000,000 has been expended in Prussia in order to develop the Berlin waterways, which now carry considerably less than half of the bulky traffic of the metropolitan district. Reference to the right-hand column of the above table shows, moreover, that water transportation is heavily subsidized each year. Of the waterways proper, only those of the Mark show a surplus from operation, and even they are not able to cover the annual interest and sinking fund. On the Netze, the Warthe, and the Oder, as far up as Breslau, there are no tolls whatever;[1] consequently the deficits from operation alone are here very heavy. A few of the harbors are able to make ends meet, but, as a rule, they too have failed to earn enough to pay interest and provide a sinking fund. In all, the deficit in 1905, an excellent traffic year, was $1,767,778. Since the total tonnage received at and shipped from Berlin in 1908 was 7,708,349, the year's donation, assuming a like de-

[1] Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 24.

ficit in 1908 (it was undoubtedly larger[1] on account of the heavy decline of traffic), amounted to 23 cents a ton. Recall now that 85 per cent of the Berlin traffic was local, nearly all of it low-class freight of small value, and more than half of it sand, clay, gravel, brick, and stone. A cost of 23 cents a ton for carrying such traffic an average distance of 15 or 20 miles is tremendously heavy in itself. The water freight rate on rock salt and iron ore from Mannheim to Ruhrort on the Rhine, a distance of 202 miles, is only 29 cents a ton;[2] while in the United States the Illinois Central Railroad hauls coal from southern Illinois to Chicago, a distance of 200 miles, for 62 cents a ton.[3] This rate, moreover, covers the full cost of the transportation. But to the 23 cents a ton above is still to be added both the tolls which the Government levies on Government waterways and the actual charge of transporting the goods, which is done by private companies owning their own boats and working at a profit. With an outright annual gift of some 23 cents a ton, the waterways are handling much less than half and an ever-decreasing portion of the Berlin traffic. Of the traffic "naturally belonging to the waterways," the proportion against them is almost as surprising.

11. It seems in place to consider here, before passing to a discussion of other German waterways which are in operation, the new "Mark Waterway," the Berlin-Stettin Canal, which is to be opened in 1912. This canal, which is also known by the name of the Berlin-Hohensaathen Waterway, is to connect Berlin with Stettin, following the route of the Havel, the Finow Canal, and the Oder. (See diagram on page 192.) It is not an enlargement of the

[1] The Government publishes no *annual* statistics of specific expenditures for waterway operation; hence 1905 has to be used as a basis.

[2] Sympher, London *Daily Chronicle*, June 2, 1906.

[3] *Report of Chicago Harbor Commission*, 1909, p. 234.

Finow Canal; a new canal is being cut and the present Finow will not be materially altered.

Rather than being national in its aim, the chief purpose of this project is to benefit the Baltic port of Stettin. "It is hoped to restore the competitive capacity of Stettin as against Hamburg and Lübeck. Hamburg is benefited by the Kaiser-Wilhelm Canal, and Lübeck by the Elbe-Trave Canal. Also the newly built Oder-Spree Canal, which is navigable for ships of 400 tons' capacity has not only afforded a good connection between Silesia and Berlin, but also greatly improved the connection of Silesia with Hamburg."[1] This quotation is from an official statement, and it has appeared in various places.[2] The argument is that since Hamburg and Lübeck possess good waterway connections with the metropolis, the rival port of Stettin must be favored in a similar manner. The needs of traffic and the cost seem to be secondary considerations.

The canal is a joint project between the Government, on the one hand, and the cities of Stettin and Berlin on the other. The Government has agreed to construct the waterway proper, at a cost of $10,750,000,[3] on condition that the two cities interested should, after the opening of the canal, annually contribute a third of the three per cent interest deficit, pay a yearly sum of $108,750, and after sixteen years a still further annual amount of $18,000, to be used as a sinking fund for the amortization of the capital; and in addition still, they are to advance $163,750 each year to help defray maintenance and operation expenditures, remaining uncovered from the receipts.[4] It is thus apparent that, at least for many years to come, it is not expected that the traffic on the waterway will yield a revenue even

[1] Gerhardt, *Die Woche*, June 18, 1910, p. 1028.

[2] *Weltausstellung*, p. 165; and Sympher, London *Daily Chronicle*, June 5, 1906.

[3] Gerhardt, *supra*.

[4] Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 51.

sufficient to pay running expenses, to say nothing of meeting interest or providing an amortization fund.

The mere cost of the canal, however, constitutes but a fraction of the total outlays connected with the scheme. Under the waterway law of 1904, the State and the city of Stettin together are expending $11,744,200 on the improvement of the Lower Oder.[1] While there are allied benefits from this improvement, in the way of protection from spring overflows and the consequent damage to agriculture, the larger part of it may be regarded as a donation to transportation. In addition, the city of Stettin has constructed a magnificent harbor at a cost of $5,337,945, in anticipation of an enlarged waterway to Berlin. The total deficit thereon in 1905 amounted to $113,394.[2] Prussia has expended upon the Stettin-Swinemünde Harbor $6,677,002,[3] but as this is of great naval importance, its cost may be omitted from our present computation. The existence of this excellent harbor entrance to the Oder is, however, of much commercial value to the port of Stettin, some distance upstream. To make Stettin a seaport and give it a waterway connection with Berlin for vessels of 600 tons' capacity is costing, then, about $27,832,145. In this amount previous expenditures on the Oder and on the old Finow Canal are not included. It represents merely the approximate total cost of enlarging the competitive capacity of Stettin as against Hamburg and Lübeck. From a national standpoint, now, — that is, disregarding Stettin's gain at the expense of her rivals, — it will be worth our while to inquire what are the prospects of remuneration from the expenditure.

The old Finow Canal has a capacity sufficient for vessels of only 170 tons' burden, while that of the new waterway will be large enough for vessels carrying 600 tons. The expected result of this enlargement upon freight rates is

[1] Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 50.

[2] Peters, *Schiffahrtsabgaben*, pp. 268, 274. [3] *Ibid.*

set forth in the following official statement: "Through the more rapid transport of commodities, and the 3.5 times enlargement of boats, the freight costs become immensely cheaper. It is hoped that between Stettin and Berlin there will be a freight moderation of from 17 to 19 cents a ton."[1] A saving of this amount, applied to the entire quantity of freight passing through the Liebenwalde locks on the Finow Canal to and from Berlin in 1908, that is, 3,369,000 tons,[2] shows a total saving of $606,420.

The savings on *new* traffic must be computed, not as against the old Finow Canal, but as against the Elbe River to Hamburg or Lübeck, that being the route from which traffic is to be diverted for the benefit of Stettin. It is difficult to see how a canal with nineteen locks, and a longer distance than the Elbe, affords superior advantages to the naturally navigable river. It would seem that the only way in which the new route can take traffic away from the Elbe is by more heavily subsidizing that traffic; and this is obviously a national loss. Consequently, we may leave such additional traffic as would have to be taken from the Elbe, if secured, out of the reckoning. The savings must be confined to the existing Finow Canal traffic, and to that naturally developing along the route.

Now, the annual interest on the $10,750,000, the cost of the waterway, and on the $11,744,200, the expenditure for improving the Oder, amounts to $674,826. The yearly contributions of Berlin and Stettin for maintenance and operation are to be $163,750; and it remains to be seen how much in addition will be left for the State to contribute for this purpose. The annual deficit on the Stettin Harbor, using 1905 as a basis, is $113,394. Taken together, these make a total of $951,970.[3] It follows from this that, even if the hoped-for reductions in charges of from 17 to 19 cents a ton eventuate, there will still be a loss, equal to the

[1] *Weltausstellung, supra*, p. 164. [2] *Ibid.*, p. 163.

[3] This does not include a sinking fund.

difference between the $951,970 of added outlay and the $606,420 of saving, or $345,550 each year. It is not expected, moreover, that there will be any considerable increase in local traffic along the route as a result of the new canal. The success of the project admittedly depends upon the Berlin-Stettin through traffic.

It is, perhaps, well to add that if the traffic is to be diverted from the Finow Canal in order to secure these savings, all the outlays that have been made on the Finow must be transferred as items of cost to the new project, and be included in its capitalization. If this be done, the above figures of loss will be proportionately increased. The cost of the boats for the 600-ton routes have also to be included.

From a national standpoint, however, the question is not so much how greatly freight charges are reduced over the Berlin-Stettin route by means of the deeper canal, as whether it is good economy to support a second water route when one alone is sufficient. The Elbe route is far from being taxed to its full capacity, and the existing railways have not been overworked. Dividing the traffic over several routes involves a heavy loss, not only on account of the unnecessary construction cost entailed, but in the actual carrying of traffic as well. The larger the traffic on a given route, the less is the haulage cost per unit of commodity. It takes nearly double the labor force and the general equipment, aside from the boats or rolling-stock, to operate two waterways or two railways, than it does to operate one alone.[1]

There is, however, another side of this question to be considered. If it be determined that the ambitious port of Stettin must share in the traffic now going to Lübeck and Hamburg, it is submitted that there is an alternative method by which this result may be secured. Suppose the total estimated annual outlay of $540,000 for interest and

[1] For an enlargement upon this point, see chapter x, pages 282–84.

operating deficit were to be devoted to reducing the railway freight rates between Berlin and Stettin. (This figure does not include the cost of the harbor, because that would still be necessary for the loading of the ocean vessels from the railways.) No new railways would be required to carry the traffic that may be expected to develop beyond the capacity of the present Finow Canal. For some years to come, at least, if a little systematic extension of railway freight facilities on existing railways were made, they could easily handle all the traffic between Berlin and Stettin, including that now traveling by water. The length of the waterway is 61.7 miles;[1] and the annual net outlay amounts, therefore, to about $8750 per mile. Give this amount each year to a railway between the two cities, and freight rates could be reduced to such an extent that even the great Elbe itself would find difficulty in successfully competing therewith. The case is analogous to that of Frankfort-on-the-Main. From the commercial point of view, therefore, it is impossible to discover the advantages of this "Grosschiffahrtsweg" even to the enterprising port of Stettin. The same expenditure upon railways would yield much larger returns.

12. Another of the seven great rivers of Germany is the Vistula, or Weichsel, as it is called in Germany. It rises in Russia and crosses the eastern part of Germany for a distance of 153 miles before reaching the Baltic Sea at Danzig. The fall is but .83 feet per mile, even less than that of the Rhine, and the interruptions on account of floods average but three days each year.[2] It has required almost no canalization, and is free of tolls. The statistics of tonnage at Thorn, near the Russian border, are as follows:[3] —

[1] Sympher, *supra*, p. 51.
[2] *Report of Royal Commission*, vol. VI, p. 183.
[3] *Statistik des deutschen Reichs*, 1909, p. 10.

Year (annual average)	Export	Import	Total	Floating timber
1873–75 . .	37,000	124,000	161,000	1,101
76–80 . .	58	154	212	757
81–85 . .	52	89	141	869
86–90 . .	29	78	107	783
91–95 . .	32	65	97	681
96–00 . .	43	47	90	818
1901–05 . .	56	63	119	699
06 . .	63	66	129	1,013
07 . .	58	54	112	893
08 . .	71	64	135	546

Despite its apparently excellent possibilities, the traffic is seen to be less to-day than it was thirty-five years ago. The timber trade is naturally falling off with the gradual exhaustion of the adjacent forest supplies. The total amount of traffic, aside from the timber, is insignificant as compared with that on the Rhine, or even the waterways of the "Mark." The reasons for the failure of traffic to develop on the Vistula are deferred until the statistics of traffic for the other waterways of eastern Germany have been presented. As the same reasoning applies to all, they can best be treated together.

The situation on the Warthe and the Netze, in east central Prussia, is little better than that on the Vistula. Their location in relation to other German waterways could hardly be improved upon. Running due east and west, together with the short Bromberger Canal, they join the Vistula and its basin with the Oder at Küstrin, and thereby with Stettin, Berlin, and Hamburg. (See map on page 223.) There would seem to be a most excellent opportunity for an extensive development of waterway traffic between the agricultural east and the industrial west. The following table shows the extent of the expansion of traffic. The statistics are for Küstrin at the junction with the Oder:[1] —

[1] *Statistik des deutschen Reichs, ibid.*, p. 11.

Year (annual average)	Upstream	Downstream	Total	Floating timber
1873–75 . .	52,000	157,000	209,000	63,000
76–80 . .	61	192	253	73
81–85 . .	71	205	276	81
86–90 . .	77	235	312	94
91–95 . .	98	255	353	111
96–00 . .	140	400	540	126
1901–05 . .	138	429	567	131
06 . .	145	507	652	114
07 . .	153	405	558	141
08 . .	178	376	554	126

While the total has a little more than doubled since 1873, it has been practically stationary for the last ten years; and the entire amount is only about one third as much as the coal traffic alone at Kosel on the Oder.

Near the eastern end of this route, at Bromberg, on the Bromberger Canal, the movement of traffic has been as follows:[1] —

Year (annual average)	Toward the Vistula	Toward the Netze	Total	Floating timber
1873–75 . .	21,000	72,000	93,000	454,000
76–80 . .	27	58	85	351
81–85 . .	35	60	95	404
86–90 . .	30	42	72	480
91–95 . .	14	51	65	343
96–00 . .	46	86	132	405
1901–05 . .	90	127	217	383
06 . .	91	201	292	504
07 . .	83	192	275	458
08 . .	109	164	273	201

While the barge tonnage has here appreciably increased, it is only half as large as that at Küstrin, at the opposite end of the route. If one includes the timber traffic, the total tonnage is now little more than it was in 1873.

There has been expended upon these waterways, exclusive of harbor construction, $3,638,153.[2] The Warthe and the Netze are entirely free of dues, and hence the annual deficit is very large, amounting, together with that on the

[1] *Statistik des deutschen Reichs, ibid.*

[2] Peters, *Schiffahrtsabgaben*, pp. 260–64.

Bromberger Canal, to $272,713.[1] The policy of heavy subsidy has, however, thus far failed to produce gratifying results. The law of 1905 provides for further improvements calculated to increase the capacity of the route to permit the use of 400-ton vessels.[2] The story of the ample Vistula, however, would seem to indicate no great quickening of traffic from this enlargement of the Warthe and Netze. As will presently be seen, the character of the country is unfavorable to a development of water traffic.

In the extreme northeastern part of Prussia, flowing into the Baltic Sea, is the Memel River, with a length of 69 miles in German territory. The river is of ample capacity and has a fall of only .48 feet per mile.[3] The traffic development at Schmalleningken, near the Russian border, has been as follows:[4] —

Year	Exports	Imports	Total	Floating timber
1876–80 . .	18,000	140,000	158,000	480,000
81–85 . .	16	104	120	522
86–90 . .	5	88	93	725
91–95 . .	6	84	90	609
96–00 . .	8	81	99	718
1901–05 . .	8	147	155	610
06 . .	11	247	258	919
07 . .	18	184	202	984
08 . .	17	249	266	555

Floating timber has comprised about three fourths of the entire amount. The supply of that cannot continue indefinitely. The barge traffic has increased only 62 per cent in thirty years, and is inconsiderable in amount. In short, the Memel tells the same story as do all the waterways of eastern Germany.

It remains to inquire what are the reasons for the evident failure of the waterways of eastern Prussia. This en-

[1] Peters, *ibid.*

[2] Sympher, *Die neuen wasserwirtschaftlichen Gesetze, supra*, p. 51.

[3] *Report of Royal Commission*, vol. VI, p. 183.

[4] *Statistik des deutschen Reichs, supra*, p. 10.

tire section affords an excellent illustration of several points which were brought out in chapter IV, in connection with the various influences affecting the possibilities of successful water transportation. In the first place, the waterways of eastern Germany are closed by ice from 90 to 135 days each year.[1] This is as against an interruption of 17 days on the Rhine. The result of this ice is probably manifested not only during the season of closed navigation, but throughout the year; for much traffic which might employ the waterways, were they serviceable at all times, doubtless goes to the railways, where there are no interruptions.

In the second place, along none of the rivers of eastern Germany are there extensive deposits of coal or other minerals. Subtracting the coal and ore tonnage from the totals of the Rhine traffic, as was seen, would more than cut it in twain. It was brought out, also, that the extensive industrial development, consequent upon the existence of the coal, was responsible for most of the remainder of the Rhine traffic. It is easy to understand, then, how the absence of coal near the rivers of the east may alone have caused their failure. It is unfortunate that in the discussion of waterway development in our own country more attention has not been given to this crucial consideration of the location of the deposits of coal in relation to the proposed water routes.

Eastern Germany is, however, a great agricultural region, and the question naturally arises, Why does not agricultural produce travel extensively by water? The answer is that the conditions of an agrarian region are such that farm produce can much more advantageously travel by rail, and the Germans generally recognize that this is true. "The raising of agricultural produce always presupposes a relatively extensive area of production, and is thus a decentralized industry, on which account, in the great majority of cases, it is only the railways that come into con-

[1] *Report of Royal Commission, supra,* p. 57.

sideration with reference to their transport."[1] The point is that practically all of the traffic has to be collected by rail in any case; and the transshipments to waterways would dissipate any advantage that might come from their being sent any portion of the way by water. People who believe that canals should be run out across the prairies of the United States, and those who believe that the constant Federal appropriations for the development of insignificant streams in remote congressional districts of the West and South are *bona fide*, and for the best commercial interests of the country, would do well to ponder over the history of the waterways of eastern Germany. With such a river as the Vistula carrying little more than 100,000 tons of traffic each year, and the amount gradually decreasing, what is the probability that a great canal, in that section of the country, with its huge cost of construction and maintenance, would be of economic value to the nation?

13. There remains one more of the seven great rivers of Germany to be considered, namely, the Weser. This river crosses central Prussia for a distance of 227 miles, midway between and parallel with the Elbe River and the Dortmund-Ems Canal. It passes through the densely populated industrial district of Hanover to the great port of Bremen, and by means of the canalized Fulda it connects with the important inland port of Cassell, in southern Prussia. The average fall per mile is only 1.67 feet,[2] while the depth is about the same as that of the Elbe. With a combination of such apparently favorable conditions, one might expect to find a tremendous tonnage on the Weser. No statistics are available earlier than 1901, but for the last eight years the traffic at Bremen has been as follows:[3]

[1] Nasse, *die Schiffahrt der deutschen Ströme.* In *Schriften des Vereins für Social politik*, vol. I, p. 152.

[2] *Report of Royal Commission*, *supra*, p. 182.

[3] *Statistik des deutschen Reichs*, *supra*, p. 13.

Year (annual average)	Dispatched	Received	Total	Floating timber
1901–05 . .	151,000	280,000	431,000	1,000
06 . .	194	299	493	1
07 . .	188	323	511	1
08 . .	168	304	472	1

The tonnage is seen to have been at a virtual standstill for eight years, and in 1908 the total is only one twenty-ninth that received at Hamburg, and only one eleventh the amount traveling on the Dortmund-Ems Canal.

In order to develop this traffic, the State has expended upon the river, including the canalized tributary, the Fulda, the sum of $3,101,241.[1] The net deficit from operation in 1905 was $148,844. If to this be added the interest and sinking fund at the usual rate, the total yearly deficit becomes $257,388.[2] These figures do not include expenditures upon harbors. Now, if one leaves out of the reckoning the insignificant amount of local tonnage along the route, the deficit for the 431,000 tons carried in 1905 is equal to 59 cents a ton. A yearly donation on one of the great natural waterways of Germany of $257,388 secures a traffic of under 500,000 tons a year. An annual gift equal to 59 cents for every ton of freight carried utterly fails to attract any considerable traffic to the waterway.

The explanation of the failure of the Weser to develop traffic, even with the encouragement of heavy Government subsidies, seems to lie mainly in the fact that coal and ores, again, are wanting here. The coal from, and the ores to, the Westphalian industrial region are more conveniently shipped either by the Rhine or by the Dortmund-Ems Canal. Since Hanover and Bremen are much smaller than Berlin, the traffic in building-materials is relatively less important than it is on the "Mark Waterways." The upper territory drained by the river is not productive of

[1] Peters, *supra*, pp. 250 and 254. [2] *Ibid.*

large amounts of raw materials, and the industries of riparian cities are mainly manufacturing. Hence the water traffic is inconsiderable. The Weser is an excellent illustration of the waste entailed in encouraging water traffic in a section of country where there is not a large amount of coal or other raw materials awaiting transport.

14. We pass now to a consideration of the greatest inland canal of Germany, the well-known Dortmund-Ems. Constructed between 1882 and 1899, its purpose was to afford an additional outlet for the coal of the Westphalian district, an outlet to the North Sea in German territory, something hitherto lacking. It was thus to insure a degree of independence from Belgium and the Netherlands, *via* the Rhine, and to benefit the northwest German port of Emden as against the ports of the Low Countries.[1] The location could hardly be improved upon. From the very centre of the mining territory the canal runs almost due north, a distance of 155 miles to the North-Sea port of Emden. (See map on page 223.) The country is almost perfectly level, and for 62 miles of the distance existing waterways were utilized, leaving only 93 miles to be entirely excavated. The capacity is sufficient for barges carrying 600 tons.[2]

The statistics of total traffic since the year of its opening are as follows:[3] —

1899	201,000	1904	1,186,000
1900	476	5	1,518
1	681	6	1,721
2	876	7	2,011
3	1,249	8	2,313

The following table shows the complete cost of the project, including the branch, Ems-Jade Canal, near Emden: —

[1] *International Ausstellung* (Mailand, 1906), p. 172. [2] *Ibid.*

[3] *Handwörterbuch der Staatswissenschaften*, vol. v, p. 768.

Canal proper to April 1, 1906	$17,812,243*
Dortmund Harbor	1,306,888†
Emden Harbor	1,725,000‡
Later canal works	1,375,000§
Ems-Jade Canal	2,273,942‖
Total	$24,493,073

* Peters, *supra*, p. 264. † *Ibid.*, p. 270.
‡ *Report of the Royal Commission*, vol. VI, p. 197.
§ *Weltausstellung*, *supra*, pp. 178–80. ‖ Peters, *supra*, p. 264.

This total cost of $24,493,073 is equal to $157,648 per mile for the 155 miles of main canal; this is once and a half as much as the average capitalization of German railways which are fully equipped for both freight and passenger service, and probably three times what it would have cost to build an all-freight railroad. The above statistics, moreover, do not include the cost of boats, a very important item, as is apparent from the amount of the traffic.

The statistics which will be found of greatest significance, however, are those which reveal the yearly cost of operation and maintenance. The State fixes the tolls that are charged for the use of the waterway at a very low figure, varying from 7.5 to 14.5 cents a ton, according to the character of the freight; while the harbor dues are from .5 to 1.5 cents a ton.[1] Although the harbor dues are sufficient to cover the mere operation outlays, those on the canal are not adequate to cover even running expenses. In both cases a large yearly interest has to be paid from general taxation sources. In the following table are gathered together statistics showing the yearly deficit. The only available statistics are those for the year 1905, as furnished by Mr. Peters:[2] —

Operation deficit on Dortmund-Ems Canal		$174,432
Yearly interest and sinking fund, at 3.5 per cent		623,428
Operation deficit on Ems-Jade Canal		16,471
Yearly interest and sinking fund at 3.5 per cent		79,588
Operation *surplus* on Dortmund Harbor	$31,361	
Yearly interest and sinking fund at 3.5 per cent	45,801	
Net deficit		14,440
Total deficit *		$908,359

* Emden Harbor is not included, statistics not being available.

[1] *International Ausstellung*, *supra*, p. 180. [2] Peters, *supra*, pp. 264–70.

The astonishing fact is here disclosed that, in order to encourage traffic on the prize canal of Germany, the Government and interested cities were obliged to donate to the waterway more than $900,000 in the single year of 1905. Let us see what this amounts to in the way of freight rates.

In the year 1905 the tonnage carried was 1,518,000. The donation in that year, therefore, amounted to a fraction less than 60 cents a ton. It is regretted that financial statistics of a later date are not available; but it is practically certain that there can have been little improvement. While the traffic has increased, thereby perhaps appreciably reducing the cost of haulage for each unit of traffic, there have been increased capital outlays amounting to $1,375,000, the interest on which is probably sufficient to counterbalance the saving from increased tonnage. The year 1905 may consequently be regarded as typical.

This 60 cents a ton, however, by no means represents the total cost of transportation on the canal. It is merely a bonus given to attract the traffic away from the railways. The State's tolls, the harbor dues, and the freight charges of the boat companies are yet to be added. We have seen that the tolls, according to the class of freight, vary between 7.5 and 17.5 cents per ton. Since the larger portion of the tonnage is low-class freight, the average charge should perhaps be placed as low as 9 cents a ton. The harbor dues varied from .5 to 1.5 cents per ton; an even cent per ton will not be far from the average. These dues, then, amount to about 10 cents per ton. The freight rates on the canal are, for all classes of freight, 1.9 pfenniges per ton per kilometer.[1] At least three fourths of this traffic travels practically the full length of the canal. In 1908, of the downstream traffic through the Meppen locks, 76.5 per cent was coal, and of the upstream tonnage, 67 per cent was iron ore.[2] All of this, at least, traveled practically the entire length of the canal. Since the total

[1] Sympher, London *Daily Chronicle*, June 2, 1906.

[2] *Statistik des deutschen Reichs, supra*, p. 6.

length of the route is 250 kilometers, one may safely take 200 kilometers as the average haul. At 1.9 pfenniges per ton per kilometer, the freight cost proper is, then, approximately 95 cents a ton. Summarizing : \$.60 (deficit), + \$.09 (tolls), + \$.10 (harbor dues), + \$.95, (freight charge) = \$1.74, the cost per ton of carrying low-class freight an average distance of about 200 kilometers, or 123 miles.

It should be noted here that since Prussian railroads are conducted at a very good profit,[1] this waterway rate is not computed on the same basis as are railway rates. Were the waterway to yield a large net revenue to the State, the rates would obviously have to be much more than \$1.74 a ton. It should be stated that the boat companies attempt to make a profit on the carrying business, but since the capital invested in barges is very small in comparison with that invested in the waterway itself, it cannot be said that this fact materially affects the situation. To earn a net profit of 2.5 per cent on the total capital invested in the waterways, as in the case of railways, would necessitate raising the water rate to more than \$2 a ton. These figures, it will be seen, are only roughly approximate, for by the nature of the case it is impossible to make a mathematically exact computation. Accepting the above figure, then, as only approximately accurate, let us compare it with the German railway rates.

The rates on the German railroads are 2.49 pfenniges per ton per kilometer for coal, and 3.55 pfenniges per ton per kilometer, for the average on all classes of goods.[2] If all of this 1,518,000 tons of canal traffic, therefore, were carried at the coal rate, the cost per ton, using the same distances as above, would be \$1.25. If it were carried at the average rate of all commodities on the railways of the country, the cost would be \$1.78 per ton. Since 76.5 per cent of the

[1] See page 231. The net revenue on all the railways of Prussia in 1905 amounted to 2.57 per cent.

[2] Sympher, London *Daily Chronicle*, June 2, 1906.

downstream traffic is coal, 67 per cent of that upstream is iron ore, and nearly the whole is low-class freight, the average freight rate would doubtless be under $1.40 a ton. This is as against more than $2 by water. And even yet, it should be observed, the cost of transshipment from rail to water, and *vice versa*, is not included in the water computation. All in all, therefore, water transportation is here seen to be much more costly than that by rail.[1] No better illustration could be desired than the Dortmund-Ems Canal, to show the fallacy of the almost universal contention that canal transportation is essentially cheaper than that by rail.

A word should perhaps be added relative to the success of the canal in fulfilling its mission of diverting traffic away from the ports of the Low Countries. As we have seen, the traffic on the Rhine across the Holland border at Emmerich has increased for many years with great rapidity; the fact is that it has increased more rapidly than ever since the opening of the canal.[2] Moreover, the canal is far from capacious enough to handle the more than twenty million tons of Rhine traffic; consequently a very large degree of independence from the ports of Holland and Belgium has not yet been attained. Still, the considerable traffic now passing through Emden may be regarded as traffic that, in the absence of the canal, might have passed to and from the sea through foreign ports. The advantage of this to Germany lies in the fact that it gives employment to German capital and labor in a carrying and transshipping business which might otherwise go to the Dutch and the Belgians. We shall not here attempt to discover if these gains are more than sufficient to offset the greater cost of transport by the canal than by the freely navigable Rhine. The vital point is whether this traffic can be carried to

[1] The comparison that has just been made, it is needless to say, is between a canal and a railway of the German type. Rates on American railroads for similar traffic are substantially lower than those of Germany.

[2] See table, page 176.

Emden cheaper by the canal than it could be by rail. The above discussion has shown that the odds are greatly in favor of the railway.

It is interesting to note that in another connection, in attempting to show that the Dortmund-Ems Canal has not injured the railways of that district, a German commission states, in proof of its hypothesis, that the railway traffic between Dortmund and Emden has greatly increased since the opening of the canal.[1] If such be, indeed, the fact, — if with tolls so low that the canal must be supported at tremendous public expense, it still does not injure the railways, it must follow that a canal on even terms would be a poor competitor indeed. The increase of traffic on the railways has not been alone in high-class freight, and the railways have not lowered their rates to meet the competition of the canal. Does not the fact that the unsubsidized railways are increasing their traffic in spite of the canal indicate that, if the annual subsidy paid to the waterway were donated instead to the railways, freight rates could be reduced much below what they now are either by water or by rail? It is at least good collateral evidence in support of the above computation showing the railway cost to be substantially less than the complete cost by water.

15. The Kiel, Kaiser-Wilhelm, or North-Baltic Sea Canal, as it is variously called, furthers rather the ocean than the inland trade of Germany, and its purpose is strategic rather than commercial. The canal was constructed between the years 1887–95, at a cost of $39,000,000.[2] The length is 53 miles, and it saves a distance of about 200 miles for vessels bound from the North to the Baltic Seas, avoiding at the same time the navigation of

[1] *Kommissionsbericht über die wasserstrassen, Vorlage des Jahres* 1904, p. 51.

[2] *Weltausstellung, supra,* p. 170.

the narrow and often dangerous waters around Denmark.[1] It has a depth of 29 feet and a bottom width of 72 feet.[2] The strategic importance lies in the fact that it permits a more rapid mobilization of the German fleet in either Baltic or North Sea waters, as the exigencies of war may demand, and at the same time obviates the necessity of traversing neutral or perhaps hostile waters.

But though the prime purpose of the ship canal is thus strategic, and though its success must be measured on naval and not on commercial grounds, we may nevertheless consider its commercial side with profit, as it is obviously freely available for commercial usage in time of peace. The statistics of traffic development since its opening are as follows: [3] —

	No. of Vesssels	Tonnage
July 1, 1895–June 30, 1896.......	16,834	1.505,983
1898............................	23,108	2,469,795
1900............................	26,279	3,488,767
1902............................	30,161	4,285,301
1904............................	32,038	4,990,287
1906............................	34,187	6,045,963
1908............................	34,121	6,012,178

While this table shows that the development has been steady, the totals, considering the size of the vessels that the canal accommodates, are far from enormous. The total barge traffic at Emmerich on the Rhine was three and one half times the total of the Kiel Canal tonnage. The St. Mary's Falls Canal, between Lakes Superior and Huron, had a traffic in 1909 of nearly eight times as much, — 46,751,717 tons.[4] At the same time the initial cost of the St. Mary's Falls Canal was only $10,000,000, about one fourth that of the Kiel Canal.

[1] *Preliminary Report of National Waterways Commission*, p. 41.

[2] *Weltausstellung*, *supra*, p. 171.

[3] *Preliminary Report of National Waterways Commission*, *supra*, p. 42.

[4] *Monthly Summary of Commerce and Finance* (U. S.), December, 1909, p. 1129.

It is not contended that the savings effected through the lessening of the distance for commercial vessels plying between the Baltic and North Seas are by any means sufficient to justify on commercial grounds alone the cost of the project. Many merchant vessels naturally use it, however, in preference to the longer route around Denmark.

It is interesting to know, since it throws light on the whole question of ship canals, that in spite of its great depth and capacity, the Kiel Canal has already proved inadequate. Commercial vessels have on several occasions gone aground and tied up the traffic of the entire route. Such a mishap in time of war, either to a commercial or to a war ship, would prove fatal. This danger, together with the fact that the increased size of both merchant and naval vessels since the opening of the canal in 1895 has rendered it already too small for the larger ships, has led to an enlargement which is now under way.[1] When completed, the depth will be 36 feet and the bottom width 134 feet. The estimated cost of the enlargement is $55,750,000,[2] considerably more than the entire original cost. This will make a total cost for the project of $94,750,000, or $1,787,736 per mile of waterway.

16. After having developed the navigation possibilities of the principal rivers of the country, and having supplemented the routes to the northern coasts by the Dortmund-Ems Canal, nothing was more to be expected than that an agitation should develop for the joining of the several parallel north-and-south routes by a great east-and-west waterway. A glance at the map on the next page shows the Rhine, the Dortmund-Ems Canal, the Weser, the Elbe, the Oder, and the Vistula to form a series of great parallel water routes from north to south; while in the east, the Warthe, the Netze, and the Bromberger

[1] *Weltausstellung, supra*, p. 172. [2] *Ibid.*, pp. 173 and 176.


NORD SEE
OST SEE
Memel
Tilsit
Königsberg
Allenburg
Insterburg
Angerburg
Elbing
Danzig
Dirschau
Graudenz
Deutsch-Eylau
Brahemünde
Thorn
Kolberg
Köslin
Stettin
Greifenhagen
Schwedt
Raduhn
Hohen-
saathen
Landsberg
Zantoch
Wasser-Str.
Oder-Weichsel
Bromberg
Schneidemühl
Weichsel
Netze
Küstrin
Frankfurt
Schwerin
Fürstenberg
Bentschen
Posen
Konin
Berlin
Stralsund
Greifswald
Rostock
Wismar
Schwerin
Lübeck
Kiel
Rendsburg
Hamburg
Altona
Harburg
Lüneburg
Elbe
Havelberg
Rathenow
Brandenburg
Potsdam
Spandau
Lübben
Spree-
wald
Kottbus
Dessau
Halle
Leipzig
Dresden
Chemnitz
Markliesa
Görlitz
Liegnitz
Mauer
Breslau
Warmbrunn
Buchwald
Oppeln
Kosel
Gleiwitz
Oder
Bober
ÖSTERREICH
Prag
Moldau
Aussig
Magdeburg
Niegripp
Heinrichsbg
Braunschweig
Öbisfelde
Peine
Lehrte
Hannover
Celle
Linden
Hildesheim
Hameln
Minden
Rinteln
Osnabrück
Bevergern
Münster
Datteln
Lippstadt
Dortmund
Hamm
Weser
Bremen
Bremer-
haven
Oldenburg
Papenburg
Leer
Wilhelms-
haven
Emden
Groningen
Zwolle
NIEDERLANDE
Amsterdam
Rotter-
dam
Emmerich
Wesel
Ruhrort
Duisburg
Düsseldorf
Köln
Aachen
Bonn
Rhein
Koblenz
Lahn
Giessen
Arolsen
Heringhsn
Kassel
Eder
Hemfurt
Münden
Erfurt
Frankfurt
Main
Mainz
Darm-
stadt
Mannheim
Ludwigshafen
Saarbrücken
Würzburg
Nürnberg
Neckar
Karlsruhe
Strassburg
Metz
Trier
Mosel
LUXEM-
BURG
BELGIEN
Antwerpen
Lüttich
Maas
FRANKREICH
RUSSLAND
0
50
100
200

Canal form an east-and-west line almost halfway across the country. Why not complete this system by building a great canal from the Rhine to the Elbe, there connecting with the "Mark Waterways," and the Oder; and, thus with all the waterways of eastern Prussia?

The attractiveness of the project led to the introduction of appropriation bills in the Reichstag, but sufficient opposition developed to defeat the scheme. The agricultural interests of the East, first of all, opposed it because they feared that it might stimulate the importation of foreign grain to their own disadvantage.[1] In addition there were two other classes of opponents. The one held that the waterways of the country were already sufficiently developed, and that a further expenditure of public funds thereon was uncalled for. The other was opposed because the bill carried with it a change of financial policy as regards the waterways of the country, a change proposing henceforth to levy tolls sufficiently high to cover all the expenses of operation, to pay interest, and to provide a sinking fund for the amortization of the capital involved.[2] The fear in the minds of these men was that tolls thus high would prohibit extensive traffic. Although the Waterway Department prepared most voluminous reports, tending to show the economic advantages of the project to the country, and although the Government attempted coercion in order to force the passage of the bill, the opposition was strong enough to defeat the measure.[3] It is still hoped, nevertheless, eventually to put it through.

The victory of the opposition was, however, only partial. Another bill, to connect the Rhine with the Weser, with an extension as far as Hanover, was later passed, on April 1, 1905.[4] (This law also authorized the Berlin-Stettin Waterway, which we have already treated.) We

[1] Statement of Professor Schmoller.

[2] Peters, *Schiffahrtsabgaben,* part III, p. 305.

[3] See page 256.

[4] Sympher, *Die neuen wasserwirtschaftlichen Gesetze, supra,* p. 51.

may profitably spend a few moments in considering the Rhine-Weser, or Rhine-Hanover Canal, as it is designated on the map on page 223.

The waterway is composed, as is seen, of several divisions, but for our purposes we may consider it as a single project. The combined length of the route, including the branch canals, is 236.5 miles, and the total cost is estimated at $62,687,500,[1] or an average of $265,625 per mile. The capacity is for vessels of 600 tons, with the exception of the Rhine-Herne stretch, which will accommodate boats of 1000 tons' burden.[2]

The purpose of this canal is to join the Rhine River and the rich industrial Westphalian region with the important manufacturing district along the Weser and with the city of Hanover. At present there is no water connection at all in German territory between the North Sea and the Rhine; and this while affording an all-German route, will at the same time greatly shorten the water distance between Dortmund and the Weser territory. Elaborate calculations have been made to show that with tolls high enough to leave no deficit from operation, high enough even to pay interest and to provide a sinking fund for eventual amortization of the capital, traffic will speedily develop and accomplish the end in view.[3] As the works will not be fully completed until 1917, we must wait many years to learn whether the fond hopes now entertained by the supporters of the project will be realized. A few comparisons may be made, however, which will furnish some indication as to the probable success of the enterprise.

It has been seen that the Dortmund-Ems Canal, though excellently located, forming a direct water route from the heart of the coal region to the North Sea, left a deficit in the seventh year of its operation of $908,359. It has been seen, moreover, that in spite of the fact that the canal

[1] Sympher, *ibid.*
[2] *Ibid.*, p. 31.
[3] Sympher, *Die Rhine-Weser Kanal;* and *Kommissionsbericht, supra.*

dues were very low, the railway tonnage parallel with the route continued to develop rapidly. Now, while in this case the low dues may be responsible for the large deficit, is it not likely that the very high dues on the new waterway will result in a traffic so small that an even greater deficit will accrue than in the case of the Dortmund-Ems? And if the Dortmund-Ems Canal, with tolls not even sufficient to defray the annual cost of operation, cannot attract all the bulky traffic in its territory, what is the probability that the Rhine-Weser Canal, with tolls calculated to cover the running expenses, pay interest, and provide a sinking fund, will be able to secure any considerable tonnage? The cost of this waterway will be more than twice that of the Dortmund-Ems Canal, — $265,625 per mile, as against $114,917 per mile for the original works of the Dortmund-Ems proper. This means more than twice as great a per mileage outlay for interest and sinking fund. Likewise, the operation and maintenance expenses will probably be heavier here because of the greater distance to be traversed and kept in repair — 236 miles, as against 155 miles.

Computations of the sort mentioned on the previous page are at best practically worthless. It is necessary to choose a certain rate ; and compute on this basis the quantity of traffic required to yield a sufficient revenue to make ends meet. Then if the traffic at the rate taken is not forthcoming, a new guess has to be made. Experience alone will tell. A little light, however, may be thrown upon the question. On the river Elbe in the third quarter of the nineteenth century traffic failed to develop when tolls were levied to cover the cost and operation of the waterway.[1] If such were the case on a great natural river, it raises a presumption that it would prove even more the case on a canal, with its enormous cost of construction.

It should be added that little through traffic with the

[1] See below, p. 306.

Rhine is to be expected, both because there is little occasion for it, and because the large Rhine boats of 1000 and 2000 tons' capacity cannot navigate the waters of a 600–ton canal.

But suppose sufficient traffic should develop to make the waterway pay for itself. Would this prove that the capital would have been well invested? We saw that on the same basis of computation on both sides of the equation, water transportation on the Dortmund-Ems Canal was nearly twice as costly as that by rail. It follows, since this canal is more than twice as costly per mile as the Dortmund-Ems, that the advantage in favor of the railway would be much greater here. It is therefore impossible to foresee a sufficient traffic development to insure financial success. It seems certain that the construction of this water route will involve a heavy economic loss to the country.

CHAPTER X

EXAMINATION OF THE GERMAN TRANSPORTATION POLICY

1. THE discussion of waterways in Germany, which formed the subject of the preceding chapter, attempted to show to what extent waterway traffic has developed on the principal rivers and canals of the country, and to compute at what cost such development has been obtained. The result of the investigation has been to bring out the surprising fact that the Rhine River alone seems to have been financially successful. While the traffic has rapidly developed on some of the other waterways, we have seen that it has been accomplished only by means of such heavy subsidies that the freight costs, all things considered, have proved much heavier than they would have been by rail. It has been found that on many of the German rivers and canals traffic has but slightly increased in thirty years, and that on some it has even declined. Having finished this important part of our study, a discussion of the general transportation policy of Germany may now be undertaken. It is hoped that this will throw light upon the causes for the degree of waterway development that has occurred, upon the feasibility of waterway development in the United States, and upon the whole question of transportation. In the following pages, therefore, the attempt will be to describe precisely what the German policy in regard to both waterways and railways is, and to examine it from the German rather than from the American point of view.

Dr. Sympher, head of the Waterways Division of the Department of Public Works, tells us, that "It was not until the middle of the '70's that a change took place in their [the waterways'] favor. It then began to be felt that it was absolutely necessary to revive water communication, as the railways, notwithstanding all modern advantages, were unable to lower sufficiently their tariffs for the transport of merchandise carried in large masses."[1]

Again, in speaking of the new waterway appropriations of 1904 and 1905, Dr. Sympher says, "The main advantages arising from the recent extensions will be the reduction of the cost of transport of merchandise sent in large quantities; the bringing together of various districts hitherto wide apart, the raising of Germany's competitive strength, not only in the home markets, but in foreign markets as well."[2] These official statements furnish us the key to the German waterway policy. It is officially believed that water transportation, whether by canal or river, is cheaper than by rail for commodities carried in large quantities. Though we shall later see that there are other reasons for the improvement of German waterways, the argument of cheapness is the basic one.

In view of the fact that the waterway policy of Germany is based on the assumption that waterways offer an economical means of transport, and in view of what has been disclosed in the above study seeming to show the contrary, it is important to inquire how it is proved by the Waterways Department that water transportation costs less than that by rail. Dr. Sympher states: "The cost of transportation on German waterways is considerably less than by rail. The freight charges between places that are situated directly on the waterways, and are reached without the aid of railways, are generally far less than the railway charges, and on long water stretches this is all the more perceptible, as the State-levied taxes cannot be considered."[3] He then quotes various rates illustrating the extent of the sav-

[1] Sympher, London *Daily Chronicle*, April 7, 1906.

[2] *Ibid.*, June 5, 1906.

[3] *Ibid.*, June 2, 1906.

ings by water. The rates for cities located on the waterways show in every case a considerable margin of difference in favor of the water route. It is also contended that, including the cost of transshipment from rail to water and back again, the combination rail and water route is often cheaper than a through route by rail,[1] though the degree of difference is here admittedly much reduced. Now, a comparison of rates is ordinarily regarded as proving the point in question. If waterway rates are considerably lower than those by rail, does it not conclusively show that water transportation is the cheaper of the two? The answer is that it does not *necessarily* prove anything of the sort.

It appears that the Germans have either overlooked or refused to consider a very important point in connection with transportation by water. The closing words of the above quotation are, "The State-levied taxes cannot be considered." That is to say, although the yearly deficit on the Main River is nearly $600,000, this amount cannot be considered as a charge against water transportation. Though the amount that the Imperial Exchequer pays out every year is equal to about 60 cents a ton for the traffic passing over the Dortmund-Ems Canal, the same for that on the Weser River, and about 23 cents a ton for the traffic of the "Mark Waterways," these expenditures are not to be considered as chargeable to water transportation. It is to be regretted that Dr. Sympher has told us neither why they may not be considered, nor to what account they should be debited.

In order better to appreciate the bearing of the method of accounting employed by Dr. Sympher, upon the question of comparative costs of transportation by rail and by water, one should know the extent of the waterway deficit as a whole and the extent of the railway deficit, or profit,

[1] *Frachtvergleichungen für gewisse Güter auf dem Bahn, See, und Binnenwasserwege.*

as the case may be. The following table accordingly places them, as nearly as they can be computed, side by side.

To April 1, 1906, there had been spent upon water transportation in Prussia the amounts shown in the following table. The total deficit uncovered by the receipts of the year 1905 is given in the third column:[1] —

Classification	Miles	Capitalization	Deficit (int. & sink. fund 3.5 per cent)	Deficit per mile
Uncanalized rivers .	2324	$68,132,572	$4,787,473	$2060
Canalized rivers and canals	1508	61,853,664	6,869,667	4555
State harbors* . .		39,826,841	1,435,255	
City and private harbors*		28,677,193	406,382	
Totals . .	3832	$198,420,270	$13,498,777	$3523

* Sea harbors are not included.

One item is necessarily omitted from this computation. Since the boats are owned by a large number of private companies and individuals, their cost cannot be given. At the same time their profits from operation must similarly be omitted. These would reduce the deficit totals to some extent, but not greatly, both because the profits of these companies are said to be usually small, — oftentimes none at all, — and because the cost of the boats on which profits are to be earned is but a small fraction of the cost of the waterways themselves. Taking it as it stands in the above table, however, the deficit on the waterways of Prussia in 1905 equaled 7.8 per cent of their capitalization. In contrast to this, the surplus revenue derived from the railways of Prussia amounted to $56,900,000 or 2.57 per cent on their total capitalization. This represents a net revenue to the State, after providing for the interest and sinking fund on the railway bonded debt, of $1,518,400,000, and after meeting all the expenses of maintenance and operation of the roads and of conducting the governmental admin-

[1] Compiled from Peters, *supra*, pp. 260–74.

istrative machinery. It is a *net* profit which the State may use for various public ends.[1]

The number of miles of Prussian railway in 1905 was 31,319.[2] The year's net profit was, therefore, equal to $1814 per mile. The waterways involved an outlay of $3523 per mile on the part of the State; the railways yielded a net revenue equal to $1814 per mile. It is obvious that if the Rhine River were excluded, the showing of the waterways would be far worse. In view of these facts, can a quotation of existing rates prove waterway transportation actually cheaper than that by rail? Suppose that the situation were reversed, that the railways were run at a heavy loss, while the waterways were conducted at a handsome profit to the Government as well as to the owners of the boats. Might not the resulting rates then show that it is the railways that are the agents in the "raising of Germany's competitive strength, not only in the home markets but in foreign markets as well"?

It is evident that the reason why the waterways of Germany have been able to secure a large share of the traffic of the country is none other than that the Government *wills* that they shall do so. The vast majority of the railways and practically all of the waterways of the country are the property of the State; and in the words of Dr. Sympher, "This is why it is possible to arrange that railway and canal do not enter into competition with one another, but mutually unite in the forwarding of merchandise."[3]

It should be stated here that while the Government directly fixes the rates on the railways, it exercises only an

[1] The profits on German railways are usually set down as about six per cent; but we have preferred to eliminate all but the strictly *net* revenue. The above statistics were taken from the *Bericht über Ergebnisse des Betriebes der vereinigten preussischen und hessischen Staatseisenbahnen*, 1908, pp. 241, 242.

[2] *Statistisches Jahrbuch*, 1909, p. 85.

[3] Sympher, London *Daily Chronicle*, June 2, 1906.

indirect influence over the water rates. The boat lines are owned by private companies and the haulage charges are consequently fixed by them. It is obvious, however, that the Government does in reality play an important part in fixing the general level of water rates through its policy of assuming the burden of the fixed charges on the waterways. By levying only slight tolls on canals (and none at all on rivers) the Government permits the boat companies to charge much lower rates than would otherwise be possible.

This virtual absence of competition between railways and waterways is maintained in divers ways. In cases where both a railway and a waterway might be rivals for given traffic, the Government may force such tonnage to go by water, by means of arbitrarily fixing the rail rate so high that it becomes more advantageous for the shipper to send his freight by water. This is done in many cases. It should also be remembered, in this connection, that the whole policy of conducting the waterways at a deficit, as outlined above, has substantially this effect.

An excellent illustration of the administrative policy of directing certain commodities to travel by water is afforded by the case of fertilizers. When a project for a canal from the Rhine to the Elbe was under discussion, it was pointed out that fertilizers, which constituted an important traffic between the East and the West, would not travel by water on account of the very low "exceptional tariff" already offered by the railways. The reply was that, if necessary, the rail rate for fertilizers could be raised sufficiently to give the waterways the advantage. Being of low value, such traffic belonged to the waterways, and rates should be adjusted so as to insure its transit by boat.[1]

In cases where transshipment is involved, the German Government has followed a policy of virtually developing the railways and waterways as a single system. In the region of great rivers and important canals, railways are often

[1] *Frachtvergleichungen, supra*, p. 2.

developed merely as feeders to the waterways. For instance, from the mines of Westphalia the coal railways are run as far as the Rhine or the Dortmund-Ems Canal, and no farther. Arrangements and facilities are there provided for the transshipment to boats, by which the coal is carried to destination, or to the point of distribution by rail. It is thus in reality a united system, so developed now that it would be impossible to carry the entire quantity of coal sent out each year all the way to destination by rail. There are enough railways within the mining district, from the mines to the waterways; but beyond that in some sections there are not sufficient railway facilities to handle the traffic. The reason is merely that the Government has chosen to develop and to use the waterways instead of developing and using the railways. The waterways are the main lines, the railways the branches. As a result, the shippers in some places have no practical alternative to the use of the waterways for at least a part of the distance.

The cost of transshipment from railways to canals and back again is of comparatively little importance to the German shipper, for the reason that he is obliged to pay only a part of it. "Distinctly favorable terms are given to the transfer between railway and waterway. . . . The freight charges for changing from boat to railway wagon, or *vice versa*, are always moderate, so that no difficulty arises in transferring merchandise from one method of transport to the other."[1] Merely an arbitrary transshipment charge is fixed, and it is not pretended that it will cover the actual cost of transferring the goods. For instance, at Frankfort-on-the-Main the writer observed the process of unloading flour from a river barge to a box car. Ten men and a boy were at work aiding the operation of a single crane. Two men with the boy were in the barge; six men were in each other's way in the box car; one man was running the crane; and the tenth one was acting as overseer.

[1] Sympher, London *Daily Chronicle*, June 2, 1906.

The combined force was unloading little more than 100 tons a day. Now, the wages amounted to about $13 a day, and the rent of the machine is fixed at $1.62[1] an hour, or $16.20 for a ten-hour day. Altogether the cost of a single transshipment was, therefore, in the neighborhood of 25 or 30 cents a ton. The State-fixed rate for this transshipment, however, is 5 cents a ton.[2] This amount is paid by the shippers; the remainder comes out of general taxation.

In view of the governmental policy of artificially encouraging waterway traffic in the ways above noted, it seems a surprising fact that the waterways do not carry an even larger proportion of the bulky commodities of traffic than they now do. We found that in the Berlin district the railways were carrying more than half the entire quantity of low-class freight and constantly increasing their share of the total. The only explanation of this phenomenon is that, strange as it may seem, in spite of all the artificial encouragement bestowed upon the waterways surrounding the metropolis, many shippers of bulky freight still prefer to use the railways. Before the tendency of shipping an ever-increasing proportion of this traffic by rail can be overcome, it would seem that the Government must still further increase the artificial margin of rate advantage in favor of the waterways. It must go still further into the vaults of the treasury, into the pockets of the taxpayers; it must meet an even larger annual deficit than the present enormous one.

Aside from the attempt to prove the greater cheapness of water transportation by a quotation of rates which are based, as we have seen, on wholly dissimilar policies, the only effort that has been made in Germany to show the economies of water transit, so far as the writer has been

[1] *Tarif für die städtischen Hafenanstalten zu Frankfurt-a-M.*, October 22, 1908, p. 3.

[2] *Ibid.*

able to discover, is that contained in the report of a special commission on the waterway proposals of the year 1904. It was there stated that on account of the less friction encountered by a boat in the water than by the wheels of a car upon steel rails, the same burden could be moved a given distance with a much less expenditure of energy by water than by rail.[1] This may very well be true; yet it by no means necessarily follows that the savings in this connection are not far more than offset by the greater initial cost of the highway itself, by transshipment, by slow speed and delays, and by a number of other waterway disadvantages. Selecting but a single item of cost, and that not the most important one, the commission attempts thereby to prove the entire case.

It has been suggested a number of times in these pages that, in order to make a fair comparison of transportation costs by water and by rail, it is necessary to include all the items of cost on both sides of the equation. It happens that precisely such a study has been made in Germany. Dr. Walther Rathenau and Professor William Cauer, of Berlin, having raised the question in their own minds as to whether the supposed cheapness of water transportation were not a myth if all factors were considered, undertook recently a painstaking investigation of the question, the results of which were published in 1909. Without placing too implicit faith in the accuracy of the computations, or the conclusiveness of the results obtained, we may nevertheless profitably spend a few moments in considering the conclusions reached by these men.

The comparison was made between the Rhine-Elbe Canal and a suppositious "Güterbahn," or all-freight railway, between the Rhine River and Berlin. The statistics used for the waterway were the official figures for the pro-

[1] *Kommissionsbericht über die wasserstrassen Vorlage des Jahres 1904,* p. 35.

posed canal, as furnished by the Waterways Department. The railway costs were computed on the basis of statistics given in the Railway Archives. The result of the computation was to show that the cost of the canal, of only six hundred tons' capacity, was almost twice that of a double-track railway.[1] It was found, also, that the water rates would have to be almost double those by rail if they covered the cost of the waterway as well as the cost of hauling the goods. "If it is also considered that often the railway has return freight, and that at certain periods of the year the waterway must use smaller boats on account of low water, or boats only partly loaded, it is not too high an estimate to hold that the pure shipping cost from the Rhine to the Elbe is at least double that by rail."[2] Attention is also called to the fact that this is exclusive of the cost of transshipping.

Another very important and very interesting conclusion was also drawn from this study. The question of carrying capacity was considered, and it was found that the capacity of a double-track railway devoted wholly to freight traffic would be very much greater than that of a canal deep enough for 600-ton barges and wide enough for boats to pass each other.[3]

At first blush this might perhaps seem improbable, for it is sometimes believed that, since a canal boat has a much greater capacity than a box car, the capacity of a canal is likewise greater than that of a railway. A 600-ton barge, for instance, varies somewhat in dimensions, but a rough average length is 200 feet.[4] On the other hand, a 15-ton German freight car is about 30 feet in length. Stretched out over the same length, therefore, about 100 tons could be loaded on a railway as against 600 tons, or six times as

[1] Rathenau and Cauer, *Massengüterbahn*, p. 73.

[2] *Ibid.*, p. 81.

[3] *Ibid.*, pp. 83–84.

[4] Thackara, *Railway Freight Rates, Inland Waterways, and Canals of Germany* (Doc. 19, National Waterways Commission, p. 54).

much, on a canal. It should be borne in mind, however, that a railway possesses counterbalancing advantages which more than offset this. First, a far greater speed can be maintained on a railway than on a canal. On an all-freight railway, with mainly through traffic, as would be the case here, a speed of 20 miles an hour could easily be attained. As against this the downstream speed, not counting stops, for through traffic on the Rhine is from 9 to 11 miles an hour, and upstream it is only from 3 to 3.75 miles an hour.[1] Obviously the average speed on a great river of the character of the Rhine is much greater than could possibly be made in the restricted channel of a small canal. Three miles an hour is very good speed for canal boats. On the canals of France the average speed is but 1.67 miles an hour.[2] This is largely due to the many interruptions which occur. Vessels must slow up when meeting each other, and there are great losses of time in the passing of locks and in the entering and leaving of harbors. A speed, therefore, of only about one seventh that by rail seems a fair estimate. This practically offsets the canal advantage cited above.[3]

Second, railway traffic can travel at night with scarcely any impediment, and with little additional expense; whereas the operation of canals at night is usually entirely impracticable. In order to permit night traffic, a canal must be brilliantly lighted with electricity on both sides and throughout its length; and even then there is consid-

[1] Nasse, *Die Schiffahrt der deutschen Ströme*, pp. 142–43.

[2] *Report of British Royal Commission*, vol. VI, p. 14.

[3] It would be necessary to run the railway trains at distances of a mile apart in order to avoid accidents, but this loss would be nearly if not quite compensated by a similar loss on a canal, granted that boats, so far as safety is concerned, may be run much closer together than trains of cars. Fifteen minutes would be the very minimum of time required to pass a lock. It would be necessary, therefore, for one boat to be fifteen minutes behind another. Now, if the speed of the boats is only three miles an hour, this means that the boats must be more than three quarters of a mile apart.

erable danger, and the speed must be lessened. The great Kiel Ship Canal is so lighted, and is used at night, but inland waterway traffic at night is almost unknown in Germany.

Third, on the canal in question navigation would be closed on account of ice for about two months each year. This means a reduction of one sixth from the capacity it might have if subject to no interruptions.

Fourth, accidents on canals are a far greater impediment to traffic movement than they are on railways. Mishaps at locks are liable to occur at any time, and barges and ships not infrequently run aground and block the traffic of a large part of the entire canal. In case of a railway wreck, the track can usually be speedily repaired, or a new one laid around the débris, and the duration of the blockade is generally but a few hours at most. But in the case of a mishap on a canal the problem is more difficult. A damaged lock must usually be fully repaired before traffic can be resumed; and a sunken barge — a most unaccommodating burden to handle — must be completely removed from the path of traffic before the commerce of the waterway can proceed as before. These four railway advantages — greater speed, night operation, uninterrupted service throughout the year, and comparatively less interruption to traffic on account of accidents — much more than offset the single advantage of the waterways. We must conclude, therefore, that the assertion of Rathenau and Cauer, that the capacity of an all-freight double-track railway is very much greater than that of a 600-ton barge canal, seems well founded. Such being the case, it is evident that the larger tonnage which a railroad might enjoy would permit a considerable reduction in the railway rate given in the above tables.

By constructing canals capacious enough for 2000-ton barges, the total carrying capacity might be made to exceed that of a double-line railway track of the German type; but in the case of such a canal, the cost of construction would be so greatly increased that the margin of saving would be more than overcome thereby. This is recognized by the Waterway Department, and it constitutes the only reason why the Rhine-Weser Canal was limited to 600-ton barges, except for the stretch from the Rhine to Herne, where the needs of the Rhine boats and the tremendous traffic promised led to the construction of a 1000-ton waterway.[1] In general, in Germany, 600-ton canals are considered to be the practical limit of size, on account of the disproportionately heavier costs for broader and deeper artificial channels.[2]

Before concluding this discussion of the relative cost of rail and water transportation, attention should be called to the situation that developed in Germany in the third quarter of the nineteenth century. Prior to the adoption of the present policy, about 1875, the railways of the different German States were for the most part left to the exploitation of private capital. And in Germany, as everywhere else, the railroads were rapidly destroying the usefulness of the waterways as carriers of traffic. It is stated

[1] *Kommissionsbericht, supra,* p. 44.

[2] Were a comparison made between a railway of the American type and a 600-ton barge canal, the advantage in favor of the railway would be found to be very much greater. German railway engines and freight cars are much smaller than those of the United States. "Of the 382,185 freight cars in use in Prussia in 1907, 35.8 per cent had a capacity of 10 tons, 60.7 per cent a capacity of 15 tons, and 3.5 per cent a capacity of 20 tons." (McPherson, *Transportation in Europe,* 1911, p. 127.) On the other hand, the size of freight car now in use in the United States varies from 25 to 50 tons. Trainloads of from 600 to 800 tons are not uncommon in regions of heavy traffic, but in Germany trainloads of over half that amount are rare. There have been individual cases in the United States, indeed, of trainloads of 6000 tons. Since the cost of transporting goods decreases as the capacity and efficiency of a railway increases, it follows that American railroads can (if they will) charge lower rates than those of Germany. This obviously greatly increases their competitive strength as against waterways. (See chapter XIX for a comparison of the relative cost and capacity of the Erie Canal and an all-freight American railway.)

by Dr. Sympher that "the development of railways, in the third, fourth, and fifth decades of the last century, was the cause of canals losing much of their importance."[1] The decline was, however, not confined to canals alone; even the great rivers were affected by the rise of the railways. On some of the waterways the falling-off in traffic during these years was absolute, but on others it was only relative. On the river Main, in spite of a series of reductions and the final abolishment of tolls, the traffic declined with great rapidity.[2] The Main-Danube Canal was a private project enjoying some Government aid; and we have seen, in a preceding section, that in spite of a constant reduction in tolls the traffic rapidly fell off until it became of very little consequence. The causes of this decline are set down as the insufficient size of the canal and the development of parallel lines of railway at the following dates: 1844, 1859, 1873, 1875, 1888.[3] Now, a glance at the table on page 190 shows that these dates closely correspond with the period of the decline of waterway traffic on the canals. The former of the two causes — namely, the small capacity of the canals — seems to have had little effect, for the mean depth of the canal is 4.8 feet from Bug to Dietfurt and 5 feet from Dietfurt to Kelhein;[4] while the busy "Mark Waterways" of the Berlin region have only a depth varying from 5.2 to 6.2 feet.[5] Running at a heavy annual deficit, the Main-Danube Canal has not been able to prevent a diversion of its traffic to railways which are conducted at a profit. Whether it is because of absolutely lower railway rates, or of better facilities, it matters not. Superior accommodation is only another name for cheapness. Even the great naturally navigable rivers, the Rhine and the Elbe, strongly felt the competition of the railways until

[1] Sympher, London *Daily Chronicle*, April 7, 1906.

[2] *Die Wasser und Hafenbauten, Frankfurt-a.-M.*, pp. 9–10.

[3] Schranz, *Donau-Main Kanal*, p. 105.

[4] *Ibid.*, p. 62.

[5] Sympher, London *Daily Chronicle*, April 6, 1906.

after the adoption of the present policy of waterway encouragement. "The Baden Line (opened 1846) from Mannheim to Basle, parallel to the Rhine, was the first great competitor to the river, whose traffic above Strassburg it killed with a single blow."[1] Even on the great lower Rhine the traffic development was comparatively slight for many years after the development of the railways of that section. "The Rheinisch, the Cologne-Minden, and the Bergisch-Markisch Railways increased their freight traffic, in the period from 1850 to 1870, from 102,000 to 20,965,000 tons, or as 1 to 20; the traffic on the Rhine at Emmerich (on the Dutch border) increased during the same period from 573,000 to 1,913,000 tons, or as 1 to 3.5."[2]

For the Elbe, thanks to an excellent study by Professor Fischer, of Jena, we are able to present some comparative statistics of particular interest. The table below shows the traffic of the Elbe and of the Berlin-Hamburg Railway, a line paralleling the river, in the years 1847 and 1869:[3] —

	Upstream		Downstream		Total	
	Elbe	Railway	Elbe	Railway	Elbe	Railway
1847	256,986	40,733	151,583	9,990	408,569	50,723
1869	418,483	225,132	388,833	191,148	807,316	416,380

"The fearful results of the dues on the Elbe and the consequent aid to the ruinous competition of the railways is clearly shown by the above table. . . . It appears still more meaningful, however, when one reflects that the slight increase in traffic on the Elbe has been alone on low-value freight, which is subject to the lowest dues, and that on commodities of greater value it has greatly fallen off."[4]

[1] Clapp, *The Navigable Rhine*, p. 26.

[2] *Ibid.*, p. 29.

[3] Fischer, *Eine Studie über die Elbschiffahrt in den letzten hundert Jahren unter speziellen Berücksichtigung der Frage der Erhebung von Schiffahrts Abgaben*, p. 135.

[4] *Ibid.*

It appears from the above table and quotation that the Berlin-Hamburg Railway had diverted a large part of the Elbe's traffic to itself, and that even bulky freight, "naturally belonging to the waterways," relatively declined on this river. The dues complained of as being ruinous to the waterway were not high enough to yield a profit on the capital invested in regulative and canalization work on the river. (It is unconstitutional to levy tolls more than sufficient to cover the cost of improvements to navigation; the waterways of Prussia have for centuries not been allowed to be used as a source of profit to the State.[1]) The railway, on the other hand, was a private enterprise conducted at a profit.

From these examples the case seems clear that during the third quarter of the nineteenth century the railways of Germany were winning in an open fight for traffic. But in the seventies the Government assumed control of both railways and waterways. It then developed the railroads as mere feeders to the waterways, wherever that was possible; it established tolls on the waterways so low that the yearly deficit now amounts to between three and four thousand dollars a mile; it fixed rates on the railways so high that the annual net profit to the Government amounts to nearly two thousand dollars a mile. The arbitrary rates thus established have succeeded in stimulating water commerce. But inasmuch as there is at present little competition between railways and waterways, and inasmuch as the rates bear virtually no relation to the cost of the service, a quotation of comparative rail and water rates can hardly be considered as proof of the economies of waterway transportation.

Attached to the waterway bills of 1901, 1904, and 1905 were provisions for the establishment of tolls sufficiently high to cover the cost of the works, though of course not high enough to yield any profit, that being unconstitu-

[1] Sympher, London *Daily Chronicle*, June 2, 1906.

tional. The result was a great storm of protest in all parts of the country. We have seen how opposition on this ground was instrumental in the defeat of the Rhine-Elbe Canal project. The contention of the opposition was that an increase of dues would destroy the present rate advantages offered by the waterways. In support of this contention a number of studies have been made, of which Professor Fischer's, above quoted, is a notable one, showing that the high dues of earlier periods were ruinous to the waterways, and that a return to that policy will spell the fate of water transport. The official seal of the Minister of Public Works for the inauguration of high dues on the new waterways was, however, given on February 6, 1908;[1] but the discussion of the subject has not yet ceased. We read in a late number of the "Handwörterbuch der Staatswissenschaften," "The question whether tolls on canals shall be raised has been long a stirring one and is to-day differently answered."[2]

On the new waterways, the Government will establish a monopoly of shipping, taking it out of the hands of a large number of boat owners or companies, hoping thereby to effect savings sufficient in amount to insure the success of the waterways, even with higher dues. But the attempt is only an experiment; and it remains to be seen what the issue will be. The fortunate circumstance is that the dues may be speedily lowered if it be found that traffic does not develop; and since, according to Dr. Sympher, the deficit cannot be counted anyhow, water transportation would doubtless still be proved cheaper than that by rail.

It should be remembered that these higher dues are not calculated to yield a profit on the capital invested, as do the rates on the railways. There is not the shadow of a doubt that were it constitutional to use the waterways, like the railways, as a source of public revenue, a bill to raise the rates on waterways sufficiently to yield an annual

[1] Peters, *supra*, p. 339. [2] *Handwörterbuch*, 1910, vol. v, p. 762.

profit equal to that on the railways would be almost unanimously voted down. Not even the Waterway Department would sanction such a step. Why? Because it is known that the waterways, with the probable exception of the Rhine, could not compete with the railroads on even terms.

2. There are other reasons for the development of the waterways of Germany, however, than that of economy of transport. Hence, even though it be settled that water transportation is more costly than that by rail, it is necessary to pursue our inquiry further. It is conceivably possible that the other ends they are supposed to serve may still prove the feasibility of waterways. It is necessary, therefore, to subject in turn each of the various other arguments to the test of validity, as was done with the argument of cheap transit. The first contention to be considered is that the waterways of Germany are necessary in order to relieve the overburdened railways in regions of congested traffic.

There are two districts in which it is said that waterway facilities are indispensable: the one, about Berlin; the other, the territory between the Rhine and Weser Rivers in northwestern Germany.[1] It is these two regions which are to be served by the new canals, provided under the law of 1905: the argument that the railways are overburdened, was, indeed, chiefly instrumental in securing the passage of that law.

Now, we found in the preceding chapter that the railways of the Berlin district have in recent years been constantly increasing their proportion of the traffic, even of such bulky commodities as "naturally belong to the waterways." This fact would seem to indicate that the present Berlin railways have not yet reached the limit of their carrying capacity. Moreover, there is no reason for

[1] Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 19.

believing that the railway net cannot be still greatly developed. The huge traffic centring in the metropolitan district of London, vastly greater than that at Berlin, is largely carried by rail; and the waterway advocates in England could not advance the argument that the railways were in need of aid.[1] The traffic handled at both New York and Chicago by rail is greater than the entire amount centring about the German metropolis, and never except for a brief period in the crop-moving seasons of 1905 to 1907, for reasons already made clear,[2] have the existing railways been seriously overworked. Moreover, no one considers that the railway systems of these cities have reached the ultimate physical limit of extension.

But let us turn to the second region of dense traffic, the Westphalian industrial district. It is said that here, in a region comprising only one one hundred-fiftieth of the area of the empire, the railway tonnage is equal to one fourth the entire railway traffic of the country,[3] and that as a consequence the railways of the district are not only taxed beyond their present carrying capacity, but actually beyond their possibilities. Extensive further development is said to be physically impossible. We shall see whether this contention stands the test of reason.

It should be observed in this connection that practically all the traffic must travel over the railways for at least a short distance, even when waterways are employed. Coal, for instance, constituting the great bulk of the waterway traffic of the region, is all brought from the mines to the waterways by rail. Suppose that the already enormous traffic should double in the next ten years; it would require a doubling of the railway capacity for the region between the mines and the waterways. This is evidently not deemed impossible. It appears, then, that the waterways are to relieve the burden on the railroads only outside the region of most dense traffic. When the writer asked an

[1] See page 103. [2] See chapter IV. [3] *Kommissionsbericht, supra,* p. 35.

engineer in the Waterway Department[1] how it was that, if the railways were able to carry all the traffic for a short distance, the lines could not be made thick enough for a longer distance, especially since outside the immediate productive area the routes would naturally spread out rather than converge, the only reply forthcoming was that the cars would have to be used a longer time on account of the greater distance. Now, while this is perfectly true, it in nowise explains, it rather evades, the point in question. More cars would be needed, to be sure, but not a greater number would be required within the area of densest traffic. Suppose five hundred cars to leave the mines in a day and travel twenty miles to a waterway, be unloaded, and sent back to the mines. Suppose, now, five hundred cars to leave the mines for a trip of several hundred miles to various markets direct, without the use of the waterways. Suppose, in the mean time, five hundred other cars to return from distant points and to reach the mines to be reloaded. Is there any greater congestion near the mines in the second than in the first case? Obviously not. On the contrary, there is less crowding in the second case, because in the former instance the cars remained in the congested area while being switched and unloaded, but in the latter case they passed outside the district of densest traffic before stopping. At Dortmund one may see a score of trainloads of coal standing on the tracks waiting to be unloaded. Were they sent directly to destination, the congestion in such a district would be considerably relieved. So long as practically all the traffic within the congested area has to be handled by the railways in any case, the contention that the waterways are relieving the congestion is entirely without foundation.

There is another side to this question, however. Suppose canals could be constructed to the very mouths of the mines, so that the railways would not have to handle

[1] Mr. Oppermann.

the traffic even for a short distance. Would not, then, the congestion of traffic be relieved? The answer is, — only in case a waterway offers greater carrying capacity in proportion to the space it occupies than does a railroad. Now, with the exception of one short stretch, the canals of this region have all been constructed to float boats of only 600 tons' capacity. We have seen above that the total carrying capacity of a double-track railway is much greater than that of a 600-ton barge canal. Moreover, a canal wide enough for boats to pass each other occupies at least twice the lateral area that a double-track railway does. In view of these facts, how is it possible for canals to unburden the railways, to relieve the congestion in areas of dense traffic?

The above reasoning applies equally well to the Berlin district, in particular to the new Berlin-Stettin 600-ton canal. A freight railway of much greater carrying capacity than the canal possesses could be constructed from the metropolis to Stettin to relieve any congestion that might exist; and it could be built for at least half the cost of the waterway.

The above arguments, it should be added, do not apply with quite the same force to a great river. In the case of a river the ground space, so to speak, is occupied whether the river is used or not. Its utilization, therefore, means the employing of space which could not be used for railroad building. A river thus materially differs from a canal. The first argument presented above, however, holds with equal force for a river. A river cannot relieve the traffic congestion where it is most needed. The greater part of the freight — all of the coal — must still be carried for at least a short distance by rail, from the source of the supply to the banks of the waterway. On only strictly riparian traffic can a river relieve the railways.

Closely connected with the contention that waterways are a relief to railroads in regions of dense traffic, is the idea that somehow or other water transportation in general is never an impediment, but often rather an aid to the railroads. This argument has been advanced in Germany, no less than in the United States.

After showing that between 1875 and 1905 the tonnage on the waterways of Germany increased from 2.9 to 15 billion ton-kilometers, as against an increase of from 10.9 to 44.6 billion ton-kilometers on the railways, the growth of water traffic taking place, moreover, with scarce any increase of waterway mileage, whereas the length of the railways more than doubled during the period in question, Dr. Sympher hastens to add that since, however, the railway traffic of Germany has increased faster than that of any other country of Europe, one can conclude that the waterways have not damaged the railways.[1] Indeed, he goes so far as to say that the waterways have been the cause of the railways' prosperity. "When one considers that the German railways, notwithstanding the dimensions of the traffic on the inland waterways, have obtained such remarkable prosperity and development, and that in Prussia, where inland navigation is so successful, the railways are most profitable, it appears evident that the harmonious coöperation of waterways and railways is distinctly to the advantage of the latter." [2]

In a thriving frontier town is a single merchant. He is able to expand his business and continually meet all the needs of his customers. A second merchant, however, appears in the place, and in thirty years has secured one half the trade of the town. At the same time, however, because of the very rapid growth of the place, the first merchant has constantly increased his business, and has continued prosperous. Can it therefore be said that the second merchant has not injured the first? Can it be contended that he has even been a blessing in disguise? The truth is, as we

[1] *Weltausstellung, supra,* pp. 42–43.

[2] London *Daily Chronicle,* June 2, 1906.

have earlier pointed out, that Germany has passed through a great industrial revolution during the last thirty years, and her business has expanded with astonishing rapidity. Hence it is that both railways and waterways have been able rapidly to increase their tonnage. The railways would seem to have prospered in spite of rather than because of the waterway policy.

The contention that waterways are an aid to the railways can be based only on the following ground. The low cost of water transportation makes possible the ready assembling of raw materials, for the purpose of manufacture. The resulting manufacturing, which would otherwise be impossible, leads to a general expansion of trade, and creates an extensive traffic in higher grades of freight which naturally goes to the railways. The obvious fallacy lies in the assumption that the cost of transportation is less by water than by rail. When that assumption is proved untrue the whole argument falls down. If subsidies corresponding to those given to the waterways were granted to the railroads a much greater industrial stimulus would result.

3. Another end which German waterways are said to serve is a military one. The railways of Germany have been laid down with an eye to the greatest possible national service in time of war, and in like manner it is contended that the rivers and canals of the country must be developed with military ends in view. This argument has been put forward particularly in connection with the Rhine-Weser Canal which is now being constructed. The military importance of this canal is said to lie in the possibility that munitions of war might thereby be carried by water from the North Sea to the Rhine district without having to traverse foreign waters, as is at present necessary.[1] A reference to the map on page 223 will show that the new canal will

[1] *Kommissionsbericht, supra*, p. 54.

furnish an all-German route from the Rhine to the North Sea and thence to all the waterways of eastern Prussia.

The probability that such a waterway connection would be extensively employed in the shipping of war supplies, of foodstuffs for the armies, etc., from the East to the West is so remote that the subject hardly needs discussion. It is well known that speed and certainty of delivery are an absolute essential in time of war. Recall now the handicaps suffered in these regards by canals as compared with railways. Attempted haste, moreover, would be almost sure to precipitate an accident somewhere, causing long delay. The disadvantages have been so concisely stated by Rathenau and Cauer that we cannot do better than quote them here: "For the traffic of war, canals would, aside from their small carrying capacity for such traffic, on account of the slowness of their service, on account of the ice during two months, on account of the impossibility of bringing the materials transported to their destination on the canals themselves (also on account of transshipments), possess in general no great importance. Altogether different, however, is the case on railway freight lines, with their extraordinarily great carrying capacity, and the possibility of carrying the traffic *everywhere* by means of the ordinary railway lines. Also, a possible destruction of a lock, a portion of the canal, or of a canal bridge is much more serious than an injury to the railway, which can be quickly repaired again."[1] The last point is particularly worth noting. With very little trouble an enemy could destroy the locks of a canal and render it wholly useless for a considerable period of time before it could be repaired. On the other hand, a portion of destroyed railway track may be very quickly relaid sufficiently well to permit the passage of traffic. The case is so obviously against the canals that it is unnecessary to argue it further.

It is sometimes stated, however, that waterways may be

[1] Rathenau und Cauer, *supra*, p. 85.

of service to the country in time of war, not in carrying the military goods themselves, but by relieving the railroads from much of the ordinary traffic of commerce, thus leaving the latter free to transport both the armies and their necessary supplies from place to place as occasion requires. Thus stated, there is considerably more point to the argument; but still the alternative seems, on the whole, to be much more advantageous. Instead of developing the waterways for military purposes, military railways could be constructed, or, as has been suggested, pure freight railways which could be especially devoted to military needs in time of war, either directly, that is, by sending the military supplies over them, or indirectly, by using them in the relief of the ordinary railways at such a time. Such railways, as we have seen, are more capacious, more convenient, and much less costly than canals.

In the case of river, as against canal, development for such purposes, the deciding factor for each river would needs be the cost of the regulation and canalization works as compared with the cost of building the railway, regard being had also to comparative capacity and serviceability. The question might be answered differently for different rivers, but in general it would unquestionably have to be admitted that the balance lay in favor of railways. The decisive factors here are that the course of a river is fixed by nature and hence its route may not follow a direction which meets the needs of the troops, and that transshipment to and from railways will almost always be necessary. However we look at the question, therefore, the military argument in favor of waterway development does not assume any very great importance.

4. A further argument for the improvement of the waterways of Germany is that by means of water transportation a very desirable decentralization of industry is effected. Factories and industrial establishments of all kinds move

out from the great industrial centres and locate along the waterways. This makes it possible for the laboring population to live in less crowded quarters and to enjoy a more comfortable existence than is the lot of the toilers of the city. Even small garden plots may be acquired, and the laborer then finds not only occupation for his leisure time and for his family, but he experiences as well some of the joys of a real home life. Very extensive maps in color have been prepared by the Waterways Department, showing the growth of industry along water routes during the past thirty years, and the considerable degree of industrial decentralization which has already taken place.[1] The maps show, naturally, a development concurrent with that shown by the statistics of waterway traffic which have been presented in the preceding chapter. It has varied greatly in different cases: along the Rhine and the Elbe there has been a very extensive decentralization, while along the waterways of eastern Germany there has been almost none. It is not to be denied, however, that on the whole the waterways have tended to decentralize industry.

This desired result, however, has obviously been accomplished only by the arbitrary fixing of low freight rates on the waterways, of conducting them at a heavy annual deficit. We have seen that an all-freight railway between the Rhine and Berlin could be constructed and run at about half the cost of a 600-ton-barge canal, and that in every case, except on the Rhine, water transportation in Germany is less economical than that by rail. It follows, therefore, that, if the railways were conducted at a loss corresponding to that on the waterways, much lower freight rates could be offered, and hence a correspondingly greater stimulus to industrial decentralization would result than has come from the present waterway policy.

[1] *Denkschrift betreffend den Einfluss der Wasserstrassen auf die Ansiedelung der Industrie und deren Decentralisierung*, 1904 (Haus der Abgeordneten, No. 96).

5. The improvement of rivers and the construction of canals in Germany has carried with it certain benefits to agriculture, and this may be regarded as a final purpose of waterway development. The better control of rivers has checked to some extent the annual spring floods and consequent overflow of low-lying riparian lands; and canals have in a few instances served as aids in the drainage of swampy tracts of territory. While these benefits are of real importance, they are properly regarded in Germany as merely incidental. The floods could be controlled[1] and the marshes drained at infinitely less cost than is required to canalize turbulent or shallow streams and to construct canals for shipping purposes. In no sense, therefore, can the aid to agriculture be considered a prime cause of waterway development. The great benefits claimed are those that we have been discussing in previous paragraphs.

6. If the above analysis of German waterway transportation be sound, we may conclude in particular that the Rhine River alone may be regarded as successful, and that, in general, waterway traffic has been developed in Germany only through the aid of a governmental policy which compels the taxpayers to contribute an enormous sum for the support of water transportation. We have found that on even terms, computing on the same basis on both sides of the equation, the railways possess decided economic advantages over the waterways as carriers of traffic. It follows, therefore, that if the waterway subsidies were discontinued, and if attention were concentrated upon railway development, the total cost of transporting the traffic of Germany might be substantially reduced. It should perhaps be added here, that Germany has no need of waterways as a means of regulating railway rates; gov-

[1] Because of the forestry policy, the naturally more equable distribution of rainfall, and the less quantity of snow suddenly melting in the springtime, floods in Germany are as nothing compared with those in the United States.

ernment ownership of railways being a sufficient guarantee against extortionate railway charges. The waterways can justify themselves only as actual carriers of traffic.

7. The transparent fallacies in the arguments which we have been discussing lead one to query whether it be possible that the German waterway officials and the German people in general can themselves be unaware of the economic losses involved in waterway expenditure. Is there something back of the scenes, some political interest, or some dominating force which virtually compels the Government to continue the policy of subsidizing the waterways, or are the German people simply in the dark as to the economic waste involved?

The committee in charge of the preparations for the International Railway Congress which met at Berne, Switzerland, in July, 1910, submitted in advance to the delegates of the different countries a series of questions to be used as a basis of discussion at the conference. Question number *thirteen* related to the possibility of an extension of present railway lines sufficient to meet the increasing needs of commerce. To this question the German railway officials replied, "We regret that we must refuse to reply to Question XIII."[1] During the discussion of this point at the Berne Congress, the Prussian delegates maintained a discreet silence, neither affirming nor denying the possibility of a further development of the railway net of Germany. During the long and spirited debate on the canal bills, from 1899 to 1905, the argument had, however, been officially put forward that the railways of Westphalia, as we have above noted, had reached the limit of development. Astonished that such an argument should be advanced, M. Colson, Director of Roads and Bridges, and Councillor of State of France, made inquiries of some officials high in the Prussian railway service as to the reason for such a conten-

[1] Colson, *Revue Politique et Parlementaire*, August, 1910, p. 364.

tion. The only reply that he could obtain was, "We were not consulted."[1] What is the meaning of these guarded remarks and this disconcerting silence on so crucial a question?

After a careful first-hand study of German waterways, M. Colson asserts that Kaiser Wilhelm is the power behind the movement. The Kaiser, it is said, believes that Germany's future is dependent upon the development of her sea-power, and he "is suffering from a delusion" that the development of inland navigation is an absolute essential to the expansion of ocean commerce. Now, it is well known that when the Kaiser's mind is made up, that when he has received an "inspiration," as the Germans themselves say, it matters not if sound arguments are wanting. Since he is satisfied in his own mind that the Fatherland needs waterways, the Kaiser virtually compels their development, regardless of the wishes of his subjects. In 1899 he dismissed twenty members from the Prussian upper house who had voted against the canal bills and appointed twenty men to take their places who were favorable to waterway development.[2] A compromise measure was then forced through the national legislature. Since the Kaiser holds the power of appointment and removal of the railway and waterway officials, it is not difficult to understand how the former may be constrained to silence on the question of waterways and the latter obliged to lend active support to the present policy.

It seems probable, however, that the support of the waterways policy in Germany may be in no small degree explained on other grounds. The attitude of the Kaiser, himself, as well as that of many of his subjects, is doubtless due to the importance that is almost always attached to the seen, as against the unseen. It is apparent to the eye

[1] Colson, *Revue Politique et Parlementaire*, August, 1910, p. 364.

[2] *Ibid.* See also *Die Nation*, April 5, 1901, and *Jahrbuch für Gesetzgebung, Verwaltung und Volkswertschaft im Deutschen Reich*, vol. 24, Heft 3 (articles by Schmoller and Lotz).

that a large traffic is handled on the waterways of Germany, and it is observed that the rates charged are substantially lower than those on the railroads. To all outward appearances the waterways are doing for the country all that is claimed for them; and the average person seldom sees beneath the surface. What might be accomplished by subsidizing the railways, instead of the waterways, is something which is not apparent to the senses; it is the unseen; and hence it seldom enters into the conception of the average individual. There can be little doubt that large numbers of people firmly believe that the waterways are of great benefit to the industrial life of Germany.

Again, the movement receives steady support from interests which are directly benefited by the present policy. Representatives of cities located along water routes are favorable to their development, because the low water rates arbitrarily guaranteed them are a direct advantage to such communities. So long as the Government adheres, on the one hand, to the policy of subsidizing the waterways, thereby offering low rates to favored shippers, at the expense of the general taxpaying public; and of fixing railway rates, on the other hand, high enough to yield a large national revenue, which comes out of the shippers directly, representatives of river and canal towns may be expected to remain favorable to waterway development. These people, together with the Kaiser and those who believe with him that the waterways are the basis of the prosperity of the Fatherland, are still able to put down the opposition to further expenditures upon inland navigation.

CHAPTER XI

A COMPARISON OF GERMAN AND AMERICAN TRANSPORTATION CONDITIONS

1. In the present chapter we shall undertake a comparative study of transportation conditions in Germany and the United States. Do the conclusions of the preceding chapters indicate that water transportation in the United States would be more or less successful than in Germany? Or may any conclusions applicable to American conditions fairly be drawn from the German study? For clearness of exposition the conditions affecting transportation may be divided into geographical, industrial, and governmental. These will be discussed in turn.

The first point to be noted under the geographic head is that of extent of territory. The area of the entire German Empire is considerably less than that of our single State of Texas, or about one fifteenth that of the United States.[1] The natural result of this is that the distances to be traversed in the transport of produce are very short in Germany as compared with those in the United States. The bearing of this fact is of much importance in canal, as distinguished from river transportation. It was seen in chapter IV, that the chances of the financial success of a canal are rapidly reduced as its length increases. This is due, it may be repeated, to the heavier cost per mile of canal as compared with railway construction. For a short distance this disparity may not seriously affect the chances of success, but if a long distance must be traversed in order to join markets, the heavy costs of canal construction may easily more than counterbalance possible advantages in

[1] Exclusive of Alaska.

other respects. The advantage in this connection is evidently decidedly with Germany.

A second geographical consideration is the extent of the natural waterways in the two countries. We have talked so much in the United States about our marvelous system of some 18,000 miles of navigable waters, that we have in general overlooked the fact that, considered in relation to area, we are not so wondrously blessed with natural avenues of commerce as many another country. Little Germany has 5260 miles of actually important rivers.[1] With one fifteenth the area, Germany possesses nearly one third the river mileage of the United States.

But more important for purposes of commercial navigation than the mere extent of river mileage are the character and location of the various streams. First, as to the nature of the waterways. The average gradient on the 1948 miles of free rivers in Prussia is only 1.26 feet per mile.[2] Interruptions to traffic on account of floods, droughts, and ice, have been seen to be of the greatest importance in determining the feasibility of water transport. The following table shows the average yearly traffic interruptions on the important rivers and canals of Germany. They are based on statistics collected by the various river and harbor boards for periods of from ten to twenty years:[3] —

Cause	Rhine	Elbe	Oder	Vistula
Floods . .	2 days	1 day	3 days	3 days
Ice	17	63	78	101
Total .	19	64	81	104

On the canalized rivers and canals, according to loca-

[1] Sympher, London *Daily Chronicle*, April 7, 1906.

[2] *Report of British Royal Commission*, vol. VI, p. 59.

[3] *Ibid.*, p. 68.

tion, the average total yearly interruptions are as follows:[1] —

a. Western Germany	25 to 75 days
b. Central	50 to 90
c. Eastern	90 to 135

On the great rivers the interruptions on account of high water are seen to be from one to three days each year. In contrast to this, the annual floods on American rivers work utter havoc with navigation for weeks every spring. The following table shows the variations in water level at various points along the Ohio and Mississippi Rivers:[2] —

Ohio at Cincinnati	60 feet
Mississippi at Grafton, Illinois	29.6
Mississippi at St. Louis	43.92
Mississippi below Cairo and the mouth of the Ohio River	45.6
Mississippi, Memphis to Helena, Arkansas	54.75
Mississippi at Vicksburg	58.98
Mississippi at New Orleans	21.02

The disadvantages of such variations in level are felt, not only in navigating the rivers at times of high water, but in the erection of transshipping equipment along their banks as well. Rivers that rise and sweep away great buildings, devastate miles of territory, and cut themselves new channels to the sea obviously always imperil stationary wharves, storehouses, and loading and unloading machinery. And without these facilities the costs of transshipment are enormously increased. From this standpoint the rivers of Germany are greatly superior to those of the United States.

The closing of navigation on account of ice is an equally important point. On all the important waterways of our Northern States, the average number of days that navigation is closed on account of ice is greater than is the case on any except the most eastern waterways of Germany. The

[1] *Report of Royal Commission*, vol. VI, p. 59.

[2] *Preliminary Report of (U. S.) National Waterways Commission*, p. 7.

Erie Canal may be taken as an example. Between the years 1885 and 1905, the average number of days that the canal was navigable each year was 204,[1] or less than seven months a year.

Of still greater importance to successful river transportation is the geographical location of the rivers of the country. A glance at the map on page 223 shows the Rhine, the Weser, the Elbe, the Oder, and the Vistula all to extend from the heart of the country to the North or Baltic Seas. They thus follow the natural direction of German commerce, and each river in itself comprises a through route to the sea. On the other hand, the United States has hardly a single river route that extends for a considerable distance in the prevailing east-and-west direction of traffic. The Columbia in the Northwest, and the Missouri from Kansas City to St. Louis are the principal ones; the importance of the Missouri is, however, greatly lessened because it has no through connection with the East. On practically all of our east-and-west routes long artificial connections are required to make them serviceable for through traffic. As compared with Germany's through routes to the only seacoast our disadvantage is readily apparent.

The location of German rivers, relatively to each other, has also a very important bearing upon the question of canal digging. The great rivers of Germany lie very close to each other, and hence the east-and-west connections need cut through no great extent of territory. The new canal from the Rhine to the Dortmund-Ems, for instance, is only 47 miles in length; and the extension to the Weser is but 77 miles. The new Berlin-Stettin Canal is 62 miles long;[2] the canals of the "Mark" are all very short, as is also the Bromberger Canal connecting the Netze and the Vistula. In the United States, on the other hand, the Erie

[1] Whitford, *History of New York Canals*, vol. II, p. 1060.

[2] Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, pp. 50–51.

Canal is 342 miles long, and the distance from Chicago to the Mississippi River is 327 miles.[1]

Equally important with the shorter distances in Germany is the less cost of construction of canals per mile. Below is a table of the cost per mile of the more important German canals. Harbor costs are not included: —

Waterways	Capacity	Cost per mile
Dortmund-Ems (proper)	600 tons	$114,911*
Rhine to Dortmund-Ems	1000	396,277†
Dortmund-Ems to Weser	600	263,000‡
Berlin-Stettin	600	173,348§

* Peters, p. 264. † Sympher, *Die neuen wasserwirtschaftlichen Gesetze*, p. 51.
‡ *Ibid.* § *Ibid.*

As compared with these figures, the estimated cost of deepening the Erie Canal from 7 to 12 feet, with a new cut for part of the distance, is $297,000 per mile, exclusive of terminals;[2] while the total cost, including all that has been expended upon the old canal, approximates $420,000 per mile.[3] The present Kiel Canal, 29.4 feet in depth, cost $735,849 per mile,[4] as compared with a cost of more than $1,600,000 per mile for the Chicago Drainage Canal, with a depth of only 24 feet.[5]

The much smaller cost of canal construction in Germany is partly due to the lower cost of materials and labor, partly to economy in building, and partly to the favoring engineering conditions there present. But whatever the chief cause, the fact must be recognized that canal construction *is* much less costly in Germany than in the United States.

On the other hand, the railways of Germany have probably cost much more than those of the United States in

[1] *Report on Survey of Des Plaines and Illinois Rivers*, 1905–06, House Document no. 263, p. 8.

[2] The total cost is estimated at $101,000,000.

[3] For cost to 1882, see Whitford, *supra*, p. 1068.

[4] See page 220.

[5] *Sanitary District of Chicago*, 1903, p. 23.

proportion to mileage. The capitalization per mile in Germany is about $110,000,[1] as against about $60,000 in this country, including watered stock in both cases. The railroads of Prussia are said to be greatly overcapitalized, the purpose in view being to conceal the excessive earnings, and to prevent thereby a protest against high railway freight rates.[2] Whether this be true the writer has been unable to ascertain; but in any event it is probable that the actual cost of the German railways has been considerably greater per mile than those of the United States. If, therefore, both sides of the equation be taken into consideration, the railways costing much more and the canals much less in Germany than in this country, it is clear that canals there stand a much better competitive chance than they do in the United States.

2. The first in importance among the industrial conditions affecting the transportation question in the two countries under discussion is that of the density of population and of traffic. In 1910 the population of the United States was about 91,000,000, or about 26 per square mile, while in Germany it is 290 per square mile.[3] Were the eastern half of the United States alone considered, the disparity would obviously be much less, but the advantage would still be greatly in favor of Germany. A dense population means a relatively heavy traffic, and, in a thriving industrial nation, an enormous tonnage. The bearing of this upon our question is that an abundance of traffic is thereby afforded for the support of both the waterways and the railways. A comparison between Germany and France is instructive in this connection. In the two countries the waterway and railway tonnage has been as follows:[4] —

[1] See page 185. [2] See Roberts, in *Scribner's Magazine*, February, 1911.

[3] *Preliminary Report of National Waterways Commission*, p. 30.

[4] *Ibid.*, p. 32.

	France				Germany			
	Wy. Miles	Ry. Miles	Wy. Tonnage 000	Ry. Tonnage 000	Wy. Miles	Ry. Miles	Wy. Tonnage 000	Ry. Tonnage 000
1885	7676	18,500	19,573	75,192	6200	22,940	27,600	200,000
1905	7483	24,459	34,030	139,000	6200	33,730	103,400	588,700

With a waterway mileage greater than that of Germany, France had in 1905 but one third as much water tonnage as the former country; twenty years earlier France possessed nearly three fourths as much as Germany. With a railway mileage in 1905 nearly three fourths as great as Germany's, France had less than one fourth as great a tonnage; in 1885, with about four fifths the railway mileage, France had a railway tonnage of considerably less than half that of the German railways. The total tonnage, both water and rail, is now about four times as great in Germany as in France. These two countries are almost equal in size, but the population of Germany has increased with tremendous rapidity, while that of France has remained almost stationary for many years. Germany now has a population of 112.14 per square kilometer as against 73.17 per square kilometer for France.[1] And as the above table indicates, the industrial capacity of the Germans is much the greater per capita. The table shows admirably the relative advantages enjoyed by the agents of transportation in the two countries. We are not in possession of the statistics of total traffic for a similar area in the United States, but they would show only a fraction of the German total. Consider more than 60,000,000 of industrious people living in the State of Texas and an idea is obtained of the possibilities of transportation under German conditions. This point of density of population and of traffic must be set down as decidedly advantageous to the waterways of Germany.

[1] *Statistische Mitteilungen,* 1909, p. 430.

But more important for the waterways than mere quantity of traffic within the country is the location of that traffic in relation to navigable rivers or practicable canal routes. We have seen that all of the important coal regions of Germany lie near navigable rivers, the great Westphalian district being cut in two by the Rhine, the Saar district lying along the Saar River, and the Silesian coal-fields near the upper Oder. We have found, moreover, that coal and ores constitute a very large percentage of the total of German waterway traffic. On the other hand, in the United States, our coal deposits are as a rule not so favorably located. The chief exception is that along the Monongahela River in western Pennsylvania, and, naturally enough, this river is the chief exception in this country to the general decline of river traffic in the past thirty years. The chief traffic that the entire Ohio-Mississippi River system now enjoys is this very coal. The greater part of the tonnage on the Great Lakes is iron ore from the mines near Lake Superior, and coal carried as return cargo from Lake Erie ports to Duluth. Aside from these instances, our coal and ores are not conveniently located near great natural waterways; canals would be needed to reach them. And in this connection it is a point well worth noting that, even were canals as easy of construction in the United States as in Germany, they would still be more uncertain of permanent success, because of frequent shifting of industrial centres in the United States. In Germany, as in all Europe, there is much greater fixity of conditions.[1] Like

[1] The *Preliminary Report of the National Waterways Commission* (p. 31) says: "Another difference as compared with the United States is the greater fixedness in Europe in the location of manufacturing cities, as well as in the lines of distribution of raw material due to the earlier development of coal mines and other sources of material. The shifting of the centres of production which arises from the development of new coal mines and new centres of manufacturing, as well as from the great growth of population, is much less common in Europe than in the United States. This makes it possible to utilize an established waterway, with a greater

the geographical conditions, the industrial factors, without exception, are thus seen to be much more favorable to water transportation in Germany than in the United States.

3. The greatest differences between the two countries, however, are governmental. In the United States the railways are in the hands of private individuals, and we have not yet been able to subject them to sufficient national control to insure rival waterways even against *unfair* competition. In Germany, on the other hand, both railways and waterways are almost entirely owned by the Government, and transportation, whether by water or by rail, is regarded as a single problem. We have seen that the Government has aimed to permit no competition, fair or unfair, against the waterways for certain kinds of freight. We have seen that where possible the railways are developed as mere feeders to the waterways and that "distinctly favorable terms are given to the transfer between railway and waterway," so as to make the two agents "mutually unite in the task of forwarding merchandise," the cost of the transshipments, meanwhile, being largely borne by the general public rather than by the shippers of the goods. Under such conditions waterways obviously enjoy a supreme advantage as compared with the conditions in a country where every effort is put forth on the part of powerful railway companies to divert the last vestige of traffic from the water routes, and where the last thing to be expected would be a mutual coöperation in the forwarding of merchandise. Even if we should succeed in the United States in preventing the anomaly of a profit-seeking railway carrying bulky traffic below the actual cost of handling it, while crushing competition, we should still have the task of stimulating coöperation between railways and waterways in

assurance of profit, and with greater dependence upon it as a means of transportation."

the handling of freight, and of encouraging transshipments. This latter could be done, as in Germany, only by fixing low rates therefor, and by covering the margin of loss out of general taxation. Harmony and coöperation between railways and waterways will probably never be attained so long as one or both agents of transport remain under private management. To secure harmonious relationship between the waterways and railways of the United States, it would certainly be necessary to place them both under the control of a single department of the Government.

From another administrative standpoint, also, do German waterways possess a very great advantage as compared with those of the United States. Waterway appropriations in Germany have never been looked upon as a most convenient instrument by which precarious Congressmen may satisfy their constituencies that they are "doing something" for the districts they respectively represent; that is, such a thing as a "pork barrel" is unknown. The story of the hundreds of millions of dollars that have been poured into our rivers and creeks and ponds, and into the pockets of those who are on the "inside," will fill one of the most shameful pages in the history of American corruption. Senator Tillman once said, "The whole scheme of river improvement is a humbug and a steal, but, if you are going to steal, let us divide it up and not go to complaining." [1] Although a board of engineers and a state committee once condemmed the scheme of canalizing Great Salt Pond, somewhere in New England, the latter stating that "this committee is convinced that the public interests have not been subserved by the expenditure of money at Great Salt Pond . . . and that further expenditures of money on this enterprise would be wasteful," a further sum of $199,000 has since been sunk in the briny waters of the pond.[2]

When bills are introduced into the National Congress

[1] *World's Work*, August, 1910, p. 13,259. [2] *Ibid.*

for the "Canalization of the roaring Kiskiminetas," [1] and for the digging of artesian wells as a source of water supply, looking to eventual navigation on an unknown Arkansas rivulet, what is to be expected in the way of a systematic development of the waterway possibilities of the country?

In sharp contrast to the American method of dealing out national funds, Germany requires from interested districts either definite contributions for the building of waterways, or else an absolute guaranty of a defrayal of a portion of the annual deficit. In this way are thwarted all attempts to draw funds from the National Treasury for schemes in which localities would never dream of venturing money of their own. Moreover, the national funds for waterway development are not turned over to irresponsible local agents to become a source of profit for political grafters interested in construction companies. Entire supervision of waterways is under the control of a special Waterways Department in the Ministry of Public Works. This makes possible a systematic development of the waterways along national lines. Furthermore, the careful training which the officials have had in administration has made it possible to determine the probable cost of an undertaking with great accuracy, and to complete the works within the limits of the time set. When a particular project is decided upon, the entire funds necessary are appropriated at once, and the work is speedily carried to completion, rather than, as in the United States, appropriating a little every few years for projects which at that rate would require generations to complete, even were the improvements thus made not wholly destroyed by the action of the waters during the lapse of time. When the German government appropriates money for waterway construction, it is certain that it is going to be spent on waterways, and spent economically and systematically.

A word should be said here of another handicap to a

[1] *Literary Digest*, June 18, 1910.

systematic development of waterways in the United States, one growing out of the nature of our system of government. In Germany the central Government is supreme, and waterways are developed by that Government to serve national, not sectional ends. In this country, however, under our dual system of government, we find the various states developing their waterways along state lines, regardless of national interests. The best present illustration of this is to be found in New York, where sectional interest alone determined the enlargement of the Erie Canal now being carried out.[1] A uniform depth or a comprehensive system of waterways can never be secured so long as improvements are not conducted along strictly national lines.

To place the United States in a position equal to that of Germany in the administration of waterway appropriations something more is necessary, however, than the mere abolishing of the "pork barrel." That is a step greatly to be desired, but it is only a step after all. The real difference between Germany and the United States lies deeper than this. Germany is an old administrative state. The citizens are proud of their Government, and the honor of holding an Imperial position is one of the greatest in the land. Pecuniary perquisites of office, in the way of shares in corruption funds or opportunities of extending Government protection to corporations in which the office-seeker is interested, are not deemed necessary inducements to office-holding, as is unfortunately often the case in the United States. Honor among legislators is not followed by a question mark. In a word, business does not dominate the Government, as it so largely does in the United States of to-day. Until we can greatly raise the standard of our political life, until we can insure that money appropriated for waterways is spent for waterways, until we can place the development of inland navigation on a systematic national

[1] See chapter XIX.

basis, there is little chance of developing an extensive waterway commerce in this country.

From every point of view, — geographic, industrial, and governmental, German waterways are greatly favored as compared with those of the United States. The combination presents an almost immeasurable degree of advantage. What, then, is to be said of the future of American inland waterways? Some of the present handicaps may eventually be overcome. The "pork barrel" method of appropriations may be abolished; and in time we may conceivably develop a conscientious and systematic administration of waterways along national lines. Population and traffic will increase, and industrial conditions will come to assume a greater degree of fixity. But the geographic handicaps will always remain. We cannot change the direction of our rivers; we cannot direct a more favorable location of our mines of coal and ores, and the great distances across which canals must be cut will ever continue the same. Though we may eventually regulate our turbulent rivers by huge impounding reservoirs, by vast systems of levees, and other controlling works, the comparative handicap will not thereby have been overcome. It will still exist in the vastly greater cost of regulating the streams for purposes of navigation. We might control our railways, even place them under Government ownership and run them so as not to compete with water transportation; we might emulate Germany and conduct the railways at a substantial margin of profit while at the same time extending to the waterways a large annual subsidy; yet we could not develop water traffic to the extent Germany has done on account of our more unfavorable geographic conditions.

CHAPTER XII

TRANSPORTATION IN FRANCE

1. No other country has expended so many millions of dollars upon waterways and no other country has so consistently striven to develop a systematic network of railway lines as has France. For many years the waterways of the country have been almost entirely Government owned, and from the very beginning French railways have been dominated by the National Government. As a consequence, France possesses to-day a transportation system which is less the product of chance development, and more the result of a conscious national policy than that of any other country. The history of French transportation, therefore, presents an unusually favorable field of study.

Before taking up the question of the cost of transportation in France, and the economic results of the French policy, it will be well to give a brief sketch of the Government's relation both to the waterways and to the railways of the country. The present waterway policy in France was adopted in 1879, when M. de Freycinet was Minister of Public Works. A law passed in that year carried appropriations for the improvement of 2500 miles of rivers and of 2250 miles of canals, and for the construction of 870 miles of new canals, at a total cost of \$186,000,000.[1] The money was to be raised by means of *extraordinary* funds, granted in each fiscal year, and by the issue of three per cent Government bonds, payable in seventy-five years. Provision was made for the gradual repurchase of concessions which had been from time to time given to private companies and

[1] *Report of (British) Royal Commission*, vol. VI, p. 5.

to individuals; and for the standardization, so far as possible, of the entire waterway system. Finally, all tolls and dues were abolished.[1]

The tremendous drain on the National Treasury resulting from this policy, amounting between the years 1879 and 1900 to $5,741,880 a year for construction and to $2,-189,700 for maintenance (a total of over $166,000,000), exclusive of the expenses of administration, led to a reorganization of the policy under the ministry of M. Boudin in 1903.[2] The new law laid down the following principles: [3] —

1. All parties directly interested in particular routes *may* be called on for financial aid in the construction of the works.

2. All interested parties *must* contribute at least half the cost of new works.

3. These parties may recoup themselves, wholly or in part, by obtaining concessions of certain dues and of the monopoly of traction.

4. The Government expenditures are henceforth to come out of ordinary revenue, experience having proved extraordinary advances and loans to be bad policy.

In 1908, at the request of the Minister of Public Works the Conseil Général du Ponts et Chaussées made a careful investigation of the feasibility of further developing the water routes of the country. After a prolonged discussion centring chiefly about the question of means of raising additional revenue, the committee recommended some increase in appropriations and a continuation of the general policy adopted in 1903.[4] Whether another change of policy will soon come it is impossible to predict. It will

[1] *Report of Royal Commission,* vol. VI, p. 5.

[2] *Preliminary Report of (U. S.) National Waterways Commission,* p. 53.

[3] *Report of Royal Commission,* vol. VI, p. 37.

[4] *Preliminary Report of National Waterways Commission,* p. 54.

depend upon the success of the plan of coöperation between the Government and interested localities and upon the condition of the National Treasury.

2. Turning our attention now to railway development in France, we find that the basis of the present system was laid down in a law of 1842. This law provided that the State, contributing $50,000 a mile, should own the roadbeds, and that private enterprise should furnish the equipment, amounting to about $40,000 a mile. Twenty-five thousand miles of line were authorized. The Revolution of 1848, however, checked progress. Building operations were resumed in 1851, and the number of companies was reduced from thirty-three to six. Five of these radiated from Paris like spokes from a hub, while the sixth was in the extreme southwest. But too much attention to systematic development, neglect of local traffic, and the financial panic of 1857 led to bankruptcy and a consequent reorganization in 1859. Under the new plan many additional lines were built. Charters were granted to the companies for a period of ninety-nine years. The Government issued four per cent guaranteed bonds, and those roads that were able to pay off their obligations to the Government were permitted thereafter to receive full profits, although the construction expenditures had been borne by the Government. At the same time those roads which were unable to meet their obligations to the Government were, curiously enough, permitted to pocket the four per cent bond dividends which the Government had guaranteed. Thus for the railway companies it was veritably a case of "heads we win, tails you lose." The policy was financially disastrous to the Government and it led to a final "settlement" in 1883.

By the terms of this agreement, which is still in force, the State operates only in the southwest. Each company is given a monopoly of its "réseau," or the district which it naturally serves. The State raises by annual installments the necessary funds for all new construction. This is to continue until the expiration of the charters in 1958.[1] The railroad companies have to meet all the expenses of equipping, maintaining, and operating the lines, and are asked to contribute large sums to the Government in the way of taxes, and to perform gratuitously certain special services for the Government. The roads are guaranteed dividends, but beyond a certain point the State receives two thirds of the profits.[2]

At the present time there are seven groups of railways, of which two are owned and operated by the State, while the others are in the hands of private companies. All, however, are subjected to a very strict governmental control of rates. The process of rate regulation is exceedingly complicated and it is unnecessary to give the details in this connection. In brief, there is an organized body of salaried railway officials, whose function is to investigate rates and collect information for the use of railways. On the basis of their findings the railways from time to time propose rate changes to the Minister of Public Works, who ratifies or rejects the proposal according to the advice of a non-partisan Consultative Committee of one hundred and fifty members, which has passed in review all of the evidence presented by the railway officials.[3] The importance of this railway rate regulation in relation to the waterways will shortly appear.

3. The theory on which the Government of France bases its policy of rate regulation is, that competition should be maintained in order to prevent the monopolization of transport by a single agent and the establishment therewith of exorbitant transportation charges. In pursuance of this end the Consultative Committee, which pos-

[1] Hadley, *Railway Transportation*, chap. x. [2] *Ibid.*

[3] Buchler, *Quarterly Journal of Economics*, vol. xx, pp. 279–86.

sesses the power of rate homologation (ratification), has adopted a twenty per cent rate differential in favor of the waterways. "In practice the committee allows a difference of twenty per cent for the benefit of water carriage in order to allow for the difference of conditions between rail and water carriage, the latter being unable to offer the same advantages from the point of view of rapidity of transport, and being obliged in most cases to exact a minimum of tonnage much higher than that with which the railway can be satisfied. The difference of twenty per cent is allowed in all cases of maritime as well as inland transportation."[1] To take a concrete case, in 1903 the Paris-Lyons-Mediterranean Railway Company submitted a proposal for a reduction of fixed charges in a special tariff affecting the transportation of chalk from Sens and Souppes to Marseilles. The committee decided against the reduction, "on the ground that the proposal did not keep intact a difference of twenty per cent in relation to rates which could be obtained by using the waterway."[2]

It appears from these quotations that shippers are arbitrarily denied the combined advantages of speedy service, convenient-sized consignments, and low freight charges. If they wish to make a speedy shipment or send a small cargo, they must forego the advantage of low rates. If, on the other hand, they wish to utilize low transport charges, they must ship by water and thus forego the advantages inherent in a railway.

It should be pointed out, however, that while this twenty per cent differential is the usual extent of advantage guaranteed to the waterways, it is not an absolute margin. Sometimes the degree of difference is increased and in rare instances it is lessened, dependent upon the exigencies of particular conditions. In 1905 the Western Railway Company submitted for confirmation a proposal to

[1] *Report of Royal Commission, supra,* p. 117.
[2] *Ibid.,* p. 118.

give exceptional fixed rates for carrying cement in complete trainloads of 10,000 kilograms each. The difference to the advantage of the waterways still remained at thirty-three per cent. On March 2, 1905, the Consultative Committee vetoed the proposal, on the ground that "the aim of the railway was without doubt to attract to its line a traffic which really belonged to the waterways, and that such a competition in such a form was not tolerable." [1]

The cases where the twenty per cent margin of difference has been set aside are exceptional. Railway rates, less than twenty per cent in excess of water rates, are granted only when it has been proved beyond question that it is impossible for the waterways to care for the traffic to the satisfaction of shippers. The benefit of a doubt is always given to the waterways.[2]

"The railways are always deterred from attempting to lower rates of which the success is doubtful, or which would serve only temporary needs, because of the practical impossibility of raising them again." [3] The Consultative Committee almost invariably refuses to permit a rate once lowered to be restored again to its former height. The result of this policy is frequently to prevent the railways from lowering their schedules to the minimum figure allowed by the committee. Practically all experimentation in railway ratemaking is thus prohibited; for, as is well known, it is often impossible to foresee the results of lowered rates. They may generate an increased traffic sufficient to yield larger returns than were afforded by the higher charges; but, on the other hand, they may bring heavy losses to the railway. The uncertainty, the fear which a railway faces under such conditions, prevents elasticity in ratemaking.

[1] *Report of Royal Commission, ibid.*, p. 117.

[2] *Ibid.*, p. 118.

[3] *Bulletin de l'Association du Congrès International des Chemins de Fer*, November, 1904, vol. 23, p. 1447.

This policy of guaranteeing water traffic is, however, applied in the main only to such commodities as are deemed naturally to belong to the waterways. As in other countries, the greater part of the waterway traffic of France is composed of a comparatively few bulky articles. The following table gives the percentages of different commodities carried by water in 1907:[1] —

Commodity	River	Canal	Total	Per cent
Coal, coke, and briquettes . .	2,693,525	7,359,550	10,053,085	29.5
Stone, gravel, and lime . . .	7,586,768	4,779,640	12,336,408	36.3
Fertilizer	777,645	652,113	1,429,758	4.2
Wood and lumber	827,297	950,726	1,778,023	5.2
Metals and machinery . . .	379,149	488,742	867,891	2.6
Oils, sugar, and sand	378,061	1,099,701	1,497,762	4.4
Industrial products	508,611	613,006	1,121,617	3.3
Agricultural produce	1,899,353	2,585,531	4,484,884	13.2
Unclassified	158,985	139,275	299,260	0.9
Raft wood	109,384	22,395	131,779	0.4
Total	15,339,788	18,690,679	34,030,467	100.0

The table shows coal products and building materials to constitute about two thirds of the total waterway tonnage, while the greater part of the remainder is of a kindred nature. Agricultural produce, comprising 13.2 per cent of the total, makes a better showing than it does in Germany. This is primarily due to the large quantities of wines which are shipped in casks over the water routes. We find, therefore, that, in order to force bulky commodities, "naturally belonging to the waterways," to travel by boat, the Government is obliged to cripple the competitive possibilities of the railways, and to give a usual margin of freight advantage to the waterways of twenty per cent.

4. In order to appreciate the extent of the aid given to the waterways, and in order to ascertain to what degree they would be able to stand alone, it is necessary to look

[1] *National Waterways Commission*, Doc. no. 16. Report of Frank H. Mason on "Railway Freight Rates, Waterways, and Canals in France," p. 74.

further than to the mere guaranteed margin of rate difference. It is necessary to inquire what enters into the making of rates on the rival agents of transport.

In the case of the waterways, the carriers, that is, the boatmen, have to bear no part of the cost of canal construction or river improvement, nor contribute anything towards the maintenance and operating expenses of the highways which they use. All tolls and all dues were abolished in 1880.[1] Since that year the State has constantly borne a heavy deficit from waterway transportation. During recent years the cost of maintenance and operation of all the waterways of France has ranged from $4,000,000 to $5,000,000 per annum,[2] exclusive of interest on the capital invested. The cost of constructing the entire waterway system of France is estimated at $360,000,000, and the annual loss of interest on this capital, computed at four per cent, is $14,400,000.[3] Adding this to the maintenance deficit, we find that the State contributes approximately $19,000,000 a year for the support of inland navigation. Since there are 7483[4] miles of navigable waters in France, the average yearly deficit per mile borne by the State is about $2500. This amount represents an out-and-out donation to water traffic. The total waterway tonnage for the country in 1905 was 34,030,000;[5] hence the State's donation was equal to about fifty-six cents a ton for all the low-class freight that traveled by water.

But in spite of the fact that the waterways are furnished them free of charge, and kept in repair by the State, and that their labor cost is slight, the boatmen have a hard time to make ends meet. "The barge master or captain is usually the owner of his boat, and derives his compensation from the earnings of the business, which vary with the

[1] *National Waterways Commission, ibid.*, p. 62. [2] *Ibid.*, p. 51.

[3] Four per cent is used here because it is used in France.

[4] *Preliminary Report of National Waterways Commission*, p. 32.

[5] *Ibid.*

abundance of freight, the current, rates, stage of water, and other contingencies, but as a rule his profits are small in proportion to the capital involved.[1] Individual cases are cited in which a bargeman owning two boats, representing together an investment of $6000, and giving his entire time to the business of navigating them, has come out at the end of the year with a net profit not exceeding $200.[2] All accounts agree that the competition of the railways, especially in miscellaneous freights, is very serious, and that barges on canals and rivers are less profitable than they were a few years ago." [3]

Turning now to the railways, we find quite a different state of affairs. In the year 1907 the Government received from the railways, in the way of taxes and special services, an income valued at $58,200,000. The entire railway administrative expenditures incurred by the Government, on the other hand, were only $45,200,000, leaving a net revenue to the State of $13,000,000;[4] this is approximately equal to $525 per mile. In direct contrast to the canal men, therefore, the railway companies are required to make rates which will yield a revenue sufficient to cover interest on the capital invested by the State, meet all of the expenditures of the State railway administration, furnish the Government, in addition, a handsome revenue, cover all the costs of maintenance and operation of the roads, and pay dividends if they can; and, indeed, in spite

[1] About two fifths of all the canal boats belong to small bargemen, and the rest to a great canal company. In 1907 there were 13,300 barges in operation in France, on which were living 18,600 men, 10,800 women, and 16,200 children. These bargees are very illiterate, their wages are small, and the standard of living is very low. The various classes of petty officials and employees along the canals and navigable rivers of France are, as a rule, meagrely paid, and are obliged in many cases to devote their leisure hours to some other form of employment. (*National Waterways Commission*, Doc. no. 16, p. 76.)

[2] This probably means inclusive of wages for himself.

[3] *Ibid.*, p. 77.

[4] *Bulletin de l'Association, supra*, p. 1403.

of all the financial handicaps imposed upon them, and in spite of the fact that they are almost universally forbidden to compete against the waterways for certain kinds of traffic, the net revenue of the railways in 1907 was $149,-200,000, or 4.18 per cent on the capitalization.[1] Were a similar policy applied to the waterways, rather than earning dividends, canal boats would soon utterly disappear from the country. By means of this policy the French Government may maintain water transportation, but it should be observed that it does so by the complete destruction of competition.

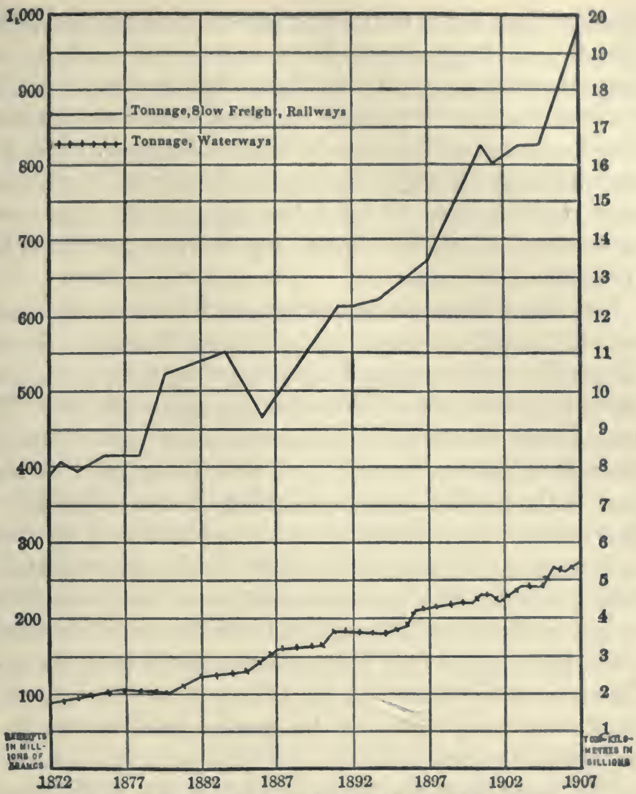
5. The next point to be considered is the extent of traffic development upon the two systems of transportation that has resulted from the above-outlined policy. From 1850 to 1880 the annual tonnage on the waterways of France remained almost constant.[2] In that year tolls were abolished, and in succeeding years the waterways were greatly improved and extended as authorized by the law of 1879. Between 1879 and 1905, 2072 miles of new waterways were constructed, increasing the total mileage from 905 to 2977.[3] From 1880 to 1905 the French railway mileage increased from 14,315 miles to 24,459 miles.[4] The result of the waterway improvement has been a steady increase in water-borne freight during the last thirty years. But, as the diagram (on page 281) indicates, the increase in water traffic has been less rapid than that of the railways even in similar kinds of freight. The total quantity of water traffic is a little more than one fourth that of the slow freight carried by the railways; the former thus having a greater traffic density so far as bulky freight alone is concerned. This probably means little one way

[1] *Bulletin de l'Association, ibid.*, p. 1403.

[2] *Ibid.*, p. 1404.

[3] *Report of Royal Commission*, vol. VI, p. 5.

[4] *Ibid.*, p. 155.



Slow Freight on the Railways and Waterways of France

or the other, however, for the reason that they do not compete for this traffic. Most of the bulky freight of the railways is in regions not served by water routes.

6. The distribution of waterway traffic in France, also affords very interesting information. From the geographical point of view it may be said that in the north and northeastern part of the country, on one fifth of the national area is carried four fifths of the entire waterway

traffic.[1] This is due to the existence in the northeast of the French and Belgian coal-fields, and in the north to the large river Seine, connecting Paris with Rouen and Havre. In 1905 the total waterway traffic of France was 34,030,-000 tons;[2] and in that year 10,202,828 tons were moved on the waterways in Paris,[3] nearly one third of the entire tonnage of the country. A brief description of the more favoring waterway conditions in this region will suffice to explain the phenomenon.

The Seine River connects Paris with the port of Rouen, and a "maritime way" extends from Rouen to Havre. Above Paris the canalized river, together with a canal, extends for a distance of 120 miles into central France. The total length of this route is 345 miles, and below Paris the river is capacious enough for 1100-ton barges.[4] A large part of the traffic received at Paris by water is Welsh coal. It is brought from Wales to the port of Rouen by boat, and is there transshipped to barges which tie up alongside the larger vessels. The transshipment under such conditions is less costly than it would be from the boats to railway cars. Sixty per cent of the upstream traffic from Havre to Rouen is coal.[5] This, with two other commodities, namely, grain and wine, make up the greater part of the Paris waterway freight.

For the importation of grain and wine the conditions are equally favorable. Large quantities of foreign grain and of Spanish and Italian wines enter at the port of Havre, and are sent by boat up the Seine to Paris. The railways are especially debarred from competing for import traffic. The governing powers, under the influence of protectionism, use the railways as a means of protecting home industry. "Everywhere opinion and the public powers demand un-

[1] *Bulletin de l'Association, supra.*

[2] *Preliminary Report of National Waterways Commission*, p. 32.

[3] *National Waterways Commission*, Doc. no. 16, p. 75.

[4] *Ibid.*, p. 111.

[5] *Ibid.*, p. 70.

ceasingly that lower railway rates shall be given on grain for export [in order to make competition with foreign grain easier],[1] while they constantly oppose any lowering of rates on imported grain."[2] A strange inconsistency is apparent when one observes that at the same time the public powers offer every opportunity for low rates on the waterways on imported commodities of all kinds; that is, by furnishing the boatmen with fully equipped waterways free of cost and by imposing no tolls upon them. "One understands with difficulty the attitude of protectionists in France who laud the construction of waterways and at the same time protest energetically against the least lowering of rates proposed by the railways for the purpose of rediverting to themselves traffic which the waterways have taken from them."[3] As a result of this sort of logic the waterways are able to enjoy a large part of the import trade of the country.

It is unnecessary to discuss separately the many canals and rivers of other sections of France. It appears, from the fact that four fifths of the waterway traffic is in one fifth the area of the country, that the extensive waterway mileage in central and southern France must fare but poorly. It is only necessary to quote from M. Colson, General Inspector of Bridges and Highways of France, and a widely recognized authority on transportation questions, to show the results of the French waterway policy in these regions. He stated to the writer that "the expenditures upon the waterways of central and southern France are absolutely a waste of national resource." Rough country to be traversed, innumerable locks, and scanty traffic were assigned as the causes of their utter failure.

7. Wherever it is practicable in France, the Government has attempted to aid water transportation by pro-

[1] Brackets mine.

[2] *Bulletin de l'Association, supra*, p. 1440. [3] *Ibid.*

viding special facilities for transshipments from railways to waterways. "Railroad tracks are invariably located on terminals of inland waterways, permitting direct transfer between railroad and water lines. In most places, thanks to the deliberate and predetermined way in which the waterways and terminals have been constructed and enlarged from time to time, there has been a patent and successful effort to bring the railway yards and the port and river docks into reasonable and logical proximity. When different lines of railway enter a single port there is always a 'belt-line' connection by which cars can be handled from one line to another without transshipment of freight."[1]

But in spite of this attempt to facilitate transshipments, waterway traffic in France is almost wholly made up of strictly riparian freight, transshipment being very rare.[2] The reason is that the cost of transshipment more than offsets the artificial rate advantage conferred by the Government upon the waterways. It is cheaper to ship all the way by rail than to break bulk. It will be recalled that in Germany this difficulty is circumvented by making the transshipment charges merely nominal, — only a fraction of the actual cost, — the difference being borne by the Government. France follows no such policy, and accordingly transshipments are very infrequent.

8. In the foregoing analysis of French transportation it has been shown that the Government supports the waterways by enormous annual outlays, and that, on the other hand, it derives a large yearly revenue from the railways, asks them to support themselves, and at the same time attempts to prevent them from competing with the waterways for low-grade freight. We have seen that before the waterway tolls were abolished, traffic had failed to increase

[1] *National Waterways Commission,* Doc. no. 16, p. 60.
[2] *Bulletin de l'Association, supra,* p. 1453.

in thirty years, and that even since the waterways have been free of dues, the railways have still been able steadily to increase their proportion of even slow-moving traffic. It is beyond all doubt, therefore, that were the railways favored on even terms with the waterways they would be able to divert the greater part of the present waterway traffic to their lines. There is good reason for believing, moreover, that they could do so were they merely permitted to reduce their rates on competitive traffic, leaving the waterways still supported as at present out of the national treasury. There are a number of cases where precisely this result has occurred. Where general public interest has undeniably demanded it, or where it has been deemed necessary to extend to certain industrial centres transport advantages corresponding to those of other localities, the railways have now and then succeeded in inducing the Government to permit them to lower their rates.[1] A few illustrations may be cited.

In July, 1903, the Eastern Railway Company secured a reduction in its tariff on coal. The results are shown in the following table:[2] —

Year	Total tons	Railway		Waterway	
		Tons	Per cent	Tons	Per cent
1901 . . .	2,322,000	1,743,000	75	579,000	25
1902 . . .	2,283,000	1,726,000	75.6	557,000	24.4
1903 . . .	2,736,000	2,052,000	75	684,000	25
1904 . . .	2,847,000	2,194,000	77	653,000	23
1905 . . .	2,379,000	2,676,000	79.1	703.000	20.9

It is seen that in two years the railway substantially increased its proportion of the total. It is worthy of notice, also, that the railway carries nearly four fifths of all the coal of the district. Another example is that of ship-

[1] *Bulletin de l'Association, ibid.*, p. 1447.
[2] *Ibid.*, p. 1448.

ments between Rosières and Paris, a reduction of the railway rates having been secured on April 20, 1898. The results were as follows:[1] —

Year	Total tons	Railway		Waterway	
		Tons	Per cent	Tons	Per cent
1895 . .	26,800	4,800	17.9	22,000	82.1
1896 . .	29,400	3,500	11.9	25,900	88.1
1897 . .	27,400	4,900	17.8	22,500	82.2
1898 . .	34,600	8,800	27.8	22,800	72.2
1899 . .	37,900	15,900	41.9	22,000	58.1

In two years the railway increased its proportion of the total from 17.8 to 41.9 per cent.

A third example, somewhat different, but equally noteworthy, is afforded by the Midi Railway. In 1898 the "Lateral canal toward Garonne" was repurchased by the State from the Midi Railway Company, which had held it as a concession. All dues on the canal were abolished, and the railway demanded the right to reduce its rates on wines, cereals, sugar, wood, and cement, in order, if possible, to protect itself from the toll-free waterway. Since the railway as concessionnaire clearly had rights in the case, permission was granted for a reduction of railway charges. "It has attained its end, for the railroad has retained almost all its traffic, and that of the canal has hardly increased, in spite of a reduction in tolls amounting to several centimes per kilometre."[2] It should not be forgotten that the railways have been able to accomplish these results while contributing a large revenue to the Government and earning dividends for their shareholders; and while the waterways are entirely supported at public expense and yield only a precarious income to the owners of barges.

[1] *Bulletin de l'Association, ibid.*

[2] *Ibid.*, p. 1449.

No further evidence is necessary to show how complete a failure are the waterways of France. It may be well, however, to repeat here the statements of M. Colson, General Director of Bridges and Highways of France. He stated to the writer: "I am very sure that the spending of money upon inland waterways — except upon great inland lakes, or upon mighty rivers of gentle gradient, as the Rhine and Volga, where the regulative costs are small — is stupid. Canals on which tolls are charged can almost never compete with the railways for any kind of freight. Discriminations must always be made in their favor. In northern France alone do French canals enjoy any considerable degree of prosperity, due to the large quantities of coal and to the import trade. But this traffic could be handled much more economically and much more satisfactorily by rail than it is by water. In the present state of railway development the spending of money upon artificial waterways is the worst sort of policy. To attempt to have canals compete against railways is like attempting to run sail boats in competition with great ocean steamers."[1]

9. It has been seen that France has chosen to divide her freight traffic between two agents of transportation rather than to allow a single agent to carry the entire amount. It is now our purpose to consider the economic results of such a policy The advantages of large-scale operation are, perhaps, in no other branch of industry, so important as in transportation. We have called attention many times to the tremendous amount of fixed capital involved in both the railway and the waterway business. In the case of a railway, the roadbed, the tracks, the terminals, the stations, the machinery of administration, — all are required for

[1] Yves Guyot, a noted French publicist and economist, and one-time Minister of Public Works, is equally strong in asserting that the expenditure of money on waterway development is a pure waste of resource. For a brief summary of his beliefs, see McPherson, *Transportation in Europe* (1910), pp. 185–86.

however small an amount of traffic that is handled. Allowing for an increase of rolling-stock and trainmen, the same equipment may handle ten thousand tons of freight almost as cheaply as a hundred tons. Similarly, a canal must be of full capacity and thoroughly equipped with locks and sluices, whether a hundred or ten thousand boats pass over its waters in a year. Probably in no other line of industry is the law of increasing profits with increasing business so admirably illustrated as here. As a consequence the division of the traffic of a country between two agents of transport, when one of them could handle the total tonnage, involves an enormous economic loss. For the rates charged on the less amount of traffic handled by each agent when the traffic is divided, must be proportionately higher than they would needs be if a single agent enjoyed the full advantages of a large-scale operation. Until the limit of carrying capacity is reached, it is obvious that increasing amounts of traffic, handled at only a slight increase of cost, raises the margin of profits at given rates, or, better stated, permits a lowering of charges without decreasing the net earnings. The larger the volume of traffic,[1] the less is the expense of handling it per unit. This is a principle universally recognized by transportation men, and is the foundation of all transportation policy where private initiative holds sway. Dividing traffic between waterways and railways does not permit a material reduction in the amount of capital invested in either; and on the other hand, it necessitates higher rates on each unit of traffic handled. It is a national loss, therefore, in two ways: two transportation systems cost nearly double what one does, and, when completed, they are unable to offer as low rates to shippers as could a single agent. It is a case where competition raises prices rather than lowers them. Granting that monopolistic freight charges can be prevented by rate

[1] The law of diminishing returns will eventually operate, but in the case of transportation the point where it begins to act is far removed.

legislation, it is absolutely impossible to secure the lowest scale of charges by means of two systems of transportation.

The above reasoning is based on the assumption that a single agent is physically able to handle all the tonnage of the country. Is such an assumption warranted? It is everywhere recognized that waterways, by their nature, are not adapted to meet *all* the needs of commerce. It is acknowledged, by even their most vigorous supporters, — except, perhaps, in the United States, — that the best they can do is to supplement the railways in the carrying of a limited number of bulky commodities of low value. In all countries where they are now used their service is almost wholly thus confined. Hence we must look to the railways as the one agent able to carry all the traffic of the country. The railways of the United States and of Great Britain have demonstrated their ability to handle all the traffic in regions of very heavy tonnage. We found that in Prussia, although the railways have not been permitted to develop their facilities to meet all the needs of commerce, there is no doubt that they could meet all demands if they were permitted by the Government to do so. In France, according to M. Colson, "There is absolutely no question as to the ability of the railways to care for all the traffic of the country. It is absurd to hold that waterways are an indispensable aid to railways."[1] The fact is so self-evident that it needs no further discussion.

At an enormous public expense of about $19,000,000 a year, France, then, is supporting a great system of inland waterways, which results only in diverting a part of the low-class freight from the railways and to prevent a lowering of railway freight rates. The cost of handling the freight which travels by water is, counting the expenses incurred by the Government, far more than it would be if it were handled by railways specially constructed for the

[1] Statement to the writer.

purpose. The fact is, however, that the existing roads are far from being pushed to the limit of their capacity. In 1905 the density of traffic on the French railways was 448,467 ton-miles per mile;[1] on those of Germany, 819,804 ton-miles per mile;[2] and on those of the United States in 1909, 953,986.[3] In 1908 the average tonnage per mile on the Pennsylvania Railway was 4,723,834.[4] Since the waterway tonnage of France in 1905 was only 34,-030,000, or only a little more than one fifth the railway tonnage, which amounted to 139,000,000 tons,[5] it is certain that all the present freight traffic of France could easily be handled by the existing railways. It is unquestionable, in the face of these facts, that the French Government is heavily taxing its citizens for the support of a great system of inland waterways which is almost, if not quite, wholly unnecessary. It is likewise not to be doubted that the result of this mistaken transportation policy is to keep railway freight rates at a much higher level in France than would otherwise be necessary. M. Colson stated to the writer that there is no question but that, if the railways were allowed to take over the present waterway traffic, they could reduce the rates of transport on the entire volume of traffic.

10. It is interesting, in the light of the above discussion, to make a comparison of French and American railway rates. Typical waterway commodities are chosen in order to show best the results of the division of traffic of which we have spoken. The French rates chosen are special rates, appreciably lower than the general tariff schedule: —

[1] *Report of British Royal Commission, supra,* p. 155.

[2] *Ibid.*, p. 211.

[3] Delano, *Speech before U. S. Rivers and Harbors Congress,* December 8, 1910.

[4] *Ibid.*

[5] *Preliminary Report of National Waterways Commission,* p. 32.

France

Commodity	From	To	Distance (miles)	Rate ($)
Coal *	Havre . . .	Paris . . .	142	1.35
Coal *	Marseilles . .	Paris . . .	536	3.00
Iron Ore † . .	Havre . . .	Paris . . .	142	1.10
Iron Ore † . .	Brest . . .	Paris . . .	388	2.82
Grain ‡ . . .	Havre . . .	Paris . . .	142	1.45
Grain ‡ . . .	Marseilles . .	Lyons . . .	217	2.70

* *National Waterways Commission*, Doc. no. 16, p. 11. † *Ibid.*, p. 19. ‡ *Ibid.*, p. 31.

The United States

Commodity	From	To	Distance (miles)	Rate ($)
Coal *	Duquoin . .	Chicago . .	287	0.90
Coal †	Pocahontas, W. Va.	Toledo . . .	456	1.45
Grain ‡ . . .	St. Louis . .	New Orleans .	718	3.00
Wheat § . .	Buffalo . .	New York .	440	1.42
Iron Ore ‖ . .	Cleveland . .	Pittsburg . .	170	1.18

* *Report of Chicago Harbor Commission*, p. 255. † *Ibid.*, p. 235.
‡ *Report of the Inland Waterways Commission*, p. 345.
§ *Report of Chicago Harbor Commission*, p. 234.
‖ *Report of Examination of the Ohio River*, 1908, p. 55.

Perhaps some general average rates may prove more significant than special rates for the present purpose. Taking the deficit on the waterways of France at $19,000,000, and applying this to the 5,400,000,000 ton-kilometers[1] (3,348,000,000 ton-miles) of waterway traffic in 1905, we find that the deficit amounted to about 5.7 mills per ton-mile. Adding to this the charges of the waterway carriers, which amounted to approximately four mills per ton-mile,[2] gives a total cost by water of 9.7 mills per ton-mile, allowing nothing in the way of profit on the capital investment. The average railway rate in France is about 13 mills per ton-mile.[2] This makes the average rate on both railways and waterways over 12 mills per ton-mile. This is as against 7.63 mills per ton-mile for the railways of the

[1] See p. 278. [2] Delano, *ibid.*

United States in 1905. Recognizing that there are considerable differences in conditions in the two countries, and that hence general averages may be misleading, it is nevertheless clear that French rates are exceptionally high. The cost of water transportation, exclusive of profits on the fixed capital invested, is appreciably higher than the cost of transporting *all* classes of freight in the United States over railways, which, as a rule, earn substantial dividends on their investments.

11. The question may with propriety be raised, why a great nation like France should persist in following a transportation policy apparently so prejudicial to the economic welfare of the country. Is it due to the constraint of long-established custom? is it because certain influential parties are personally interested in the success of water transportation? or is it because the Government is grossly ignorant of the losses entailed? The truth seems to be that all of these factors have been operative.

The many thousands of bargemen with their families, who spend their entire existence upon the waterways, have a sort of vested interest in water transportation, and the hesitation to deprive these people of their long-established means of livelihood is an unquestioned influence in determining the Government's policy toward the waterways. Again, the fact that many millions of money had been expended upon the waterways of the country before the railways were extensively developed, has also influenced the continuation of waterway expenditures. The railways of France passed through a very checkered history up to 1883, the date of final settlement; and when the great "nationalizing" waterway law of 1879 was passed, the railroads of France had by no means clearly shown their superiority over the waterways, or at least had not demonstrated their ability wholly to dominate the transportation field. They were much less efficiently developed at that time than those of most of the other great countries. It is only natural now, after the waterways have been nationalized and extensively developed, that the Government should hesitate to declare the more than $400,000,000 expended upon them during the past century wholly wasted. It is easier to close the eyes to the painful truth and to continue the suicidal policy of subsidizing the rivers and canals, to the distress of the railways and to the detriment of the nation.

A much stronger reason, however, for the continuation of the policy is a political one. A deficit of $19,000,000 a year on account of water transportation would hardly be perennially faced with composure were the public officials merely concerned with maintaining a favorite employment for illiterate bargemen, or only reluctant to acknowledge that the Government has been pursuing a mistaken policy. Such forces have an influence, but they are usually much less potent than more direct interests. A well-known writer on European transportation asserts that the Consultative Committee, which has the power of rate ratification, is dominated by the waterway interests, thus accounting for the persistent refusal to allow rate reductions which would be prejudicial to the waterways.[1] How much truth there is in this assertion the writer has been unable to discover. An effort was made to ascertain the facts, but it was to no avail. When the question was raised among those who might know, the writer met with a disconcerting silence, although those interrogated were only too eager to tell what they knew of the inside history of waterway legislation in other countries. The impression was unavoidable that "political interests" were at work behind the scenes. When the question was put to a high American official resident in Paris, he stated emphatically that, although he did not *know* the facts, he would have not the slightest hesitation in wagering that there is political chicanery connected with the determination of rates.

[1] Meyer, H. R., *Government Regulation of Railway Rates*, p. 124.

M. Colson stated that "the Government favors the waterways and supports them from general taxation because it desires to create an impression that it is *doing something* of great importance for its citizens. The unreasoning public does not appreciate that when the indirect waterway taxes are added to the water freight rates, the total transport cost is much greater than it would be on an efficient railway system which was allowed to develop the full possibilities of its freight service."

Again, there are many honest citizens and officials who really believe that the waterways serve a valuable national end in the handling of low-class freight, and that they are an aid to the railways in relieving them from the burden of carrying great quantities of bulky traffic. It is the same argument that we have met in Germany. In support of this belief some interesting cases have been cited in connection with the Northern and the Eastern railways. It is shown that a reduction of freight rates in coal resulted in an increase of coal tonnage, but not in a proportional increase of revenue. The statistics are as follows:[1] —

Northern Railway

Year	Ton-kilometers	Receipts
1900	1,811,054,078	$11,051,559
1905	1,973,769,843	10,734,151

Eastern Railway

Year	Ton-kilometers	Receipts
1900	539,778,139	$3,842,477
1905	790,199,453	$9,072,406

In the case of the Northern Railway there was an increase of traffic and a decrease of revenue. In the latter case an increase of traffic of forty-five per cent yielded merely a five per cent increase of revenue.

At first glance these figures are deceiving. On the surface it looks as though the law of diminishing returns

[1] *National Waterways Commission*, Doc. no. 16, pp. 77, 78.

were surely operating. It is necessary to reflect, however, that the railway rates had been considerably reduced. The figures merely show that they had been lowered so far that the diminished revenue per unit, in the one case, was not counterbalanced by the increased traffic carried, and, in the other case, were but little more than counterbalanced. A rate midway between the old rate and the reduced one might have yielded a larger revenue than did the original one. Experimentation alone can decide where the point of maximum return lies. But, it may be asked, was it not necessary to lower the rate to the full extent of the reduction, which was in fact made, in order to secure a diversion of waterway traffic, and does not the result prove that the railways are better off with a smaller proportion of such freight?

It is, indeed, possible that, under existing conditions, it was necessary to make the full reduction in order to attract the traffic; but it must be remembered that the existing conditions are conditions of inequality, since the waterways are supported out of the public exchequer. As has been shown above, if the waterways were deprived of this subsidy, or the railways granted a similar one, it would be absolutely impossible for the waterways to compete successfully for the traffic. Hence it would be unnecessary for the railways to reduce their rates one iota, in order to divert to their lines practically all of the coal now traveling by water. With substantially the same margin of profit on each ton of coal, and with a vastly increased tonnage, the total receipts of the railways would be greatly increased.

But leaving out of the consideration the inequality of conditions between the two modes of transport, the above statistics still by no means prove the truth of the contention that the waterways serve a useful national end in sharing with the railways superabundant low-class freight. Although the increased tonnage did not yield a proportional increase of revenue, there is no evidence to show that the railways are not still making a fair profit on their coal traffic. It is certain, moreover, that the shippers of coal are in a better position than before the reduction of rates. It is possible, also, that were the railways sure of the entire quantity of coal traffic, they could decrease expenses of operation sufficiently to yield a still larger margin of profit per unit, and thus still further reduce rates. Be this as it may, it is impossible to discover from these statistics any evidence that shows that the waterways are serving a valuable end.

It should be recalled, moreover, that, even were there a superabundance of low-class freight, — granted a few particular lines were overburdened, — there is always the alternative method of relieving the congestion by constructing additional railway lines, and, as has been conclusively shown elsewhere, this could be accomplished at a much less cost than by building canals. The utility of canals must rest upon their economy. Where their advocates cannot prove them more economical carriers than the railroads, there is left no other argument to which they may resort.

12. It only remains to say a few words by way of comparison between French and American transportation conditions. Although the geographic factors in France are, on the whole, less favorable to waterway development than they are in Germany, it must be admitted nevertheless that they are in general more favorable than those of the United States. The great river Seine, carrying one third of the entire waterway tonnage of the country, connects the metropolis with the great seaport of Havre, and is thus in the very pathway of greatest traffic. Our great rivers, on the other hand, generally run crosswise to the direction of heavy commerce. The distances to be traversed in France in the building of canals, are very short as compared with

those of the United States, a decided advantage on account of the heavy cost of construction per mile of canals as compared with railways. Finally, the climate of France is very mild, and interruptions to traffic on account of ice are only from 0 to 10 days a year on the open rivers, and from 0 to 36 days on the canals.[1] This is as against several months of closed navigation each year in all the Northern States of this country.

From the administrative point of view, also, conditions in France are much more favorable to successful waterway development than they are in the United States. The waterways of France belong to the National Government and are efficiently supervised by the Department of Public Works. We have seen how the Government officials bestow all their sympathy upon the waterways, and how they prevent the railways from competing for traffic that can be handled by water. In contrast to this, the United States has no administrative machinery whatever for developing a system of waterways. Our rivers now are, and bid fair to remain, mere pawns in a political game. Our railways, on the other hand, are remarkably well developed, and at present almost completely dominate the transportation field. We have not, as yet, been able to subject them to sufficient control to guarantee the waterways against even unfair competition, while coöperation between railways and waterways in the United States, so long as the former remain in private hands, seems to be a mere idle dream.

[1] *Report of Royal Commission, supra*, p. 14.

CHAPTER XIII

THE WATERWAYS OF BELGIUM

1. Belgium possesses an excellent system of internal waterways, which for many years has been under the complete supervision of the National Government. Until about 1830 the waterways of the country had for the most part belonged to the various provinces and communal centres, or to concessionnaires, that is, to private interests controlling them either under State guaranty of a monopoly of traffic, or of a remission of dues. The State owned only about ten per cent of the total mileage in 1830, but after that date it commenced a systematic purchase of the various water routes, and by 1870 as much as eighty-three per cent of the total waterway mileage was owned by the government; while at the present time practically the entire mileage is State-owned.[1] Very extensive improvements of the system have been made since 1875. Between that year and 1907 the sum of $119,853,000 was expended by the Belgian Government on its canals and rivers,[2] and many millions more were spent by the various cities for harbor construction and improvement. The entire system is now almost complete; and future expenditures will be mainly for the purpose of perfecting the present routes, and for the completion of one or two projects now under way.

2. In response to this systematic development of waterways in Belgium, there has been a steady and rapid in-

[1] *Preliminary Report of (U. S.) National Waterways Commission*, p. 52.

[2] *National Waterways Commission*, Doc. 20 (Report of Ethelbert Watts on "Railway Freight Rates, Inland Waterways, and Canals," November 16, 1909), p. 20.

crease in the tonnage of water-borne freight during the past twenty-five years. The growth of water traffic is shown in the following table:[1] —

Year	Metric tons
1880 *	24,836,000
1890	25,242
1895	30,242
1900	38,178
1905	53,345

* *Preliminary Report of National Waterways Commission*, p. 21.

The tonnage is seen to have more than doubled since 1880, and the table seems to indicate the complete success of the Government policy in regard to waterways.

If we consider this increase of tonnage, in comparison with that on the railways, however, we find that the development of traffic on the waterways has not been phenomenal. During the period from 1875 to 1905 the total waterway traffic of the country increased by 166 per cent, while during the same years the railway increase was nearly 400 per cent.[2] Statistics of the value of the traffic handled would show even more favorably for the railways, since their freight is largely of high grade, where tonnage is of relatively less importance. The increase in railway mileage, however, has been somewhat greater than that of the waterways. From 1890 to 1905 there was no change in the waterway mileage, while the railways laid about five hundred miles of new lines.[3] At best, however, the Belgian waterways can be regarded as having had only a fair increase of traffic in recent years. Let us now inquire whether this traffic development has occurred under conditions of even competition, or whether special aid has been extended to one or the other agent of transport.

3. It is necessary to state that the railways of Belgium, like the waterways, are all under State supervision. Of

[1] *Report of (British) Royal Commission*, vol. VI, p. 169.

[2] *National Waterways Commission*, Doc. 20, p. 28.

[3] *Report of Royal Commission*, vol. VI, p. 176.

the 2634 miles of railroad within the country, 2295 miles are owned and operated by the Government; and the remaining 330 miles, though privately owned, are subjected to rigid governmental control.[1] Now, the railways and waterways of Belgium are administered, as in Germany, by a single department of the Government, and, as in Germany, a deficit from the operation of one transport agent is paid out of the profits derived from the other. And here, as everywhere, we find that it is the waterways that are conducted at a deficit while the railways are affording an annual surplus.

Before the coming of the railways, the expenditures upon the waterways of Belgium were largely met by tolls. Between the years 1840 and 1860 the receipts from tolls covered not only the cost of improvements and upkeep, but also afforded a surplus to be applied in part payment of the annual interest.[2] "The tolls have been considerably reduced since that time, but they still cover a part of the cost of current improvements and maintenance, which in 1905 amounted to $440,000, not including cost of personnel. When the interest on the capital, invested at 3.5 per cent, is added to the deficit for maintenance, the total annual charge to the State is about $2,740,000."[3] The year 1905 was an exceptionally good traffic year, and hence this deficit may be considered as a minimum average. For comparison it may be stated that the year 1902 showed a net loss from operation of $602,412,[4] as against $440,000 in 1905.[5] The interest charged was of course practically

[1] *National Waterways Commission*, Doc. no. 20, p. 7.

[2] *Report of Royal Commission, supra*, p. 49.

[3] *Preliminary Report of National Waterways Commission*, p. 53.

[4] *Report of Antwerp Consulate* on "Waterways of the Consular District of Antwerp," August 10, 1909, p. 161.

[5] As in Germany, the Government does not directly fix the canal rate. It merely assumes the entire support of the physical equipment of the waterways, thus leaving the bargemen free to make rates which need yield a profit merely on the capitalization of the boats.

the same.[1] The annual deficit, using 1905 as a basis, is equal to about $2700 per mile of waterway.[2]

4. In contrast to the policy in regard to the waterways, the railways of Belgium are conducted at an annual profit, and the surplus is applied in paying the deficit on account of water transportation.[3] The railway rates are arbitrarily fixed by the Government from forty to fifty per cent higher than those on the waterways for certain kinds of traffic.[4] As a consequence, comparisons of rates can obvi-

[1] The above amounts, however, do not represent the total deficits on account of water transportation in Belgium. They are merely the statistics for the central Government. Besides these, the various cities contribute large amounts each year. They frequently spend large sums of their own accord on the improvement of their particular water shipping facilities. For example, between 1900 and 1908 Brussels expended upon her port and upon the canal connection with Rupel a total of $3,416,100. (*Brussels Consulate Report*, Nov. 16, 1909, p. 8.) Similarly, the competitive cities of Antwerp, Ghent, and Bruges spend large sums from time to time; statistics of the exact amounts, however, are not at hand. The chief cities have together probably expended to date about $25,000,-000 on their harbors, quays, and docks. (*Report of (U. S.) Inland Waterways Commission*, p. 401.) The various communal districts are, moreover, required to provide and maintain a certain part of their harbor works; the apportionment of expenditures between the Government and the cities being made on this basis: the Government provides and maintains the harbors, buoys, lights, etc., — in short, everything pertaining to the water, — while the city must provide and keep in repair its own land equipment, docks, dry-docks, loading machinery, etc. (*Antwerp Consulate Report, supra*, p. 158.) Statistics of the amounts thus spent, and of the yearly deficits incurred, are not available, but it is obvious that for a great port such as Antwerp, ranking fourth in the world, these outlays are of no little importance. On account of the fierce competition with the ports of the Netherlands, moreover, the harbor dues have to be made very low, and there is little doubt that a large deficit has here to be met each year. While a large portion of these expenditures are chargeable to ocean-going, rather than inland traffic, it is none the less true that inland navigation receives much of the benefit.

[2] The total length of Belgian waterways is 1344 miles, of which 330 is of little importance. (*Preliminary Report of National Waterways Commission*, p. 52.)

[3] Statement of the American Vice-Consul at Antwerp.

[4] *Antwerp Consulate Report, supra*, p. 159.

ously prove nothing as to the relative costs by the two methods of transport; cost of service not being the basis of ratemaking. So far as one is able to draw any conclusion on this point, without making a detailed study of particular routes, it would seem that the necessity of greatly reducing the tolls on the waterways, in order to preserve the traffic since the advent of the railways, indicates that the conclusion must be the same for Belgium as for other countries, — wholly unfavorable to the waterways.

5. As in France and Germany, so also in Belgium there is practically no competition between the railways and waterways. While there is no definite differential in rates, as is the case in France, and while there are many variations in schedules in order to meet the varying exigencies of traffic, it has been seen that rail rates are fixed as a rule from forty to fifty per cent higher than those on the waterways; and it is a firmly established policy, moreover, that "State railways do not try to compete with canals for carrying certain goods which naturally belong to waterways."[1] Thus again we find this favored expression, of freight "which naturally belongs to the waterways." It seems, in the psychology of European transportation, to be "natural waterway traffic," even though it must be forced to travel in boats by wholly artificial means. This is an excellent illustration of the persistence with which old ideas survive, long after the days when they may have had force have passed into history. There may have been a time when bulky freight "naturally" traveled by water, but the fact that nearly everywhere in Europe the waterways of to-day have to be supported by huge Government subsidies, surely can indicate only that the "naturalness" has given place to artificiality.

This situation exists in Belgium, as in France and Germany, even though the railways are not efficiently devel-

[1] *Brussels Consulate Report,* Nov. 16, 1909, p. 5.

oped for the carrying of heavy freight. The question may well be raised, therefore, If, where no attempt is made by the railways to compete for bulky traffic, it is still necessary to run the waterways at an annual deficit of about $2700 per mile, in order to prevent shippers from using the railways, what chance would the waterways have against railways which were free to compete, by offering both excellent facilities and attractive rates for low-class freight? The question is self-answering.

In explanation of the policy of conducting the waterways at a loss, it is contended in Belgium that the Government looks upon its waterway system from a broad national, as against a sectional, viewpoint, and that thus viewed the results are wholly beneficial. "The Government of Belgium considers it a wise policy to keep up the canals and waterways for the public benefit, and has arranged its canal system so as to be a benefit to the entire industrial community and not to any particular branches of industry, with the endeavor to have every section of the manufacturing centres in direct touch with all the large cities, with the seaports, and with the manufacturing centres of neighboring countries."[1] Now, while it may well be wise national policy to attempt to stimulate industry in all parts of the realm by means of favoring transport charges, the above statement hardly touches the real point at issue. It does not follow, merely from the fact that transportation is regarded from a broad national standpoint, that the waterways are able to subserve the ends in view more efficiently and more economically than could the railways under a policy of similar encouragement. Unless the historical lesson drawn above is wholly erroneous, it seems certain that the ends might be better served by a comprehensive development of the railways of the country.

6. In addition to encouraging water transportation by

[1] *Antwerp Consulate Report, supra,* p. 161.

discriminative rates in favor thereof, the Belgian Government has made excellent provision for the mutual coöperation of railways and waterways. "Railroad tracks are located everywhere on terminals of inland waterways, and in every important place these lines form a belt railway connecting all the railways at given ports; such is the case in Brussels, Antwerp, Ghent, and other ports."[1] The railways are thus built up around the waterway system, serving as feeders thereto, and facilitating the transfer of commodities from rail to water and *vice versa.* Assistance of this kind is of the utmost importance to the success of waterways, for they can seldom rely entirely upon strictly riparian traffic. They must have connecting railway lines, both for the collection and for the distribution of a large part of their traffic. And as shown elsewhere the rates must be so adjusted that the cost (to the shipper) will be less by the broken rail and water route than by an all-rail route. Though the railroads are able to stand alone, harmony between the two agents of transport is an absolute essential to the waterways.

7. We may now turn our attention to a comparison of the conditions of transportation in Belgium and the United States. First, as to the geographic factors.

Belgium has an area of little more than 11,000 square miles,[2] and is thus but slightly larger than the State of Maryland; yet within this small territory are 1015 miles of navigable waters, only 334 miles of which are canals.[3] In proportion to area, therefore, Belgium has been far more favored with natural highways of commerce than has the United States. Practically all these rivers, moreover, as is the case in Germany, connect directly with the great shipping and exporting centres. The incalculable advan-

[1] *National Waterways Commission,* Doc. no. 20, p. 24.

[2] *Statistische Mitteilungen,* 1909, p. 430.

[3] *Report of Royal Commission,* vol. VI, p. 43.

tage of this situation need not be dwelt upon again at this time.

In the second place, the physical character of Belgium is favorable to water transportation. The larger part of the country lies low and flat, and no considerable elevations need be traversed in the construction of canals, the average height overcome by the 334 miles of existing canals being only 4.3 feet.[1] This is but little less favorable than the condition in Germany, where the average height overcome is 3.55 feet per mile.[2] Canal building is accordingly beset with no great engineering difficulties, and hence the cost of construction is relatively low. River regulation, likewise, is comparatively inexpensive. There are no great torrential streams, as in the United States, the control of which well-nigh baffles the science of river engineering. The interruption to navigation on account of floods averages but 4.5 days a year.[3]

In the third place, the warm climate of Belgium is a distinctly favorable circumstance for water transportation. Ice closes navigation on an average of but 12.5 days each year,[4] even less than is the case on the Rhine in Germany. The advantage of this, as compared with the situation in eastern Germany and in the northern half of the United States, where the waterways are frozen over for several months each year, is very great. In Belgium water traffic is interrupted from all causes, including suspension of operation for repairs, only 27 days a year.[5]

From the industrial standpoint, we find that the density of population and of traffic is greater in Belgium than in any other country in the world. Within an area but little greater than that of Maryland are 6,693,548 industrious people.[6] The population per square mile in the United States is about 26; in Germany 290; and in Belgium it is

[1] *Report of Royal Commission*, vol. VI, p. 43.
[2] *Ibid.*, p. 59. [3] *Ibid.*, p. 46. [4] *Ibid.* [5] *Ibid.*
[6] *Statistische Mitteilungen*, 1909, p. 430.

620.[1] No section of the United States has a density of population comparable to that of Belgium. The density of traffic is still more noteworthy. In the year 1905 the combined waterway and railway tonnage of Belgium, France, and Germany, with their respective areas, was as follows:

	Tonnage *	Area † sq. km.	Tonnage per sq. km.
Belgium	118,664,000	29,455	4,028
France	173,030,000	536,464	322
Germany	692,100,000	540,778	1,279

* *Preliminary Report of National Waterways Commission*, p. 32.
† *Statistische Mitteilungen*, 1909, p. 430.

With one eighteenth the area of France, Belgium has a total traffic tonnage sixty-nine per cent as great. With only one nineteenth the area, little Belgium has a traffic tonnage equal to one fifth that of mighty Germany.

This tremendous traffic is to be accounted for partly by the fact that Belgium has a much denser population than France or Germany, and partly by the fact that perpetual peace is guaranteed to her without the existence of a huge standing army and powerful navy. Practically all of her people and her capital may constantly be devoted to industrial pursuits. But a third very important factor is the passage of an enormous foreign traffic through Belgian territory. Twenty-four per cent of the entire traffic is international, and of this amount, twenty-five per cent is with France, and seventy-five per cent with the Netherlands and Germany.[2]

This international traffic is entirely due to the geographic location of Belgium, and might have been included under the geographic advantages enumerated above. It seems more naturally to belong, however, to a discussion of traffic conditions. The rivers of Belgium lead across her

[1] *Preliminary Report of National Waterways Commission*, p. 30.
[2] *Report of Royal Commission*, vol. vi, p. 46.

borders and connect with the waterways of France and Holland, and with the Rhine River from Germany. In early days the Belgian rivers formed practically the only outlet for the traffic originating along these international streams, within the borders of the other countries, and the Belgians found the development of the carrying and transshipping business extremely lucrative. It gave employment to men and capital within the country and it built up Belgian ports, greatly stimulating the ocean trade of the nation. Of particular importance has always been the traffic coming down from the Rhine.

The Rhine reaches the sea in Holland, but navigation on its lower course was always very difficult, owing to obstructions near its mouth. As a consequence, Antwerp found little difficulty until the opening of the Rotterdam Waterway, about 1870,[1] in diverting to itself, by way of the river Scheldt, a large share of the Rhine trade. Competition with Rotterdam became more severe after the opening of the Rotterdam outlet to the sea, but the construction of the Hansweert Canal in 1867,[2] connecting Antwerp with the canals of South Holland, and with the Meuse and Rhine Rivers, a canal with locks large enough for the passage of several Rhine boats at once, has enabled Belgium to retain a share, though admittedly a decreasing share, of this German freight. Every effort is being put forward to maintain Antwerp in her proud position in the shipping world. Ruinously low rates are offered in order to attract traffic away from Rotterdam, and huge Rhine barges are towed all the way down the river Scheldt to Antwerp,[3] although they can travel to Rotterdam under their own propulsion. Since Antwerp's prosperity is largely based on her shipping business, it is deemed an imperative necessity to maintain and develop that shipping at almost any cost.

[1] See chapter XIV, p. 311.
[2] *Antwerp Consulate Report, supra,* p. 166.
[3] *Ibid.*, p. 159.

It is, indeed, quite possible that the business generated in Belgium as a result of attracting foreign produce to her ports, both for export and import, may much more than overbalance the deficits from operation incurred on the waterways. These advantages, however, do not exist on the strictly internal routes of the country, and hence the latter should be judged solely on a basis of comparison with the railways.

Finally, from an administrative point of view, Belgian waterways, like those of Germany and France, are favored by being under the control of an honest and efficient Government body. When money is appropriated, it is appropriated for definite and feasible projects; it is certain to be used for the purposes for which it is appropriated, and the construction of the works is speedily carried to completion. The utter lack of system, or even honesty, in connection with waterway development in America has been sufficiently dwelt upon in the chapter on Germany, and the contrast need not be redrawn here. The point should, however, be borne in mind as one absolutely essential to the success of water transportation. On the whole, therefore, it must be concluded that conditions are far more favorable to waterway development in Belgium than they are in the United States.

CHAPTER XIV

THE CANALS OF THE NETHERLANDS

1. ATTENTION has so often been called to the success attained by "the thrifty Dutch," in the building of canals and in the utilization of natural waterways, that our discussion of European transportation would be incomplete were we to devote no space here to a consideration of transportation conditions in the Netherlands. We shall accordingly present in the following pages a brief history of the inland waterways of Holland. It is a story of transportation development which should prove unusually interesting and suggestive, as showing the part played by unique geographic and commercial conditions in shaping the transportation policy of a country.

There are at present as many as 265 different canals in the Netherlands, which approximate a total length of 2100 miles. Twenty of these, aggregating a length of 326 miles, have been constructed and maintained by the Government, while the remainder belong to the various provinces, communities, "polders," and societies, or to private persons.[1] Since the Government owns and controls only about one thirteenth of the total number of canals and but one seventh of the mileage, it might appear that it had exercised comparatively little influence upon the transportation development of the country. This is far from being the case, however, since only the minor projects are privately owned, as will hereafter appear. For convenience of discussion these canals may be divided into four classes, — ship canals, canals connecting with the Rhine River, inland canals, and lateral canals. We shall describe the devel-

[1] *National Waterways Commission*, Doc. no. 18, p. 50.

opment of each class separately, because each has been the outgrowth of peculiar geographic or commercial conditions.

2. The wider known, and perhaps the more important, of the two ship canals of Holland is the North Sea Canal, which extends from the western coast, across the peninsula which reaches into the North Sea, to the city of Amsterdam on the Zuider Zee. Largely because of its favorable commercial situation, Amsterdam had become as early as the seventeenth century a very important banking and commercial city; but the growing size of ocean-going vessels, together with the increasing shallowness of the Zuider Zee, in time virtually closed the old port of Amsterdam, and necessitated the building of what was called the North Holland Canal, from the extreme northern end of the peninsula, south for a distance of fifty miles, to the city of Amsterdam. This canal, which admitted vessels with a draft of seventeen feet, was constructed by the Government between the years 1820 and 1852. Becoming, in turn, of insufficient capacity for the ever-increasing size of ocean vessels, it was determined in 1865 to cut a deep waterway, the present North Sea Canal, directly across the peninsula, a distance of fifteen miles; and in 1876 the work was completed. Improvements and enlargements have since been made, and the waterway is now navigable for vessels 720 feet in length, 79 feet in width, and 30 feet in draft.[1]

It is evident from this brief sketch that the motive for building this ship canal was an entirely unique one, that of maintaining a seaport which had long played an important part in international commerce. Amsterdam was doomed to decadence unless she could maintain her ocean trade; hence a ship canal seemed an absolute necessity. It should perhaps be added that the demand for this new outlet to the "deep water ocean" arose before the era of railways;

[1] *National Waterways Commission*, Doc. no. 18, p. 47.

and even the final plan of a huge ship canal was decided on before the real importance of railways had become fully established.

The second deep waterway of the Netherlands is known as the "Maas" or Rotterdam Waterway, connecting the city of Rotterdam with the North Sea. The Rhine River of Germany reaches the sea through Dutch territory. Navigation on the lower course was always very difficult, owing to many obstructions, including ever-moving sand banks near its mouth in the North Sea. As a consequence of this, a large and increasing portion of the Rhine traffic was being diverted to Antwerp in Belgium, and the Dutch were thereby losing the exceedingly profitable transshipping business afforded by the German freight. Now the city of Rotterdam was favorably located on the Nieuwe Maas River, and had become by 1850 a thriving commercial city, and a doughty rival of Antwerp. It became evident that if the greater part of the Rhine freight could be diverted to Rotterdam and that city be made the point of transshipment to ocean vessels, not only would Rotterdam be given a tremendous impetus, but traffic which would otherwise pass to the sea through Belgian territory would thereby be saved to Holland. These considerations proved sufficiently strong to induce the Government of Holland to begin the construction in 1866, the same year that the North Sea Canal was undertaken, of the Rotterdam Waterway, connecting the Rhine River with the sea by a new channel, utilizing the Maas River from Rotterdam to the ocean. It is navigable for vessels drawing as much as thirty-two feet of water.[1]

3. The second class of Dutch canals is composed of the

[1] There is a third deep water canal entering Holland territory, namely, the one from Ghent in Belgium to Terneutzen in the Netherlands, on the river Schelde; but since this is a Belgian undertaking it cannot properly be classed with Holland waterways.

smaller canals which connect with the Rhine River. Not only the Rhine, but many other rivers in Holland are international streams, and as such their navigation involves international commercial considerations. The development of the railroads of the Netherlands eventually necessitated the construction of railway dikes across the Easter Schelde and the Sloe Rivers, two streams forming the connecting links in the waterway route between Antwerp and the Rhine. It was incumbent upon Holland to compensate Belgium for the closing of this important highway; and an arrangement was consequently entered into by the two Governments, whereby two canals were constructed to replace the now impassable river route, the South Beveland Canal, completed in 1866, and a second through Walcheren, finished seven years later.

The third so-called Rhine Canal owes its existence to the need of connecting the port of Amsterdam with the Rhine River and the German hinterland. Amsterdam had early shared in the interior trade through the avenue afforded by two small rivers, the Vecht and the Krumme-Rhine, passing through Utrecht and Vreeswyk. The tortuous course and shallow depth of this route, however, in time proved unable to meet the needs of transport, and in order to maintain the German traffic the Merwede Canal was planned, and carried to completion in 1893.

The competition of the three rival ports of Amsterdam, Rotterdam, and Antwerp — the first two Dutch, and the latter Belgium — has thus been seen to have been the determining factor in this waterway development. The rich commerce from the Rhine provinces of Germany, with the tremendous transshipping business afforded thereby, was the prize sought. We have seen that the commercial possibilities of Rotterdam led to the construction of the great Rotterdam Waterway, and that the desire of Antwerp to maintain her former share of the Rhine traffic forced the Netherlands to aid in the perpetuation of a route through her own territory to that city. It remains to inquire why the Government of Holland should furnish the necessary funds for constructing a second outlet for the German traffic, by way of Amsterdam, when already a great part of the Rhine trade was insured to Holland by means of the Rotterdam Waterway. Why Amsterdam should desire water connection with the Rhine requires no explanation, but why the Government should further the project is perhaps not immediately apparent.

In Holland, as in other countries, political pressure not infrequently plays a leading rôle in the shaping of administrative policy, especially in the matter of distributing funds for internal commercial development. Amsterdam, as the chief city of the country, was not disposed to contribute through the avenue of taxation to a Government enterprise which would accrue only to the benefit of her commercial rival, Rotterdam, without receiving in return some corresponding stimulus to her own interior trade. Amsterdam needed a canal connection with the Rhine, and, moreover, was in a position to ask, with a reasonable expectation of success, for a Government contribution therefor. Furthermore, viewed solely from the Government's point of view, there was an undoubted commercial advantage in possessing a second outlet for the German trade. Established business connections and traffic routes through Amsterdam, and the great commercial importance of that city naturally caused a considerable portion of the interior traffic to prefer Amsterdam to either Rotterdam or Antwerp. Again, good waterway connections through Amsterdam might divert thither some North German traffic, which would otherwise find an outlet through German ports. At any rate, it was certain that the two routes would place Holland in a much more favorable competitive position, as against Belgium, than would merely a single route alone. Hence no difficulty existed in inducing the Government to connect Amsterdam with the Rhine.

4. The third class of canals in Holland includes the vast number of small waterways, which everywhere traverse the lowlands of the country, and which have been constructed mainly by private persons, societies, communities, or provinces. The majority of these canals were constructed ages ago for the purpose of meeting needs far more pressing than those of transportation. It is well known that a large part of the territory of Holland lies even below the level of the ocean. The wonderful achievement of the Dutch people in creating a country in which to live by driving back, by means of huge sea walls, the ocean covering their land, has been universally extolled; though somewhat less has been written of their perhaps equally great achievement in solving the perennial problem occasioned by the annual rainfall. When once the sea was removed, it yet remained to devise a means of making water run uphill, as it were. While in other countries the chief problem in connection with the run-off of the annual rainfall is the prevention of its running so fast that it endangers navigation, property, and life, in Holland the problem has been only how to make it flow off at all. Some artificial means of draining the country was of imperative necessity. The means devised was a system of belt canals, or "Ringvaart," as they are called. An elevated canal was built around every reclaimed "polder," high enough above the level of the land to be, paradoxical as it seems, also above the level of the sea. Into these belt canals the water is pumped from the ditches and surface canals of the surrounding territory by means of the ever-working Dutch windmills. It goes almost without saying, further, that the surfaces of these reclaimed districts must be crossed by a veritable network of ditches in order to make the land cultivable. For purposes of drainage, then, rather than for purposes of transportation, were these semi-private canals of Holland constructed. That they should be used incidentally for transportation purposes was of course in-

evitable. Indeed, in early times they were almost the sole means of transit, ordinary road-building being exceedingly difficult and expensive on account of the lowness and consequent sponginess of the land. We shall later see that this same consideration has hampered the development of the railways of the country.

To the third class of inland canals, also, belong those of northeastern Holland, in the provinces of Drenthe, Groningen, and Oberysel, and in North Brabant. This section of the country was originally covered to a considerable depth with a great peat fen, the removal of which offered a twofold source of profit. Not only could the peat be marketed as fuel, but the underlying soil was excellent agricultural land. Canals were consequently constructed by the enterprising inhabitants for the purpose of exploiting this rich resource. Though these canals were mainly constructed before railways were in existence, it is altogether probable that even to-day canals would meet the needs of similar conditions better than any other agents. The peat was distinctly a canal commodity. But more important than this, the low, marshy fens were exceptionally favorable to canal building; but unfavorable to railway construction. Moreover, the canals served as aids in draining such a territory. To render the fen lands tillable required, as in the case of the polders, innumerable ditches, and the canals furnished the necessary main arteries in the drainage system. Such considerations appear to have tipped the balance decidedly in favor of canals. Though most of these waterways are no longer needed for the removal of peat, they are now maintained and extensively used for the transportation of the produce of the reclaimed underlying soil.

5. There is what may be called a fourth class of canals in Holland, which is commonly referred to as the "lateral canals." A large number of small rivers cross the upland

portions of the country, and, early and late, the Government has laid out large sums of money in the improvement of their courses and in the connecting of them by artificial channels, namely, the lateral canals. In the early days these rivers naturally formed invaluable highways of commerce. Anything that could be done to improve the navigation thereon and to join their sources with one another was a direct benefit to the riparian and intervening land. Conditions, moreover, were exceptionally conducive to a full development of all the waterway possibilities of the country. The almost perfectly flat territory and the numerous parallel rivers, separated by insignificant distances, peculiarly invited the construction of lateral canals; while the vast system of drainage canals, already constructed, had developed on the part of the inhabitants an aptitude for, and at the same time a habit of canal building. This last consideration leads us to a slight diversion on the question of why these canals and rivers may have been continually nurtured and improved, even since railways have come into use in Holland. It is a diversion which it is believed will throw light, not only on this particular class of waterway, but on the general transportation policy of the country in recent times as well.

6. Nations, like individuals, generally shape their courses not as the result of any definitely reasoned-out and carefully prearranged plan, but rather as the result of historical events, particular exigencies, and the constraint of custom. We have seen how the dire necessities of the situation in which the Dutch people early found themselves forced them into the construction of inland waterways, there being no alternative other than migration. Now a people whose entire history has been one continuous struggle to control the flow of water, whose whole national life has been bound up with the construction of dikes, of ditches, and of canals, would naturally come to regard the waterways of the coun-

try as an inseparable part of their existence. When this history is borne in mind, it is not difficult to understand why the Dutch should have continued to improve the canal facilities of the country long after the imperative necessities of the early days were passed. It would have been unnatural, or at least unexpected, had the waterways of Holland been allowed to languish in recent times, as has been the case in countries where they have played a much less important rôle in national development. We shall further see that this same historical habit has had a decided influence upon the maintenance of waterway traffic and upon the policy of the Government in the matter of tolls.

7. One who believes that comparisons can be drawn between Dutch and American transportation conditions, who believes, that since waterways are extensively used in the one country, it follows that they would be in the other if properly encouraged and developed by the Government, should have the opportunity of observing the interesting spectacle afforded by the market-place of a Dutch city in the early morning. Even in the largest cities canals enter the very centre of the business districts. The market produce of the surrounding country is brought into the city in boats by the good Dutch farmwives, is spread out for display in the market-place, and sold direct, in large part, to families desiring a day's supply of fresh fruit or vegetables. This has been the custom for centuries past and it will doubtless be the custom for centuries yet to come. Having seen this spectacle the observer should call to mind the great commission businesses of American cities, and the fast freight trains which bring milk or perishable fruit to market from distances many times as far as the entire expanse of Holland.

The above is but one illustration of the peculiar conditions which serve to maintain traffic on Dutch waterways.

Many more might be given, but it is sufficient to note that everywhere business, whether agricultural or industrial, has been built up around the waterways; and even did the constraint of custom not forbid the inhabitants to think of changing to another mode of transport than the one with which they have from time immemorial been associated, the process of change itself would involve many inconveniences, and often actual losses. This is undoubtedly a strong deterrent. Furthermore, since the great ramifying waterway system is there at hand, since many millions of dollars have been laid out on its development, since the country is committed to waterways, whether for good or for ill, why should they not be used as much as possible? If a transportation system had to be constructed anew under modern conditions, a different development might follow in some sections even of Holland.

This general consideration will bear emphasis. In all of the Continental countries which we have been considering the present governments are face to face with this proposition: Hundreds of millions have been expended upon waterways, and industries have been built up along them. To give up the waterways now and go over to the railways entirely would involve enormous losses. If the waterways have cost, for instance, \$200,000,000 and the railways \$200,000,000, the total cost of the transportation system has been \$400,000,000. Were it to be constructed anew, of railways entirely, it could be done for, let us say, \$300,000,000. But if the present waterways be replaced by railways costing \$100,000,000, the total government expenditures will have amounted to \$500,000,000. It often appears to a government to be good economy to continue the use of the existing waterways rather than to discard them. Then there is the further consideration that a change would involve a reconstruction of a large part of the industrial machinery of the country. In Great Britain and the United States, on the other hand, conditions are the opposite to these. The railways have been thoroughly developed and industries have been established primarily with the view of using the railways to carry their freight. A change to water transportation, therefore, would occasion enormous losses in the readjustment of industry to the altered conditions of transport. To reconstruct the terminal railways at a great centre like Chicago, for instance, would involve tremendous outlays.

Another point of sharp contrast between transportation conditions in the Netherlands and in the United States is that of the density of traffic. It is well known that the Low Countries, with the probable exception of portions of China and India, are the most thickly populated districts in the world. The abundant energy of the Dutch has produced a tremendous volume of traffic requiring transport within a small area. Attention should also be directed to the geographic position of Holland, no less than Belgium, as an *entrepôt* of the great Continental hinterland. When to its own vast freight tonnage is added the enormous traffic passing to and fro between Rhenish Germany and the sea, Holland is found to possess a greater density of traffic than exists anywhere else, with the possible exception of Belgium. The result of this is to furnish an abundance of freight for both agents of transport. The conditions are at least so infinitely superior to those of the United States as to be beyond comparison.

8. We have now to consider another phase of the transportation question in Holland, namely, the development of the railways and their relation to and effect upon the canal transportation of the country. We find that, whereas conditions have been peculiarly favorable to the development of water transportation in the Netherlands, they have been, on the other hand, unusually discouraging to railway development.

The low, marshy, and soggy soil of the country has rendered the maintenance of a solid roadbed exceedingly costly, while the vast number of bridges required in the crossing of the great network of waterways has involved extraordinary expense. On a single line between Amsterdam and Rotterdam, there are no less than eighty bridges, of which eight are of the swing-bridge type.

Perhaps an even greater impediment to railway development, however, than these natural handicaps has been the indirect one of governmental control. Of the approximately 1600 miles of railway in the Netherlands, about 900 miles are operated by the State through a "Company for the Exploitation of the State Railway." The remainder, of which 205 miles also belong to the State, is operated by the Dutch Iron Railway Company.[1] These companies pay a rental to the Government for the use of the lines belonging thereto and in addition they must share with the State in all profits over five per cent on the capitalization.[2] The result of this has been to discourage private railway enterprise, to deter the investment of large sums of money in railway building, and consequently to prevent the development of efficient railway systems.

Furthermore, the action of the Government in maintaining its waterways free of toll has resulted in rendering the railway development one-sided, facilities for freight carriage being largely neglected. It is of course obvious that the poorer the railway freight service the greater is the possibility of successful canal competition.

9. Tolls were abolished upon all of the Government canals and rivers in 1900, since which time the waterways have been a source of constant loss to the Government.

[1] *Moody's Magazine*, January, 1910, p. 48.

[2] In 1899 the railway companies paid dividends of 4.5 and 5 per cent respectively. In 1908 they paid 3 per cent. The yearly rental paid to the State averages about 1.5 per cent on the State's investment. (McPherson, *Transportation in Europe*, p. 171.)

In 1908 the outlay for the maintenance of its 326 miles of canals was $700,000, or $2147 per mile.[1] In the case of the third class of canals, those not owned by the Government, dues are as a rule still levied upon carriers, but they are small in amount and in most cases insufficient to yield profitable returns from transportation. "In many cases the cost of maintenance exceeds the amount collected for tolls,"[2] and "it is only in exceptional cases that the increase from dues is enough to pay for maintenance, as well as for the establishment of a sinking fund for the original cost of construction. This might be reached by levying higher rates on vessels using the canals, but it is feared that navigation under such circumstances would not be able to compete with other modes of transportation. It must further be taken into consideration that a large number of canals are essential for the drainage of the country and it would thus be unjust to charge navigation with all the expenses."[3]

It has now become apparent that, whereas the railways of Holland are expected to earn a reasonable profit upon their investments by charging rates sufficiently large therefor, it is, on the other hand, not expected that either the Government or private waterways shall yield such returns, at least so far as transportation alone is concerned. In the case of the Government waterways, no tolls whatever are charged; in the case of the private or community canals, a portion of the expense of maintenance is charged off against incidental, or perhaps it would be better to call them extraordinary sundry benefits. This, may, indeed, under the circumstances, be quite a proper method of accounting. But when making a comparison of the freight tariffs that exist, and when estimating the comparative advantages of canals and railways from the transportation point of view, we should not forget that this *is* the method of accounting employed.

[1] *National Waterways Commission*, Doc. no. 18, p. 50.
[2] *Ibid.*, p. 51.
[3] *Ibid.*

Whether the railways under free competition could succeed in diverting the waterway traffic to themselves is another question. It would seem, from the fact that the Government deems it necessary to protect its waterways by abolishing all tolls, and that the private canals refrain from raising their transportation rates to a level that would yield profitable returns, through fear "that navigation under such circumstances would not be able to compete with other modes of transportation," that the railways would, indeed, even in Holland, be able to secure a large portion of the present water traffic, were it not for the artificial handicap imposed upon them by the Government.[1] Be that as it may, it is perfectly obvious that, under the existing unequal conditions, no conclusions as to comparative economic advantages of the two systems of transportation may fairly be drawn.

10. Only a few words by way of conclusion are necessary. To the query, Does the history of the canals of Holland indicate that the development of canal transportation in the United States is advisable? the answer must unqualifiedly be in the negative. Transportation conditions in the two countries are altogether non-comparable. To the question, Have the canals of Holland been successful from the Holland point of view? the answer seems to be that not only have they aided in the material development of the country, but that without them, on account of the exceptional conditions there existing, the present degree of development would have been impossible. To a third question, In view of the possibilities of railway development, is the continued improvement of waterways in the Netherlands advisable? the answer is less certain. Since, however, the waterways of Holland are apparently handling the traffic of the country with reasonable satis-

[1] In point of fact, the railways handle only about ten per cent of the freight traffic of the country.

faction to the shippers, since a large part of them are still needed for purposes of drainage, and since the industries of the country have been built up around them, it may well be sound policy to continue to encourage water transportation. A change to extensive railway transportation would involve a heavy immediate loss, as well in the cost of thoroughly developing a second transportation agent as in the necessary readjustments of industry to the changed conditions of transport. Consequently, it may be best to maintain the waterways as the chief freight carriers of the country, and to use the railways mainly for passenger traffic, and only incidentally for freight, — where special conditions seem to demand it. This problem, however, is for the Dutch rather than for us to decide.

CHAPTER XV

THE LAKES-TO-GULF SHIP CANAL

1. The most important water transportation project before the United States at present is what is known as the Lakes-to-Gulf Waterway. The proposed route extends from Lake Michigan at Chicago, by way of the Chicago Drainage Canal, the Des Plaines, and Illinois Rivers, to the mouth of the latter at Grafton, Illinois, a short distance above St. Louis; and thence directly down the Mississippi to the Gulf. Varying depths have been proposed. The Government engineers urge a depth of nine feet; "fourteen feet through the Valley" has met with much favor; and there are many who advocate a great ship canal deep enough to permit the passage of large ocean vessels to the inland waters of the Great Lakes. Our attention will first be given to the consideration of a Lakes-to-Gulf Ship Canal, discussion of the less ambitious projects being reserved for following chapters.

The argument for a ship canal from Chicago to the Gulf is based on several notions. In the first place, there are those who believe that if Chicago could be given a deep waterway connection with the ocean, she might soon supplant New York as the metropolis of the country. Her position on the Lakes makes her a natural transshipping point, both of commodities destined for export and for the finished goods yearly distributed to the consumers of the great West. To use the words of Professor Goode: "The manifest destiny of Chicago is that she shall become the commercial focus between the rich central plain and all the rest of the world. To do this one absolutely essential step is plain, *Chicago must become her own seaport*." [1]

[1] *Report of Chicago Harbor Commission*, 1909, p. 149.

A second argument for a deep waterway, as opposed to one of moderate capacity, is advanced by James J. Hill. He urges that "waterways that are to play an important part in traffic must be *deep* waterways. This point cannot be emphasized too strongly. A vessel that carries 1000 tons cannot compete with a box car. With a steamer of 10,000 tons, you have it beaten."[1] Mr. Hill considers that a depth of at least twenty feet is necessary in order to meet the competition of the railways.

A third argument for a ship canal from Chicago to the Gulf is that it is essential in order to meet the competition of Canada. It is well known that Canada has been contemplating the building of a canal twenty-two feet deep from the St. Lawrence River to the Georgian Bay on Lake Huron *via* the Ottawa River, Lake Nipissing, and Lake George. It is pointed out that the opening-up of this great route through Canadian territory would divert a vast amount of traffic from American to Canadian ports, unless the United States should provide a correspondingly deep waterway through American soil.

The far-reaching possible consequences of a Lakes-to-Gulf ship canal are readily apparent. If it is practicable, hardly any undertaking could be of greater importance to the country. On the other hand, if for any reason it is impracticable, either from an engineering or a commercial standpoint, scarce any undertaking could prove more wasteful. Our present problem, then, is to ascertain whether the project is in fact economically feasible.

2. It is necessary, in the first place, to consider the probable cost of the undertaking. Unfortunately for our purposes, no engineering estimate of the complete cost of a Lakes-to-Gulf waterway twenty or more feet in depth has ever been made. The Government engineers have confined their investigations to the fourteen and eight or nine

[1] *World's Work*, 1910, "Highways of Progress," p. 12,785.

foot projects. Hence the estimates presented here can be made only on the basis of collateral evidence. This is admittedly an unsatisfactory method, and it is adopted only because direct data are wanting.

Since the waterway convention which was held at St. Louis in November, 1910, placed itself on record as favoring an eventual draft of twenty-four feet (fourteen feet being but a step on the way), and since that is likewise the depth of the Chicago Drainage Canal, twenty-four feet may best be taken as the basis of our present estimates. Now the Chicago Drainage Canal, thirty-four and one half miles in length, and twenty-four feet in depth, cost $53,000,000, equal to nearly $1,100,000 a mile.[1] The distance from the end of the Drainage Canal to the Mississippi is 327 miles.[2] At an equal per mileage cost with the Drainage Canal, it would require approximately $500,000,000 to connect the Drainage Canal with the Mississippi. The Lockport-to-Utica division, sixty-one miles long, is in the "Rock-Bound Valley," and bedrock would have to be excavated all the way. In the Illinois River, while it is thought that a depth of fourteen feet could be secured by means of dredging in the alluvial bottom, to secure a depth of twenty-four feet would require the excavation of bedrock.

By way of comparison it should be recalled that the State of New York has appropriated $101,000,000 with which to deepen the Erie Canal from seven to twelve feet. The length here is but little greater than is that of the Illinois project and the increased depth to be secured is but five feet, though for a considerable portion of the distance a new channel is to be excavated. It would seem that the construction of this great ship canal, with a depth of twenty-

[1] *Proceedings of the Board of Trustees of the Sanitary District of Chicago*, January 26, 1910, p. 78.

[2] *Report of a Special Board of Engineers on a Fourteen-Foot Waterway from Chicago to the Mississippi River.*

four feet, would be at the very least three times as costly an undertaking as the enlargement of the Erie.

Another method of estimating the probable cost of the undertaking is by comparison with other ship canals. A statement of the dimensions and cost of the principal deep-water canals of the world is presented below: —

	Length (miles)	Depth (feet)	Cost ($000,000)	Per mile ($000)
Kiel Canal *	53	29	39	735
Suez Canal †	100	26	80	800
Manchester Ship Canal ‡ .	35.5	28	74	2,100
Forth and Clyde Ship Canal (estimated) § . . .	35	30	100	2,850
Panama Canal (estimated)	49	41	375	9,100

* *Weltausstellung*, Brüssel, 1910, p. 170. † *Encyclopædia Americana.*
‡ See pp. 147–48. § See p. 165.
‖ *Preliminary Report of National Waterways Commission*, p. 41.

These statistics show the cost of the leading canals of the world, excluding the Panama, to have varied between $735,000 and $2,850,000 per mile for depths of from twenty-six to thirty feet. Since engineering conditions vary greatly from place to place, more than a roughly approximate estimate cannot safely be made on the basis of these figures. While the science of engineering has greatly improved in recent years, it should be borne in mind that the cost of labor and materials is to-day higher than ever before, and in America higher than elsewhere, and that American public works are notorious for the lack of economy in construction. It would seem, therefore, that a canal from Chicago to the Mississippi would cost at least as much, according to capacity, as any of those enumerated above. The average cost shown in the above table is about $1,600,000 per mile. At that rate a canal of like size through Illinois would cost over $500,000,000. One twenty-four feet in depth would doubtless cost, then, at the very least, $300,000,000. Such seems to be the verdict of all the collateral evidence that is to be found.[1]

To construct the second portion of the route, from the mouth of the Illinois River to the Gulf of Mexico, would be no less an undertaking than that which has just been considered. As it is not generally understood how difficult is the task of subjecting the Mississippi River to control, a brief statement of the engineering problems is here presented.

The engineering investigations that have thus far been made have had in mind the feasibility of a channel fourteen, or eight to nine feet in depth. Consequently, there are as yet no data bearing directly upon the question of a waterway twenty-four feet deep, and as before, we must be content with indirect evidence.

A Special Board of Engineers, under the direction of the War Department, submitted a report in 1909 on the cost of providing a channel in the Mississippi from St. Louis to

[1] Tentative estimates have been made by engineers in the employment of the Lakes-to-Gulf Waterway Association which show a cost considerably less than this amount for a depth of twenty-four feet. These estimates must, however, be taken with a grain of salt, because these engineers know that, in order to secure appropriations from the National Government, the cost of the project must be made to appear not excessive. They are willing to take chances on securing additional appropriations for the completion of the work. In case they do not succeed in getting the extra amounts, they will nevertheless have had many millions to spend and years of work to do. A bird in the hand is worth having.

Attention should also be called to the fact that the cost of undertakings of this kind almost invariably greatly exceeds the original estimates, however unbiased they may be. It was at first estimated that the Drainage Canal could be constructed for $16,000,000 (*Journal of Political Economy*, May, 1910, p. 582), but, as seen above, it required more than three times that amount to complete the work. It was thought that the Panama Canal could be built for $140,000,000; the present estimate of the engineers is $375,000,000 (*ibid.*). The estimates for the Suez Canal began at $30,000,000, but $80,000,000 was required to complete the project (*Encyclopædia Americana*, vol. xv). The Manchester Ship Canal cost nearly twice the amount of the exceedingly careful preliminary engineering estimates (see page 149).

the Gulf, with a depth of fourteen feet throughout the year. Seven different means of securing the end in view were considered: Dredging, regularization, canalization with movable dams, canalization with fixed dams, lateral canals, reservoirs, and a combination of methods. It is unnecessary to discuss all of these methods at this time or to consider any of them in great detail. The Board recommended a combination method, namely, the completion of a regularization project, which had been proposed in 1881 to secure a permanent controlling depth of eight feet between St. Louis and Cairo, and then to rely upon perennial dredging to secure and maintain the further increase in depth. Two other methods have, however, received so much attention in recent discussions that a few words should be said of them here. The one calls for regularization works which would confine the river to a narrow channel of the desired depth. The other is by means of impounding reservoirs in the upper valleys, which would hold back the water in time of flood and increase the flow in time of low water, thereby insuring navigability throughout the year.

As to the first of these two methods, engineers are in disagreement. It is contended by one party that if the river were confined to its own natural bed by means of embankments, the more concentrated and rapid flow of the water would cause a permanent scouring which would render dredging unnecessary, and perhaps eventually make it possible to dispense with the levees themselves.[1] On the other hand, the conclusion of the Special Board of Engineers is that, while revetments might be feasible for a depth of eight feet between St. Louis and Cairo, and ten feet below Cairo, they are impracticable for a channel with a depth of fourteen feet. For the shallower depths revetment would involve no serious change in the regimen of the river. It would be allowed to follow the sinuous course to which it naturally tends, with deep pools in the bends,

[1] *World's Work*, May, 1910, p. 12,899.

and sandbars between, which rise and fall with variations in gauge height.[1] In the case of a channel fourteen feet deep, however, conditions are changed. The Board states that "great care would have to be exercised in making so great a contraction as would be necessary to confine the river to a fourteen-foot channel. As a river is reduced in width and increased in depth, a much smaller proportion of the discharge comes in contact with the river bed, and the velocity of the river current rapidly increases. A condition soon obtains where, instead of the bar being alternately scoured out and filled up as the river discharge decreases and increases, there is a constant scour. The dam which nature has placed between the pools is then destroyed. The material which formed this dam is washed into the lower pool, tending to raise it, while the upper pool tends to fall to the same level. If those dams between pools were destroyed for long distances, as between St. Louis and Cairo, a very serious change in the regimen of the river would result. Its slope would be diminished, immense quantities of material would be washed down into the lower river, adding enormously to its bars, filling up its pools, raising its flood levels, and making necessary expensive additions to its levee system; and falls or rapids might be created at the Chain of Rocks above St. Louis, which would be destructive to the navigation of this portion of the river."[2] It would seem that whatever truth there may be in this contention would be increased rather than diminished in the case of a waterway twenty-four feet deep.

The reservoir scheme of control was proposed by Mr. M. O. Leighton, Chief Hydrographer of the United States Geological Survey, and the full details of the plan are printed in the "Preliminary Report of the Inland Waterways Commission." Mr. Leighton's scheme is for the con-

[1] *Report by a Special Board of Engineers on Survey of Mississippi River*, 1909, p. 14.

[2] *Ibid.*

trol of the Ohio River, and consequently his cost computations are not applicable to the present study. The Special Board of Engineers, however, has made some investigations of the approximate cost of reservoirs adequate to hold back the waters of the Mississippi. The Board estimates that it would cost approximately $400 per million cubic feet of water restrained.[1] Now, since "the maximum reservoir facilities of the river, including 10,000 cubic feet per second that may come through the Chicago Sanitary Canal and the Illinois River, amounts to about 69,500 cubic feet per second for ninety days, equal to a total storage of about 540,000,000,000 cubic feet,"[2] the total cost would approximate $216,000,000. This is nearly twice the cost of the regularization and dredging method favored by the Board. It is very important to learn, moreover, that the 540 billion cubic feet of total storage which is possible would be sufficient to maintain throughout the year between St. Louis and Cairo a depth of only eight feet, and that, to secure a depth of fourteen feet, more than 5000 billion cubic feet of annual storage would be required, or about ten times the amount that is available.[3] The reservoir scheme is, then, clearly impracticable, at least so far as the Mississippi River is concerned.[4]

[1] *Report of Special Board, supra,* p. 18. [2] *Ibid.* [3] *Ibid.*

[4] Grave doubt has been cast upon the feasibility of the reservoir scheme which Mr. Leighton proposes for the Ohio River. The project has been attacked by various army engineers as visionary in the extreme. It is pointed out that the surface covered by the reservoirs would be hundreds of square miles in extent, that much valuable land now occupied by thousands of people would have to be condemned and permanently submerged. It is held that the reservoirs would rapidly fill up with sediment and become useless; and finally it is contended that the great pressure of the enormous quantity of water that it would be necessary to hold back would subject the impounding walls to the constant danger of breaking. The bursting of a dam far up in a system of dams would let loose such a volume of water as to sweep away all the dams below and carry death and destruction in its path.

The issue of the debate that has waged over the scheme is not decisive, but it appears that Mr. Leighton had undoubtedly greatly underestimated

The Board of Engineers favor, as has been said, a combination method of control, by means of regulation works and dredging. They estimate that the cost of providing by this method a channel fourteen feet deep from Chicago to the Gulf would be approximately $158,697,462.[1] These estimates do not include the cost of the necessary improvements between St. Louis and the mouth of the Illinois River at Grafton, a distance of thirty-seven miles. Now it is obviously impossible to say precisely how much more a twenty-four foot channel would cost than one only fourteen feet in depth. Some idea of the probable cost of the larger undertaking may be gained, however, by a consideration of the character of the river.

In the year 1908, between Cairo and the mouth of the Red River, there were as many as eighty-eight places that would have required dredging in order to maintain a depth of fourteen feet.[2] Above Cairo there was an even greater

the cost of the reservoirs, and at the same time greatly overestimated the profits to be derived from the sale of water power. Some of the army engineers contend that the reservoirs would cost $500,000,000, while Mr. Leighton's estimate is only $125,000,000. It is admitted by Mr. Leighton that the reservoirs in themselves would not be sufficient to insure a depth of nine feet in all parts of the Ohio River; that canalization would still be necessary in the worst parts of the stream. (For the engineering debate on Mr. Leighton's project see *Engineering News* for the following dates: May 7, June 11 and 24, October 8, and November 4 and 5, 1908.)

Out of this engineering debate rose another discussion which is unusually interesting to the layman, and closely related to the question of river regulation by whatever means. Colonel Hiram M. Chittenden, of the Corps of Army Engineers, has attacked the plan of reforestation as a means of preventing destructive floods. A general discussion has ensued, in which expert opinion seems fairly evenly divided. One faction contends that floods are no more destructive now than formerly, and no worse in forested than in deforested lands. The opposition holds exactly the reverse. Neither side is lacking either in theory or in historical data in support of its contention. What the verdict will be we do not wish to predict. (For a brief account of the discussion see Quick, *American Inland Waterways*, pp. 195–211.)

[1] *Report by Special Board, supra*, p. 5.

[2] *Ibid.*, p. 13.

number of shallow places in proportion to the distance. Obviously for a channel twenty-four feet in depth a vastly greater amount of dredging would be required, and at the same time it would become increasingly difficult. The Board states that while the character of the material requiring removal for a fourteen-foot channel "is mainly soft, easily handled material such as mud and sand, with occasional clay, gravel, boulders, and logs, the dredging at greater depths would likely encounter a greater proportion of more solidly bedded material, through reaching deposits longer undisturbed."[1] At one place, below Thebes, Illinois, bedrock has been disclosed at a depth of only seventeen feet.[2]

The unruly character of the Mississippi, and the very great difficulties in the way of controlling its flow, are not commonly appreciated. In the first place, the width of the river at low water varies greatly from place to place. Between St. Louis and Cairo there are variations of from 650 to 4900 feet, and below Cairo from 1000 to 7500 feet.[3]

In the second place, the destructiveness of floods on the Mississippi are hardly paralleled anywhere else. The vast extent of territory from which the river draws its water supply gives rise in time of heavy rains to an enormous discharge of water into the main channel of the stream. Again the sudden melting of the accumulated snows of winter produces annual floods which are well-nigh uncontrollable.

In the third place, the character of the river bed is very unfavorable to navigation. "The Mississippi River from St. Louis to the Gulf is typically a river with an unstable bed, — that is, one of caving banks and shifting bottoms. No river in the world under improvement for purposes of navigation equals it in the magnitude of its bed disturbances."[4] "The extent and variety of caving banks on the

[1] *Report by Special Board, supra,* p. 124.
[2] *Ibid.,* p. 10.
[3] *Ibid.,* p. 33.
[4] *Ibid.,* p. 40.

Mississippi are not realized, as a rule, even by members of the engineering profession, unless they have had the opportunity of inspecting the river during all of its stages."[1] The caving of the banks is due to erosion. "In aggravated cases within the past twenty-five years erosion has been known to cut the bank back at one place a distance of 500 feet in three months, at another 800 feet in a single year, and 1.5 miles in sixteen years at a third place."[2] Between 1884 and 1906 the Commerce "cut-off" and the Bordeau Chute "cut-off' caused the destruction of over 600,000,000 cubic yards of earth.[3] This is six times the volume of the excavations of the Panama Canal.

Equally serious with the eroding banks are the shifting bottoms. Sandbars are formed in the river, for the most part from the deposits of material that has been eroded from the banks. These bars, as a rule, extend diagonally across the stream, and have a length equal to two or three times the width of the river. "A bar once formed . . . moves gradually downstream, its upstream material being washed down by the current and redeposited on its downstream side, its height diminishing as it moves along and its old location in many places being occupied by a new bar as troublesome as itself originally. Such traveling bars, as actually found in the lower river and measured, have shown heights as great as 22 feet, distance between crests as great as 1000 feet, and daily travel downstream as great as 40 feet, and have been found in depths of water as great as 90 feet."[4] "Between St. Louis and Cairo the amount of material rolling along the bottom is so great that, where the bottom is scoured out at one stage of river (even if to twenty feet, as sometimes near Thebes and Grand Tower), it may be filled up again regularly at the next opposing stage, and where reaches of two or more miles in length show continuous deep pools along the best channel in one

[1] *Report by Special Board, supra,* p. 48.

[2] *Ibid.,* p. 40.

[3] *Ibid.,* p. 42.

[4] *Ibid.,* p. 44.

year, these pools may be found converted into shoals, and the converse after an interval of a few years."[1]

These facts furnish some indication of the enormity of the task of maintaining deep-water navigation in the Mississippi. To control the river in a manner that would prevent the yearly floods that now devastate the valley, let alone maintain deep-water navigation throughout the year, is said by engineers to be a greater task than building the Panama Canal.[2] It is a safe statement that no engineer would contract to provide a channel twenty-four feet deep in the Mississippi River between St. Louis and the Gulf for less than $500,000,000. In all probability it would cost far more than that amount.

We have now considered two portions of the Lakes-to-Gulf Waterway, the one from the end of the Chicago Drainage Canal to the mouth of the Illinois River at Grafton, the other from St. Louis to the mouth of the Mississippi River. On the basis of such data as is available, it has appeared that the former portion would doubtless cost in the neighborhood of $300,000,000, and the latter at least $500,000,000. To complete the route it would still be necessary to deepen the portion of the Mississippi between Grafton and St. Louis, a distance of thirty-seven miles. This part of the river has at present a low-water depth of less than eight feet. To give this stretch a minimum depth of twenty-four feet at all times would without doubt cost many millions. In order to be extremely conservative, however, we shall omit this from the computation and consider $800,000,000 to represent approximately the total cost of the entire route.

It has come to be recognized only recently that adequate harbors and terminal facilities are as essential to water transportation as is a waterway itself. To the above costs, which are for the waterway alone, it will therefore

[1] *Report by Special Board, supra*, p. 44.
[2] *World's Work*, May, 1910, p. 12,899.

be necessary to add the costs of providing extensive harbor facilities along the route and of bringing railway terminals into harmonious relation with the waterway.

Plans for a Chicago harbor have been under discussion for some time. Now, whatever may be the merits of an outer harbor on the Lake front as compared with an increase of shipping facilities along the Calumet, or Chicago River, or the Drainage Canal, when the end in view is to meet the needs of present Lake shipping or of a shallow-depth waterway to the Mississippi, it is certain that if great ocean vessels, in sufficient numbers to render feasible the construction of a costly ship canal, are to come inland to Chicago, a great outer harbor is an absolute essential. Some idea of the probable cost of such a harbor may be gained by a comparison with the cost of harbors elsewhere. Below is a statement of expenditures that have been made on important harbors of the world in recent times:[1] —

New York City (1870 – 1907)	$ 89,292,109
Glasgow (1860 – 1909)	44,000,000
Liverpool (1859 – 1907)	150,000,000
Newcastle-on-Tyne (1860 – 1909)	85,000,000
Hamburg (1880 – 1909)	100,000,000
San Francisco (improvements recommended, 1909)	50,000,000

The cities listed above have, from the beginning, attempted to develop their harbor facilities with a view to providing an economical transfer from the railways to ocean-going vessels. The railway men likewise have constructed the railroad terminals with the same end in view. But, on the contrary, the vast net of railways centring in Chicago has not been laid down with a view to Chicago's becoming a port for ocean vessels. For the most part the railways have rather attempted to cripple shipping on the Lakes by refusing to facilitate transshipment to Lake vessels. It is by no means certain that the railways can be induced to act in conjunction with a waterway which

[1] *Report of the Chicago Harbor Commission*, 1909, pp. 25 and 26.

has been constructed primarily for purposes of competition with them. But granting the possibility that they may be brought into harmonious relation with the waterway, it is evident that a complete reorganization of existing railway lines within the city, and a reconstruction of practically the entire present terminal system, would require the expenditure of an enormous amount of money. It seems impossible that it could be done for less than $100,000,000, while it is more than likely that it would cost twice that amount. At any rate, it is beyond question that to build a harbor which would accommodate ocean vessels and to reconstruct the railway terminals of Chicago would require an expenditure of at least $200,000,000.

The other cities along the route would, in like manner, be obliged to provide harbor facilities and to reconstruct existing terminal arrangements to meet the changed conditions of shipping. It is unnecessary to attempt to estimate here what the cost in the various important river towns would be. It is enough that we recognize that such expenditures should not be overlooked, and that they are of no little importance.

It appears from the above rough estimates that it is reasonable to believe that a ship canal, twenty-four feet deep between Chicago and the Gulf of Mexico, could not be constructed and placed in harmonious relationship with the railways for less than $1,000,000,000. It should be added that, if the plan of building first a fourteen-foot waterway, to be enlarged later to twenty-four feet, be followed, the total cost would in all probability prove greatly in excess of this amount. The Board of Engineers states that "in case it should become necessary to obtain increased depth (beyond fourteen feet), canals, dams, and complete regularization works would have to be modified under great difficulties and at great cost. Canal locks would have to be rebuilt and canal trunks deepened and partially relocated. Movable dam wickets, larger than any yet built, would become more difficult of manipulation and their operation perhaps impracticable, and the substructure would have to be rebuilt. Cross-sills of complete regularization works would have to be taken out and rebuilt at lower levels in the channel-way, or extensively raised outside the channel-way. In each case the difficulty and cost of securing the increased depth would of course be much greater than if the extra depth were obtained at the time of first construction."[1] The experience of the German Government in enlarging the Kiel Canal affords a good illustration of the cost of reconstructing waterways. The original cost of the canal, for a depth of twenty-nine feet and a bottom width of seventy-two feet, was $39,000,000. To enlarge it to a depth of thirty-six feet and a bottom width of one hundred and thirty-four feet is to cost $55,750,000, considerably more than the entire original amount.[2] If we consider, therefore, that a twenty-four-foot waterway from Chicago to the Gulf, if constructed at all, will doubtless be built on a step-at-a-time plan, the conclusion is unavoidable that the total cost would, in the end, greatly exceed a billion dollars.

3. Having estimated the probable cost of a Lakes-to-Gulf ship canal, it will now be interesting to inquire how large a traffic would be necessary in order to yield returns on the capital investment. For this purpose we shall assume the cost to be an even billion dollars.

Were the Government to issue bonds to the extent of a billion dollars there is little doubt that the interest rates thereon would be at least three per cent. At that rate the annual interest charges would be $30,000,000. This amount, plus the annual maintenance charges, represents the minimum total savings which the canal would eventually be expected to effect each year in order to prove successful. What the maintenance costs of such a

[1] *Report by Special Board, supra*, p. 20. [2] See page 222.

waterway would be cannot be stated out of hand; but the Special Board of Engineers, above referred to, has estimated, on the basis of ten years of practical experience, that the annual cost of dredging a fourteen-foot channel between St. Louis and the mouth of the Red River would be $4,100,000 a year.[1] For the entire distance of 1610 miles between Chicago and the Gulf the cost of dredging in a twenty-four foot channel would obviously be exceedingly heavy. It costs about $6000 per mile each year to dredge the Manchester Ship Canal in England.[2] At an equal rate the Lakes-to-Gulf Waterway would require nearly $10,000,000 a year for dredging. The Manchester Ship Canal is only thirty-five miles in length and is fed by two or three small rivers. The amount of sediment that is yearly carried into the Mississippi River from its thousands of miles of tributaries and from its own eroding banks is incomparably greater. Erosion may be prevented by revetments, but the sediment coming down from the tributaries must always be reckoned with.

Dredging is only one of the sources of annual expense, though it is doubtless the heaviest of any. Repair of locks, of regulation works, and of general equipment are sources of perennial outlay that cannot be escaped. Without attempting to estimate the extent of these expenditures in particular, it may safely be predicted that the total annual charges, including interest, would not be less than $50,000,000. We may now inquire into the amount of traffic that would be necessary in order to effect so great savings. Since this obviously depends on the extent of reductions in freight rates that could be made, it will be necessary to take up first the question of rate reduction.

The distance from Chicago to the Gulf over the proposed route is 1610 miles. We may call the round trip approximately 3200 miles. Assuming the average capacity of the vessels entering to be 10,000 tons (a high average), the

[1] *Report by Special Board, supra*, p. 13. [2] See page 153.

number of ton-miles of traffic handled in a round trip would be 32,000,000. Now, it is difficult to compute accurately what the possible savings per ton-mile might be, but the approximate amount may nevertheless be estimated. The average rate per ton per mile on all the railways of the country in 1909 was 7.63 mills. As was stated in an earlier chapter this figure was derived by averaging the ton-mile rates on all classes of freight, traveling under all manner of conditions. It averages rates, which are low on account of a long haul, water competition, or low value of the freight, with those which are high for opposite reasons. Now, it is certain that the average railway rates from the Central West to the Gulf are much lower than the average for the entire country. They have at all times been subject to the potential if not actual competition of the Mississippi River; and at the same time the railways leading to the south have been forced to meet the competition of the roads leading to the Atlantic seaboard. As is well known, these east-and-west lines have in turn been forced to give low rates on account of the water competition in that direction, as well as the competition with each other. It is probable, therefore, that the average level of rates to be affected by the ship canal is not over four mills per ton-mile. The average rate on the Illinois Central is 5.96 mills; and on the Wabash it is 5.73, while the average *cost* is set down at 4.31.[1] Since it is the vast number of very high rates charged for short hauls under non-competitive conditions that raises the general level of rates to nearly eight mills per ton-mile, it would seem that the through rates on the Illinois Central and Wabash could hardly average more than four mills per ton-mile. It is necessary to ascertain, in the next place, for how much less than this amount 10,000-ton vessels could carry the traffic.

We shall assume the canal to be supported at public

[1] *Annual Report*, 1910, p. 29.

expense, and to be entirely free of dues. Only the haulage charge is to be considered. The Great Lakes furnish us a basis for estimates. In 1907 the average freight rate per ton per mile was .8 mill. In considering this low rate it should be borne in mind that much the largest portion of the tonnage was of the lowest class of freight, — raw iron brought down from Lake Superior to South Chicago or to ports on Lake Erie, and coal on the return trip to the Upper Lakes. It should be considered, also, that the Lake lines which handle this traffic are the property of the United States Steel Corporation, and hence that there is no attempt to make a profit on the transport of the ore. The coal for the return voyage, moreover, can be profitably hauled at exceptionally low rates, on the principle that something is better than nothing. In the absence of this traffic the ore boats would have to make the return trip empty.

Now, the character of the traffic that would be shipped to and from Chicago over the ship canal would not be so distinctly low-grade. Coal and ore is not exported to foreign countries. A very considerable portion of the traffic would be of manufactured goods, which always are expected to pay higher transport rates than raw materials. Again, it is not to be expected that the vessels on the ship canal would be extensively owned by companies which were using them to transport their own produce, as in the case of the ore boats on the Lakes. The owners of the ocean vessels would expect a profit on their carrying business, and since the cost per ton of carrying capacity of ocean vessels is much greater than that of the Lake boats, this means in itself much higher rates than would be necessary in order to earn profits on the Lake vessels. If it be further considered that the average speed that can be made on a canal or river is not, at best, more than one fifth (movement at night is practically impossible) what can be attained on the open Lakes, and that at the same time the risks of navigation, and hence the rates of marine insurance, are greatly increased,[1] it is apparent that the average rate per ton-mile on the deep waterway could not possibly be less than two mills per ton-mile, while it might well exceed the level of rail rates.[2] Taking it at two mills per ton-mile, however, the saving over the assumed rail rates would be two mills on each ton-mile.

It should be further noted that since the distance from Chicago to the Gulf by water is much greater than by rail, the ton-mile rate by water must be much lower than by rail if the cost of shipping between the two points is to be the same. The distance by water from Chicago to New Orleans is 1610 miles, as against 930 miles by rail. A rate of two mills per ton-mile by water, therefore, is equivalent to more than 3.5 mills per ton-mile by rail. In the present computation, however, we shall overlook this consideration and assume the saving by the water route to be two mills per ton-mile.

At an average saving of two mills per ton-mile, 25,000,000,000 ton-miles of traffic would be required to effect a saving of $50,000,000 a year. At 32,000,000 ton-miles per round trip, as estimated above, it would require about 780 vessels, of 10,000 tons' capacity each, to handle the necessary tonnage. Making allowance for the closing of navigation on account of ice during the winter months and on account of floods at other times, the waterway would not be open for much over 250 days each year. This means that an average of about three ships would have to enter and three clear at the port of Chicago each day. As will be shown in a later paragraph, it would require about 45 days for a vessel to make the round trip from the Gulf to Chicago. This being true, it is apparent that about

[1] These points will be treated more fully in following pages.

[2] It should be borne in mind that the cheapest method of handling water traffic is in barges. The cost of a steam vessel is so much greater than that of a long flat barge that rates must be very much higher in order to cover capital charges.

135 ships would have to be on the waterway at all times; this means that the ships would have to be only about twenty-four miles apart in each direction; it means one ship for about every twelve miles of waterway.

To look at this matter in another way, it may be stated that the total tonnage of the 780 vessels entering and clearing at Chicago would be 7,800,000. Now, in the year 1909 the tonnage of vessels entering and clearing at our greatest American seaports was as follows: —

New York	24,395,136 tons
Boston	4,833,828
Philadelphia	4,500,011
New Orleans	4,186,670
Baltimore	2,459,565
San Francisco	1,774,533

This table indicates that the tonnage at Chicago, on the basis of the above estimate, would have to be nearly twice that of any of our great seaports except New York. It should be recalled here that the savings on this 7,800,000 tons of traffic would merely meet the annual outlay on account of the ship canal. To effect the enormous savings to the nation that are promised by the advocates of the project, it is evident that a much greater tonnage would be required.

4. Having estimated the probable cost of a ship canal from the Great Lakes to the Gulf of Mexico and the amount of traffic that would be required to make the project feasible, it remains to inquire as to the probability of ocean vessels making extensive use of such a waterway. Is there assurance that if the route were open ships from all the world would choose to come sixteen hundred miles inland to discharge and receive their cargoes at Chicago?

It is a well-known fact that the old so-called "tramp" steamers are rapidly disappearing from the ocean. The

[1] *Statistical Abstract of the United States,* 1909, pp. 309–10.

size of the tramps that remain, moreover, is rapidly increasing. According to Lloyd's "Register of British Shipping" there were in 1893–94 only 87 British steamers with a capacity as large as 5000 tons or more, while in 1908–09 the number had increased to 599. During the same years the number of vessels with a capacity of between 2000 and 3000 tons decreased from 1277 to 1013.[1] A large Philadelphia shipping firm reports that twenty years ago it possessed thirty or forty vessels with a capacity of from 1800 to 2000 tons, but that to-day it has only twelve or fifteen with a capacity as low as 4500 to 6000 tons.[2] "A memorandum supplied by the Savannah Chamber of Commerce in November, 1909, states that the increase in the size of ships at that port, owing to the increase of the depth of the channel to twenty-two feet at low water, has been forty per cent in the last ten years, and that during the same period marine insurance has fallen twenty-five per cent, and freight rates thirty-seven per cent."[3] The deepening of the harbor of Boston has in the last fifteen or twenty years lowered the freight rates from that port by about fifty per cent.[4]

The larger and more strongly constructed vessels are much less subject to damage at sea. "A light-draft steamer in rough water is thrown about by every wave; her way is deadened by pitching into a heavy sea and her engines are always in danger of breaking down, owing to the racing of the propeller as the stern rises out of the water. . . . Both the small ship and her cargo are liable to serious damage by heavy rolling."[5] It is clear, therefore, why the rates of marine insurance should be materially higher on small vessels than on those of sufficient size to weather with reasonable safety the heavy seas to which they are subjected.

[1] *Preliminary Report of National Waterways Commission*, p. 40.

[2] *Report of Commissioner of Corporations on Transportation by Water*, part I, p. 138.

[3] *Preliminary Report, supra*, p. 40. [4] *Ibid.* [5] *Ibid.*

Again, the costs of operating a large vessel do not increase in proportion to capacity. "A modern ocean carrier of 5000 tons' displacement requires 1000 indicated horse power to drive her at a speed of ten knots, and a carrier of the same type, symmetrically enlarged to 10,000 tons' displacement, requires only 1587 horse power to drive her at the same speed; that is, the cargo-carrying capacity is doubled at the same speed with an increase of a little more than fifty per cent for fuel. The increased expense of labor is less than one per cent."[1]

In the light of these considerations it is easy to understand the tendency for ocean vessels constantly to increase in size as far as the depth of water in the harbors will permit. The same reasons explain also why harbors the world over have been constantly deepened in recent years.

At present a ship canal twenty-four feet in depth from Chicago to the Gulf would be large enough to accommodate many of the vessels still traveling the ocean. But the draft of the larger freighters is now around twenty-eight feet, and for these such a canal would obviously be too small. In another twenty years, judging from the tendency shown by the above statistics, a depth of more than twenty-four feet will have become the rule. It would take twenty years to construct the waterway, at the end of which time it would be practically out of date.

Turning now to another consideration, we find that the cost of ocean vessels per ton of carrying capacity is much greater than those plying on inland waters. For the steam vessels engaged in the coastwise trade along the Atlantic and in the Gulf of Mexico the average value per ton of carrying capacity is $133, while on the Great Lakes and on the St. Lawrence River it is but $61, less than half as much.[2] The obvious reason for this is that on the ocean a vessel is subjected to a severer strain and hence must be more strongly built. It will be seen presently that this consider-

[1] *Preliminary Report, supra,* p. 40. [2] *Ibid.*

ation has a very important bearing on the question of the probability of an ocean vessel's navigating a ship canal for hundreds of miles inland.

Since ocean-going vessels are very expensive in first cost and in daily operation as well, they must be put to the fullest utilization possible if they are to prove remunerative. It is well known that steamers are, as a rule, run on a narrow margin of profit, and that a few days' delay often serves to eat up the profits of an entire voyage. It will be necessary to inquire, therefore, how much time would be required by a vessel to make the trip from New Orleans to Chicago and return.

An ocean vessel cannot possibly make a speed of more than five miles an hour in a canal. Indeed, in a crooked canal, with locks to pass, and where the traffic in both directions is heavy, the average speed would probably be much less than this amount. Night traffic, furthermore, would be out of the question, on account of the dangers involved. In Europe traffic on inland waterways at night is almost unknown, except on the Kiel Canal, and there it is accomplished only by means of brilliant electric lights on both sides of the canal. The naval importance of this canal is all that leads to this practice. Fourteen hours a day, therefore, must be regarded as the maximum number that could be utilized on the Lakes-to-Gulf Waterway. A ship could, therefore, cover a distance of about seventy miles a day. At this rate about forty-five days would be required to make the entire round trip of thirty-two hundred miles. In that period of time a vessel could easily make a trip from an Atlantic port to Europe and return.

In addition to losses on account of time consumed in the slow passage through the waters of a ship canal, vessel owners would have to reckon with an increase in insurance rates, on account of the great dangers involved in navigating inland channels.

In the first place, there is an ever-present danger that a vessel may go aground. "If the draft of a vessel approaches very near to the limit fixed by the depth of the channel, the suction is so great, owing to the little water between the ship and the bottom of the canal, that the vessel will obey the helm very sluggishly, even if there is neither wind nor current, and an instant off the course in a narrow channel will put the vessel aground."[1] Ships have grounded a number of times in the Kiel Canal, which has a depth of twenty-nine feet.

Again, there is a possibility that a vessel may become lodged in a canal. It has happened on the Kiel Canal that a ship has stuck against one side of the canal and swung around at right angles, thus blocking up the traffic of the entire waterway.

Similarly, there is always an element of risk in the passing of locks, and any serious mishap may prevent traffic on a considerable portion of the entire route.

In the case of the Mississippi River, in particular, there are special dangers arising from the character of the stream. "In the present state of the art, even light-draft screw steamers cannot be used to advantage at any considerable distance above New Orleans. . . . The need for constant backing and turning at the innumerable bends makes the stern-wheel paddle the only generally successful method. The latter, of course, is useless in the open sea."[2]

Special attention should be given to the consideration that an accident of any kind to a vessel on a canal may, through blockading the passage, affect the movement of the majority of the ships on the waterway at the time.

[1] *Preliminary Report, supra,* p. 42. It is practically certain that towing would have to be resorted to for almost if not quite the entire distance. On the Manchester Ship Canal the large vessels are all taken inland in tow. The expense and inconvenience of this would prohibit large vessels from coming sixteen hundred miles inland, to Chicago. The freight could be handled much cheaper by barge or by rail, transshipments included.

[2] *Report of Commissioner of Corporations,* part I, p. 10.

This is a consideration which would not be overlooked by a shipowner who was considering the advisability of trusting his vessel to the waters of a canal. Delay means heavy loss, and the possibility of that delay might altogether deter a ship from undertaking the trip inland.

The dangers mentioned above would inevitably result in greatly increasing the rates of insurance which vessel owners would have to pay. As a plain business proposition it is apparent that no insurance company could be expected to offer as low rates where the risks of navigation are greatly increased.

The above considerations have shown that there are two factors which are strongly against the use of a Lakes-to-Gulf waterway by large ocean vessels. The great loss of time involved would greatly reduce the earning capacity of a vessel; it would amount to running the ship on part time. The higher insurance rates would greatly increase the annual outlays, and hence proportionately reduce profits. It is exceedingly doubtful, therefore, if any considerable number of ocean vessels would choose to make use of the waterway were it placed at their disposal absolutely free of tolls. Indeed, a recent writer says that several leading shipping companies have stated, over their own signatures, that they would make no use of the waterway were it constructed; that even if they could navigate it safely, the expense would be prohibitive.[1]

In this connection it should be called to mind that the fourteen-foot waterway connection between the Great Lakes and the Atlantic by way of the Welland Canal and the St. Lawrence River, large enough for many of the smaller ocean vessels, is wholly unused. The Corinth Canal, connecting the Gulf of Corinth with the Gulf of Ægina, four miles in length and twenty-three and one half feet in depth, shortens the voyage from the Adriatic by one hundred miles. Nevertheless, "none of the foreign steamship

[1] Howard Gross, Chicago *Daily Tribune*, December 8, 1910.

companies navigating the Mediterranean now use the canal. It is mostly used by small Greek passenger steamers."[1] Admiral Sperry, of the United States Navy, holds that great ocean vessels can never economically use long inland canals, and that, conversely, "even the largest of the vessels using our inland waters, deepen and improve our waterways as we may, can never navigate the high seas economically or safely as compared with an ocean carrier of to-day of even moderate proportions."[2]

It is no more to be expected that the Lake vessels would engage in the ocean carrying trade. This whole question was exhaustively considered by Major Thomas W. Symons of the United States Engineering Corps, apropos of the much-discussed ship canal from the Great Lakes to the Atlantic. The conclusions of Major Symons are stated as follows: —

> Ocean vessels, fitted for combating the storms of the North Atlantic, are built much heavier, stronger, deeper, and on finer lines than are the Lake ships. The machinery differs radically, owing to the salt water, and is more expensive and differently placed. In the ocean ships surface condensers are imperative, and much brass or lead piping is required. The machinery, placed amidships, interferes with rapid loading and unloading. The hatches are too small and too few, and not properly spaced to suit docks, elevators, etc., and the rapid handling of freight in Lake ports. The coal bunkers are too large, occupying valuable room. All deck constructions, the rudder, anchors, chains, etc., are heavier and more expensive than are required for the Lakes. The decks add weight and interfere with loading, storing, and unloading bulky, coarse freight. Speaking comparatively, the bottoms of ocean vessels are made for floating and the bottoms of lake vessels for grounding.[3]

It has been argued by some, however, that American ingenuity might devise a special type of boat adapted to

[1] *Preliminary Report of National Waterways Commission*, p. 42.
[2] *Ibid.*, p. 41.
[3] *Engineering News*, November, 1897, p. 319.

both inland and ocean transportation. On this point Major Symons says: —

Vessels which ply upon the ocean and those which ply upon the Lakes are notably different in their costs, construction, and their operation. So great are the differences that I am convinced the two cannot economically change places. . . . While it is possible, from an engineering standpoint, to build a vessel which shall combine to a limited extent the particular necessities and advantages of both Lake and ocean vessels, such a vessel would not be a good business enterprise.[1] However carefully a vessel may be designed for service on both Lakes and ocean, she must necessarily be a compromise between two widely differing types, and inferior to each on its own waters. She can neither carry cargoes on the

[1] W. H. Curtis, an engineer of Denver, has recently secured a patent on a combination and adjustable steel barge, for the purpose of raising seagoing vessels, that they may navigate interior waterways, and eliminate the unloading and reloading of cargoes. This barge is so constructed that it can be opened through the centre, to any desired width, so as to allow a deep seagoing vessel to enter between. The end members of the barges are movable and run in heavy cast grooves. After the vessel is between the main barge members, the end is then run over and locked, making the vessel in the centre completely surrounded with a strong and rigid steel floating structure. It is the belief of the inventor that by means of this barge ocean vessels, drawing twenty feet of water or more, may be raised so that they can navigate inland waters with a depth of eight or ten feet. Granting that the scheme is practicable from an engineering standpoint, and that the more than double lateral expanse of the floating body that would be necessary if the vessel were thus raised, would not give a width too great for safe navigation and safe passing in a narrow canal or tortuous river channel, let us briefly consider its commercial feasibility. The scheme involves the use of tugboats for the towing of the barge and vessel. If the cargo were transshipped to an ordinary self-propelling barge or to a railway train, only the weight of the cargo would need to be carried inland; but here the dead weight of both the ocean vessel and the barge which supports it would have to be carried. And it seems probable that the cost of doing this would in itself equal the cost of transshipping the cargo. But more than this, the ocean vessel would be subjected to a great loss of time. The speed maintained on inland waters could be only a fraction of that on the open ocean, and the profits for the owner of the vessel would be correspondingly reduced. It appears, therefore, that the ingenious invention offers little promise.

Lakes as cheaply as the Lake ships, nor on the ocean as cheaply as the ocean ships; and even supposing that the avoidance of transfer will more than make up for these disadvantages and the time necessarily lost in any canal that can be constructed, she would have this advantage for little more than half a year, and the remainder of the year she must run at a loss on salt water as compared with other ships.[1]

In the case of a short canal which saves a journey of thousands of miles, as the Suez or Panama, the situation is much different. Where the length of the canal is relatively short, it may be possible to give it a capacity great enough to permit vessels to pass through with reasonable safety. The cost of so doing is, however, prohibitive for a canal of great length. Again, where a voyage is shortened by several thousands of miles, the savings in time may easily induce vessels to incur the costs and risks of a canal. With the Lakes-to-Gulf Waterway the conditions are obviously altogether different from those of the Panama or Suez Canal.

5. This investigation has indicated, in the first place, that a ship canal from Chicago to the Gulf of Mexico, together with the necessary harbors and connections, could not be constructed, in all probability, for less than the enormous sum of a billion dollars; in the second place, that assuming a saving of 2 mills per ton-mile, a traffic nearly double that of great ocean ports like Philadelphia, Boston, and New Orleans would be required in order to effect savings merely sufficient to meet the annual outlays; and, finally, that it is practically certain that no considerable number of ocean vessels could be induced to use the waterway were it at their disposal free of tolls.[2] It is

[1] *Engineering News*, November, 1897, p. 318.

[2] It may be contended that, even though ocean vessels should not use the canal, the waterway would nevertheless force down railway rates through potential competition and thereby possibly pay for itself. All that need be said relative to this point here is that a waterway of much

abundantly evident, therefore, that the project is visionary in the extreme, and that the dream of one day beholding the flags of all nations unfurled before Chicago breezes will never be realized. It is fortunate that the National Government is not disposed to listen to the extravagant contentions of the Lakes-to-Gulf Waterway Association.

shallower depth could accomplish as much in this way as a ship canal. For barges are more economical carriers than ocean vessels on an inland water route. The question of potential competition may therefore be postponed until we consider the fourteen- and eight-foot projects.

CHAPTER XVI

"FOURTEEN FEET THROUGH THE VALLEY"

1. The immediate purpose of the Lakes-to-Gulf Waterway Association is to secure a water route with a depth of fourteen feet for the entire distance between Chicago and the Gulf of Mexico. This is the project which has attracted the widest attention in the agitation for a revival of waterway transportation in this country. Passing, as it would, through the heart of the great Middle West, it is of immediate interest to the people of more than thirty states. It will be the purpose of the present chapter to test the merits of this scheme which calls for "fourteen feet through the Valley."

It is apparent at once, that if ocean vessels could make little use of a waterway twenty-four feet deep to Chicago, a waterway with a depth of only fourteen feet would be of scarcely any service to them. The comparatively few ocean vessels that have a draft of less than fourteen feet would not undertake to navigate a winding inland channel for thousands of miles. They are not constructed for such purposes, and the loss of time, to say nothing of the heavy insurance charges, would entirely prevent the use of the proposed route. It would require a special type of shallow boat for the purpose; but such a vessel could not meet the competition of the larger ocean steamers after it passed out of the inland channel to the open sea. Such vessels would thus have to confine their operations entirely to inland carriage.

It is urged by many, however, that while ocean vessels could not be expected to navigate a waterway fourteen feet deep, the vessels on the Great Lakes would nevertheless make extensive use of such a channel. It is believed that they would make regular trips between Lake and Gulf ports. In order to ascertain what ground there may be for such a belief, it will be necessary to inquire what is the prevailing size of vessels now navigating the Great Lakes.

In 1901 the draft of two thirds of the vessels entering the Chicago River was more than fourteen feet;[1] and since that time the draft of Lake boats has been rapidly increasing. Indeed, a chief reason for the relative decline of shipping at the port of Chicago in recent years has been the inadequate depth of the Chicago Harbor. Like those on the ocean, the harbors of the Lakes have had to be continually deepened to meet the needs of modern shipping. "At the present time the value to commerce of a thirteen-foot harbor on the Great Lakes is entirely incommensurate with the cost of maintenance. To be accessible to even the smaller available vessels, a harbor should have a depth of at least sixteen feet."[2] "During the season of 1907, of a freight tonnage of 58,217,214 tons which passed through the canals at the Sault Ste. Marie, only 800,000 tons were in vessels of a registered draft of fourteen feet or less, and 10,400,000 tons were in vessels of nineteen feet registered draft, or over."[3] Only 1.4 per cent of this tonnage was carried in vessels which would be able to make use of the proposed Lakes-to-Gulf Waterway. The tendency of the Lake vessels, moreover, will unquestionably be to continue to increase in size in the future. Most of the remaining shallow draft boats are old vessels not yet discarded. Practically all of the new boats draw more than fourteen feet of water, and it is probable that by the time the proposed waterway could be constructed, hardly a boat on the Lakes would be able to make use of it.

[1] *Report of a Board on a Survey of a Waterway from Lockport to St. Louis*, 1905, p. 13.

[2] *Report of Chief of United States Army Engineers*, 1908, p. 1965.

[3] *Report by a Special Board of Engineers on Survey of Mississippi River*, 1909, p. 23.

There is every reason to believe, moreover, that such remaining Lake vessels as are small enough to make use of a waterway fourteen feet deep would choose not to risk the dangers of navigating it. The vessels employed in the Great Lakes service are not adapted to the navigation of a canal or tortuous river channel. "The ratio of length to beam is too great and the rudder power insufficient. Such vessels have been constructed for special purposes, and, while affording a most economical method of transporting freight on the Great Lakes, would be a failure if employed in either ocean or river navigation." [1]

Even were it possible for the Lake boats to navigate a channel fourteen feet in depth, it would not be profitable for them to do so, for they would be unable to compete with barges. The average cost, per ton of carrying capacity, of constructing steam vessels used on the Great Lakes and the St. Lawrence River is \$61.[2] On the other

[1] *Report by Special Board, supra*, p. 26. During the hearings before the Committee on Commerce of the Senate of the United States, in 1910, representatives of two Lake shipping concerns submitted testimony, at the instance of the junior Senator from Illinois, to the effect that they would make use of a fourteen-foot waterway to the Gulf of Mexico were it available. Cross-questioning, however, revealed that neither knew anything about the difficulties in the way of navigation on the Mississippi. One based his case solely on the fact that his vessels drew less than fourteen feet of water; and the other, on the same fact with the additional one that his ships had actually passed through the Soo, the St. Clair, Detroit, and St. Lawrence Rivers. He made no mention of the difference in conditions of navigation on such broad, deep, and straight channels as the first three of the rivers mentioned, and on the Mississippi; and he was forced to admit that the high insurance rates on the St. Lawrence, charged on account of the dangers of navigation there, made shipping over that route in Lake vessels very unprofitable. This is the sum total of evidence that the advocates of the waterway have been able to secure in support of the contention that the Lake boats would use the fourteen-foot channel. These witnesses were W. D. Hamilton, a vessel builder in Chicago, and Edward Hines, of the Edward Hines Lumber Company of Chicago. See *Hearings before the Committee on Commerce*, Sixty-first Congress, Second Session, February 28, 1910.

[2] See page 344.

hand, "a Mississippi River steamboat and ten barges, capable of transporting 10,000 tons of freight (on an 8.5-foot draft), can be built for about twelve dollars per ton of freight carried." [1] Since a large steam vessel can make no greater speed on a narrow channel than can the barges, it is obvious that the latter offer the cheaper means of transport. On the open Lakes the larger steamers are necessary in order to weather the storms which prevail; while speed is also a factor working in their favor. But on inland channels barges offer the most economical means of transport that is known.

2. It is sometimes contended, as a final argument for a depth of fourteen feet, that if for any reason the Lake vessels should not engage in a regular carrying trade on the waterway, they would nevertheless be floated down it empty at the approach of winter for the purpose of participating in the coasting trade. Navigation on the Great Lakes is closed for several months each year on account of ice, and the Lake boats are compelled to lie idle during the winter months. Boats with a draft of much more than fourteen feet when loaded could easily be floated down a fourteen-foot channel when empty. Why not, then, give the Lake boats an opportunity to engage in the coasting trade during the season of closed navigation on the Lakes?

In regard to this argument it is only necessary to call attention to the fact that there has been for many years a waterway fourteen feet deep from the Lakes to the ocean, by way of the Welland Canal and the St. Lawrence River. The very obvious reason why the Lake boats do not avail themselves of the opportunity they now have of engaging in the coasting trade during the winter months is that they would be unable to compete with the regular coasting vessels for this trade. The amount of the coastwise traffic in the winter is relatively small, and the regular lines would

[1] *Report by Special Board of Engineers, supra,* p. 24.

have the first claim upon it. The Lake vessels, moreover, are not constructed to withstand such severe storms as occur off the Atlantic and Gulf coasts during the winter months.[1] As was shown in the preceding chapter the cost of the coastwise vessels per ton of carrying capacity is more than twice that of the boats on the Great Lakes. The argument appears conclusive, therefore, that neither the ocean nor the Lake vessels would ever be able to make any considerable use of a Lakes-to-Gulf waterway fourteen feet in depth.

3. If a waterway fourteen feet in depth is to be constructed, it must, therefore, be for the purpose of barge traffic. This point being settled, we may now raise the question, What depth of channel is required for the most economical sort of barge transportation?

On the Ohio and Mississippi Rivers from Louisville to New Orleans, the steamer Sprague sometimes tows as much as 60,000 tons of freight at a single trip. As compared with this, the Kaiserin Auguste Victoria, one of the largest of ocean-going vessels, has a freight capacity of only 25,000 tons. At the same time the horse power of the steamer Sprague is but 2175 as against 17,000 for the Kaiserin Auguste Victoria.[2] The towing of barges in small fleets is the cheapest method of water transportation that is known, and it does not require a great depth of channel. The Ohio River below Louisville has a depth of six feet for only 284 days each year, and of more than nine feet for only 230 days. These barges travel all the way down the Ohio from Pittsburg, and in the upper part of the river the depth is less than six feet for the greater portion of the year.[3]

On the Rhine River, in Germany, barges of 2000 tons'

[1] See discussion of preceding chapter relative to lake *versus* ocean vessels, p. 345.

[2] *Report of Examination of the Ohio River by United States Engineers*, 1908, p. 17.

[3] *Ibid.*, p. 7.

capacity regularly ascend the river as far as Mannheim, where the low mean channel depth is only 6.52 feet. Between Mannheim and Strassburg, the head of navigation, the low mean depth is but 3.91 feet, but barges of 800 tons' burden reach the latter port. And 3000-ton barges are used where the depth of the river is but 10.78 feet.[1]

In the light of these facts, what ground is there for the contention that a depth of fourteen feet from Chicago to the Gulf of Mexico is an absolute necessity? Such a depth would not permit the use of Lake or ocean vessels, and is several feet deeper than is necessary to accommodate the most efficient sort of barge traffic. By the use of long and shallow barges a depth of eight feet would be entirely adequate. It should be stated here that barges of more than two or three thousand tons' capacity are not contemplated by the advocates of the fourteen-foot project. In general they have in mind the 1000-ton or 1500-ton barge, and are merely under a delusion that a great depth is necessary to float such vessels. It should be said, also, that in most cases the 1000-ton barge is preferable to the larger type. Grain is more likely to be heated when stored in the larger mass, and there is more breakage of coal when it is loaded into very large barges. The 1000-ton barge is also frequently much more convenient for the shipper than the larger ones. At any rate, three barges, each of 1000 tons' burden, can be towed as a fleet at as low, if not lower, cost than a single barge of 3000 tons' capacity. From the transportation side, therefore, there appears to be absolutely no reason why a depth of fourteen feet should be provided.

The cost of a fourteen-foot waterway, as compared with one eight feet in depth, would be almost as dollars to dimes. It is estimated that the division of the waterway which the State of Illinois proposes to construct — namely, the stretch from the end of the Chicago Drainage Canal, at Lockport, to Utica — would cost approximately $20,000,-

[1] Sympher, in London *Daily Chronicle*, April 7, 1906.

000. We shall presently see, however, that in all probability more than fifty millions would be required to complete this section. For the remainder of the distance — that is, from Utica to the Gulf of Mexico by way of the Illinois and Mississippi rivers — it is estimated by the Special Board of Army Engineers that the total cost would be \$158,697,462.[1] This makes the cost for the entire distance in the neighborhood of \$200,000,000.

On the other hand, it is estimated by the government engineers that the cost of an eight-foot project would be comparatively small in amount. There is already throughout most of the year a depth of eight feet from St. Louis to the Gulf, and the cost of completing the regularization works now being constructed promises to be not excessive. From Utica to St. Louis it is estimated that the total cost, if the existing locks be used, would be only \$1,050,000. For the stretch from Lockport to Utica it is believed that the \$20,000,000 voted by the state for the construction of a fourteen-foot channel between these points would be ample to provide a depth of eight feet.[2] This would make the total cost of the eight-foot project about \$21,000,000, in addition to what is necessary to complete the regularization works below St. Louis. Why spend several times this amount in securing an extra depth of six feet which is not needed? The board of Army Engineers has rightly condemned the fourteen-foot scheme as an absurd proposition.

4. One other phase of the fourteen-foot project remains to be considered. The plan provides for the withdrawal of 10,000 cubic feet of water per second from Lake Michigan, and it is urged by the advocates of the scheme that the profits from the sale of water power that could be de-

[1] *Report by Special Board of Engineers, on a Survey of the Mississippi River*, 1909, p. 5.

[2] *Report of Special Board*, 61st Cong., 3d Session, House Doc. no. 1374.

veloped from this flow would, in a very few years, pay the entire cost of the Lockport-to-Utica division, for which the people of the state recently voted $20,000,000. It is pertinent to inquire, therefore, if there is any assurance that the amount of water power that could be developed and sold would be of sufficient value to warrant the expenditure of the large sums of money which the scheme involves.

When the National Waterways Commission, in January, 1910, submitted its report on waterway conditions in Europe, and cast considerable doubt upon the feasibility of canal transportation in the United States, the advocates of the Lockport-to-Utica division of the Lakes-to-the-Gulf Waterway immediately changed tactics.[1] The contention has since been that the prime purpose of the Illinois project is to develop water power, not to carry traffic. An interesting local struggle has arisen in Illinois over this, in which politics, financial interest, and newspaper jealousy are the most conspicuous elements. Those opposed to the waterway contend that the original purpose of the $20,000,000 bond issue, which the people of Illinois voted in 1908, was to create a waterway for the carrying of traffic; and that if the purpose has been changed now to one merely for the development of water power, the proposition should be resubmitted to the people at the polls, when it should be voted down as a foolish enterprise. The friends of the scheme, on the contrary, claim that since the people sanctioned the bond issue once by an overwhelming majority, there is no occasion for taking the trouble and time for another vote. They silence all doubts as to the value of water power by pointing to the fact that private interests are already on the ground, anticipating the use of power which they hope will be developed at the expense of the state.

[1] The leaders of the movement are Governor Deneen and Senator Lorimer. The former insists that the State of Illinois should take the initiative in the matter, while the latter holds that it is the duty of the United States Government to commence the work. Both favor the scheme. Perhaps political interest may explain their respective attitudes.

Now, while no one doubts that no inconsiderable amount of water power may be developed, there is a real question whether it would be of sufficient value to warrant the expenditure of the large sums of money which the scheme involves. In the " Prospectus of the Plan Proposed by the Internal Improvement Commission of Illinois," it is estimated that the portion of the Lakes-to-the-Gulf project for which the people of Illinois voted $20,000,000, namely, for a cut fourteen feet deep from Lockport to Utica, would cost $18,258,986. It is estimated further that "the net salable power may safely be taken as 100,000 horse power, and a conservative rental for 24-hour power is $25 per horse power per year in excess of operating expenses. The annual net revenue will therefore be $2,500,000." Placing this in a sinking fund bearing interest at two per cent, would permit the paying-off of the $20,000,000 in fourteen years, and in addition it would leave a handsome balance in the public treasury. There would then be a princely annual revenue to be used in reducing the taxes of the citizens of the state. On page 362 is given the tabulated statement which was presented to the people for consideration. The prospectus adds that "this presents the case in its most unfavorable aspect."

This prospectus will bear analysis. If the initial cost should prove to be more than $18,258,986, the revenues to the state would of course be proportionally reduced. In this connection it is well to recall that at the time of the passage of the bill for the construction of the Panama Canal it was estimated that the cost would be approximately $140,000,000, and that in no case would it exceed $160,000,000. The engineer who is now in charge estimates that the cost will be $375,000,000. The original estimate of the cost of the Drainage Canal of Chicago was about $16,000,000, whereas $53,000,000 has been expended thereon. In fact, such has been the history of all public works. Why? Because it is much easier to secure an appropriation if it appear modest

Year	Power rentals	Interest income on sinking fund	Gross earnings	Interest charges on bonds	Net earnings	Sinking fund
First	$2,500,000.00	–	–	$800,000.00	$1,700,000.00	$ 1,700,000.00
Second	2,500,000.00	$ 34,000.00	$2,534,000.00	800,000.00	1,734,000.00	3,434,000.00
Third	2,500,000.00	68,680.00	2,568,680.00	800,000.00	1,768,680.00	5,202,680.00
Fourth	2,500,000.00	104,053.60	2,604,053.60	800,000.00	1,804,053.60	7,006,733.60
Fifth	2,500,000.00	140,134.67	2,640,134.67	800,000.00	1,840,134.67	8,846,868.27
Sixth	2,500,000.00	176,937.37	2,676,937.37	800,000.00	1,876,937.37	10,723,805.64
Seventh	2,500,000.00	214,476.11	2,714,476.11	800,000.00	1,914,476.11	12,638,281.75
Eighth	2,500,000.00	252,765.64	2,752,765.64	800,000.00	1,952,765.64	14,591,047.39
Ninth	2,500,000.00	291,820.95	2,791,820.95	800,000.00	1,991,820.95	16,582,868.34
Tenth	2,500,000.00	331,657.37	2,831,657.37	800,000.00	2,031,657.37	18,614,525.71
Eleventh	2,500,000.00	372,290.51	2,872,290.51	800,000.00	2,072,290.51	20,686,816.22
Twelfth	2,500,000.00	413 736.32	2,913,736.32	800.000.00	2,113,736.32	22,800,552.54
Thirteenth	2,500,000.00	456,011.04	2,956,011.04	800.000.00	2,156,011.04	24,956,563.58
Fourteenth	2,500,000.00	499,131.27	2,999,131.27	800,000.00	2,199,131.27	27,155,694.85

SUMMARY

Sinking-fund accumulation		$27,155,694.85
Interest on bonds during construction period, 6 years at 4 per cent	$ 4,800,000.00	
To retire bonds	20,000,000.00	24,800,000.00
Balance earned over and above cost of waterway and water power		$2,355,694.85

in amount. After $20,000,000 has been expended, if only $10,000,000 more be required, the pressure for an additional appropriation is very strong. The original $20,000,000 should not be wasted for want of another paltry $10,000,000, it is argued, and the remainder is usually forthcoming.

The President of the Board of Trustees of the Chicago Sanitary District states that sufficient investigations of the probable cost of the enterprise were not made by the Internal Improvement Association to warrant any accurate estimates, and he points out that the figures given are with the proviso that the entire right of way be furnished free, "an idea predicated upon the confiscation of the real estate, channels, and retaining walls of the Sanitary District from Lockport to Patterson Island in Joliet, which are worth in their present condition much over $2,000,000." [1]

It should be noted, further, that the Special Board of Army Engineers, which was appointed by the United States Government to investigate the project, estimate that the $20,000,000 which was voted by the people of the state would be merely sufficient to construct a channel eight feet in depth.[2]

Again, the estimates make no allowance for the cost of maintaining the waterway. The support of an administrative office and of a law department for the adjustment of claims would involve heavy annual outlays. "With the limited discharge of 4200 cubic feet per second, which was all that had been authorized prior to 1905, 224 suits had already been brought against the trustees of the district, the claims aggregating $4,409,170."[3] The diversion of so much as 14,000 cubic feet of water per second from Lake Michigan into the Illinois River would cause extensive damage

[1] *Proceedings of the Board of Trustees of the Sanitary District of Chicago,* January 26, 1910, p. 86.

[2] See page 359.

[3] *Report by Special Board of U.S. Engineers on Survey of the Mississippi River,* 1909, p. 27.

to the lands subject to overflow, for which the Sanitary District of Chicago would be liable.[1]

Among the many items of expense in the maintenance of a waterway in good condition for navigation, the cost of dredging is particularly heavy. The Drainage Canal, although entirely without tributaries, is beginning to fill up with sediment, and according to a recent report of the Board of Trustees provision must soon be made for a dredging equipment.[2] The Lockport-to-Utica division would receive the deposit of a half-dozen tributary streams. The Manchester Ship Canal, 35.5 miles in length, and having comparatively few tributaries, requires an expenditure of more than $200,000 a year for dredging.[3] Surely, then, in computing the revenues to flow into the treasury of the state, such items as these cannot fairly be entirely omitted.

Now, let us consider the estimates of the value of the water power to be developed. In the first place, it is to be noted that the computation assumes that all of the water power available for sale can at all times be disposed of. Is it not reasonable to believe that at least some of the available product might for a time be unable to find a market? The above computation, while presenting the case "in its most unfavorable aspect," is based on the assumption that the very first year that the waterway is open, the full 100,000 horse power would be sold. Of course no one can determine precisely how much of the product could be marketed at all times, especially at the rates named; but there is little question that an estimate which purports to be ultra-conservative should make considerable deduction to cover possibilities of failure to market all of the available supply.

[1] *Report by Special Board.* It would also probably affect the level of the Lakes and thus involve international complications. This has been a subject of much dispute and is still unsettled.

[2] *Proceedings, supra,* p. 87. [3] See page 153.

It should be remembered that there are a large number of steam plants in existence in and about Chicago which could not be expected to shut down until they are worn out, and that there are many plants which use the by-products of their own manufactures in the creation of steam, thereby making the cost of power very small. Furthermore, in all these surrounding towns are public service corporations with franchises, most of them with existing generating machinery. They will not shut down their existing plants to take water power, except at a marked advantage; and, moreover, they are more or less connected in a combination and will act in concert against the state's competition.[1]

In the second place, it is assumed that all the power that can be developed along the route will belong to the state. Now, if private interests should gain control of a part of the water power, it is clear that the revenues to the state would be proportionally decreased. And the fact is, that the state is far from being in control of all the water-power rights along the route. The Economy Light and Power Company, connected with the Commonwealth Edison Company, acquired from the Illinois and Michigan Canal Company on September 2, 1904, a twenty-year leasehold interest in the best site along the entire waterway, at Dresden Heights, about four hundred feet north of the junction of the Des Plaines and Kankakee Rivers where they form the Illinois. Suit was brought by the Governor of Illinois in the name of the people for the purpose of ejecting the Economy company from the premises. In October, 1909, the Supreme Court of the state rendered a decision against the people, sustaining the electrical company at every point. The court held that "if the powerful hand of the Government is to lay hold of this gigantic enterprise, it must do so with due regard to the sacred rights of every citizen, however humble and insignificant those rights may

[1] *Proceedings of the Board of Trustees of the Sanitary District, supra,* p. 86.

seem in contrast with the great public consummation."[1] Vested interests in an unnavigable stream are sacred in the eyes of the law and must be protected even at the expense of what appears to be public weal.[2]

Let us see what effect this situation has upon the proposed financial scheme of the state. Before the decision of the Supreme Court of Illinois was given, Governor Deneen, the champion of the water-power idea, admitted that "so large a deduction from the total available power would render abortive the proposed financial scheme of the state."[3] The Illinois internal improvement commissioners[4] have estimated that the water-power rights at Dresden Heights which are owned by the Economy Light and Power Company, "are over 28,000 horse power, and the holdings of the same company at Hickory Creek are about 14,000 horse power, making a total of 42,000 horse power."[5] They further say that, as the market develops, this "power may reach an investment value of $1000 per horse power, as in older countries, and it may produce taxable wealth of three or four times this amount."[6] These value estimates were made of course for the purpose of showing the people how rich they were to grow from the development of the state's resources, and not for the purpose of informing the Economy company what price the state would be willing to pay for its holdings in case the state should wish to purchase the site at Dresden Heights. While the present value of these sites is but a fraction of this amount, the possibility of a large future earning power has been already heavily capitalized, and there is little question that if the state should desire to purchase these rights it would

[1] *Illinois Reports*, vol. 241, p. 291.

[2] Had the Des Plaines River been a navigable stream the decision would have been against the electrical company, because the law holds that the public interest in a navigable waterway is paramount to all others.

[3] Message to the legislature, November 6, 1907.

[4] Isham Randolph, H. M. Schmoldt, and H. W. Johnson.

[5] *Report of 1909*, p. 51.

[6] *Ibid.*, p. 52.

be asked to pay handsomely therefor. If several million dollars be added on this account to the original cost of over $18,000,000, the water-power scheme loses much of its golden promise. The situation would not be bettered should the state decide not to purchase these rights from the Economy company; for in that event more than forty per cent of the estimated revenues from the sale of water power by the state would have to be canceled.

There is yet another assumption in this computation which is open to serious criticism. It is put as a conservative estimate that all of the 100,000 horse power available can be marketed at an average price of $25 per horse power per annum, net, — that is, above operating expenses. Let us examine this estimate.

The United States Government has leased water power at rates varying from 50 cents to $3 per horse power per year [1] and even at such low rates much of the power available has found no market. "The Government has many dams already built that give immense potential horse power, and an unappreciative and unpatriotic public coldly passes them by and buys coal at $4 a ton with which to produce power. At the dams on the Muskingum River in populous Ohio, energy is now sold at 50 cents per horse power per annum and at . . . Augusta, Georgia, it is sold for $1 per annum." [2] The amount of power that can be sold and the price it will bring, will of course vary greatly in different sections of the country because of differences in industrial conditions. Some regions may have comparatively little demand for electrical power; other sections may be well supplied with cheap fuel for the manufacture of steam power; still other places may bid high for hydro-electric power. Consequently, no general estimates of the value of hydro-electric power can safely be made. The conditions in Ohio may, however, be regarded as some-

[1] *The World To-day*, March, 1910.

[2] Peyton, *The American Transportation Problem* (1907), p. 23.

what comparable to those in Illinois. Again, conditions in western New York may be considered as not greatly different from those in Illinois. The Niagara Falls Power Company furnishes electricity to tenant companies on its lands at rates ranging from $18.60 per horse power per annum, for a 60-kilowatt motor running ten hours a day, to $28.80 for a 10-kilowatt motor running ten hours a day; while for special service in amounts of 500 horse power or more the rate is $28 per horse power per year.[1] These figures, be it observed, do not represent net earnings. They include all of the costs of production. Now, if it be assumed that the power company makes a profit of 10 per cent, the net earnings per horse power per year vary from $1.86 to $2.88. "In North and South Carolina the average charge is $15 per horse power per year for sixty-six hours per week."[2] Mr. W. E. Herring, an engineer in the United States Forest Service, states that "water power can be and is sold for as low as $20 per horse power per year when necessary to secure the business."[3] That is, it is sold for that price except where monopoly conditions permit a higher price.[4] These estimates all mean that private companies can make a profit when selling hydro-electric power at about $20 per horse power per year. The net profit would therefore doubtless be something near $2 per year. Such facts as these do not give much assurance that the State of Illinois would be able to dispose of all of its available power at an average net profit of $25 per horse power per year.

It seems, moreover, that the rates paid for the water power would, in nearly every case, be entirely under the control of the Commonwealth Edison Company. This company "controls all the franchises and all the power plants, excepting

[1] These rates were secured from the Niagara Falls Power Company.

[2] *Preliminary Report of the Inland Waterways Commission*, p. 449.

[3] *Ibid.*, p. 450.

[4] The only case cited by Mr. Herring where private companies have a virtual monopoly is in California. There in some cases power has been sold for as much as $98 per horse power per year (*ibid.*, p. 448).

that of the Sanitary District and three or four insignificant municipal plants, within a radius of fifty miles of the city hall of Chicago. From Waukegan to Oak Park, from Joliet to Harvey, the Commonwealth Edison Company holds sway. It owns the Cosmopolitan, it owns the North Shore, it owns the Economy Light and Power Company. It proposes to control all the electric railroads, surface and elevated, and to furnish power to the steam roads as well. It has an enormous steam power production, and will not furnish water power except at a bargain.[1]

"Now, the present plan provides that the state shall erect power houses, water wheels, and generators and sell power at the power houses. Who will come to bid? The Commonwealth Edison Company and its constituent companies? Yes, and at their own price. Anybody else? If so, who and how?"[2] There is no chance whatever for independent concerns to compete with the Commonwealth Edison combination.

In the light of these many considerations it is apparent that very little revenue could be derived from the sale of water power along this route. The power now being developed along the Drainage Canal is sufficient to supply any demands that may arise, and the chief result of the increased flow between Lockport and Utica would be to strengthen the position of the Commonwealth Edison Company.

[1] Such a control of all the lines of the Chicago district has been secured since the above was written.

[2] *Proceedings of the Board of Trustees, supra,* p. 88.

CHAPTER XVII

A DEPTH OF EIGHT FEET FROM LAKES TO GULF

1. THE two previous chapters have considered the projects for a waterway from the Great Lakes to the Gulf of Mexico which call for depths of twenty-four and fourteen feet respectively. It remains to inquire as to the feasibility of constructing an eight-foot waterway from Chicago to New Orleans. The Government engineers, who have denounced the building of a deep waterway, are nevertheless disposed to regard this project with favor. In fact, a compromise on this depth between the enthusiastic advocates of waterway development, on the one hand, and the more conservative Government Engineering corps and the National Waterways Commission, on the other, is not unlikely.[1]

Plans for the regularization of the Mississippi River, now nearly completed, will give it a permanent channel depth of eight feet from St. Louis to the Gulf. The present question, therefore, narrows down to a consideration of the practicability of constructing a channel eight feet deep from Chicago to St. Louis.

The proposed route is by way of the Chicago River and the Drainage Canal for a distance of thirty-six miles to Lockport. This section would need no improvements. From Lockport to Utica, a distance of sixty-one miles, it would follow the Des Plaines River through what is called the "rock-bound valley." From Utica the route would utilize the Illinois River for a distance of two hundred

[1] A depth of nine feet has been given a great deal of consideration. The army engineers believe, however, that a present depth of eight feet, which can be extended to nine feet if later developments so warrant, is the more feasible.

and thirty miles, to its mouth at Grafton; thence the Mississippi to St. Louis, thirty-six miles below. This portion of the route, from Utica to St. Louis, already has a depth of about seven feet for most of the distance. The increased discharge of water from the Drainage Canal would materially raise the level of the Illinois River, and it is estimated that by means of dredging a depth of eight feet could be provided at comparatively small outlay.[1]

2. It is now our purpose to consider the probability of an extensive development of traffic on the proposed route. The spirited debates on the relative merits of the different depths of channel that have been proposed have tended to divert attention from the question of traffic. The Government engineers have pronounced a verdict that a waterway eight feet in depth would be of sufficient size to care for all the prospective traffic, present and future; but this may not be a sufficient justification for the construction of the waterway. Ought not the question to be raised whether the prospective present and future traffic is sufficient in amount to care for the waterway? Or, in other words, is there any assurance that there is sufficient traffic which will use the waterway to justify its construction?

It may be concluded at once that it is certain that this waterway, like every other one of shallow depth, would have to rely almost entirely upon bulky traffic of relatively low value. It would unquestionably be of the same general character as that which moves on the present waterways of this country and on the barge canals of Europe. In the succeeding pages we shall, therefore, consider the relation to the route in question of such commodities as usually travel by water, in an attempt to ascertain the extent of traffic development that could be expected between Lake Michigan and points along the Mississippi River.

[1] For cost estimate see p. 359.

3. It is claimed by the advocates of the Lakes-to-Gulf Waterway Association that a vast quantity of grain and other agricultural produce would be readily marketed by means of this waterway; whereas now, for want of adequate railway facilities, it not infrequently must remain for weeks, and often eventually spoil, in the hands of the farmers.

To test the truth of this contention, it is only necessary to recall what was learned in a preceding chapter, namely, that one of the chief reasons for the decline of traffic on American waterways has been the cost of transshipment. Only a small fraction of a per cent of the agricultural produce of the Middle West is grown near enough to this or connecting water routes, to allow of direct loading from the farmers' wagons to barges. And, due to the fact that we are consuming within this country an ever-increasing proportion of our agricultural produce, double transshipments are becoming more and more necessary where water lines are used; that is, it is necessary to transship freight first from rail to water, and then again from the waterway to the railroad which is to carry the traffic to the final destination. This is in contrast with export traffic where only a single transshipment is required before it reaches the shipping port. Where double transshipments are necessary, there is no possibility that any considerable amount of traffic will use a waterway. It should be recalled here that France has been utterly unable to develop a transshipping business, and that it has been secured in Germany only by means of heavy subsidies.

It is also recognized in Germany, it should be recalled, that agricultural produce cannot advantageously be carried to market by water for the reason that farming is a decentralized industry, and the produce must be collected from a relatively wide area. The Germans recognize that when it is once on the railways it is cheaper to allow it to go all the way to market by rail. Only in the case of imported foodstuffs, the destination of which is industrial towns on the banks of water routes, does agricultural produce make extensive use of the waterways of Germany; and the same is likewise true of France. It is needless to say that there is practically no import trade in foodstuffs in the United States.

In this country, however, agricultural produce which is destined for export might possibly travel the long distance from Chicago to the Atlantic Ocean or to the Gulf of Mexico, if efficient water routes were available. Without at this place going into the question of the amount of export traffic in foodstuffs, or the relative cost of moving it by rail and by water from the Middle West to the seaboard, it can be stated with certainty, nevertheless, that farm products whose destination is in Europe would not travel from Chicago or Duluth by way of the Gulf of Mexico, when they could use a route several thousand miles shorter by way of the Great Lakes and the Erie Canal, or by way of the Great Lakes, the Canadian canals, and the St. Lawrence River. It may also be said without fear of contradiction, that we never will export large quantities of foodstuffs to South America, for the good reason that the South American continent is better adapted to the growing of agricultural products than is North America. Traffic in farm products between Chicago and New Orleans would therefore be a negligible quantity.

4. The commodity which it is thought would make most extensive use of a waterway through Illinois is coal. It is argued by some that coal might be brought all the way to Chicago from Pennsylvania; that is, that it would travel down the Ohio, then up the Mississippi and Illinois Rivers, and the new water route to Chicago. As throwing light upon the possibility of such a development, two facts of importance should be mentioned. First, but a very small part of the coal which is at present floated down the Ohio

is sent up the Mississippi to St. Louis, although the depth of the river is eight feet for nearly the whole year. Second, there is an abundance of coal much nearer Chicago, in the Indiana and Illinois coal-fields. If any coal would use the waterway it would be that from the Illinois fields.

In order to discover whether coal produced in Illinois would be carried to Chicago and St. Louis by water, it is necessary to give attention to the precise source and the ultimate destination of this coal. As to its source, it should be noted that it is not located immediately upon the banks of the proposed water route, where, as in western Pennsylvania, it could be loaded at once into barges. Much the greater part of it, at least, would have first to be brought to the waterway by rail and then be transshipped to boats. In order to insure the carriage of this coal by water, therefore, the savings in haulage charges, on the waterway — granting, for the sake of argument, that there would be savings — would have to be more than sufficient to cover this cost of transshipping. Now, since the distance from central Illinois to either Chicago or St. Louis is comparatively short, the savings in hauling by water would at best be relatively unimportant. It is a cardinal principle in European transportation that, in order to offset the losses involved in transshipping, the savings on the waterways must be extended over a long distance. (It should be borne in mind here that when we speak of savings on the waterways we are not admitting that water transportation is cheaper, all factors considered, than that by rail. The lower rates on waterways are usually due to the fact that they are supported by the Government. We are merely calling attention to the consideration that, even if there were savings in particular cases so far as the mere hauling between two points is concerned, the whole story is by no means told thereby. We must consider the entire charge from point of origin to point of destination.)

Let us now consider the destination of this coal. Only a very small portion of it would be used by factories located on the banks of the Drainage Canal and the Chicago River. The belief that the district along the Drainage Canal is soon to become a veritable hive of industry is based on the assumption of a *deep-water* connection with the Gulf. If ocean vessels were to come inland to Chicago it might be to the distinct advantage of industrial establishments to locate along the waterway. But manufactured products are not profitably shipped by barge or canal boat, and there would hence be little inducement for plants to locate near a Lakes-to-Mississippi barge canal, so far as considerations affecting the shipments of their finished products are concerned. It might, indeed, be thought that they would so locate for the purpose of receiving their supplies of fuel and raw materials by water, but since it is absolutely imperative that they be in touch with railway communication, it cannot but be expected that they will make the determining factor in the choice of a site the excellence of railway accommodations. In support of this, witness the fact that everywhere in this country our industries have been built up around the railways, and have almost wholly disregarded the possibilities of water transit. Not until a waterway exists which can be depended upon to carry all the traffic of establishments, at all times, and to all destinations can we expect to see it attract them to its banks.

The present industries of Chicago, at any rate, are for the most part not in close proximity to the proposed route, and it is apparent, therefore, that coal brought into Chicago by canal would have to be carted a greater or less distance across the city in order to reach its final destination. Here arises the same consideration that was found to be decisive in London.[1] "The railways penetrate every part of Chicago with their spurs, sidings, and industry tracks, and place coal very near if not immediately beside the furnace where it is to be burned. Delivery by vessel generally involves

[1] See chapter VI.

an extra handling at the docks and a long haul by team, which frequently costs as much as the entire transportation from the mine."[1]

In the case of coal for household consumption, the railways possess the twofold advantage of being able to deliver it in the section of the city where it is needed, and of carrying it with less breakage than could the waterway. Then, too, the canal would be blocked by ice for a considerable portion of the year, and at the very time when coal is most in demand by the householders.

We find, therefore, that there would be heavy extra costs at both ends of the line, if coal were shipped to Chicago by water. If the Illinois canal were supported free of tolls, it would still be folly to suppose that the slightly lower haulage rates for a distance of a couple of hundred miles, which might possibly result, would be sufficient to pay for the cost of transshipping from the railroads to canal boats and the cost of a long wagon haul in the city. To believe that this coal would be shipped to Chicago in large quantities by water is wholly to ignore the history of water transportation in this and other countries.

Let us now inquire as to the probable extent of the reduction in freight rates that may be expected on this canal. The following are some average rates on coal per net ton by rail in Illinois, and by water in Europe for similar distances:[2] —

	Distance	Rate
Antwerp to Charleroi *via* Scheldt and canal . .	87.87	$ .56
Streator to Chicago *via* Sante Fé	94.00	.81
Charleroi to Ghent *via* Scheldt and canals . .	110.37	.66
Danville to Chicago *via* C. & E. I. R. R. . . .	123.40	.67

[1] Tunell, in *Report of Chicago Harbor Commission*, p. 227.

[2] *Ibid.*, p. 235. These railroads entering Chicago were recently permitted to raise their rates on coal seven cents a ton. To obtain the present rates this amount should be added to the figures in the table.

	Distance	Rate
Antwerp to Paris *via* Scheldt and canals . . .	287.50	1.70
Duquoin to Chicago *via* Illinois Central . . .	287.04	.90
Antwerp to Cologne *via* Rhine	256.25	.55
Wenona to Chicago *via* Illinois Central . . .	138.04	.55
Antwerp to Mannheim *via* Rhine	418.75	1.10
Eldorado to Chicago *via* Big Four	306.80	1.00

It may be seen from this table that the railway rates on coal in Illinois compare very favorably with the water rates in Europe. It should be recalled here that these water rates are not sufficiently high to cover permanent charges on the fixed capital invested. In most cases they represent little more than the mere haulage charges, the Rhine River, for instance, being entirely free of tolls. On the other hand, the railways in Illinois are attempting to earn profits on their entire investment. In the light of these figures there is little reason to believe that the rates for coal on a canal through Illinois, even if no tolls were charged and the canal were supported out of general taxation, would be any lower than those on the present railways. This being true, and with heavy extra costs at both ends of the route if the coal were carried by water, the case appears conclusive that the railroads would continue to furnish Chicago with her supply of coal. The situation at St. Louis is practically the same. The lower Illinois and the Mississippi, moreover, are at present deep enough to carry coal to St. Louis, but very little of such traffic has developed.

It should be observed, finally, that a large part of this coal in Illinois is owned by the railroads, — a fact sufficient to dispel any lingering hope that it would forsake the railways if a water route to Chicago were available.

It cannot be expected that any traffic in iron or other ores would develop along a water route between Chicago and St. Louis, for the reason that there are no deposits of ore in this section of the country.

5. The water tonnage, after coal and ores, which is usually of most importance is that in building-materials of various kinds, sand, clay, gravel, cement, etc. It seems, however, that a canal through Illinois would be of little use in the transport of these materials.

In the first place, building-materials are seldom brought from long distances. The supply of sand within the city of Chicago is unlimited, and excellent clay is near at hand. Stone of good quality can be found at many places within the city limits and along the Drainage Canal. The Illinois Steel Company has a huge cement plant, just across the state line in Indiana, and Chicago will continue to receive the greater part of her cement supply from there. A waterway connection from Lockport to the Mississippi River would be of no service whatever in furnishing Chicago with building-materials. The Drainage Canal and Lake Michigan already afford all the waterway service for this sort of traffic that is required.

Even were it necessary to ship building-materials to Chicago from a distance, the railways would possess a decided advantage over a canal for that purpose, in being able to deliver the materials near the sites of the building operations, thereby saving the heavy cost of trucking within the city. A builder in Chicago, at any considerable distance from the Drainage Canal or the river, will say without hesitation that the cost of trucking his materials from the river or canal for several miles across the city is prohibitive. This consideration accounts for the fact that comparatively little of such traffic now makes use of the Drainage Canal.

For similar reasons the opening-up of a through route from Chicago to the Mississippi would not aid St. Louis in this regard. The Mississippi and the Missouri in their present state furnish sufficient means for carrying such traffic as demands water transportation. Again, few building-materials would be shipped in from a distance.

Some local traffic in building-materials might be expected to develop at intermediate points, but it could not be heavy at best, for the reason that there is comparatively little sand, clay, or brick requiring shipment. The greater portion of it is always produced at home and is carried for the short distance necessary by wagons.

6. Traffic in lumber presents another possibility for a water route between Chicago and Mississippi River points. In order to ascertain the future of lumber as a waterway commodity, it will be necessary to consider the sources of the lumber supply of the Middle West.

The states of Michigan, Wisconsin, and Minnesota were once covered with what was considered an inexhaustible supply of timber. Millions upon millions of feet of white and Norway pine and of the less valuable grades of timber were in the early days annually floated down the streams tributary to the Lakes and the Mississippi to be manufactured in Chicago, Milwaukee, Muskegon, and other Lake cities, and in Minneapolis, St. Paul, St. Louis, and many other towns on the Upper Mississippi. Timber made up the great bulk of the water traffic of the Northwest. But in recent years conditions have materially changed. Our forest resources have proved to be far from inexhaustible; already great sections of these Northern States have become burned-over "slashings"; while the virgin forests familiar to the preceding generation are almost a thing of the past. Stream after stream has sent down its last log, and lumber town after lumber town has turned its attention to some other form of manufacture. The forests adjacent to the rivers were the first to be depleted, and what timber remains is now so far removed from the streams that the old method of floating logs down them in the spring has been abandoned. The sawmills have been removed from the river towns to new lumbering centres, inland near the source of the timber supply. And from these interior mills the manufactured lumber is sent to market more advantageously by railways, since they obviate the necessity of transshipping en route.

Changed methods of doing business at the mills also partly account for the increasing lumber traffic by rail. "It is now the custom to sort lumber where it is sawed and to fill orders of consumers and country dealers directly from the mills. These consignments generally go by rail. Formerly the sorting was done by the wholesalers at the great distributing centres about the Lakes, who bought supplies by the cargo and often made a large portion of their profits by a nice manipulation of the mixed stocks received." [1]

The exhaustion of the supply of the timber in the region bordering the Great Lakes makes it certain that there would be almost no lumber traffic to be shipped by water from Chicago to points on the Mississippi River. The receipts of lumber at Chicago by Lake reached their maximum as early as 1882, since which date the total has rapidly declined, as shown in the table which follows.[2]

Year	Receipts of lumber
1882	1,872,976,000,000 feet
1885	1,504,186
1890	1,349,921
1895	1,073,847
1900	590,270
1905	448,163
1907	411,947

The diminishing supply of lumber in the territory surrounding the Great Lakes is becoming more and more insufficient to meet the needs of local consumers.

But while it may be true that lumber would not be shipped by water from Chicago to points on the Mississippi River, is it not likely that an extensive traffic in the opposite direction would develop?

[1] *Report of the Chicago Harbor Commission*, 1909, p. 205. [2] *Ibid.*

Attention was called in chapter v to the decline of the lumber traffic on the Upper Mississippi River as a result of the exhaustion of the timber supply near its tributary streams, and it is consequently only necessary to state here that traffic in lumber between Upper Mississippi towns and Chicago is not to be expected.

If any lumber traffic is to develop on the water route in question it must be in lumber shipped from places on the southern Mississippi or tributaries to Chicago. The exhaustion of the timber supply in the Northern States has necessitated the opening-up of the great forest resources of the South, and it is believed by many that if a Lakes-to-Gulf waterway were constructed, a very extensive waterway traffic would develop between the Southern forest regions and the Northern markets.

The bulk of the timber immediately along the Mississippi has, however, already been manufactured. What remains is almost entirely in the hands of speculators, who are holding it for a higher price at some future day. There is at present comparatively little manufacturing of lumber carried on in the towns on the Lower Mississippi. The mills have moved to interior points, near the source of supply, and such lumber finds the railways the more economical means of shipment.

There are great quantities of pine, cottonwood, and gumwood, however, which are located along the headwaters of such rivers as the Arkansas, the Ouachita, the Black, the Red, the White, and the St. Francis, western tributaries of the Mississippi. And until the process of exhausting the supply of timber along these streams is completed, it is possible that they might serve as important feeders to the Lower Mississippi. Granting this to be true, the question which concerns us here is whether this lumber would be sent to Chicago by water if a waterway connection were available.

It should be recalled that by far the greater part of the timber traffic on our rivers has been in the form of logs. The method employed has been to float these downstream, without the use of vessels of any kind. Now, it is manifestly out of the question to float this timber up the Mississippi and the Illinois River for more than a thousand miles. The timber that is shipped north will be mainly in the form of manufactured lumber.

The timber along these rivers might, however, be floated down to the Mississippi to be manufactured in towns along its lower course, whence it could be shipped by way of the river to Northern markets. The fact is, however, that the lumbermen have preferred rather to build new mills along these tributaries than to float the logs for long distances down them to cities on the Lower Mississippi. The mills are following the tributary streams and keeping close to the source of the supply of the timber. Consequently, if this manufactured lumber is to be sent to Chicago by water, it must first travel down these tributaries to the Mississippi, by boat, and then be sent north. This process would involve transshipping from the smaller boats on the tributary streams to the larger vessels on the Mississippi; or else foregoing the advantage arising from the use of the large boats for a part of the journey. And, moreover, it would involve traveling over a most roundabout course in order to reach the final destination.

The distance from the upper courses of the rivers above mentioned to St. Louis or Chicago is two or three times as far by river as it is by rail. If shipped by river this lumber would have to travel several hundred miles down these tributary streams in a direction almost opposite that of their final destination. Then the extraordinary sinuosity of the Mississippi makes the distance by water from one point to another nearly as far again as that by rail. The distance from the Upper Arkansas River to St. Louis is nearly four times as far by river as by rail. With such a handicap in the matter of distance added to that of transshipment, the river route would be utterly unable to compete with the railways for this traffic.

If there were decided advantages in shipping Southern lumber to market by water, we would expect to find an extensive development of water traffic between southern Mississippi points and St. Louis. Since the Mississippi has a depth of eight feet as far north as St. Louis for nearly the entire year, there is as much reason to believe that the water traffic to St. Louis should have increased in recent years as to believe that it would develop on an eight-foot waterway to Chicago. The statistics below show the receipts of lumber at St. Louis by rail and by river from 1902 to 1906 inclusive. They include receipts from both directions, but since there is now comparatively little lumber traffic on the Upper Mississippi, they fairly represent the situation as regards the lumber trade from the South.[1]

	1902	1903	1904	1905	1906
By rail, — cars . .	131,576	125,847	124,045	137,083	146,741
By river, — feet . .	51,957,800	33,083,600	21,663,800	11,773,300	5,312,800

The traffic on the railways shows a substantial increase, while that by water has decreased with surprising rapidity. The amount carried by boat, moreover, is but a small fraction of that on the railways.

The same railway advantages are present in the case of the lumber traffic as in the case of coal and building-materials. When it is carried by rail, transshipments are unnecessary, and at the same time it can be delivered as a rule much nearer the spot where it is to be used. It would seem certain, therefore, that very little traffic in manufactured lumber could be expected to develop between Mississippi River points and Chicago.

7. Cotton is another commodity which it is believed would make extensive use of a waterway between Chicago

[1] *Report of the Inland Waterways Commission*, p. 157.

and the Gulf of Mexico. The development of manufacturing in the Middle West will without doubt result in an increasing proportion of the cotton supply of the South being sent north each year to such central points as St. Louis and Chicago. The bulky nature of raw cotton at once suggests the possibility that it would incline to water transportation were a water route available.

In the chapter treating of the decline of water transportation in this country in recent years attention was called to the heavy falling-off in the receipts of cotton by water at New Orleans.[1] The following table shows that St. Louis has had a like experience. The statistics are for the receipts of cotton by river and by rail at five-year intervals:[2] —

Year	By river (bales)	By rail (bales)
1889–90	13,539	525,371
1894–95	9,213	917,072
1899–00	7,172	873,079
1904–05	3,039	546,876

The receipts by water are seen to be almost negligible, and there is no more reason to believe that cotton would make a more extensive use of an eight-foot waterway to Chicago than it does to St. Louis. What is the reason for the failure of cotton to use present waterways?

Attention was called in chapter v to the shifting of the areas of cotton production after the Civil War. In the early days the cotton plantations were confined almost entirely to the river valleys, and the cotton was loaded directly from the wagons of the farmers to the river boats. But with the development of other means of transportation in the South, the culture of cotton has been pushed further and further back from the banks of rivers, until now the greater portion of it is produced in interior points

[1] See page 93.

[2] *Report of the Inland Waterways Commission*, p. 157. These statistics are not kept by calendar years.

which possess no waterway connection. It must be collected by the railroads. Hence the familiar handicap of the cost of transshipment comes up again and operates to compel the cotton to go all the way to market by rail when once it is on the railway cars. Cotton does not differ from other agricultural produce; it is produced over a relatively wide area, and for this reason cannot advantageously make use of water transportation. If cotton were produced in Germany it would be no more extensively shipped by water there than it is in this country.

8. It is believed by some that a considerable quantity of certain kinds of manufactures would make use of a waterway between Chicago and the Mississippi. For instance, it is thought that such commodities as canned goods and packet freight, which do not require great speed in delivery, could very advantageously be shipped by water from Chicago to cities along the Lower Mississippi. Now, the truth is that shipments of this sort from St. Louis by water are negligible, and that the quantity shipped on the Erie Canal is very small, and that even this is under the control of the railroads. Railways may afford to make use of a toll-free waterway supported by the State, but they would never think of undergoing the cost of constructing a canal for this purpose. Such freight as this does not make up one per cent of the traffic on the waterways of Germany, and it could not be expected to do more in this country.

Even though a considerable amount of such traffic should develop, it is by no means clear why all the inhabitants of the country should contribute to the building and the maintaining of a waterway free of tolls (for if tolls were charged it would not be used at all) in order to benefit a mere handful of dealers who chance to be able to make some use of it. Unless a waterway can be used extensively in the transport of a class of freight, the cheap carriage of which affects the well-being of the majority of the people, there is no economic justification for the State's constructing it.

9. Much promise has been held out for the development of an extensive trade with South America as a direct result of the opening of a waterway connection between the Great Lakes and the Gulf of Mexico. The trade routes of the future seem destined to swing from the general east-and-west direction which has prevailed so long and to follow that of the meridian circles. A Lakes-to-Gulf waterway, then, it is urged, will in the near future be in the very pathway of a great traffic between the United States and the countries of South America. With the opening-up of the Panama Canal an immense traffic may be expected to develop between the western coast of South America and our Middle Western States. In view of these prospective trade developments it is pertinent to inquire precisely what the relation of a waterway eight feet in depth would be to the commerce with South America.

It should be called to mind, first, that the belief that a vast waterway traffic would develop between the region about the Great Lakes and South America has been predicated upon an assumption of a waterway of sufficient depth to permit the passage of ocean or Lake steamers. Such vessels were to load at Chicago and proceed, without breaking bulk, directly to South American ports. Now, it is plain that if the Lakes-to-Gulf Waterway is to be only for barges, then quite a different aspect is given to the situation.

When barges are employed, transshipment to ocean vessels at New Orleans is necessary, thus destroying the advantages which a through water route possesses over the broken journey. Again, very few manufactured commodities could be expected to use a barge waterway. It is necessary, therefore, to raise the question, What sort of bulky produce, which alone could use a barge waterway, will the United States be likely to ship to South America?

Grain and other agricultural produce are suggested first. The truth is, however, that South America is rapidly gaining upon the United States in the production of grain and other foodstuffs, and possesses probably much greater ultimate capacity in this direction than does the northern continent. We cannot, therefore, expect to witness any traffic development of this sort over the route in question.

Such commodities as coal and building-materials cannot at present be sent the great distances that are here involved, on account of their low value. It may be said further that South America will never have need of our building-materials, and if the time should come when she will demand coal for the purpose of manufacture the United States will not have any to spare.

It is needless to say that we have no lumber for export, and that raw cotton will never be sent to South America to be manufactured. The trade from North to South America will be confined to manufactured products and these can seldom make use of a barge waterway.

In one class of manufactures alone does there seem to be much if any possibility of a development of water traffic in the South American trade. A considerable amount of heavy and cumbersome structural steel and iron materials are being demanded now in South America and these might be sent from Chicago to the Gulf by water.[1] It must be said, however, that the bulk of these materials is at present sent to South America from Europe, and there is no guaranty that the United States would be able to secure the trade by means of a waterway from the Lakes to the Gulf. The freight savings (to the shippers) on a toll-free waterway, might not be sufficient to defeat the years of persistent effort on the part of the English and the Germans to cultivate friendly trade relations with

[1] Transshipment at the Gulf would still be necessary.

South America. But granting that we could secure the lion's share of this traffic, it is readily apparent that this would be of importance chiefly to the United States Steel Corporation.

As regards the import trade from South America, the prospect of the utilization of a Lakes-to-Gulf waterway is little if any better. The principal South American products sent to the United States are coffee, cocoa, dyewoods, nitrates, and guano. These are distributed over wide areas within this country, and the railways, in almost every case, offer much the more convenient means of transit, and they eliminate the necessity of transshipping en route. Statistics of water transportation in this country and others reveal that such commodities as these do not usually travel by water. The only import traffic on the waterways of Germany and France which is important is that in grain, ores, and coal in Germany, and grain, coal, and wines in France. In the absence of an import trade of this sort, the waterways are doomed to receive but a scanty traffic at best.

The trade possibilities of the United States with Mexico and Central America are very similar to those with South America. These countries offer a market for our manufactured products, and they send us in turn mainly coffee and fruits.

The total freight tonnage passing between Chicago and St. Louis is not heavy at best; and it is shared by three railroads; the Chicago and Alton, the Illinois Central, and the Wabash, none of which has approached the limit even of its present carrying capacity. "During the fiscal year ending June 30, 1904, the quantity of freight moved by these three roads from Chicago to St. Louis was 449,115 tons, and from St. Louis to Chicago was 633,182 tons,"[1] making a total traffic of but little more than a million tons. Any one of these roads could easily handle this entire

[1] Peyton, *American Transportation Problem*, p. 239.

tonnage in ordinary times, and the struggle for traffic is keen.

Thus, from whatever angle we view this situation, it appears that there is very little traffic which is assured to the waterway. The statement of the Army Engineers that a waterway eight feet in depth would be of sufficient capacity to care for all the traffic of the region, prospective and future, is unquestionably true. But it seems as equally certain that the present and prospective traffic is not sufficient to care for the waterway, that is, to make its construction economically feasible.

We are committed to a waterway eight feet in depth from St. Louis to the Gulf. Purposes of stream control and the prevention of the overflow of lands adjacent to the Mississippi, combined with transportation considerations, in the opinion of the Army Engineers make the securing of such a depth advisable. Since the revival of water transportation in the United States is at best an experiment, the rational method to follow would be to test the possibility of developing traffic on the Lower Mississippi before authorizing the construction of a waterway between that river and the Great Lakes.

10. In the light of the foregoing considerations relative to the possibilities of traffic development along the route in question, what is to be said of the bold statement of the advocates of a Lakes-to-Gulf waterway, to the effect that the construction of such a water route would permanently relieve the congestion of freight traffic in thirty-three great states of the Middle West? We have been assured that a waterway through the Valley would almost wholly remove the necessity of extending the railway system in a region covering more than half our national area. We have been told, in so many words, that to develop the railroads of the country to a point where they can meet the needs of commerce would require an expenditure of more than five bil-

lions of dollars in ten years, and that, on the other hand, a waterway costing at best a couple of hundred millions would practically solve the entire problem. But we have found, alas! that the merest fraction of the traffic requiring shipment in the Middle West is located immediately upon the waterway in question; that practically all of it would still have to be collected by the railways; and that hence the additional railway facilities would none the less be required.

An all-important consideration in regard to the question of traffic congestion should be raised in this place, because the fact doubtless still sticks in the mind of the reader that there was a serious congestion of traffic on the railroads only a few years ago, and that a recurrence of that condition is not improbable. Attention should be directed to the fact that this congestion was primarily due, however, not so much to an insufficient number of cars, as to a lack of adequate transfer facilities between different lines and different sections of the same line. Cars are oftentimes delayed for days on sidings and in yards before there is an opportunity to switch them to the proper tracks. These delays mean that the existing cars are not utilized to their full capacity, and a failure to get cars when they are desired is almost always traceable to a congestion of traffic at important terminal and transfer centres. If waterways, then, are to relieve the congestion of traffic that sometimes occurs, they must do it by relieving the tension at these centres.

The fact seems to be clear, however, that this they would be entirely unable to do. Since the greater portion of the water traffic must originate on the railways, transshipments, as we have pointed out many times, would be unavoidable. Now, it is a plain proposition that the transshipment of a cargo from a railway car to a canal boat requires more time than the mere transfer of a car from one railway track to another. In order to relieve the congestion of traffic it is necessary to shorten the time required in making transfers en route. But the breaking of bulk that is necessary in order to use a waterway for a part of the distance has a directly opposite effect. It greatly increases the time required to move traffic a given distance, and it only intensifies the congestion at the places of transfer.

The remedy for the congestion of freight traffic that sometimes occurs lies primarily in aiding or compelling the railways to increase the number of their cars, to construct more sidings and yards, and to improve the machinery of transfer at railroad centres.[1]

[1] This question of the capacity of the railways to expand with the needs of growing commerce will be treated more fully in succeeding chapters.

CHAPTER XVIII

IMPROVEMENT OF THE OHIO RIVER

1. CLOSELY related to the construction of a Lakes-to-Gulf waterway is a project for improving navigation on the Ohio River. For several years the Ohio Valley Improvement Association has besieged the National Government for appropriations with which to deepen the Ohio River to nine feet, and to give it a slack-water navigation, by means of a system of locks, throughout the year. With the support of President Taft and a Board of Army Engineers, appointed for the purpose of investigating both the engineering and the commercial aspects of the case, Congress adopted in 1910 a plan for improving the River at a cost of about $63,000,000. Annual appropriations are now being made in pursuance of this plan, and it is hoped that the improvement will be completed in twelve years.

The Ohio is unusual among American rivers in that it alone has retained a large traffic in recent years. The statistics of water traffic in coal at Cincinnati show that there has been an increase from 56,434,707 bushels in 1893 to 62,572,000 bushels in 1906.[1] Though this increase is comparatively slight, and though the railway tonnage had increased relatively very much faster, the showing of the Ohio, as compared with other rivers, has nevertheless been remarkably good.

Again, the possibilities of an extensive future development of traffic on the Ohio appears much better than it does on any other American river. At its headwaters is situated the great industrial region known as the Pittsburg district, and along its banks, and those of the Lower Missis-

[1] *Preliminary Report of the Inland Waterways Commission*, p. 153.

sippi, are a large number of industrial towns which carry on an immense trade with the Pittsburg region. The Ohio, therefore, lies in the direction of a heavy existing traffic, and in a region that seems certain to develop rapidly in the future. These two reasons, the existence of a large water tonnage at present, and the excellent location of the river in reference to trade routes, account for the preference that is being shown the Ohio River project. It may, indeed, safely be said that if an experiment had to be performed in water transportation, the Ohio River was well chosen for the purpose.

It is by no means clear, however, that an experiment of this sort is justifiable. There are many considerations that have not been touched upon by the advocates of the Ohio River project, and there are some comparisons of paramount importance that seem not even to have occurred to those who profess to have studied the question. It is the purpose of the present chapter to direct attention to these important points.

2. It is necessary, in the first place, to inquire what sort of traffic it is hoped will develop upon the Ohio River when the proposed improvements are completed. The Report of the Ohio Valley Improvement Association, from which we quoted extensively in chapter III, indicates the general belief that a vast traffic in all manner of produce will inevitably result from an improvement of the river. The report pictured the benefit to the farmer, to the artisan, to the manufacturer, to the wholesaler, to the retailer, — in short, to every class of people. The Governor of Ohio went so far as to state that individuals may own their own boats and transport their own traffic, of whatever kind, to market. Every speaker before the last convention of the association in 1909, laid emphasis upon the great future development in manufacturing that is to take place in the Ohio valley, and urged the improvement of the river as

an indispensable aid, both in the assembling of the raw materials to be manufactured and in the marketing of the finished products. The Board of Army Engineers, which reported favorably on the project, came to the conclusion that a very extensive traffic in agricultural produce, in lumber, coal, building-stones, raw materials of all sorts, and in general manufactures would unquestionably be assured if the Ohio were given a depth of nine feet throughout the year. It is apparent, then, that the river is expected to be a general carrier of practically all kinds of freight.

3. It should be obvious at once, that there is no more future for the Ohio than for any other river in the carrying of the products of general manufacture. Precisely the same sort of considerations would operate here to prevent the carrying of such produce by water, as are operative elsewhere in the United States, and in Europe. The amount of package freight on the Great Lakes is very small, while there is almost none on the Erie Canal, or on the Lower Mississippi. In France and Germany, even where both the origin and destination of manufactured goods are along the very banks of waterways, practically all of such traffic is nevertheless shipped by rail. It is only in the case of certain heavy products of manufacture, as iron and steel, that the waterways can be of important service to the manufacturer. We may therefore dismiss from the consideration of traffic all commodities which are of high value. The manufactures of iron and steel in relation to the Ohio River will be considered presently.

4. The Ohio Valley does not export large quantities of agricultural produce, and hence the Ohio River cannot be expected to carry the products of the farm to the seaboard. In the carrying of agricultural produce to domestic markets, where relatively short hauls are involved, and where the process of collection and distribution necessarily re-

quires the use of the railways, a waterway, as has been proved time and again, can be of comparatively little service.

Cotton may be placed in the same category as other farm produce. It is no longer extensively grown near enough to the waterways to eliminate the necessity of transshipment, and hence the railways are the preferable carriers. It should be recalled that cotton is no longer carried on the Mississippi to any extent, and especially northward. There is as little reason to believe that it would be shipped north by water to points on the Ohio.

5. Lumber traffic on the Ohio presents no more promise than it does on the Mississippi, for reasons that have been stated at length elsewhere. At best, the amount of lumber carried would be, as it is at present, extremely small. The boats which now carry coal down the Ohio and Mississippi return empty, for the most part. There would seem to be a strong incentive at present to bring Southern timber north to points on the Upper Ohio, in order to furnish a return cargo for these coal boats, but the fact that practically all of it, nevertheless, comes north by rail augurs ill for the waterway as a carrier of lumber.

6. In regard to building-materials, it may be said that the Ohio River in its present state meets the needs reasonably well. In so far as sand, gravel, and clay can be economically handled by water, they can be handled successfully in boats of shallow draft. Such traffic moves but short distances at best, and no through traffic can be developed. It should be remembered, moreover, that the cost of trucking to destinations which are at a distance from the waterway often make it impossible to use a water route when one is available.

In the case of cement, however, there is much more promise. There is a very extensive vein of ferriferous limestone covering a large area along both sides of the Ohio River, near Portsmouth, Ohio. Several companies have been chartered, and some are already engaged in the manufacture of cement from this limestone. Two Portland cement factories have been constructed near Louisville in the last two years.[1] Louisville now ships out annually more than 1,500,000 barrels of cement of 265 pounds per barrel. In so far as the destination of this cement is other river towns, and in so far as the sites at which it is to be used are not too far distant from the banks of the river, it may be shipped by water. There are no statistics, however, to show how extensive such a traffic might be.

7. Perhaps the most extensive traffic development upon an improved Ohio River that is expected is in the various sorts of raw materials which enter into manufactures of all kinds. The Ohio Valley is becoming a great manufacturing centre and a vast quantity of raw materials is annually consumed in the mills and factories of the industrial cities on the river. In order to ascertain to what extent these materials could make use of river navigation, it is necessary to consider their character and their place of origin.

The chief industries of Louisville are the manufactures of "agricultural implements and wagons; cast-iron pipe and bar iron, enameled bath tubs, and brass and iron plumbers' supplies; staves and castings, clothing, leather, woolen goods and yarn, fertilizers, harness and saddles, refined vegetable oils and soap, flour, vinegar and pickles, lumber and boxes, structural iron, tobacco, furniture, terracotta and tile, white lead and paints, wire goods, boilers and ice machines, whiskey, packing-house products, machinery, woodenware and brooms, and cooperage."[2] "The great proportion of the raw material, both as to quantity

[1] *Examination of the Ohio River*, 1908, p. 26. (Report of Special Board of United States Army Engineers.)

[2] *Ibid.*, p. 67.

and value, used in the industries referred to, comes from Kentucky and the states surrounding it, and but a very small and almost inappreciable quantity comes from abroad. The pig iron comes principally from Alabama and Tennessee, though some comes from Pennsylvania and West Virginia. In woodworking industries the lumber comes from Kentucky, West Virginia, Tennessee, Alabama, Mississippi, Michigan, and other portions of the central section of the country. A very large business has grown up here in the last few years in the importation of mahogany logs from Honduras and other parts of Central America. . . . The mahogany logs are received at Pensacola and New Orleans and shipped to Louisville in all cases by railroad. The tobacco for manufacturing comes, to a very large extent, from Kentucky, Indiana, Illinois, and Tennessee, though some comes from Virginia, West Virginia, and Ohio, and a very little from outside the United States. The whiskey is made from grain produced in Kentucky and the grain-producing states. The refined vegetable oils and soap are made from cotton seed and crude oils coming from the cotton states to the south and southwest of Kentucky. The cured meats and packing-house products are made from cattle, hogs, and sheep received from Kentucky and surrounding states."[1]

The manufactures at Cincinnati and Wheeling are in general similar to those at Louisville. Wheeling, however, also manufactures large quantities of glass, and it is interesting to note the source of raw materials therefor. "The principal raw materials in the manufacture of glass are sand, nitre, soda-ash, and lime. The sand comes from Pennsylvania, West Virginia, and Ohio; the nitre comes from South America by way of Baltimore, New York, Philadelphia, and New Orleans; the soda-ash was formerly made in England, but American manufacturers are now supplying the country; and there are at present six or eight

[1] *Examination of the Ohio River*, 1908, p. 67.

plants located in Michigan, Virginia, New York, and Ohio. The lime comes principally from northern and central Ohio."[1] Now, attention should be directed to the point that most of these materials are brought from wide areas, and that in the majority of instances they are not located immediately on the Ohio or its tributaries. They must be collected by the railroads in the first instance; and hence they will naturally travel by rail the entire distance to market.

The chief possibility for a water traffic in raw materials is offered by iron ore, which might be brought down from the Pittsburg district to cities along the Ohio. This would obviously furnish a very considerable tonnage. Most of the other materials, however, would have to be assembled by means of the railways. In the import of raw materials from abroad the testimony of manufacturers has been almost unanimous that the water route by way of the Mississippi and the Ohio would be of very little importance.

8. The commodity, which, by all odds, is of chief importance to the Ohio is coal. The mines in western Pennsylvania are located so near the banks of the Monongahela River that the coal can be loaded directly into barges on the river without the use of railroads, thus eliminating the cost of transshipping. The many industrial towns along the Ohio and the Lower Mississippi at the same time afford a very extensive market on the very banks of the waterway. It should be recalled that the coal which is shipped down the Ohio is destined mainly for the bunkers of river steamers and ocean-going vessels, and railway coal yards along the banks of the Lower Mississippi. Truckage costs are here unnecessary, and hence in these respects the water route is not at the usual disadvantage as compared with the railways.

In addition there are a considerable number of industrial plants located on the banks of the Ohio in such cities as

[1] *Examination of the Ohio River*, 1908, p. 73.

Wheeling, Cincinnati, and Louisville, which, since transshipments are unnecessary, can make use of the Ohio in securing their supply of fuel. If navigation on the river were assured for practically the entire year, it is not unlikely that some establishments which now employ the railways exclusively would make use of the river. The uncertainty of navigation at present is undoubtedly a deterrent to the use of the water route.

9. Finally, there seems to be a strong likelihood that if the Ohio were given more reliable navigation there would develop a considerable traffic in the heavy products of iron and steel manufacture. Replies to questions, sent out to iron and steel manufacturers along the route by the Board of Army Engineers which investigated the project, indicate that they might use the river for the transport of from twenty to twenty-five per cent of their product. Plants in the Pittsburg district furnish the supply of structural materials to many cities along the Ohio and the Lower Mississippi, and the river would be well adapted to the handling of such traffic. Again, the export trade in iron and steel products with the West Indies, Mexico, Central and South America will undoubtedly furnish some traffic which might use the Ohio and the Lower Mississippi.

We find, therefore, as regards traffic in general that, while the prospects of an extensive development on the Ohio River are much less rosy than they appear to the advocates of the waterway project, they are nevertheless exceptionally good as compared with those on other water routes in this country. While the tonnage would be confined to a relatively few commodities, these are of sufficient importance to insure a comparatively heavy traffic. The question of traffic is, however, only one of the factors to be considered. It is necessary also to inquire at what cost this traffic development is to be secured and whether the resulting transportation rates will be sufficiently below the existing rates by rail, and those on the Ohio River in its present state, to justify the proposed expenditures.

10. The project recommended by the Board of Army Engineers which was appointed to investigate the scheme calls for a system of locks and movable dams, fifty-four in number, which would give the river a depth of nine feet for practically the entire year. The estimated cost of the locks and dams is $63,731,488.[1] In addition to this, the Board estimates that the initial cost of providing the necessary dredging-plant would be $5,000,000,[2] which raises the total cost of the project to $68,731,488. This does not include, however, the cost of developing the necessary harbor and terminal facilities. And it may or may not be the usual underestimate.

In order to furnish some idea of the probable cost of developing the necessary shipping facilities along the river, a brief description of the present state of the Ohio River ports is here given. Pittsburg has about thirty miles of river frontage within the city limits, comparatively little of which is improved. There is very little warehousing space, no belt railway, and almost no coördination between rail and water lines.

At Cincinnati there is a river frontage of about twelve miles within the city. The paved public landings consist of only two blocks, at which are three wharf boats, owned by water lines. Aside from about fifteen coal elevators, there is little other transshipping machinery. There is no coördination between rail and water lines.

At Louisville there are about 5.5 miles of frontage. There are about 2500 feet of paved city landings, with two wharf boats owned by packet lines, and about a dozen coal and sand "landing-floats." A few coal elevators constitute the only transshipping machinery, and there is no coördination of rail and water lines.

[1] *Examination of the Ohio River*, 1908, p. 39. [2] *Ibid.*, p. 35.

At Cairo the important frontage belongs almost wholly to the Cairo Trust Property, a private interest, connected with the New York Central Railroad. The city owns no frontage, and there are but three wharf boats, two of which are owned by railroads. There is no coördination between rail and water lines, and only a little transshipping machinery of a crude sort.[1]

The development of the necessary water shipping facilities along the Ohio would beyond question cost many millions of dollars, all of which would be fairly chargeable to the cost of transportation by the river. Since statistics are not available, however, we shall accept the figure of $68,731,488 given above as a basis for the comparison which we are about to make.

11. The Board of Army Engineers undertook a computation to show the probable cost of transport on the river when improved. For the basis of its computation it assumed a traffic of 3,500,000 tons of coal to be moved in a year from Pittsburg to Cairo, a distance of 967 miles. The result of the computation showed that a boat company might earn a profit of five per cent on its investment while carrying coal from Pittsburg to Cairo at an average rate of 43.25 cents per ton;[2] or about 0.5 mill per ton-mile. This rate is observed to be only about one eighth the average rail rate on similar commodities.[3] If one is disposed to give careful attention, however, to what is included, or rather what is not included, in the making-up of these rates, he will find that the advantage in favor of the waterway is not what it appears on the surface.

In the first place, this rate by water is computed on the assumption that a given number of boats and barges could be utilized to the limit of their theoretical capacity. The

[1] *Report of Commissioner of Corporations on Transportation by Water in the United States*, part III, pp. 28–29.

[2] *Examination of the Ohio River*, 1908, p. 35.

[3] *Ibid.*, p. 18.

report states that this would be a possible rate only if the freight offered itself "in thousand-ton lots and with regularity sufficient to keep the boats moving at all times except during extreme floods and for a few weeks in the year when ice may interfere."[1] That is to say, if the boats never had to wait for a supply of traffic to ship or for a demand for traffic which was awaiting shipment, and if it was always available in thousand-ton lots, it would be possible to carry freight at the cost given above. The Board admits, indeed, that "the calculated costs even for the commodities assumed are thought to be lower than such rates would be in practice, since a constant supply and demand will never exist."[2]

Now, it is well known that the amount of traffic requiring shipment varies enormously in different seasons of the year and at any given season demand for and supply of traffic seldom precisely coincide; while thousand-ton lots are the exception rather than the rule. If railways could depend on thousand-ton offerings of freight, day after day, in a steady stream, it is apparent that the problem of making rates would be reduced to straight mathematical computation and that the average rate would be much smaller than, probably only a fraction of, the present average. It cannot be doubted that the cost would be at least cut in two. In the case of the Ohio River, therefore, it would seem that the actual rate would have to be fully twice the theoretical one given above. This would raise the total cost to at least 86.50 cents per ton; or about 0.9 mill per ton-mile.[3]

In the second place, the rate stated above does not include the cost of insurance of the cargo. Since a railway always insures its own cargo it will be necessary to add the cost of insurance to the water rate if we are to make a fair

[1] *Examination of the Ohio River*, 1908, p. 18. [2] *Ibid.*, p. 35.

[3] This seems by no means too high an estimate when it is recalled that the average on the open Lakes, where large vessels can be used, is 0.8 mills per ton-mile.

comparison, for it is all the same to the shipper whether he pays the insurance directly or indirectly. The insurance rates charged on the Ohio are equal to one tenth of one per cent of the value of the cargo insured.[1] Taking the value of a ton of coal at three dollars, this amounts to approximately three mills per ton. This raises the above rate to 86.80 cents per ton.

In the third place, the rate quoted does not include any of the charges made at river ports for wharfage, loading, unloading, etc. A prominent steamboat official has said: "I believe that the wharfage question is the most serious one with which the steamboat man has to contend. This question on the Ohio River involves a charge amounting to practically one third of the boat's net profit."[2] It is doubtless true at present that independent owners of harbor facilities, and municipal owners as well, often exact unreasonably heavy tolls from boats stopping at the various ports along the river. If the Federal Government were to assume control of all the harbors and wharves these charges might be somewhat reduced, but if they were expected to be self-maintaining the tolls charged would still remain of no little importance. It is impossible to make any estimates of the probable cost of such items per ton of traffic because the statistics are not available. Boats are charged a certain amount per trip at each port, and the total that a given vessel would have to pay on any trip down the river would depend upon the number of ports entered as well as the amount of the cargo carried. In the absence of any definite information on the subject it will be necessary to omit these costs from our computation.

Finally, the water rate which we are considering is not calculated to cover any part of the annual charges on the fixed capital invested in the waterway itself. The assump-

[1] *Report of the Commissioner of Corporations on Transportation by Water*, part I, p. 359.

[2] *Ibid.*, part III, p. 338.

tion of the Board of Engineers is that since the waterway is to be built and maintained by the Government there will be no charges to be set off against the capital invested in the improvement of the river. It is true that so far as the shipper is concerned the cost of the waterway has no effect on the rate of transport, provided the Government shoulders all the burden of building and maintaining it. But the same thing would be true in the case of a railway under similar circumstances. If the government were to build and maintain a railway free of charge, the rate that could be quoted to the shipper by a railway carrier could obviously be much lower than if the railroad company itself must provide the roadbed, and keep it in repair. The point we are making is simply the familiar one, that it is inaccurate to compare rates which cover the interest on the capital investment in the highway itself, as well as the haulage costs proper, in the one case, with those which cover only the direct haulage charges in the other. Let us see what tolls would have to be charged on the Ohio were the route to yield returns on the capital invested.

As stated above, it is estimated that the cost of the project to the Government would be approximately $68,731,488. If bonds were issued by the Government for the purpose of raising this capital, the annual interest rate thereon would doubtless amount to approximately three per cent. But in the present case let us assume that the Government would pay for the project out of current revenues, and that hence no annual interest charges on borrowed capital would have to be met. Since we are to compare the water rates with those on profit-earning railways, it is necessary to assume, however, that the rates charged should earn a reasonable profit on the investment in the river. In computing the rate which the boat companies would have to charge, the Board of Engineers allowed for a profit of five per cent per annum on the capital invested in the boats. We may take the same figure in this case, for it seems a fair rate of return on an investment of this sort. With this point settled, the following tabular exhibit may be presented, showing the annual items that should be covered by tolls on the Ohio River:[1] —

Interest on capital at five per cent	$3,436,574.40
Maintenance of locks and dams	810,000.00
Dredging	850,000.00*
Total	$5,096,574.40

* *Report of Examination of the Ohio River*, p. 39.

Let us now see what this means in the way of tolls. The above estimates of the cost of haulage were computed on the basis of 3,500,000 tons of freight moved from Pittsburg to Cairo, a distance of 967 miles. This is equal to 3,384,500,000 ton-miles of traffic. To cover $5,096,574.40 the tolls on this amount of traffic would have to equal 1.51 mills per ton-mile.

Translating the rate of 86.80 cents per ton, which appeared above, into a ton-mile rate, gives .89 mill per ton-mile. Adding the toll of 1.51 mills per ton-mile to this gives a total rate of 2.40 mills per ton-mile by water, rather than merely 0.5 mill, as stated by the report of the investigating board.

There is yet another factor to be reckoned with, however, before we shall be in a position to make a comparison with rates by rail. We must take into consideration the relative distances by rail and by water between given points. It is obvious, for instance, if the distance between two points is twice as great by water as by rail, that the rate per mile may be twice as high by rail as by water and yet the cost to the shipper be the same in both cases. This is a consideration of the greatest importance, and yet it is almost universally omitted in making comparisons of rates by water and by rail. The distance from Pittsburg to Cincinnati by water is 468 miles as against 326 miles by way of the Baltimore and Ohio Railroad. Cincinnati is

[1] *Examination of the Ohio River*, 1908, p. 2.

chosen rather than Cairo here for the reason that Cairo has no direct rail connection with Pittsburg.[1] The river distance from Pittsburg to Cincinnati is thus 1.42 times that by rail. Since traffic by water must move 1.42 times as far as by rail to pass between the same points, we must therefore multiply the water rate by 1.42 to place it on a parity with the rate by rail. This would raise the above rate from 2.40 mills to 3.41 mills per ton-mile.

Let us now compare this rate with the railway charges on coal. In 1909 the average rate per ton-mile on coal on the Chesapeake and Ohio Railroad was 3.19 mills.[2] The Illinois Central carries coal from the southern part of Illinois to Chicago at an average rate of 3.13 mills per ton-mile.[3] These roads, moreover, pay interest on a large bonded indebtedness, an item excluded from the above computation of the cost of transportation on the Ohio River. And in the case of the Illinois Central seven per cent of the profits of the road go to the State of Illinois. The average ton-mile rate on coal for the entire country has never been computed, but it is probable that it would be less than four mills.[4] In any case, it is apparent from the rates quoted above that it would be easily possible for a railroad to carry coal at a less rate than could the Ohio River if the river charge were calculated to secure a return on the capital invested in the works of improvement.

We may also make a comparison of the cost of transport on an improved Ohio River and on railways in another

[1] The comparative distances from Pittsburg to New Orleans show a still greater difference. By the Ohio and Mississippi Rivers the distance is 2220 miles; while by way of the Baltimore and Ohio and Louisville and Nashville Railroads it is only 1253 miles.

[2] *Report of the Company*, 1909.

[3] *Report of the Chicago Harbor Commission*, 1909, p. 234.

[4] Ton-mile rate comparisons are seldom entirely accurate, and are often misleading, for the reason that a ton-mile rate depends upon the amount of traffic and the distance it travels, no less than its character. In the present case, therefore, the results must be regarded as representing only approximate truth.

manner than by comparing rates, namely, by setting off against the cost of improving the river the cost of building a railroad. The estimated cost of the river improvement, exclusive of terminal facilities of all sorts, and of equipment, is, as stated above, \$66,731,488. This amounts to approximately \$71,000 a mile. On the other hand, the average capitalization of the railroads of the country, including watered stock, is under \$60,000 per mile. The capitalization of certain roads in the south central section of the country is as follows:[1] —

Kansas City and Southern	\$46,000 per mile
Louisville and Nashville	30,000
Nashville, Chattanooga, and St. Louis	31,000

It is evident from these statistics that the cost of a railroad in this section of the country, exclusive of terminals, passenger stations, and rolling-stock, would probably not be over \$35,000 per mile at the outside. This is about half the estimated cost of improving the river. Furthermore, since the distance by water from Pittsburg to Cincinnati, for instance, is 1.42 times that by rail, the advantage in favor of the railway is still greater than appears from the statistics just presented. Making allowance for the difference in distance the comparative costs may be set down as follows: —

	Distance (miles)	Cost per mile	Total cost
Railway, Pittsburg to Cincinnati . .	326	\$35,000	\$11,410,000
Waterway, Pittsburg to Cincinnati .	468	71,000	33,228,000

For this given distance, therefore, it appears that the estimated first cost of improving the river is approximately three times the cost of building a railway. For the full length of the Ohio this ratio would not be appreciably changed.

[1] From annual reports of the roads.

But since the Ohio connects with the Mississippi, and thereby furnishes a through route to the Gulf, it is perhaps not fair to compare the cost of improving the Ohio with the cost of building a railway the length of the Ohio alone. Assuming that the entire cost of the water route from Pittsburg to New Orleans is represented by the expenditures on the Ohio alone, — in other words, assuming that the Lower Mississippi needs no improvement, — let us see if an advantage from the standpoint of cost is still possessed by a railway. The rail distance from Pittsburg to New Orleans, by way of the Baltimore and Ohio and the Louisville and Nashville Railways, is, as stated above, 912 miles. At the above rate of construction a railroad could be built between these points for $31,920,000, or for less than half the cost of improving the Ohio River alone.

The advantage that the railway enjoys, by virtue of its lower cost of construction, it should be added, is offset to some extent by the greater cost of equipment necessary to handle a given quantity of traffic. The cost of barges and towing steamers of the thousand-ton type averages from ten to twelve dollars per ton of carrying capacity;[1] while the cost of the average freight car is about twenty dollars per ton of carrying capacity.[2] If we include the cost of the engines this figure would be considerably raised. There is obviously some advantage here for the waterway; but inasmuch as the cost of equipment is slight in comparison with the original cost of the highways themselves, it can by no means be regarded as substantially offsetting the railway advantages that have been noted.

There is a general impression that a waterway, once constructed, needs thereafter, in striking contrast with a railway, comparatively little attention. Statistics, however, give the lie to such a belief. The annual cost of maintaining the locks and dams on the Ohio is estimated at

[1] Symons, *Engineering News*, 1897, p. 319.

[2] Delano, *Speech before River and Harbor Congress*, December, 1910.

$810,000, and of dredging at $850,000.[1] This amounts to $1717 per mile. Were the cost of maintaining wharves, docks, and other facilities included, this total would obviously be greatly increased. As compared with this the cost of maintenance of way and structures on the Wabash Railroad amounted to only $1299.60 in 1909, and on the Chesapeake and Ohio, $1450 per mile in 1910.[2]

These rough general comparisons of the cost of construction, operation, and maintenance of the river and of a railway unquestionably substantiate the conclusion reached by the comparison of rates which was made above, namely, that, everything considered, the cost of transport on an improved Ohio would be greater than on present railroads.

There remains to be considered, however, one other factor of importance, to wit, the relative capacity of the river and of a railway. A decided advantage in favor of the waterway here would serve to upset the tentative conclusions which have been reached.

It is evident that the capacity of the river under the proposed plan of improvement would be limited to the capacity of the locks. On this point the Board of Engineers, in their report on the project, estimate that it would be possible to move through a lock as much as 20,000 tons in one and one half hours. This they further state means a total capacity for a year of 100,000,000 tons.[3] This enormous total capacity is evidently computed somewhat as follows: —

24 hours = one day.
16 = number of lockages in one day.
20,000 = number of tons at one lockage.
16 x 20,000 = 320,000 tons in one day.
312 = number of days of navigation in a year.
312 x 320,000 = 100,000,000 tons in a year.

[1] See table above, p. 405.

[2] Annual reports for the years named.

[3] *Examination of the Ohio River*, 1908, p. 112.

It is of course obvious that such a total represents merely a theoretical maximum. If the locks were utilized to their full capacity every hour of the day for 312 days in a year; if there were no necessity of returning the boats through the locks to the place of starting; if, in a word, there were a steady stream of traffic all going in one direction, then 100,000,000 tons might pass through a lock in the course of a year. Suppose we compute in a similar manner the ultimate capacity of a railroad: —

One trainload = 25 cars of 40 tons = 1000 tons.
Speed = 20 miles an hour.
Trains, 1.5 miles apart.
Therefore, one train about every five minutes,
Or twelve trains per hour.
12 x 24 = 288 trains per day.
288 x 1000 = 288,000 tons per day.
288,000 x 365 = 105,120,000 tons per year.

We may thus compute a greater theoretical capacity for the railway than for the river. Indeed, were we not conservative in limiting the trainload to 1000 tons, a vastly greater tonnage would be shown for the railroad than for the river. Of course in practice it is probable that no railroad could handle so enormous a tonnage as this, but the same thing is equally true of a river. We have merely adopted this method of computation for the purpose of setting the result off against one obtained in a similar manner for the river. The conclusion may fairly be drawn, however, that the actual capacity of the Ohio River under the proposed system of locks would be no greater than that of an all-freight railway.

The above analysis has shown that if tolls were to be charged upon the Ohio River sufficient in amount to defray the annual expenses of maintenance and operation, including interest on the capital investment, there is little doubt that the rates by river would be somewhat higher than those by rail on similar commodities. It should now be further considered that unless water rates are substantially lower than those by rail, the traffic will seek the railroads. In France, for instance, a margin of twenty per cent advantage in rates is deemed necessary to insure the movement of traffic by water. Scores of instances in this country could be cited where railways, on account of their greater "serviceability," are able to attract traffic, although their rates are appreciably higher than those on competing water routes. It seems altogether certain, therefore, that the Ohio, in the absence of Government subsidies, would not be able to meet the competition of the railways.

Of course, if the Government spends sixty or seventy millions of dollars in improving the river and a couple of millions annually in keeping it in repair, and if it expects no return on the capital invested, — in other words, if it furnishes a waterway entirely free to boatmen, it cannot be doubted that water transportation companies could offer rates low enough to divert certain kinds of traffic from self-supporting railways. But from a broad economic point of view this by no means indicates that the people's money would have been well spent, or that transportation would have been in reality cheapened. It would merely have given a few favored shippers the advantage of low rates at the expense of the general taxpaying public![1]

12. After all, the real question in connection with the improvement of the Ohio River is whether it would insure substantial reductions over the rates of transport on the river in its present state. Our analysis of traffic conditions

[1] It is usually argued, in defense of the proposition that it is entirely justifiable to lower the transportation rates to shippers, by means of subsidizing water routes, that the general public which advances the subsidy in the form of taxes reaps an indirect benefit, much more than sufficient to reimburse it, through a reduction in the price of commodities resulting from a lessening of freight charges. For a discussion of this point see chapter III, pp. 39–41.

above indicated that the chief traffic on the river at present is in coal, and that the possibility of an extensive future development lies mainly with this particular commodity. Practically all of the coal that is shipped from the Pittsburg district south to New Orleans goes by boat, the present method of transportation on the river having reduced the cost of haulage to a minimum. The method is described as follows: "A stern-wheel steamboat of about 1000 horse power will ordinarily leave the headwaters of the Ohio on suitable stages of water for southwestern points with a tow consisting of about 12 coal boats and 3 barges. After passing the Bellaire Bridge, 96 miles below Pittsburg, 5 more coal boats will ordinarily be added to this tow, making a total of 17 coal boats, and 3 barges, the cargo of which will be about 18,500 tons. Ordinarily this boat will proceed with the above tow to Louisville, Kentucky, and, after passing through the canal, will deliver its tow to a larger boat. From the canal at Louisville to New Orleans a boat of the most powerful class will tow from 30 to 60 coal boats, each boat being loaded with about 1000 tons of coal."[1]

The rates charged are said to be only about four tenths of a mill per ton-mile, but "in view of the fact that the same corporation owns the mines, the loading and unloading facilities, the boats and barges, and to some extent the wharves, this rate is a mere matter of bookkeeping, and too much reliance cannot be placed upon it."[2] The cost is nevertheless in all probability less than a mill per ton-mile. The Board of Engineers has recognized that the present method of transportation on the river should be interfered with as little as possible, and for that reason favors the installation of movable rather than fixed dams. "A wide navigation pass is constructed in the dams, which can be lowered whenever a rise occurs and leaves an unob-

[1] *Examination of the Ohio River*, 1908, p. 19.

[2] *Report of National Waterways Commission*, Doc. 11, p. 45.

structed river through which coal fleets can be moved as at present."[1] If anything, the installation of the system of locks and dams would impede this particular sort of navigation rather than aid it, and as a consequence the transport rates would be higher rather than lower than they are at present. Be this as it may, it at least cannot be held out that the improvement of the river will tend to increase these through shipments of coal to the South. Moreover, the capacity of the river for purposes of this through traffic will not have been enlarged. Finally, it is not improbable that a more extensive development of the coal resources of the South in the future, particularly in Alabama and Tennessee, will reduce the demand in the South for Northern coal. These mines are comparatively near to New Orleans, and if the contemplated improvement of the Tombigbee River is carried out, there will be opened a water route from these mines to all of the ports on the Gulf.

The chief advantage in improving the Ohio River lies in its furnishing more reliable navigation on its upper course. At present during the dry season there is an inadequate depth of water, and the proposed locks and dams would relieve the situation by furnishing slack-water navigation in times of low water. This, it is believed, would insure a much larger tonnage on the river than exists at present. Of the total river traffic passing through Davis Island Dam below Pittsburg in 1907 ninety-one per cent was coal.[2] In tonnage, this amounted to 2,283,965 tons, of which 1,244,720 tons reached Cincinnati, 1,154,991 tons passed through the falls of the Ohio at Louisville, and approximately 1,000,000 tons reached New Orleans.[3] A little under 2,000,000 tons, then, is the amount of coal traffic pertaining to the Upper Ohio River, proper, and the total traffic of all kinds is approximately an even 2,000,000 tons. The

[1] *Examination of the Ohio River*, 1908, p. 112. [2] *Ibid.*, p. 112.
[3] *Report of National Waterways Commission*, Doc. 11.

benefits to be derived from an improvement of the Ohio must be to traffic over and beyond this amount.

The exhaustion of the supply of coal in mines immediately along the banks of the Monongahela is at best only a matter of a few years, and when such a time arrives the conditions which alone now make possible an extensive traffic on the Ohio will no longer exist. The coal will then have to be loaded into railway cars, and once in the cars the tendency, as elsewhere, will be for it to go all the way to market by rail in order to avoid transshipment en route. Of course, again, it probably would be possible — if the waterway were maintained entirely free of tolls, and if merely nominal charges were made for the transshipments, the deficit being met by general taxation, as in Germany — to compel this coal to go by water for a part of the distance; but, as shown above, such a process would obviously not have lessened the cost of transportation.

13. With the Ohio River becoming less important in the carrying of coal, on account of the development of mines in the South and the shifting of the source of supply back from the shores of the Monongahela, its future must depend upon the development of traffic in other lines. Now, in our discussion of traffic conditions we found that some traffic might be expected in such commodities as iron and steel, cement, and to a very small extent general manufactures; but these commodities would travel by water only on condition that no tolls were charged. With tolls sufficient in amount to cover the expenses of operation and maintenance and to yield returns on the capital investment, we have found that the cost of transport by water is greater than that by rail. From the standpoint of transportation, therefore, the expenditure of sixty or seventy millions of dollars upon the improvement of the Ohio River, in accordance with the plan proposed, will be an economic loss to the nation.

14. It remains to inquire what indirect benefits in the way of prevention of floods and the purification of water supply would result from the proposed improvement of the Ohio River. The regulation of our natural waterways should have these ends in view, no less than transportation, and accordingly some attention should be given to them in connection with the project which we are now considering.

The plan of improvement proposed by the Special Board of Engineers which examined the project seems to be designed for transportation purposes alone. It should perhaps be stated that the method this board favors is not the one advocated by Hydrographer Leighton, of the United States Geological Survey, which called for a system of reservoirs at the headwaters and a series of dams along the river. The Leighton plan had two main purposes in mind in addition to transportation; namely, to prevent the annual floods which now devastate the valley, and to enable the development of a large amount of electrical power at the dams. But this scheme was adjudged by the engineers entirely impracticable.[1] Now, the present plan involves neither the building of reservoirs nor the construction of fixed dams. In order to permit the present method of coal transportation on the river, it is proposed, as stated above, to use movable dams which can be lowered in times of high water. With such a system the river will continue to rage as it does at present and carry death and destruction down the valley during the seasons of melting snows and heavy rains. The proposed method of improvement aims merely to secure as reliable navigation as possible at as low a cost as possible, and is not designed to prevent floods.

The proposed plan, moreover, will not tend to purify the water supply of the Ohio Valley and thereby prove an aid to public health. On the contrary, it may have an opposite effect. In order to facilitate upstream traffic, and in

[1] See chapter xv, p. 330.

order to insure an adequate depth of channel for transportation during the summer months, it has been deemed advisable to secure by means of the locks and dams slack-water navigation during the periods of low water. Slack water would seem to be more, rather than less, inimical to public health than the running water of an open river.

CHAPTER XIX

THE ENLARGEMENT OF THE ERIE CANAL

1. THE Erie Canal has played a very important rôle in the industrial development of the United States. Constructed before the age of railroads, it opened the first real avenue of commerce between the Atlantic seaboard and the interior states, and paved the way for the settlement and development of the Middle West. For fifty years after its opening in 1825, it played a very important part in the fixing of transportation rates from the entire West to the Atlantic Coast. The rates offered by the water route from Chicago to New York laid the basis of practically all east-and-west railway schedules east of the Missouri River. No other water route in this country has exerted so great an influence on the rates of transportation as the Erie Canal.

Until about 1870 the tolls levied by the State of New York upon traffic over the canal had yielded returns much more than sufficient to cover the cost of its construction and the charges for operation and maintenance. But the competition of rival ports and the fierce rate wars of competing railways played havoc with the canal receipts during the next ten years. Traffic declined so rapidly that in an effort to prevent its complete diversion to the railroads all canal tolls were abolished on January 1, 1883, since which date the entire support of the canal has been provided for by general taxation.

The abolishment of tolls, however, did not check the rapid decline of traffic that had set in. Reference to the charts on page 70 shows that the decline has continued to the present date, and that the once important canal has ceased to be of any considerable influence in trade development.

2. The people of New York viewed with uneasiness the continuous decline of canal traffic in the state, and as early as 1884 the New York Board of Trade and Transportation called a state convention, which was held in the city of Utica in the following spring. The purpose of the convention was "to consider what steps should be taken to secure the permanent improvement of the state's waterways."[1] Out of this convention grew the Canal Improvement Union, composed of influential commercial and manufacturing interests in the state. This union held annual conventions in the interest of waterway development, and in 1895 succeeded in securing the passage of an act appropriating $9,000,000 for deepening the Erie Canal from seven to nine feet. This sum proved utterly inadequate to make the enlargement contemplated, and seems to have been entirely wasted.

Following this useless expenditure, there set in a strong reversion of public feeling, which came near checking for good the rehabilitation of the old canals. The New York Board of Trade and Transportation again tried to arouse public interest in the question, but failed completely. Finally, they presented a series of resolutions to Governor Roosevelt, and on March 8, 1899, he appointed the Commission on Canals of the State of New York. The apparent indorsement of the canal movement by the popular Governor served to revive the waning interest in the project, and a great state convention was soon called. It met at Utica in the summer of 1900, and with but a single dissenting vote adopted resolutions favoring the substantial improvement of the defunct canal system.[2]

[1] *Canal Enlargement in New York State* (Publications of Buffalo Historical Society), p. 2.

[2] *Ibid.*, p. 10.

Meanwhile, the State Committee on Canals prepared a report. The question of the feasibility of a ship canal deep enough for ocean-going vessels, as compared with a canal adapted for barge transportation only, had long been debated in New York. Major Thomas W. Symons, of the United States Engineering Corps, finally succeeded in convincing the state Committee, of which he was a member, to pronounce in favor of a barge canal of 1000 tons' capacity. By extensive computations he showed the cost of transportation to be materially less on a barge than on a ship canal, and at the same time substantially demonstrated that, on account of the loss of time and the increased dangers involved, few, if any, ocean vessels would use a ship canal through New York were one available. It was recommended, therefore, that a barge canal 12 feet in depth, with a bottom width of 75 feet, should be constructed between Buffalo and the Hudson River. The route determined upon as most feasible follows the present Erie Canal for about a third of its length, and for the remainder of the way utilizes the chain of lakes in the central part of the state. The locks were to be 28 feet wide, 328 feet long, and 11 feet deep.[1] This law has since been modified, however, and the locks are being built 45 feet wide, 328 feet long, and 12 feet deep.[2] Since the channel will be in places but 75 feet in width, it follows that 36 or 37 feet will measure the width of barges that can be used while permitting them to pass each other. It is probable that the boats that will be used will be 150 feet long by 36 or 37 feet wide, having a capacity of 1500 or 1600 tons. There are those, however, who favor tows of smaller barges, of 700 or 800 tons' burden each, four of which could be locked at once.[3]

Following the recommendation of the State Committee on Canals the Legislature of New York passed an act in

[1] Fairlie, *Quarterly Journal of Economics*, 1904, p. 290.
[2] Personal letter from the State Engineer and Surveyor. [3] *Ibid.*

April, 1903, appropriating $101,000,000 for the purpose of carrying out the work proposed. It then only remained to secure the sanction of the people by a referendum vote. This proved the most difficult part of the entire project.

The New York Produce Exchange inaugurated a remarkable campaign for the purpose of educating the public to the benefits expected from the enlargement of the old canal. Probably no other referendum vote in this country ever attracted the amount of interest that this one did. It was an absorbing topic of discussion in all parts of the state for many weeks before voting day. When the vote was taken on November 3, 1903, it showed a substantial majority in favor of the appropriation.[1]

It will be of unusual interest, however, to analyze the vote on the measure. "At the election, the non-canal counties voted against the project by large majorities. St. Lawrence County, for instance, being 12 to 1 against it, and Steuben County 10 to 1 against it. . . . For some unexplained reason, Monroe County, in which Rochester is situated, and Onondaga County, in which Syracuse is situated, voted against it. The overwhelming vote, however, in the counties at the two terminals, New York and Buffalo, made a majority of 245,312 in the entire state in favor of the project out of a total vote of 1,100,708."[2] The vote of New York City, especially, proved the deciding factor. "The project was fought by the press outside of New York and Buffalo with singular unanimity and the polls showed a crushing defeat for the improvement until the returns began to come in from New York City, where an overwhelming vote in favor of the new waterway carried the proposition."[3] The majority of the county of New York alone amounted to 223,629.[4]

[1] For an excellent account of the campaign, see *Canal Enlargement in New York State*, pp. 66–75, 100–107.

[2] *Ibid.*, p. 116.

[3] Quinn, *World To-day*, 1906, p. 169.

[4] *Ibid.*, p. 193.

3. This analysis of the vote on the canal appropriation measure illustrates to a nicety the play of sectional interests. Why were Buffalo and New York so strongly in favor of the proposition, in contrast to the state at large?

The former city, by virtue of its location at the western terminus of the canal, saw the possibility of developing an extensive transshipping business from Lake to canal vessels, and *vice versa*,[1] and also to secure a larger portion of the traffic shipped eastward from the Central States to the Atlantic seaboard than now falls to her lot. The commercial interests of that city accordingly contributed large sums to the campaign fund, and succeeded in getting out a large vote in favor of the project.

The New York Produce Exchange was, however, the life and soul of the movement. It had long viewed with concern the relative decline of New York City in the grain trade. This was due, it was averred, to the railway combination which had given Baltimore and Philadelphia a differential rate advantage over New York. It was hoped that an enlarged canal through the State of New York would enable the metropolis to regain her former commanding position; hence extraordinary efforts were put forth in the city to secure the passage of the referendum. The circumstance of the ability of those interested to control a tremendous urban vote enabled them to carry the day against the wishes of the rest of the state.

Since the expense of constructing the canal was to be borne by all the state, since no tolls were to be charged, and since the entire cost of operating and maintaining the canal was to be paid out of general taxation, Buffalo and New York hoped to reap an advantage at the expense of the state at large. It would be interesting to know precisely the part played in the campaign for the passage of the law by politicians hoping to receive benefits from the spend-

[1] It has been said that the so-called "Elevator Pool" was largely instrumental in getting out the large vote in favor of the project.

ing of the money. The estimated amount necessary to construct the waterway was first set down as $82,000,000, but this was raised, almost at the last moment, to $101,000,000. This fact may or may not be significant.

Attention should be called to the fact that it was deemed necessary, for some unknown reason, to provide a channel twelve feet in depth[1] (eleven feet over the sills at the locks) in order to float barges of 1000 tons' capacity. As has been shown elsewhere in this treatise, such a depth is wholly unnecessary to float boats of that size. On the Rhine River barges of 3000 tons' capacity are used where the depth of the river is less than eleven feet, and barges of 1000 tons' burden freely navigate channels with a depth of less than seven feet. Why must so vast a sum of money be expended in giving the Erie a depth of twelve feet in order to float barges carrying only 1000 tons of freight?

4. Construction work was begun upon the canal according to schedule, and on February 1, 1911, the value of the work under contract amounted to $72,710,553, and of the work actually completed, to $26,387,933.[2] It was originally hoped that the project would be completed in 1914, but there is now practically no chance that the hope will be realized. "Of the eighty-one contracts that have thus far been let, thirty-eight are noticeably backward in progress, and trouble may be looked for on the contracts that are much behind the schedule."[3] It is too early as yet to foretell with certainty, but it is highly probable that the eventual cost will exceed the estimate of $101,000,000 by a considerable figure. It is certain to do so if the cost of providing the necessary terminal facilities be included.

New York voted to enlarge the Erie before realizing that terminals are absolutely essential to the success of

[1] The amendment was explained above. This does not, however, change the nature of the proposition.

[2] *Barge Canal Bulletin*, February, 1911, p. 43.

[3] *Ibid.*, p. 44.

water transportation, and no attention was given to the cost of providing the necessary terminal equipment. It was not until 1909 that the question of terminals received any particular attention in the waterways agitation in this country. In May of that year, however, the State of New York appointed a commission for the purpose of investigating the question so far as the Erie Canal is concerned. The commission was instructed to ascertain what it would cost to procure the necessary sites, if indeed they were procurable at all, and to provide the necessary terminal facilities in both New York and Buffalo. Ten thousand dollars was appropriated for the purpose, and the commission visited all the important canal ports of the state. In New York City they found that "the space from the west side of Pier No. 3 to the east side of Pier No. 8, on the East River, and from the north side of Fifty-first Street to the south side of Fifty-fourth Street, on the North River, is reserved by law for the exclusive accommodation of canal boats and barges engaged in transportation on the Hudson River. The city has gradually leased this property, however, until now only Piers Nos. 5 and 6, East River, are left for canal purposes."[1] There is almost no equipment at present, and it is evident that large expenditures will be involved in its provision. The commission has under consideration a general terminal for import and export business, as well as one for local traffic.[2]

In Buffalo the terminal situation is well-nigh hopeless for the canal. "About half of the river frontage is owned by the railroads, with some small holdings by water lines. Of the five miles on the two sides of the City Ship Canal, four miles are owned by railroads. On the Lake front the total frontage protected by breakwaters is about four miles, of which railroads own about three, subject to some dispute as to title. The city owns about three fourths of a mile, but, with the exception of two blocks, practically none of its

[1] *Report of Commissioner of Corporations*, part III, p. 90. [2] *Ibid.*, p. 91.

frontage can be reached without crossing railroad property. The city owns and controls nine small docks at street ends."[1] It thus appears that the railways almost completely dominate the situation. The state must spend a large amount of money in order to acquire the sites now controlled by the various roads in the city; and, moreover, the way in which the railway terminals of the city have been developed will seriously handicap the development of a convenient and adequate system of water terminal arrangements even after the terminal sites have been secured. It may be possible to develop in Buffalo terminal facilities adequate to meet the needs of canal shipping, but it is certain to cost many millions in order to do it.

A bill was recently drawn up by a New York Barge Canal Terminal Commission providing for a bond issue of $16,500,000 by the state for the purpose of constructing the necessary terminals along the route. This became law in November, 1911. In addition to this New York City has a terminal project, independent of the state, which calls for an initial expenditure of $12,000,000 on terminal facilities. These figures, which must be regarded as only tentative estimates, make the total cost of the project nearly $130,000,000.[2]

5. Having thus briefly given the history of the Erie Canal project to date, let us now turn our attention to the economic aspects of the situation. First in order is the question of traffic.

As usual, the advocates of this project predict a universal cheapening of the cost of transportation. "Manufacturers will be benefited by the reduction of freight rates both on raw materials and on finished products, an advantage that cannot fail to attract to this favored territory, not only those industries dependent on the metals, but count-

[1] *Report of Commissioner of Corporations*, part III, p. 25.

[2] *Barge Canal Bulletin*, April, 1911, pp. 107–108.

less workers in other metals. The farmers of the State of New York will be benefited by the growth of the capacity for consumption of his home market and by the cheapening of transportation on his products and of everything he buys. The working man will benefit through the upbuilding of manufacturing industries throughout the state and by the reduction in the price of the necessities of life which the lowering of the rates of freight on the improved canal will bring about." [1]

It is unnecessary to state again the reasons why manufactures do not travel extensively by water. It is certain that the traffic on the Erie Canal, as on other waterways, will be confined for the most part to freight of low grade. And, indeed, it is generally admitted by its advocates that the economic justification of the canal rests primarily upon its ability to carry at low rates two commodities: grain, and structural materials of iron and steel. The lumber trade in this section of the country is now unimportant and growing less in amount each year, and no hope of an important traffic is to be looked for in this direction. We may, therefore, confine our attention to the possibilities of an extensive traffic in grain and in the heavy manufactures of iron and steel.

6. The table on the opposite page shows the decline in the export of wheat and wheat flour from the United States in the last thirty years.[2]

This table indicates that the export of wheat from the United States is rapidly declining relatively to production, and that it is even decreasing in absolute amount. This is due not so much to a relative decline in the amount produced as to the heavy increase in the amount consumed at home. The tremendous increase in urban population in the last thirty years has opened a much larger domestic

[1] *Canal Enlargement in New York State*, p. 75.

[2] *Report of Chicago Harbor Commission*, 1909, p. 215.

market for our grain. It is now generally recognized, also, that in a very few years the United States will cease altogether to export wheat and flour and will probably even have to import from Canada. In like manner corn, corn

QUANTITIES OF WHEAT PRODUCED IN THE UNITED STATES AND OF DOMESTIC WHEAT AND WHEAT FLOUR* EXPORTED AND RETAINED FOR CONSUMPTION 1880 TO 1908

Year ending June 30	Production — Bushels	Exports of domestic — Bushels	Domestic retained for consumption — Bushels	Per cent of domestic product exported
1880	448,756,630	180,304,180	268,452,450	40.18
1881	498,549,868	186,321,514	312,228,354	37.38
1882	383,280,090	121,892,389	261,387,701	31.82
1883	504,185,470	147,811,316	356,374,154	29.83
1884	421,086,160	111,534,182	309,551,978	26.49
1885	512,765,000	132,570,366	380,194,634	25.86
1886	357,112,000	94,565,793	262,546,207	26.48
1887	457,218,000	153,804,969	303,413,031	33.66
1888	456,329,000	119,624,344	336,703,656	26.23
1889	415,868,000	88,600,742	327,267,258	21.31
1890	490,560,000	109,430,467	381,129,533	22.31
1891	399,262,000	106,181,316	293,080,684	26.60
1892	611,780,000	225,665,812	386,114,188	36.88
1893	515,949,000	191,912,635	324,036,365	37.20
1894	396,131,725	164,283,129	231,848,596	41.47
1895	460,267,416	144,812,718	315,454,698	31.46
1896	467,102,947	126,443,968	340,658,979	27.07
1897	427,684,346	145,124,972	282,559,374	33.93
1898	530,149,168	217,306,004	312,843,164	40 91
1899	675,148,705	222,618,420	452,530,285	32.97
1900	547,303,846	186,096,762	361,207,084	34.00
1901	522,229,505	215,990,073	306,239,432	41.36
1902	748,460,218	234,772,515	513,687,703	31.37
1903	670,063,008	202,905,598	467,157,410	30.28
1904	637,821,835	120,727,613	517,094,222	18.92
1905	552,399,517	44,112,910	508,286,607	7.99
1906	692,979,489	97,609,007	595,370,482	14.09
1907	735,260,970	146,700,425	588,560,545	19.95
1908	634,087,000	163,043,668	471,043,332	25.70
1909	664,602,000	114,268,468	550,333,532	17.19 †

* Wheat flour is reduced to wheat at the rate of 4½ bushels to the barrel.

† *Statistical Abstract of the United States*, 1909, p. 586.

meal, and oats are not extensively exported. In the year 1908 only 2.17 per cent of the corn crop[1] and much less than one per cent of the oat crop was shipped out of the country.[2] Now it is evident that for purposes of distributing grain to domestic markets extending over wide areas, the Erie Canal can be of little service. Its usefulness must be primarily confined to the export trade in grain.

Attention is now directed to a second table, which shows the shifting of the areas of wheat production in recent years. The table gives the annual receipts of wheat at the great primary grain markets from 1887 to 1910:[3] —

Year	St. Louis	Minn.	Duluth	Milwaukee	Chicago
	(In bushels)				
1887	14,510,315	45,504,480	17,136,000	9,346,756	21,848,251
1888	13,010,108	44,552,730	7,993,000	8,129,315	13,438,069
1889	13,810,591	41,734,095	17,136,000	7,469,289	18,762,646
1890	11,730,774	45,271,910	15,341,000	8,046,462	14.248,770
1891	25,523,183	57,811,615	40,392,000	10,846,495	42,931,258
1892	27,483,855	72,727,600	46,661,000	15,205,639	50,234,556
1893	14,642,999	57,890,469	32,910,000	12,806,319	35,355,101
1894	10,003,243	55,000,610	32,226,000	8,101,616	25,665,902
1895	11,275,885	65,436,390	49,599,000	9,697,379	20,637,642
1896	12,651,248	69.568,970	58,293,000	9,336,036	19,933,402
1897	12,057,735	72,801,530	48,069,000	9,526,878	28,087,147
1898	14,240,252	77,159,980	66,413,000	13,539,840	35,741,556
1899	10,428,163	87,961,830	54,982,000	12,345,383	30,971,547
1900	19,786,614	83,312,320	31,815,000	10,848,939	48,048,298
1901	20,860,805	90,838,570	47,001,000	13,050,850	51,197,870
1902	30,667,212	88,762,120	39,525,000	10,360,593	37,940,953
1903	23,533,800	86,804,070	29,091,000	9,031,615	27,124,585
1904	22,797,308	86,935,980	26,635,205	8,240,860	24,457,347
1905	20,684,439	93,263,910	31,186,725	7,576,600	26,899,012
1906	17,361,005	80,694,580	41,558,151	7,832,426	28,249,475
1907	17,473,947	86,030,990	55,300,838	8,947,093	24,943,690
1908	19,258,781	91,739,900	53,890,816	10,943,842	21,168,442
1909 *	21,142,317	81,111,410	52,867,496	7,761,305	26,985,112
1910 *	19,412,989	99,721,600	32,284,956	10,313,810	27,540,100

* Statistics for 1909 and 1910, *Monthly Summary of Commerce and Finance*, December, 1910, pp. 1000–07.

[1] *Report of the Chicago Harbor Commission*, 1909, p. 214.

[2] *Ibid.*, p. 217.

[3] *Ibid.*, p. 219.

This table shows very distinctly the shifting of the centre of wheat production to the Northwest. The receipts at St. Louis, Milwaukee, and Chicago are but little greater now than they were twenty-three years ago, while those at Minneapolis have doubled and those at Duluth have about tripled during the same period. Canada is becoming the great grain producing area of North America. "Six years ago the Canadian Northwest raised about eight million bushels of grain. Last year (1908) its production was in the neighborhood of eighty-five million bushels."[1] The receipts of the terminal elevators at Fort William and Port Arthur from 1901 to 1909 were as follows:[2] —

1901	5,959,920	1906	56,056,560
1902	30,141,536	1907	60,553,693
1903	41,302,474	1908	40,689,868
1904	32,080,627	1909	58,088,727
1905	31,508,617		

This shifting of the area of wheat production to the Northwest and to Canada means that an ever-increasing portion of that which is exported will naturally tend to seek an outlet through Canadian ports. It is interesting to note the relative increase that has taken place during the past few years in the export of wheat from Montreal as compared with that from New York. Statistics of the export of both American and Canadian wheat from Montreal are not available prior to 1907: —

Year	Montreal *	New York †
1907	18,938,061	22,769,338
1908	30,461,946	20,578,068
1909	27,061,792	12,587,537

* *Canadian Trade and Commerce Reports*, 1910, Session Papers, vol. XLIV, no. 6.

† *Exports of Domestic Breadstuffs, etc.*, Bureau of Statistics, December, 1909, p. 4.

[1] *Report of Chicago Harbor Commission*, p. 195.

[2] *Canadian Trade and Commerce Reports*, 1910, Session Papers, vol. XLIV, no. 6.

It is well known that Canada has been considering the building of a great ship canal from the St. Lawrence River to the Georgian Bay. In case this project is carried out the Canadian route will enjoy some advantage from the standpoint of distance. From Duluth to Montreal by way of the proposed Georgian Bay Ship Canal the distance is 997 miles, as against 1500 miles from Duluth to New York City. From Montreal to Liverpool the distance is 3170 miles, as against 3052 miles from New York to Liverpool. This shows the Canadian route from Duluth to Liverpool to have an advantage of 385 miles.

The Canadian route would possess another and more important advantage from the fact that the depth of twenty-two feet proposed for the Georgian Bay Ship Canal would permit the passage of Lake vessels. This would make it possible to unload grain directly from the Lake boats to the ocean vessels at Montreal. On the other hand, the Erie Canal is not deep enough for the passage of Lake vessels, and as barges cannot safely and economically navigate the open Lakes, it will be necessary to transship the grain from the Lake boats to the barges at Buffalo, and again from the barges to the ocean vessels at New York.

The number of days of navigation on the two routes would not vary materially. Between 1885 and 1905 the average number of days of navigation on the Erie Canal was 204.[1] It is estimated that the open season on the Georgian Bay route would be 215 days,[2] but this is probably slightly overestimated.

Since the port of Montreal is closed for several months each year, it might seem that New York would have an advantage during the winter months. But since the Erie Canal is closed at the same time, it is apparent that the railways of New York would reap the advantage rather than the canal. It is doubtful anyway if New York City

[1] Whitford, *History of New York Canals*, vol. II, p. 1061.

[2] Canal Statistics, Canada, 1909.

can take this traffic away from Canada, for the Canadian railways can carry it to the port of St. John when Montreal is closed to navigation.

It should be said in this connection that the Canadian Government seems determined to secure this grain trade at whatever cost. In case the Georgian Bay Ship Canal is not put through, the Government will probably subsidize the railways, guarantee them dividends if necessary, and let them make rates which will be sure to draw the trade away from the United States. With the advantage that Canada possesses from the standpoint of distance, this would not be a difficult thing to do. It appears, then, that the probable future outlet for the grain of the Northwest will be primarily through Canada.

been

The second important source of traffic for an enlarged Erie Canal is said to be manufactures of iron and steel. New York and other cities on the Atlantic require enormous quantities of structural materials which it is thought can be most advantageously shipped by water from Buffalo when the barge canal is opened. It is believed that the tendency will therefore be to develop great manufacturing plants at Buffalo, since the ore can be brought there precisely as well as to South Chicago or Lake Erie ports. This would not only furnish an extensive canal traffic, but it would give a decided stimulus to industrial development in western New York as well.

We find, however, that conditions at Buffalo are not so favorable to the development of the iron and steel industry as might be expected. "Nearly all the property fronting on the outer harbor in this city is owned by the railroads, and is not available except to the railroads; no private interest can get in there. People who want to come here and establish a big industry and get a piece of property where it can be reached by Lake ships, canal boats, and railroads, can find no place to go."[1] "So far back as

[1] *Report of Commissioner of Corporations,* part III, p. 186.

1904 the president of the Chamber of Commerce of Buffalo stated: 'At present there is no available land with water facilities requiring extensive sites in or about Buffalo.' The New York Steel Company, recently organized, was unable to get a site in Buffalo at which ore could be delivered by water at present. Aside from two or three small pieces of land on the Buffalo Creek Railroad there is not a single site, not already taken, available for manufacturing purposes, with both rail and water connections, either in the city or adjacent to it."[1] The only possibility of securing sites for the erection of great iron and steel plants is along the Niagara River between Buffalo and Tonawanda.[2]

The contention that there would unquestionably be a great development of traffic in iron and steel was, as is usual in the case of predictions of waterway traffic, made before any investigation of the problem had been undertaken. It is another case where the wish is father to the thought, and it proves once more the absolute necessity of removing from the domain of politics the appropriation of large sums of money for the construction of public works.

7. But suppose it be granted, for the sake of argument, that there is a large quantity of traffic available for the canal route in question. It still remains to be shown that from a broad economic standpoint the project is justifiable. All things considered, can the Erie Canal when enlarged reduce the cost of transport? This is the main point at issue.

The cost of enlarging the waterway, exclusive of terminal facilities, and of the boats, is estimated at $101,000,000, though it will probably greatly exceed that amount. At that figure, however, the cost will equal $294,460 per mile. In contrast to this, the cost of constructing the New York Central Railway is given as $156,601,150.55, inclusive of terminals, but exclusive of equipment.[3] If this

[1] *Report of Commissioner of Corporations*, part III, p. 188. [2] *Ibid.*, p. 189.

[3] *Annual Report of New York Central Railway*, 1907, p. 20.

figure be correct, it appears that the railway cost only about $41,000 per mile.

The Erie Canal joins the navigable Hudson at Albany and thus makes a through route from Buffalo to New York. The distance from New York to Buffalo by way of the New York Central is 440 miles. At the above rate of construction, therefore, a railway could be built from New York to Buffalo for $18,223,920, little more than a sixth of the cost of enlarging the Erie Canal. If the cost of the canal terminals be included, the proportion becomes as one to seven or eight. At the present day it is probable that a railway could be built between these two cities for about $20,000,000, if the cost of providing the necessary terminals were not included.

8. Let us now inquire as to the capacity of the enlarged Erie Canal as compared with a railroad. It is commonly believed that the capacity of a canal is very much greater than that of a railway and that the disadvantage of the greater additional cost of the former is more than counterbalanced thereby. The statistics employed in showing this, however, generally proceed upon the assumption that the canal is utilized to its maximum capacity, while the data for the railway are based upon actual tonnage statistics. Since a railway is seldom utilized to anything like its full capacity, and since the statistics chosen are usually those of a line which carries passenger as well as freight traffic, the comparisons that are made are wholly inconclusive. Since the New York Central is a four-track system, and since our problem is one of comparing a canal with an all-freight railway, we may make a comparison of a canal and of a double-track railway devoted to freight traffic alone.

The capacity of the enlarged Erie Canal is usually set down as 20,000,000 tons per annum.[1] That is to say, 20,000,000 tons could pass through each lock in a year, or, in

[1] Fairlie, *Quarterly Journal of Economics*, 1900, p. 234.

other words, pass by a given point. Let us analyze these figures and ascertain at how frequent intervals barges would have to pass through a lock. The following tabular statement will serve to make the point clear: —

200 days = season of navigation;
20,000,000 ÷ 200 = 100,000 tons a day;
1500 tons = capacity of barges;
100,000 ÷ 1500 = 67 barges per day;
16 hours = daily period of navigation;
67 ÷ 16 = 4 (approximately) barges per hour; or
1 barge every 15 minutes.

One or two statements may require explanation. The season of navigation, as stated on page 429, averaged 204 days between 1885 and 1905. Allowing for interruptions for repairs, which would be frequent with a tremendous tonnage, 200 days may be taken as a fair round number that the canal could be used each season. It would be impracticable to navigate the canal at night, and sixteen hours is a high average of daylight. Fifteen-minute intervals for the passage of a lock continuously for sixteen hours each day means working on an exceedingly narrow margin, and it is doubtful if so much as 20,000,000 tons could be handled in a year. With traffic going in both directions it is certain that more than fifteen minutes would be required on the average for the passage of a lock. But let us accept this interval as possible of attainment. At that rate, if a steady stream of traffic were available for sixteen hours a day for 200 days a year, the capacity of the canal would be 20,000,000 annually. Now, let us compute in a similar manner the potential capacity of a double-track railway used entirely for the carriage of freight. This computation will differ from the one made in the preceding chapter only in that there we were considering a single-track road only.

We may predicate a block-signal system which would permit trains to run at intervals of 1.5 miles. Such a system is in use on some of our four-track systems at present. At a speed of twenty miles an hour a train could thus be run about every five minutes. Taking the average train-load as 1000 tons (25 cars of 40 tons each) we may compute the following theoretical maximum capacity: —

12 trains = number per hour;
12 x 24 = 288 trains per day;
288 x 1000 = 288,000 tons per day;
288,000 x 365 = 105,120,000 tons a year in each direction;
105,120,000 x 2 = 210,240,000 tons both ways.

This means that if there were a steady stream of traffic from both directions every hour in the day for every day in the year the road might handle more than 200,000,000 tons of traffic in a year, or ten times the amount that could pass through the locks of the enlarged Erie Canal. Both from the standpoint of original cost and of capacity, therefore, the advantage is seen to be overwhelmingly in favor of the railway.

9. There remain to be considered the costs of maintenance and of operation of the two agents of transport. Statistics for such a computation are not so satisfactory as one could wish, but nevertheless an idea may be gained of the comparative advantages in this regard.

The chief items in the maintenance account may be given with some degree of accuracy. One of the largest is of course the interest on the capital investment. At three per cent the interest on the waterway capitalization of $101,000,000 amounts to $6880 per mile of waterway,[1] while the interest on the capitalization of the New York Central Railway, as given above, amounts to $1242 per mile of line.[2] Though this comparison involves the original cost of construction and hence has already been covered, it has seemed advisable to present it here again in more concrete form. As to the cost of maintaining the physical equipment of the new canal, we have no direct data; but the Welland Canal, fourteen feet in depth, will

[1] This is for the 440 miles, which includes the Hudson River.

[2] *Annual Report of New York Central Railway*, 1907.

serve to give some idea of the cost of upkeep of a waterway. In the year 1909, an average year, the cost of maintenance and renewals on this canal amounted to \$5665 per mile.[1] This is as against \$3296 per mile of line on the New York Central system. Together these items give a total of \$12,-551 per mile of waterway as against \$4528 per mile of railway. Here again the advantage is greatly in favor of the rail route.

Statistics of the cost of operation of canals in the United States are not available, and if they were they would be far from adequate to our present purposes because the canal traffic is very small and the canals have not been kept in a state of good repair. For similar reasons it is difficult to set off against statistics of canal operation those of railway operation. The amount of traffic handled, the character of the country traversed, the method of accounting employed, unite with various other factors in determining the amount of the operating expenses of any road, and it is hence impossible to make a reliable direct comparison. All that may be said is that the cost of boats, as indicated in the preceding chapter, is somewhat less per ton of carrying capacity than the cost of railway rolling-stock, and it is probable, though this point has been frequently denied, that the direct cost of moving a given ton a given distance is somewhat less on a waterway than on a railway. In the case of a canal where the wash against the banks is heavy, where the suction on the bottom is considerable, and where there are many locks to pass, the greater economy of movement by boat is much more in doubt than it is on the open lakes or freely navigable rivers. It is from the latter, however, that the statistics purporting to prove the point are usually taken.

It should be observed in this connection, also, that the cost of hauling a single boatload a given distance cannot fairly be compared with the cost of hauling a single train-

[1] *Annual Report of Department of Railways and Canals of Canada*, 1909–10, p. 15.

load of equal weight the same distance. The transportation business is subject to the law of increasing returns to an unusual degree, and hence we must compare the cost per unit of the total tonnage carried by rail and by water respectively. The far greater capacity of the railway is evidently a decided advantage in this regard; but of vastly more importance than this is the much greater adaptability of a railway to systematization. The very fact that a canal is usually operated by independent boat-owners, "by whoever wishes to carry his own produce to market," precludes the possibility of a systematic operation of the route. At best, even with a monopoly of traffic by a single company, a canal, for reasons that have been indicated elsewhere, is inherently not so well adapted to efficient organization of the carrying business as is a railway. In view of these considerations it is by no means certain that the direct cost of operation on the Erie Canal would be any less than on an all-freight railway. We may grant, however, that the cost of moving a given tonnage a given distance is considerably less by boat than by railway car, and yet conclude that the numerous advantages of the railway as enumerated above greatly outweigh this single advantage of the canal.

10. In making the above comparison of the cost of transportation on an all-freight railway and on the enlarged Erie Canal, we were proceeding on the assumption that additional transport facilities between the Great Lakes and the Atlantic seaboard were indispensable. The fact of the case is, however, that there is no present need of additional transportation lines in this region. Additional terminal facilities and sidings are doubtless necessary, but the existing main lines are by no means taxed to their full capacity. The density of traffic on the New York Central, for instance, is only 2,855,610 tons per mile,[1] which is much

[1] *Annual Report*, 1907, p. 25.

less than that of some of our other roads which are not equipped with a four-track system. The purpose of the canal is not to provide absolutely indispensable transportation facilities; its purpose is avowedly to lower the cost of transportation, either directly by carrying the traffic itself, or indirectly by forcing lower rates on the railroads. Since this is true, it is then not necessary that it be shown that an all-freight railway could be constructed which would carry this traffic cheaper than can the canal. If the aim is to secure low freight rates by state aid to transportation, it may be accomplished in a far more economical manner than by constructing a canal.

Suppose that the New York Central Railway were relieved by the state from paying the annual interest on its bonded indebtedness of $18,223,920;[1] suppose, even, that it were relieved of the yearly fixed charges on the total capitalization of the road; suppose, in addition, that the state should bear all the expense of maintaining the way and structures of the road, amounting to $12,462,046 annually; suppose that the railway company were relieved of its present annual taxes on real estate, on special franchises, on capital stock, on bonded debt, and on gross earnings, amounting in all to $3,439,287; — suppose, in a word, that the New York Central Railway Company were merely obliged to earn dividends on the cost of its rolling-stock, while using the state's highway entirely free of charge, and an idea is gained of the low freight rates that might be offered were the state to extend to it the same aid as it is to grant the Erie Canal.

11. It is unnecessary to push this question further. From whatever angle we approach the problem we find support for the contention that transportation by rail is cheaper than transportation by canal, when there is included in the cost on the canal the state-levied taxes which cover the

[1] The statistics in this paragraph are all from the *Annual Report* of the road for 1907.

original cost of the highway, and the annual expense of maintenance. As has been pointed out time and again in the course of this study, the fallacy of leaving out of the computation of the cost of transportation by water the cost of constructing the waterway itself and of keeping it in a state of repair, underlies the whole waterways movement in this country. Water transportation cannot in this manner be proved cheaper than transportation by rail; and unless it can be proved the cheaper mode of transit, the construction of *artificial* waterways, at least, must be pronounced bad economy.

To guard against misunderstanding it should be stated that it has not been our purpose in the above paragraphs to advocate that the State of New York should subsidize her existing railroads, or construct additional lines and enter the field in direct competition with the private railways of the state; though either could doubtless be defended on the same grounds as is the competition of canals with private railways. The attempt has merely been made to bring home to the reader in as many ways as possible the truth that canal transportation, when all factors are included, is more costly than transportation by rail, and that hence the enlargement of the Erie has no justification on economic grounds.

By way of summary, it should be restated that this project was authorized through the influence of sectional interests hoping to benefit at the expense of the state as a whole; that no adequate investigation of the possibilities of increased traffic was ever made; that it was decided upon before the vital question of terminals was apparently conceived of; and that absolutely no computation was made of the inclusive cost of transport on the enlarged canal, as compared with the cost by rail. The enlargement of the Erie Canal is a typical example of the wholly unscientific manner in which Government funds are commonly voted in this country for purposes of public improvement.

CHAPTER XX

EXPLANATION OF THE WATERWAYS MOVEMENT AND CONCLUSION

The evidence of the foregoing investigation has obviously pointed strongly against the feasibility of water transportation in the United States. Before stating our final conclusions, however, it seems advisable to attempt to explain briefly why the waterways movement should have enjoyed such a vogue in this country and commanded such widespread support. The reader has doubtless already asked himself many times how it is possible, if the conclusions reached in this investigation be sound, that a large proportion of the American people could have become convinced that the development of water transportation in the United States is an imperative necessity, and especially how economists, statesmen, and men of business could have been so badly misled in the matter.

In the first place, it should be observed that history has afforded many illustrations of popular movements similar to this one for waterways. Money inflation and internal improvement schemes, religious, prohibition, and suffrage movements have periodically swept over countries in response to emotional states which seem to have been superinduced by a combination of psychological influences. Even in this very field of canal building this country has already passed through a veritable craze, one which culminated in widespread disaster.

The remarkable success of the Erie Canal, which was opened in 1825, precipitated a widespread movement for internal improvements, approximately covering the period from 1825 to 1840. It spread not only to those states which were in need of lines of communication with the West, but it led to comprehensive transportation plans within the Western States themselves. Pennsylvania, jealous of New York, and lured also by great expectations of bountiful returns, in 1826 planned a vast system of internal public works — canals, turnpikes, and railways. Little forethought was exercised, and the geographic disadvantages of Pennsylvania in having to build public works across mountains were almost wholly disregarded. In stirring up popular enthusiasm "reference was made to the advantages England had derived from her canal system, to the stimulating effect of the Middlesex Canal upon the dormant industries of New Hampshire,"[1] and, above all, to the beneficent results of the Erie Canal in the State of New York. "The advantages that would accrue to all classes from improved transportation methods were carefully detailed. The farmer would find increased demand, brisker sales, and higher prices for his produce; the merchant, a wider field for his business; the manufacturer and mechanic, more certain employment and better pay for their industry; the capitalist, a better interest on his money; and the owner of lands and houses, a rise in rents of twenty-five or thirty per cent."[2] "It was predicted that the tolls would support the government and educate every child in the commonwealth."[3] "Construction was carried on for years and many miles of works were built; but underestimates of cost, lack of traffic, corruption, and the panic of 1837 eventually carried the state to bankruptcy."[4]

[1] Bishop, *State Works of Pennsylvania*, Publications of Yale University, 1907, p. 177.

[2] *Ibid.*, p. 178.

[3] *Ibid.*, p. 174.

[4] "The total financial loss to Pennsylvania on account of the public works was $57,824,681, to say nothing of a debt of $40,000,000, which remained unpaid at the time of the sale of the public works, and which was incurred largely for the construction of transportation improvements." (*Ibid.*, p. 229.)

The first Governor of Michigan declared in 1837 that "the period has arrived when Michigan can no longer, without detriment to her standing and importance as a state, delay the action necessary for the development of her vast resources of wealth. With a prudent and wise forecast to be exercised by the legislature and the people, we cannot fail soon to reach that high destiny which awaits us."[1] The people were assured that not only would the returns from the investments prove sufficient to pay off the state debt speedily, but that there would actually be a plethora of funds in the treasury which would forever free the inhabitants of Michigan from the burdens of taxation. In 1846 two strips of railway were sold for $2,500,000, and "here virtually ceased to exist all our works of internal improvement. Nothing but the débris of our airy castles remained, and that only to plague our recollections."[2]

Illinois also went through a similar period of speculative building of public works. In his message to the special session of the legislature, begun December 7, 1835, Governor Duncan said: "When we look abroad and see the extensive lines of communication penetrating almost every section of our sister states, when we see the canal boat and the locomotive bearing, with seeming triumph, the rich products of the interior to the rivers, lakes, and ocean, almost annihilating time, burthen, and space, what patriot bosom does not beat high with laudable ambition to give Illinois her full share of those advantages which are adorning her sister states, and which a munificent Providence seems to invite by the wonderful adaptation of our whole country to such improvements."[3]

[1] Cooley's *Michigan*, p. 291.

[2] *Ibid.* The young state of less than 200,000 people plunged into debt to the extent of $5,340,000 in attempting to build great canals and railroads. Finally, being unable and unwilling to raise the necessary funds to run the government, meet the interest payments, and pay off their enormous debt, the people of Michigan denied their obligations and repudiated the state debt.

[3] Davidson and Stuvé, *History of Illinois*, p. 434.

All that seemed to be needed to insure the prosperity of Illinois was a comprehensive system of transportation routes. It was urged that these routes could be constructed on the faith and credit of the state. "The dazzling scheme was vigorously agitated. The press espoused the project, public meetings were held all over the state, and resolutions, as the expressions of the people in favor of the scheme, were adopted."[1] "The wildest reasoning was indulged. Every theory that the teeming brain of man could suggest was brought into requisition to further the success of the schemes. Possibilities were argued into probabilities, and these latter into infallibilities."[2] "The manifest destiny of government was portrayed in glowing colors; deductions from similar systems in other states were made applicable to Illinois, and their success driven home and clinched with predictions; and who can argue against prophecy?"[3]

Large appropriations were made for a great system of internal public works; but only to end, as elsewhere, in disaster.[4] Bonds were sold until the credit of the state was exhausted; and the people became unwilling and unable to pay higher taxes. In 1841 the state defaulted on its interest, while repudiation of the entire debt was long imminent.

In this second waterways movement, there are to be noted the same popular demonstrations, the same sort of political promise of great financial returns to the state, the same chimerical hopes of unnumbered benefits to every

[1] Davidson and Stuvé, *History of Illinois*, p. 434.

[2] *Ibid.*, p. 435. [3] *Ibid.*, p. 439.

[4] In "An Act to establish and maintain a general system of internal improvement, February 27, 1837, the legislature went far beyond expectations and appropriated $10,230,000." (Davidson and Stuvé, p. 436.) This was soon found, however, to be only about one half the sum necessary to complete the grand scheme. The population of the state in 1835 was 271,727, making a per capita debt of over $37. Total collapse came in 1840, leaving a state debt from this source of $14,337,348. (*Ibid.*, p. 448.) The annual revenue was but $117,821 at the time, no more than necessary to meet the ordinary expenses, leaving an annual deficit to the state of $830,182 to augment the debt. (*Ibid.*, p. 448.)

class of society, and the same reasoning from foreign precedent as existed in the earlier mania. In the introductory chapter a quotation was given from the solemn resolutions adopted at the great New Orleans convention in October of 1909. These resolutions were the outgrowth of several days of jubilant celebrating, accompanied by some remarkable oratory.

The Governor of Kansas exhorted as follows: "Ask every commercial club in the union to work for the advancement of every Congressman who favors the proposition, and for the retirement of those who do not." He said that the details could be disregarded. "You are going to have water transportation in this country, you will have to get it, not stand around and question its feasibility. The question of details does not come up in the consideration of railway building, and waterways are a better transportation proposition than rails." The Governor of Missouri in a glowing speech said, "There are a hundred rivers flowing unused past Missouri. The possibilities of waterways exceed all the questions in which the American people are interested;" while the Governor of South Carolina sounded the keynote of the convention in his telegram, — "We want water, more water, and deeper water."

The resolutions themselves gave excellent expression to the moral issues believed to be involved. "Believing in our hearts that the needs of the country and the fundamental principles of our government herein set forth, involve moral no less than material issues . . . we do hereby deliberately and firmly and in the full realization of our duties and responsibilities demand and direct" that the waterway be constructed immediately.

The junior Senator from Illinois added the final word, and "argued possibilities into probabilities, and these latter into infallibilities," when he attacked the unfavorable report of the army engineers, saying: "I don't blame these men who have not studied the problem thoroughly for being cautious. But no one questions the feasibility of the fourteen-foot channel between Chicago and St. Louis, or of a twenty-four-foot channel, for that matter. You may investigate from now till dooms-day ; you may secure what engineers you may; they may study the river and the problem, and they will be forced, *on their honor*, to report that a fourteen-foot channel between Chicago and St. Louis is feasible." [1]

At the Chicago convention in the autumn of 1908 a noted speaker declared that "thirty great states will enjoy the tremendous advantages of water transportation. Twenty thousand miles will have been added to the coast line of the Republic. The congestion of the American railway system will be cured. Nearly every problem of modern American transportation will be solved. The era of moderate freight rates will be permanently installed. And the sea will be brought to the American farmer." Forgetfulness of party lines, of factional divisions, and of neighborhood interests was urged for the sake of the great undertaking.[2]

The Chief Engineer of the Chicago Sanitary District is credited with the following statement: "It is my conviction that a deep waterway across the State of Illinois would be worth all it could possibly cost, within the limits of the most liberal estimates which have ever been placed upon it, even were there no Mississippi to receive its affluent waters, and no hope of ever floating a craft beyond the line which limits the sovereignty of the commonwealth." [3] And the present Governor of Illinois, like his prototype of 1835, has repeatedly given assurance that the proceeds from the sale of water power along the Lockport-Utica

[1] For accounts of the convention see any daily papers for the last few days of October, and the first day of November, 1909. The above quotations are taken from the Chicago *Tribune* of November 1, 1909.

[2] The Chicago *Daily Tribune*.

[3] *Report of the Deep Waterway Committee of the Chicago Commercial Association*, June, 1906, p. 3.

stretch of the Lakes-to-Gulf Waterway would in a few short years permit a substantial reduction of the taxes which now burden the good people of Illinois. The reports of practically every waterway association set forth in glowing colors the great benefits to accrue to all classes of society, and especially to the tiller of the soil.[1] The early craze for internal improvements in the United States is paralleled at every point by this second agitation for waterway development.

We may go further, however, than merely to note the parallelism between the present and the earlier movement for waterways in this country. Until very recent years great popular movements have been surrounded with more or less of mystery; but the science of social psychology has now furnished an explanation of such phenomena. The underlying principles may be briefly stated.

The forces tending toward a popular craze or a group spirit are: recurrent suggestion, broadside and voluminous suggestion, and authoritative suggestion. If the same idea be repeatedly brought to the attention, it assumes some degree of importance; if, in addition, it comes from a great number of sources, and in different forms, its importance is very greatly enlarged; and if it be backed by prestige, by authoritative sanction, its force becomes well-nigh irresistible. Coupled with these principles of suggestion is the law of imitation, impelling the individual mind to accept the current thought as perforce correct. It is the inherent desire to be like-minded, to be one of the majority. The operation of these forces upon the public mind results in an unreasoned conviction, a sort of mental aberration, in which individuality is lost, or merged in the anonymity of the group, and the power of thought is virtually inhibited. A mob-mind has been developed in which the faculty of reason is held in abeyance, until such time as counteracting influences may restore again the normal condition.

[1] See pages 16–17.

There is no warrant, moreover, for the belief that crazes or waves of popular excitement are of less common occurrence in these days of twentieth-century enlightenment. On the contrary, rather than belonging merely to the simple-minded peoples of benighted ages, they seem to become more and more frequent as civilization advances. A complex society, widely disseminated information, and strenuous existence are particularly conducive to popular delusions rather than preventive of them. The receptivity of the mind to suggestion is increased by whatever lessens its vigor and its power of discrimination. Fatigue and nerve strain would, clearly enough, then, prepare the mind for a ready acceptance of fallacious ideas, especially if they offered alleviation of existing hardships. "Every line we read or write, every human face that we see, every conversation that we carry on, every scene we perceive, sets in activity our sensory nerves and our brain centres. Even the little shocks of railway traveling, not perceived by consciousness, the perpetual noises, and the various sights in the streets of a large town, our suspense pending the sequel of progressing events, the constant expectation of the newspaper, of the postman, of visitors, cost our brain wear and tear."[1] Again, the overthrow of hallowed customs and beliefs, leads to uncertainty and confusion of thought, paving the way for a ready acceptance of all manner of transitory ideas. "In a dynamic society so many readjustments are necessary, such far-reaching transformations are experienced in half a lifetime, that the past is discredited. One forms a habit of breaking habits. Ancestral wisdom, the teachings of social experience, are refuted and discarded at so many points that they lose their steadying power.[2] The present age, with its nerve

[1] Cooley, *Human Nature and the Social Order*, p. 39.

[2] Ross, *Social Psychology*. Furthermore, the increasing use of the telegraph and the telephone, the extensive travel of a large portion of the people, and the daily newspapers, carried even to the homes of the farmers

wear, its multitudinous interests, and extensive intercommunication, is peculiarly productive of popular movements.[1]

It is our purpose now to apply these psychological principles to the present waterways movement. Attention should be directed to the incessant suggestion in public discussion and in the press that transportation upon our rivers and canals should be revived. The remarkable conjunction of influences should be recalled, namely, the lingering glory of our waterways, the widespread movement for the conservation of all our natural resources, the relation of waterways to the reclamation of flooded lands, to the development of water power, and to sanitation, the supposed remarkable cheapness of water transportation, the opposition to the monopolistic tendencies of railways, the inadequacy of the railway service to meet the country's needs, the alleged benefits of waterways even to the railways, the avowed advocacy of waterway development by railroad men, and the extensive use of waterways in foreign countries. Finally, it should be noted that, in addition to this incessant and broadside suggestion, the movement has had the active support of some economists, and of many prominent business men and politicians, who have served to give the necessary sanction of authority. Under such a cumulation of causes and combination of influences, it was

by means of free rural delivery, have largely broken down all group barriers. What formerly interested but a particular section of the country and a particular group of people may now readily affect the entire nation, and all parts well-nigh simultaneously. This is an era of publics rather than of crowds, due to the facilities for the intercommunication of ideas.

[1] It is recognized that as man increases in knowledge, as he becomes more rational, he grows proportionally less susceptible to emotion and delusion. (See Hobhaus, *Evolution of Morality*.) It is a very small fraction of our population, however, that can be regarded as having attained any considerable degree of rationality. The great majority is not capable of understanding and assimilating the multitude of considerations and problems that are constantly arising. We have a long road yet to travel before society will have arisen above delusion and emotionalism.

utterly impossible for the average individual to weigh the various arguments which were presented or to subject them to the test of reason; and it is not surprising that a large portion of the populace should have grown excited over the matter and jumped to the conclusion that the industrial growth of the country is fundamentally dependent upon the development of water transportation.

The objection may be raised, however, that while it is true that the common lot of mankind may thus easily be carried along on a wave of popular excitement, the support of the waterways movement by well-educated and prominent men cannot be satisfactorily explained by the principles of social psychology. This may possibly be the case in some instances, though it has been the experience of the writer to meet a great many men of high intelligence who have been drawn into this current of popular enthusiasm without having given any reflection to the subject whatsoever. But if it be true that there are some supporters of the waterways movement who are not under the influence of popular excitement, their attitude may usually be explained on other grounds. This is particularly true of the real leaders of a movement of this kind, namely, politicians, and other specially interested parties.

The politician may inaugurate a popular movement or he may merely follow public sentiment and assume the leadership when once he has discovered the current of popular feeling. In either case he has a distinct end in view. It is incumbent upon a servant of the people to devote himself to the interests of his constituency. If there are no issues of importance before the public, it devolves upon him to manufacture some. If, on the other hand, there chance to be questions pressing for solution, he must take a stand and attempt to secure wise legislation. In any case, upon the expiration of his term of office he must be able to point to work accomplished if he desires a reëlection. The greater the work performed the larger appears the statesmanship;

and the more closely it appears related to the welfare of all the inhabitants the greater appears the honor due the servant of the people. Consequently, the development of natural resources always furnishes a very attractive field to the office-holder who would further the interests of the state. Doubtless many of our statesmen, actuated by the highest motives, but with misdirected zeal, have enthusiastically advocated the building of public works, which resulted in great losses instead of enormous profits. But, on the other hand, it must be said that too often in our history there have been motives other than those of public service actuating our men in office. The expenditure of great sums of public money always carries with it a large amount of political patronage. That is, the control of the State's purse is always of great strategic importance. For the building of the public works contracts are given to private construction companies. These contracts may be let with the distinct understanding that there is to be given in return not only ordinary political support, but positive aid in elections, by cash contributions to campaign funds, and through direct influence upon the voting of laborers engaged upon the public works. Thus the party machine is strengthened. It is also true that not infrequently we have had politicians who were financially interested in construction companies, or who have held property so located as to be enhanced in value by the building of public works. In many ways, then, are politicians interested in enterprises which promise to be a great boon to society, and which carry with them the expenditure of vast sums of public money. It secures them lasting renown if benefits accrue; it gets votes, in any case, whether legitimately or illegitimately; and it may in addition make office-holding profitable. There is consequently, every incentive for men in office, especially if they be unscrupulous, to create and direct popular movements involving large money outlays.

For similar reasons, certain special interests may always be counted upon to render valuable aid to the politician. Chief among these are representatives of lumber, coal, and other companies who hope to be able to ship their goods at less cost to themselves, since on a public waterway part of the cost of transportation comes from the general public in the form of taxes to the Government, instead of entirely from the shippers as in the case of a private railway. Second, there are those who own, or who expect to secure, land which will be enhanced in value because of proximity to the waterway. Third, there are companies which hope to get control of water-power sites and to utilize the water power created at the expense of the state. Fourth, there are contractors who hope to be allowed to build the works. Were there no opportunities for exorbitant profits from building public works, contractors would still be very desirous of securing such gigantic projects as canals to build; and with the possibilities of graft that always exist in enterprises of this kind it is not surprising that contracting companies should join with the others and manifest real zest for the waterways.

The many waterway conventions that have been held all over the country,[1] the annual Lakes-to-Gulf jubilee, and the National Rivers and Harbors Congress entail the expenditure of no small amount of money. The various waterway associations [2] send out great quantities of literature and support permanent salaried officials at heavy expense. For instance, the annual statement of the Ohio Valley Improvement Association, September 30, 1909, showed an expenditure for the preceding year of $11,232.79. It is obvious that those who defray these expenditures are looking for direct return on their investments.

In the State of Illinois the Lakes-to-Gulf project has been inseparably connected with a political imbroglio in

[1] A list of those held in 1907 is given in chapter I, p. 2, note.

[2] For list of associations, see chapter I, p. 3, note.

which two rival leaders are struggling for supremacy.[1] It may be said, indeed, that waterway appropriation is the prize around which has centred the entire struggle of political factions in Illinois in recent years,—a struggle

[1] The struggle has centred about the junior United States Senator, and the Governor of the State of Illinois. The Lakes-to-Gulf waterways movement owes its existence largely to the organizing ability of this Senator. A few years ago, in company with a small group of political friends, he journeyed all the way from Chicago to New Orleans in a launch, organizing waterway associations in every town of any importance along the route, and then combining these into one grand organization, the Lakes-to-Gulf Waterway Association. The Senator has persistently contended that the National Government should take the lead in building the waterway through Illinois, and that all that stands in the way of federal grants for that purpose is the attitude of Illinois in assuming independence in the matter, and of making appropriations before securing the aid of the Federal Government. He argues that the plan was originally intended to be a coöperative affair, and that it is consequently essential that the people of Illinois should know for a certainty that the National Government is going to perform its part before the state spends millions on a waterway which might never be completed. The Governor, on the other hand, has as persistently urged that the State of Illinois should spend a large amount of money on the waterway, in the hope of thereby inducing the Federal Government to aid in the completion of the work. Illinois must prove herself in earnest in the matter before asking assistance of the Government at Washington.

Both, then, favor the waterway; they differ only as to which should take the initiative, state or nation. A reasonable explanation of their respective attitudes might perhaps be found in the fact that, if the state takes the initiative, the Governor would be able to strengthen his political standing by means of the political patronage he would have at his disposal, and that, if the United States Government should make a liberal contribution for the commencement of the work certain advantages of a political nature would go to the Senator.

It is now a matter of common report how the Senator controlled the Schmidt Bill in the legislature, and refused to allow it to be brought up for final vote until sure of enough votes to defeat it; how he repeatedly blocked all attempts of the Governor to proceed without aid from the National Government; and how he gracefully gave up the idea of a $16,000,000 appropriation by the Federal Government, which was at first deemed absolutely necessary, for any appropriation whatever, however small a fraction of the original amount, as being better than no appropriation at all. And it is almost as well known that the Governor and his friends entirely changed their conception of the fundamental purpose of the which has disgraced the very name of the state. It may be added that unless the whole question of waterways is removed from the domain of politics, and placed in the hands of impartial investigating bodies, this country will

proposed waterway through Illinois when it became apparent that there was little hope of getting legislative sanction for the spending of the state's money until the Federal Government had guaranteed to finish the project.

When the agitation for a waterway from the Lakes to the Gulf was first started, very little was heard of the water-power aspect of the case. It was to be a transportation project of such far-reaching importance that it would relieve the traffic congestion of more than thirty states in the great Middle West, and for all time solve the problem of low freight rates from the interior to the seaboard. The development of a certain amount of water power was, indeed, to be an additional benefit, but comparatively little emphasis was at first placed upon this phase of the project. Primarily as a transportation project, therefore, it went before the people of Illinois for an appropriation of $20,000,000, to be spent contingent upon the promise of the United States Government to furnish the funds for the completion of the work. The Senator is right on this point; with this understanding the appropriation was sanctioned by the people of Illinois by a large majority.

But in anticipation of the day when the canal should be completed, certain private interests secured possession of valuable water-power sites along the route, hoping to reap large returns from the sale of water power developed at the expense of the state. This was promptly seized upon by the Governor and his friends as a reason for the immediate expenditure of the $20,000,000 authorized, without waiting for the expected aid from the Government at Washington; and they are now clamorously contending that the prime purpose of the waterway from the beginning has been not to secure a transportation route but to develop water power, and therefore conserve a great natural resource of the state. While it is perfectly obvious that if the function of the canal has now become to develop water power rather than to be used for transportation, the people of the state should again be given the opportunity of a referendum vote, every effort is being made to prevent the submission of the question to such a vote, because it is morally certain that it would now be voted down. The advocates of the scheme attempt to silence all doubts as to whether sufficient water power could be developed and marketed to warrant the expenditure of so large a sum as is involved, by merely pointing to the fact that private interests deem it of sufficient importance to attempt to get control of it; utterly ignoring the while that these private interests would not for a moment think of venturing their own money in the construction of the canal route. The interests will profit only in case the state spends its millions in opening the canal along which the power is to be developed.

doubtless continue to waste its millions in projects for canal building and river improvement, the chief result of which will be to enlarge the patronage or further line the pockets of our practical politicians.

CONCLUSION

In concluding this study of the comparative merits of waterways and railways in the field of modern transportation it seems in place to direct attention to the general trend of economic advancement in relation to the development of the agencies of transportation, and to lay special emphasis upon certain important aspects of the question which we have been considering.

Economic progress, it is needless to state, has been conditioned at every stage by transportation considerations. And until very recent times it has been almost exclusively the water routes that have mainly determined the industrial and economic development of the world. It is unnecessary to relate here the part played by the natural commercial highways of mediæval days in the history of that time, or the influence of trade routes upon the discovery and settlement of the New World. It is well known that until late in the eighteenth century the commercial development of every country was almost wholly confined to its seacoast or to its navigable lakes and rivers. But with the development of large-scale production and the widening of the market, which came with the industrial revolution toward the close of the eighteenth century, it became necessary to supplement the natural water routes by artificial ones; and it was not long until the genius of man showed itself in the construction of canals, to serve as connecting links in a system of natural water routes, and even as independent lines in themselves.

The countries of continental Europe, England, and the United States all in turn passed through a great era of canal building. The result of these new commercial highways was to lower tremendously the cost of transportation, and to spell the fate of the old through routes of travel by the turnpike road. The industrial revolution could not have been complete without this supplementing of the natural water routes by extensive systems of artificial canals. In the first half of the nineteenth century, particularly, the canals of both Europe and the United States were of enormous influence upon economic development. The cost of transporting goods for long distances in sections not favored by natural waterways became but a fraction of what it had been hitherto, and the new regions opened up by means of canals enjoyed long periods of remarkable prosperity. During these years, moreover, whether the canals were privately or publicly owned, tolls were everywhere levied upon the water traffic sufficient in amount to cover not only the entire cost of operation and maintenance, but to cover as well the original cost of construction of the waterway itself. Indeed, since the utter inability of the old-fashioned stage-roads to compete with them gave the canals a virtual monopoly of traffic, they were usually exceedingly profitable sources of investment.

But in all the principal countries of the world another tremendous change took place about the middle of the nineteenth century. The invention of the steam locomotive and the steel rail with its great load-carrying capacity, together with the perfection of the telegraph and the telephone and the development of the corporate form of industry, have ushered in a second industrial revolution perhaps even more far-reaching in its consequences than the one half a century earlier. Old methods of doing business have been almost entirely superseded in the last two generations, and the commercial world of to-day is as different from that of fifty years ago as the latter was from the world of the eighteenth century.

With the development of railway carriers, industrial enterprise, which had hitherto clung close to the banks of the waterways, now moved out from the river valleys and covered the entire area of a country. The ability of the railways to strike out from the old beaten lines of travel, to cross prairie and mountain, and to extend their lines to the farthest ends of a country, completely revolutionized commercial development. The railways spread like a great net over a country, and almost no section, however remote from a navigable water route, is now without more or less adequate transportation facilities. By means of sidings and spur lines they can extend to almost every recess of great urban communities as well as to the heart of mining districts where the depressions caused by exhausted mines make canal building virtually impossible. Rapid and economical shipment of goods is no longer confined to trunk-line water routes, aided by such additional lines as the physical character of a country allows; for by means of a modern railway system traffic may be sent to all the points of the compass, and by virtue of the standard gauge of tracks it may be sent to any destination, however distant from the original place of origin, without transshipment. In a modern industrial state, where division of labor has been carried to a great extreme and where traffic is assembled from, and distributed over, widely separated areas, this is of paramount importance. Herein, indeed, lies the tremendous superiority of the railways in the carrying of traffic under modern conditions.

We have found from our study that everywhere, in Europe no less than in the United States, there has occurred *pari passu* with the development of railways in the third quarter of the nineteenth century a rapid decline in the amount of traffic carried on inland water routes. This decline has continued to the present day in England and the United States, and it has been checked in the countries of continental Europe only by the extending of Government subsidies to the waterways. In order to prevent the almost complete diversion of traffic from the waterways it has been necessary for Governments to assume all, or nearly all, the fixed charges connected with water transportation, to pay for building, equipping, and maintaining the water routes, and to furnish them free of charge to the water carriers. When thus relieved of all save the mere direct cost of operating the boats, it is usually, though not always, possible for the water carriers to offer rates which enable them to compete with railways, which are entirely self-supporting. Even then, it is not infrequently necessary to protect the waterways still further from railway competition by arbitrarily compelling the railways to quote rates from twenty to fifty per cent higher than those by water, as is the case in France and Belgium; and although the cost of transportation by water, when to the rate charged by the water carriers are added the taxes levied by the state in support of the waterways themselves, is usually much greater than that by rail, many people have still clung, strange as it may seem, to the belief that canal transportation is much cheaper than that by rail.

There can no longer be any question, however, that so far at least as *canals* are concerned, the cost of transportation, all factors included, is almost universally much greater by water than by rail. It is only in the case of very short canals which connect long stretches of naturally navigable waters that they can have any economic justification at the present time. While canals satisfactorily served the needs of an earlier period, their day, like that of the sickle, the hand-loom, and the spinning-jenny, is now forever past. Precisely as the canal supplanted the horse in the carriage of through freight, so in turn has the railway, in the course of industrial progress, come to take the place of the canal in the field of transportation. To attempt now to return to the antiquated system of transportation of a half-century ago, or to make canals an integral part of a national transportation system, whether for the carriage of high-class or low-grade freight, it matters not, is to attempt to turn backward the clock of time.

In the case of *rivers*, however, the situation may at times be somewhat different. But, after all, river transportation is usually analogous to that by canal, for comparatively few of our streams are really *natural* highways of commerce. As a rule they are navigable for the purposes of modern transportation, in name only, rather than in fact. So long as the cost of canalization of a river amounts to forty, sixty, or a hundred thousand dollars a mile, it belongs in the same category as a canal. A river like the Rhine, whose banks are firm, whose gradient is gentle, whose water supply is constant, and the cost of regulation of which is almost negligible, may, indeed, be regarded as a *natural* avenue of commerce; but a river such as the Mississippi, with ever caving sides and shifting bottoms, with periods of alternating floods and droughts, and the control of which is, in the opinion of engineers, a greater task than the building of the Panama Canal, is no more to be regarded as a *natural* highway of commerce than any artificial channel whatsoever. The test of the commercial success of such a river must lie in the cost of rendering it navigable for the purposes of modern transportation. Our investigations have indicated that it is only in rare instances that river transportation can be made as economical as transportation by rail.

THE END

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