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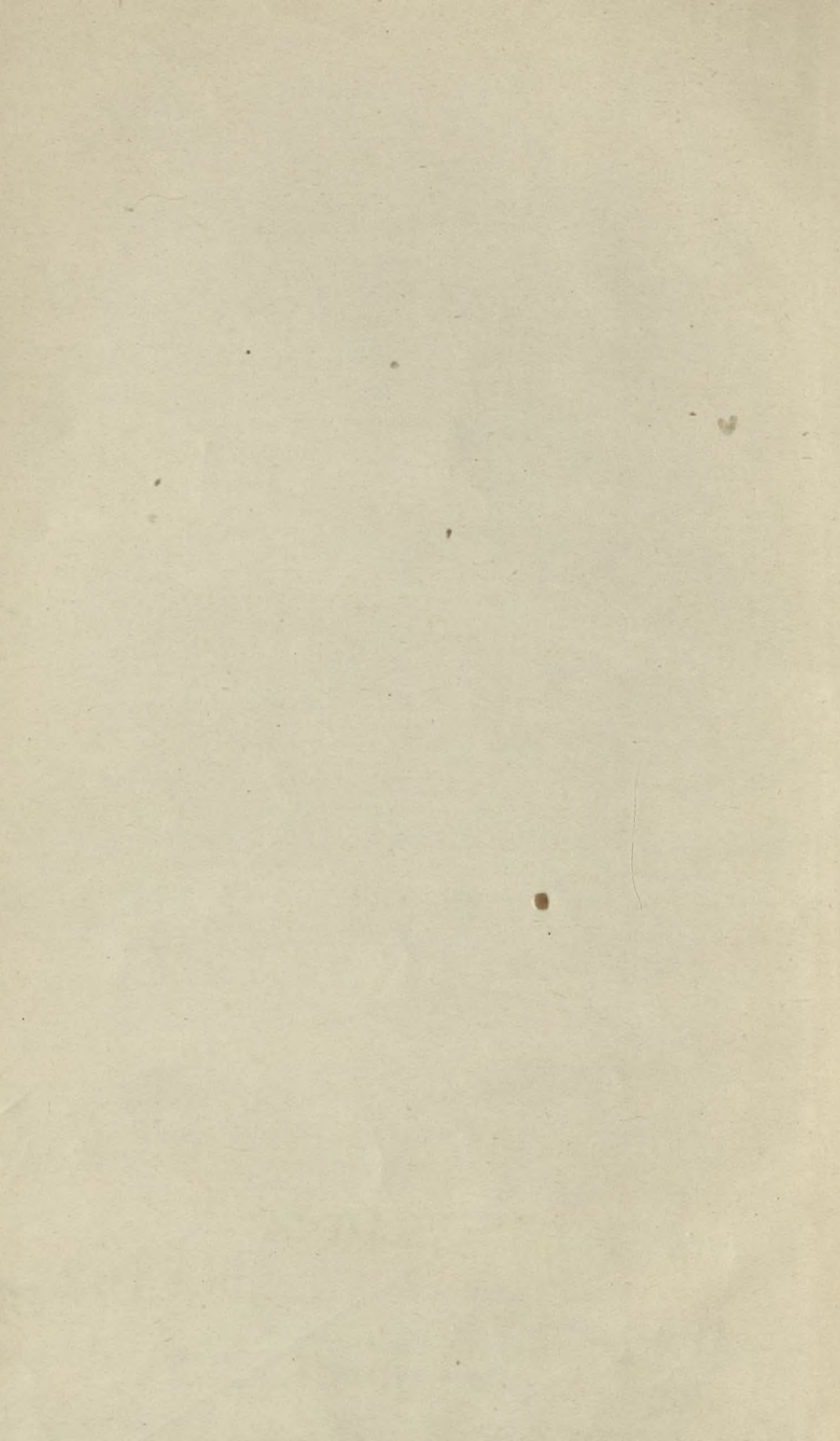
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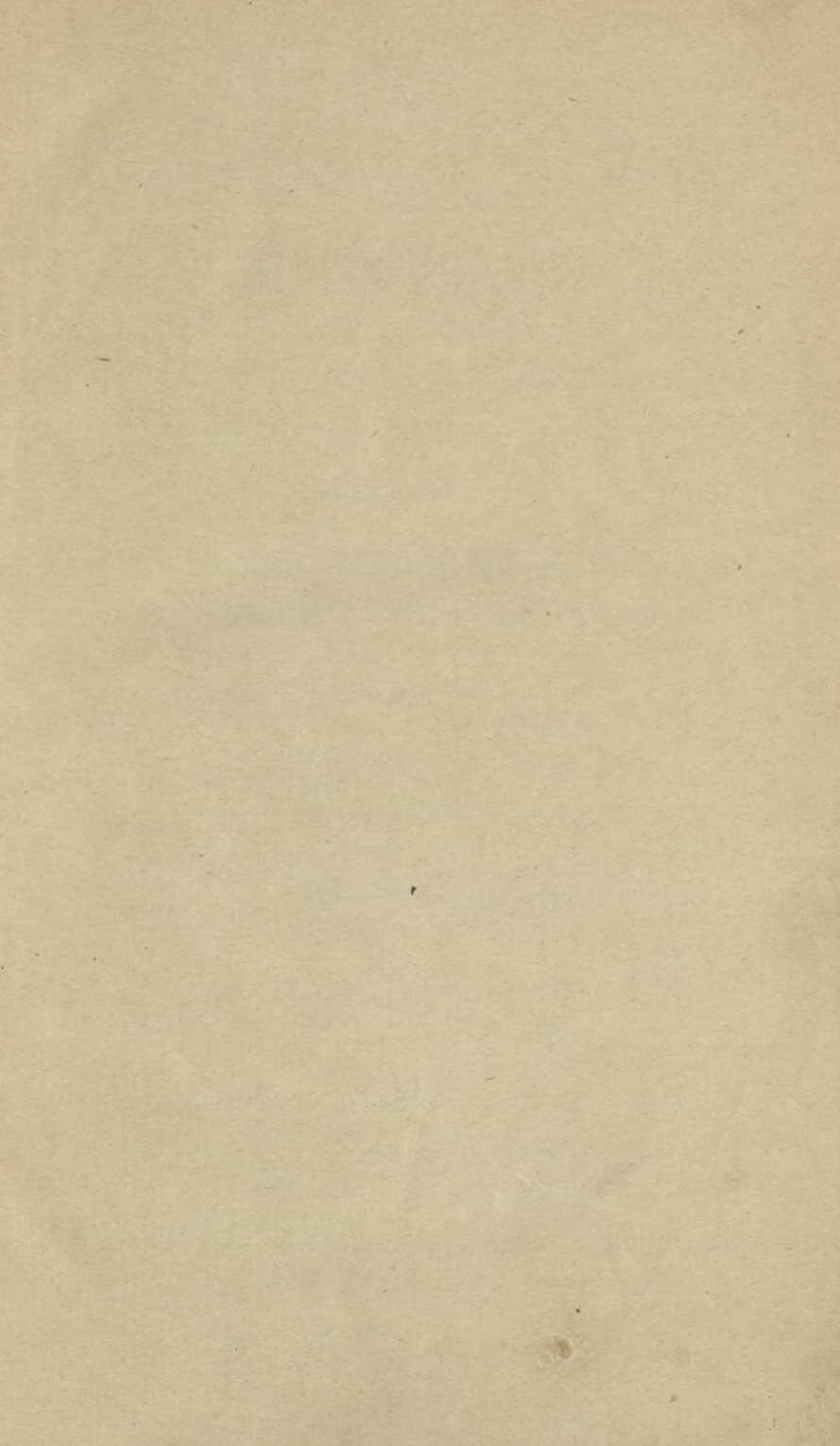
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The Thousand-Ton Barge Improvement.

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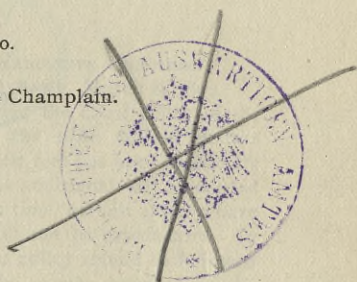
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PRESENTED BY

The Executive Committee of the Canal Improvement State Committee.

- GUSTAV H. SCHWAB, New York, Chairman.
- HENRY B. HEBERT, New York, Treasurer.
- FRANK BRAINARD, New York.
- JOHN W. FISHER, Buffalo.
- ROBERT R. HEFFORD, Buffalo.
- FREDERICK O. CLARKE, Oswego.
- FRANK S. WITHERBEE,
Port Henry, Lake Champlain.



Correspondence is requested with all friends of
Canal Improvement in New York State.

Address,

CANAL IMPROVEMENT STATE COMMITTEE,
Produce Exchange, New York.

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The Thousand-Ton Barge Improvement.

Presented by

The Executive Committee of the Canal
Improvement State Committee.

John W. Brown, New York Chairman
James H. Brown, New York Treasurer
James H. Brown, New York



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Address
CANAL IMPROVEMENT STATE COMMITTEE
Produce Exchange, New York

PREFACE.

The accompanying collection of data bearing upon the canal question is designed to present in compact form for ready reference all the facts underlying the demand for the improvement and modernization of the waterway system of New York State. It includes the substance of the one thousand-ton barge canal bill, the essential portions of the report of the State Engineer and Surveyor, presenting details of construction and precise estimates of cost, the opinions of experts on waterway construction in support of the plans and estimate of cost, the general consensus of opinion of the representative commercial organizations and leading men of the State, giving the reasons and the justification for the improvement of the Erie Canal as proposed under the one thousand-ton barge canal plan following the "canalized Mohawk River, Oneida Lake, Seneca Route."

There is now practically no division of opinion with regard to the imperative need of the improvement of the waterways of the State. Both of the great political parties are explicitly committed to this policy in their platforms.

PRESIDENT ROOSEVELT'S POLICY AS GOVERNOR.

EXECUTIVE CHAMBER,
ALBANY, March 8, 1899.

MY DEAR SIR: I am very desirous of seeing the canal policy of the State definitely formulated. As you know, the nine million dollars designated to deepen the canal to the depth of nine feet has been practically expended, and it is reported that sixteen millions additional will be needed to carry this scheme through, while, at the same time, certain experts have said that the scheme, when carried through, will not be satisfactory. In short, there is much conflict of opinion as to what policy should be followed with reference to the canals, and even as to the proper terminus of the canal on the lakes.

I desire the opinion of a body of experts, who shall include in their number not merely high-class engineers, but men of business, and especially men who have made a study of the problems of transportation, who know the relative advantages and disadvantages of ship canals, barge canals, and ordinary shallow canals, who are acquainted with the history of canal transportation as affected by the competition of railroads, and who have the knowledge that will enable us to profit by the experience of other

countries in these matters. I have decided to ask five of the citizens of New York, whose reputation in these respects stands highest, to act with the Superintendent of Public Works, Col. Partridge, and the State Engineer and Surveyor, Mr. Bond, to make the necessary investigations (and where necessary to call in the aid of special experts), to enable them to report to me, at as early a day as convenient, the proper course we should follow as regards this vital interest of the State of New York. I desire very much that you serve on this committee. The other four gentlemen will be Major T. W. Symons, Hon. John N. Scatcherd, Hon. George E. Green, and Hon. Frank S. Witherbee.

Last year the questions which arose affecting the canals were really twofold in character, namely: Those affecting the actual administration of the canal, and those affecting the general canal scheme of the State. As regards the former, the questions are now well on their way to solution. Three of the best qualified lawyers in the State have been retained to investigate and press home any charge of corruption against any canal official which, in their judgment, can be sustained, and Col. Partridge is so administering the office of Superintendent of Public Works as to guarantee the honest, efficient, and economical management of the canals as they now are. The broad question of the proper policy which the State should pursue in canal matters remains unsolved, and I ask you to help me reach the proper solution.

Very sincerely yours,

THEODORE ROOSEVELT.

To GENERAL FRANCIS V. GREENE.

PENNSYLVANIA'S MISTAKE.

While other States were disposing of their public works and artificial waterways, New York retained possession of the Erie Canal, and conferred upon the nation a boon almost incalculable, because the Erie Canal exerts a power that is unequalled in regulating the commerce of the country. Every wageworker and small consumer East and West is a gainer by it. Had not the wise men of New York extended its usefulness and interposed to protect the canal property from the encroachments of railroad managers, the trade of the nation would, to-day, be entirely at the mercy of a trunk line pool composed of the executive officers of five railroads. The price of bread would be higher, and the tariff would flow in currents marked out by vast combinations of capital.

The State of Pennsylvania transferred its public works to a railroad corporation thirty-eight years ago, and to-day nearly all the canals in the State are useless. The Pennsylvania Railroad Company applies to the Legislature at every session to abandon an additional section of the canal system, which it obtained under a pledge to maintain forever, and as each

year's work is completed the damaging results of the transfer become more and more apparent. The Pennsylvania Railroad Company drives traffic off the canals and on to its own tracks. The Susquehanna and the Juniata Valleys are almost completely at the mercy of a monopoly because of the absorption of the canals, and because the Pennsylvania Railroad Company violates the terms of its contract with the State in 1861, and disregards the provisions of the State Constitution guaranteeing equal rights to all shippers. The Schuylkill Canal was likewise brought under the control of the Reading Railroad Company, and all the industries of that rich section were placed for a time at the mercy of a railroad president. The Lehigh Valley Railroad Company also contributed to the destruction of artificial waterways, and thereby destroyed a competition which was healthy, and which would have protected the State from the exactions imposed upon it by companies that were chartered as common carriers. No events in the history of our State have done more to retard its growth than the absorption of its canals by rival railroad lines.—*Philadelphia Record*.

ODELL FOR 1,000-TON CANAL.

Increasing demands and new problems are continually before us, and to-day we are facing a situation where the commercial supremacy of our metropolis and State is threatened because the canal system has not been sufficiently improved to meet the requirements of commerce. The Democratic party proposes to build a 1,000-ton barge canal at a cost of nearly \$85,000,000 without providing means for the payment of the principal and interest except by a direct yearly assessment on the people of nearly \$7,000,000, while the Republican party proposes to produce the same results by extending the payment over a period of fifty years and to meet the principal and interest through indirect sources of revenue, thereby relieving the farm and the home from direct taxation.

The Republican platform commits the party to an enlargement sufficient to meet the requirements of commerce, and it being generally understood that those who have given to this subject the greatest study and attention believe in the 1,000-ton barge plan, I have no hesitation in declaring myself in favor of a canal of such capacity. There is no force in the Democratic criticism that this plan will delay the work, because immediate plans for providing the necessary revenue and the preparation for the work can be formulated and enacted into laws by the coming Legislature, so that the question can be submitted to the people in 1903 accompanied by information which will enable them to judge intelligently as to the scope of the improvement and, at the same time, assure them of the entire practicability of the work being carried out and the money provided without subjecting them to a direct tax.

Good road building and the assumption by the State of a part of the expense should be continued upon more liberal lines by providing revenues in full in the same indirect way for the construction, so far at least as the main thoroughfares or highways leading from one county to another are concerned.

With the knowledge gained by two years of service to the State, I have no hesitation in assuring the people that the plans thus outlined for the improvement of the canals and the building of good roads can be accomplished under proper revenue laws without imposing a dollar of direct tax.—From Gov. Odell's Address of Acceptance of Republican Nomination, October 8, 1902.

COLER ON CANALS.

Wherever waterways exist all nations of the civilized world are now spending vast millions in their improvement, because even the development of the railroad to its present high state of efficiency has left unchallenged the fact that water transportation under like development is by far the cheaper. Coal is carried west from Buffalo on the Great Lakes at a quarter of a mill per ton mile, which is twelve times lower than the lowest coal rate upon any railroad in the United States. Such waterway improvement is the policy of England, France, Germany, Belgium, and Russia; and even our neighbor, Canada, has expended out of her limited resources \$86,000,000 for the purpose of diverting New York's commerce to Montreal through the Welland Canal, which is a 14-foot canal accommodating vessels of 2,200 tons.

The Democratic party ruled the State of New York when the Erie Canal was built; the Erie Canal was thrice enlarged when the Democratic party ruled in the State, and now under the changed conditions of modern commerce that same Erie Canal urgently needs further immediate enlargement to a 1,000-ton barge capacity, with terminal facilities suitable for handling both through and local traffic. The Democratic platform so declares squarely and unequivocally, and the canal history of the State justifies full belief in that declaration by every citizen who is in earnest in urging the canal enlargement as the paramount issue of this campaign.

The Democratic party is and always has been a canal party; such are its traditions, such is its history. The Republican platform in general terms favors some vague, undefined sort of canal enlargement; it is a platform meant for campaign purposes only; it is a platform meant to deceive. After reading the canal plank in the Democratic platform, Gov. Odell, in his letter of acceptance, adopts it in preference to the declaration of his own party; he suddenly discovers that he also is in favor of a 1,000-ton barge canal. Is this because of a change of conviction on his part since last winter, when he entertained entirely different ideas, or is it because

some of his friends have told him that it might be better to be in favor of a 1,000-ton barge canal—at least until after election?

But even if the people should accept at its full face value Gov. Odell's apparent conversion to a Democratic doctrine, it is certain that the Republican party can not be trusted with the vast problem of canal enlargement, because it is essentially a railroad party.—From an Address by the Democratic Nominee for Governor, at the Manhattan Club, New York, October 23, 1902.

BOSTWICK-DAVIS CANAL BILL.

Entitled "An act making provision for issuing bonds to the amount of not to exceed one hundred and one million dollars for the improvement of the Erie Canal, the Oswego Canal, and the Champlain Canal, and providing for a submission of the same to the people to be voted upon at the general election to be held in the year nineteen hundred and three."

Section 1 provides that bonds of the State in an amount not to exceed one hundred and one million dollars shall be issued and sold for the improvement of the Erie Canal, the Oswego Canal, and the Champlain Canal.

Section 3 directs the Superintendent of Public Works and the State Engineer to proceed to improve the Erie Canal, the Oswego Canal, and the Champlain Canal on the route beginning at Troy on the Hudson River, thence to Waterford, thence westward to the Mohawk River above Cohoes Falls, thence in the Mohawk River canalized to a point about six miles east of Rome, thence to and down the valley of Wood Creek to Oneida Lake, thence through Oneida Lake to Oneida River, thence down the Oneida River to Three River Point, thence up the Seneca River to the mouth of Crusoe Creek, thence north of the New York Central Railroad to a junction with the present Erie Canal about one and eight-tenths miles east of Clyde, thence following substantially the present route of the canal with necessary changes and running across the country south of Rochester to a junction with the Niagara River at Tonawanda, thence by Niagara River and Black Rock harbor to Buffalo and Lake Erie. The Oswego Canal is to be improved from a junction of the Oswego, Seneca, and Oneida Rivers northward to a junction with Lake Ontario on the route of the Oswego River canalized and the present Oswego Canal. The route of the Champlain Canal as improved is to begin at the Hudson River at Waterford, thence up the Hudson River canalized to near Fort Edward, thence following the route of the Champlain Canal to Lake Champlain. The Erie, Oswego, and Champlain Canals are to be improved so that the canal prism in regular canal sections shall have a minimum bottom width of 75 feet, and a minimum depth of 12 feet. On the rivers and lakes the canal is to have a minimum bottom width of 200 feet and a minimum depth of 12 feet. Full and explicit directions are contained in this section with regard to the construction of locks, bridges, dams, and a harbor

in Onondaga Lake for Syracuse, and connection from the new line of the Erie Canal south of Rochester into the City of Rochester with a harbor at the northerly end.

Section 8 authorizes the Governor to employ five expert civil engineers to act as an Advisory and Consulting Board of Engineers, whose duty it shall be to assist the State Engineer and Superintendent of Public Works to exercise a general supervision over the work in progress and to report thereon from time to time to the Governor, the State Engineer, and the Superintendent of Public Works as they may require, or as the Board may deem proper and advisable.

Section 14 provides that any surplus from the sale of the bonds, the sale of abandoned lands over and above the cost of the entire work of the improvement shall be applied to the sinking fund for the payment of the bonds.

DEPEW FAVORS CANALS.

Hon. Chauncey M. Depew, speaking in 1891 as President of the New York Central and Hudson River Railroad, said memorably: "I am in favor of canals. There is an impression that from official and business associations I ought to be opposed to the canal, but that is a very narrow view of the situation: The canals compete with the roads with which I am connected at every point, that is true, but the canals, in their connection with the Great Lakes, those inland seas of our country, compel the commerce which floats upon those seas to find the Port of Buffalo, in the hope of getting through the canal to the seaboard. The surplus which the canal can not carry goes to the railroad, and the prosperity which the canal and the lakes give to the State of New York in the promotion of their business comes in turn to the railroads."

PART I.

COMMENT ON CANAL IMPROVEMENT BY COMPETENT AUTHORITIES.

VIEWS OF ANDREW CARNEGIE.

FEBRUARY 8, 1902

HENRY B. HEBERT, Esq., Chairman, Canal Association of Greater New York.

MY DEAR MR. HEBERT: Complying with your request, I repeat in writing the substance of what I said at Mr. Clark's dinner.

I stated that the Carnegie Steel Company had purchased 5,000 acres of land surrounding its port of Conneaut on Lake Erie, and had the plans ready to begin work at an estimated cost of \$12,000,000, in which, I believe, products of steel would have been manufactured at a cost less than elsewhere. One of the reasons which determined the site was that New York State was spending money in enlarging the Erie Canal, and the implicit confidence we had that never would New York State fail to enlarge that waterway as needed.

On the shores of Lake Erie we had the ironstone of Lake Superior by water, coke from Pittsburg in empty cars over our own railroad, costing us nothing for transportation, and, above all, we had the facilities for reaching Buffalo and the cities of central and eastern New York, Albany, Troy, Syracuse, and New York City itself by water.

With an enlarged canal, barges could go to any part of New England without transshipment of cargo, and, on the other hand, we had those empty barges in which we could bring from New York City to our works on the lake the ores which must be imported from South Africa and the Caucasus. The saving over rail transportation to Philadelphia and Baltimore would be so great that the western part of New York on the lakes would inevitably become one of the principal seats of manufacture. Nothing

can prevent this if a suitable waterway between Buffalo and the ocean be kept open. We intended to manufacture pig iron at Conneaut to supply Rochester, Utica, Syracuse, Troy, and, of course, New York and the eastern parts, so that the foundries of these cities would have cheaper pig iron than ever before.

I am certain that the Empire State can maintain her position as the Empire State only by developing her manufacturing facilities through the Erie Canal.

The citizens of New York should take note that the State of Pennsylvania has gained more rapidly in population, until the last decade, when years of depression in manufactures arrested her ratio of increase, but there is no question but that during the past few years Pennsylvania has resumed her more rapid growth. Indeed, if it were not for the abnormal increase of New York and Brooklyn, the State of New York would have ranked second in population ere this.

This is no time for New York to forego anything that she now has; on the contrary, as the Prince of Wales recently said to Britain, "she must wake up." It is well known that the port of New York is not receiving her due proportion of the increase of exports and imports. The other fact, perhaps not so well known, that the State of New York (excluding Greater New York) is not increasing as fast in population as her great rival for first place, Pennsylvania, but so it is.

Before that admirable report of General Greene's Committee was published, I ventured to write Governor Roosevelt my views about the canal. It gave me much pleasure some time later to learn that the conclusions arrived at by that able Committee were those which I ventured to express to the Governor.

These were, briefly, that it would never pay to run big ships from Buffalo to New York through any canal, not even a ship canal. It is much cheaper to transfer from a 10,000-ton lake vessel to a 1,000-ton barge, and send it through the canal at slow speed to be unloaded alongside into ocean-going ships, than to send ocean or lake vessels through the canal. The time required is too long to justify the enormous cost of the ship's crew, interest on capital involved, etc.

The Carnegie Steel Company transfers ironstone from big lake vessels into railroad cars at a cost of seven cents per ton, and agricultural products and cargoes in bulk can be transferred at the same price with proper facilities in New York and Buffalo. A 1,000-ton barge canal is, therefore, an ideal canal for the Empire State.

Yours very truly,

ANDREW CARNEGIE.

THE EFFECT OF WATERWAYS UPON RAILWAY TRANSPORTATION.

BY S. A. THOMPSON.

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A Transportation Paradox.—The controlling effect of waterways upon the rates of competing railways is conceded by every one who has given the slightest attention to the subject. This control arises from the fact that the carriage of the freight by water costs so much less than carriage by rail—the average rate per ton-mile on the Great Lakes, for instance, being about one-tenth of the corresponding rate on the railways of the United States. As the Isthmian Canal would affect a greater volume of railway traffic than any other waterway ever constructed or proposed—with the possible exception of a ship canal from the Great Lakes to the Hudson River—it becomes a matter of the utmost importance to determine, so far as this can be done beforehand, just what effect will be produced thereby. While the controlling effect of competing waterways on railway rates has been generally recognized, another effect, of equal or greater importance, has been almost completely overlooked. For, paradoxical as it seems, waterways are not only the most powerful possible regulators of railway rates, but are also the most powerful possible promoters of the prosperity of railways with which they compete.

The best thing that could happen to every railway in the United States—or elsewhere, for that matter—would be to have a waterway paralleling every mile of its track, and the deeper the waterway, within reasonable limits, the greater would be the benefit derived by the railway. If the managers of the transcontinental American railways were really awake to their own interests, instead of opposing an Isthmian Canal they would use all their influence in its favor. Nay more; if Congress should fail to act, the capitalists who control the transcontinental railway lines ought to underwrite a sufficient amount of bonds to secure the construction of an Isthmian Canal, and to get it built at the earliest possible date, and this not as a matter of sentiment or patriotism, but as a cold-blooded business proposition. This opinion is based upon the fact that many instances can be shown in which the construction or improvement of a waterway has resulted in great benefit to competing railways, while not a single instance has come to my knowledge, in the course of a study of the subject covering many years, in which the result has been otherwise than beneficial. But as the unsupported opinion can have little or no weight, it will be in order to offer the incredulous reader a few of the facts upon which it is based.

Some Suggestive Figures.—During the fifteen years in which improvements were being made on the River Elbe, in Bohemia, the river traffic,

as a natural result of the deepening of its channels, increased five-fold. But the traffic on the competing railways increased still more largely, and the dividends on the main line, from Teplitz to Aussig, rose to 16 per cent. per annum. I know holders of American railway stocks who would be glad of a dividend half as great as that. A mere coincidence, say you? Well, possibly. But if it be, I have a fine lot of striking coincidences to submit for your consideration.

A report of a committee of the Senate of France shows that out of 196 waterways enumerated in the statistics of inland navigation, only 73 had, in 1887, a traffic of more than 70,000 mile-tons, and every one of these was in close proximity to railroads, while the Northern Railway Company, whose system traverses a region containing 43 per cent. of the boating capacity of France, was the only one that was not obliged to call upon the government to pay the interest guaranteed upon its stock.

"Made in Germany."—Equally interesting and conclusive are some illustrations taken from the experience of Germany. The canalization of the River Main from Mayence to Frankfort was completed in the latter part of the year 1886. As a result of this improvement, which gave a channel vastly better and deeper than was before available, the river traffic showed an increase of 64 per cent. in 1887 and a further gain of 42 per cent. in 1888.

Frankfort is abundantly supplied with railroads, having among others an independent line on each bank of the Main all the way to Mayence. Did these roads go into bankruptcy or suffer a serious falling off in their traffic? On the contrary, their business increased 36 per cent. in 1887 and an additional 58 per cent. in 1888. Two years constitute rather a short time from which to judge of the permanent effect of this improvement, but fortunately Consul General Mason, from whose report the above figures were taken, submitted another report under date of December 10, 1897, from which it appears that the river traffic, which amounted to only 150,000 tons annually before the improvements were made, had increased to 700,000 tons in 1891, and to 1,693,112 tons in 1896, while the traffic by rail, which amounted to 930,000 tons in 1886, had risen to 1,400,000 tons in 1891, and to 1,639,229 tons in 1896, *being nearly double what it was ten years before, when the railways had a practical monopoly of the freight business of Frankfort.*

The greatest railway mileage in the world under one management is to be found in Germany, unless some of the recent "community-of-interest" arrangements in the United States are to be interpreted as constituting common ownership. On July 1, 1888, out of a total of 16,281 miles of road, 14,665 belonged to the German Government. Yet the Reichstag, in 1887, passed an act providing for the completion of nearly 1,500 miles of canals and canalized rivers, although there were then finished and in use 1,289 miles of canals and 4,925 of canalized rivers. Other improvements have been authorized and completed since the date named, until to-day Germany has over 9,000 miles of canals and navigable rivers, and there are nearly 18,000 miles of State-owned railways

in Prussia alone. Does any one believe that the German Government would expend millions of marks out of the national treasury for the construction and improvement of waterways, if the result would be to lessen the national revenues by reducing the traffic on the national railways? Or is it possible that the German Government does not know what it is about? Let us see. To quote from Consul General Mason:

"If further testimony on this general topic were needed, it would be found in the steady, growing prosperity of the railways of Prussia, which from their location are brought into the most direct competition with the principal waterways. During the fiscal year 1896-97 the Prussian railroads earned \$247,381,970 and the budget estimate, always conservative, for the present year (1897-98) is \$264,000,000 from the same source. This is considerably more than half the entire income of the Prussian Government, and after deducting all expenses of operation, repairs, construction, new equipment, interest on bonds, etc., leaves a net revenue of \$52,122,000 to be turned into the treasury of the State.

"That a portion of this surplus should be devoted each year to extending the canal and navigable river system is in furtherance of a policy the wisdom of which time and experience have fully confirmed."

At Home and Abroad.—The Manchester Canal has hardly begun to pay its fixed charges as yet, but it has caused such a tremendous development of the trade and commerce of that city that new buildings have been erected by thousands upon thousands, and every railroad has been compelled to enlarge greatly its terminal facilities.

For a number of years the United States Government has been improving the navigation of the Great Kanawha River by a system of locks and movable dams. Two railroads run along the banks of this river, the Chesapeake & Ohio and the Kanawha & Michigan. The following table shows that the shipments of coal by rail have increased even more rapidly than the shipments by river. The figures show shipments in bushels from points below Kanawha Falls for fiscal years ending June 30:

YEAR.	RIVER.	RAIL.
1881	9,628,696	6,631,660
1886	17,861,613	13,958,747
1891	25,761,346	28,668,025
1892	26,787,888	30,844,100

No official record has been kept of the rail shipments since 1892, but a note from the resident engineer states that they have largely increased since that date.

The great cities of the United States are all situated on waterways, and the greater cities are without exception on the deeper waterways. The New York Central and its western connections, considered as one system, is paralleled by a waterway almost every mile of the distance from New York to Chicago; and where else in the United States can be found such a succession of prosperous towns and cities, almost within sight of one another all the way, as along the railway system named? Instances could be multiplied without limit, but those given must suffice,

and it is now in order to consider the reason for the results which have been shown.

The Reason Why.—Speaking of the German transportation system, Consul General Mason, from whom quotation has already been made, says:

“German statesmanship was among the first to foresee that the time would come when railways having reached their maximum extension and efficiency, there would remain a vast surplus of coarse, raw materials—coal, ores, timber, stone, and crude metals—which could be economically carried long distances only by water transportation, and that in a fully developed national system the proper role of railroads would be to carry passengers, and the higher classes of merchandise manufactured from the raw staples which the waterways had brought to their doors.”

The debates in the Senate of France in 1863-65 resulted in the declaration that it is to the interest of the State to foster both railways and waterways. This principle was reaffirmed in 1872, again in 1878, and still again in 1889, when it was stated that experience had fully confirmed the predictions which had been made. They have certainly had wide experience with waterways in France, for they began building canals in that country more than a hundred years before Christ was born—and they have not stopped yet. The legislators of France have shown their faith by their works, for in that land, which is so much smaller than the single State of Texas, there has been spent since 1814 out of the national treasury more than \$750,000,000 on waterways and harbors, more than \$700,000,000 on railways, and more than \$650,000,000 on wagon roads. Within the past few weeks the House of Deputies has passed a bill appropriating no less than \$132,500,000 for the construction of canals and the improvement of rivers and harbors. And it may be remarked in passing that the people of France are quite as well informed as to the value of waterways as are their legislators, for when a *plébiscite* was taken some years ago to learn the popular feeling as to a proposed canal from Paris to Rouen, at an estimated cost of about \$49,000,000, out of 345,000 votes cast only thirteen were in the negative! It would seem to have been in order for some one to move to make it unanimous.

Facilities Create Traffic.—One-sided views are always wrong views, and the railway managers who look only at the traffic which would be taken away from their lines by a waterway, and not at all at that which would be brought to them by the waterway, are as wrong and short-sighted as the mobs that destroyed power looms or harvesting machinery with the idea that fewer men would be employed. The surface roads in New York City desperately opposed the elevated roads, fearing that their traffic would be ruined thereby. But the surface roads are more profitable than before the elevated lines were built, and the latter possess an enormous and profitable traffic which it would have been utterly impossible for the surface roads to develop. The tonnage which goes around the Cape of Good Hope is as large now as before the construction of the Suez Canal,

which means that the traffic of 8,000,000 tons a year passing through that waterway has been created thereby.

Not a tittle of the truth is told by the figures which have been given showing the increased tonnage on the Mayence-Frankfort railways since the canalization of the River Main, because those figures do not show the fact that this tonnage is of a higher grade and pays a much higher freight rate, and make no mention of the greatly increased revenues from passengers, express matter, and mails.

The first locks of St. Mary's Falls were opened in 1855, in which year the registered tonnage was 106,296 tons. The half-million mark was reached in 1863, and the one-million-ton mark was passed in 1873. In 1881, exactly coincident with the opening of a much larger lock, the Northwest began to grow by leaps and bounds and the tonnage of the canal rose from 2,000,000 tons in 1882 to 9,000,000 in 1890 and to 16,000,000 in 1896. During the past five years, two more enormous locks have been in operation, one of them on the Canadian side of the river, and in this short time the tonnage of the canal has leaped up to nearly 28,500,000 tons. This colossal tonnage is simply a manifestation of the development which has taken place in the Northwest, along with which has come the building of thousands of miles of railroad, including two lines from the head of Lake Superior to the Pacific Coast. If by some cataclysm of nature the Great Lakes should be dried up, the enormous traffic now carried on their waters would not be divided among the railroads—it would simply cease to exist. The whole galaxy of cities from Buffalo to Chicago and Duluth would be overwhelmed in hopeless, irretrievable ruin, and the railroads could in no wise escape the general disaster.

GOVERNOR ODELL FAVORS IMPROVEMENT OF THE CANAL SYSTEM.

“The canal always has been of great importance to the State, and I believe that if we are to maintain the commercial supremacy of our State and to retain our commercial interests something should be done to improve conditions and to make the canal adequate for the requirements of such commerce as naturally seeks the Port of New York. Of course, we must take account of the fact that in the building of the West and in the development of its railroad facilities a large part of that commerce which hitherto came as a matter of necessity now comes as a matter of choice, and that if the Port of New York is discriminated against because of the railroad combinations and because of the inadequate facilities for handling grain products of the farmers of the West, an enlarged canal will not entirely cure the evils, but that it will be but a beginning which must be followed up through legislation which shall provide for additional docking facilities and other necessary details.

"It is unfortunate that some of our people are opposed to such an improvement as the one under consideration. This may be accounted for through the failure of the last appropriation. But the greatest mistake at that time was that there was not a well thought out plan, and that the absolute and ultimate cost of the improvement was not frankly told to the people. The greatest error, therefore, was in the deception thus practised and which has led all to look askance upon every proposition since and upon the burden of debt which would fall."

QUESTION OF FUNDS.

After reviewing the past canal legislation, the Governor said the first step had already been taken in carrying out the plan suggested in the Republican platform.

"We have," he continued, "demonstrated the wisdom of hastening slowly, and have placed the proposition in such form that it can be intelligently passed upon by the people. In fact, there is nothing that I know of which would prevent this proposition from being passed upon during the year 1903. Another serious obstacle has been removed by enactment of laws which provide almost enough funds to meet the requirements of the State through indirect sources of revenue. The Republican Party, while pledging itself to the canal improvement, also pledges itself to freedom from direct State taxes, and has, therefore, the important work before it of providing such additional funds as may be necessary to meet annual charges in the sinking fund.

"The next step that will be necessary will be the lengthening of the period in which funds may be paid, so that instead of 1-18 each year, as we would be required to do under the Constitution, the payments may be reduced to 1-50 or 1-75 each year. For that, of course, a constitutional method must be devised and submitted to the people, but work need not be hindered, because with the new revenues which may be derived and before first bonds would be due a constitutional amendment could be framed and submitted which would permit the refunding of the bonds to be paid within fifty or seventy-five years.

"The point, therefore, which I wish to impress upon you is that the Republican Party can be relied upon to make such canal improvements as are necessary without delaying, and it will provide for the discharge and payment of the debt without unduly burdening the people through additional taxation. With a Republican Legislature I can promise you that no interests that are now taxed will be disturbed in any way."

The Governor expressed confidence that with wise legislation and by properly financing a loan there would be received enough additional revenues from various interests that will come both as a result of a new canal system and of wise corporation laws to not only meet the increased expense, but to provide money enough to meet every dollar of bonded debt made necessary by canal improvement.—From speech of Governor Odell in Convention Hall, Buffalo, October 25, 1902.

The protection of our waterways and the improvement of our canals, to which we stand pledged, should receive from the Legislature careful and immediate consideration, and only such measures adopted as will accomplish the result desired with the least possible expenditure of the people's money. The commerce which has always marked the progress of our State it should be our effort to retain, nor should we through unwise economies permit it to be taken away by sister States or foreign nations. It should be the pride of each to lend his own efforts and to encourage those who are charged with a greater responsibility in the work of protecting and enhancing the valuable privileges which have come to us. While the State's expenditures may seem at times large, we should recollect that we are not only the most progressive, but the wealthiest, State in our commonwealth of nations, and that whatever is for the good of our people should be accorded without reference to its cost, a business axiom which permits at the same time a careful and prudent oversight of the disbursements of the State.—From Governor Odell's Inaugural Address, Albany, January 1, 1903.

The desire to maintain the commerce at the ports of New York and Buffalo, and the failure of canal transportation to adequately meet the demands of trade have led those who have given consideration to this subject to suggest a very material increase or enlargement of canal facilities.

There is, perhaps, no subject which you will be called upon to consider that is fraught with so many difficulties, and the failure of every attempt in recent years to make canal traffic more effective should be a warning, and should preclude hasty conclusions as to the proper remedy to be applied.

That the Erie Canal has performed an important work in the development of our State is not questioned. That it is the desire of all of the people that it should remain as a factor in the adjustment of freight rates is equally true. But as to the extent to which the State should go in the direction of improvement, there is a wide divergence of opinion.

There has been, unfortunately, no policy in this matter which had the character of permanence. Neither the lowering nor the abolition of tolls upon the canals brought, as was hoped, an increase of traffic. On the contrary, there has been a gradual but certain decrease, both in tonnage and in the number of boats engaged in canal traffic.

Under the present system, disregarding for the time being the factor of cost which the State in the nature of a subsidy grants, the fact is apparent although the per ton mile cost of canal transportation is but nineteen-one-hundredths of a cent, while upon the railroads fifty-nine-one-hundredths of a cent, that the railroads are increasing their traffic while the canal is gradually losing it.

Why shippers are willing to pay this increased cost becomes, therefore, a proper subject for inquiry. Is it because of greater facilities and

more prompt shipment at other outports that this decline in canal traffic is due? And will an enlarged canal win back the commerce which we have lost?

It can be taken to be a certain and fixed conclusion that commerce will follow the line of least resistance, where the cost is lowest and where facilities for reloading freight for export are best. The inability to use the canal for at least five months of the year to my mind is, first of all, a serious consideration in competition with railroad transportation, which, in addition to the terminal charges at New York and breaking of bulk at Buffalo, seem to give to the railroads an advantage which should be thoroughly considered before an enlargement of the canal is authorized.

Still lower freights seem to be the remedy which it is hoped may restore this inland commerce. This can be accomplished in one of two ways—either by greater speed upon the canal, or increased carrying capacity of the boats. If it is possible to accomplish the desired results through either of the methods suggested, I am convinced that by reason of the decreased cost we can exact a toll which, while in no way interfering with the use of the canal, would assist in its maintenance and in the payment for the improvement.

FAVORS THE 1,000-TON BARGE PLAN.

I have endeavored to give to this subject the consideration which its importance demands, and have heretofore expressed myself and now reaffirm my belief in the 1,000-ton barge plan.

I can not urge too strongly upon the Legislature the necessity for immediate attention to this important problem, and while recommending that every consideration shall be given to the various interests involved, we should recollect that above every other claim the prosperity and up-building of our State are foremost. While giving all weight to the expense involved, we should not be deterred from any expenditure that will hold the supremacy of which we are all justly proud.

I hope that the conclusion reached may be so supported by data and figures that there shall be no dissent from the deductions which are thus arrived at, and that the people may be put in possession of every detail that is necessary to enable them to speedily pass upon and express their approval or disapproval of the plans to be submitted.

In my last message I advocated the deepening of the canals to a nine-foot level, with locks capable and large enough to provide for 1,000-ton barge tonnage. To this subsequently suggestions were added that both the Oswego and the Champlain Canals should be equally enlarged.

This proposed measure failed of passage, I am convinced, because of an honest belief upon the part of many members of the Legislature that the plan proposed was inadequate to meet the requirements of commerce. At the time of the submission of the nine-million-dollar plan it was generally conceded by those interested in canal traffic that a nine-foot canal would be adequate to meet all demands.

The failure of that sum to complete the improvements led to the appointment of a commission by my predecessor, which commission submitted a plan for the 1,000-ton barge canal, and to that project the commercial bodies of New York and Buffalo stand committed in the belief that no other remedy will produce the desired results, while the interior cities and others who are affected are as earnest in their opposition of the larger plan and are as firmly convinced that a canal completed along the plan of the nine-foot level will be sufficient for all requirements.

Therefore, the friends of the canal, while united in the greater cities, are at odds in other sections of the State over the amount of expenditure which the Commonwealth should authorize for the completion of this important work.

So far as the 1,000-ton barge canal is concerned, I had thought that the route known as the Oswego, Ontario, and Olcott at a much less cost would be sufficient for all purposes and would secure the result desired much more speedily than the so-called interior route. Those who have given the Lake Ontario, Oswego, and Olcott plan study are firmly convinced, however, that it is impracticable, and that at the time when the canal traffic would be at its heaviest it would be impossible because of adverse winds and dangers of navigation.

So we are forced to the conclusion that the only practical route for canal traffic for a 1,000-ton barge would be along the more expensive line, which can only be built at a cost under the State Engineer's estimate, and assuming that the bonds were for fifty years and the interest at 3 per cent., of \$193,980,967.50, principal and interest.

This plan only contemplates the deepening of the Champlain Canal to seven feet, but the advocates of canal improvement now desire that it should also be deepened to a twelve-foot level, which would increase the cost to \$215,000,000.

It is well known that no great undertaking of this character ever was completed within the engineer's estimate, but owing to increase in the cost of labor and material there should be a factor for safety of at least 20 per cent. more, which would make a probable ultimate cost for construction of over \$255,000,000 in principal and interest, from which should be deducted the interest of the sinking fund.

ELECTRIC EQUIPMENT AN ALTERNATIVE.

Suggestions have been made, and it is but fair that they should be presented to you, that if the canal were enlarged to a nine-foot level and by the use of the water powers of the State and by the introduction of electric motors, not only the same object could be accomplished, but that sufficient revenue could be derived from the sale of power to almost maintain the canal.

The cost of electric equipment and providing water power would be much less than under the 1,000-ton plan, and perhaps would accomplish the same results.

If this be feasible I am sure that all who are interested in the welfare of the canals would be glad to give it consideration. If this plan should be adopted, the canal could be constructed within two or three years and the constant withdrawal of commerce could be checked much more rapidly than under the 1,000-ton barge plan, and it could be provided for under the present Constitution. The former would require an amendment.

If it should be deemed wise to select the 1,000-ton barge plan, it could be submitted to the people this fall under the eighteen-year bonding clause of the Constitution, and no work performed until the adoption of a Constitutional amendment extending the time of payment. In the event of a refusal by the people to so amend Section 4 of Article VII. under the same section the Legislature can repeal or render inoperative the expenditures authorized, and thus safeguard against excessive taxation, which would be required for the improvement.

In the event of the 1,000-ton barge plan being authorized, I would recommend the adoption of a concurrent resolution providing for the reimposition of limited tolls, which would perhaps produce revenue enough to provide for the maintenance of the canal, believing that the lowering of the freight rates would be so great that a tollage could be easily met without interfering with the results which it is hoped to accomplish under this plan.

The money for payment of principal and interest of the debt could be met by a dividend tax upon the capital stock of manufacturing corporations, which would produce about \$2,400,000, and by modifications of existing revenue laws by slightly increasing the rates affecting others than corporations. But as it is not necessary to provide this revenue until the plan shall be approved by the people, there is no immediate necessity for the consideration of this part of the problem other than the adoption of a resolution for the reimposition of tolls, which must be by Constitutional enactment.—From Governor Odell's Annual Message to Legislature, January 7, 1903.

“New York and its prosperity are of as much importance to the people who live upon the farm as to any of its own citizens. Increasing manufacturing interests and a growing population make demands and afford markets for the farmer and the mechanic, no matter how remotely they may be situated from the metropolis. We are as much interested in your having honest and efficient government as you are yourselves, because whatever tends to break down or lower the standard of the administration of any of the municipalities of the State furnishes a bad example to others and leads to wasteful extravagance, neglect of duty and the law.

“Therefore, in building up our great cities and villages they should all receive the same consideration and fairness of treatment. It was this conclusion that led the Republican Party to adopt as a plank of its platform the proposition for the enlargement of the canals. The great commercial bodies of New York and Buffalo are sanguine in the belief that

the decadence of the commerce of the port of New York is due to the inadequacy of the facilities of our artificial waterways.

THE CANAL QUESTION.

"True it is that opposition has met every phase of this question, and that for years perhaps its proper consideration has been delayed, and yet it is not the Republicans of the rural districts who are entirely to blame, because there are many of the so-called canal counties whose representatives, Democratic and Republican alike, during the last session of the Legislature refused to submit the question to the people in the form of a referendum. Perhaps this delay may have been for the best. It is an important question and one in which we may well hasten slowly. Many of the features which have heretofore caused objections to be raised have been eliminated from the Republican platform. It not only proposes a remedy, but also pledges itself to make this improvement without entailing a dollar of taxation upon the farm and the home. It is made by a party which fulfills its promises, and I have had no hesitation in saying that with the continuance of our party in power this improvement will follow, providing the scheme itself receives the approval of a majority of the citizens of the Empire State."—From speech of Governor Odell in Clermont Avenue Rink, Brooklyn, October 14.

"In committing myself to the 1,000-ton barge canal, I did not violate one idea of the Republican platform, because it committed itself distinctly to a policy of enlarging the canal in a manner to adequately meet the requirements of commerce. If, as it seems to me, such requirements demand a 1,000-ton barge canal, it was far from my thought to stand in the way of such improvement, and it was eminently proper for me to announce my position."—From speech of Governor Odell in Fitz Hugh Hall, Rochester, October 24, 1902.

OPEN LETTER TO GOVERNOR ODELL.

"I wish to call your attention to what, to my mind, is one of the most important public improvements that can be made for the benefit of the people of this State, namely, the improvement of the Erie Canal.

"The widening and deepening of the Erie Canal means continued prosperity to the manufacturing industries of this State. It means that the raw material will come to our different towns, villages, and cities at an extremely low cost, and that we will then be able to compete with the manufacturing industries of the great Middle West. Unless this is done, there is but one alternative, that this great State lose its commercial supremacy, which would also mean a great loss in population. People must be employed. If they can not secure work they will go to that market where their services can be utilized at good wages.

"The farmers of this State must remember that conditions have

changed in regard to the products of the farm. Eastern farmers can not, because of natural conditions, produce grain and meat products as well as Western farmers can. Therefore, Eastern farmers can not profitably compete in these products. They think that cheap grain and provision freights from the West to the seaboard give Western farm products a still greater advantage, and, therefore, are opposed to them. That may be true; but will choking the Erie Canal, so that the New York Central Railroad Company can maintain high local freight rates on manufactured products and high-class traffic, keep Western farm products from reaching the seaboard as cheaply as now? We can prevent Western grain and provisions from passing across the State of New York, and the present railroad policy is rapidly doing it; but the only effect will be to send the traffic through Canada and by rail routes to Boston, Philadelphia, Baltimore, Newport News, Charleston, and especially New Orleans and Galveston. That will greatly harm this city, but what good will it do to the New York State farmer?

“The true market for a large part of this State’s farm products must be local and the demand must come from the creation, development, and prosperity of local industries throughout the State, and these in turn depend upon cheap freight rates, such as the Erie Canal will insure. Those cheap rates will enable the important cities of Central New York to obtain iron ore and coal as cheaply as the lake ports and the Pennsylvania towns now obtain those raw materials, and will give the manufacturers of those cities a considerable advantage in freight charges upon products intended for export. Factories in the midst of farms, with cheap freight outlets, is the ideal condition for industrial prosperity. This condition will reach its highest point by development of the Erie Canal.

“It is the duty of the people of the State to avail themselves of that which nature has provided, the greatest waterway in this country, if not in the world, the Great Lakes. The connection of the Erie Canal with the Hudson River also means a connection with the East River, and turns Long Island Sound into an outlet of the Erie Canal, by which freight from the great West can be transported to the Eastern States. With the Erie Canal improved, New York would become the greatest harbor in the world. It would bring about a continuance of the enjoyment by this city of the import trade of the nation. It would also make New York the outlet for the export trade of the United States with other countries, making New York City not only the greatest financial center, but also the greatest commercial city. We have about 110 miles of water front available for shipping. This water front should be made available for additional shipping, so that the export trade could be increased, making New York City the center for export trade, the same as Liverpool is in England. This can only be done by the improvement of the Erie Canal.

“It is up to you, if you are reelected Governor of the State, to advocate a referendum to allow the people to vote for the building of a 1,000-ton barge canal. The party ignoring this issue is, to my belief, doomed to defeat. The people throughout the State are aroused to the

importance of the question. They are determined to be allowed to vote on this question."—Letter of William F. King, President, Merchants' Association of New York City, September 23, 1902.

INTERVIEW WITH GOVERNOR ODELL.

"Inquiry was made of the Governor last night about a statement which he made in his speech of acceptance with regard to canal improvement, which has excited a good deal of interest among the canal men. In its platform adopted at the recent State Convention, in Saratoga, the Republican Party declared in favor of canal improvement, without specifying any plan, and also declared in favor of meeting the cost of such improvement from the revenues raised by indirect taxation. In his speech of acceptance Governor Odell said:

"There is no force in the Democratic criticism that this plan will delay the work, because immediate plans for providing the necessary revenue and the preparation for the work can be formulated and enacted into laws by the coming Legislature, so that the question can be submitted to the people in 1903.'

"To raise the necessary funds for the improvement of the canals a Constitutional amendment will be required, and any amendment to the Constitution must pass two Legislatures, the Senates of which are not the same, before it can be submitted to the people for their approval. As a new Senate is elected this year the general impression has been that any legislation with regard to the improvement of the canals would have to pass the Legislature which will meet in Albany on January 1 next, and also the Legislature which will meet in 1905, the Senators elected this year serving for two years, before it could be passed upon by the voters.

"When, therefore, Governor Odell in his speech of acceptance made the statement above quoted, that the question could be submitted to the people in 1903, there was an impression that he had misstated the facts. The assertion in his speech that the canal question, under the proposed Republican plan, could be submitted to the people in 1903 was read to the Governor last night, and he was asked if that was what he meant to say. He said it was. When asked to explain the doubt raised by his assertion, he said:

"The statement which I made in my address was a deliberate utterance, carefully considered. It speaks for itself. I do not care to add anything to it. Everybody knows that it requires the ratification by two Legislatures of any amendment to the State Constitution.'

"But your statement conveys the impression that work need not be delayed beyond 1903, or the life of one Legislature.'

"I guess that's right.'

"That was all the Governor would say, and an explanation of the mystery was sought from other sources. Information was obtained which is believed to furnish the solution.

“Article VII. of the State Constitution, the subject of which is ‘the limitation of the legislative power to create debts,’ provides, after certain reservations which have no bearing upon the point at issue in this matter, as follows:

“No debts shall be hereafter contracted by or on behalf of this State unless such debt shall be authorized by law, for some single work or object, to be distinctly specified therein; and such law shall impose and provide for the collection of a direct annual tax to pay, and sufficient to pay, the interest on such debt as it falls due, and also to pay and discharge the principal of such debt within eighteen years from the time of the contracting thereof.’

“In the Republican platform adopted at Saratoga it was advocated that there be an extension of the time in which a debt created under the article of the Constitution quoted could be paid. Article VII., in addition to the provision quoted above, further provides that a law authorizing a debt for a specific purpose shall become operative after it has been submitted to the people and received a majority of all the votes cast for and against it.

“Therefore, under those provisions of the Constitution a debt for canal purposes could be created and the money be made available in one year, provided it contained a provision for the imposition and collection of a direct annual tax to discharge the debt. But, inasmuch as the Republican platform distinctly declared against the raising of funds by direct taxation for the discharge of the proposed canal debt, it was not clear how the necessary delay to cover that point was to be obviated until a member of last year’s Legislature called attention to a concurrent resolution which was passed at the last session and received the signature of the Governor. This resolution provides as follows:

“‘The Legislature may appropriate out of any funds in the Treasury moneys to pay the accruing interest and principal of any debt heretofore or hereafter created, or any part thereof, and may set apart in each fiscal year moneys in the State Treasury as a sinking fund to pay the interest as it falls due, and to pay and discharge the principal of any debt heretofore or hereafter created under Section 4 of Article VII. of the Constitution, until the same shall be wholly paid, and the principal and income of such sinking fund shall be applied to the purpose for which said sinking fund is created and to no other purpose whatever; and in the event such moneys so set apart in any fiscal year be sufficient to provide such sinking fund, a direct annual tax for such year need not be imposed and collected, as required by the provisions of said Section 4, Article VII., or of any law enacted in pursuance thereof.’

“This resolution, having passed the last Legislature, can be submitted to the Legislature which meets next January, and which will have a Senate different from that of the Legislature which met last winter, and if passed by the coming Legislature, can then be submitted to the people for their approval at the election which will be held in November of 1903. If it is ratified by the people at that election, the way will then be open, it is said, for the immediate undertaking of whatever plan of

canal improvement the Legislature may decide upon.”—Governor Odell on proposed canal legislation; interview in *New York Times*, October 9, 1902.

CHAIRMAN HEBERT'S OPINION.

“I think it will be sound policy for each party—Republican and Democratic—to put a strong canal plank in its platform. This canal question is a living issue throughout the State. To submit the question of canal enlargement to the people could have but one result. There never has been any hesitancy on the part of the votaries of this State to sanction improvements of the great waterway that has been of such inestimable benefit to the State at large. According to the language of the report of the Committee on Canals appointed by Governor Roosevelt, and of which General Francis V. Greene was Chairman, it is proposed to reconstruct the Erie Canal so that it will be of sufficient size to permit the passage of boats 150 feet in length, 25 feet in width, and 10 feet draught, with a cargo capacity of approximately 1,000 tons each. The prism of such canal to be not less than 12 feet deep throughout, with not less than 11 feet of water in the locks and over all structures, and the locks to be 310 feet long and 28 feet wide, so as to pass two boats at one lockage. Such a canal will be capable of carrying a tonnage equal to the capacity of the St. Lawrence Canal. There is urgent necessity for immediate action in this matter of enlarging the canal.

“In their present condition the canals are not adequate to the public demands. They are not in condition to compete with the rival routes in the transportation of east and west bound freight. The proposed enlargement will enable rates to be made on the canal below anything that the railroads could afford to offer. Business men in general, I believe, are of one mind on this question. From Buffalo to New York there is a strong sentiment in favor of the Erie Canal. As General Greene in the Committee's report just alluded to says:

“‘To the Erie Canal more than any other cause is due the phenomenal growth and commercial supremacy of the City and State of New York. It opened up the great West to settlement, and in turn attracted the products of the West to the low-grade line through the Appalachian chain which exists only in the State of New York. The tolls on this waterway have more than repaid the cost of construction, maintenance, and operation. In addition, it has paid over \$360,000,000 of freight money within the limits of the State, and the disbursement of this money along the line of the canal has built up great interior cities from Buffalo to Albany, forming a continuous line of commercial centers which has no counterpart in any other State.’

“I am satisfied that a barge canal such as is proposed will restore a regulation of the freight rate from the lakes to tidewater in the fullest measure. It is the part of wisdom for the great political parties to give the people an opportunity to discuss this subject of canal enlargement and

vote on it. The lawmakers at Albany, of course, must obey the people's mandate, and if the people, after careful and thorough consideration of the needs of the Erie Canal, direct that that waterway shall be reconstructed, the sooner the work is begun the better it will be for the State.

"Opposing forces are active. That is one reason why the friends of the canal should work quickly and energetically. Some railroad men with a narrow view declare that the canal has outlived its usefulness. That might be true, if the canals were to remain in their present condition. Once make them modern and up to date, and they will be able to demonstrate a much larger scope of usefulness than heretofore.

"In this connection it is a pleasure to recall the opinion of Chauncey M. Depew with regard to the usefulness of the canals. In an address delivered in Elmira in October, 1891, he said:

"There is another great question in which we as owners are all interested, and that is the State canal. I am in favor of canals. There is an impression that from official and business associations I ought to be opposed to the canal, but that is a very narrow view of the situation. The canals compete with the roads with which I am connected at every point, that is true, but the canals in their connection with the Great Lakes, these inland seas of our country, compel the commerce which floats upon those seas to find the port of Buffalo in the hope of getting through the canal to the seaboard. The surplus which the canal can not carry comes to the railroad, and the prosperity which the canal and the lakes give to the State of New York in the promotion of their business comes in turn to the railroad.'

"This idea of the diffusion of prosperity through the canal traffic is one that should be constantly kept in mind. An enlarged canal, permitting the passage of 1,000-ton barges, would enable a reduction of rates of freight so as to attract a very large volume of traffic between Buffalo and New York. This will naturally increase the industries along the line of the canal. It will improve farming industries by causing an increased demand for local consumption."—Interview with Mr. Henry B. Hebert, Chairman, Canal Association of Greater New York, *New York Times*, September 22, 1902.

DEMOCRATS FOR CANALS.

"The canals have given to the State of New York the commercial primacy of the Union. They have earned millions of dollars in direct revenue from tolls over and above the cost on construction, improvement, and operation, while by their traffic the wealth of the State has been incalculably increased, a chain of populous cities stretching from Albany to Buffalo created, and the trade of the country immensely benefited by the maintenance of low rates of transportation.

"Under Republican neglect the canal system of the State, a priceless asset of the people, has wasted in value and in utility from year to year,

until the public calamity of their entire destruction and abandonment can be averted only by measures of improvement.

"Our Republican opponents, cowering under the responsibility of the incompetence and corruption through which \$9,000,000 of the people's money was irrevocably squandered upon an ill-advised project of canal enlargement, dare not ask for a fresh authorization and further funds. Their insincere platform discloses their deliberate intent to postpone the issue until the ruin of the canals shall have become complete.

"We pledge ourselves to save and build up and improve the canals. Believing that State money spent in makeshift and halfway measures would be wholly wasted, we covenant with the people to prepare and submit to them immediately for their sanction a plan of canal improvement providing for a barge capacity of 1,000 tons for the Erie and Oswego Canals, and adequate and necessary improvement of the other canals of the State. The maintenance of water transportation by modern methods between the Atlantic seaboard and the Great Lakes will meet the needs and promote the prosperity of communities of the interior and will give to the farmer, the manufacturer, and the tradesman the benefit of low rates of transportation, which will attract to the waterways of New York a traffic that the Republican policy of neglect has diverted to other channels, and will establish the export and import trade of our great seaport city in unconquerable supremacy."—From Platform of Democratic Party, State Convention, Saratoga, October 1, 1902.

REPUBLICANS FOR CANALS.

"Good roads and canals are the two important features which make for the material welfare and progress of the Commonwealth. The canals provide a channel for commerce and enable New York City to hold the first rank both as the exporting and importing center of our country; while better highways bring the markets closer to the doors of the farmer. The two are equally important. They can not be separated. The one obstacle to the successful consummation of necessary improvements is the Constitutional prohibition against long extensions of the bonded debt of the State. The alternative is direct yearly taxation upon the people.

"The Republican Party, having already through economies and legislation rendered a direct tax almost unnecessary, believes that these improvements should not be the cause of again imposing such a tax upon the people, and that without imposing unnecessary burdens upon individuals or other interests there should be an extension of time in which payment of the principal and the money for the payment of the yearly interest should be provided.

"We favor, as the first step toward these improvements, an extension, under the Constitution, of the time when such payments shall be made. To secure these preliminaries the consent of the people must be first

obtained, and we favor such legislation as will afford them an opportunity to pass upon these important questions.

"We believe that the policies inaugurated by a Republican Legislature and by a Republican Governor, which are giving to the State a better system of highways, should be continued, and we believe in the enlargement and improvement of the canals, to such an extent as will fully and adequately meet all requirements of commerce, the expense of such improvement, however, to be met through sources of revenue other than by direct taxation. To such legislation the Republican Party pledges itself and its candidates."—From Platform of Republican Party, State Convention, Saratoga, September 24, 1902.

PART OF THE REMARKS OF MAYOR LOW AT THE MEETING OF THE NEW YORK PRODUCE EXCHANGE.

"Mr. Chairman and Gentlemen, it gives me a great deal of pleasure as the Mayor of this city to receive an invitation to be present this afternoon to speak to the members of this commercial body on the subject of a 1,000-ton barge canal. I need scarcely say to you that if this did not seem to me a matter of the greatest importance to the welfare of the State and city, I would not be here, for commercial bodies are pressing their views continually on subjects of more or less importance. It is only when a matter of supreme importance is before the public that the Mayor would be justified in coming to such a meeting, but the importance of the Erie Canal in all its past history, it seems to me, can not be successfully assailed, and I think it is capable of being quite as influential upon the future history of the city and State of New York as it has been in the past, provided the canal be modernized as the railroads have been modernized. My reasons for that belief can be very plainly stated. It must be admitted, I think, that there is no transportation known to man so cheap as water transportation. It is the most economical method, and it has been from the beginning of time. If one were to seek a demonstration of that fact, you can find it, it seems to me, from the practice of the railroads themselves in shipping coal by water instead of rail when they can. One has only to travel upon the Sound, or live a few weeks upon Narragansett Bay, to see tow after tow of coal loaded for New York. If it were cheaper to send that produce by rail than water, there is no reason why it should be subjected to the expense of transshipment at any point. Therefore, we seem to have before our own eyes a demonstration of the fact that water transportation is the cheapest transportation known to

man. The other factor of the problem is evidently this: That size, the size unit that is necessary in order to get the cheapest possible freight. In the days when my father sent his sailing ships to China and California, they used to receive \$1.00 per cubic foot—not cubic yard—for freight space, during the palmy days of California. I suppose that two of those ships, the largest of them, could be put inside of one of the existing schooners of to-day. These large schooners with sails raised by an engine, are capable of carrying freight inconceivably cheaper than was known a generation ago.

“The size of the docks for Atlantic Ocean steamers in New York City at the present time is about to be increased to 800 feet in length in order to accommodate steamers of to-day, and we have been told that inside of five years we must expect to see Atlantic Ocean steamers 1,000 feet in length. In other words a large unit is an essential element of cheapness in transportation. The question arises whether it is not practicable to improve the Erie Canal on a unit sufficiently large to make it worth while.

“When in Europe some time ago I made the acquaintance of Captain Mahan, of the United States Navy, and in the course of conversation he told me that he had been spending a great deal of his time in making a study of what France had been doing in the development of her internal waterways, and he made this observation: That no one realizes the vast sum that France has expended within the last thirty years in developing her canal system and transportation; and among other details that were most interesting he cited certain instances which came to his knowledge where a railroad which was in private hands favored the construction of canals which were to parallel the railroad's tracks, and that it had done so because it realized that the canal would carry the bulkier freight which was of little value to the railroad, and thus relieve it, and let the railroad free to handle more valuable freight, on which it received a greater profit.

“So we find in France, so far from abandoning their waterways, they have spent many millions of dollars in later years in making them modern. The same thing is going on in Germany. Nothing is so near the heart of the German Emperor than to develop the water facilities of Germany until Germany can profit by them as other countries are profiting by them. It seems to me that if the State of New York should think of abandoning the Erie Canal, it would be presenting a policy absolutely contrary to what other wise and prosperous people have adopted, and it is also clear that if New York expects to profit by its canal system, that canal system must be modern. There is no use of expecting to compete with a modern railroad through the agency of an antiquated canal. (Applause.)

“The proposition to make the Erie Canal a 1,000-ton barge canal is the most far-sighted and practical suggestion, it seems to me, that has

ever been laid before the people of the State on that subject. It is the recommendation of a very able commission appointed by the State to consider the subject, and its report has been before us now for several years. Whether it is as large a canal as some would like to see, I don't know, but it is the deliberate conclusion of a body of very able men who have studied the subject very carefully with the desire of reaching the best conclusion possible."

VALUE OF CANAL TO TRADE.

"GENTLEMEN: The question before your Honorable Committees is the following:

"Do the commerce and industries of the State of New York require an enlargement of the present waterways of the State, and to what extent?

"An examination of the condition of the foreign commerce of the State, and particularly of the City of New York, which represents the State, will show that there has been a serious loss in the foreign commerce of New York as compared with competing cities of this country during the last twenty years. The report made to the Chamber of Commerce of the State of New York by its Committee on the Harbor and Shipping in February, 1898, on the diversion of trade from New York, contains a comparison of the figures of the foreign trade of the Port of New York in the years 1877, 1896, and 1897. This comparison shows that 'the proportion of imports through New York fell from 69 per cent. in 1877 to 63.3 per cent. in 1897, while the imports of all other ports rose from 31 per cent. to 36.7 per cent. The percentage of the domestic exports from New York fell from 43.6 per cent. in 1877 to 41.5 per cent. in 1897, while the exports of all other United States ports increased from 56.4 per cent. to 58.5 per cent. of the whole, the total commerce to and from New York during these twenty years showing a decrease from 53.7 per cent. to 51 per cent., and that of all other ports an advance from 46.3 per cent. to 49 per cent. The Chamber of Commerce Committee, furthermore, in comparing the year 1896 with the year 1897, found that whereas there had been a general increase in the value of domestic exports in 1897, as compared with 1896, of \$105,000,000, from all ports of the United States, there actually had been a loss to New York of \$23,000,000 in the value of domestic exports from her own port in 1897 as compared with 1896.'

"The annual report of the Chamber of Commerce for the fiscal year ending June 30, 1902, on the foreign commerce of the port of New York, shows that the total foreign commerce of New York City during the year ending June 30, 1902, suffered a decrease of \$43,198,321, as compared with the same period of the previous year, and \$23,756,248 as compared with the period ending June 30, 1900, thus showing a growing decrease during the period comprised by these three years.

"The report of the New York Commerce Commission appointed by Governor Black to examine into the commerce of New York, the cause of its decline and the means for its revival, contains some very instructive information bearing upon the decline in the foreign commerce of New York. The Commerce Commission states as follows:

"A discussion of the total foreign commerce, including imports, presents the most favorable exhibit for New York. Her retention of the import trade in a measure conceals the extent of her loss in exports. But for how long will she continue to maintain her preeminent position in the import trade after steamship lines have been established and new channels of trade created between rival ports and the foreign exporting nations, resulting from the loss of New York's export trade to those rival ports?

"New York's proportionate decline in her foreign commerce, steady and certain though it has been, reached a level below one-half of the nation's total foreign commerce for the first time since she achieved her preeminence in the fiscal year ending June 30, 1897, in which year New York's total was \$35,578,497 less than half.

"In 1880 New York's total was \$100,700,541 more than one-half of the nation's total. In 1885, \$64,733,967 more. In 1890, \$60,745,308 more. In 1895, \$33,567,125 more. In 1899 New York's total had fallen below one-half of the nation's total by \$37,156,818.

"To avoid the possibility of being misled by any fluctuations occurring in particular years from special and transient causes, an average of two decades will be taken for a comparison, with the year 1880 as a standard. The value of the nation's total foreign commerce for the fiscal year ending June 30, 1880, amounted to \$1,503,593,404. The annual average for the nineteen succeeding years to June 30, 1899, was \$1,590,037,782, showing an average annual increase for the nation of \$86,444,378.

"The total of New York's foreign commerce in 1880 amounted to \$852,497,243. The annual average for the nineteen succeeding years to June 30, 1899, was \$835,839,827, an actual average decrease per annum of \$16,657,416.

"The value of the foreign commerce of the United States for the past nineteen years, in the aggregate, has been \$1,642,543,195 greater than it would have been had the average for each year been exactly the same as for the year 1880, while the aggregate value of the foreign commerce at the port of New York during the same period has been \$316,661,887 less than it would have been had New York succeeded in maintaining an annual average for the past nineteen years equal to her foreign commerce in 1880. Instead of sharing in this vast aggregate increase of the nation's foreign trade during the past nineteen years, the port of New York has actually fallen behind to the extent of more than \$300,000,000.

"From these figures it must be apparent that there has been an actual as well as a relative decline in the foreign commerce at the Port of New York."

"The records of the tonnage in foreign trade entered in the port of New York corroborates the findings of the Chamber of Commerce and of

the Commerce Commission that I have referred to. These records show that 'in the year 1880 vessels of an aggregate tonnage of 7,611,282 tons entered in the port of New York, as against a tonnage of 5,517,203 entered in the five outports—Montreal, Boston, Philadelphia, Baltimore, and New Orleans; while, in the year 1898, a tonnage of 7,771,412 tons entered in New York, and 8,009,224 tons in these five outports. In other words, New York's tonnage has remained approximately the same as in 1880, whereas the five Atlantic ports that I have named have increased their tonnage by 2,500,000 tons, and have now outstripped New York in foreign tonnage. The outports have attracted regular steamship lines that formerly sent their vessels to New York, but that are now not only receiving their outward cargoes in these outports, but are building up a large importing trade that is lost to New York. The Hamburg-American Line, one of the largest lines running to the port of New York, and employing a large number of vessels in the trade between Hamburg and New York, until about thirteen years ago maintained a regular service across the Atlantic between Hamburg and New York exclusively. Export cargo then began to be offered in larger quantities at Baltimore, and the line despatched extra steamers, which discharged at New York and proceeded to Baltimore, there loading for Hamburg. This very soon developed the import traffic via Baltimore. The Hamburg-American Line gave up calling at New York to discharge, and despatched their steamers directly from Hamburg to Baltimore, returning from Baltimore directly to Hamburg. In the same manner, the Hamburg-American lines to other ports on the Atlantic seaboard have developed, so that at the present day the Hamburg-American Line maintains a regular and direct service between Hamburg and Baltimore, between Hamburg and Philadelphia, between Hamburg and Boston, between Hamburg and Portland, Me., and between Hamburg and Montreal—the last named service, of course, only during the summer months. Thus New York not only lost a large part of the export, but also of the import traffic of this line to the outports and to Canada.

"On consulting the Canadian official records, we see that Montreal's exports have increased from \$32,245,941 in 1880, to \$64,040,982 in 1899; they have actually doubled in nineteen years. Montreal's imports have risen from \$42,412,648 in 1880 to \$65,018,544 in 1899.

"The remarks I have made have so far referred to the total commerce of the port of New York, but on examining the export trade of the port of New York, the decline in commerce becomes even more accentuated.

"The statistics compiled by the New York Produce Exchange show us that wheat exports from New York have fallen from 56.02 per cent. in 1880 to 51 per cent. in 1899; corn exports from New York, from 52.73 per cent. in 1880 to 26.25 per cent. in 1899; flour exports from New York, from 70.90 per cent. in 1880 to 34.24 per cent. in 1899. The percentage of the total exports of flour, wheat, and corn, in bushels, fell from 56.3 per cent. in 1880 to 32.9 per cent. in 1899, while Boston in the same period of time increased her exports of flour, wheat, and corn from 7.9 per cent. to 13.3 per cent.; Philadelphia, from 13.7 per cent. to 16.3 per cent.;

Baltimore, from 22 per cent. to 26.6 per cent.; Norfolk, from 1 per cent. to 2.8 per cent.; and Newport News, from nothing to 8.4 per cent. of the aggregate exports from the Atlantic ports I have named. In considering the question, it must be borne in mind that to arrive at a clear comprehension of the actual situation, we can only compare the exports of New York with those of her competing ports. While the claim can not be made that there has been a great decrease in the total exports of flour and grain from New York, compared with former years, the enormous increase in the production and in the shipment of breadstuffs via Buffalo certainly justifies the contention that an advance in the exports via New York at least approximately corresponding to this increase should appear. In other words, New York City has not received her share of the trade. She has by some means been prevented from securing that which she had a right to expect.

“What have been the causes that have operated to bring about this decline in the foreign commerce of New York City?

“The combinations entered into by the trunk line railroads of the country in 1877 resulted in the adoption of certain differential rates against New York, by which it was intended to offset the advantage New York was supposed to possess in lower ocean rates. The ocean rate has since that time been more or less equalized, but the discrimination against New York has remained unchanged, and will never be removed as long as the interests of the railroads oblige them to maintain their combinations. By these differentials an artificial diversion of trade from this port to other cities is created, which is the principal cause through which the City of New York has lost and is now losing her trade. I again quote from the report of Governor Black's Commerce Commission, as follows:

“‘To offset all the advantages enjoyed by New York City by an inland discriminating rate against New York is an arbitrary imposition of a burden upon all the export products of the territory tributary to New York in the competition to which they are subjected in the markets of the world. Such an imposition is not only indefensible from any standpoint of legitimate competition; it is not only an injury to the Harbor and to the State; it is a crime against the commerce of the nation.’

“The competition of our Canadian neighbors, who, more far-sighted than their competitors, have extended, enlarged, and deepened their canal system at an expenditure of over \$56,000,000 during the last fifty years, and the construction of canals capable of taking vessels of about 2,000 tons capacity, with a draft of from 12 feet to 14 feet, is another and subsidiary cause of the loss in New York's commerce.

“All commerce is dependent upon means of transportation, and unless transportation rates are fixed at such a level as to enable the importer and exporter to compete with the other producing countries of the world, our foreign commerce will not prosper, but will, as it has done, surely decline. The transportation business from the great producing fields of the Northwest to European markets has undergone most striking changes within the last thirty years, on the lines of the well-known principle that water

transportation is the cheapest form of transportation known to man at the present day.

“The ocean transportation business has shown a most striking development during the period I have referred to by the great increase in the size and carrying capacity of ocean vessels, which, accompanied by constant improvements in the application of motive power to their propulsion, has rendered it possible to very materially reduce the cost of transportation per ton of cargo moved.

“Thirty years ago, the largest steamship employed in the ocean-carrying trade between New York and Europe measured 3,989 tons, gross register. At the present date forty-five steamships over 10,000 and up to 13,797 tons, gross register, carrying from 7,500 to 12,200 tons dead weight cargo, run in regular lines between New York and Europe. I leave out of account the large fleet of vessels under 10,000 tons. To accommodate these enormous freight carriers, the largest of which, when fully loaded, draw 36 feet, a greater depth of water in the channels leading into and out of the harbor of New York has been called for. These demands of commerce have been most liberally met by the national Government from time to time, and as the channels were increased in depth the number of large freight carriers grew. To illustrate the adaptation of commerce to the depth of the channels, let us compare the years 1870, 1880, and 1890. In 1870 the minimum depth of water in the channels of New York harbor, at mean low tide, was 23 feet, and the maximum draft of vessels at that time was 22 feet. In 1880 the depth of water in the channels had been increased to 24 feet, and the deepest draft of vessels was then 23 feet. During the following ten years the successful efforts of the Government resulted in a depth of 30 feet in all channels, permitting the increase in size and carrying capacity of the freight carriers that have been constructed of late years. And now the increasing demands of the foreign trade of New York have resulted in the provision by the national Government for an improved and straightened channel to the sea of 40 feet in depth and 2,000 in width, work on which is now being prosecuted.

“The great benefits conferred upon the producer by thus enabling him, through the medium of cheapened transportation to the markets of Europe, to compete with South America, Australia, and India, will be realized on comparing the average rates of freight from New York to one of the Continental ports of Europe as they prevailed in the years 1870, 1880, 1885, 1890, 1895, 1900, and 1902:

	1870.	1880.	1885.	1890.	1895.	1900.	1902.
Grain, per 100 lbs.....	\$0.38	\$0.30	\$0.15	\$0.08½	\$0.08	\$0.12	\$0.05
Provisions, per 100 lbs .	.50	.36	.22	.21	.20	.20	.15
Cotton, per 100 lbs.....	.80	.50	.37	.35	.25	.27	.17
Tobacco, per hogshead..	10.00	7.80	6.60	6.00	6.00	6.00	5.00
Tobacco, per case.....	3.00	2.85	1.68	1.35	1.20	1.35	1.35
Measured goods, per c. ft.	.24	.20	.15	.13½	.11	.09½	.09½

"The rates for 1902 are abnormally low, owing to the great depression in the freight market, but the figures quoted illustrate the general decline of ocean freight rates rendered possible by improvements in the vehicles of transportation. The rates of transportation for grain to Liverpool are generally considered the standard rates. The average rate from New York to Liverpool on grain in 1873 was 21 cents per bushel, from which figure there was a steady decline, with some slight recoveries, until the third quarter of 1894, when the rate reached the abnormally low figure of $2\frac{1}{2}$ cents, or $\frac{28}{100}$ of a mill per ton mile. The average rate of the last six years for grain from New York to Liverpool was $2\frac{1}{2}$ pence per bushel, or $\frac{6}{100}$ of a mill per ton mile. The consideration of the conditions of ocean transportation shows that there has been a continual and very material reduction in the rate of transportation across the ocean.

"The same phenomenon appears in lake commerce, and we have here the same story of the increased size of lake vessels, the deepening of harbors and channels to accommodate them, and the radical reduction of rates of freight on cargoes, which reduction is rendered possible by these improvements.

"To this should be added the extensive improvements in the facilities for loading and unloading that contribute to a large degree toward the lessening of the cost of transportation. Until recent years there have, unfortunately, been no regular statistics published covering the traffic of the Great Lakes, but the report made to the Bureau of Statistics by Mr. George G. Tunell, of Chicago, and published in 1898 by the Treasury Department, contains most valuable information on the remarkable development of this branch of commerce. The reports of the United States Army Engineers also give us some figures showing the volume of the commerce moving on the lakes. These statistics show that the tonnage passing through the St. Mary's Falls Canal, which includes shipments from Lake Superior points to Lake Michigan, increased from 1,567,741 tons in 1881 to 25,255,810 tons in 1899. The freight tonnage moved through the Detroit River, which was 9,000,000 tons in 1873, grew to 40,067,380 tons in 1898. These Detroit River tonnage figures represent the estimates of the United States Engineers, based on information taken from all the Custom House records on the upper and lower lakes, as no accurate statistics of the freight movement through the Detroit River are obtainable.

"Mr. Tunell, in his interesting report, states that the recent rapid progress in lake transportation dates from the year 1886, in which year the new era of substitution of steamships for sailing vessels, construction of large steamships, improvements in the fueling, unloading and loading of vessels, and in the enlargement of locks began, factors that, combined, enabled the lake carriers successfully to compete with the railroads and to secure the lion's share of the transportation business of that part of the West bordering on the lakes. How great this success has been is shown by Mr. Tunell's estimate that the gain in the goods movement on the whole lake system in the seven years from 1889 to 1896 was 112.8

per cent. As the gain in goods movement on all the railroads of the United States in the same period of time was only 24.9 per cent., the lake record must appear a very favorable one. The average gross tonnage of the steamers built on the lakes in 1886 was only 269.10 tons, while in 1897 it was 1,436.91 tons, and reference is made in Mr. Tunell's report to a steamer then building of a carrying capacity of about 6,500 gross tons, on a mean draft of 17 feet. The daily papers have reported the sailing of a new steamer from one of the Lake Superior ports with 7,000 tons of iron ore. Sailing vessels have been transformed into barges, and are now towed, and steamers constructed of iron and steel have taken their place as independent carriers."—Remarks made before the Joint Committees on Canals of the Senate and of the Assembly of the State of New York on Tuesday, February 3, 1903, by Gustav H. Schwab, on behalf of the Canal Association of Greater New York.

IMPROVEMENT OF THE ERIE CANAL.

CHAMBER OF COMMERCE,
OF THE STATE OF NEW YORK.

The following resolution was unanimously adopted by the Chamber of Commerce, February 19, 1903, and a copy ordered to be sent to the Governor of the State and to the members of both Houses of the Legislature, with the remarks of Mr. A. Barton Hepburn on the subject:

Resolved, That the Chamber of Commerce of the State of New York hereby approves the proposition now pending in the Legislature of this State for the improvement of the Erie Canal, the Oswego Canal, and the Champlain Canal by the construction of what is popularly termed the 1,000-tons barge canal, and we respectfully urge the Legislature to enact legislation necessary to enable the same to be submitted to and voted upon by the people at the general election to be held in the year 1903."

REMARKS OF MR. HEPBURN, CHAIRMAN OF THE COMMITTEE ON INTERNAL TRADE AND IMPROVEMENTS.

"It is impossible not to feel annoyed at the trend of events with reference to the canals of our State. Several years ago we voted to expend \$9,000,000 in order to put them in efficient condition. The profligate expenditure of a portion of that sum and the total inadequacy of the sum appropriated to even approximately modernize canal transportation has had a baleful influence upon the canals ever since. In 1900 the Legislature authorized the State Engineer to make elaborate surveys and estimates of cost as to different routes and different sized prisms. A report of more than one thousand pages followed. This was supplemented by the report of the Greene Commission and the United States Board of Engineers on Deep Waterways. We have been surfeited if not confused by the data furnished.

"Last year Governor Odell recommended that the locks of the canal be enlarged to a 1,000-ton barge capacity and that the prism of the canal be deepened to nine feet. This Chamber endorsed the recommendations of the Governor. Certain interests of this city went to Albany and, adopting the motto of a 1,000-ton barge canal or nothing, united with the rural opponents of the canal to defeat the act submitting the proposition to the people for approval. By their action they have brought the commercial interests of this State perilously near to the alternative—nothing.

"However, the proposition now pending is a 1,000-ton barge canal to cost something in excess of \$101,000,000, and certainly presents a question upon which this Chamber must have views and ought to express them.

"The canals were completed to the depth of seven feet in 1862, and since then nothing has been done to increase the navigable capacity of the canals. What have the railroads done in the past forty years? They have increased the maximum railroad train capacity from 300 tons or 10,000 bushels of wheat to 2,700 tons or 90,000 bushels of wheat. The capacity of a canal boat plying the Erie Canal thirty years ago was 220 tons, equal to 74 per cent. of a train load; to-day it is 240 tons, which equals .088 per cent. of the maximum train load of to-day. Since 1862 the New York Central & Hudson River Railroad has increased the number of miles of road which it controls and operates 9,658 miles, capitalized at nearly three-quarters of a billion dollars, gridironing the East and Central West in its laudable ambition to reach and control business. The Baltimore & Ohio has spent for equipment, betterment, and improvements in the past two years \$15,000,000, and has contracted for or determined upon the expenditure of as much more. The Lehigh & Wilkesbarre has expended \$8,000,000 in the past two years for the same purpose; the Delaware, Lackawanna & Western \$10,000,000, the Erie \$7,500,000 and now has authorized a bond issue of \$50,000,000 for improvements and equipments. The New York Central has expended \$7,500,000 and is about to expend upon its terminals \$40,000. The greatest of all our railroads, the Pennsylvania, has expended \$45,000,000 recently to improve its efficiency, has a \$50,000,000 tunnel on hand and bridge construction and other improvements, the cost of which I won't venture to estimate. All this has been done by railroads terminating in New York, and hence competitors of our canals. Curves must be straightened and grades reduced, the capacity and facility of equipment increased, and no one doubts and no one questions that it is wise economy and good business judgment. If it is wise economy and good judgment as applied to railroads, is it not incumbent upon the great State of New York to apply these principles in the management of our system of canals?

"No prudent man would build canal boats of the present capacity with the impending prospect of having the capacity of the canals increased; hence the present canal equipment is especially run down and decrepit. The necessity for action and early action is important.

"I was a member of the Legislature representing one of the northern counties when the tolls were removed from the canals. I opposed making

them free, not because I was opposed to the canals, but because I feared, as I then stated, that the time would come when the canals would be ground out of existence between the upper and nether millstone of false economy on the part of some of the rural counties and inevitable rivalry of other carriers of freight. That pretty nearly describes the condition that confronts us to-day. The removal of tolls inured principally to the benefit of the handlers of freight at the terminals. An amendment of the Constitution so as to leave the question of tolls in the discretion of the Legislature would, I feel sure, inure to the benefit of the canals and the commerce of the State.

"In their present unsatisfactory condition the canal transportation for the year 1901 amounted to 3,420,613 tons, 1,113,617 tons of which had for its terminus the City of New York, or about 25 per cent. of the total. The canals should be maintained primarily as a regulator of the cost of transportation as fixed by the railroads, and for this purpose their annual worth to the commercial and business interests of the State would exceed their annual cost. Secondly, they are needed to supplement as well as rival the railroad traffic of the country.

"When the anthracite miners' strike was declared off and coal was being mined in abundance, the community still suffered because of the inability of the railroads to transport and deliver the same. There has been a terminal congestion of freight in all the larger cities and business centers of the country. Even the Pennsylvania Railroad had to lay off its twenty-hour passenger train to Chicago in order that the trackage might be used in distributing the freight of the company and relieving the congestion.

"Under these circumstances the great State of New York ought to conserve the business interests of its citizens and defend its own primacy by applying the principles and rules of management of the conduct of its canals which business experience and business foresight have proven to be necessary in order to preserve and promote the efficiency of private transportation enterprises."

A true copy.

GEORGE WILSON,
Secretary.

NEW YORK, *February 21, 1903.*

J. EDWARD SIMMONS,
Vice-President.

STATEMENTS TAKEN FROM "INLAND WATERWAYS—THEIR RELATION TO TRANSPORTATION."

BY EMORY R. JOHNSON,

INSTRUCTOR IN POLITICAL AND SOCIAL SCIENCE AT HAVERFORD COLLEGE, AND
LATE OF THE UNIVERSITY OF PENNSYLVANIA.

The best regulator of railroad rates is the independent waterway. Competition between railroads and water routes is quite different from that of railroads with each other. It is bound to produce cheaper rates, and can do this without detriment to the railroads.

The waterways can regulate rates by carrying only a fraction as much as the competing railroad, and it by no means proves the inability of the waterway to fix rates to show that the volume of freight passing over the railroads is several times that of the competing routes of navigation. The rate charged by the waterways sets a limit—not so low, it is true, as the tariff on the waterway—beyond which the railroad can not go without surrendering its traffic to the waterway.

A well informed engineer, John L. Van Ornum, Chief Topographer of the International Boundary Survey between the United States and Mexico, stated in a letter written January, 1892: "It is the universal experience in America that water communication tends to keep down railroad rates. Instances are not rare where railroads have carried freight for the same rate that competing boats have done, until the boats have been sent away or sold on account of lack of business, and then at once the railroads have raised their tariffs. In all the number of instances I know of when water navigation has been resumed, the competing railways had been obliged to lower their rates. Herein lies the great value of our waterways, not so much in actual tonnage carried as in their far-reaching indirect effect in forcing down railway rates."

The influence of the waterway on tariffs is felt beyond the region immediately bordering on the navigable route. When, for instance, the lakes, the Erie Canal, and Hudson River fixed the railroad rates from Chicago to New York, they also fixed the limits of charges from such interior cities as St. Louis, Indianapolis, and Cincinnati to the East. The testimony before the Hepburn Committee was to the effect that by agreement of the roads existing at that time, the rate from Chicago to New York was taken as a basis, and the charges on slow freight from Cincinnati, Kansas City, Louisville, etc., were made a certain percentage of that basis; such a percentage, that is to say, as would prevent freight from being sent first to a lake port and then shipped East by water instead of being forwarded directly through by rail.

The influence of the Great Lakes on rates is shown by the following illustration: For certain reasons (cheap return rates on grain boats) rates

on coal from the East are cheaper to Duluth than to Chicago; and thus it comes about that Duluth dealers can sell coal as far south as Kansas City and supply many cities that are much nearer Chicago. As another illustration may be mentioned the case of Aberdeen, Watertown, Huron, and other Dakota cities, where wheat rose 7 cents a bushel and coal fell \$2.00 a ton, when railway connections with Lake Superior were secured.

The conclusion to which the Cullom Committee (Senate Commerce Interstate Commission) came as the result of its investigation in 1885 on the effect of water competition upon railroad charges, is in perfect harmony with the position taken in this discussion. The report of the Senate was that "the evidence before the Committee accords with the experience of all nations in recognizing the water routes as the most efficient cheapeners and regulators of railway charges. Their influence is not confined within the limits of the territory immediately accessible to water communication, but extends further and controls railroad rates at such remote interior points as have competing lines reaching means of transport by water. *Competition between railroads sooner or later leads to combination or consolidation*, but neither can prevail to secure unreasonable rates in the face of direct competition with free natural or artificial water routes. The conclusion of the Committee is, therefore, that natural or artificial channels of communication by water, when favorably located, adequately improved, and properly maintained, afford the cheapest method of long distance transportation now known, and that they must continue to exercise in the future, as they have invariably exercised in the past, an absolutely controlling and beneficially regulating influence upon the charges made upon any and all means of transit."

No one, it is to be hoped, will interpret the foregoing discussion to imply that the small, ill-equipped, antiquated canals constructed three-quarters of a century ago to meet the requirements of the commerce of that time can exert any important control over railroad traffic. The waterways which have such power, are those that more or less fully meet the requirement of the commerce of to-day.

PART II.

SUMMARY OF REPORT OF STATE ENGINEER AND SURVEYOR EDWARD A. BOND, ON THE BARGE CANAL FROM THE HUDSON RIVER TO THE GREAT LAKES.

STATE OF NEW YORK:
OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, February 12, 1901.

Honorable BENJAMIN B. ODELL, Jr., Governor of the State of New York.

SIR: Having completed the surveys, plans and estimates for improving the Erie Canal, the Champlain Canal and the Oswego Canal as directed by Chapter 411 of the Laws of 1900, I have the honor to report as follows:

Chapter 411 of the Laws of 1900 became a law April 12, and I at once commenced the organization of the proper force to carry the law into effect by appointing as Consulting Engineers, Mr. Trevor C. Leutzé, of Albany, N. Y. (division engineer of the eastern division New York State canals), and Mr. David J. Howell, of Washington, D. C. (who had charge of the work on the eastern division of the Mohawk and Oswego line of the deep waterways survey), with Mr. Howell as engineer in charge.

The necessary instructions for the survey parties were at once formulated and submitted to the following board of engineers: Mr. George S. Greene, of New York City; Mr. George Y. Wisner, of Detroit, Mich.; Mr. Edward P. North, New York City; Professor Palmer C. Ricketts, Troy, N. Y., and Mr. J. Nelson Tubbs, Rochester, N. Y.

William B. Landreth was assigned to the position of special resident engineer in charge of the middle division; James J. Overn as special resident engineer in charge of the western division; and to John R. Kaley, assistant engineer, was assigned the work of preparing the estimates for the Champlain Canal from notes in this Department in connection with previous improvements of said canal.

As soon as the organization of the survey was completed and the field forces well at work, I realized more than ever the great scope of the work undertaken. In scrutinizing the bill and its various requirements,

and considering the short space of time granted for their accomplishment, a definite plan of action was settled on as to the time of completion of the various tasks. The questions to be solved were numerous, but in the organization it was my aim to secure only masters of each branch of the profession, and now submit the results of my work.

The canal to be surveyed and estimated for in accordance with the specific terms of the act and the orders of the Canal Board, extends from the Hudson River to Lake Erie by three routes:

First. By way of the canalized Mohawk River, Oneida Lake, Oneida and Seneca Rivers, and the present line of the canal to Lake Erie with several minor deflections.

Second. By way of the present route of the Erie Canal modified by passing through Oneida Lake, Oneida and Seneca Rivers, also with several minor deflections.

Third. By either of the above routes from the Hudson to the junction of Oneida and Oswego Rivers (known as Three River Point); thence down the Oswego River to Lake Ontario, via Lake Ontario to Olcott or the lower Niagara River, and thence to Lake Erie.

The canal is to be of size suitable for barges 10 feet draft, 25 feet width, and 150 feet length. The canal as planned and estimated for by these routes is first class in every respect, with locks of the most modern type capable of passing two boats at once, with recent improvements and methods for filling and emptying the locks, with power generated to pull the boats into and out of the locks, operate the gates and valves, and furnish electric light. The locks are provided both up and down stream with masonry and timber walls for the use and convenience of fleets of boats passing the locks, and they are arranged on one side of the axis of the canal so that they can be readily duplicated in the future when the commerce developed renders this step necessary. The prism is 75 feet wide on the bottom, with side slopes of one or two in earth section, and corresponding size in rock section, giving a ratio of prism to loaded boat of 4.75. In the river and lake channels the minimum width is 200 feet. Both the bottom and sides of the canal are to be thoroughly puddled wherever necessary, all embankments have a thick puddle core, all sloping sides are provided with well-constructed wash walls, and all vertical walls are made of masonry. Guard locks are provided wherever required, and in the canal sections guard gates are provided at distances apart not exceeding ten miles, so that any section can be shut off for repairs whenever necessary.

A full complement of first class new bridges is provided wherever required, and of sizes and descriptions to suit their particular locations.

An abundant and liberal water supply is provided for, and in this matter and in the location of the canal, private, corporate, and municipal interests have been carefully considered and conserved.

The detailed plans and estimates will show fully what has been planned and provided for, and nothing further need be said here than that these plans and estimates have been made with scrupulous care, and include

everything which experience or study teaches is essential or desirable in the construction of a canal of greatest efficiency.

By foreseeing everything as far as possible, and constructing the canal in a first class manner, it is believed that the cost of maintenance and operation will be greatly reduced below what it would be if the canal were planned and estimated for on a cheaper basis, and would thus better subserve the purpose for which it is intended.

Besides the canal as above outlined, plans and estimates have been made for improving the Oswego Canal to a nine-foot depth for boats of the present size, and the Champlain Canal for boats of the present size drawing six feet of water.

LIFT LOCKS.

The ascent of the canal around the falls of the Mohawk River at Cohoes has been one of the most difficult problems to solve, and has, therefore, received my earnest attention. First, there was the location to choose, and, secondly, the kind of locks to be decided upon.

My predecessor had, as early as 1894, advocated a mechanical lift lock at Cohoes and other localities similarly situated on the Erie Canal, notably Lockport. Although mechanical lift locks of various types are in more or less successful operation in Europe, none have a lift exceeding 60 feet, while that necessary to overcome the falls at Cohoes would be about 121.3 feet.

Plans for such a mechanical lift lock at Lockport were made and submitted by Chauncey N. Dutton and adopted by the Canal Board, June 24, 1897. The failure of the \$9,000,000 appropriation to complete the contemplated improvement, however, stopped all progress on that work, and the contract for that lock was never awarded. While the successful accomplishment of a mechanical lift at this spot is a very alluring proposition, considering what a saving of water would result; on the other hand, failure of the machinery, which would involve closing the entire canal, is a serious proposition.

Believing that in a matter of such magnitude as this, all information possible should be obtained, I invited other engineers to submit plans, with the result of receiving one on the hydraulic principle from the Buffalo Engineering Company. Another operated by electricity was submitted by Mr. Wm. R. Davis, chief bridge designer of this department, who went more into detail as to cost than any of the others. Being thus equipped with plans of locks of the mechanical lift type, I had prepared, for the purpose of comparison of cost, plans for a series of concrete masonry locks which would overcome the height of the fall by a flight of four locks each having 30.3 feet lift.

ADVISORY BOARD.

Thus armed, I called together a board of advisory engineers, composed of the following, who are men well and favorably known to the engineering profession:

Hon. Elnathan Sweet, ex-State Engineer and Surveyor, chairman.

George S. Morison, Member of the Isthmian Canal Commission.

Thomas W. Symons, Major, Corps of Engineers, U. S. Army.

William H. Burr, Member Isthmian Canal Commission, and Professor Columbia College.

Dan C. Kingman, Major, Corps of Engineers, U. S. Army.

At a meeting of the Board held September 7, after carefully considering the matter of mechanical lift locks, a report was unanimously adopted in favor of the ordinary type of masonry lock.

In consequence of this decision of the Board, the estimates for this work are based on the ordinary type of masonry lock, for, although the advantages of the mechanical lift are many, a proper conservatism demanded the use of the old and tried type rather than a comparatively new and experimental one.

Much higher lifts are made with the new locks than anything heretofore attempted on the present Erie Canal. The problem of a high gate, more than anything else, kept former engineers from risking the higher lifts, but this difficulty has been so thoroughly overcome by the solidly built gate in use on the Canadian canals that at the present time it is not thought impracticable to build a lock with a forty or fifty foot lift. The maximum lift on the different lines, for which estimates have been made, is 40 feet on the Lewiston-La Salle line, while that on the Waterford line is 33.8 feet. The single locks are 328 feet long between hollow quoins, 28 feet wide in the clear and for lifts over 8 feet, are fed through a culvert running parallel to the axis of the lock in the lower part of each wall. Smaller feed pipes discharge from these culverts into the lock and are placed from 15 to 20 feet apart. The opening and shutting of these culverts for filling and emptying is controlled by a valve operated by electricity.

In the flight of locks, all of which are double, the culverts will be controlled by Fontaine lift valves, except the outlet of the lowest one, which will be controlled by a gate of the Stoney type. As a general thing, where enough fall can be obtained the power to operate all machinery will be electricity. This will also be applied to the opening and shutting of the gates, the lighting of the lock at night, and all other work incident to lockage.

It may be of interest to the layman to briefly describe the side walls of a flight of locks such as are proposed at Cohoes. Standing in the bottom of the first lock and looking up we have a wall which provides for 12 feet of water in the ordinary stage, plus 30.3 feet when the lifting is done plus 4.6 feet in height of the wall above the water surface of the filled lock, or a total of 46.9 feet. As in a flight of locks the wall of each upper lock laps the lower lock for a distance of about 20 feet, the height of the lower wall is increased by the lift of the next upper lock or $46.9 + 30.3 = 77.2$ feet. Thus a man in the bottom of the lock near the upper breast wall, stands at the foot of concrete walls, both 77 feet high and, of course, of suitable thickness, being 30 feet wide at the bottom and 22 feet wide at the

top. The gates are 47.8 feet high, and with a full upper lock the one immediately below it having only 12 feet of water in it, the water 47.8 feet deep will press against one side of the gate only. An idea can be formed from this statement of the enormous strength that is necessary to be furnished in one of the gates, the pressure exerted against each leaf of the gates being 606.9 tons of 2,000 pounds. The gates of the mitre type and built up of solid beams of timber well fastened and bolted together. Each beam is keyed to the next succeeding one, and iron rods extend through all from the top to the bottom of the gate. It is proposed to use Pacific coast fir timber in the construction of the gates. On the present Erie Canal the gates have to be balanced by beams extending over the walls of the lock to keep the toe post from binding in the bottom of the lock. The Pacific coast fir has such buoyancy that with solid gate, the balance beam is unnecessary, and, as a general thing, the gate will have to be weighted over the toe post to keep it on the bottom. Those for higher lift locks are built on similar plans.

As locks and gates of this description have been in successful operation in Canada for many years, there is nothing of the nature of an experiment in these designs.

No doubt the Board was influenced to a great extent in their conclusions by the decision of the Attorney-General, which was rendered at my request early in June. As this decision is of great interest, I quote Chairman Elnathan Sweet's letter to me, which was transmitted to the Honorable John C. Davis, Attorney-General, for his opinion.

"ALBANY, June 12, 1900.

"DEAR MR. BOND: An important question in determining the relative merits of mechanical and ordinary locks at the Cohoes site is that growing out of the large consumption of water by the ordinary locks of the enlarged size that the barge canal will require when used in a flight, as will probably be necessary at Cohoes. I will suggest that it is desirable that the Advisory Board should have the Attorney-General's opinion as to the preferential right of the State to the waters of the Mohawk River at Cohoes, and whether its right goes to the extent of enabling it to use the greatly increased volume of water that the barge canal with ordinary locks would necessitate at this point creating liability for damages to riparian owners.

"Very truly yours,

"E. SWEET."

The answer of the Attorney-General was unqualifiedly in favor of the title of the State to all the waters of the Mohawk River at Cohoes.

The work at this point has been so planned, however, that the Cohoes Company will not be the loser, but, on the contrary, will have an increased head of water and a more constant supply than ever before.

GENERAL ADVISORY BOARD.

After the receipt of the report of the Advisory Board on the lift locks in September, and being greatly impressed with the responsibility of

settling the grave questions that arose, I made careful study of the finances available and decided that ample means were at my command to continue this Board in an advisory capacity. As Major Dan C. Kingman was stationed at Chattanooga, Tenn., it was not convenient for him to continue as a member of the Board on account of the long travel involved, and I reluctantly accepted his resignation. I was most fortunate, however, in securing the services of Mr. Alfred Noble, of Chicago, member of the Isthmian Canal Commission, and also one of the three engineers composing the United States Deep Waterways Board.

STANDARD SECTIONS AND PLANS ADOPTED.

The first meeting was held at Albany on September 12, and the Board organized by the election of Hon. Elnathan Sweet as chairman. Some plans were submitted to them, namely, standard sections for both river and canal; standard locks, standard retaining walls, lock approaches, etc. Before adjourning the Board suggested the placing of the locks to one side of the prism of the canal, with a view of doubling the same later on when the volume of traffic demanded it.

DATA ON FLOOD DISCHARGES APPROVED.

Another meeting was held September 26 with a full attendance. The sizes of the maps to be published were decided upon, and some lock plans approved. It was then decided that the walls at the head of the locks and the head gates should be raised for all river locks, providing against overflow during the maximum discharge estimated, and that the head walls should be two and one-half feet above the flood limit. The secretary presented the data on which was based the ultimate flood discharge to be provided for during the period of navigation based on a maximum velocity of four feet per second. The above provided for a channel to accommodate a discharge of 35,000 cubic feet per second at Cohoes Falls, diminishing as we ascended the Mohawk River to 10,000 cubic feet per second above the West Canada Creek at Herkimer.

CARGO CAPACITY APPROVED.

The cargo capacity was approved; also the maximum velocity used, namely, four feet per second. A memorandum was also presented on the cargo capacity of and displacement of steamers and consorts for the new canal. The conclusion was reached that two lockages per hour, based on an equal distribution of traffic with full cargoes going east, and one-third cargoes going west, would provide for the 10,000,000 tons per canal season. The Board advised that a water supply be provided for a tonnage as above stated, and that a separate estimate be made of the cost of providing a water supply for the moving of 5,000,000 tons per canal season.

On October 10, 1900, unit prices were established by the Board after careful discussion.

In arriving at unit prices, samples of material procured from the borings in different localities were exhibited to the Board and, after a description of the extent and the nature of the deposits by the special resident engineers in charge, the Board affixed a price, having discussed the best manner of handling the same. Soft mud, loam, clay, soft rock, hard rock, quicksand, and marl were all discussed in their turn, and prices agreed upon. Prices on timber and structural steel were adopted, the market rates governing, and every price received careful attention.

WATER SUPPLY INVESTIGATION OUTLINED.

Mr. Emil Kuichling, Engineer for water supply, presented an outline of his investigation to the Board. A resolution was adopted pertaining to the water supply of the summit level of the canal, not only to provide storage reservoirs sufficient to operate the canal, but also to establish additional storage to make the supply safe. After passing on some minor changes in lock valves the Board adjourned until February 4, 1901.

Meeting again on the morning of February 5, many matters were discussed relative to the various routes. It was decided to publish a geological map of the State in connection with Mr. Kuichling's report on water supply. Before adjourning sine die the Board adopted the following resolution:

"WHEREAS, The Advisory Board of Consulting Engineers, appointed by Hon. Edward A. Bond, State Engineer, has examined the maps, profiles, and other records of surveys and plans of the proposed barge canal, between the Hudson River and Lake Erie, and also of the proposed enlargement of the Champlain and Oswego Canals, and has familiarized itself with the manner in which these surveys have been conducted, and the plans and estimates prepared.

"Resolved, That in the opinion of this Board the work has been done thoroughly and in a manner which meets its approval, and that the estimates and reports in which the results of these surveys and work have been embodied are entitled to the confidence of the people of the State of New York."

I should add that the State Engineer and his consulting engineers were present at every meeting of the Board.

PERSONNEL OF ADVISORY BOARD AND ENGINEERING FORCE.

The general distrust that prevailed about canal work in this State, as well as the great interest displayed in the solution of this transportation problem, impressed me deeply, and it became my aim to have the survey and estimate completed in a most thorough manner, and on as economical a basis as possible, taking into consideration each subject involved therein.

Therefore, not a step has been taken in the preparation of these estimates without the most mature deliberation on the part of myself and my consulting engineers, and to make doubly sure all conclusions reached were submitted to the Advisory Board. As stated before, the personnel of

this Board has such a reputation that the State of New York may be congratulated on having men so pre-eminently identified with the engineering profession of this country as its counselors. As a body their decision should carry great weight.

In speaking, as I have, of the excellence of the Board of Advisory Engineers, it was not my intention to neglect or withhold due credit from those actually employed in the field and office. Seldom, I think, has an engineering force been gathered either for private or public service that for efficiency, zeal, and harmony equaled the one just disbanded. It was my aim to get only the best men, and in this I succeeded. Fortunately many of the engineers in charge appointed by me had just severed their connection with the United States Deep Waterways Board, and were perfectly familiar with the class of work expected of them. The surveys were made without a single hitch or delay, and office work and computations were started at the time originally set for them in the schedule prepared beforehand and made to insure the completion of the estimates at the earliest date possible.

APPRAISERS FOR RIGHT OF WAY.

As the act authorizing this survey calls for detailed estimates of the value of land and property to be acquired for right of way for the new canal, and the sale of abandoned land should any such contingency arise, I selected Patrick McNamara as appraiser for these lands. Mr. McNamara's connection with the Attorney General's office and Public Works Department for a period extending over twenty-five years, and his intimate knowledge of the value of the lands in the vicinity of all the canals of the State, acquired by him in the discharge of his duties in connection with the Court of Claims, leaves no doubt as to his fitness. He has been in attendance at every session of the court since its creation, was at all sessions of the old Board of Claims and was always prominently engaged in canal claims before the old Board of Canal Appraisers. Suffice it to say that no other man has as intimate knowledge of canal land and property in this State as Mr. McNamara.

To still further fortify this report, experts were consulted as to the values of lands and property where the canal runs through large cities, such as Utica, Syracuse, and Rochester, and these jointly with Mr. McNamara settled on the value. They are well known in the localities where they live, and their judgment should carry weight.

INVESTIGATIONS FOR WATER SUPPLY.

I was fortunate in being able to secure the services of so distinguished a hydraulician as Emil Kuichling, to whom I entrusted the investigations of a water supply for the new canal. The problem of furnishing an ample supply for the summit level of the canal has been solved by him in a very ingenious and efficient manner.

A storage reservoir on West Canada Creek is provided near Hinkley, far above the dam of the Equitable Gas and Electric Company of Utica, N. Y., at Trenton Falls. The creek is tapped at Trenton Falls below the tail race of the power plant and by a short feeder the diverted water is carried to the valley of the Nine Mile Creek, which discharges into the Mohawk River just a little above Oriskany. From a suitable point, above the mouth of this creek, the water is then conducted into the summit level of the barge canal by either the river route or the route following the present canal. For the latter, another small storage reservoir is projected at Stittville to gather the water from the Nine Mile Creek watershed.

The plan adopted for feeding the summit level of the canal is briefly outlined as follows:

The present Erie Canal from Rome westerly to the Butternut Creek feeder, near Syracuse, is retained as a feeder to the barge canal, taking advantage of the existing reservoirs that furnish water to that portion of the canal.

According to Mr. Kuichling's investigations we can rely on a minimum net delivery of 16,000,000 cubic feet per day from this source of supply, after deducting all probable drains upon it, such as leakage and evaporation. The amount necessary for the successful handling of a 10,000,000-ton traffic on the summit level of the canal route is 39,000,000 cubic feet per day. We, therefore, have a shortage of 23,000,000 cubic feet per day for which we must look elsewhere. This amount can be obtained from the Nine Mile and West Canada Creek watershed, and thus the problem of attaining the desired 39,000,000 cubic feet per day is solved.

This, however, leaves no reserve supply in case of accidents to feeders or failures from other causes. The investigations show that several of the present sources of supply on the Middle Division are capable of much greater development than was attempted for the present Erie Canal, and by the full storage development of the Limestone Creek and the Upper Mohawk River, together with some slight changes at Cazenovia Lake, we will be able to draw an additional 18,000,000 cubic feet per day for the summit level in case of accidents to or failure of the Nine Mile Creek and West Canada Creek supplies.

The foregoing figures are based on the reconstruction of the Erie Canal with its present summit level. For the river route, however, a different proposition will govern. Some of the drains upon the gross delivery are eliminated in this case, and Mr. Kuichling estimates that the required supply for the river route will only amount to 30,000,000 cubic feet per day during the season of navigation and 7,000,000 cubic feet per day for the remainder of the fiscal year, considering always that the leakage at dams in the alluvial soil of the Mohawk Valley is not very large. To secure this supply it will suffice to develop the storage capacity at the head of the Mohawk River at Delta, also that of the Limestone Creek, West Canada Creek, and Cazenovia Lake, retaining, however, all other existing sources of supply between Syracuse and Utica. This will give about 44,000,000 cubic feet per day, an excess of 46 per cent. over requirements.

This supply will be in five items: First, 10,800,000 cubic feet per day from the Erie Canal at the west end of the summit level; second, 9,000,000 cubic feet per day from Black River Canal; third, 8,200,000 cubic feet per day from the Mohawk River; fourth, a delivery of 13,000,000 cubic feet per day from West Canada Creek, and fifth, a delivery of 2,900,000 cubic feet per day from Oriskany Creek via Erie Canal as at present. Counting the Mohawk and Oriskany supplies together as a single one, it will be seen that since any three of these four feeders will furnish nearly the full daily amount required, stoppage of navigation would only result if two of said sources were disabled at the same time during a year of minimum rainfall, which is not likely to occur. Should more storage be required, however, we can fall back on the Oriskany Basin, which can be made to yield an extra 12,000,000 cubic feet per day, without trouble. By this plan the building of the reservoir and several other structures on Nine Mile Creek can be avoided and a saving made in favor of the river route of \$1,113,000.

One reason for the extra large supply needed per day is the proposition to retain water in the barge canal every day in the year, and allow it to spill over the structures in the winter. This is considered the safer way, as affecting the integrity of the banks.

All these figures, however, are based on the assumption that our canal banks will be watertight and the amount of puddle in the estimate will show that this portion of the work has not been neglected. It has been the endeavor to secure as nearly as possible impervious bottom and sides.

It may also be mentioned that in the plans for the various proposed storage reservoirs, liberal provision has been made for conserving the existing water powers on the streams affected.

The scope of Mr. Kuichling's investigation has been wide. As the available data of leakage and evaporation on the Erie Canal were very old, I furnished him with field parties and outfits for gauging the present canals, to gather such additional data as could be secured in the short time available. Float measurements were carefully taken on many levels of the old Erie and other canals representing different depths and cross sections; evaporation was also noted. The float measurements were checked, when practicable, by current meters in the hands of experts; and finally, to establish the trustworthiness of either method, recourse was had to the hydraulic experiment canal at Cornell University, where exhaustive tests were made and comparisons noted, which proved the gaugings taken in the canal to have been practically correct. All of this appears in the detailed report.

Foreign authorities have been freely consulted and many deductions made therefrom.

It is particularly pleasing to me that I have been able to collect the very latest statistics of rainfall, run-off, and canal lore in existence, both in this country and in Europe, and the books from which such information was culled are on file in the library of this Department, furnishing a very valuable addition to the same.

INVESTIGATING FLOOD DISCHARGES.

The time was so short that the various gauge readings necessary to form a more accurate idea of flood discharges in the Mohawk Valley do not extend over a sufficient period to be absolutely reliable. To deduce accurate data from these readings they should cover a considerable period of time, much more than that granted by this act. A number of gauges have been established in connection with this survey at controlling points along the Mohawk River, and gauge readings are being taken twice a day at each gauge. I earnestly recommend that these readings be continued, in order that before any construction begins, more valuable data may be gathered for use in all projects for canalizing the river. Of course, we have a mass of foreign data which has been condensed and can be applied to the Mohawk by comparison, but accurate gaugings extending over a long period of time are absolutely essential.

DAMS.

Two forms of dam will be used on the barge canal: fixed masonry dams and fixed timber dams.

Masonry dams will be built where rock is available for foundation and timber dams where gravel or other kindred material is found. It was thought advisable not to adopt any standard section of concrete dam at present, but estimates were based on plans outlined from existing structures and sufficiently full to cover any possible cost. The same course was followed with the timber dams as it was thought better to wait before making any settled section that advantage could be taken of all benefits that might accrue from later experience and models. Any probable cost, however, is amply provided for. The question of movable dams was discussed, but not enough time was available to make sufficient investigation. I do not think there would be much difference in cost between improvements based on the two types of dams. In a valley as narrow as that of the Mohawk, all bottom lands would be flooded under either conditions, as in fact they now are in every spring, and some fall floods, without dams. The contemplated storage dams would have a very beneficial effect in checking these floods.

STREAM CROSSINGS.

On the route following the line of the old Erie Canal, especially in the Mohawk Valley, many streams cross the line of the canal. Aqueducts now span the creeks, but with the silt deposit of years the creek bottoms have been so filled that little or no clearance exists under the bottom of the trunk of a canal with seven feet of water. A canal of twelve foot depth, therefore, would necessitate the building of a dive bottom under such a trunk, which is an undesirable construction. Therefore, in many cases it has been decided to take these creeks into the new canal. As these water courses are subject to sudden floods in the summer time, a

spillway has been designed immediately opposite the entrance of these creeks. These spillways are from 150 to 200 feet long and have steel bulkheads with sluice gates, each capable of discharging 140.4 cubic feet per second under a twelve foot head. Every spillway has at least four of these gates, some of them eight, according to the size of the stream taken in. At Schoharie Creek the aqueduct has been abandoned entirely and the boats will cross in the pool formed by a new dam to be built there. A crib baffle dam will be built higher up the creek to arrest the deposits of gravel and silt which will be carried down by the floods to which the stream is subject. In case of the smaller streams, however, as stated before, the creek is taken bodily into the canal, spillways and waste gates being provided to guard against floods. When sufficient head room is available the canal will be carried over the streams by aqueducts.

BRIDGES.

As will be seen by the plans of the different type of bridges decided upon, they were divided into various classes, namely, farm, highway, and fixed and lift bridges in cities. The farm bridges have a clear roadway of twelve feet, the highway type a clear roadway of sixteen feet, and the city bridges vary both as to width of roadway and number of sidewalks. The clearance between water surface and the lowest part of the bridge was fixed at 15.5 feet on the barge canal and river section, and as 13 feet on the canals of seven and nine foot depths. Ample approaches were estimated for, and taken as a whole, including abutments, these bridges represent the best modern construction. Each individual case was studied separately, and detailed figures for the same are on file in this office. In railroad crossings a rule was adopted by which each estimate included the necessary alterations of all track and structures within the limit determined by a maximum grade of one-half of one per cent. for main lines in general, and of one per cent. for branch lines and special cases. These railroad changes form no small part of the outlay.

NAVIGATION BUOYS AND LIGHTS.

In the navigation of the proposed canals only steam, electric, or other mechanical motors have been considered, consequently the towing path will be a thing of the past. The estimate covers the marking the channel of the canalized rivers by spar buoys anchored to the bottom of the river and easily distinguished. These can be gathered in to protect them from any ice run and towed to a place of safety at the close of the canal season.

For night navigation it is assumed that each boat will be equipped with a search light, by the aid of which the channel can be easily located. Large Pintsch gas buoys have been estimated for at Oneida Lake, one at each end, and at Cross Lake small buoys surmounted by a lantern and iron cages will be used in lighting the channels of these lakes at night. It is

assumed that the United States Government will provide the customary lights at Olcott harbor.

Each lock is equipped with four arc lights on the lock proper and one on each approach. Besides these, incandescent lighting will be furnished for the lock houses.

RESISTANCE TO TRACTION.

The Honorable Elnathan Sweet, Chairman of the Advisory Board, served as Division Engineer on New York State canals for some years, and was State Engineer and Surveyor from 1884 to 1888. While Division Engineer in 1878 he made some experiments in regard to resistance of traction of boats in a restricted channel and evolved a formula to be used in calculations of this nature. The same has been widely copied and commented on, especially so by European engineers, where this subject has received much attention, many excellent treatises having been published on the subject. DeMas in France, Chief Engineer of Ponts et Chaussées, Captain Suppan in Austria, and Haak and Engel in Germany, have gone into the subject at great length.

Mr. Sweet brings the foreign information up to date. After reviewing all the different experiments, the following conclusions are reached: A boat that will travel with the same power 3 miles an hour in a canal of our standard section, that is 1,188 square feet area, will travel $3\frac{1}{2}$ miles in a river canalized as proposed as ours, with a bottom width of 200 feet or more, and 4.4 miles in open water. If the canal speed is $3\frac{1}{2}$ miles per hour, the canalized river speed, is 4.2 miles per hour and 5.2 miles per hour should be attained in open water. If 4 miles per hour is the speed of the barge canal, then 4.75 miles per hour will be made in the river, and but 5.9 miles per hour in open water. The time consumed to make the round trip would vary with the different routes.

First, a barge canal on the old Erie line, but diverging from the present canal between Cohoes and Rexford Flats where the Mohawk River is canalized, between New London to Clyde, where Oneida Lake, Oneida and Seneca Rivers are occupied, and between Tonawanda and Buffalo the Niagara River is followed. Its length is about 345 miles, of which 257 is nearly all of the standard trapezoidal earth section, 53 miles of canalized river, and 35 miles of open water. This route has 45 locks, and after adding all necessary detentions at locks, etc., Mr. Sweet's conclusions as to the time elapsed on these trips over the different routes enumerated, will be found given in the following table. It is assumed that the boats on the return trip will be only one-third loaded, giving them an immersed section of about two-thirds of their loaded section.

The second route is common with the first, except Troy to Cohoes, where it follows the Hudson River to Waterford, and thence by the north branch of the Mohawk and a short line of artificial channel in the pool at the head of Cohoes Falls, and from Rexford Flats to Rome it occupies the canalized Mohawk.

On this route there are 170 miles of standard canal section, 107 miles of canalized river section, and 68 miles of open water. The number of locks is 38.

The third route is common with the second from Troy to the Oswego River at Three River Point, thence it follows the Oswego River to Lake Ontario, through this lake to Lewiston, thence by an artificial channel around Niagara Falls to the Niagara River at La Salle, thence by Niagara River to Buffalo. By this route the standard canal section will obtain for 48.5 miles, the canalized river section for 104 miles, and open water for 195 miles. The number of locks is 41.

This route, however, involves open lake navigation from Oswego to the mouth of Niagara River, and would require a stronger style of barge than for the interior routes and would be more subject to detentions from storms.

In the Lockport-Olcott route very nearly the same condition will be found as on the route just described.

Comparison of probable time elapsed on trips between Troy and Buffalo and return using three routes, the present canal modified, the Mohawk-Seneca route and a Lake route by way of Oswego to Buffalo, using either the Olcott or the Lewiston Line.

DESCRIPTION OF FLEET.	No. 1. INLAND ROUTE USING PRESENT CANAL MODIFIED.			No. 2. RIVER ROUTE, MOHAWK-SENECA.			No. 3. LAKE ROUTE MOHAWK-OSWEGO- BUFFALO.			Difference between Nos. 1 and 2.		Difference between Nos. 2 and 3.		Speed.
	Total time elapsed.		Hours.	Total time elapsed.		Hours.	Total time elapsed.		Hours.	Hours.	Hours.	Hours.		
	Going up.	Coming down.		Going up.	Coming down.		Going up.	Coming down.						
Steam barge and consort.....	98.50	119.25	188.75	91.75	112	203.75	82.50	99.75	182.25	35.5	21.50	} With power for 3-mile rate in canal.		
Steam barge and three consorts	119.25	138	255.25	107.75	128	235.75	99.75	117.50	217.25	38	18.50			
Tug and five barges.....	132.25	153	285.25	120.25	140	260.25	113.25	131.50	244.75	40.50	15.50			
Steam barge and consort.....	84.75	104	188.75	79.50	97.50	176	71.25	86.50	157.75	31	18.25	} With power for 3½-mile rate in canal.		
Steam barge and three consorts	108.50	123.75	232.25	95.50	114	209.50	88.50	103.75	193.25	34	17.25			
Tug and five barges.....	118.50	137.75	256.25	108	120.50	228.50	102	117.25	219.25	37	15.25			
Steam barge and consort.....	76.25	92.75	168	70.75	85.75	156.50	63.25	77	140.25	27.75	16.25	} With power for 4-mile rate in canal.		
Steam barge and three consorts	95.00	111.50	206.50	86.50	101.75	188.25	80.50	94.25	174.75	31.75	13.50			
Tug and five barges.....	110.00	126.50	236.50	99.25	114.25	213.50	94	107.75	201.75	24.75	11.75			

By these experiments we also find it safe to estimate that the power required to run one fully loaded barge and consort at 3 miles per hour is 100 I. H. P., at 3½ miles per hour is 160 I. H. P., and 4 miles per hour is 275 I. H. P.

For the propeller towing five barges the estimated power would be for the 3 mile per hour canal rate 265 I. H. P., for the 3½ mile rate 440 I. H. P., and for the 4 mile per hour 750 I. H. P.

The great increase of power and consequent cost of the higher rates of speed compared with a moderate saving of time, leads Mr. Sweet to believe that a higher speed than three miles per hour for loaded boats in the standard section of this canal will be economically undesirable.

COMPARISON OF ROUTES WITH REFERENCE TO COST OF SAME.

I have assumed that I was authorized and directed to ascertain the cost of constructing and improving the canals by the various routes mentioned in the act, purely on engineering lines, without reference to the sentiment in different sections of the State either favorable or opposed to a barge canal project. The routes are specifically stated in the act, with the exception of such minor changes as have been ordered by the Canal Board, namely, a line from Olcott on Lake Ontario to the junction of the Erie Canal two miles west of Lockport and the line from Lewiston to La Salle; the additional lines in and around Rochester and the structures on the Champlain Canal.

ERIE CANAL.

MOHAWK-SENECA RIVER ROUTE.

In case the canal is constructed inland from the Hudson to the Niagara River, the line, I believe, most practicable is that from Waterford to Cohoes Falls; thence through the Mohawk River to Rexford Flats and Little Falls, recrossing the New York Central Railroad four miles east of Genesee Street, Utica; running north of Utica and recrossing the New York Central Railroad about two miles west of Oriskany, passing south of Rome to Fort Bull; thence down Wood Creek to Oneida Lake and going 19.58 miles in deep water through said lake; thence following the Oneida River, with the exception of two large bends west of Brewerton, to Three River Point, where cut-offs will be constructed; thence up the Seneca River to the outlet of Onondaga Lake;* continuing west from said outlet along the Seneca River through Baldwinsville to and through the State ditch at Jack's reefs; thence westerly following said river to a point

* This estimate includes the cost of construction of a line through said outlet, Onondaga Lake and Syracuse harbor in said city.

west of Savannah; and paralleling the New York Central Railroad, and to the northerly of it to a junction with the present Erie Canal 1.8 miles east of Clyde, with a change of about 4,800 feet near Lyons; thence along the present Erie Canal, with the exception of about one-half mile at Newark, to Macedon; thence following the present line of the Erie Canal as described in route "D" to a point one-half mile east of Fairport; thence across the country south of Rochester, until it reaches the Genesee River near South Park. Here it crosses in a pool formed by a dam in the Genesee River, and, keeping to the west of the outskirts of Rochester, joins the present Erie Canal again about one mile east of South Greece. To provide Rochester with a harbor on this route the river would have to be canalized for nearly a mile; or, in other words, to the mouth of the present feeder. This feeder enlarged to proper dimensions would then furnish a harbor for Rochester. The entire distance to be traveled on this additional piece of canal is about $2\frac{3}{4}$ miles; from thence following the line of the present canal to a point near Medina, where there is a change in alignment of some 3,500 feet, crossing the Oak Orchard Creek, about 1,500 feet to the north of the present location; from thence to Lockport, following substantially the present location, and so on to Tonawanda, with the exception of one or two changes in Tonawanda Creek; from Tonawanda to the Niagara River and continuing in the river to the sloop lock at Black Rock harbor, and thence through said harbor and the Erie Canal to the City of Buffalo.

MOHAWK-OSWEGO RIVER ROUTE.

From Waterford via the line described in the Mohawk-Seneca River route to Three River Point; thence down the Oswega River to Lake Ontario; thence by way of the lake and Olcott from Oswego to the junction of the old canal two miles west of Lockport; thence via Tonawanda and Upper Niagara River and Black Rock harbor as heretofore described, to Buffalo, the estimate includes the building of a suitable harbor at Olcott consisting of two piers 1,900 feet long each and a breakwater 2,000 feet long. The necessary dredging is also included.

From Waterford via the Mohawk-Oswego River route to Lake Ontario, at Oswego; thence via Lake Ontario and the Lower Niagara River to Lewiston, and from Lewiston to La Salle; thence by way of Upper Niagara River to Black Rock harbor and Buffalo, as heretofore described.

This through line was also surveyed, and is described as follows:

PRESENT CANAL ROUTE MODIFIED.

Beginning at Waterford, as described in Mohawk-Seneca River route; thence on the Mohawk-Seneca River line to Rexford Flats; thence practically along the line of the present Erie Canal through the cities of Schenectady and Amsterdam to a point about three-fourths of a mile east of Schoharie Creek, following the line of the old feeder to the south of the

present canal for a distance of about a mile; thence following the present line through Fultonville, Canajoharie, and Fort Plain to a sharp bend below present lock No. 37 at Little Falls; thence passing to the north of a rocky knoll and again entering the present line of the Erie Canal at a point to the east of present lock No. 39 and continuing along the line of the present canal westerly to within two miles of Herkimer. At this point 4,000 feet of new canal would be constructed. From this point westward the present canal would be followed practically through the City of Utica, the villages of Whitesboro and Oriskany and the City of Rome, and continuing westward to a point about one mile west of New London, being about eight miles west of Rome. Here it would diverge toward Wood Creek Valley, forming a connection with the Mohawk-Seneca River route heretofore described, and following that line to and through Oneida Lake, the Oneida and Seneca Rivers, including the Syracuse harbor, as heretofore described to Clyde Junction, as described in the Mohawk-Seneca River route; thence following substantially the present line of the Erie Canal to Lyons, where a change from the present alignment of 500 feet in length is made; thence following the present line of the Erie Canal (with the exception of about one-half mile at Newark) to Brighton; at Brighton the estimate covers the flattening of the sharp bend by the construction of about one-half of new canal to the south of the present canal, and at Clinton Avenue in the City of Rochester the construction of about 1,500 feet of new canal passing about 150 feet to the south of the junction of Byron Street and Clinton Avenue. A change is also proposed at the aqueduct crossing the Genesee River. From thence the route follows the present line of the canal to a point four miles west of Rochester where, for a distance of one-fourth of a mile, a new canal would be constructed correcting a sharp bend at that point; thence following the present canal to a point one mile east of South Greece, and from thence to Tonawanda and Buffalo along the line described in the Mohawk-Seneca route.

IMPROVEMENTS BY UNITED STATES GOVERNMENT.

There has been a radical change in the canal situation at Buffalo recently, brought about by the construction of the north breakwater, covering the gap between the old breakwater and the Bird Island pier. It is now practicable for canal boats coming up Black Rock harbor to make their way in thoroughly protected waters to the Erie Basin and to the Buffalo Creek and Blackwall Ship Canal. This fact renders it quite unnecessary to enlarge and improve that portion of the Erie Canal from the vicinity of Fort Porter to its southerly end at Commercial Street, and the cost of this work can be saved.

The proper way to improve the Erie Canal between Fort Porter and the sloop lock near the foot of Squaw Island is to merge it with Black Rock harbor by removing the dividing wall. The river and harbor bill of the general government, which has passed the House of Representatives, and which it is expected will become a law before March 4 next, contains

an item of \$814,000 for excavating a deep channel from Lake Erie at the north end of the old breakwater to the entrance to Black Rock harbor, and another item for an examination, with survey and estimates, for extending this channel through Black Rock harbor. If this is followed to a finish, as it probably will be, it will result in the general government merging the Black Rock harbor and the Erie Canal into one, excavating the same to a depth sufficient for deep draft ships, and building a large and commodious lock at the foot of Squaw Island. There are several reasons why the Government will want to do this: First, for the local benefits that will accrue to Black Rock harbor; second, for the benefit that it would be to the commerce of Lower Black Rock, Tonawanda, and Niagara Falls, enabling lake vessels to reach these points without passing the rapids at the head of the river; and third, that it would permit regulating work to be put in Lake Erie at the head of the Niagara for controlling the level of the lake.

This will render unnecessary any work by the State on the portion of the Erie Canal between Fort Porter and the sloop lock, and, in fact, render unnecessary any work between Tonawanda and Buffalo, it being understood that the present canal will be retained as a feeder.

COMPARISON OF THE MOHAWK-SENECA RIVER ROUTE WITH THE PRESENT CANAL ROUTE MODIFIED.

The river route possesses great advantages over the canal route. First of all, viewed as an engineering proposition, the canal will be in its proper place, not on a side hill location where great loss from leakage will occur. Second, the cost of annual maintenance will be decidedly reduced.

For the river route the maintenance will consist simply of the various dams, a few highway bridges, and the locks; while on the present canal route modified these exist, as well as the culverts, aqueducts, and vertical walls. The immunity from all danger of breaks in the embankments and the old structures is entirely in favor of the river route. Another factor is the one-half mile an hour increase in speed in the river channel as compared with the standard canal section as has been shown.

By locating the river route at the fourth branch of the Mohawk, near Waterford, passing through North Side, Cohoes, to the pool formed by the new dam at the head of Cohoes Falls, Cohoes gains the advantage of being able to eliminate the winding canal from the center of the town where it has long been a detriment to property owners by reason of its frequent overflows, and a constant source of expenditure to the State on account of damage suits. A constant menace also exists in the possibility of bad breaks in the high embankments on which the canal is carried through this town. By the proposed dam the head of water at the Cohoes Company's plant will be increased by about eighteen feet. It will make thriving towns of both North Side and Waterford on account of the additional traffic it will bring to them, especially at the crossing of the new

canal and the Champlain Canal in Waterford. From thence to Rexford Flats the State is greatly benefited by being able to dispense with the two aqueducts by which the present Erie Canal crosses and recrosses the Mohawk River. These structures are maintained at great expense, and the small towns of Crescent and Rexford Flats will enjoy the same facilities with the river route as with the present canal.

Schenectady has nothing to lose and much to gain by this change. Here the present canal can be filled in and the bridges abandoned, while the new water front will furnish much increased space for handling freight.

Amsterdam will have the advantage of having the canal pass through the center of the city. Here the old canal can be filled in as at Schenectady, and the river fronts on both sides will give much greater facilities for handling goods than the old canal ever afforded. And this is the case with all of the towns and villages as we go higher up in the valley.

Fultonville and Fonda, Sprakers, Canajoharie, and Fort Plain will all be benefited by having the old canal reclaimed and filled in. At St. Johnsville the canal will be brought to that side of the valley, thus facilitating shipments, and at Little Falls the greater capacity of the canal will bring additional prosperity to that thriving town. Herkimer and Mohawk will be benefited by the canalized river. Ilion and Frankfort can both reclaim and build on the site of the old canal, while their shipping facilities will be increased.

Utica's dream of river straightening can be realized, as the new canal line runs to the north of the city and accomplishes that long sought object. There will be a space north of the tracks of the New York Central Railroad and extending to the canalized river 1,200 feet broad on an average, and certainly four miles long, covering about 500 acres, where factories can be erected, where shipping facilities will exist in both front and rear the canal for heavy and cumbersome traffic, the railroad for the light and perishable goods. With the canal filled and leveled, with business houses erected on the space, with the unsightly canal structures eliminated in the heart of the city, there is no doubt that Utica will be benefited by the barge canal in the Mohawk River.

Rome will be benefited in a like manner. The old Erie Canal can be filled and an enlarged water front will afford better shipping facilities.

Finally, the water supply in the river route is much easier and cheaper to procure and the speed will be greater than that of the ordinary canal, and as in nearly every case the dams in the river are located above the cities, the water power created by them will be of benefit to the citizens of the valley. These are some of the advantages of the river route.

The old location of the Erie Canal lacks many of the advantages enumerated above. The great cost of annual maintenance, the cost of bridges, the culverts, the aqueducts, the repairs to the walls, the leakage and consequent damage suits all operate against this route, and added to this is the disagreeable proposition of passing through the cities with an enlarged section, inviting damage suits by injury to the foundations of buildings which can not well be estimated. The maximum amount

of water will be necessary to handle the traffic, while only the minimum speed can be attained, and that will be retarded by the many lift bridges to be encountered in the cities and towns.

Here the comparison between the Mohawk-Seneca River route and the present canal route modified, as contemplated in the act, ceases; and the river route goes down Wood Creek through Oneida Lake and the Oneida River into the Seneca River. The towns on the present Erie Canal, between New London and East Syracuse, do not suffer, as this part is retained as a feeder as far as Butternut Creek, very near Syracuse, the old canal being open for navigation as heretofore.

By the river route Syracuse is approached from a different direction, the canal proper coming no nearer than the outlet of Onondaga Lake at the so-called "Mud Lock." By enlarging this outlet we gain Onondaga Lake, and passing through the same continue through the abandoned salt lands to the vicinity of the West Shore Railroad, furnishing an excellent location for the erection of manufactories, forming a harbor for the city of Syracuse, and taking away the unsightly canal structures from its very center. If it should be deemed wise that at some future time this property of the State be abandoned, the possibilities for Syracuse to make use of the same are very great.

This would solve the vexed question of the railroads crossing at grade, which has so longed disturbed Syracuse. I refrain from details in this direction, but can see no good reason why an arrangement can not be entered into between the city of Syracuse and the New York Central and West Shore Railroads by which the purchase from the State of the right of way along the present canal through the city can not be consummated. The tracks of these railroads taken out of the streets and located in the bed of the present Erie Canal would thus do away forever with the menace now existing there. Better speed can be attained by the railroad trains through this busy city, and the snail like pace made necessary at both ingress and egress by the crowded condition of the streets and the attendant danger will be eliminated.

By this route it is proposed to reclaim the Montezuma marshes. The fact that this was possible was first established by this survey. The only possible damage that could arise to the water powers at Baldwinsville and on the Oswego River would be that the storage contained in these marshes would be reduced by about four feet in depth over the area occupied by them; but the supply in the canalized river direct from Lake Erie would probably give them a more steady flow than ever before. The supply of water from the summit level of the barge canal which the Oswego River will receive if this canal is constructed, will (it is believed) fully compensate the water powers on this river for any storage lost in the Montezuma marshes.

**COMPARISON BETWEEN AN INLAND ROUTE (VIA MOHAWK-
SENECA RIVER LINE) AND A LAKE ROUTE (VIA
MOHAWK-OSWEGO RIVERS AND LAKE
ONTARIO) FROM TROY TO
BUFFALO.**

The main advantage of the lake is a saving in cost of construction. The next advantage is increased speed.

Mr. Sweet in his article on Resistance to Traction, points out that a speed of three miles per hour on the standard canal section will give a speed of three and one-half miles per hour on the canalized river section and 4.4 miles per hour in open water with the same expenditure of power. Later, in discussing the completion of the \$9,000,000 project, he states that under the same conditions as above, the economic rate of speed would be two miles per hour; and making the proper allowance for detention at locks, increased time and probable cost of fuel and labor for passing a greater tonnage, the cost of transportation would be 40 per cent. greater than for the same tonnage over a barge canal.

On the lake route there will be only 48.5 miles of standard canal section, 104 miles of canalized river section, and 195 miles of open water. The number of locks is 41. The round trip between Troy and Buffalo with power for a three-mile per hour canal speed, or about 100 I. H. P. for a barge and consort, will consume 182 hours; or for a propeller of 265 I. H. P. towing five barges, 244.75 hours.

On the inland route a barge and consort and a propeller and five barges under the same conditions consume respectively 217.75 hours and 285.25 hours. This is a gain of 35.5 hours for the barge and consort and a gain of 40.5 hours for the propeller and five barges in favor of the lake route. The item of annual maintenance would practically be nothing on the 195 miles of open water navigation, and is therefore another factor of the lake route.

The inland route has 257 miles of standard canal section, 53 of canalized river, and 35 miles of open water with 48 locks.

One factor against the lake route is the fact that barges of stronger build will be necessary on Lake Ontario than on the inland route, involving extra cost of construction and the inconvenience of depriving present shippers of a canal line from Clyde to Rochester, who are now accommodated, but who would not be by the lake line. Should a lake route be adopted and the industries on the inland canal demand the retention of certain portions of the canal, as, for instance, the quarry industry of Medina and vicinity, they could be easily retained if that industry combined with local traffic justified it. If that portion of the Erie Canal lying between Rochester and Buffalo were retained, it would not prove an expensive item of maintenance, as only five combined locks at Lockport would need to be manned. I make no recommendation, however, either for or against either route, preferring to lay before the public the facts as they exist for its deliberation and conclusion.

Another line was surveyed, beginning at the Hudson River and what is known as the West Troy side cut; thence through the south branch of the Mohawk River to near lock No. 1 of the present Champlain Canal; thence following the said canal to the crossing of the Mohawk River at the present State dam below Cohoes; thence by way of the canalized Mohawk and flight of locks to the pool above Cohoes.

After carefully considering the cost of this line and the risks attending the crossing of the Mohawk River in times of flood, it was deemed wise to adopt the Waterford route described in the Mohawk-Seneca River route, the latter also being \$1,114,390 less expensive.

A survey was made beginning at a point two miles west of Oriskany, keeping to the north of the New York Central Railroad, joining the present Erie Canal in the city of Rome and following along the same to Fort Bull, where it joins the Mohawk-Seneca River line heretofore described, running south of Rome.

After carefully considering the river lines north and south of Rome, it was decided to recommend the line to the south, it being \$287,746 cheaper and avoiding a great number of bridges that are necessary on the line through the city of Rome, and not having as much lockage as the Mohawk line would have.

Another line known as the "Cicero Cut-off" (route No. 18) was surveyed, which leaves the main line in the Oneida Lake, passing through South Bay by way of Cicero Swamp to Mud Lock, in Seneca River. The use of this Cicero cut-off would have saved 7.43 miles in distance, but as it was found that it would cost \$2,508,880 more by this route than by the Oneida River, the latter route was adopted and the Cicero cut-off abandoned.

CHAMPLAIN CANAL.

The location begins at lock No. 4 at the north side of the Mohawk River at Cohoes, and continues along the present line of the Champlain Canal to Stillwater, passing the Waterford side cut into the Hudson River (which is one-half mile north of lock No. 4). At Stillwater the bad curve at the northerly end of the village is reduced. Beyond Wilbur's Basin several bad bends will be eliminated, which means new canal construction for about 2,200 feet. At Northumberland small changes are made in the location of the lock. From there to Moses Kill there will be only minor changes. Here it is proposed to change the location of the lock and straighten the existing bend. Beyond Moses Kill is a bad embankment at the river bank, and the canal will be shifted inland to avoid this. From Moses Kill to Fort Edward only slight modifications will be made, from thence it will follow the line of the present canal until we strike Wood Creek at Fort Ann. Here three existing locks will be replaced by one new lock. Wood Creek will be improved by eliminating bends. After leaving Wood Creek the line again follows the present canal into Whitehall, where we step down into Lake Champlain, with one new lock replacing the existing three locks.

FROM TROY TO WHITEHALL VIA THE HUDSON RIVER.

This line steps up through the Sloop Lock at Troy and continues through the pond of the Troy dam to Waterford. No expense is connected with this part of the route as it exists to-day, and is in constant use. At Waterford a new dam will be built and a lock to step up into this pool, which is followed up the river. Nothing is encountered until the Hudson River Power Company's dam is reached, about one and three-fourth miles below Mechanicville. No change is made in the elevation of the crest, and the proposed lock is located on the island between the dam and the sluice gates. At the Duncan Company's dam above Mechanicville it cuts through a small point of land on the east side of the river, where lock No. 3 will be located. No change is made in its crest elevation. About one mile above the Mechanicville dam we follow a branch of the main river to about the mouth of the Hoosick River. Here we cut through a strip of land 3,000 feet long and enter the river again about 1,200 feet above the Stillwater dam. No change is made in the crest elevation, and we follow the river to one mile south of Northumberland. Here we enter the present line of the Champlain and lock up over the Northumberland dam. No change in crest elevation is made here, and the Hudson River is followed to Fort Miller, where we lock around the dam, on the old canal location. No change is made in the crest elevation. The river is followed to within three-fourths of a mile of Fort Edward, where we lock up into the level of the present Champlain Canal. From here the route follows the Champlain Canal to Whitehall, as has been described in "Champlain Canal via present route from Cohoes to Whitehall on Lake Champlain."

OSWEGO CANAL WITH TWELVE-FOOT DEPTH OF WATER.

The Mohawk-Seneca route forms a junction with the Oswego Canal at Three River Point. From there it follows the channel of the river to Phoenix. At Phoenix we have lock No. 1 with a lift of 9 feet and a new dam about 1,000 feet above the present one, but this will not interfere in any way with the existing water power at Phoenix. From here the river channel is generally followed until Fulton is reached. Here lock No. 2 with an 18-foot lift is contemplated just east of the present Oswego Canal. A new dam with a crest length of 700 feet will be built here about 500 feet above the present dam, and will give the mills an increased head of 6.4 feet if they care to utilize it. Lock No. 3 with a lift of 28 feet is located just below the lower bridge over the river at Fulton. The crest elevation of this dam will be left undisturbed, but the water power will be carried under the canal by combination steel and concrete structure. Ample provision is made for this change in the estimate. As the mills on this power will remain idle while the change is being made, the estimate also includes a compensation for this stoppage, based on a ten per cent. profit of the output of the mills during that time. One mill will be destroyed, but this has not been occupied for the past fifteen years; Fulton

will not be hurt in any other way by the change; any damage will be temporary. From Fulton to Battle Island the river is followed with occasional cut-offs to procure alignment. It is proposed to abandon the Battle Island dam. Lock No. 4 with a lift of 28 feet will be located about 6,000 feet above the high dam above Oswego. The dam for this lock will be about 3,300 feet above the present Minetto dam. At Minetto a cut-off is made to the east of the hill, where an apparently natural canal location exists. This cut-off will be protected against floods by guard gates. The present Minetto dam remains, and there is absolutely no interference with the existing conditions here. If they see fit they can gain an additional head of 12 feet by extending their hydraulic canal up the west side of the river for about 3,300 feet and raising its banks to the proposed new crest elevation.

Lock No. 5 with a 13-foot lift will be located in the same position as the Oswego Canal lock at the east end of High Dam. It is proposed to rebuild this dam with the same crest elevation. To obtain a rock foundation the new dam will be located 500 feet down stream from the present dam, and the estimates provide for carrying the tail race of the waterworks power house to the new dam in order to keep this power unimpaired.

Lock No. 6 will be a lift of 21.6 feet, located about 1,200 feet below the curved dam below Oswego as situated in the present prism of the Oswego Canal. This is the last lock, the water surface below the same being that of Lake Ontario.

The Oswego Canal for 9-foot depth practically follows the improvements laid out under the \$9,000,000 appropriation, and follows the alignment and locks of the present Oswego Canal without a radical change.

It has been my aim to formulate the facts and present them without argument, leaving the discussion of the subject to the Legislature and the people of the State.

Respectfully submitted,

EDWARD A. BOND,

State Engineer and Surveyor.

SUMMARY OF REPORT OF THE COMMITTEE ON CANALS OF NEW YORK STATE.

FRANCIS V. GREENE, *Chairman.* MAJOR THOMAS W. SYMONS, *U. S. Engineer.*
GEORGE E. GREEN, FRANK S. WITHERBEE,
JOHN N. SCATCHERD, EDWARD A. BOND, *State Engineer and Surveyor.*
JOHN N. PARTRIDGE, *Supt. of Public Works.*

JOHN A. FAIRLIE, *Secretary.*

[Appointed March 8, 1899, by Gov. Roosevelt.]

SHALL THE CANALS BE ABANDONED?

The inestimable benefits which have been derived from the Erie Canal in the past are not disputed by any one. To it, more than to any other cause, is due the phenomenal growth and commercial supremacy of the city and State of New York. It opened up the great West to settlement, and in turn attracted the products of the West to the low-grade line through the Appalachian chain, which exists only in the State of New York. The tolls on this waterway have more than repaid the cost of construction, maintenance and operation; in addition it has paid over \$360,000,000 of freight money within the limits of the State, and the disbursement of this money along the line of the canal has built up the great interior cities from Buffalo to Albany, forming a continuous line of commercial centers, which has no counterpart in any other State. The growth of these cities in turn led to the construction of railroads paralleling the canal, and these by consolidation and scientific management have gradually reduced the cost of transportation during the last thirty years from an average of two cents per ton mile to about six mills per ton mile.*

No one disputes these evident facts; but the question which now confronts us is whether the railroads, with their large capital and scientific management, their durable roadbeds, powerful locomotives, larger cars, greater train loads, greater speed, and more certainty of delivery, will be able now or in the early future to reduce the cost of transportation below what is possible on the canals. If they can do this, then it is obviously unwise and improper to expend any more public money upon a method of transportation which, however important in the past, would no longer be able to compete with other and improved methods. The determination of this

* Changes in the rates of charges for Railway and other Transportation Services, by H. T. Newcomb. Published by the U. S. Department of Agriculture, 1898, page 19.

question seems to us to lie at the very foundation of the canal problem, and we have therefore given it the utmost attention.

The claim for the railroads has been put forward at great length, and with ability, by the *Engineering News*, whose editorial articles on the subject are printed at length in the volume of Minutes and Correspondence. In brief, they are to the effect that while the average railroad charges in recent years on the railroads of New York State have been about six mills per ton mile, yet a lower rate has prevailed on grain, lumber, and similar articles, which have hitherto formed the bulk of the goods transported over the canal. The grain rates fixed in April, 1899, from Buffalo to New York were as follows per bushel:

Wheat	3½ cts.
Rye	3¼ "
Corn	2¾ "
Oats	2½ "

The rate of 3½ cents per bushel on wheat is about \$1.17 per ton, or 2½ mills per ton mile. It is further argued in these articles that the Chesapeake & Ohio Railroad is carrying coal at a profit on a rate of 2¼ mills per ton mile; and that on the completion of locomotives now under construction by the New York Central and other railroads, designed to haul trains with from 2,000 to 2,400 tons of paying freight, the rate on such articles as grain, coal, ore, etc., by rail will be reduced to about 1 mill per ton mile. In other words, the argument in favor of the railways is that private enterprise and private capital will at an early date produce on the railroads as low a freight rate as can be produced on the canal by the expenditure of large sums of public money.

If this argument were correct, it is needless to say that no further money should be spent on the enlargement of the canals, but that they should remain in their present condition until plans could be carefully matured for the disposal of them. In our judgment, the argument is not correct. It would carry more weight if it were advanced or approved by practical railway managers; and we therefore sent the articles to the presidents of the New York Central Railroad, of the Illinois Central Railroad, and of the Pittsburg, Bessemer and Lake Erie Railroad, the last of which was specially built under the most favorable circumstances for the express purpose of carrying ores and low-grade freight at a minimum cost from Conneaut on the lakes to Pittsburg. The reply of Mr. Fish is explicit that there is no probability of a rate of one mill per ton mile by rail in the near future. The reply of Mr. Callaway, while not so positive, leaves no doubt in the mind of the reader that the New York Central Railroad has no expectation of quoting any such rate. The reply of Mr. Reed states that during the past summer nearly a million tons of ore were hauled from Conneaut to Pittsburg at an actual cost for transportation alone of 1½ mills per ton mile; the freight rate being 3.65 mills per ton mile.

It is evident, therefore, that the views expressed in the *Engineering News* are not sustained by practical railway managers, responsible to their stockholders for the profitable management of their roads.

The keeping of railway accounts is an intricate science; the system is not entirely uniform among different roads, and it is very difficult for any one to be able to state whether the carrying of grain at a rate equivalent to $2\frac{1}{4}$ or $2\frac{1}{2}$ mills per ton mile is done at a loss or a profit. It is more than probable that it has been done at a loss, the corporate wealth of the railroads enabling them to carry this loss, provided they were making a profit on other classes of goods, and they considered it desirable to hold the business until on the return of more prosperous times they would be able to secure a profitable rate. It is to be noticed that these extremely low rates have prevailed during the hard times from 1893 to 1898, during which many manufacturers thought it better to keep their factories in operation at a loss rather than to close them entirely. With the return of prosperity during the two years just ending, the price of manufactured goods has increased from 30 to 60 per cent. (and more in some cases), and the railroads are already claiming that they have not shared in this prosperity, and that the time has come for an advance in railroad rates. Already the rate on grain across the State of New York has advanced from $3\frac{1}{2}$ to 4 cents per bushel. The price of rails, cars, locomotives and labor during the year 1900 will be very much in excess of what the railroads have been paying during the last few years, and this must inevitably be reflected in a considerable advance in freight rates. We believe, therefore, that the reduction in railroad rates, which has been almost constant for the last thirty years, has received a check, and that an increase may be looked for until the present prosperity shall be succeeded by depression, when it is probable that they will again decline; but it is very doubtful if they will go any lower, if as low, as the rates recently prevailing.

In our judgment, water transportation is inherently cheaper than rail transportation. It varies slightly with the size of the vessel and the restriction of the waterway. On the ocean, where the waterway is entirely unrestricted and the size of the vessel is the maximum, it averages about half a mill per ton mile;* on the lakes, where the vessels are not so large, and occasional restrictions are encountered on the waterway, it is about six-tenths of a mill per ton mile;† on the canals of New York, where the boats are very small, the waterway greatly restricted, and obsolete methods are employed for handling the business, it is about two mills per ton mile. By the enlargement of the canal which we recommend, and the introduction of improved methods of management, we believe that the canal rate can be reduced to two-thirds of one mill per ton mile, or very nearly as low as the lake rates. All of these rates have varied in the past and will vary in the future to correspond with prosperity or

* It is stated by Mr. E. L. Corthell (Minutes and Correspondence, page 89), that wheat has been carried from California to England for 3-10 mill per ton mile, and coal on the return trip for 1-5 mill.

† On the lakes return cargoes of coal are carried from Lake Erie to Lake Superior ports, about 1,000 miles for 25 cents, or $\frac{1}{4}$ mill per ton mile.

depression in general business. But there is every reason to believe that they will maintain a corresponding ratio, the ocean, lake, and canal rates being from one-third to one-fourth of those by rail. The reductions which may be made hereafter in the railroad rate can be met by similar reductions in all three classes of the water rates, provided the same methods of skilled management are applied to all.

Moreover, the canals have been largely limited in the past to the lower grades of freight and this is equally true of the transportation on the lakes. The canal has thus been in competition with the classes of freight which pay only between two and three mills per ton mile, and which the railroads will carry at a loss rather than lose the business, whereas, the railroads carry other classes of freight, some of which brings as high as fifteen to twenty mills per ton mile, and the average freight, including the low grades, as we have seen, being about six mills. There is no reason why the canals, if enlarged and properly managed, should not compete for the higher grades of freight, which, at prices far below those charged by the railroad, would bring very profitable returns on the lakes and canal.

The local tonnage on the canals has for many years exceeded the through tonnage, just as it does on the railroads, although not to the same extent, and an enterprising transportation line, skilfully managed, could give an enormous development to this local traffic at profitable prices, and thus be in a position, just as the railroads are, to carry through freight of low grade at cost or less in case of necessity. With the canal enlarged so as to carry boats of 1,000 tons each, and these boats assembled in fleets of four or six, with a total capacity of 4,000 or 6,000 tons, each fleet having detached mechanical motive power—the system of handling being analogous to that of a train composed of cars and a detached locomotive—it will be possible to send a boatload of freight of the highest or the lowest class through from the lakes to any point on the Atlantic coast from Boston to Philadelphia.

The system of using barges with detached motive power in the coast-wise traffic between New York and New England has been in operation for many years, and has reached enormous proportions. We feel certain that if the waterways across the State of New York is enlarged so as to afford facilities for boats of 1,000 tons, and is so managed as to produce safety and certainty of delivery by responsible transportation lines, a very large business will develop along such routes in all classes of goods, and at enormous benefit to the State of New York, and particularly to the two great cities at its eastern and western ends.

In considering this question of the relative advantages and cost of rail and water transportation, we have given much study to what is being done on the Continent of Europe; and one of our committee, Mr. F. S. Witherbee, has visited Europe for the purpose of gaining information on this point. His report is transmitted herewith, and a large number of documents, plans, and photographs which he brought back have been deposited in the office of the State Engineer. It is found that on the continent

of Europe so far from the canals being decadent during the last thirty years, they have been constantly enlarged and improved, enormous sums having been spent for this purpose, and the result has been an extraordinary increase in this class of transportation. It is well known that the railroad rates in Europe are much higher than in America. There are several reasons for this. In Europe there is none of the long-haul traffic, which is so much less expensive to carry, and accounts for so large a part of the lower ton mile rate in America. The management of the railroads is also less efficient. On the other hand, the management of the canals has been more efficient than with us. The result has been a far greater development in water traffic than in rail traffic during recent years in France, Belgium, Germany, and Russia.

In France, since the war with Prussia, over 400 miles of new canals, and nearly 500 miles of new river navigation have been constructed, making nearly 7,000 miles of internal waterways; the water traffic has increased from 1872 to 1897 by 140 per cent., whereas the rail traffic has increased but 75 per cent. The little State of Belgium has expended since 1860 not less than \$50,000,000 for enlarging its canals, and the water traffic increased from 1888 to 1896 by nearly 40 per cent., and it is significant that the increase in the transportation of miscellaneous package commodities during the same period was 54 per cent.

In Germany, the same process of betterment and extension of canals and water routes is continued. During the past year the new canal from Dortmund to Emden has been completed, and opened for traffic; this canal being especially noteworthy for the famous pneumatic lock at Henrichenburg, where vessels are lifted 45 feet from one canal level to another at one operation. The modern type of canal boat in use on this canal is a barge of 1,000 tons carrying capacity, built of steel, about 230 feet long, 30 feet wide, and $7\frac{1}{2}$ feet draft, and costing only \$5,000 each. The propulsion is entirely mechanical—either by steam or electricity. It is well known that the German government is planning a trunk route between the rivers Rhine and Elbe, and is strongly in favor of a large extension of its canal system; and that its plans would now be in process of being carried out but for the opposition of the agricultural interest, which fears the effects upon its property of the reduction in rates which would certainly follow the execution of these plans.

In Russia, even greater efforts have been devoted to the development of the water routes on canals and rivers, the sum of \$30,000,000 having been expended from 1891 to 1896 for this purpose, and in the same period the internal water traffic has increased by 70 per cent. This traffic on Russian internal waters accommodates 1,500 steamers and 60,000 canal boats, with crews numbering 300,000 men. Vessels 200 feet long can traverse the whole length of the country from the Caspian Sea to St. Petersburg or Archangel (2,500 miles).

We do not think that these facts can be overlooked in the consideration of this problem. They show that in countries where the keenest competition exists not only within each country, but between each and its neighbor,

effort is being made to gain an advantage, or, at least, keep on an equality, in the competition, by reducing the rates of transportation, and that to accomplish this large sums of public money are being spent to enlarge and improve the water routes; thus confirming the general proposition that under equal conditions of management the water route, even in a restricted way like a canal, is cheaper than the rail route.

New York has certain topographical advantages which it would be folly not to utilize. Through the valleys of the Hudson and the Mohawk and the comparatively low and level lands west of Oneida Lake, it is possible to construct a water route connecting the Great Lakes and the Atlantic Coast, and no such water route can be constructed through any other State. It has no rival except in the St. Lawrence route. This State will inevitably have to compete with the routes by rail, and possibly by water, from the grain fields of the West to ports on the Gulf of Mexico. But in the transportation from the lakes to the Atlantic it has a great advantage, provided it is properly utilized. If the water route is abandoned, then New York must take its chances in the railroad competition with Portland, Boston, Philadelphia, Baltimore, Newport News, and Savannah. In this competition it is hardly on an equality even, but it is subject to many disadvantages; the distance to the Southern points is less than to New York; the other cities have harbors, which, while not so capacious and deep as that of New York, are still sufficient for the purpose, and the price of real estate and dockage at these several cities is very much less than in New York. If the city and State of New York are to take their chances in open railroad competition, then we must inevitably look to see the relative proportion of exports through New York constantly decreasing, as it has been for the last ten years. While New York may possibly hold its own in the actual volume of business, yet the increase will go to the other cities, which, as railroad termini, offer greater advantages for through business; and the relative volume of the business coming to New York will steadily decrease. On the other hand, if the State of New York enlarges its waterway to the utmost limit, then it can be sure that it will offer the lowest transportation rate, and will secure an increasing share of the business.

The State of New York must be prepared to face from this time on a serious competition in the export trade over the St. Lawrence route. The Soulages Canal, which was the last link in the improvements around the rapids of the St. Lawrence River, has been completed during the year 1899 and nominally opened for business. It will be actually opened for business with the spring of 1900. This chain of improvements gives a waterway from Lake Erie through the Welland Canal, Lake Ontario, the St. Lawrence River and its canals capable of carrying boats or barges of about 2,200 tons capacity; the size of the locks is 270 x 45 x 14, admitting vessels 255 feet long, and 12 to 14 feet draft, depending on the stage of Lake Erie. The expenditures for construction and enlargement of this route during the last fifty years have been over \$56,000,000, a sum which bears the same ratio to the wealth of Canada

as \$100,000,000 would bear to the wealth of the State of New York. The distance from Lake Erie to Liverpool by the St. Lawrence route is about 450 miles shorter than by any route across the State of New York. It is certain that the Canadian government will do everything in its power to realize every possible advantage from this enormous expenditure. Already propositions have been submitted by a group of Chicago and Buffalo capitalists to the Harbor Commissioners of Montreal and accepted by the latter, the result of which will be to divert about 35,000,000 bushels of grain from the New York route. These propositions involve the immediate construction of at least 15 barges of the maximum size which can be used on the canal, and costing \$100,000 each, in addition to elevators, warehouses, and other structures in the harbor of Montreal, costing more than \$4,000,000. These propositions contain no exclusive privileges, and is open to another group of capitalists to make similar arrangements for the diversion of other large amounts of the grain which now passes through New York.

It is evident that the water route via the St. Lawrence on the one hand, and the short rail lines to Gulf ports on the other, will inevitably prove serious competitors in the future to the export trade of New York. If it desires to retain its export grain trade, it must improve its own water route to the utmost limit of which it is capable; it can not retain this trade by taking its chances in the railroad competition of half a dozen routes from the lakes to the Atlantic.

It is not alone, however, the export grain trade which requires the enlargement of the Erie Canal. The chief argument for its construction eighty years ago was to have a cheap transportation route for grain and lumber, and this has continued to be its most important function down to the present time. But the changes which are now taking place in the iron trade give reason to believe that if an adequate waterway can be secured between Lake Erie and the Hudson River, the center of the iron industry can be brought within the State of New York. This has hitherto been within the State of Pennsylvania on account of its own resources in ores, coal, and limestone. But the discovery within a comparatively recent period of almost inexhaustible beds of iron ore in the upper lake region, combined with cheap water transportation on the lakes, has led to the abandonment of its own ore and substitution of those from the lakes. These ores can be laid down at any point on a water route between Buffalo and New York at less cost than they can be laid down in Pittsburg; there is also a great abundance of suitable limestone within the State of New York and adjacent to the water route; and the improvements which we recommend will make available the Lake Champlain iron ores as well as those of Cuba for a very economical mixture. The only advantage which Pittsburg would have over Buffalo or New York in the manufacture of iron and steel is in its greater proximity to the coking coals. It is believed that this advantage can be overcome by the saving in the cost of ore and limestone and the great saving in cost of transportation of the finished product. Between Pittsburg and

tidewater the finished product must be transported a distance of 350 miles over a range of mountains, whereas from either Buffalo or New York, or any intermediate point on the water route, the enormous market for steel and iron in New York and New England, as well as abroad, can be supplied at greatly reduced charges for transportation. We believe that a suitable enlargement of the Erie Canal at the present time is justified by the prospect of its use in connection with manufacture of steel and iron and shipbuilding, fully as much as its original construction was justified by the prospect of transporting breadstuffs. Indeed, it is not too much to expect that with a canal which can carry manufactured steel from Conneaut to New York for 50 cents a ton, and distribute this from New York to points on the New England coast without breaking bulk, the vast steel and allied industries centering at Pittsburg, which support a population greater than that of Chicago, will seek an outlet for their products by rail to Conneaut and thence by the Erie Canal, rather than across the Alleghenies to Philadelphia.

Within the last ten years the United States have wrested from Great Britain the supremacy in the iron trade, and during that period the imports of iron and steel have diminished from \$51,000,000 to \$11,800,000 in value, and the exports have increased from \$21,000,000 to \$93,700,000 in value. There is every reason to believe that the iron and steel trade, and the manufactures depending on it, in the United States will continue to increase during the next twenty years in enormous amounts, and it is of the utmost importance that the State of New York shall promptly take steps to bring this industry within its borders, and to provide a cheap transportation route for the finished product both for export and for consumption on the Atlantic Coast. Such a route can be provided by the Erie Canal, enlarged as we recommend.

The possibilities of manufacturing development along the banks of the Niagara River between the Falls and Buffalo should not be overlooked in considering the transportation problem. Factories are already established in the vicinity of Niagara Falls, utilizing the cheap power obtained from the Falls to an extent of about 75,000 horse-power, and these will be doubled within a very few years. The problem of transmission of power has been so far solved as to permit the lighting of Buffalo and the operation of its street car system at a distance of 22 miles from the power house. It is probable that in less than ten years the transmission of power, at least as far as Rochester, will be commercially practicable. These advantages, if properly utilized, will make Western New York the center of such a manufacturing district as the world has never seen. The lakes give cheap transportation to the West, and it only needs a suitable water route to the Hudson in order to give cheap transportation eastward, which will enable these manufactured products to compete in every market in the world.

The late Mr. Albert Fink, than whom there was no higher authority on the transportation question, made a statement before the Windom Committee some twenty years ago that the Erie Canal regulated the rates.

not only on the railroads of New York State, but on every trunk line connecting the lakes with the Atlantic. This statement has never been successfully disputed, and it will continue to be true if the canals continue to keep pace with the railroads in enlargement and management. If the canals are left stagnant, both in size and management, as they have been for a whole generation, while the railroads are improving year by year, then the time will come, and at a very early day, when this statement will cease to be true. To leave the canals in their present condition is virtually to abandon them. The Constitution of New York distinctly forbids this. For more than eighty years public money has been spent on the waterways connecting the Hudson with the lakes, and during fifty years these waterways were enlarged and improved to keep pace with the increase in the traffic, and to decrease the rates. The State has made this expenditure for the purpose of utilizing its natural advantages and keeping within its own limits the route which should produce the minimum freight rate. We believe that the policy which has prevailed in the past, and which has been the chief factor in the commercial prosperity of this State, should be continued in the future. If these views are wrong, then it is in order to stop spending money on the canal and to propose an amendment to the Constitution which will permit of their abandonment and disposal by sale or otherwise. In our judgment, such an amendment to the Constitution would not receive even a respectable minority of votes.

In the southern portion of the State there is a sentiment in favor of turning the management of the canals over to the Federal Government, but this idea is entertained by such a relatively small portion of the people of the State of New York, and its adoption seems to us in every respect so unwise, that we do not deem it necessary to discuss the matter at length. The proposition was brought before the Chamber of Commerce in New York during the year 1898, and a committee reported in favor of it; but on a thorough discussion in the Chamber the arguments in opposition to such a course, and especially those brought forward by Mr. A. S. Hewitt, were so strong that the Chamber unanimously adopted a resolution disapproving of any such course. These arguments, published in the Report of the Chamber of Commerce for 1898, seem to us unanswerable.

What has been said in the foregoing refers especially to the Erie Canal, but it applies equally to the Oswego Canal, which gives access to Lake Ontario, and to the Champlain Canal, which connects the Hudson River with Lake Champlain. We recommend that the project of 1895 be completed, which would provide for boats of 320 tons on the Oswego and 240 tons on the Champlain Canal.

In reference to the minor canals, namely, the Black River, and the Cayuga and Seneca, they were originally intended to be branches or commercial feeders, and in this light we think that they will no longer prove to have much value; but they are of great value as water feeders, and must be maintained for this purpose; and the additional expense of main-

taining them in a state suitable for navigation is so slight that we think they should be maintained in that condition. We see no necessity, however, for their enlargement.

THE SHIP CANAL PROJECT.

The enormous interest of the great West in the raising of food products, of which one-fifth is exported for foreign consumption, naturally leads the people of that section to seek the cheapest possible freight line for conveying such products to their final destination. They believe that an all water-route from the upper lakes to Europe will be of great benefit to them in enabling them to compete on more favorable terms with the grain producers of India, Russia, and the Argentine Republic. For many years this sentiment has been growing, and it has resulted in Deep Waterway Conventions, at which much interesting statistical information has been brought forward, and much accomplished in the way of interchange of ideas. The sentiment of these conventions has been practically unanimous in favor of a water route of either 21 or 28 feet depth from Lake Erie to the Atlantic Ocean. In response to this sentiment Congress has made appropriations amounting in all to \$465,000 for the purpose of making the necessary detailed surveys in order that an intelligent opinion could be formed as to the probable cost of such a project. The surveys are being made under the direction of a Board of Engineers on Deep Waterways, and it is anticipated that their report and the result of their surveys will be laid before Congress at the present session. Such a waterway necessarily involves a deep canal across the State of New York, or some portion of it. Two routes have been under consideration, each of which involves a canal around Niagara Falls. The first route leaves Lake Ontario at Oswego, and goes by way of Oneida Lake to the Valley of the Mohawk, and thence to the Hudson. The second route connects the St. Lawrence River with Lake Champlain either through the upper part of the State of New York or through the adjacent portion of the Province of Ontario under some convention with Canada.

It seems to us that there are certain insuperable difficulties in the way of such a canal ever being a success, no matter by whom constructed. It is intended to be used by a vessel which can navigate the ocean, the canal, and the lakes. We do not believe that such a vessel can be constructed so as to be economically and commercially successful. The ocean steamer is built to withstand the fierce storms of the Atlantic, and costs in its most modern type about \$71 per net ton of carrying capacity.*

* Report of Major T. W. Symons, in Report of Chief of Engineers U. S. Army for 1897, page 3174.

The vessel to navigate the lakes is built to withstand less frequent and dangerous storms; it has less draft, on account of the smaller depth of the harbors on the lakes, and it is built much less substantially; its cost is about \$36 per net ton of carrying capacity.*

The cost of a canal fleet, consisting of a steamer and three consorts, with a total cargo capacity of 3,900 tons, according to figures furnished us by boat builders, would be \$28,500†, or \$7.31 per ton.

The Cleveland Steel Canal Boat Company estimates that steel canal boats of the above capacity (150 feet long, 25 feet wide, and 10 feet draft) will cost \$15,000 for each consort and \$25,000 for a steamer, which is \$18 per ton of cargo capacity for a fleet of four boats.

We have, then, the difference in first cost between \$71, \$36, and \$8 per ton of carrying capacity for the three types of vessels which, in the evolution of business, have been produced as the most economical for the particular class of work each has to do. We do not believe that it is possible to combine these three types into one vessel, which will be as economical for the through trip as to use the three existing types with two changes of cargo, one at Buffalo and one at New York, or to use the boat of 1,000 tons capacity going through from the lakes to New York and there transferring its cargo to the ocean steamer.

The average speed on the Suez Canal is only six miles per hour, and this on a canal with a total length of about 90 miles, of which fully two-thirds is a large lake. In a restricted waterway 350 to 400 miles long we do not believe that ocean steamers or lake steamers could attain an average speed exceeding five miles an hour. They are built to run from 15 to 20 miles an hour, and if they run at only five miles an hour we think that in order to be profitable the now existing rates on the ocean and lakes of about one-half of a mill per ton mile would have to be very largely increased.

Finally, we think that this project is not one for serious consideration by the State of New York, because there are as yet no data which would enable any one to give even an approximate estimate of its cost. We have seen various statements placing the cost of a ship canal at figures ranging from \$125,000,000 to twice or even three times that sum. None of them are founded on data sufficiently accurate to justify careful examination. The Board of Engineers on Deep Waterways is now preparing its estimates, and these will be the first based on adequate surveys. Until their figures are known, all that we can say is that a ship canal will cost very much in excess of the project which we recommend. On the other hand, it will not, in our judgment, produce a freight rate, or other advantages, commensurate with this increased cost.

While, therefore, it seems eminently a proper subject for consideration by the Federal Government, even though, as is probable, the result

* Ibid., page 3176. These figures were based on the actual cost of vessels constructed between 1893 and 1896. At the present time, owing to the increased price of steel, the cost of each would be largely increased.

† See page 64.

of such an examination shall be the abandonment of the project, we do not think it is a subject which should receive any serious consideration from the State of New York.

PROJECT RECOMMENDED.

In the foregoing we have given reasons which have led us to the conclusion that it is not wise for the State to abandon its waterway, and that the ship canal will involve an enormous expenditure without producing a satisfactory result. It then remains for us to consider to what extent the waterway across the State should be enlarged. A number of projects have been under consideration, involving plans for a canal of different depths, from 9 to 14 feet, carrying boats with capacities of from 320 to 1,500 tons, and involving an expenditure of from \$13,000,000 to \$80,000,000. In order to arrive at an intelligent decision, it is necessary to determine with reasonable accuracy what each of the proposed projects will produce in the way of freight rate, and what it will cost.

In regard to the latter, the information and data which have become available within the last few months are far more extensive than were at the disposal of the State Engineer when the project of 1895 was prepared, or at the disposal of Major Symons when he made his report to the War Department in 1897 on the barge canal project, or at our own disposal when we sent out our circular letter of May 1, 1899. The surveys of the Board of Engineers on Deep Waterways have been of the most thorough and complete character, and covered every possible route for a waterway through this State east of Oswego and Syracuse. The results of these surveys will not be available to the public until after the report shall be presented to Congress, which it is anticipated will be done during the present season, but through the extreme courtesy of the members of the Board their records and surveys have been placed at the disposal of engineers employed by us. The engineers of the State while the project of 1895 was being carried out made very complete surveys in the immediate vicinity of the canal, including cross sections at intervals of 100 feet. In order to obtain the data for estimates on the portion of the route west of Syracuse and Oswego we have employed our own engineers, who have made their own surveys. Finally, we have had the advantage of the maps of certain portions of the State recently published by the United States Geological Survey on a scale of 1-62,500, or about 1 inch to the mile, with contours at 20 feet interval. With all of this data it has been possible to prepare estimates of cost which we feel justified in relying upon as sufficiently accurate to form a basis for recommendations to yourself and the Legislature. These estimates will be found on pages 81 to 107. They

were prepared by Messrs. G. W. Rafter, D. J. Howell, and F. M. Sylvester, all of whom have had long experience in engineering work connected with the canals. They were made under the personal direction of Major Symons, and have been carefully examined and approved by him. They have been further examined by Messrs. William H. Burr and William Barclay Parsons, whose statements as to their adequacy will be found on page 109. The original estimates of Messrs. Rafter, Howell, and Sylvester, covering nearly 300 pages of typewritten manuscript, are considered too voluminous to be published *in extenso* with this report, and have, therefore, been deposited in the office of the State Engineer. They contain data of great value on the canal question, and we recommend their publication by the State.

It should be further noted that our estimates provide for the construction of mechanical lift locks at Cohoes at the risk and expense of the State. Chapter 519 of the Laws of 1899 provides a method by which these locks can be constructed by private capital at its risk, the State paying a rental in case of success. Should this method be put into practical operation, our estimates will be reduced by \$1,200,000 for the smaller project, and \$1,700,000 for the larger project.

We fully realize the responsibility attached to the making of these estimates, and we feel that we have taken every precaution within our power to avoid the error of estimating below actual cost. While further surveys are necessary in order to make working plans and prepare contracts (and we recommend that such surveys be made immediately), yet we feel reasonably confident that the figures we now present are sufficiently accurate as a basis for legislation and a vote of the people, and we think the result of further surveys will be to decrease to some extent the estimates we now present.

The other factor in the problem is to determine the probable freight rate; or, more exactly, the actual cost of transportation, which will result from carrying out each particular project under consideration. Major Symons has made a most careful study of this feature, and has procured from boat builders, canal boatmen, and from every other available source the data bearing upon the actual cost of running boats of different sizes. The result of his investigations is printed in full in the memorandum beginning on page 95. It is believed that every item of cost, expense, and depreciation has been fully taken into consideration. As a check upon the figures obtained in this manner, we have had the actual freight rates in force upon the Lakes and upon the canals under existing circumstances.

The foregoing explanations are given so that every one can determine just how much weight to attach to our figures.

The Erie Canal was originally built with locks 90 feet long, 15 feet wide, and 4 feet deep, and with a prism of corresponding depth. The boats first used carried 30 tons. It has been successfully enlarged at different times. At the end of 1862 it had double locks, 104 feet long, 18 feet wide, and 7 feet deep, and carried boats of 240 tons. No improvements have been made during the last thirty-seven years, except to lengthen the

locks on one tier so as to pass two boats at one lockage. This work had been completed on all the locks except at the four flights of Cohoes, Little Falls, Newark, and Lockport. It was anticipated that at these points modern lift locks would be desirable, and that it was unwise to expend any money in lengthening the locks of the old pattern. This was the condition of the canal at the time of the adoption of the project of 1895 (Chapter 79 of the Laws of 1895). This law described the project in the following language: "The said improvement to the Erie and Oswego Canals shall consist of deepening the same to a depth of not less than nine feet of water, except over and across aqueducts, mitre sills, culverts, and other permanent structures, where the depth of water shall be at least eight feet, but the deepening may be performed by raising the banks wherever the same may be practicable; also the lengthening or improving of the locks which now remain to be lengthened, and providing the necessary machinery for drawing boats into the improved locks, and for building vertical stone walls where, in the opinion of the State Engineer and Surveyor and Superintendent of Public Works, it may be necessary. The improvement upon the Champlain Canal shall consist in deepening the said canal to seven feet of water, and the building of such vertical stone walls as in the opinion of the State Engineer and Surveyor and Superintendent of Public Works shall be necessary. The work called for by this act shall be done in accordance with plans, specifications, and estimates prepared and approved by the State Engineer and Surveyor."

The contracts let under this project were all upon the prism and none upon the locks (except at locks 21 and 22). The plans and estimates, so far as we can learn, contemplated locks which would provide for the passage of two boats, each 104 feet long, 17½ feet wide and about 7½ feet draft. It was estimated that this would increase the carrying capacity of the boats about one-third, namely, from 240 tons to 320 tons.

This is what we understand to have been the project of 1895.

In his report for 1897, State Engineer Adams recommended the lengthening and deepening of the locks by the use of a different type of gate, so as to provide for boats of 115 feet in length, 17½ feet wide, and 8 feet draft. This would increase the carrying capacity of the boats to 400 tons.

In the report of Messrs. North and Cooley, the Engineers of the Investigating Committee of 1898, it was pointed out that many items had been omitted in the project of 1895, such as "the strengthening of banks and repairing or renewing of locks, aqueducts, waste weirs, etc. . . . all locks deepened and lengthened or replaced with pneumatic lifts, as at Lockport and Cohoes, . . . and pneumatic lifts at Newark and Little Falls." The carrying out of this additional work necessarily increased the estimates of the engineers of the Investigating Commission beyond those of the State Engineer.

We have considered the cost and value of the original project of 1895 when completed, as well as that including the modifications suggested by Messrs. North and Cooley, and we have also considered the cost of a similar project with locks sufficient to take two boats, each 125 feet in

length, $17\frac{1}{2}$ feet in width, 8 feet in draft, with a cargo capacity of 450 tons. We also considered the cost of widening one tier of locks so as to pass boats $125 \times 25 \times 10$ feet with the idea that these boats might be temporarily used on a six foot draft, and thus derive a partial advantage in the increased cargo and decreased freight rate, pending the final completion of the project. This plan was very favorably received by boatmen and others interested in canal transportation, and this led us to make a very careful examination and test of the accuracy of the estimates of cost which we had used in our circular letter of May 1 as a basis for discussion, and which had been obtained from such published data as was then available. The result of such examination showed that the figures which we had been considering were erroneous. We also caused plans to be made of the sharp bends and other points of the canal where the navigation by boats 25 feet wide pending the enlargement would be difficult, and the result of such examination clearly convinced us that such boats could not be used to advantage until the final completion of the entire project. We also learned that a similar plan of temporarily navigating the canal on a single track basis with turnouts had been tried during the enlargement of 1855 and found to be impracticable. We were, therefore, compelled to abandon further consideration of the project designated as "Plan 2."

We have also considered with some care the project of a barge canal for barges of 12 to 14 feet draft, and capacity of 1,200 to 1,500 tons; but we became convinced that a barge of this size would cost very much more than a barge of 1,000 tons capacity; that the corresponding canal would cost very much more than the canal suitable for the 1,000-ton barge, and that the cost of transportation, or freight rate, would be substantially the same in both cases. We, therefore, have not made any detailed estimates of the cost of a barge canal for 1,500-ton barges.

The result of the investigation, therefore, reduced the number of projects to four, and the cost and economic value of each have been very carefully considered. In considering the three smaller projects, we became convinced that the completion of the project of 1895, as originally designed, and producing a waterway to be used by boats of 320 tons, would produce so slight an improvement over existing conditions as not to justify the expenditure of public money. As between the projects for boats 115 feet or 125 feet in length, each having $17\frac{1}{2}$ feet width and 8 feet draft, we concluded that the increased saving in transportation cost by the larger boat was sufficient to justify the increased expenditure.

We thus eliminated from consideration all of the various projects except two, and the relative advantages of these will be stated in some detail in order to explain fully why we have finally decided to recommend the larger project.

Each of the projects contemplates that the first work to be done will be that upon the locks so as to fix the size of the boats, enable builders to resume the building of boats, and pending the completion of the prism to pass three of the present boats at one lockage. There are two points on the canal where an entirely different system of locks should be introduced; one

at Cohoes, where a double pneumatic or other mechanical lift should replace the existing sixteen locks; and the other at Lockport, where a similar lift should replace the existing five locks. There are two other points, namely, Little Falls, where the four existing locks should be replaced by three new locks; and Newark, where the three existing locks should be replaced by one new lock. At other points the existing locks are to be rebuilt with greater length and greater depth. Each plan also contemplates the use of quadrant gates in place of the present gates, and of mechanical power, either steam or electricity, for operating the gates and for working the boats into and out of the locks.

Each plan also contemplates a new canal for about 100 miles, or 30 per cent. of the entire length. One diversion is from Clyde to New London, following the line of the Seneca and Oneida Rivers and Oneida Lake, avoiding the treacherous foundation which is such a fruitful source of expense across the Montezuma marshes, and giving a wide waterway through the rivers and lake above mentioned, so as largely to increase the speed of the boats. The other diversion is to begin at the West Troy side cut (cutting out two locks and seven miles of canal between that point and Albany), and construct a new canal leaving the Hudson River at the West Troy side cut and following the line of the existing Champlain Canal, and the bed of the Mohawk River, to the Cohoes Falls; to canalize the Mohawk River from the falls to Rexford Flats, near Schenectady, and possibly as far up as Little Falls, if the result of further surveys shall show that this is cheaper than to follow the present route. The canalization of the Mohawk River between Cohoes and Rexford Flats will do away with the two aqueducts, the expense of rebuilding which on either of the plans for enlargement would be very great.

The aqueduct at Rochester, and the line of the canal through that city are so located that the expense of enlargement will be almost prohibitive, and we, therefore, advise the adoption of a new line to the south of Rochester, as is fully set forth in the estimates of the engineers. The adoption of the new line between Clyde and New London would carry the main canal about six miles north of Syracuse, but an outlet is provided for into Onondaga Lake, where large and satisfactory terminal facilities can be provided for the benefit of the Syracuse trade at comparatively small expense.

Our estimates provide for carrying the enlarged canal through the City of Utica on the present route, but further surveys are necessary to show whether it would be cheaper to carry it around the City of Utica.

For many years it has been suggested by engineers that it would be desirable to carry the canal between Clyde and some point in the vicinity of Rome by a southern route which should give a constantly descending canal from Lake Erie to the Hudson River. It has also been suggested that the Syracuse level might be extended east and west so as to provide a constantly descending canal. These projects were so attractive that we employed Mr. George W. Rafter to ascertain definitely what they would cost. His complete report has been filed with the State Engineer, and we

recommend its publication. He surveyed one route to the south of the present line, one to the north, and one intermediate for extending the Syracuse level east and west. His surveys showed that the cost of the southern route, 58 miles in length, would be \$29,000,000; the northern route, 58 miles, would cost \$22,400,000 and to extend the Syracuse level east and west 113 miles, would cost fully \$32,500,000. These estimates are based on a canal of 12 feet depth, sufficient to carry boats 25 feet wide and 10 feet draft. The adoption of either of these routes would involve a cost of from \$17,000,000 to \$25,000,000 in excess of the routes which we recommend by the Seneca and Oneida Rivers and Oneida Lake. In our judgment, no advantage would be gained corresponding with such an increased cost, and we, therefore, advise the adoption of the route via the Seneca and Oneida Rivers, and Oneida Lake.

The route to be followed by either of the two projects which we now submit is, therefore, the same, and the difference in cost is that which arises from the difference in the size of boats and the difference in the size of locks and prism to carry them. The smaller project is for boats 125 feet in length, 17½ feet in width, and 8 feet draft, and a capacity of 450 tons; and the larger project is for boats 150 feet in length, 25 feet in width, and 10 feet in draft, with a capacity of 1,000 tons. The cost of transportation in one case will be 0.88 of a mill per ton mile, or 1 1-3 cents per bushel of wheat from Buffalo to New York; and in the other case 0.52 of a mill per ton mile, or 8-10 of a cent per bushel of wheat from Buffalo to New York. The cost of transporting a ton of freight from Buffalo to New York by the smaller project will be 44 cents, and by the larger project 26 cents. The smaller canal will have a capacity of 10,000,000 tons per annum, and on that tonnage the saving, as compared with the present canal, will be \$4,300,000 per annum; on the same tonnage, the saving by the larger canal will be \$6,100,000 per annum, but its capacity would be in excess of 20,000,000 tons per annum, and on that tonnage the saving as compared with the present canal would be \$12,200,000 per annum. As compared with the lowest rail rate ever quoted across the State of New York, the saving on a tonnage of 20,000,000 tons per annum would be nearly \$18,000,000 per annum.

As between these two projects, the undersigned are unanimously of the opinion that it is best for the State to adopt the larger project. Whether these views will meet the approval of the Legislature and the people it is not for us to say. We confine ourselves solely to advising you what in our judgment is the proper policy for the State to pursue in regard to its canals, leaving to those on whom the responsibility rests to decide whether these views should be carried into effect. We feel confident that on mature reflection the Legislature and people of the State will ultimately adopt these views. We have hesitated to recommend the expenditure of a sum of money which, although small in proportion to the resources of the State, is still a very great sum; but after much deliberation we are unwilling to recommend any temporary or partial settlement of the canal question. We do not believe that the adoption of the smaller plan will result in *permanent*

benefit to the State of New York, and as the money expended on the smaller project would be almost entirely wasted in case a larger project should be determined upon later on, we do not feel justified in recommending the expenditure of so large a sum as \$21,000,000 for a temporary purpose. We feel confident that the larger project will result in a transportation cost across the State of New York as low as that by the St. Lawrence canals, which constitute their chief rival at present, far less than any rate which is possible by railroad at any time within the immediate future, equal substantially to the results which could be obtained by a large barge canal or a ship canal, and, in short, would be a complete and permanent solution of the canal problem. It would give New York advantages in the low cost of transportation, and the commerce resulting therefrom which would be possessed by no other State on the Atlantic Coast.

We believe it is unwise to spend large sums of money in a mere betterment of the existing canal; what the present situation requires is a radical change, both in size and management, and what we recommend is practically the construction of a new canal from Lake Erie to the Hudson River, following the present canal for something over two-thirds of the distance, and new routes for the remaining distance of a little less than one-third, and utilizing the existing structures and prism so far as they can be made use of. We are firmly of the opinion that any less complete solution of the problem will in the end prove to be unsatisfactory; and that while the sum of money required to put this into execution is large, yet the resources of the State of New York are so enormous that the financial burden will be slight.

FINANCES.

Much has been said at various times about "the burden of taxation" for canal improvements and canal expenses, which, in our judgment, is not warranted by the facts; and it seems to us desirable that there should be a clear understanding of the matter.

As to the Erie, down to the close of the year 1882, at which time the tolls were abolished, the revenues collected on this canal exceeded all sums paid out upon it for any purpose whatsoever by the sum of \$42,599,718. This profit has been reduced in subsequent years by the expenses for ordinary and extraordinary repairs, maintenance, and operation, and for enlargement under the Nine Million Dollar Act, and against this outgo for expenses there has been no income from tolls; so that the net balance to the credit of the Erie Canal is now a little more than \$20,000,000.

It is important that this fact should always be borne in mind, that the Erie Canal has paid unto the State more money by many millions of dollars than has been spent upon it in the aggregate.

MANAGEMENT.

As stated in the beginning of this report, in our judgment the efficiency of the canals depends quite as much upon the way the business is handled on them as upon their physical size, and we advise against the expenditure of any more money for their enlargement unless it shall be accompanied with measures which will lead to the adoption of more modern methods in conducting the business of water transportation across the State. The policy of the State hitherto has been to discourage the adoption of modern business methods and to foster the handling of the traffic by canal boatmen owning each a single boat, or small companies owning a few boats. This prevents the State from taking advantage of those improvements in business management which have brought about such enormous economies in other lines. Canal legislation has been largely in the interest of the comparatively small number of canal boatmen, but it has resulted in failure so far as they are concerned, for experience has shown that they are unable to cope with the methods employed through corporate action.

The statistics which accompany this report show that in 1868 the canals carried 44 per cent. of the tonnage across the State, and in 1898 only 5 per cent. In the matter of grain (including flour) in 1868 the canals carried 76 per cent., and in 1898 10 per cent. Yet during all of these 30 years, the rail rate has always been in excess of the canal rate. There must be a reason why shippers and merchants are willing to pay more for transporting grain and other articles by rail than by canal, and the reason is chiefly because the railroad conducts the business according to modern methods and the canals do not. There is, in our judgment, no reason why the same business methods can not be applied to the canals as to the railroads; and if they are applied they will produce an equally satisfactory bill of lading, equal certainty in the time of delivery and equal responsibility on the part of the carrier.

In order to accomplish this, so much of chapter 934 of the laws of 1896 as limits the amount of capital which shall be employed in the business of canal transportation should be repealed. This law reads as follows: "No corporation organized under this act, and designed to navigate any of the canals of the State, shall have a capital stock exceeding \$50,000." It has been charged on the one hand that this law was passed at the instance of the railroads in order to destroy the usefulness of the canals; and, on the other hand, it is asserted that it was passed for the benefit of the boatmen in order to prevent the formation of large corporations, which, by greater economy, could first drive the small boatmen out of the business, and then by some alliance or understanding with the railroads, increase the rates. Whatever the origin of the law may have been, it has proved in practice to be of no benefit to the boatmen. Their business has continued to diminish and to grow still less profitable year by year since this law was passed. They do not make living wages under existing conditions, and they can not. They are attempting to maintain an antiquated method of business in competition with the modern methods which have

brought about the extraordinary increase of wealth during the last 30 years. They can not possibly succeed, and the State is not justified in expending any more public money unless the conditions are so changed as to derive the full benefit from its investment.

We, therefore, recommend in the most positive terms that the above quoted law of 1896 be repealed.

The next step is the reduction of terminal charges at Buffalo and New York. The improvements which we recommend are designed to produce a freight rate not to exceed one cent per bushel from Buffalo to New York. The prevailing rate on the lakes from Chicago to Buffalo during the last few years has been 1½ cents, making a total of 2½ cents for transportation alone for a distance of 1,500 miles. The cost of handling at Buffalo and New York is 2 1-10 cents, made up as follows:

		Cents.
Elevator charges at Buffalo625
Receiving, weighing, and discharging at New York	\$6.25 per 1,000 bu.	
Canal boat trimming	1.50	“ “ “
Ocean vessel trimming	2.00	“ “ “
Floating elevator	5.00	“ “ “
	\$14.75	1.475

Total for rehandling 2.100

We think that the cost of rehandling is out of proportion to the cost of transportation. It is equivalent to 78 cents per ton. Ore and coal are handled at terminal points on the lakes, in large quantities, at a cost of 8 to 10 cents per ton. We believe that the grain can be handled at a cost per ton little, if any, in excess of ore and coal.

Within the limits of the present City of New York and within the new harbor of Buffalo, there are miles of unoccupied and cheap water front where suitable structures and appliances for handling the grain out of the lake steamer into the canal boat at Buffalo and out of the canal boat into the seagoing vessel at New York can be erected, the result of which will produce a reduction in the grain rate fully equal to that which can be produced by an enlargement of the canal. If the elevator charges are not voluntarily reduced, then, with a waterway enlarged and made free as we recommend, the grain will be sent through from Chicago to New York in a fleet of four or six barges (133,000 or 200,000 bushels) without breaking bulk. This, combined with the Montreal competition, will soon force the adoption of improved and cheaper methods of rehandling.

We do not believe that it is necessary to attempt to bring about these results by legislation. If the use of the canal is made free, without restriction as to amount of capital employed, these results will be brought about in the natural course of trade and competition.

Again referring to the iron trade and the marvelously cheap cost of transporting ore, we find that this business is managed by large concerns

owning their own mines, their own lake vessels, and their own railroad from the lake port to Pittsburg. At the points where bulk has to be broken, modern mechanical devices are installed for handling the material out of one carrier and into another in enormous quantities and at a minimum cost. We believe that, if the canal is enlarged and made free, analogous methods will be introduced in the grain trade under which responsible companies with adequate capital will take charge of the grain at Chicago or Duluth and deliver it in the hold of the seagoing vessel at New York, making use at all points of the line of their own property in lake steamers, elevators (both movable and floating), canal boats, and tow boats, and giving one through bill of lading. Such companies, it is hardly necessary to say, would not tolerate the antiquated method of hauling canal boats by horses or mules; self-interest would prompt and compel them in a very short time to find the best means of mechanical traction, whether by steam or electricity, whether to have the motive power in each boat, or to have a self-propelled boat which carries freight as well as tows other boats, or to have the motive power in a boat which carries no freight, but is used only for towing. The cost and methods of traction would be studied by such a transportation line with the same care that railroads now study improvements in locomotives, and the result would be constant improvements in the method of traction similar to those which have been in progress on the railroads for the last thirty years, and have resulted in the low rates which have practically driven the old-fashioned canal boat and methods out of the contest. Such a transportation line with such appliances would be able to run boats through the canals on schedule time, and with a more certain adherence to their schedule than the railroads make with their freight trains. It is well known that the schedule time of the lake steamers is far more certain than that of the freight trains on the railroads paralleling the lakes. The canal boats ought to be able to make at least four miles an hour, including lockage, night and day, which would bring the time from Buffalo to New York down to 126 hours, or 5¼ days, in place of about 12 days, as at present.

The other points where we think the canal management is open to great improvement relate to matters entirely within the control of the State, namely: the kind of locks, and the method of handling the locks; the efficiency of the force engaged in the engineering and management of the canals; and the method of carrying on public works by contract. On these points we think legislation is desirable, as well as a more businesslike enforcement of the laws, than has hitherto prevailed.

In regard to the locks, we have explained on a previous page the modern arrangement which we think should be introduced at Cohoes, Little Falls, Newark, and Lockport, which will reduce the total number of locks from seventy-two to fifty-four; this will save at least eight hours in the time of passage, and will dispense with the services of a great number of lock tenders. At the remaining locks it is possible to use an improved modern type of gate, occupying much less space than the old-fashioned gate, invented about four hundred years ago, and to operate these

gates by mechanical power at a still further reduction in the expense for management.

In regard to the force engaged upon the canals and other public works of the State, the State Constitution (Article 5) provides for a State Engineer and a Superintendent of Public Works, and defines their duties. It is impossible to change the Constitution in this respect, if it were desired. In point of fact, the only serious objection we see to the system is that these officers have equal powers and responsibilities, and neither is subject to the other. So long as they work in harmony all goes well, but if they see fit to antagonize each other there is an opportunity for a deadlock, and delay and confusion in the transaction of public business. The system can not, however, be changed in any reasonable time, and must be accepted. Except in the matter of their having coordinate powers, it is not different from the system pursued by railway, steamship or any other transportation lines, in every one of which there is a manager or superintendent at the head of the operating department, and a chief engineer to supervise the engineering work. The Constitution provides that the State Engineer shall be elected by the people for a term of two years, and the Superintendent of Public Works appointed by the Governor for the period of the latter's term. It is not possible to amend the Constitution in these respects, and it is, therefore, useless to discuss any other method. That prescribed by the Constitution must be followed, and the people or Governor must be relied upon to put competent men in these places.

The Constitution further provides that the Superintendent of Public Works shall appoint not more than three Assistant Superintendents, and that he shall appoint all persons employed in the care and management of the canals, except collectors of tolls and those in the Department of the State Engineer, and that all his appointees shall be subject to suspension or removal by him. The Legislature, however, has power to prescribe the duties of his assistants, and to fix their compensation. As to the employees under the State Engineer, the Constitution is silent.

If the Erie Canal is enlarged in the manner we recommend, and becomes again a large factor in the transportation question in this State, the work in its two departments of engineering and management, as well as the minor public works of the State, will afford a life career to the graduates of scientific institutions which they would gladly enter if they could feel sure that their tenure of office depended on good behavior, their promotion upon merit, and that they were not liable to be turned out at any moment for some political reason. While the Constitution places in the hands of the Superintendent of Public Works the power of appointment and removal in his department, yet the law has already restricted his absolute power in the matter of appointments by prescribing examinations and tests of fitness which must be passed before he can make the appointment; and similarly, the Legislature can restrict his power of removal so as to limit it to removal for cause. It is also competent for the Legislature to classify and grade the permanent employees in both the public works and the engineering departments; to prescribe that appointments shall be

made only in the lowest grade, and that promotion from one grade to the next higher shall be made after a suitable examination. We recommend that such legislation be passed; and we consider this essential in order to secure permanently an efficient, honest, and economical administration of the canals and other public works of the State. If the State creates a service in which men will take pride in serving and removal from which will constitute a stigma of disgrace, it will be able to secure for this class of work men of a higher order of ability, integrity, and character for a comparatively small compensation. We believe that a unique opportunity now exists for establishing the service of the public works in this State on this basis, to have such legislation firmly planted in the statutes of this State, and to get the system fairly inaugurated and put into practical operation. Your own experience in these matters so far exceeds that of any member of the committee that it seems to us unnecessary that we should attempt to point out in detail the character of this legislation. We have only to call our attention to the matter, and to state that in our judgment the proper administration of the canals and other public works requires legislation which shall prescribe tenure of office during good behavior, appointment only to the lowest grade, promotion from one grade to the next by selection, both appointment and promotion to be determined by suitable tests, and no removals to be made except for cause.

Trusting that the result of our labors during the past year may be of some assistance in enabling you and the Legislature to "formulate definitely the canal policy of the State"—a matter which we consider of vital importance to its commercial and industrial welfare—we remain, very respectfully,

FRANCIS V. GREENE, *Chairman.*

GEORGE E. GREEN,

JOHN N. SCATCHERD,

THOMAS W. SYMONS,

FRANK S. WITHERBEE,

EDWARD A. BOND,

State Engineer and Surveyor.

JOHN N. PARTRIDGE,

Superintendent of Public Works.

REPORT ON EUROPEAN CANALS.

BY F. S. WITHERBEE.

GENERAL F. V. GREENE, Chairman Committee on Canals, New York City.

DEAR SIR: On your suggestion, I endeavored to make something of an investigation of the various canal systems in Europe this summer. I regret I had but little time at my disposal to cover so large a field, and that therefore the information I obtained is more or less fragmentary. It is also a matter of regret to me that some other member of the committee with more technical knowledge of the subject could not have had the excellent opportunities afforded me, for the subject of canal development is receiving much more serious attention abroad than with us.

I will not make a formal report to you, but will briefly describe what I was able to see of the various canals in the order in which I visited them.

LA LOUVIERE (BELGIUM) LIFT LOCK.

This lock is near Louviere, and about two hours by train from Brussels. It is located on a canal tributary to a large coal district, and when completed will connect the Charleroi Canal with the Mons and Brussels Canal.

The lock was constructed to overcome an elevation of about $11\frac{1}{2}$ metres (about 34 feet), and is a double one worked in balance. The tanks for holding the boats are 43 metres (about 140 feet) long, 5.8 metres (about 19 feet) wide, 2.5 metres (about $8\frac{1}{4}$ feet) deep, and have a capacity of locking 40 boats of 400 tons capacity per day of ten hours. It takes thirteen minutes to lock a boat through. Lift gates are used for admitting boats to the tanks, and the official in charge of the locks said he knew no reason why they could not be used on any ordinary lock, although he knew of none now in use in Belgium. This lock was constructed in 1888 at a cost of about \$300,000. The contract work was done by the Cockerill Steel Company. The lock has been but little used, as the canal is not yet fully completed. Work, however, is now being vigorously pushed on it, and it is contemplated to build three more locks similar to the one at La Louviere.

BRUGES (BELGIUM) SHIP CANAL.

Bruges is situated about thirteen miles from the North Sea, and is at present the center of six canals diverging to different parts of Belgium. A ship canal about the size of the Suez Canal is now being built from Bruges to the North Sea with the intention of making Bruges a seaport similar to Manchester in England. The idea is that coal and various manufactured products can be cheaply shipped by the present canal system to Bruges and there loaded on sea-going ships for the export trade. The work now going on at Zee-Bruges, the proposed seaport of Bruges, is on an extensive scale. A very large break-water is being built out into the sea

to afford an ample harbor for the largest ships to enter, and the entire work will cost the Government about \$8,000,000.

The only lock on the canal is the tidal one at its entrance, and it is said to be the largest and best in Europe. The gates of this lock are worked by electricity and slide into the side walls. The resident engineer, M. Cousins, told me he knew of no slide gates in use on the smaller canals of Europe, but he saw no reason why they could not be utilized, as they were used on some of the large tidal locks elsewhere. For further information and details regarding this very interesting work now going on at Zee-Bruges, I would refer you to an accompanying pamphlet, marked No. 1, by Charles Pieds, the State Engineer of Belgium.

Since visiting Zee-Bruges, I see by the papers they have discovered in their excavations there an old Roman ship lying about thirty feet below the surface, and supposed to be about two thousand years old.

PETROLEUM MOTOR BOATS ON LAKE LUCERNE (SWITZERLAND).

While stopping at Lucerne I was particularly impressed with the fact that a large number of the barges on the lake were propelled by petroleum motors, and learned that they had almost entirely displaced the sailboats formerly used by the farmers and small manufacturers to convey their produce to the railroad at Lucerne.

The following figures as to the cost of operating these boats may be of interest, and were obtained by me from a reliable source. The boats are about 26 metres (about 85¼ feet) long, 5½ metres (about 18 feet) wide, and carry about 50 tons each. The motors are 6 horse-power, and weigh 3,500 pounds, costing about \$1,200. A two-bladed screw is used, and a speed of three and a half miles per hour is made by a loaded boat. Petroleum costs 11 cents per gallon, and about 85 cents' worth is consumed for a day of ten hours. The same man operates the engine and steers, and I noticed that very little wash was made when the boats were moving. The motors are made by the Demler Motor Company of Constance, Switzerland, and I understand similar boats are used on the canals in Amsterdam, Holland.

THE DORTMUND-EMS (GERMANY) CANAL.

This canal was undertaken by the Emperor to connect the large coal and steel making districts of Germany with the North Sea at Emden. It is designed eventually to connect with the Rhine near Oberhausen, and also by a lateral canal, to be built from a point near Munster, to connect the Rhine with the Elbe. The distance from Dortmund to Emden is about 170 miles, and at different points along the route the Ems River has been canalized. This canal has been constructed in four years, two of which were taken up in preliminary surveys. It was a very difficult canal to construct from the fact that it is located near large manufacturing and coal mining districts, with a perfect network of railroads to cross. The scheme of the canal has been to make it as straight as possible, with

wide curves, so that long boats can be utilized. The work is of the most substantial character, and as it is the most recent large interior canal completed in Europe, it has all up-to-date improvements. I regret I was not able to ascertain its cost. It accommodates boats 68 metres (about 223 feet) long, 9 metres (about 29½ feet) wide, drawing 2.25 metres (about 7 1-3 feet) of water, with a cargo capacity of 1,000 tons. These boats are built of steel, and cost about \$5,000 each. At present they are towed by small tugs, but experiments are being made for electric haulage.

HENRICHENBURG LIFT LOCK.

There are twenty-one ordinary locks between Dortmund and Emden; two are operated by electricity and the others by hand. One large hydraulic lock known as the Henrichenburg Lift Lock is located about eight miles from Dortmund. This lock overcomes a difference in elevation of about 14 metres (about 46 feet), and cost about \$750,000. It is a single lock, and the actual lifting of a boat of 1,000 tons capacity from one level to other takes but two minutes. Lift gates for the tank are used similar to those at La Louviere. It takes thirteen men to operate this lock for two lifts. It is a magnificent steel structure, and for further details regarding it I would refer you to an accompanying publication by Messrs. Haniel & Lueg, of Dusseldorf, who had the contract for constructing the lock. I would also refer you to an accompanying supplement of the *Zeitschrift des Vereines Deutscher Ingenieure* for August 12, 1900. Both of these publications contain numerous illustrations of the lock when under construction. I also visited on this same canal the electric lock at Munster.

THE ELECTRIC LOCK AT MUNSTER.

This is one of the two ordinary locks on the Dortmund-Ems Canal operated by electricity. The lock is about 70 metres (229½ feet) long, 9 metres (about 29½ feet) wide, and overcomes an elevation of about 6.2 metres (about 20 1-3 feet). The difference in the level is utilized to run a 6 horse-power electric motor, by which the water valves and gates of the lock are operated. These gates are of the ordinary swing pattern, made of steel, and can be opened in thirty seconds. It takes about ten minutes to complete the locking of a boat from one level to the other. The snubbing-post at each end, to which the hawsers of the boats are attached, are made to revolve by electric power, and boats are thus drawn in and out of the lock. By the use of two reservoirs at each side of the lock a saving is made of about 60 per cent. of the water required for lockage. Only two men are required to lock a boat, and it could be done with one. The electrical and mechanical work of this lock cost about \$37,000.

The Dortmund-Ems Canal will eventually have a very large traffic in the exportation of German products and the import through it of large quantities of grain and Swedish and Spanish iron ore. From Amsterdam and Rotterdam to Dortmund the present rail rate on iron ore is about

\$1 per ton, or say, seven mills per ton per mile, and it is expected that the canal will materially reduce this rate.

The canal question is a very absorbing one in Germany to-day. The Emperor, backed by the manufacturing interests, is anxious to increase and enlarge the canal systems, while the agrarian, or agricultural, interests are bitterly opposed to this policy, fearing the importation of foreign cereals will injure them. It is an interesting commentary on the present prosperity of Germany that, although this Dortmund-Ems Canal was built to develop the export trade of Germany, yet the first cargoes to pass through it will be English coal and pig iron to supply the actual shortage in these commodities now existing in Germany.

HYDRAULIC LOCKS, ST. DENIS CANAL (FRANCE).

This canal is a sort of junction canal located on the outskirts of Paris. The locks are of the ordinary type, but the gates and valves are worked by hydraulic power. There are two parallel locks, the larger one being about 44 metres (144 1-3 feet) long, 7.7 metres (about 25¼ feet) wide, and 3.25 metres (about 10 2-3 feet) deep. The larger one accommodates boats carrying 500 tons and overcomes a difference in level of 10½ metres (about 34½ feet). The traffic through these locks is very large, and it takes two men to operate them on each shift, and about ten minutes is required for lockage. As in Germany, steel boats are largely being substituted for wooden ones, and are built to carry about 10 per cent. more load. The gates of these locks open outward, so as to give the full length of the lock to the boat.

It is interesting to note that the climate of France is such that this canal was closed only about 40 days in the year 1898. The canals are always operated unless the ice exceeds five inches in thickness.

HYDRAULIC LIFT LOCK AT LES FONTINETTES (FRANCE).

This lock is located on the Neufosse Canal near St. Omer, which is part of the Northern Canal System of France, and is also part of an international system leading into Belgium and Germany. A very large traffic passes through it. The Les Fontinettes Lock was constructed in 1888 to take the place of six ordinary connecting locks, and to overcome an elevation of about 13½ metres (about 44¼ feet), and accommodates boats of 400 tons capacity. The lock is a double-balance one similar to the one I have described as being located near La Louviere in Belgium. Its two tanks are 39 metres (about 128 feet) long, 5 metres (16½ feet) wide, and 1.8 metres deep. It has the same lift gates as are used at La Louviere. Owing to poor foundations, the lock was not at first a success, and the ordinary locks adjoining it have always been kept in repair to be used in case of accident to the hydraulic locks, but during the last two years, since the extensive repairs have been made, the lock has been in constant and successful operation.

Owing to the congested traffic on this canal, it used to take boats frequently three hours to pass through the old, ordinary single locks; now, less than fifteen minutes is required through the new lock. It takes four men to operate the lock, though only one handles the valves. It took three years, and cost about \$400,000, to construct the lock. The enclosed picture gives a very good idea of its proportions.

ELECTRIC HAULAGE NEAR BAUVIN, FRANCE.

A great deal has been done on the French canals in the past five years in the way of developing some sort of mechanical haulage.

Three systems have been tested—the cable system, running along the bank of the canal to which the boats can be attached, the use of electric motors on the boats themselves, and the use of locomotives running along tracks on the towpaths. All these systems have proved more or less a failure, but a new system consisting of a machine known as the “electric horse,” a sort of an automobile which moves along the towpaths without rails and drags the boat, has recently been tested at Bauvin on the Northern Canal System, not far from Lille, and it is hoped that this system will solve the problem of mechanical traction. The “electric horse” resembles very closely one of the small mechanical rollers used in making roads and pavements. The wheels are very broad so as to overcome any inequality or moisture of the towpath. Each machine weighs about two and a half tons, and is capable of drawing three boats with a load of, say, 750 tons at a speed of about two kilometres (about $1\frac{1}{4}$ miles) per hour. It is expected that the price of traction will be greatly reduced by this new system, as it has already fallen from two mills to one and one-tenth mills per ton per mile. The experiments that have been made at Bauvin and Bethune have been so satisfactory that a plant is soon to be constructed to handle all the traffic on this canal, which is one of the most important in France, as a large amount of coal is shipped through it to Paris. It is interesting to note that coal is transported to Paris, a distance of about 200 miles, for \$1.10 per ton. Sufficient electric power is generated by a 150 horse-power engine at Bauvin to operate a trolley system consisting of ten “electric horses.” These machines are built by Deneffe & Company, No. 119 Boulevard Montemarte, Paris, and I understand they have a contract with the French Government for a term of years to operate their system on this canal. The French Government has always followed the policy of giving a franchise to a corporation for towing on their canals, but has reserved the right of fixing the tolls to be charged and the right to inspect the animals used. It is not too much to prophesy that within two or three years the horse will have entirely disappeared from the canals of France.

For further details on canal haulage and statistics regarding the canal traffic of France, I would refer you to two accompanying reports by M. La Riviere, the Chief Engineer in charge of the Northern Canal System at Lille. I have marked these reports No. 5 and No. 6.

CONCLUSION.

France, Germany, and Belgium are all much interested in the question of their canal improvements, and each seems to realize that in the struggle for the world's trade their canal systems are to play no unimportant part. Many schemes are now on foot for improving present, or building new, canals. Electricity is likely to be used very largely for haulage and the operation of their locks, but it was a matter of disappointment to me to learn that practically nothing had been done on their smaller canals to substitute lift or slide gates on their locks; but, as I have said above, the officials in charge of the large locks on which these improved gates are used told me they saw no reason why they could not be utilized on their smaller canals.

The towpaths are vastly superior to ours, many of them being paved or macadamized, and most of the canals have rows of trees along each bank, not only as a protection to man and beast against storms, but also to protect the canal banks. Wherever practicable, rivers are canalized. In Germany they are working up to a standard of a boat with a capacity of 1,000 tons. They seek to obtain this capacity by the length and width rather than the depth of the boat; in other words, with longer locks and broader curves. They claim this is cheaper than a deeper canal. Russia, on the other hand, is planning to build a ship canal 1,000 miles long and 30 feet in depth to connect the Baltic and Black Seas. Strategic as well as commercial reasons are doubtless behind the size of this proposed canal. I was impressed everywhere with the size of the rudders of the boats, and the claim was made that the boat was much easier handled around the curves in consequence. Another device which seems to be generally used in Europe is a movable mast, generally elevated at an angle of about forty-five degrees, to the end of which a hawser is attached. This enables the boats to pass each other easier, as, by dropping the mast, one boat can pass under the hawser of the other. These masts can also be utilized for hoisting the cargo out of the hold. There are also many other details in the operation of European canals which would repay a close inspection on our part.

A Congress of Navigation is held every few years in different parts of Europe, and matters of importance to the various canal systems are discussed, and a great deal of mutual information is thus exchanged. The next Congress is to be held in September, 1900, in Paris, and I sincerely hope our government will be well represented by competent authorities on our canal system.

In conclusion, I want to express my appreciation of the courtesies that were extended to me on all sides in Europe. Every opportunity was given me for my investigations, and especially are my thanks due to M. de Bruyn, Minister of Agriculture in Belgium; M. Geirard, Chief Engineer of Public Works in Belgium; and also to M. Cousins, Engineer in charge of the Harbor and Canal Improvements at Zee-Bruges; to Hon. J. G. A. Leishman, United States Minister at Switzerland, for information regarding the petroleum motors on Lake Lucerne; to Hon. Andrew

White, United States Ambassador to Germany, for introductions to the officials of the Dortmund-Ems Canal; to Mr. Henry Vignaud, Secretary of the United States Embassy at Paris, for letters to the proper French officials, and to M. La Riviere, Chief Canal Engineer at Lille, who was good enough to accompany me to Bauvin to inspect the electric haulage experiments now being conducted there.

Yours truly,

F. S. WITHERBEE.

NEW YORK, November 1, 1899.

MEMORANDUM ON COST OF TRANSPORTATION AND VALUE OF CANAL.

BY MAJOR T. W. SYMONS.

In making a recommendation to the State of New York to enlarge and improve the Erie Canal, it is necessary to know not only the cost of the improvement, but to show as plainly and clearly as practicable the advantages that would accrue from it in cheapening the cost of transportation.

The following study has been made of the cost of transportation by the present Erie Canal and by the canal improved in the various ways that have been under discussion by the Committee on Canals. No effort has been made to ascertain or estimate the cost of transportation by the Champlain or Oswego Canals. These are recognized as of minor importance to the Erie Canal, but it is assumed that these canals will be benefited by improvements proportionally with the benefits accruing to the Erie Canal from similar improvements.

The basis of the computations and estimates of the cost of transportation are the ascertained figures of cost by the present Erie Canal navigated by fleets of four boats hitched together tandem, two by two, the forward pair consisting of a steamboat and an ordinary boat, and the rear pair of two ordinary boats, the steamboat pushing one and towing two ordinary boats, this being the method now in common use. No consideration is given to the system, still largely prevalent on the canal, of towing ordinary boats by horses or mules. This is more expensive than steam canal transportation, and can have no place in any improved canal of the future. It is recognized that it is quite within the bounds of probability that something better than steam propulsion may be devised for the canals, but up to the present time there are no tangible results in this direction. If a system or systems of propulsion by the use of electricity, compressed air, gasoline, or anything else can be devised to replace economically steam, as at present used, they will lower the cost of transportation below the figures given in this paper.

The following tables give the estimated data concerning loads and costs of steamers and ordinary boats (all built of wood), expenses for running the same, and the cost of transportation on the canal in its present condition and as improved in various ways. In all cases it is estimated that the principal business will be *down* the canal toward the sea, and that the *up* loads will amount in the aggregate to one-third of the down loads.

As a basis of comparison, the estimated cost of transportation is computed first by the ton, and second, by the bushel of wheat (assuming all freight reduced to wheat), and third, by the ton mile. This estimated cost includes all ordinary expenses for labor, material, fuel, and engine supplies, repairs, insurance on fleet and down cargo, 5 per cent. on investments, and 5 per cent. deterioration. It is expected that most of the boats of a canal fleet would get a considerable revenue for storage during the winter, which would help to pay some of the fixed charges, but this is not taken into account in the following estimates, all expenses being charged against the revenues from transportation simply.

PRESENT ERIE CANAL.

The present poor condition of the Erie Canal with its antiquated locks and liability to accidents permits boats to make but about seven trips per year. The dimensions of the boats in use are 98 feet long, 17½ feet wide, and 6 feet draft.

Load of steamer.....	150 tons or	5,000 bushels of wheat
Load of ordinary boat.....	240 tons or	8,000 bushels of wheat
Load of fleet.....	870 tons or	29,000 bushels of wheat

Seven trips annually.

Total down freight per annum.....	6,090 tons or	203,000 bushels
Total up freight per annum.....	2,030 tons	
Total up and down freight per annum.....	8,120 tons	
Total up and down freight, in wheat.....	270,667 bushels	
Value of steamer.....		\$8,500
Value of three consorts.....		9,000
Value of fleet.....		\$17,500

SEASON'S EXPENSES.

Wages and subsistence.....	\$2,982.00
Fuel, oil, waste, etc.....	1,400.00
Ordinary repairs	196.00
Insurance on fleet.....	217.50
Insurance on down cargo.....	456.75
Miscellaneous small expenses	100.00
Interest on investment at 5 per cent.....	875.00
Deterioration, etc., at 5 per cent.....	875.00

\$7,102.25

Cost per ton $\frac{\$7,102.25}{8,120}$ equals 87 cents.

Cost per bushel $\frac{\$7,102.25}{270,667}$ equals 2.62 cents.

Cost per ton mile equals 1.75 mills.

ERIE CANAL COMPLETED UNDER ACT OF 1895.

SEYMOUR PLAN.

The State of New York has entered upon an improvement of its canals and has expended some \$9,000,000 thereon.

The "Nine Millions" act provided as follows:

"The said improvement to the Erie and Oswego Canals shall consist of deepening the same to a depth of not less than nine feet of water except over and across aqueducts, mitre sills, culverts, and other permanent structures, where the depth of water shall be at least eight feet."

Under this plan the Erie and Oswego Canals would be provided with such a depth of water as would enable boats to draw barely seven and one-half feet. The length of boats provided for under this improvement is limited to the capacity of the lengthened locks of the canals. These locks as lengthened have a chamber length between hollow quoins of $221\frac{1}{2}$ feet, suitable for two boats, each 104 feet long.

The work if completed under the \$9,000,000 act will, therefore, have a capacity suitable for boats of the present width, $17\frac{1}{2}$ feet, draft of $7\frac{1}{2}$ feet, and length of 104 feet. An ordinary boat would carry 320 tons and a steamer 230 tons, and in considering the transportation value of such a canal it is assumed that nine trips per season are practicable.

On the same basis as before, the transportation value of such a canal is shown in the following table:

Load of steamer.....	230 tons or 7,667 bushels of wheat
Load of ordinary boat.....	320 tons or 10,667 bushels of wheat
Load of fleet.....	1,190 tons or 39,667 bushels of wheat
Nine trips annually.	
Total down freight per annum.....	10,710
or 357,000 bushels of wheat.	
Total up freight per annum.....	3,570 tons
Total up and down freight per annum.....	14,280 tons
Total up and down freight, in wheat.....	476,000 bushels
Value of steamer	\$9,000
Value of three consorts.....	10,500
Value of fleet	
	\$19,500

SEASON'S EXPENSES.

Wages and subsistence.....	\$3,200.00
Fuel, oil, waste, etc.....	1,800.00
Ordinary repairs	200.00
Insurance on fleet.....	240.00
Insurance on down cargo.....	803.25
Miscellaneous small expenses.....	150.00
Interest on investment, 5 per cent.....	975.00
Deterioration, etc., 5 per cent.....	975.00
	\$8,343.25

Cost per ton $\frac{\$8,343.25}{14,280}$ equals 58 cents.

Cost per bushel $\frac{\$8,343.25}{476,000}$ equals 1.75 cents.

Cost per ton per mile equals 1.16 mills.

ERIE CANAL ENLARGED TO PROVIDE FOR BOATS 115 FEET LONG AND 8 FEET DRAFT.

SEYMOUR ADAMS PLAN.

There is another plan, not sanctioned by law, but which has been proposed by the former State Engineer and Surveyor, which looks to so enlarging all locks that they will each admit two boats of 115 feet in length and of the present width, and to so deepening all structures that a boat draft of 8 feet will be available. This involves much work not covered by the estimates under the \$9,000,000 act. Under this plan the already lengthened locks would be slightly lengthened and provided with a different kind of gates, and all the locks not yet lengthened would have their dimensions made to correspond.

Assuming that on such a canal business is done in four-boat steam fleets, which can make nine trips per season, the transportation value of such a canal on the basis before given would be as follows:

Load of steamer.....	300 tons or 10,000 bushels of wheat
Load of ordinary boat.....	400 tons or 13,333 bushels of wheat
Load of fleet.....	1,500 tons or 50,000 bushels of wheat

Nine trips annually.

Total down freight per annum.....	13,500 tons or 450,000 bushels of wheat.
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Total up freight.....	4,500 tons
Total up and down freight.....	18,000 tons
Total up and down freight, in wheat.....	600,000 bushels
Value of steamer	\$10,000
Value of three consorts.....	12,000
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Value of fleet	\$22,000

SEASON'S EXPENSES.

Wages and subsistence	\$3,200.00
Fuel, oil, waste, etc.....	2,000.00
Ordinary repairs	225.00
Insurance on fleet	270.00
Insurance on down cargo.....	1,012.50
Miscellaneous small expenses	150.00
Interest on investment, 5 per cent.....	1,100.00
Deterioration, etc., 5 per cent.....	1,100.00
	<hr/>
	\$9,057.50

Cost per ton, $\frac{\$9,057.50}{18,000}$ equals 50 1-3 cents.

Cost per bushel, $\frac{\$9,057.50}{600,000}$ equals 1.51 cents.

Cost per ton per mile, equals 1 mill.

NEW ERIE CANAL PROPOSED AND CONSIDERED BY CANAL COMMITTEE.

The essential and underlying idea of the new Erie Canal, as proposed and considered by the Canal Committee, is to adapt it for use by the largest practicable boat of the width of the present boats, to utilize to the greatest degree possible the work that has already been done under the \$9,000,000 appropriation, to make such changes in the route of the canal as seem dictated by sound engineering and business reasons, and to make such changes in the locks as will make them accord with the very best modern practice.

The principal features of the new Erie Canal as proposed by the Committee, are as follows:

1. The prism of the canal to be left at its present width generally, but to be deepened to 9 feet throughout, at aqueducts and structures as well as in the canal levels, and to be put into condition for use by boats of the present width and drawing 8 feet.

2. Three important changes in the route of the canal to be adopted. The first and greatest change is to deflect the canal to make several river and lake cut-offs to shorten distance and give better alignment.

The second change is to do away with the two aqueducts across the Mohawk River and the portion of the canal in Saratoga County. This is to be done by throwing the canal into the Mohawk at Rexford Flats, and following down the river to the vicinity of Cohoes Falls.

The third change is at the West Troy side cut where, instead of the awkward right angle turn requiring even small boats to uncouple, a diagonal deflection is made which will enable fleets to pass directly and conveniently into the Hudson without breaking up.

3. Pneumatic or other mechanical locks or appliances for the passage of boats to be provided at Cohoes and Lockport, and possibly at Newark. All other locks (one of each pair) to be lengthened and enlarged to take in two boats of 125 feet length, 8 feet draft, and of the present width. The locks to be provided with water power generating apparatus wherever necessary, with steel quick-acting quadrant gates, equipped with spring buffers, or other gates equally good, with power capstans at each end of the lock for pulling the boats in and out, and generally with everything of the most modern and up-to-date character. The other small lock of each pair of locks to be lengthened to take in one boat 125 feet long.

On such a canal, with its greatly improved route, its less liability to detention from accident, and its quick-acting locks, it is believed that four-boat steam fleets can make ten round trips per year if the business is properly managed, and the boats are given reasonably quick dispatch at terminals.

The following is the estimated cost of transportation by such a canal:

Load of steamer.....	350 tons or 11,667 bushels of wheat
Load of ordinary boat.....	450 tons or 15,000 bushels of wheat
Load of fleet.....	1,700 tons or 56,667 bushels of wheat

Ten trips annually.

Total down freight per annum.....	17,000 tons or 566,667 bushels of wheat.
Total up freight per annum.....	5,667 tons
Total up and down freight.....	22,667 tons
Total up and down freight, in wheat.....	755,555 bushels
Value of steamer	\$10,500
Value of three consorts.....	13,000
Value of fleet	\$23,500

SEASON'S EXPENSES.

Wages and subsistence	\$3,200.00
Fuel, oil, waste, etc.....	2,500.00
Ordinary repairs	250.00
Insurance on fleet	287.50
Insurance on down cargo.....	1,275.00
Miscellaneous small expenses.....	150.00
Interest on investment, 5 per cent	1,175.00
Deterioration, etc., 5 per cent.....	1,175.00
	\$10,012.50

Cost per ton, $\frac{\$10,012.50}{22,667}$ equals 44 cents.

Cost per bushel, $\frac{\$10,012.50}{755,555}$ equals 1.32 cents.

Cost ton per mile, equals .88 of a mill.

ENLARGED ERIE CANAL.

The great demand on the part of many people in the State for a much larger canal with widened and deepened locks, and a prism to correspond which would furnish transportation at a minimum cost, influenced the Canal Committee to make as thorough an examination as possible into the cost of such an improvement and the benefits derivable therefrom.

After giving due consideration to every feature of the problem, the Canal Committee decided that if the canal be materially enlarged its new dimensions should be such as would fit it for use by barges of 150 feet length, 25 feet width, and 10 feet draft of water, with all locks arranged to take in two boats coupled together tandem.

The following is the estimated cost of transportation by such an enlarged Erie Canal:

Load of steamer.....	900 tons or	30,000 bushels of wheat
Load of ordinary barges.....	1,000 tons or	33,333 bushels of wheat
Load of fleet.....	3,900 tons or	130,000 bushels of wheat
Ten trips annually.		
Total down freight per annum.....	39,000 tons	
	or 1,300,000 bushels of wheat.	
Total up freight per annum.....	13,000 tons	
Total up and down freight per annum.....	52,000 tons	
Total up and down freight, in wheat.....	1,733,333 bushels	
Value of steamer		\$13,500
Value of three barges.....		15,000
Value of fleet		\$28,500

SEASON'S EXPENSES.

Wages and subsistence	\$4,000.00
Fuel, oil, waste, etc.....	3,300.00
Ordinary repairs	300.00
Insurance on fleet	352.50
Insurance on down cargo	2,925.00
Miscellaneous small expenses.....	200.00
Interest on investment, 5 per cent.....	1,425.00
Deterioration, etc., 5 per cent.....	1,425.00
	<u>\$13,927.50</u>

Cost per ton, $\frac{\$13,927.50}{52,000}$ equals 26 cents.

Cost per bushel, $\frac{\$13,927.50}{1,733,333}$ equals 8-10 of a cent.

Cost per ton per mile equals .52 of a mill.

These figures as to the cost of transportation by canals of various capacities, etc., are based upon using four-boat steam fleets, making an estimated number of trips each year, which number is dependent upon the rapidity of transit through the canal and open waterways, the time consumed in lockage, the dispatch at terminals, and the liability to accidents and detentions.

There are various possibilities which may enable the cost of transportation to be still further reduced. Six-boat fleets may be used instead of four-boat fleets; the motor boats may be run independently of the ordinary motorless consorts and all the components of the fleet used to better advantage; and some other better and more economical method of supplying propulsive power may be devised and put into operation.

The figures as to cost of transportation are also based upon the idea that the canal transportation will be carried on in a business-like manner, as nearly as practicable in accordance with modern railroad practice. As the reduction in the cost of transportation would affect not only the canal freight, but rail freight as well, it is certain that the gross tonnage benefited would vastly exceed 10,000,000 per annum, and the benefits to the producing, manufacturing, and business interests of the State and country would be several times the largest amount stated in the appended table.

The Canal Committee has also considered the proposition advocated by many simply to widen and enlarge the locks of the Erie Canal to permit passage by boats 125 to 150 feet long and 25 feet wide. The Committee does not endorse this proposal as a work by itself, but insists that if the locks are enlarged to accommodate boats of greater width and draft, the prism of the canal shall be correspondingly enlarged, and that the ultimate necessity for the enlargement of the prism should not be lost sight of in considering the enlargement of the locks solely. The prism of the present Erie Canal is properly proportioned for boats of the width of

those now using it, *i. e.*, 17½ feet, but is not suited for boats of 25 feet width, and if the locks should be widened, the running thereon of 25-foot boats would be attended with great difficulty and delay, and would be most unsatisfactory, and the demand would inevitably and immediately be made for the enlargement of the prism. Such being the case, it is deemed proper to consider the cost of all the work required at the outset.

For purposes of comparison the following table has been prepared, giving the estimated cost of transportation by the present Erie Canal, and by the canal improved to the different sizes and capacities as specified herein. In stating the cost of the different canals, the amount required in each case for the passage of the Cohoes Falls is included. In case a private contract is made for the locks required for this passage, as authorized by Chapter 519 of the Laws of 1899, which permits them to be built and operated on a rental basis, the estimated amount which the State would require to raise would be reduced by from \$1,200,000 to \$1,700,000.

COST OF TRANSPORTATION BY PRESENT ERIE CANAL AND SAME CANAL IMPROVED TO
DIFFERENT CAPACITIES.

<p>Cost of transporting a ton of freight between Buffalo and New York.....</p> <p>Cost of transporting a bushel of Wheat between Buffalo and New York.....</p> <p>Cost per ton per mile.....</p> <p>Assuming a tonnage of 10,000,000 tons annually the cost of transporting it between Buffalo and New York would be.....</p> <p>Under above assumption, the annual saving in cost over present Erie Canal would be.....</p> <p>Relative cost of transportation, assuming that by present Erie Canal as unity.....</p> <p>Relative value of canals considering cost of transportation simply. Present Erie Canal as unity.....</p> <p>Assuming a tonnage of 10,000,000 tons annually with the saving in cost of transportation as indicated in this table, and money at 5%, the economic value of the different size canals over the present Erie Canal would be.....</p>	<p>Present Erie Canal.</p>	<p>Erie Canal Completed under \$9,000,000 Project.</p>	<p>Erie Canal Completed under \$9,000,000 project, and same farther extended to allow use by boats 115 ft. x 17½ ft. x 8 ft. draft.</p>	<p>Erie Canal Completed in accordance with project of Canal Committee, for use by boats 125 ft. x 17½ ft. x 8 ft. draft.</p>	<p>Recommended Canal for barges 150 ft. long, 25 ft. wide and 10 ft. draft.</p>
	<p>87 cents,</p> <p>2.62 cents.</p> <p>1.75 mills.</p> <p>\$8,700,000</p> <p>0</p> <p>1.00</p> <p>1</p> <p>0</p>	<p>58 cents.</p> <p>1.75 cents.</p> <p>1.16 mills.</p> <p>\$5,800,000</p> <p>\$2,900,000</p> <p>.67</p> <p>1.50</p> <p>\$58,000,000</p>	<p>50 cents.</p> <p>1.51 cents.</p> <p>1 mill.</p> <p>\$5,000,000</p> <p>\$3,700,000</p> <p>.57</p> <p>1.74</p> <p>\$74,000,000</p>	<p>44 cents.</p> <p>1.32 cents.</p> <p>.88 mills.</p> <p>\$4,400,000</p> <p>\$4,300,000</p> <p>.50</p> <p>1.98</p> <p>\$86,000,000</p>	<p>26 cents.</p> <p>.80 cents.</p> <p>.52 mills.</p> <p>\$2,600,000</p> <p>\$6,100,000</p> <p>.30</p> <p>3.34</p> <p>\$122,000,000</p>

PART III.

ADDRESS OF PROFESSOR WILLIAM H. BURR,

PROFESSOR OF ENGINEERING AT COLUMBIA UNIVERSITY AND MEMBER OF THE
ISTHMIAN CANAL COMMISSION APPOINTED BY THE PRESIDENT AND OF
THE ADVISORY BOARD OF ENGINEERS ON THE BOND SURVEY OF
1901, BEFORE THE JOINT CANAL COMMITTEES OF THE
SENATE AND ASSEMBLY OF NEW YORK,
ON FEBRUARY 24, 1903.

"Mr. Chairman and Members of the Committee: It was my good fortune to be a member of the Advisory Board during 1900 and 1901 when the plans and estimates for the barge canal along different routes then planned were worked out with so much care.

"Certain features of this matter will occur to any one who gives to it that careful study and attention which engineers are obliged to give to all questions coming before them. Perhaps the most striking feature of the entire question is the fact that conditions bearing on transportation at the present day require a great volume of traffic at a low rate. The day of smaller volumes of traffic at high rates is past, except under local and other exceptional conditions of either railroad or canal transportation. The railroad train unit at the present time is approaching three thousand tons. It has not yet quite reached that amount, but it probably will at no great distance in the future. The canal unit in this State is practically what it was forty years ago—two or three hundred tons only. Any one who has familiarized himself at all with present conditions of transportation will realize what these figures mean. Under such circumstances, canal transportation is finished, it will die. The canal must be given the same free chance for development which the railroads have had. The railroads have been developed under the favoring conditions of private management; the canals of this State are almost ready to be buried under public management by the State. It seems to me that the best, the fairest thing that can be done is for the State to remedy this difficulty and put its canals into such condition that they may compete with railroad transportation and take their places as channels of traffic worthy of the name. It seems to me that there is one plain duty of the State for its own welfare.

"The grain production of the West is largely west of the Mississippi River, in a portion of the country nearer the gulf ports than the Atlantic seaboard at New York, in nearly or quite all of its parts. That grain production has stimulated a flow of through and local traffic toward the East so great in volume that I believe it has been equalled nowhere else in the world. It is an enormous traffic, and it is a mistaken idea to suppose it is all of a through character. It is through traffic largely so far as the Great Lakes are concerned, but it not all through traffic so far as points of consignment in New York and New England and other Eastern points are concerned. I have not the statistics before me, but I am under the impression that what may be termed the local grain traffic—that is, that which moves eastward to supply the centers of industry in New York and New England and other Eastern States—is much larger than that destined for foreign shipment.

"The prosperity of the State of New York has been largely influenced by the presence of the Erie Canal; in fact, it is not much of an exaggeration to say that its prosperity has been based upon it.

"The local traffic of which I spoke a moment ago is, to my mind, even a greater factor in determining what should be done in improving the canals than the through traffic, which is so great a factor that we all instinctively consider it aloud in discussing this question.

"Another feature of this situation which must be reckoned with, and reckoned with seriously, is the competition of the Canadian canals. We are, perhaps, not disposed to give to our Canadian neighbors the credit which belongs to them, in the matter of their canal transportation. Their business sagacity and their energy are certainly evident enough if we consider what they have done in the development of their canals, many of them at least with fourteen feet depth of water. The current of traffic which sets through the Great Lakes certainly tends to seek that channel which gives the least resistance to movement. By far the shortest distance from the Great Lakes to the Atlantic lies not through this State but through the Georgian Bay district to Montreal and Quebec; the latter city being destined to be a great foreign shipping point of Canada. Rail communication is already carrying large quantities of grain along that line, and it will soon be reinforced by canal transportation. These facts must be carefully considered in studying this question of how best to maintain the current of traffic through this State, down the Hudson and to the Atlantic at New York. It is of the utmost importance to develop the New York State canals so as to make them the most attractive channels possible for the great grain and other traffic seeking a path from the Great Lakes eastward across this State. This question of the benefit of the greatest possible traffic which can be invited and encouraged through the State has been so covered by many others that it is scarcely necessary to touch upon it further than in this general way by a civil engineer whose remarks should perhaps be devoted more particularly to the engineering features of the improved waterway which is now before this honorable body.

"The plans and estimates which are now before you were reached through a study by a body of engineers whose operations were characterized, I believe, by a degree of thoroughness and technical preparation which has never been excelled in the consideration of any similar engineering question. Complete surveys and the most careful investigations of all questions were made. The Board of Consulting Engineers and its staff not only executed its own examinations, but they had before them the great mass of surveys and examinations of the United States Deep Waterways Board, a large portion of which work lay in this State directly along the line of the proposed improved waterway.

"After these plans were developed by the Board of Consulting Engineers and its staff, they were laid before the Advisory Board, of which it was my privilege to be a member, and I have, therefore, spoken with emphasis because I know, as a member of the Advisory Board, what excellent work was done and what careful investigations were made by the engineering force organized by the State Engineer at that time.

"The unit of 1,000 tons, that is, of the 1,000-ton barge, I believe, is as small as should be considered in this connection. These barges may be towed or may be propelled by their own power in small fleets, so that the railroad train unit will be equalled by the canal unit, even though the present railroad train load be considerably increased. Whatever is done, the principal result to be kept in view and reached at all costs is to put the conditions of navigation of the canal in so favorable a shape that the competition with the railroads may be real and not merely nominal. Just what these conditions may be it is, perhaps, difficult to define precisely, but at any rate the general statement will carry with it, I think, a clear enough conception of the conditions to be attained.

"One of the serious features of this question at the present time is the possible variation in the estimates of cost made two or three years ago. If the report of the State Engineer on the barge canal be referred to, it will be found that the matter of unit prices on which these estimates are based, received most careful attention, not only by the Consulting Board and its staff, but also by the Advisory Board. I believe that all the natural exigencies which might attend work in this State were carefully kept in view, such as the increased cost due to working in winter and the contingencies of flood for so much of the line as lies within the reach of floods. I have given this matter very careful consideration since the present session of the Legislature began, and while there may be room for some differences of opinion, I have been unable to conceive of any substantial reason why the estimates made at that time will not hold at the present. It is true, as has been stated, that prices of some commodities have been enhanced since this estimate was made. The price of labor has possibly risen to some small extent, although I think not much; the prices of some materials have increased, but substantially not much, except in the case of cement. The price of Portland cement has risen considerably since these estimates were made. I believe it may be stated, as one of my colleagues on the Advisory Board, Mr. Morison, has stated, that the

excess in price of Portland cement may be taken at about seventy cents per barrel. These are facts which must be met in considering this portion of the question, but there are other features also which should be considered. In the first place, there are some prices, like those of iron or steel, which are certainly full, even if the present prices continue. The figures which you will find in the estimated cost are not those which belong to these special developed conditions, but to the ordinary conditions of work found throughout the State at the present time. In other words, there would be the same class of economies in the special appliances and special organization, which attend any great consolidation of mechanical operations like those of the great manufacturing concerns of the country. The influences of such special developments were not given any sensible weight in ascertaining the prices of this work, but I think they should be most carefully considered in discussing the question whether the estimates made then will hold now.

“The apprehended additional cost of that portion of the work involving the use of Portland cement is, I think, largely or entirely imaginary. Civil engineers have already learned in many quarters that the best method of making concrete is not the old one of screening the materials so that the broken stone or gravel used is all or nearly all of uniform size, but that the interests of economy and strength are both served by using graded sizes, even from sand, or, in some cases, from the actual crusher dust, up to the largest stone used, perhaps two inches in greatest dimension. The voids which are found in a mass of broken stone and gravel of very nearly uniform size will vary from one-third to nearly one-half of the total volume. When graded sizes are used those voids are largely filled with the smaller sizes of the mass, so that the volume filled by the mortar in which the cement is found may be reduced to one-half of that used in the old methods.

“The economy and other advantages gained by special organization and special plant are not elements which are properly recognized to their full value in making estimates of cost of work on which appropriations are to be based, and they were not so used in this case, but they are proper elements to be considered in studying the future cost of the work as actually to be performed. I am strongly of the opinion that after every class of work involved in the construction of this improved waterway is examined, in view not of speculative conditions, but of work already actually performed, it will be found that the total estimates made two years ago are ample to cover the cost of the work to-day. If any one had prophesied at the beginning of the construction of the Chicago sanitary canal that the prices at which work was finally done would rule for that work he would have been considered visionary. In other words, special plant and efficient organization were brought into requisition, with the result that the unit prices were carried down far below anything at first considered possible, and there is not the slightest reason to doubt that similar results would follow in this case.

“Observations similar to these might be made in connection with

nearly every portion of the estimates for this improved waterway, but I think enough has been said to show why I believe that the estimates as made are sufficient at the present time.

“Another feature which has been, I think, discussed to a considerable extent is the effect of the flood waters of the Mohawk on the canalized portion of the river. That matter was also carefully considered both by the Consulting Board and its staff and by the Advisory Board. It was thought that if sections in the canalized portions of the river were provided of sufficient area to reduce the flood currents to not more than about four feet per second, all damage to structures and to the banks would be eliminated, and of that there is no doubt. In fact, it may be stated, although it was not so stated at the time, that the velocity of current might approach even five feet per second without damage either to the bed of the canalized river or to structures. As a matter of fact, the canalizing of that part of the Mohawk River required for the purpose and the storage of water in reservoirs needed for feeding the canal would have a most beneficial effect upon the floods along the Mohawk Valley. The latter would be reduced very materially. The storage reservoirs would keep back a portion of the flood waters, to be discharged later when the stage of the river was lower. The requisite dams along the river would hold back a portion of the floods and distribute the excess of waters in such a way as to prevent the violent features of a concentrated flood wave. The construction of the proposed improved canal, therefore, would actually improve the flood conditions of the Mohawk River.

“A reference to the report of the State Engineer on the barge canal, to which I have already adverted, would also show that an ample water supply was provided for all the purposes of the canal. The amount of traffic for which the supply was first estimated was ten million tons a year, but there is available in the watershed of the Mohawk River and its tributaries' abundant supply for a practically unlimited increase in traffic. On that question, therefore, there can be no serious apprehension; there is an abundant supply obtainable at a very reasonable cost.

“Summing up the whole matter, the physical conditions along the entire route from the Hudson to Buffalo are such as to invite the construction of this important waterway, and its resulting benefits would make that construction a most valuable investment for the State.

“The appointment of a competent Board of experienced men who are in the habit of pushing work under their supervision would expedite the execution of contracts and guard the interests of the State. It goes without saying that the appointment of such a Board should be made with great care, but if made with the same efficiency that characterizes the management of a private business the appointment would aid in expediting the construction. Under such conditions I believe the work can be done in five years and that the interests of the State would be thoroughly safeguarded.”

REMARKS OF MR. GEORGE S. MORISON.

PAST PRESIDENT AMERICAN SOCIETY OF CIVIL ENGINEERS, MEMBER OF THE
ISTHMIAN CANAL COMMISSION APPOINTED BY THE PRESIDENT AND
OF THE ADVISORY BOARD OF ENGINEERS ON THE BOND SURVEY
OF 1901, BEFORE THE JOINT CANAL COMMITTEES OF
THE SENATE AND ASSEMBLY OF NEW YORK,
ON FEBRUARY 27, 1903.

"Gentlemen, I supposed I was coming here to answer special engineering questions, and if you wish to ask any such questions, I will try to answer them.

"There are one or two things which have occurred to me while I have been listening, which, perhaps, it is worth while to speak of. It is a fact that no system of transportation can handle business or be successful to-day which is conducted on the principles on which it was conducted and with the machinery with which it was conducted twenty-five years ago. I think there is not a single railroad except those doing a very small local business which could be operated at other than a heavy loss if it had to use the same cars and the same locomotives that it used twenty-five years ago. I think there is not a single line of steamships on the ocean which could be operated except at a great loss if it had to use the same ships that it used twenty-five years ago. And I think that same condition exists if anything in a much more marked degree, on the Great Lakes, where the cheapest transportation that we know exists now, and is done at rates which would be very much less than the cost of handling with the class of vessels that existed twenty years ago.

"There are only two exceptions to that improvement in transportation. They are on the Western rivers and on the canals. On the Western rivers very much the same class of boats are now used that were used forty years ago. And what is the result? There is no transportation of any consequence on any of the rivers where it is done by power. The only transportation which is profitable on the Mississippi River or any of its tributaries is the transportation down stream, which is all done by gravity. Where cargoes have to be brought back there is nothing except for local points. The idea which has been spoken of, a ship canal connecting the Mississippi River with the Great Lakes, is a ship canal connecting a navigable stream which no ship can navigate with lakes which they can.

"In every case where water transportation has not been improved, where methods have not been improved, railroads have taken it away. That is simply due to the fact that railroads are operating with modern machinery. And in every case where the water lines have kept up with the same rate of improvement they have held their own end better.

"In this country it is customary to speak against canals—and canals of small dimensions have everywhere given way to other lines of transportation. But in the countries which have kept them up, their importance is at least as great as ever. I do not know the statistics, but I feel very sure that more than one-half the supplies consumed in the City of Paris, which is an inland city practically, are brought in by water, either by the Seine or by canal.

"Now, it is perfectly true that the Erie Canal can not in its present condition compete with the railroads; it is perfectly true that the only way in which it can be made to supplement the cheapest transportation in the world, that is, the transportation of the Great Lakes, is to increase its capacity. You may say it should be increased to a ship canal. A ship canal through the State of New York, following substantially the lines of the Erie Canal might possibly be the cheapest way of bringing transportation from the lakes to New York City, but it involves a much more expensive class of navigating craft than a barge canal would; it involves a much more expensive construction, and it involves a much greater interference with all the country along its line, because a ship canal passing through the heart of New York means a drawbridge at every single farm crossing or road that crosses that canal in the whole State.

"There is another alternative, and that is building a ship canal which would not go through the whole State, which would go around Niagara Falls and come across from Lake Ontario. Such a canal would leave out entirely that portion of the State west, you might say, of Rome, west certainly of Syracuse. Furthermore, whenever you once take the ships of the lakes into Lake Ontario you encourage them to go down the St. Lawrence rather than to come this way.

"When this question was talked of some years ago as something which should be taken up by the general government, the answer was, that is something which will benefit the State of New York; the West does not need it; they can go down the St. Lawrence or some other way; here are other solutions of the question other than this. The State of New York is the State that will benefit by it. The fact that the cities and States bordering on the Great Lakes are becoming populous, using up their products, is the reason why such a thing is needed to take this business here. The exporting grain country has now moved beyond the Missouri River. The exporting grain country is nearly as far from Chicago as it is from Galveston; and what is needed to keep that grain traffic in this direction is to make the freight rates from Chicago to foreign ports as cheap by way of New York and the Hudson River, by way of the City of New York, as from the Gulf ports direct.

"This is something I had not expected to speak about, but as I have spent a good deal of my lifetime in the West, I felt I wanted to say it.

"I acted as one of a Board of Advisory Engineers in the plan and estimates for this 1,000-ton barge canal. The manner in which those plans were prepared, the manner in which the estimates were worked out, and, I think I may say, the *esprit de corps* of the engineers who made them,

were as good as I ever saw. Everything was calculated in detail; everything was mapped out and estimated with a great deal of care; and every estimate, every price, after being considered by the engineers in immediate charge, was submitted to this Advisory Board and approved or disapproved or changed. I do not think there was a single item of any importance omitted in those estimates and calculations; and I think the prices which were put on all the features of the work were as fair as can ever be done in an engineering estimate.

"In some respects they would undoubtedly prove to be low, and in many respects they would prove to be high. I fully believe that the average will prove higher than the price at which the work can be let under proper conditions.

"The question has been raised sometimes as to whether prices of materials had not gone up now. I have been looking over the prices to-day, and the only one which seems to me may possibly be low is the item of concrete, the price of cement having risen. The price of Portland cement to-day is in the neighborhood of seventy cents a barrel higher than the lowest price it has ever been. We are going through one of those conditions that occasionally occur, in which a material not formerly manufactured in this country at all was suddenly brought into prominence as an American manufacture, and it was found that it could be manufactured for a very much lower price than anybody supposed; prices went down, demand came up; and a great many things are being made of cement and concrete which nobody would have thought of making in that way ten years ago. Meanwhile all the mills are doubling their capacity; some of them much more. Cement now is selling for something more than double what it costs to make it. That is a condition which can not continue; as soon as the price falls to a fair basis in comparison with the cost, the estimate made in this report of the State Engineer for this item will be correct again."

COMMENTS OF MR. D. J. HOWELL.

FORMERLY CHIEF ASSISTANT OF STATE ENGINEER BOND IN THE SURVEY FOR THE
IMPROVEMENT OF THE ERIE, CHAMPLAIN, AND OSWEGO CANALS,
BEFORE THE ISTHMIAN CANAL COMMITTEES OF THE
SENATE AND ASSEMBLY OF NEW YORK,
FEBRUARY 17, 1903.

"I would preface what I have to say with the statement that I really have no personal interest whatever in this canal and am merely here in a professional capacity, to give to this Committee any information that I can as the representative of the Canal Committee from the Merchants' Association of Buffalo.

"I would state that I had charge of this work, under the State Engineer, when this survey was made, from its first inception until its completion, and the work was very carefully organized from the beginning, and it was carefully mapped out and prosecuted through all its several steps and stages, in a most painstaking and careful manner.

"We were fortunate in having a corps of very competent assistants, and through the courtesy and leniency of the State Civil Service Commission, Mr. Bond, the State Engineer, was able to employ men on that work, who had been experienced in that special kind of work, and were able to perform the work more quickly and perhaps with more care than it would have been able to be done if we had had to train new men into it.

"The whole work was gone through in a great deal of detail. The report that was prepared, of course, is, we may say, merely an outline of it. The detailed maps, calculations, and all the specifications are on file at the office of the State Engineer and are open to the inspection of any one who sees fit to go through them.

"As the work progressed every feature of it was submitted to and laid before the Board of Advisory Engineers, one of the members of which was Mr. Morison, who has spoken to you here this afternoon, and in addition to that, there were four other members of the Board. Everything was submitted to this Board—all the calculations, plans, etc., as the work progressed, and criticised by them, and if any suggestions were offered they were followed, and when the whole work was finally summed up and the quantities all calculated, the question came up then of placing unit prices upon these several amounts, for the rock, for the earth, etc., and I would further say, that the question of the character of the material along the entire canal was a matter that received especial care.

"A large amount of money was spent in borings along the several routes that were investigated, and samples of the material encountered were preserved and marked at what depth below the surface it was found, and all the notes from this are embodied on the map, and before the unit price was fixed the several classes of material were separated into the different classes, the amount of rock, of earth, and of hardpan, and such other materials, so that a clear understanding of the matter could be had.

"The question of right of way was another matter that was very carefully considered, not only for the amount of land that was to be submerged, but the amounts of land required for spoil-banks—that is, for wasting the material, excavated from the canal.

"Each route was gone over very carefully, and the limits marked out on the detailed maps, all of which are on file, and the amount of land required for this spoil material and the amount of acreage calculated.

"Mr. Bond, the State Engineer, delegated Mr. McNamara, who is a man who I understand is very expert and very experienced in the prices of land through the State, and he also consulted a number of other authorities as to the value to place on the several pieces of land proposed to be taken, all of which was summed up, and in that way the question of right of way was arrived at.

"The unit prices received very careful consideration, not only by comparing other prices that had been used before, but for other pieces of similar work, as far as they could be obtained, although I am frank to say there were none of sufficient magnitude to be comparable with this.

"These prices were then submitted to and acted upon by this Advisory Board, and the total results of each estimate arrived at in that way.

"It is my honest opinion that these estimates can be entirely relied upon, and they were certainly made with the utmost amount of care and detail."

PERIL TO NEW YORK'S TRADE.

The report that two steamship lines are curtailing the dispatch of freight vessels from this port from two sailings a month to one, and that another line contemplates withdrawing altogether, affords further evidence of the peril to the foreign trade of New York. One steamship agent has declared that but for the passenger traffic half the steamship sailings for foreign ports would be discontinued. Statistics of our foreign trade month by month exhibit the tendency of exports through New York to dwindle, while they increase at some other Atlantic ports, increase still more largely at the Gulf ports and tend more strongly to the Canadian routes. For eleven months of the present fiscal year there was a decline of more than \$8,000,000 in the value of breadstuffs and provisions shipped from the Atlantic ports, while there was an increase of more than \$14,000,000 in that sent from the two ports of New Orleans and Galveston. More corn and wheat were shipped from New Orleans alone than from New York. For the week ending June 20 more wheat went from Portland, Me., than from this port. Less than 260,000 bushels came this way for export, while more than 1,360,000 went by way of Canada and Boston. So far as railroad transportation is concerned, New York is finding itself at a disadvantage in the export trade, partly on account of the agreements among the railroads which the lines passing through this State seem to be unable to avoid. The same rates are allowed for the longer distance to Boston, while differentials are allowed to the Atlantic ports southward and the Canada lines work independently. Traffic officers of the railroads between Chicago and New York are just now seeking to obtain a readjustment of the through export rates by way of the Gulf ports, because, as they claim, they can not compete with the low railroad rates down the Mississippi Valley.

The source of the peril is the failure of New York to utilize its one great advantage of water communication from the lakes, which, properly developed, would outweigh every other consideration, and would bring the railroads themselves to better terms. There has been enormous improvement and great reduction of cost everywhere except on the line of the Erie Canal. Ocean freights have been reduced in recent years, and it needs only the maintenance of a large volume of business to insure a

lower cost of transportation from New York to Liverpool than from any other port on our entire coast. It is the inland cost that puts a handicap on the traffic. The increase in volume and the lowering of rates has been much greater wherever there is water communication than where railroad development is relied upon. The increase of tonnage has been immense upon the lakes since the enlargement of the canal at St. Mary's Falls. The increase in size and number of the lake vessels has reduced freight charges beyond anything that is possible on land. When the lake ports are reached the advantage ceases except for routes that can continue water transportation. There are only two such routes, one through Canada and the other through New York State to the Hudson River. That through Canada is natural except for certain relatively short links which have to be canalized, and Canada has appreciated the importance of doing this work to get the benefit of the natural advantage.

New York has permitted its share in that advantage to fall into abeyance, so that its connection with lake ports has practically become one by railroad alone, which puts it upon virtually the same footing as other Atlantic ports. It has become substantially a question of railroad competition, and the strongest force in the competition has favored Philadelphia, Baltimore, Norfolk, and Newport News, and given Boston the same rates as New York, while the whole trunk line combination has to struggle with the routes through Canada and down the Mississippi to the Gulf. While ocean steamers have grown in size and number, and ocean rates have been reduced, and while the lake traffic has developed enormously with a corresponding reduction of charges, New York has neglected its waterway and left itself at the mercy of railroad combinations to determine the cost of transportation from the lakes and control the distribution of export traffic. Its own chief railroad line can not prevent this, and is itself put at a disadvantage by the lack of an effective waterway, which would control competition with the other routes from the interior to the sea and bring traffic its way to its own great benefit.

While development and improvement have made such strides on the ocean, on the lakes and on the rival railroad systems East and South, the Erie Canal has been left with its narrow and shallow channel, throttled with frequent contracted locks, and navigated with the old-fashioned boats, mostly hauled by mules plodding on the antiquated towpath and owned by impoverished boatmen. Everything has fallen into decay and inefficiency, because nothing effective can be done without an enlargement of the channel and the locks. Given a waterway that could be navigated by 1,000-ton barges, owned by capitalized companies and propelled by steam or electricity, and this great link of water communication from the lakes would revive in activity and energy and restore to New York the benefit which nature conferred in making a rift for it through the mountain barrier that shuts the coast from the interior. It would bring down the cost of transportation by this route so as to make it the controlling factor and restore the supremacy which it created in the days before the railroads came. This year the people of New York have the opportunity

of deciding whether this shall be done or the commercial prestige of the State shall be lost.—Editorial from *The Journal of Commerce and Commercial Bulletin* of June 25, 1903.

CANAL IMPROVEMENT RECOMMENDED BY FIVE GOVERNORS.

The public sentiment in favor of radical canal improvement manifested itself upon the delegates to the Constitutional Convention in 1894, and in accordance with that sentiment they proposed an amendment to the Constitution which was as follows: "The canals may be improved in such manner as the legislature shall provide by law. A debt may be authorized for that purpose in the method prescribed by Section 4 of this article, or the cost of such improvement may be defrayed by appropriation of funds from the State Treasury or by equitable annual tax," (Section 10, Article 7, Constitution), which was approved by the people at the general election in 1894.

At the convening of the Legislature in January, 1895, Governor Levi P. Morton in his message to the Legislature, among other things said: "The improvements and administration of the State canals should command most careful and enlightened attention at the present session. Since the inception of that great enterprise the Erie Canal, more than three-quarters of a century ago, the people of this State have continually recognized the impetus it has given to the general progress and commercial prosperity of the Commonwealth. It has been a prime factor in the establishment and maintenance of the commercial eminence of the port of New York.

"It is my duty to emphasize the lesson which these figures teach, and to urge upon you the importance of prompt and statesmanlike action in providing for improvement of the canals and their administration upon a sound basis, unmixed with political or other subordinate purposes and policies."

Thereafter and at that session of the Legislature the \$9,000,000 canal improvement act was based.

The act of 1895 was approved by the people by a very decisive vote, and the State was thereby committed to the improvement contemplated by the law.

Governor Levi P. Morton at the next session of the Legislature said further in regard to canal improvement that "the deepening and enlargement contemplated will doubtless greatly increase the capacity and usefulness of the canals."

Governor Frank S. Black in his message to the Legislature in January, 1897, said that "the improvements to be made on the canals under the

\$9,000,000 act are likely to be justified by the result. They will retain the advantages secured to us by nature and previous expenditures. The progress so far appears satisfactory, and work may be prosecuted with the utmost energy in order that the money provided may not be consumed in the usual experience of commissions and examining board and supernumeraries under different titles, and that also the benefits contemplated may be speedily enjoyed."

Governor Black further said in his message to the Legislature in 1898 that "the canals have been a potent factor in the development of the State. The Erie Canal was completed in 1825, and over it for more than seventy years the enormous traffic of the West has found its way to the Atlantic seaboard. The cost of building all the canals, of maintaining them since and enlarging them now is upwards of \$97,628,867.45, and yet the commerce passing over them paid that enormous amount in tolls in less than sixty years."

Governor Theodore Roosevelt in his message to the Legislature in the year 1899 said that "New York State took the lead in this country in the promotion of the canal system, and the operation of the Erie Canal has been of incalculable benefit, not merely to Buffalo, New York, and Brooklyn, and cities of the Mohawk Valley, but to all of the State; for, when a part of it is benefited, the benefit is shared ultimately by the whole."

"It is essential to the State no less than to the City of New York that our commercial supremacy should be maintained."

In his message to the Legislature in 1900, Governor Roosevelt said further that "the first matter which had to be dealt with on the incoming of the new administration was the question of the canals. New York City led the Union in the development of canal navigation. Of recent years the change in the methods of transportation, by immensely increasing the railroad competition with the canal, has greatly altered the conditions of successful administration of the latter. There were really two questions to be solved in reference to the canals—the first was as to their administration; the second as to the general canal policy of the State in the future. A very slight examination showed that as regards the latter there were not sufficient data to warrant the formulation of an intelligent policy. I accordingly appointed a committee consisting of General Francis V. Greene, Mr. F. S. Witherbee, Major Symons, Mr. John N. Scatcherd, and ex-Mayor G. E. Green, to examine the whole canal question. Their report will be ready in about a fortnight, and will be submitted to the Legislature in a special message, probably submitted at the same time the report of the Commerce Commission."

In the year 1900 public sentiment had so far crystallized on the subject of canal improvement that the Legislature in compliance therewith passed what is known as the "two hundred thousand dollar survey bill" in order that adequate data might be had as to the cost of the construction of a 1,000-ton barge canal as well as the cost of smaller sized canals, all of which had

been included in the report of the Roosevelt Commission appointed by him to make such examination. A corps of engineers under the supervision of the Honorable Edward A. Bond, State Engineer and Surveyor, worked during the year 1900 on that survey and made their report to the Legislature in the year 1901.

THE FREE CANAL QUESTION.

VIEWS OF EX-GOVERNOR SEYMOUR ON THE SUBJECT.

To the Hon. J. W. Higgins, Chairman of the Assembly Committee on Canals,

DEAR SIR: It was my purpose to visit Albany to go before your Committee with regard to the pending amendment to the Constitution. Ill health prevents me from doing so. I therefore venture to address this letter to you. Dictated in a sick room, it will neither be as full nor as clear as I wish. I claim no special intelligence with regard to our canals, but I have been familiar with their history since their commencement to this time. I was in the Legislature in 1842, when all that related to them was fully discussed, not only in that body, but by the press and the citizens of this State. As Chairman of the Committee on Canals, it was my duty to learn all I could with regard to them, and to submit a report to the Assembly. Since then I have had occasion, as Governor, to make communications to the Legislature with regard to them. As a citizen and as an official, I have studied all questions bearing upon our internal commerce by railroad and by water routes. My investigations, which have run through many years, have convinced me that the interests of our State demand

A LIBERAL POLICY.

with regard to both of these promoters of its wealth and prosperity. I have, therefore, not only urged reduction of toll, but also that the right to carry freight, which some of them did not originally have, should be given to the railroads, and that they should be relieved from the payment of tolls to the canals, to which many of them were subjected. As Governor I signed the bill which consolidated the various corporations which now make what is known as the Central road. This legislation has proved to be of immense value to the stockholders; it diverted every year large sums of money from the Treasury of the State for their benefit, and has enabled them to increase their stock and their facilities for business until the united roads have become one of the greatest routes for commerce in our own or other countries.

The question now is, shall the State be as wise and liberal toward its own canals and boatmen as it has been toward the

RAILROAD CORPORATIONS?

Notwithstanding the immense loss of revenue by the State from this policy with regard to the railroads, all now see that it has gained wealth and prosperity by taking off taxes upon commerce. I repel the idea that railroads, or their agents, could be so unwise or ungrateful as to oppose the pending amendment. If our canals should be destroyed in this way it would make a deep and lasting feeling of resentment in the minds of our people. They have been liberal, not only toward what is now known as the Central Road, but also with regard to the Erie Road, which they released from its liabilities to pay a large sum of money. I advocated this release, because I thought it was right.

Many seem to think that the question involved in the pending amendment is only to determine if the canals shall be supported by those who use them, or by taxation upon all parts of our State.

This is very far from being a true view.

TOLLS ARE TAXES

of the most hurtful kind to the whole community. They are a form of special taxation that have been found so hurtful in all parts of the civilized world that they have been abolished to a great degree. They fall oppressively upon labor, industry, and commerce; their exactions, after they have once been paid by the carrier, are transferred and thrown upon our mechanics and other classes of citizens.

All would deride the folly of a city government which should impose a tax upon those who use their streets as thoroughfares or marts of commerce, upon the ground that these avenues were expensive to maintain. Is there any more wisdom in the government of a State which imposes tolls or taxes upon those who use its avenues for the purpose of bringing to it articles needed to promote its commerce and its industries? While other sections are trying to divert traffic from our State by making cheaper routes, is it wise for us to drive it away by taxation? . . .

The object of the amendment is not only to relieve our boatmen and to save our canals, but to

LIGHTEN TAXATION

in every part of the State. That it will do this can be shown not only by reason, but more clearly by experience. When our canals were first projected, they were opposed, because it was feared that, while they might benefit some sections, they would injure others away from their lines. This proved to be the reverse of the truth. The wise way to lighten taxation is to add to the wealth and prosperity of the community. Since the completion of the canals the ratio of taxation upon the extreme northern and

southern sections of New York has been reduced, while the markets for their products have been improved and enlarged.

But it may be said that it is unjust to tax parts of the State for the maintenance of canals which are of no benefit to them. It is not true that this amendment will increase taxation upon such sections; on the contrary, it will lessen the ratio of their assessments. The history of the Erie Canal proves this. When that work was suggested, it was urged in the northern and southern sections of our State that it would tax them for a work too remote to be of any service to them. The result was the opposite of this; the ratio of their assessments has steadily decreased as the commerce of the State has increased. The tables printed in the State Engineer's last report, show that the rate of assessments on St. Lawrence County in the north, and upon Delaware in the southeast, is less than in 1818, before our canals were built, although these counties have increased in wealth and population. This is true of other counties in all parts of the State. To understand why this is so, we must keep in mind the system upon which assessments are made and distributed for State purposes. These are imposed upon each county in proportion to its wealth. Whatever, therefore, contributes to increase the value of property in any section cuts down taxation in all other parts of the State. In 1818, the valuation of the City of New York and Kings County together was less than twenty-five per cent. of the whole State. In 1880 it had risen to nearly fifty-six per cent., or more than one-half of the valuation of the whole State.

If our citizens will consult their County Treasurers, they will learn how much they pay into the State Treasury, and how much is paid out for the cost of the schools, judiciary, etc., for their counties. The excess of receipts is all from the cities of

NEW YORK AND BROOKLYN

which are made prosperous by channels of commerce. The excess of assessments upon our cities is not due to the greater wealth of their citizens, so much as to the fact that trade draws to commercial points large sums and investments from other States and countries. Immense amounts of real and personal property in the Cities of New York and Brooklyn are owned by non-residents, who are thus made taxpayers for the benefit of the whole State. I do not think that the average wealth of the residents of cities is greater than that of those of the country. While in towns many have acquired large fortunes, there are great numbers in abject poverty. It is commerce which brings vast amounts of wealth under the influence of our laws from all parts of the world. These facts show that all parts of the State are directly interested in the growth and prosperity of our chief cities, for they not only contribute largely toward the cost of government and education, but they also make the markets which keep up the value of our lands. The amounts which will be paid by the counties remote from the lines of our canals are and will be small compared with the sums received from points interested in their maintenance. Even this small payment will be temporary. This is proved by the following state-

ment with regard to the growth of New York alone. It does not include expenditures in Brooklyn and at other points on the lower Hudson and the harbor.

"During the year 1881, plans for 2,682 buildings, to cost \$43,691,300, were filed at the Bureau of Buildings. Of last year's buildings, 940 were dwellings, whose estimated cost was \$12,521,500; 356 were flats, costing \$8,080,480; 808 were tenements, costing \$8,284,100; eight were hotels, costing \$923,700; 123 were stores, costing \$3,643,500; 23 were for office purposes, costing \$4,453,500; 116 were factories, costing \$1,723,935; 13 were places of amusement, costing \$1,106,300; six were churches, whose aggregate cost was \$216,000, and six were school houses, that were to cost \$217,000. One thousand four hundred and ninety-seven plans for alteration of existing buildings, at a cost of \$4,142,070, were filed."

These expenditures add not only to the value of the lots improved, but also to all the real estate in the vicinity. It will be safe to assume that the amount of the assessed valuation will be increased nearly one hundred millions in that part of the State, added to wealth by the low cost of transportation during the past year. This low cost of transportation during 1881 has had much to do with the prosperity and growth of New York and of the adjacent cities and towns. It has also restored, to a degree, the relative amounts of the transportation to these points, which have been reduced of late years by rival routes. Can those who are receiving so much from commercial points for the education of their children, the support of government, and for the salaries of their members of the Legislature—of which New York and Brooklyn pay more than one-half, (although they have but 46 representatives of the 106 of that body)—can they be unwilling to make a small contribution to sustain this tide of prosperity which enriches themselves as well as others?

The effort to turn commerce away from our State is an injury aimed at

OUR FARMERS

as directly as against the citizens of our towns. It calls for united resistance from all classes, and from all industries and pursuits. It threatens all kinds of property in every part of the State. But it may be said that the Erie Canal has lost much of its importance by the decrease of railroads. This is a mistaken idea; it grows in value as railroads multiply. It is true they have drawn from it much of its tonnage, but what would their charges have been for carrying had there been no canals? What would they be, if they are destroyed?

It is claimed by railroad officials that they are trustees for the stockholders, and that it is their duty to act with reference to the interests of those who confide this property to their care. There is truth in this. It would be very unsafe to allow trustees to act upon any other principle. If the canals are destroyed, our only protection will be legislation, and this will draw into the lobbies of the capitol swarms of agents employed to influence members of government; suspicions of corruptions, even if they are unfounded, tend to produce corruptions; the belief that

foul practices can be made profitable will draw to the capitol unworthy and dishonest men; this will lead to many unjust suspicions in the public mind which will not spring up while our canals, by the competition of our boatmen, keep charges down to reasonable rates. The public is startled and alarmed at the appearance of a new power, a self-constituted body, which assumes one of the highest prerogatives of a State, that of regulating commerce. Its object is to prevent competition and to form combinations. It claims the right to say what the cost of transportation shall be to different commercial points; it demands that they shall be greater through this State and to the City of New York than to rival markets. If this is persisted in, and is not resisted with proper patriotism and spirit, it will lead to disastrous results. During the past year the Hudson and Central Railroad has asserted its right to carry property upon such terms as it deemed best. This wise and patriotic course has restored to New York much of the trade which had been diverted from it. What the policy of railroad corporations may be in the future we can not foresee; but this we know, while our canals are maintained and their traffic is untaxed, the State will always be protected from hurtful combinations.

It has been proposed to

SURRENDER OUR CANALS

to the general government, if it will enlarge and keep them in repair. The advocates of this overlook the fact that it will put them under the control of influences which are striving to divert trade to rival ports. Baltimore, Philadelphia, and Boston will have in the East the influence of sixty-two members of Congress to aid them in their designs, while New York will have but thirty-three. In the Senate, New York will have but two members, while the rival cities will control sixteen members. This statement does not include the large number of other members who seek to turn the current of transportation down the Mississippi. We have had abundant evidence in judicial decisions and in Congressional schemes of a desire to wrest the control of our canals from our State.

It may be said that this is giving our canals too much credit for their influence, in view of the fact that this tonnage is less than that of the railroads; but their value is not shown merely by the amount they transport and the low rates at which they carry products; we must also bear in mind their influence in reducing the charges on all other routes. So long as they are kept in good condition, we shall be saved from the evils of combinations or unjust discriminations against our State. If they do not carry a pound of freight, it would be wise to keep them in order, so that they would be ready for use to defeat unjust and hurtful charges against the business of New York.

The chief element in the prosperity of every State or nation is the economy of transportation of persons and property. It is the most marked fact in the difference between civilization and barbarism.

Respectfully yours,

Utica, February 27, 1882.

HORATIO SEYMOUR.

THE INTERNAL NAVIGATION OF FRANCE.

BY PIERRE BAUDIN.

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At the present moment France is as deeply preoccupied with the development of her means of transport as she was at those periods when she first had to consider the establishment of her network of railways and of her navigable waterways. She is anxious on account of the inadequacy of most of her maritime ports, which are nearly all either too shallow or too difficult of access, or are lacking in length of quay, warehouse accommodation, means of loading and unloading. The Ministry of M. Waldeck-Rousseau, in spite of its political difficulties, did not shirk the task imposed on it by the situation. In March, 1901, it introduced into the Chamber a "bill to complete the national equipment by the execution of a certain number of waterways and by the improvement of canals, rivers, and ports." It will be noticed that in this project there is no proposal for the construction of new lines of railway, and for this reason: the last program passed in 1879 was so complete that it has not yet been entirely carried out; it is achieved automatically year after year by means of the railway companies, and through the State administration of the railway system it has had the benefit of a financial organization of a very different nature from that adopted in the case of the waterways and ports. Whereas the latter have been constantly checked by variations in the national budget and subjected too frequently to discussion, the railways have received regular subsidies and have been extended systematically in all parts of the country, even into regions where the conditions or the poverty of resources prohibited all return for the capital expended. However, this lack of harmony in the administrative and financial organization of the means of transport in France could not destroy the necessarily close connection of the one with the other in view of the rôle which they play in the national economy. In England, indeed, such solidarity does not exist. Free competition and the absence of State control have enabled the railway companies to undermine the canal traffic, and on the other hand the want of cooperation on the part of the canal builders has destroyed their only means of defense in the violent war waged on them by the railways. I could not describe the state of English navigation better than by quoting here a passage from a report of Mr. Courtenay Boyle:*

"With us the State does not interfere in the construction of canals and railways. In certain parts of the United Kingdom it has contributed a paltry sum for the construction of railways, but that has only occurred at certain points, and, from the commencement, the making of canals and railways has been entirely given over to private enterprise. The State has

* Statement of Mr. Courtenay Boyle at the Fifth International Congress on Internal Navigation, Paris, 1892 (general report on question 9: The respective functions of canals and railways).

stood aside and allowed, as far as possible, complete liberty both to the proprietors of canals and to the business men who make use of them, and has done no more. The result of this non-intervention is that our canal system comprises such varieties of gauge, depth and *régime*, that the carriage of merchandise from one end to the other of the kingdom by water presents the greatest difficulties. . . . The necessary transshipments become so numerous as to increase to a very considerable degree the cost of transport."

This condition of affairs in England has been the subject of vehement complaints on the part of those who have represented the commerce and industry of the country at the various international economic congresses; it has given cause for reflection to the most determined opponents of State intervention as to the dangers of a *régime* which has secured to the railway companies tyrannical domination over the whole economic life of a nation. In France, as in Germany, there is general antagonism between the railways and the waterways; the former put all their methods in motion, money, influence, competitive tariffs, in order to ruin the latter; but we believe that both means are equally necessary in a well organized State. When the purpose of a new canal or port is to be expounded it can not be treated apart from the whole system of transport. I will, therefore, proceed to take a general view of the system in France, and will then discuss more minutely the new proposal of 1901.

II.

The period when the railways sprang into existence in France dates back to the year 1851, when the first stage of our economic revolution was achieved by this incomparable method of carriage.

The national system which had been planned out on paper in 1842 was then beginning to spread over the surface of the land. Already great lines radiated from Paris to the land and sea frontiers, lines destined to unite the capital with the principal cities of the circumference. The length of lines in operation, which ten years before had scarcely amounted to 500 kilometres, was now about 3,250 kilometres, with a traffic of 462,000,000 of ton-kilometres and a net profit of 58,500,000 francs. The figures even then were considerable enough to excite the imagination of the public, who were inclined to look upon the positive results of the railroad and the locomotive as nothing short of miraculous. M. Thiers's peevish remark that the railroad was at best a good toy to amuse the Parisians with was soon forgotten when the advantages of what Lamartine called "the unknown, but the assured unknown" twelve years later began to force themselves more clearly into the minds of the people. They saw that the prophetic views of the illustrious orator of 1838 were on the point of realization: "The iron roads mean the conquering of the world, of distance, of space, of time, and multiply indefinitely the forces of human industry."* Enthusiasm being very exclusive, all this admiration and infatuation could not run its course

* Lamartine's oration delivered in the Chamber on May 10, 1838.

without a certain amount of contempt for the older modes of locomotion, including not only the coach, but also the river and canal boats, the *pinnacle* of the North with its strong sides and wide beam, the fluted *bilander* of Nivernais and Berry, the flat *rigue* of the Rhone and the light *sapines* of the South. The same predictions of an approaching end were launched at them all. And yet at that epoch internal navigation was carried on in France on a vast scale. The system, which comprised 670 myriametres * of river and 375 myriametres of canal waterways, involved a boat traffic of 2,718,000,000 of ton-kilometres. Navigation was particularly active on the Loire, the Seine, and the northern canals. But in five or six years the proportion was completely reversed in favor of the railroads, and the difference became more and more marked up to the year 1880, when the traffic, expressed in ton-kilometres, was five times as great on the railways as on the waterways (10 milliiards to 2 milliiards). This enormous increase in railway traffic was not achieved without considerable extension of the railroads. In 1860 the whole working system was 9,167 kilometres in length, and the traffic was more than 3 milliiards of ton-kilometres; in 1870 the traffic was 5 milliiards of ton-kilometres and the length of rail 15,544 kilometres; and finally in 1880 there were 10,350,000,000 of ton-kilometres traffic over a length of 23,000 kilometres rail. The progress made is largely due to the constitution of the great railway companies and to the amalgamation of the smaller companies with the larger, which enabled the working of them to be effected with greater economy and better arrangements, and consequently with more advantage to commerce. Before 1852 thirty-three companies divided among them the 3,500 kilometres of railroad then constructed. From 1852 to 1857, owing to State influence and to the successive buying up of concessions, the railroads were concentrated into the hands of the six great companies which are in existence at the present time. In 1880 the six great companies possessed 23,000 kilometres of railroad, and 22 lesser companies shared about 1,300 kilometres between them. The cost of transport was at last reduced to a remarkable extent. The average price per ton-kilometre for the carriage of merchandise in general came down from 7.70 centimes in 1851 to 6.14 centimes in 1870 and to 5.95 centimes in 1879-80. I may add that at that period, according to the able calculations of M. Picard, the national output rose, under the influence of the railways, about 5 milliiards, that is to say, 50 per cent. of the capital employed.† Still the railway tariff, though five or six times less than the price of carriage by road, was not by any means so cheap as carriage by water. And yet, whilst the railway companies used every means to destroy the rival which persisted in surviving, the public authorities, hypnotized by the brilliant career of the new method of locomotion, somewhat neglected the rivers and canals. The pretentious aspirations of the railways to monopolize the traffic seemed likely to achieve their purpose in the period from 1867 to 1875. In 1866 the kilometric tonnage of the whole

* A myriametre—a little more than six miles.

† Picard. *Traité des Chemins de Fer*. Tome I., p. 159.

of our navigable system rose to 2 milliards 200 millions. Until 1878 it remained at a figure somewhat below the 2 milliards. I ought to mention that 510 kilometres of waterway were handed over to Germany. However, the boat traffic decreased from day to day on the Loire and on the southern canals. Wherever the railway conquers, it immediately raises the cost of transport, thus disclosing the true object of differential tariffs, temporary weapons which are supposed to be set up solely in the interest of the public with the idea of ultimate reduction. It must be admitted that our system of waterways was far from uniform and displayed numerous gaps, so that it was hardly in a condition to sustain such aggressive competition. Finally, the navigation dues, unimportant and chaotic as they were, still further encumbered the water traffic by an appreciable burden which constituted an additional inferiority. Besides this, at a time when industrial undertakings were only in an embryonic stage, the carriage of minerals and heavy materials was very little developed; the true value of water-carriage was not then recognized—that its slowness is compensated by the smallness of the cost. But as raw materials of cumbrous nature and low value came into request for more and more complex uses, and when industry and agriculture demanded them in more considerable quantities, while, on the other hand, competition was forcing on economies in the cost of transport, recourse was again had to the waterways and to the barges which were infinitely cheaper than trains. As soon as the utility of the canals and rivers again became manifest, in spite of the power of the railways and simply as a result of economic evolution, attention was directed, in view of local experiences, to the grave danger of allowing powerful societies to monopolize the carrying trade of a great country. Immediately after the war of 1870, in face of the necessity, more imperious than ever, of renewing our equipment and developing the forces of the nation, M. Krantz first pointed out in the National Assembly the miserable condition of the waterways, and proposed that the existing channels should be improved and new ones constructed.

During the period from 1831 to 1847 the sums appropriated to waterways had averaged 20,000,000 a year; after 1847 they did not amount to more than 10,000,000.* What was that in comparison with the sums demanded by the roads and railways?† Unfortunately during the succeeding years the budget credits were necessarily much reduced. The State, unable to meet the requirements of the most urgent public works from the slender resources of the Treasury, adopted a system of advances. This is how the system was worked. The State applied to the departments and the

* Krantz. Statement in the National Assembly, *Journal Officiel*, June 24, 25, and 27, 1872.

† "Out of an expenditure of about 16 milliards for the establishment of our system of railways, the State and others interested, apart from the Companies, provided something like $4\frac{1}{2}$ milliards, say more than a quarter, that is, a sum three times larger than that allotted to the canals and navigable channels." (General report of the Commission charged with the inquiry into the bill for the completion of the national equipment, by M. Aimond, Deputy.)

syndicates of the departments, and to the towns and the Chambers of Commerce, requiring them to raise loans on her behalf which she would refund. From 1871 to 1878 work was carried on to the extent of 241,500,000, on which as much as 146,500,000 of money were advanced, and the contributions of the shareholders amounted to 12,000,000. The Eastern Canal was dug (65,000,000), the Saône was canalized (9,000,000), so that communications by water were reestablished which had been interrupted on those lines by the loss of the Alsace and Lorraine provinces. The Northern Canals were deepened, as were those of the Pas de Calais, which were brought to a gauge of two metres (5,900,000). Finally, during this period of reaction in favor of waterways and of sea ports, which had also been too long neglected, a number of undertakings commenced before 1871 were completed, amongst others the National Docks at Marseilles (15,000,000 francs).

In 1878 M. de Freycinet became Minister of Public Works, and under his vigorous guidance several projects were successfully passed through Parliament (April 6 to June 17, 1878) :

	FRANCS.
Seine. To be hollowed to a depth of 3 metres 20 cent.	
between Paris and Rouen	32,000,000
And to a depth of 2 metres between Paris and Montereau	3,500,000
Rhone. General improvements between Lyons and the sea	45,000,000
Yonne. Deepening to the extent of 2 metres between Montereau and Laroche	6,500,000
Burgundy Canal. Improvements	10,000,000
Boulogne. Construction of a deep-water harbor	17,000,000

To justify so much expense it suffices to learn that over the whole navigable system the traffic rose from 1,440,000,000 of ton-kilometres in 1870 to 2,005,000,000 in 1878, and that the tonnage of our maritime ports, which was 12,373,000 tons in 1870, increased to 18,094,000 tons in 1880.

These first results were destined to constitute the principal argument in favor of a far greater development of our means of internal transport and of our maritime constructions. The progress of foreign ports also made demands on our activity. With regard to the waterways the needs of commerce became more pressing; the railways could no longer suffice to serve a country in which all the economic forces were developing simultaneously; limits began to appear to the supposed unlimited powers of the railroad. The fertile principle had already been propounded of dividing the functions between land and water transport, between the barge of 300 tons and the goods van of 10 tons, between the line monopolized practically by a single master and the line open to free competition, a principle not of merciless strife and systematic obstruction, but of cooperation, mutual understanding and parallel development; a

truth which is incontestable to-day, but which has not been uncontested, has indeed been always combated like a noxious weed by those railway companies which are animated by the same old spirit of exclusive domination as before.

In spite of the importance of the works which we have just enumerated, reproaches similar in gravity to those of 1870 might still be made against our navigation system. Not to speak of long gaps in its continuity, it was more like a somewhat imperfect collection of separate trunks than a network in the strict sense of the word, if by such a term we mean to imply a uniform system of channels. There were as many differences of depth, as many varieties of lock and of gauge as there were rivers or canals. On the coasts the rapid changes of naval plant, the new demands of navigation, made new improvement works necessary at the sea ports. That they should be accessible in all states of the tide and to the largest modern liners, that the putting in and the various operations of ships should be facilitated, such was the object to be attained in that quarter. It was realized more or less, together with the unification of the waterways, by M. de Freycinet's program contained in two bills introduced into the Chamber of Deputies on November 4, 1878, on behalf of the Government. These two bills, which involved an expenditure estimated in the case of the maritime ports at 2,906,000,000 and suggested for the waterways at 8,956,000,000 (rivers, 156,225,000; canals, 739,405,900) were the basis of two laws, the first passed on July 28, and the second on August 5, 1879, the latter being entitled a Waterways Improvement Act.

The waterways were divided into two classes: principal lines and secondary lines. The first were those which appeared to meet the general interests of the country and to serve the main traffic. They were not to be handed over to concessionaires. Their dimensions were fixed by law as follows:

Depth of water	2 metres.
Length of lock	38 metres 90.
Width of lock	5 metres 20.
Height above water under the bridges	3 metres 70.

These dimensions allowed the Flemish barge—which carries 300 tons—to enter the field of action. The law included those channels called principal channels, but it did not convey a declaration of public utility. Only laws or decrees to be brought in subsequently on each project could keep the expenses within the limits of the available resources.

To sum up, the proposed improvements involved 4,000 kilometres of river channels, 3,600 kilometres of canals, and 26 sea ports, and the construction of 2,400 kilometres of canals. Adding to these undertakings the completion of the works already in progress, a total estimated expenditure was reached of more than 1,500,000,000.

Of the new lines in contemplation the "principal" ones were:
Canal from the Scheldt to the Meuse.

Canal parallel with the Lake of Thau.
 Canal from the Loire to the Rhone.
 Canal parallel with the Loire (from Combleux to Nantes).
 Canal from the Marne to the Saône.
 Canal from Montbéliard to the Haute-Savoie.
 Canal from the Nord down to Paris.
 Canal from the Oise to the Aisne.
 Canal from Havre to Tancarville.
 Trench from Moulins to Sancoins.
 Improvement of the Garonne between Castels and Bordeaux.

Under the head of unification and improvement were included most of the older canals. In order to meet the expense incurred by these works, in addition to the ordinary sums allocated by the Budget, the Treasury were to have recourse to a loan provided for in a third section added to the Budget under the title of extraordinary Budget, which would constitute a special endowment for the new work. Finally, an act of June 11, 1898, authorized the issue of a public fund at 3 per cent., to be paid off in seventy-five years. But the expenditure still had to be met which would be occasioned by the building of fresh railways provided for in a third act, another and by no means the least part of M. de Freycinet's program, since it involved the spending of $3\frac{1}{2}$ milliards.

Alas! these estimates were far below the truth. The Budget estimates rose from 52,000,000 in 1879 to 103,000,000 in 1880, and to 146,000,000 in 1883. But even so they were not sufficient, although at that point they reached their maximum. In fact in 1882, after a declaration of public utility had carried about half of the undertakings, a revision was made of the program drawn out in 1879. An increased estimate of 458,000,000 over the figures of the original valuation had then to be faced. In the meantime fresh needs were becoming urgent, so that not $1\frac{1}{2}$ milliards, but as much as 2 milliards 450 millions were required to be sure of carrying to completion the public works which had been duly planned. These enormous figures frightened the Government and the Chambers, who, finding themselves driven to the raising of a new loan, preferred to sacrifice a considerable portion of the program involving about 1 milliard (1888). The sums allotted in the Budget fell accordingly to 30,000,000 until the year 1888, when the extraordinary Budget was suppressed, then to 16,000,000 in 1897; they rose slightly between 1897 and 1900. In short, in the period from 1879 to 1900 the amount of expenditure rose to 1,211,000,000. At first sight an examination of the system of waterways in France in 1900 does not show development at all in correspondence with the program of 1879. The total length of canal has increased by 500 kilometres since 1880, and the navigable rivers by 690 kilometres, roughly a total increase of 1,170 kilometres only (10,940 kilometres in 1880, and 12,110 kilometres in 1900).

Referring to the plan of new lines drawn up in 1879, it will be observed that the carrying out of the greater part of it has been postponed. This was the case with the Canal de la Chiers, the canal from the Scheldt to the Meuse, the Canal du Nord, the Loire Canal (Combleux to Nantes),

the canal from Moulins to Sancoins, the canal from the Loire to the Rhone. Only the following had the good luck to be started: the canal from the Oise to the Aisne, the canal from St. Dizier to Passy, the Tancarville Canal, the canal from the Marne to the Saône (still unfinished). Finally the Eastern Canal was terminated, as well as several canals completing the system for the Nord and the Pas de Calais.

But the work accomplished must not be judged by referring solely to these connections, for a considerable feat was achieved during those twenty years by bringing up 3,256 kilometres of waterway to the normal dimensions laid down in the Regulation Bill. From 1879 to 1896 the new works absorbed only 115,000,000, whilst the improvement works took 480,000,000, which shows that they were the most important.

These improvement works have brought up the length of channel having a 2 metre depth from 1,459 kilometres to 4,175 kilometres; the locks have been lengthened to 38 metres 50 and widened to 5 metres 20. "Owing to these works the navigation system, of which the principal lines had been constructed at very different periods and without any regard for general uniformity, was brought to a homogeneous system and unified with the larger channels. The waterways have become great arteries, designed no longer for local traffic merely, but for long-distance transport."*

Passing over the progress made in the equipment, I will endeavor to estimate the benefits accruing, not by the progress itself, but by the increase in traffic which has resulted. We shall find that the figures are extraordinarily eloquent, and will give pause to the most exclusive partisans of the railroad. The kilometric tonnage for the whole system has gone up from 2 milliards of tons in 1880 to 3 milliards 216 millions of tons in 1890, and to 4 milliards 675 millions in 1900.† The total weight of merchandise carried on the rivers and canals, which at the commencement of the unification of the waterways was 19,740,000 tons, was more than 32,500,000 in 1898, an increase of 64.8 per cent. The average distance traveled per ton rose from 110 kilometres in 1882 to 143 kilometres in 1897. Finally the average freights per kilometre on the canals rose from 183,000 tons in 1880 to 384,000 tons in 1900, an undeniable sign of prosperity, and not merely an increase of total traffic due to the opening of new lines.

The suppression of the navigation dues, which finally took effect in 1880, also contributed to raise the transport to these large proportions. "In crossing the frontier of the Nord for Paris a ton of coal was taxed 4 fr. 28 c. The cost of transport by rail being 7 fr. 25 c., there was not much more than 3 fr. per ton margin for the boat service. Now in ordinary times, the freight for coal for that particular journey is from 4 fr. 50 c. to 5 fr."‡

* M. Aimond's Report, already quoted.

† 2 milliards 689 millions of kilometric tons on the canals, and 2 milliards 985 millions on the rivers.

‡ Cauwès, Lectures on Political Economy. Paris, 1893.

Other elements of success were also introduced into the boat service, such as the improvement in towage, the substitution of mechanical traction on many of the waterways for towing either by men or by horses, the erection on several of the quays of powerful cranes; all these things have facilitated rapidity, regularity and security of transport, and have gradually contributed to a lowering of freights, which means a constant widening of the field for commercial operations. The fact that the Government works have been the prime factor in this revival of boat traffic is finally proved by the statement that the increase of business has taken place on the principal waterways. The secondary channels have remained stationary; their kilometric tonnage was 169,000,000 ton-kilometres in 1872; in 1898 it was not more than 288,000,000 ton-kilometres.

I will quote from among the waterways on which the traffic is thickest the following figures:*

	Length in kilo- metres.	Actual tonnage of ship- ments (millions of tons.)	Kilometric tonnage (millions of tons).
Paris to the Belgian frontier at Mons...	284	2,012	982,134
Junction of the Scheldt to the North Sea	221	4,864	390,562
Paris to the frontier on the East side..	494	1,919	456,144
Eastern Line from Givet to Corre.....	432	1,924	332,399
English Channel to the Mediterranean through Burgundy	2,358	8,224	1,155,752
Line parallel with the Loire	275	648	195,165
Atlantic to the Mediterranean	609	1,315	112,849

With regard to the traffic itself, it is composed of the following items:

Nature of Merchandise.	Kilometric tonnage (millions of tons).
Minerals for combustion	2,058
Building materials, minerals	742
Agricultural and food produce	576
Metal industries	535
Wood—fuel and timber	329
Industrial products	255
Soil and manures	122
Various	31
Floating timber	15
Machinery	8

The strength of the canals lies almost exclusively in the carriage of heavy merchandise; rivers, which, like the Seine, lend themselves to steam navigation and the swifter conveyance of goods, can afford the

* Statistics of Internal Navigation. Vol. II., 1900.

same conveniences of transport as the railway for all kinds of articles. In the Nord, where navigation is the same on the rivers as on the canals, the increase from 1891 to 1894 was 612,000,000 of ton-kilometres heavy merchandise (coal, wood, minerals, building materials), and 179,000,000 only for other kinds. But on the other waterways heavy merchandise did not increase more than 458,000,000 of ton-kilometres, whilst other sorts of merchandise went up 488,000,000.* To sum up, therefore, the waterways are practicable for all kinds of transport.

In the meantime what has become of the railways during the last twenty years? They have by no means been forgotten. The sum devoted to the making of new lines is estimated at something like 5 milliards during this period; on the other hand the buying up of railway concessions has absorbed 700,000,000 to 800,000,000. In 1883 the Government, unable at the time to meet the construction of the new system, had handed it over to the companies, promising in return to guarantee the interest of sums subscribed for that purpose. This new scheme of considerable length embraces only the secondary lines, which so far from laying claim to as much output as the principal lines cause a falling off in the companies' receipts. Between 1878 and 1898, whilst the waterways increased only very slightly, the railways grew from 21,435 kilometres to 32,255 kilometres; but when the kilometric tonnage during that period of twenty years was doubled on the canals and rivers, there was an increase only of from 11,064,711,000 to 14,864,940,000 ton-kilometres on the railways. A more serious point is that the average tonnage over the whole distance diminishes singularly in the case of the railway, falling from 448,000 tons in 1880 to 399,000 tons in 1898. The active competition of the boat service is not the only cause of this depression, but there is no denying that it has contributed to force the railway companies materially to reduce their tariffs. On the P.L.M. Line this competition, by the admission of the director, M. Noblemaire, himself, lowered the average cost of transport of the ton-kilometre by one centime between 1886 and 1898.

In spite of this the prices for the carriage of goods demanded by the railway are appreciably higher than those of the boat service, which, as it gradually becomes organized and perfected, reduces freights on the rivers and canals to the lowest scale. To-day the average cost of carriage per ton-kilometre over the whole navigable system is .01 centime. Over the whole railway system it remains between .041 and .052 centime (average .042). So that at the present moment the traffic on our rivers and canals may be estimated at a third of that on the railways, and as the latter comprise three times the length of the former, we may conclude that the bulk of traffic is practically the same by land or by water for journeys of equal length.

M. de Freycinet's program has been attacked for being drawn up on too vast a scale; for having been planned without taking sufficient account of the financial resources of the Government; above all, for having dis-

* M. Aimond's Report.

sipated strength over too large a number of secondary points which were of no use, unless to satisfy electoral greed; and for undertaking the co-ordination of a general system of our economic arteries before the fundamental framework had been completely laid down. There seems to be considerable justification for this criticism with regard to the maritime ports. Between 1879 and 1900 564,000,000 were spent on them without distinct results. The available length of quay grew from 140 kilometres to 205 kilometres, an increase of 46 per cent., and the number of ports with a minimum depth of 7 metres at the highest tide of neap tide, rose from 9 to 15; nevertheless, our most important seaports did not make sufficient progress, and were far outdistanced by their foreign rivals. The fact was that instead of concentrating our resources on the essential points, Marseilles, Havre, Dunkirk, Bordeaux, Rouen, and Saint-Nazaire, seventy other ports had a share of the Treasury's *largesse*. Nantes, which had been almost forgotten and was not nearly so well endowed as Boulogne or Fécamp, did indeed revive, owing to its own will and energy. The development of our chief commercial ports is shown in the following table:

Ports	Total tonnage of ships (standard gauge.)		Total weight of cargoes (tons of 1,000 kilogrammes). The scale of importance is determined by this weight.	
	1870.	1900.	1870.	1900.
	Marseilles	4,372,687	12,376,266	2,665,324
Havre	2,820,406	5,747,750	1,720,559	3,459,000
Dunkirk	973,515	3,225,784	831,834	2,901,000
Bordeaux	1,891,628	4,152,675	1,334,601	2,853,000
Rouen	724,435	2,622,435	435,286	2,684,000
Saint-Nazaire . . .	541,322	1,930,980	323,611	1,755,000
Nantes	348,256	1,194,538	393,628	1,062,000
Cette	621,825	2,052,891	445,245	832,000
Boulogne	613,940	3,026,108	833,676	779,000

Besides Nantes, which is almost a new port, since ships of 2,000 or 3,000 tons have only lately had access to it, it will be noticed that Rouen and Dunkirk have made particularly rapid progress. They are fortunate in being connected with the network of waterways which acts as a valuable means of disposing of or concentrating merchandise. Since the tonnage of ships at Marseilles has only increased by 121 per cent. between 1870 and 1899, and at Bordeaux similar progress has only been made at the rate of 89 per cent., whilst at Rotterdam it was 526 per cent., at Hamburg 445 per cent., at Antwerp 400 per cent. during the same period, the fact of the inferiority of the French ports must be attributed to their not having the support, like their rivals, of a system of waterways radiating from the coasts into the interior.

III.

In spite of these very considerable efforts, the last phase of which I have just been discussing, the definite upshot of a general examination of our canal system at this moment is that the canals mostly run in one part of the country only, to the almost total exclusion of other parts; and by the force of circumstances these are privileged regions. These are the regions where the means of transport are most largely maintained by the abundance of the products, thanks to the rapid progress of commerce and industry. It will be enough to mention the north and the east, the valleys of the Seine and the Saône, and the triangle formed with them by the Loire, from Briare to Roanne. The district through which the boat of 300 tons moves is described by the lines from Dunkirk and Lille to Paris, Rouen, and Havre; from Paris to Nancy, Nancy to Chalons-sur-Saône, Lyons, and Roanne. Starting from the Channel or North Sea coast one is practically unable to reach either the Atlantic or the Mediterranean. Navigation on the Rhone is inadequate, and worse than all, Marseilles is cut off from it. From Cette to Bordeaux the dimensions of the canals are quite below the exigencies of modern traffic. The Loire is unusable from Nantes to Orleans, and quite fails in its natural task of connecting the heart of France and the center of Europe with our Atlantic quays. So that, in spite of the natural advantages of our geographical situation which have been so often pointed out, we are by no means the necessary intermediaries of continental Europe in the transactions between nation and nation; even along the lines of our frontiers, owing to the inadequacy of our waterways, traffic languishes, and the collection or distribution of merchandise is slow and costly. Two equally deplorable consequences ensue. The resources of the interior remain undeveloped in those districts which are traversed by no canals or only by impracticable rivers. The materials are of low value, no doubt, but the traffic is great in wood, forage, manure, stone, minerals, peat, slag, oil-cake, and other waste products which would be choked off by the high price of carriage by rail. On the one hand not to utilize these materials increases the burden of production and retards the accumulation of wealth; on the other, it deprives our ports of an excellent export freight, and this privation is the cause of all the weakness of our mercantile marine.

The second drawback due to this state of things, and equally prejudicial to maritime interests in France, consists of a serious diminution in transit business. "France, instead of being a gateway, a passage, a garden, tends to become an enclosure; the world's commerce choked off, avoids it and goes round," said M. le député d'Estournelles de Constant not long ago.* At Marseilles the transit, which was a considerable standby in the business of the port, decreased in proportions which were all the more distressing because the foreign port of Genoa was getting the benefit of the diverted traffic. In the business of our own port transit counted for more than a third in 1870; it formed only one-eighth in 1900. The build-

* *Revue des Deux Mondes*, 1897.

ing of the St. Gothard Tunnel was partly the cause of this. The Italian port became the purveyor for Switzerland, and every day adds to the international through-traffic on the Genoa-Milan-Basle-Strasbourg Line, which has supplanted the French one. On the north side of Europe the ports on the Scheldt, Rhine, and Elbe have monopolized the trade not only with America but with the Far East, for these rivers serve a considerable hinterland. Even Dunkirk has been deserted by our mineral quarries in the Ardennes, which conduct their business by Antwerp because the waterway leads more directly to the Belgian than to the French coast.

There is, therefore, a considerable task to be undertaken. The work of 1883 has by no means reached its termination, but it will soon do so, and its completion will leave untouched the gaps and weaknesses both of our coast stations and of our waterways. Such as it is, it has already enabled the country at many points to disclose the extent of its resources and has given rise to fresh requirements; it will have facilitated the task which still remains to be accomplished in the future. What is needed is the establishment of a vigorous intercourse over the whole extent of our territory, so that national production, called forth by the mobility of capital, may victoriously maintain the struggle against foreign competition.

In districts already furnished with all the means of transport and at the principal maritime centers business has developed to such an extent that the channels leading to them have become distinctly inadequate. Thus the St. Quentin Canal, on the way from Paris to the departments of the Nord and the Pas-de-Calais, is positively choked with traffic. In the year 1902 it afforded passage to five millions of tons. To double the number of locks would be a feeble palliative, for another difficulty arises, that of supplying them with water. Besides this, the scattered lengths of channel must be connected or equalized and the interrupted communications re-established. The whole scheme elaborated by the Waldeck-Rousseau Ministry is proceeding with this double aim, and as progress allows no time for delay, the realization of the scheme ought to follow immediately on that of the program, which is still in process and ought to be completed about 1905.

Speaking generally, it presents a three-fold advantage, the fruit of lessons learned in the past. Compared with the program of 1879 that of 1901 is singularly modest, and that fact should insure its complete and rapid execution. In spite of the serious expenditure it would entail, it need not throw fresh burdens on the budget, thanks to a financial combination which has served to exclude from the program all works not of incontestable utility. And finally the bill, as passed by the Chamber of Deputies, contains a new facility. It practically contains a provision that works provided for by law may be declared to be of public utility by a simple decree, *as long as the general conditions laid down by law for the amount and apportionment of the funds are maintained.** Half the funds

* It is to be hoped that the Senate will itself ratify this provision, which would shorten the necessary delay before starting the work. Up to now the Commission entrusted with the examination of the bill has shown some hostility to it.

must be found by the Government and half by the districts to be benefited, in the case of new undertakings; for mere improvements the assistance of interested parties is not necessarily required. This innovation which, apart from lightening the charge on the public finances, has the advantage also of bringing local initiative and responsibility into play, will not pass without provoking some objections. In order to recoup themselves for their outlay, the departments, communes, chambers of commerce, etc., are to be allowed to refund *the whole or part of their expenditure by the collection of certain tolls and by letting the right of towage*. Now it has been objected that this would be a return to the old navigation dues, which were abolished in 1880 after more than thirty years of persistent and universal opposition. It has also been said that part of the country, the very districts which had up to that time been disinherited, would again be sacrificed and placed in a distinctly inferior position, in not getting the benefit of a free gift of the new works. The whole point is to discover whether, given our financial situation, the Government alone could undertake to pay for the works. The answer must be, no; and as it would be better to run a canal with a small toll charge than to keep on hoping indefinitely for the gift of a free canal, the interested parties have now definitely rallied to the Government scheme, as is manifest from the inquiries and reports which preceded the drafting of the bill. The theoretic objections are of equally little value; the old navigation dues were an impost which together with others flowed into the general State Treasury; they prevailed all over and were permanent. The new dues would have a specific object; they would be local and temporary and would in part be mere tolls. As to concessions for towage and the use of machinery which would arise from the application of the new law, those already in existence serve to show the advantages to be obtained in the way of rapidity and economy in working waterways for important traffic.*

From the financial point of view, the development of the works described in the canal program may again be divided into two schedules, one for improvements to be undertaken or completed, the other for new enterprises. A third schedule comprises works to be executed at the seaports. The estimated total expenditure amounts to 703,000,000, of which in round numbers 50,000,000 would be spent on improvements, 485,000,000 on new canals, and 185,000,000 on the ports.† The bill as it was first drawn up by the Government involved an expenditure of 610,000,000—41,000,000 for improvements, 456,000,000 for new enterprises, and 113,000,000 for maritime ports; 326,000,000 were to be given by the State.

In the North Eastern district two great proposals first engage attention, the canal from the Scheldt to the Meuse, prolonged by the Canal de la Chiers (154 kilometres and 85 kilometres), and the Canal du Nord (94 kilo-

* This is the case on the St. Quentin Canal, and on the canals from the Marne to the Rhine, and from the Sambre to the Oise, on the Upper Scheldt, on the Meuse, etc.

† We have here taken the estimates of the bill as modified and completed by the Chamber of Deputies and passed in January, 1902.

metres, to be constructed). The first will satisfy the desires of Dunkirk and the Ardennes to be economically interdependent. The interest lies entirely in this, that transport through Belgium practically costs about 6 fr. 70 c. per ton from Longwy to Antwerp, and that the freight from Longwy to Dunkirk by the newly projected waterway would come down to about 5 fr. per ton.* Finally the distance by canal from Dunkirk to Nancy and to Mezières will be less than from Antwerp. At present that is not so, and merchandise is consequently turned aside from the frontier provinces into the Belgian ports. There will be coal and coke for cargoes going east, and minerals and wrought metals for the return cargoes. In view of the extension of business which the opening of this canal will ensure to the port of Dunkirk, a considerable enlargement of its docks is provided for.

The Canal du Nord will relieve the St. Quentin Canal of its overplus of traffic, and in running alongside of it will permit of an increase in the transport of coal from the north to Paris. Business will no longer be at the mercy of any accident on the only existing waterway which may unexpectedly keep an interminable string of barges at a standstill for months. The new canal will branch off at La Sensée and go up as far as Noyon-sur-Oise, reducing the distance by 42 kilometres on the line from Paris to the coal wharves at Sens, and enabling freight to go down to the normal rate of 3 fr. 60 c., that is, .012 centime per kilometric-ton instead of .019, which is what was paid on the present canal in 1899-1900.

In the basin of the Loire the program consists of the making of a canal between Nantes and Orleans, the first section of which is to make use of the bed of the principal river and will be begun at once. It will be the outlet of the great central artery which is to reach Basle and carry the sphere of action of Saint-Nazaire and Nantes as far as the Rhine. Basle is 824 kilometres from Rotterdam and 1,006 kilometres from Nantes; there is a difference of 182 kilometres in favor of Rotterdam, say 2 fr. per ton less in the cost of transport; but we are well aware that in the ports of Rotterdam, Hamburg, and Bremen, ships arriving from the Atlantic pay 5 fr. per ton more than in our Atlantic ports. In favor of the mouth of the Loire there will be therefore a bonus of more than 3 fr., which will suffice to draw the traffic. In addition to this rivers and canals will be joined on which, even in their present isolation, there is considerable local traffic. Thus Nantes receives or dispatches 300,000 tons of merchandise each year by the canals of Brittany, the principal line extending as far as Brest; the Maine, formed by the conjunction of three rivers, carries traffic of more than 100,000 tons to the port of Angers. In the region of the Lower Loire, which is a most active hive of industry, and where the dockyards are equal in productive power to those of Provence and the Basse-Seine put together, the navigability of the Loire would be a new and most decisive source of prosperity. The great iron girders, horizontal shafts, rudder-posts, sheets

* Statement of M. Dreux, Director of the steel works at Longwy, at the Congress of Chambers of Commerce for the Eastern district.

of armor-plating for iron-clads, on account either of their weight or of their bulk, can not travel by rail; starting from Creusot, they make a long circuit by the Central Canal, the Saône, the Seine, and the English Channel, and reach Nantes or Saint-Nazaire at a distinctly high cost. Is there any wonder that the ships built in our yards are so dear? We have now some idea of the effect that the carrying out of these important works will have on the development of the ports of the Loire. The latter are preparing to equip themselves accordingly, and the bill of 1902 largely supports their enterprising spirit. Ships of a draft of 8 metres will have access to the wharves of Nantes directly through the Loire. The proposed expenditure ought not to exceed 22,000,000. The large meadows which now lie in the middle of the river might be worked on and transformed as need arises into docks or yards for the handling of traffic. Saint-Nazaire is to have an armament dock which will free the other docks from too great an encumbrance of ships in course of completion. A bill passed some time ago is now being carried out which will give this port a new entry accessible to the largest liners in all states of the tide.

On the Mediterranean side, Marseilles has secured as her share of the scheme a sum of 34,000,000 for the extension of her docks.* For a long time the obstruction has been so great that ships could not lie alongside the quays, and unloading could only be carried on by the slow and costly means of lighters. The regular lines have appropriated almost all the available space, and the operations of ships arriving without notice drag on for long enough. Modern business and the important capital employed in a steamer can not put up with such delays. We make the mistake in our country of following the current of affairs instead of foreseeing and being beforehand with it. In the contest with foreign ports our inferiority is partly due to this. Our position has to become untenable before we think of altering it; we wait too long and then take everything in hand at once. On the land side the bill ought to have provided at the same time for the construction, so many times postponed, of the canal from Marseilles to the Rhone. So strong is the attraction of water carriage that merchandise, delaying no longer, has resolved to do without the canal for the time being. Communication is kept up between Marseilles and the Rhone by means of tugs adapted to both river and sea traffic. In 1900, 678 tugs, called sea-barges, brought in 48,000 tons which had come down the Rhone, and carried up nearly 100,000 to their destinations, over the whole upper basin of the river. Such an expedient can only be applied to a very limited class of goods. Marseilles ought to be connected with the Rhone as quickly as possible in order to protect herself effectively from the competition of the port of Genoa and recoup herself for the business which the Italian route has snatched away. The near prospect of the opening

* The total area of the port of Marseilles is 232 hectares. The water surface is 150 hectares, the quays 82 hectares. There are two outer harbors and six docks open to shipping, one armament dock. A new dock is now in course of construction, 68 hectares in extent; 47 hectares of it will be water and 21 hectares, quays.

of the Simplon again suggests prompt action. Finally, from the point of view of export freights, the new channel will no doubt yield very satisfactory results. Marseilles suffers, indeed, from a lack of freights, and most of the magnificent liners which call there sail under conditions which are ruinous to the shipping people. If you study the figures, you will see that Marseilles is the one amongst our great ports where the average ship-cargo is lowest in proportion: a ton of standard gauge reckons to carry 519 kilogrammes of goods—that is to say, the total capacity of the ships is nearly double the amount they really carry.

With regard to the Rhone, where improvements are continuing, is it likely to be in good enough condition for navigation? It has been said not. But as it is now, although it ends in an *impasse*, and although the enlargement of the locks of the Upper Saône and adjacent canals is still unfinished, so that the district traversed by its own special class of material is at present reduced, yet the section from Lyons to Arles, which is the longest and most difficult, has seen its net tonnage rise from 440,000 tons in 1887 to 580,000 tons in 1900. These figures are not to be despised. The transformation of the locks on the Saône, which is being effected between Verdun and Gray, will afford for carriage from the coast to the center a uniform channel 605 kilometres in length, that is, equal to the length of the Elbe between Hamburg and Aussig in Bohemia, with a depth which is practically the same at low water.

I have enumerated the principal objects aimed at by the bill now submitted for the approval of Parliament; but it is destined to bear also on the other weak spots which I have already pointed out.

In the first place there is the waterway from Bordeaux to Cette. It is proposed to regulate it better for the passage of boats of from 300 to 400 tons, instead of the 100 to 150-ton boats which pass along it with great difficulty now. Since the canal parallel with the Garonne and the southern canal were bought up, under a concession made formerly to the Southern Railway Company, which took effect in 1898, the kilometric tonnage has gone up by two-fifths; this increase augurs well for the future. As for the railway, which in old times endeavored to close up the waterway by the establishment of prohibitive dues, as the English companies owning canals do, it has been obliged to admit that it has profited by this recrudescence of traffic. In any case, the port of Cette ought to benefit considerably. Maintained in former times by trade in wines and cereals, it is now striving to become a center for industrial operations. The Government bill tends to facilitate this movement. It will be connected with the Rhone by a more modern canal. Its triple outlet to the sea, to the valley of the Garonne and to that of the Saône will suffice to attract industry to the shores of the Pool of Thau, which would become directly accessible to cargo boats drawing 7 metres 30 of water. The movement is already indicated by the recent establishment on its banks of petroleum refineries, manure works and blast furnaces.

I will refer secondly to the proposal for a canal from the Rhone to the Loire on the level of Givers and Saint Etienne (at an estimated expendi-

ture of 123,000,000). The chambers of commerce of these towns complain very justly of the exceedingly high charges exacted without shame on merchandise by the Paris-Lyon-Mediterranée Railway Company who have the exclusive monopoly of transport in the district. One fact is certain, that from 1880 to 1894 the production of metals on the Loire fell from 248,000 tons to 118,000 tons; and that of the 76,000 tons of coal consumed at Roanne in 1896, only 35,000 tons were supplied by the coal industry of the department; now formerly this industry extended its operations into 43 departments and even to Switzerland and Italy.* It is for disadvantages of this character that a remedy is required.

The bill also comprises improvements on the Seine in the ports of Rouen and Havre, where the channels and docks are too shallow and too narrow to admit of the great transatlantic ships turning with any ease. The Seine which is of capital importance passes through our two largest internal ports, Paris and Rouen. Taking all the Paris ports together, the traffic has gone up to 9,300,000 tons in 1900; at Rouen in the same year it was more than 1,930,000 tons, whilst in this place of the highest commercial rank the traffic by rail was not much more than half that amount. The canal service carries to their furthest destination more than half the goods imported by sea, and brings back in return to the ships more than three-quarters of the cargoes destined for export.

There still remain to be noticed the ports of Boulogne, Dieppe, and Bayonne, which are also to have a share in the extension; they are secondary ports, but nevertheless useful in view of the considerable development of our coasts. Boulogne—to mention only the most prosperous—has seen a very rapid increase of business during the last three years, for it has been used as the last European port of call by the Netherland and German liners belonging to the Rotterdam and New York and the Bremen and New York Lines. The traffic handled in its all too narrow docks is now as much as 900,000 tons, and the tonnage of ships entering or leaving reaches the imposing figure of 4,200,000 tons (fishing smacks, 1,150,000 tons; merchant boats more than 3,000,000 of tons).

In this manner the renovation of our equipment should proceed over the whole territory of France. A dozen years are required to bring this operation about successfully and to reap the fruits of it; but from this moment, owing to the very fact of the formulating of this bill and the minute investigations to which it has given rise, the efforts after a better use of the national stock have had free scope and have produced results. We know now how to proceed in order to get the maximum return from any canal or river. All the elements which go to make up the one significant figure, the cost of transport, have been disentangled and analyzed. Subjects for comparison have been sought in all the countries of the world,

* Bellecroix. Connections between the Canal Service and the Commercial Seaports. Paris, 1902.

and by the singular irony of things applications of theories born on French soil have occasionally been found. One society alone, whose name should by no means be kept secret, the *Société de la Loire Navigable*, founded at Nantes in 1893, has accumulated more documents than the cause is worthy of in favor of waterways and on the subject of their proper functions. One of the statements emphatically laid down, apart from questions as to the dimensions required for business purposes of the present canals, the towage of the boats, the organization of the professional bargemen, the management of the internal ports and the rate of freights, is that we must insist on the necessity, universally expressed, of a good understanding between the railways and the canal service which will bind them in close collaboration. The Government, by all means in its power, is striving to effect this, and the few preliminary successes, difficult as they have been of attainment, have nevertheless already given satisfaction in this direction. We said indeed last year in the Chamber that the greater part of the work done by the State for the waterways would be wasted unless we could obtain from the railway companies the necessary agreements which commerce and industry have so long demanded. This question of the future of the railways and waterways will have the constant attention of the Consultative Committee for Internal Navigation and Ports which I established before leaving the ministry. The work which remains to be done in this direction may be estimated by the facts that the points of contact with the railroads are 1 in 109 kilometres on the Rhone, 1 in 130 kilometres on the Garonne, 1 in 176 kilometres on the Loire, and 1 in 187 kilometres on the Saône; and finally by the fact that in the case of twelve of our navigable rivers which together measure 2,253 kilometres, and fifteen of our canals which comprise a total length of 1,378 kilometres, there is not a single point where goods can be transferred from barge to truck and *vice-versa*.* In Germany, on the contrary, there are points of contact on the great rivers at distances of 38 kilometres.†

We have been thinking of infusing a new spirit into the regulations. Up to now the railway companies have shown far too little interest in the public welfare and have forgotten that they were just associates of the Government in its work of civilization. They have assumed exclusive sovereignty over their system, just as the feudal lords ruled their dominions in open hostility with their neighbors. The Government is resolved to break down these principles of uncompromising selfishness and to keep its hand more than ever before on the toll rights of its vassals. The fertile idea of cooperation is to be imposed on the great and powerful administrations which have endeavored to wrap themselves up in proud isolation to the great disadvantage of the public.

I have now only to express the hope that the work which I have just to a considerable extent sketched out may be promptly achieved. Time presses, for our neighbors are also making progress and more rapid progress than we, modifying by their incessant activity the conditions of

* Bellecroix; already quoted. † Laffitte.

economic life. Germany is arranging for the completion of her marvelous framework of waterways. Austria, Russia, and Italy are dreaming of grand canals; Belgium is anxious to enable her sea-vessels to sail up into the heart of her provinces; England is proposing to connect the waters of the Thames with those of the Mersey, and the waters of the Forth with those of the Clyde, and to endow Sheffield with a ship canal like that at Manchester, whilst at the same time she is pressing forward the construction of a new port at Dover, the "National Harbor," in which the State has shares to the extent of 100,000,000 francs.

Maritime ports are subjects of constant anxiety. The Atlantic Trust, which so far from destroying competition, sustains it, announces an order for twelve liners which are to be stronger and swifter than the largest specimens of the fleet. The old Cunard Company meets the challenge by putting ships on the stocks which are to be 750 feet long and to go at 25 knots. This is a warning that the prediction of engineers are likely to have a speedy fulfilment, and that the ship of 30,000 tons will be frequently seen on the high seas. Those who wish to keep their place in the struggle must therefore be equipped, and we hope that the present efforts in our country may provoke new ones. Old Europe is arming against the power of America, and France must learn how to make her alliance with other nations a desirable thing.

REPORT TO THE STATE DEPARTMENT, WASHINGTON, D. C., ON RIVER AND CANAL IMPROVEMENTS IN ITALY.

In nearly all the commercial countries of Europe the canal seems to be regaining its long-lost prestige. Germany has expended during the past ten years hundreds of millions of marks for the construction of artificial water courses, and Austria will expend during the next nine years no less than 325,000,000 crowns (\$65,975,000) for a like purpose, while Italy seems to be determined not to remain far behind in the improvement of inland navigation.

About two years ago the Italian Government appointed a commission to investigate and report upon the advisability of establishing a system of national waterways in the northern part of the kingdom. This commission, which is presided over by the former Under Secretary of State and present member of Parliament, Romanin-Jacur, has just made its report. It recommends the establishment of a network of inland water courses of a total length of 3,400 kilometres (2,112 miles). This great work can be achieved the more easily because northern Italy has already 2,700 kilometres (1,677 miles) of navigable rivers and canals, and these can be connected

with each other by a system of auxiliary canals of a total length of less than 700 kilometres (434 miles). The commission estimates the total cost of the proposed improvements at 118,000,000 francs (\$22,774,000). The opinion is expressed, however, that the actual cost to the Government will not exceed 77,000,000 francs (\$14,861,000), as at least 41,000,000 francs (\$7,913,000) are to be realized, it is hoped from gain of water power, estimated at 48,000 horse power, and from increased facilities for agricultural irrigation.

The main line of the proposed system would be a canal connecting Venice with Milan and Turin. Another canal would connect Milan with Bologna, and a third Bologna with Venice. It is further proposed to open an inland water course from Venice to the Austrian frontier for which purpose the rivers Stella, Corno, and Ausca could be utilized.

An improved system of water highways would be a powerful stimulus to the farms and factories of northern Italy, enabling manufacturers to collect their raw materials and fuel with less labor and expense and opening more distant and more profitable markets for both industrial and agricultural products.

There is no doubt that the proposed system of canals would benefit principally the port of Venice, and for this reason it is likely to be opposed by the Ligurian provinces. Another opposing element would probably be the railroad interests. The canal commission denies, however, that it would curtail either the foreign trade of Genoa or the volume of railway traffic. While the heavier freights—coal and certain kinds of raw material—would go to the canals, there would be a corresponding increase in freights requiring speedy carriage by rail and sustaining proportionally higher transportation charges.

It is worthy of note that some of the canals which it is proposed to make use of in this national system of waterways were constructed nearly five hundred years ago, and that one of them is known to have been equipped with lift locks as early as 1497.

FREDK. W. HOSSFELD, *U. S. Consul.*

TRIESTE, June 19, 1903.

THE ERIE CANAL—ITS PAST AND FUTURE.

BY M. M. WILNER.

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The canal system of the State of New York now consists of one trunk and two branch canals. The main trunk canal is the world-famed Erie, extending from Buffalo to Troy, whence boats go by the Hudson River to New York. The Oswego Canal extends from Onondaga Lake,

near Syracuse, to Oswego, on Lake Ontario; the Champlain, from the Hudson River, near Troy, up the banks of the river to Fort Edward, and thence to Whitehall, on Lake Champlain. Formerly there were three other lateral canals, reaching the southern sections of the State at Olean, Elmira, and Binghamton; but these have long since been abandoned, as has the Delaware & Hudson Canal, connecting the Hudson River with the anthracite coal regions, which was owned by a private company. The three existing canals, however, are the only ones which have been considered in the great scheme of improvement for which the New York Legislature has proposed the expenditure of \$101,000,000. The Erie Canal is now 352 miles long, has a depth of from 7 to 9 feet, and a width on the bottom of 52½ feet. The capacity of its boats is 240 tons. The variations in depth are due to the fact that the improvements begun in 1895 were left uncompleted. The Oswego Canal is 38 miles long, with the same varying depth as the Erie; and the Champlain Canal is 66 miles long, with 7 feet as its greatest and 5 feet as its governing depth.

What is now proposed is to enlarge all three of these canals to a uniform depth of 12 feet, with a minimum bottom width of 75 feet, making them capable of carrying boats 150 feet long, 25 feet beam, and with a draft of 10 feet. The cargo capacity of these boats will be 1,000 tons, or more than four times that of the present boats. This amounts practically to building a new canal system, and for considerable portions of the routes followed it will be a new canal, involving the total departure from and abandonment of the present channels. Where the early engineers preferred to dig a ditch along the bank of a natural watercourse, the new plans call for the utilization of rivers and lakes as much as practicable. Boats will use the Niagara River between Buffalo and Tonawanda; instead of an aqueduct at Rochester, a pool will be formed by a dam in the Genesee River south of that city, raising the river to the canal level; the Seneca and Oneida Rivers will be utilized and the canal carried through Oneida Lake, and the Mohawk River will be canalized from Little Falls nearly to Cohoes. In like manner the Hudson River will be utilized as far north as Fort Edward. This will shorten the Erie Canal to 342 miles, the Oswego to 23 miles, and the Champlain will remain of about the same length as at present.

The undertaking thus planned is almost as great an enterprise for to-day as was the building of the original Erie Canal for its day. It is a greater public improvement for the State of New York to carry out than is the building of the Panama Canal for the United States Government, and enthusiasts believe it is of hardly less commercial value. Its cost will be more than half the estimates for the Panama. The decision of the Legislature is the culmination of an agitation that has been carried on persistently by the commercial interests of New York, especially in New York City and Buffalo, since a commission appointed by Governor Roosevelt reported, in 1899, that a 1,000-ton canal was the best solution of the State's transportation problem. General Francis V. Greene, now Police Commissioner of New York, was the head of that commission.

Numerous alternative plans have been considered at various times, but these were reduced by the Legislature of this year to the simple choice of appointing a commission to confer with the authorities of the United States Government and see if it would consent to assume the whole or a part of the expense of building a ship canal across the State. That proposition was rejected, and the \$101,000,000 appropriation will now be submitted to the people of the State, to be approved or rejected finally, for under the Constitution a referendum is required on all appropriations for public improvement involving an expenditure of more than \$1,000,000.

GOVERNOR CLINTON'S "BIG DITCH."

The triumph of the canal bill before the Legislature invites a look backward into the history of New York's famous system of internal waterways. On the evening of October 25, 1825, Governor De Witt Clinton and a distinguished party of gentlemen from Albany and New York arrived in Buffalo. It was a journey which public men did not make so often then as they do now, for horses furnished the most practicable means of locomotion. The following morning, October 26, was ushered in by an artillery salute. At nine o'clock a procession, in which marched nearly every man in Buffalo who had legs to march with, moved down Main Street, headed by a band of music and a company of riflemen, and followed by a party of workmen with spades. Governor Clinton, in a carriage, brought up the rear. The procession marched to the Erie Basin, where the Governor and other eminent gentlemen boarded the canal boat *Seneca Chief*. Jesse Hawley, the first public advocate and probably the actual originator of the Erie Canal, made a brief speech on behalf of a committee from Rochester, to which Judge Oliver Forward replied on behalf of a Buffalo committee. At ten o'clock the attached horse power was put in motion, and the *Seneca Chief* set out on its journey to the Hudson amid the wildest cheering of the assembled people. Its departure was announced by the firing of a 32-pound cannon. Other cannon, stationed at convenient intervals along the canal, repeated the shots, one after another, and thus the news was carried to Albany, 350 miles distant, in one hour and forty minutes. Up to that time this record for rapid transmission of news over so long a distance never had been equaled. Governor Clinton's entire journey to New York was a triumphal progress, unique in American history. On arriving in New York, he sailed out into the bay and emptied there a keg of water brought from Lake Erie. His boat, the *Seneca Chief*, was followed by one containing a committee of the most eminent citizens of Buffalo, who, upon their return, brought with them a keg of water from the Atlantic Ocean, which was taken out into Lake Erie and emptied. Thus the waters of the lake and ocean were mingled.

The canal opened to commerce by Governor De Witt Clinton was and is the longest in the world, outside of China. At the time Governor Clinton traversed it, it was 70 feet wide on the surface and 28 feet wide on the bottom, and its depth was 4 feet. The boats which it was built to

accommodate were 78.62 feet long, 14.46 feet wide, and drew $3\frac{1}{2}$ feet of water. Their capacity was 75 tons. A man could have waded across it at any point without having to stop a conversation for fear of getting his mouth full of water. Governor Clinton was a man of imagination and foresight, but it may be doubted if in his wildest dreams he ever looked forward to a time when his little ditch would grow to a size that would accommodate boats 150 feet long and 25 feet wide, with a draft of 10 feet and a cargo capacity of 1,000 tons. From a 75-ton boat to a 1,000-ton boat in about eighty years seems marvelous, when considered in the abstract; but when considered in connection with the general commercial growth of this continent, the conclusion must be that eighty years have been much too long a time to wait for this enlargement. It is now acknowledged by nearly all who admit any need for canals that the day for the 1,000-ton boat has come. Both the Republican and the Democratic parties in New York, at their State Conventions last September, pledged themselves substantially to enlarge the canals to this size. The fact that the party leaders would not permit a political division on the subject is a significant recognition of the popularity of the enterprise.

A PAYING INVESTMENT.

One explanation of this, no doubt, is the fact that until the last few years the canals of New York always have paid. Previous to the construction of the original 4-foot ditch it cost \$100 to move a ton of freight from Buffalo to Albany. After the opening of the canal the cost immediately fell to \$10 a ton, and even at that the profit to the boatman was very large. The trade of the rapidly growing West, which up to 1825 had gone down the Ohio and Mississippi Rivers to New Orleans, began to come down the lakes to Buffalo, and on through the State by canal to New York. The cities along the canal route—Buffalo, Rochester, Utica, Syracuse, Albany, and Troy—received an impetus of which their present size, as compared with the corresponding row along the southern border of the State—Dunkirk, Olean, Hornellsville, Elmira, and Binghamton—is an evidence. Most important of all, the great port of New York was given its proper standing as the metropolis of the country, and its position remained unchallenged and unapproachable until the decline of the canals had destroyed to a great extent their control over commerce. It was the Erie Canal which made New York the Empire State.

The immense proportions of the commerce which passed over this waterway are shown by the fact that up to 1883, when tolls were abolished, it had turned into the State Treasury \$131,801,797.91. This sum exceeded the total cost of building, improvements, and maintenance by so large an amount that, if the balance had been turned into a special canal fund and invested at 4 per cent., it would now be very nearly sufficient to pay the entire cost of the proposed enlargement. In 1835, the Legislature authorized an enlargement of the canals, similar to the one now planned. This work dragged along for many years, and was not finally completed

until 1862. It nearly doubled the size of the 4-foot ditch which had been built by Governor Clinton, making its general dimensions and capacity of boats substantially what they are now.

Commerce immediately showed the effects of this improvement. The first year after the enlarged canal was completed, the amount of produce carried increased by more than 1,000,000 tons. During the ten years following, the canals carried each year nearly double what they had averaged in the later years of the 75-ton boat. That is another reason for the confidence of those who have studied the subject that similar or greater results will follow the enlargement which is now contemplated.

CANAL VERSUS RAILROAD AS A FREIGHTER.

The most attractive arguments, however, are not historical, but statistical. The estimates of engineers put the cost of carrying a ton of freight from Buffalo to New York in barges of 1,000-ton capacity at 26 cents. Compare that with the \$100 a ton from Buffalo to Albany previous to 1825, and with the \$10 a ton that was paid originally for canal transportation. This rate of 26 cents a ton is equal to .8 of a cent for a bushel of wheat, or .52 of a mill per ton per mile. On the present Erie Canal the cost of transportation averages 87 cents a ton, or 2.62 cents for a bushel of wheat, or 1.9 mills per ton per mile. The cost of railroad transportation from Buffalo to New York for the last few years has averaged about 6 mills per ton per mile. The cost of carrying wheat, which is the principal article in competition between the railroads and the canal, has been considerably lower, but it has still kept in the neighborhood of 3½ cents a bushel, or \$1.17 per ton, or 2½ mills per ton per mile. Arithmetic is dry reading, but no one who appreciates the importance of commerce in developing the prosperity of a commonwealth can fail to be interested in these figures. The contention is incontrovertible that, with such a reduction in freight rates between New York and Buffalo as this canal would cause, New York would again become master of the trade of the West as absolutely as when the cost of carriage from Buffalo to Albany was cut from \$100 to \$10 a ton. The difference between .52 of a mill and 2½ mills per ton per mile is as great for this age as was the difference between \$100 and \$10 per ton for 1825.

THE TRAFFIC THAT WAITS ON CANAL ENLARGEMENT.

The canal which has been planned will be comparable with no other in the world. There are ship canals of more imposing dimensions, so far as depth and width are concerned, but even the great ship canals are dwarfed when the length of the New York waterway is taken into consideration. The estimated cost of this new Erie Canal, with its branches, is about the same as that of the Suez Canal. It may safely be predicted that the tonnage which it will carry annually will much exceed that of the Suez.

The trade already brought to the borders of New York and clamoring for a cheaper outlet to the seaboard is so enormous that figures fail to give an adequate conception of it. The traffic which passed through the canals at Sault Ste. Marie in 1901 amounted to 28,403,065 tons, of which 23,087,742 tons came east. The Suez Canal, in 1901, passed 10,823,840 tons. And the trade that comes down from Lake Superior is only a part of the grand total which concentrates in Lake Erie. Almost as great a quantity originates in Lake Michigan ports. Of grain alone, flour reckoned as wheat, the port of Buffalo received, in 1902, 119,534,437 bushels, and the figures have reached as high, in 1898, as 262,912,849 bushels. That represents only a little of the great prize for which the people of New York are reaching in building this canal. But, some one asks, does not New York already get the cream of this commerce? It did at one time, and its proportion is still very large, but investigation has shown that the commerce of the port of New York has been increasing more slowly in the last ten years than that of rival ports, and its supremacy has been growing more and more doubtful. Its grain exports fall considerably below the annual receipts at Buffalo. In 1898, the Legislature of New York directed the Governor to appoint a commission to investigate the causes of the decline in New York's commerce. The fundamental idea in the report of this commission was that the remedy for the decline is to enlarge the canals.

NEW YORK'S INDUSTRIAL POSITION DEPENDENT ON SHIPPING FACILITIES.

Nor is this commercial feature the only one. New York has not been getting its share in the manufacturing development that has marked the last decade of American history—or, at least, New York has not been getting the share that should come to the State with a proper development of its natural advantages. Especially is this true of the towering giant among manufacturing industries—iron and steel. The entire capital invested in iron and steel plants in the State of New York was shown by the census of 1900 to be but \$13,292,346, and the total value of the product was but \$13,858,553. This represented a decline from an output of nearly \$16,000,000 in 1890, and more than \$22,000,000 in 1880. Pennsylvania's output of iron and steel in 1890 was \$434,445,200; Ohio's, \$138,935,256; Illinois', \$60,303,144. Each of these States made enormous gains during the decade—from \$265,000,000 in Pennsylvania; from \$65,000,000 in Ohio; and from \$39,000,000 in Illinois. In nearly all of the other manufacturing States the gain in iron and steel production was very great. Indiana's output advanced from \$4,742,760 in 1890 to \$19,338,481 in 1900; New Jersey's, from \$11,000,000 to \$24,000,000; Alabama's, from \$12,000,000 to \$17,000,000. New York alone fell behind. It is manifest that New York's only great natural advantages are her commercial routes, harbors, and water power. There are few mines of importance in the State; no large forests remain; New York farms are too small and too poor to produce much of the raw material for manufactures, except of butter and cheese. It is commercial position

alone which makes New York the first manufacturing State in the Union. If shipping facilities have developed New York's manufactures, their improvement is essential to continued progress, for in commerce and industry a commonwealth must either go forward or backward; there is no dead center for it to rest in.

The fact that the State has lost ground in such a vital industry as iron and steel is, therefore, cause for alarm. Pennsylvania's start as the great iron-producing State was due to the possession of iron and coal mines. At present, however, the great source of iron supply is northern Michigan, Wisconsin, and Minnesota. The ore either goes to Chicago or comes down the lakes to northern Ohio ports. This trade has built up iron manufacturing in Ohio and Illinois. A great part of the ore, however, is transshipped by rail to Pittsburg and neighboring points. Then the manufactured product also has to seek an outlet by rail. In 1901, the rail rates were so high that Pittsburg tried successfully the experiment of shipping its steel to Conneaut, on Lake Erie, transshipping it by lake to Buffalo, and then by canal to New York. Cleveland also has tried the experiment of shipping steel in canal boats to Buffalo, and thence to New York. It is obvious that, if a water route is of such vast importance to iron manufacturers, a locality which can combine the advantages of all-water transportation both for the raw material and the finished product affords exceptional attractions, and that is what the entire Niagara frontier of New York can offer when the canal is improved. In 1894, the people of the State voted \$9,000,000 to deepen the Erie Canal to 9 feet. The appropriation was made hurriedly, without any adequate surveys or estimates to show what sum would actually be required for the work. The result was that it failed to accomplish more than about a third of the improvement expected. Yet the prospect held out by this improvement had much to do with starting on the shores of Lake Erie, adjoining Buffalo, an iron and steel plant, with a capitalization of \$40,000,000, which promises to be one of the greatest in the world. Since then still another, though less extensive, plant has been begun. With such object lessons, the conviction is unavoidable that a water route to tide-water capable of making a rate of 26 cents a ton will quickly put New York in its proper place among the great iron-manufacturing States.

The importance of this manufacturing development to the whole State must impress all who consider what it implies. It will not merely add millions to the trade of the metropolis and to Buffalo, at the western terminal, but it will give to all cities and towns within reach of the canal system an advantage that must have an incalculable effect on their growth and prosperity. The manufacturers of machinery through Central New York can secure their raw material and ship their finished product at the same rates that will build up the terminal industries. Shipbuilding plants on the Hudson River and around New York will have an advantage unequalled by any other points in the United States. Through the Oswego and Champlain Canals, the cheap transportation will extend to the northernmost limits of the State, developing especially the Adirondack iron

mines, and through the interior lakes, it will reach well into the southern portion. There is hardly a corner of the State so remote as not to feel the throb of this new business life.

CHEAP TRANSPORTATION FOR WESTERN GRAIN.

But aside from State prestige, the advantage of this reduction in transportation charge would be sufficient to make it well worth while. Its effect on the price of food products alone is a very important consideration. The price of wheat is now made in Liverpool. The New York price is, roughly speaking, the Liverpool price, less the cost of transport across the ocean; and the Chicago price, which controls the West, is the New York price, less the cost of transport from Chicago to New York. Wheat is now brought from Chicago to Buffalo by lake often for as low a rate as 1.2 cents a bushel. The average for 1902 was 1.5 cents. It costs about $3\frac{1}{2}$ cents a bushel to send the grain on from Buffalo to New York. The new canal is calculated to take $2\frac{1}{2}$ cents off this charge. Whether this means a higher price to Western farmers or a lower price to Eastern consumers is a matter for argument. But if it causes a higher price, New York farmers will benefit by it, too; and if the consumers get the saving, New York has more of them than any other State.

This Western interest has led many persons to urge that New York should turn its whole canal system over to the Federal Government, which should build for it a canal that would enable lake vessels to go through to the seaboard without breaking bulk. Probably no idea ever has appealed more strongly to dreamers of commercial greatness or been more often rejected by practical men after careful investigation. One great argument against it is suggested by what already has been said in this article about the effect of the water route on New York's rivalry with other States. Whatever the gain to Western grain shippers, New York would be the one great beneficiary of this canal. Its advantage would surpass that of all other States combined. Would it be reasonable to expect the representatives in Congress of other States to vote millions to build an internal trade route in New York which would directly promote New York's rivalry with their own constituencies? New York's commercial decline means the relative advantage of every other port from Portland to Galveston. Every one of them has been gaining on New York in recent years. The trade down the Ohio and Mississippi Rivers fell away after the opening of the Erie Canal, and has been reviving since the canal's decline. The rivals of New York in Congress are and must always be more numerous than its friends. Could New York trust the maintenance of its commercial supremacy in such hands?

WHY A SHIP CANAL IS IMPRACTICABLE.

That is the local view. There is a broader and more convincing one. Every argument that has been made on behalf of a ship canal has this

fatal weakness—that it fails to give proper weight to the great length of the waterway and the time required to traverse it. From Buffalo to West Troy is 352 miles. A lake vessel going at the rate of four miles an hour, which is reasonable speed in a canal, would require three days and sixteen hours to make that journey, supposing it traveled twenty-four hours a day, which, in practise, would be impossible. Then there would be the trip down the Hudson to New York, much of which would require nearly as slow progress, and the same time for the return voyage to Buffalo. In a word, the lake vessel could make at least two, and very likely three, round trips of the lakes in the time it would take to go to New York and return to Buffalo by canal and river. Not only is the time of the lake vessel valuable, but the ship also represents a heavy investment of capital, on which it must pay dividends. In order to make a canal voyage pay, therefore, the lake boat would have to charge at least three and probably four or five cents a bushel for wheat, and a proportionate rate for other commodities. That is more than it costs now to ship by rail. As an illustration of the value of time to a lake vessel this incident may be mentioned: During a strike at Buffalo in 1900, by which the unloading of vessels was delayed, a lake captain, who had reached port with a cargo of 175,000 bushels of corn, said that he was losing \$350 a day for every day he was held at Buffalo. Would that captain have cared to take his vessel on to New York and back under such circumstances?

Whoever advocates a ship canal across New York meets with a very discouraging reception when he talks with a practical lake seaman. The men who would be expected to use such a canal know that it would not pay to do so. If built, a special barge would have to be designed for the ship canal, and the transshipment of cargoes would continue as at present. Doubtless the immense barges that a 22-foot canal could carry would reduce still further the transportation charge, but the reduction would not be enough to compensate for the difference between a \$101,000,000 and a \$200,000,000 canal. This will be still better appreciated when it is remembered that the labor and power cost of operating the larger boat would be at least as great as for the smaller, and the investment of capital considerably greater.

The plain fact is that there is a limit beyond which it would not pay to enlarge a canal so long as the Erie. That limit would probably be passed if anything greater than the 1,000-ton canal were attempted. At least the 1,000-ton canal represents the greatest economy in transportation that the best engineers who have studied the subject can compute. That is why it has finally been preferred to all other plans. Up to this year a considerable element in New York believed the completion of the 9-foot waterway, upon which \$9,000,000 already has been spent, would be the wiser course, but discussion and study appear finally to have convinced all that the truest economy is to enlarge to the greatest practicable limit at once, and let the lost \$9,000,000 be charged to unhappy experience. A channel 12 feet deep will be a ship canal for all practical purposes.

CANAL CASE SUMMED UP.

BY THE CANAL IMPROVEMENT STATE COMMITTEE.

For a period of nearly twenty years past, the business interests of the State have been patiently and persistently working for a proper improvement of the State's waterways.

This agitation was begun and continued for the reason that year after year the port of New York has been steadily losing its proper share of export and import traffic of the country, and the growth in manufacturing and industrial enterprises in the State has not kept pace with sister States in proportion to our natural advantages. In order that the best plan of improvement might be secured, having in view the present needs of the State and with careful consideration of the future, most competent commissions were appointed by Governors Black and Roosevelt carefully to investigate this proposition. In addition, most careful surveys and estimates were made, and information was collected by the State authorities through the office of the State Engineer. As a result of the conclusion reached by these various eminent authorities, the business interests of the State have decided that the commercial, manufacturing, industrial, and agricultural supremacy of the State will best be preserved and maintained through the construction of the 1,000-ton barge canal.

These twenty years of agitation have served to bring forth certain phases of opposition to the proposition, and it is proper that the various arguments against canal improvement should be carefully considered.

One of the most common statements made by the enemies of the canals is that the demand for the improvement of the canals can be traced to certain terminal, dock, and elevator interests in the cities of New York and Buffalo. The facts are that while perhaps not the sole owners, the railroads centering at Buffalo and New York practically control the terminal, elevator, dock, and lighterage interests of those ports, and certainly they would not be likely to be clamoring for canal improvement. The opposition leave out of sight the fact that there is not a single commercial organization in the Cities of New York and Buffalo that does not demand the enlargement and improvement of the Erie Canal as provided for under the 1,000-ton barge canal plan, and the further fact that the preponderating business interests of both cities emphatically agree in urging the adoption of the proposed plan for the improvement of the waterways of the State.

The statement is sometimes made that there is no condition or emergency in the development of the great commercial centers of New York and Buffalo which would justify the incurring by the State of an indebtedness for the construction of the 1,000-ton barge canal; practically saying that the rate of increase in the population and wealth of the cities of New York and Buffalo justifies the conclusion that the cities of New York and Buffalo have sufficiently prospered and do not require any further aid through the improvement of the waterways of the State.

Admitting that the Cities of New York and Buffalo have developed and prospered under the construction and operation of the Erie Canal, which was a most efficient transportation route until within the last thirty years, the fact yet remains that the former commerce of the City of New York has not only shown a relative decrease as compared with competing cities of this country during the last twenty years, but has actually fallen off in export as well as in import trade in the last few years. Proofs as to the correctness of this assertion can be found by consulting the reports of the Chamber of Commerce of New York, the reports of the Commerce Commission appointed by Governor Black to examine into the commerce of New York, the cause of its decline and the means for its revival, and the report of the Committee on Canals of New York State appointed by Governor Roosevelt, and we do not believe that the concurrent testimony of these bodies, consisting of most competent men who have given very careful attention to the subject, can be lightly disregarded. This testimony goes to show conclusively that the commerce of the State of New York is now at the mercy and under the control of the railroad combinations, which, through discrimination, divert traffic to other ports and to other States as may best suit their convenience or their business interest; that the Erie Canal is at the present time in a nearly useless condition, in which it can not furnish the service required to compete with the railroads and exercise its former vocation of a regulator of transportation rates, whereas the roads have steadily and enormously increased their efficiency.

The conclusions arrived at by the Committees of the State of New York are in a line with the views announced by the Committee of Interstate Commerce of the United States Senate in 1885, as follows:

"The evidence before the Committee accords with the experience of all nations in recognizing water routes as the most efficient cheapeners and regulators of railroad charges. Their influence is not confined within the limits of territory immediately accessible to water transportation, but extends further, and controls railroad rates at such remote interior points as have competing lines reaching means of transportation by water.

"Competition between railroads sooner or later leads to combination or consolidation, but neither can prevail to force unreasonable rates in the face of direct competition with free natural or artificial routes. The conclusion of the Committee is, therefore, that natural or artificial channels of communication by water when favorably located, adequately improved, and properly maintained, afford the cheapest methods of long distance transportation now known, and that they must continue to exercise in the future, as they have invariably exercised in the past, an absolutely controlling and beneficially regulating influence upon the charges made upon any and all means of transit."

The Erie Canal to-day, in its neglected condition, carries a larger quantity of local freight, i. e., between points within the State, than foreign goods, and the same proportion will obtain in the improved canal, besides which, the possibilities of industrial development along the line

of the canal through the saving in water transportation of coal, iron ore, and other raw materials are unlimited. Andrew Carnegie writes on this subject as follows:

“With an enlarged canal, barges could go to any part of New England without transshipment of cargo, and, on the other hand, we should have the empty barges in which we could bring from New York City to our works on the lake the ores which must be imported from South Africa and the Caucasus. The saving over rail transportation to Philadelphia and Baltimore would be so great that the Western part of New York on the lakes would inevitably become one of the principal seats of manufacture. Nothing can prevent this if a suitable waterway between Buffalo and the ocean be kept open. We intended to manufacture pig iron on Lake Erie to supply Rochester, Utica, Syracuse, Troy, and, of course, New York and Eastern parts, so that the foundries of these cities would have cheaper pig iron than ever before.”

Certainly this possible development of the industries of the interior of the State justifies the assertion that the proposed development of the Erie Canal is expected to and will redound to the benefit of not only New York and Buffalo, but practically the entire State from the lakes to the sea.

The statement has been made that New York and Buffalo are “two towns of very moderate relative importance to the rest of the State.”

As evidence of how much importance these “two towns” really are to the State at large, we may observe what each county whose representative at Albany last winter was opposed to canal improvement received from the State in various ways and what it paid to the State Treasury in return. The items in the first column show what these various counties paid into the State Treasury for direct tax, for excise moneys, and for transfer tax. They could not pay a penny into the State Treasury in any other way. The second column shows what these counties received from the State for their schools, the support of their insane, their share of legislative expenses, their share of court expenses, for support of State charities, State prisons, and the Agricultural Department, but omits many proper items that should be charged against the various counties but can not be so easily separated. The list given is by counties, and gives the names of their representatives, who have been especially bitter against canal improvement:

Senator	County	Payments to State	Received from State for Items Noted
Raines	Ontario	\$25,379	\$121,820
“	Wayne	10,474	99,388
E. R. Brown	Jefferson	45,833	168,437
“	Lewis	4,939	70,693
Armstrong & Lewis	Monroe	134,587	449,954
Allds	Sullivan	7,049	74,001
“	Delaware	8,241	111,737

Senator	County	Payments to State	Received from State for Items Noted
Allds	Chenango	15,678	94,961
Ambler	Columbia	29,036	89,618
"	Dutchess	68,906	176,324
"	Putnam	9,904	50,721
W. L. Brown	Otsego	16,682	111,502
"	Herkimer	18,021	100,987
Barnes	Rensselaer	87,554	270,954
McEwan	Albany	141,727	341,351
Fançher	Cattaraugus	44,039	146,199
"	Chautauqua	51,222	164,239
LeFevre	Ulster	13,352	167,721
"	Greene	16,918	70,510
Malby	St. Lawrence	15,834	198,252
"	Franklin	7,355	85,693
Sherwood	Steuben	27,628	199,862
"	Yates	5,206	60,944
Stewart	Chemung	31,051	131,390
"	Tompkins	19,894	83,386
"	Schuyler	3,725	46,661
Stevens	Wyoming	6,103	70,189
"	Livingston	14,081	94,538
"	Alleghany	6,807	98,009
Wilcox	Cayuga	31,369	146,070
"	Seneca	9,626	61,336
		<hr/>	<hr/>
		\$928,220	\$4,157,447

We have, then, the counties composing the district which last winter bitterly opposed the canal improvement proposition receiving from the State, for only a few items of State expenses, over \$4,000,000, and paying into the State Treasury less than \$930,000. What these various counties are not taxed for, the "two towns of very moderate relative importance to the rest of the State," New York and Buffalo, contribute, to the amount of eight-five per cent., and thus relieve them from paying the enormous sums which they would otherwise have to pay.

The suggestion is sometimes made that a four track railroad should be constructed by the State along the present route of the canal. It is evident that this suggestion is made solely for the purpose of opposing canal improvement, for any thinking person must acknowledge the utter impracticability and economical impossibility of such a proposition. They must realize that such a route would be practically worthless if built only from Buffalo to Albany, and that to be of any service whatever, except for purely local traffic, it must not only have traffic arrangements (which is surely could never obtain) with competing railroads belonging to sys-

tems connected therewith through the State of New York, and outside of the State, but it must also extend to the City of New York, with proper terminals. In view of the enormous sums the Trunk Line Railroads have found it necessary to spend for the construction of proper terminals in the City of New York, it is not difficult to understand that the building of a railroad for the local traffic alone from Buffalo to New York would cost a fabulous amount. Assuming that it were possible to obtain and construct terminals in New York for such a railroad and to fill in the connecting link between Albany and New York, how could such a railroad be operated? It could not be used by everybody and anybody as a highway or a canal can be, in which the vehicles of transportation can freely pass each other or stop, at will, without hindrance or special regulation, but a railroad, to be of any service, must be operated under a single authority or by a single corporation. Is the State to be that authority, and is the State to go into the business of not only owning but also operating a vast railroad system between Buffalo and New York City? What would the present Trunk Line Railroads say to such a proposition? Would they submit to a State-owned and State-operated railroad paralleling their lines and competing with them, and would the people of this State for one moment seriously consider such a scheme?

The experience of the civilized countries of the world is that water transportation has been, is, and probably always will be, the cheapest form of transportation known to man. Notwithstanding these facts, there are occasionally found those so bold as to consider the experience of the rest of the world in water transportation as being a matter of no importance in solving the problem of transportation in this State. Although Germany, Austria, France, Russia, Belgium, etc., are burdened with enormous national debts, these countries do not hesitate to increase their indebtedness continually in order to add to their means of transportation the most modern and improved artificial waterways, the construction of which occupies the time and attention of their best statesmen and the highest engineering talent of the present day. It is estimated that France, since 1814, has spent more than \$750,000,000 on waterways and highways. Germany to-day has over 9,000 miles of canals and navigable rivers, and is now planning the construction of a canal to connect the Rhine to the River Elbe. Russia has under consideration the construction of a canal connecting the Baltic with the Black Sea, and other countries are planning similar waterway improvements in every direction. If no importance is attached to foreign experience in this matter, behold the results of water transportation as developed on the Great Lakes! It is incontestably true that products are now moved over the Great Lakes at the cheapest rate of freight possible on any inland transportation route in the world. This fact has been recognized by the great railroads of this State, who have established lake lines of steamers which carry the products of the West to Buffalo and the produce of the East to Chicago, a distance of one thousand miles, at rates enormously less than the same roads can move

traffic by rail from Buffalo to Chicago, a distance of less than five hundred miles.

The statement is sometimes made that there is the highest degree of probability that the estimates of cost of construction of the 1,000-ton barge canal are too low. This statement invariably emanates from men who are not engineers and who have had no experience in the construction of great public works, but who make this wild and random statement simply for the purpose of misleading others. Such assertion is entirely unsupported by the opinion of any engineer of standing, and those who make it have certainly not consulted any expert opinion in the matter of the estimates of the cost of construction. The plans and estimates on which was based the cost of canal improvement were the result of a study of years by a body of engineers whose operations were characterized (as stated by Professor William H. Burr, Professor of Engineering in Columbia University and a member of the Isthmian Canal Commission) by a degree of thoroughness and technical preparation which has never been excelled in the consideration of any similar engineering question. Professor William H. Burr and Mr. George S. Morison, Past President of the American Society of Civil Engineers, and a member of the Isthmian Canal Commission, were both members of the Advisory Board of Engineers of the Canal Survey, and these eminent engineers emphatically stated at Albany that the most complete surveys and most careful investigations were made of all questions connected with the estimates and plans for the proposed canal improvement. The Board of Consulting Engineers and its staff also had before them a great mass of surveys and examinations made by the United States Deep Waterways Commission directly along a large portion of the line of the proposed improved waterway. All the plans and estimates after their development by the Board of Consulting Engineers and its staff were laid before the Advisory Board of Engineers, consisting of Professor Burr, Mr. Morison, Mr. Elnathan Sweet, the former State Engineer; Major Kingman, Corps of Engineers, U. S. A.; Major Thomas W. Symons, Corps of Engineers, U. S. A.; and Mr. Alfred Noble, President of the American Society of Civil Engineers and now in charge of the construction of the Pennsylvania Railroad terminals in New York City. Mr. Morison, Professor Burr, Major Symons, and Mr. Noble emphatically stated that, in their opinion, the estimates upon which the 1,000-ton barge canal plan was based would be sufficient and would not be exceeded. Mr. Sweet is dead, and Major Kingman did not appear before the Committee. Mr. Morison, Professor Burr, and Major Symons expressed the opinion that there had been but a slight advance in the price of labor since the survey was made. The price of materials, in the opinion of these eminent engineers, would not be materially exceeded, with the exception, perhaps, of Portland cement, which enters into the construction of the improved canal; they thought, however, that the present high price of Portland cement would

in the course of the next few years probably be considerably reduced by the construction of new Portland cement factories. In this connection, Professor Burr made the following statement before the Joint Canal Committees:

"This work can not be done in a season; it would be spread over a number of years, and it is as certain as anything human can be that when so great a work as this shall be undertaken, special plans, special appliances, efficient organizations, and all those things which go to make up a businesslike treatment of the work, will reduce the cost materially below these figures, which apply to ordinary quantities of such work performed under ordinary conditions."

Mr. Morison at the hearing stated as follows:

"I believe that if it is properly handled, with a competent set of engineers and a competent staff of inspectors, with a perfectly fair letting and everything handled in the best way in which the best management handles it, this canal can be built inside of the estimate."

There is a suspicion frequently expressed that there may be corruption in connection with the proposed canal construction, and this is sometimes urged as another objection to the improvement. The act passed by the Legislature and to be submitted to the people next fall contains stringent regulations formulated by Major Thomas W. Symons, Corps of Engineers, U. S. A., and designed to prevent fraud and waste. Under its provisions, the work is to be divided into suitable sections, each of which shall be under the charge of a resident engineer, with assistant engineers and inspectors, all to be appointed by the State Engineer. Contractors are placed under bonds for the faithful performance of their work, and the same guarantees are required of these contractors that are demanded by the United States Government in the construction of public works. Unbalanced bids, which have been a faithful source of corruption in the past, are prevented by the provision in the act prohibiting the award of any contract to a bidder whose bid as a whole or in any items varies more than a fixed percentage from the estimate of the State Engineer, unless the variations can be explained to the satisfaction of the State Engineer and the Canal Board, consisting of the Lieutenant Governor, Secretary of State, Comptroller, State Treasurer, Attorney General, Superintendent of Public Works, and the State Engineer and Surveyor. Work before being contracted for must be advertised once a week for four weeks in newspapers in the Cities of New York, Albany, Rochester, Buffalo, and Syracuse, also in each county in which the particular piece of work is located. The act gives the Canal Board full power to assume the direction and control of the work when it appears that the quantity of any item of work is unduly over-running the Engineer's estimate, and provides further for the appointment of a Board of Expert Civil Engineers, to be named by the Governor, to advise and aid the State Engineer and the Superintendent of Public Works, and to exercise general supervision over the work. The responsibility for the careful and economical construction of the work is, therefore, lodged primarily in the hands of the

State Engineer, who is subject to the Canal Board, and whose work is supervised by the Board of Expert Engineers appointed by the Governor. In view of all these precautions adopted in the act, it would hardly appear that the work could be safeguarded in a more thorough manner.

It has been stated that the work of canal improvement will bring an excessive influx of foreign labor into this State to the detriment of its existing labor interests. If this argument were a sound one, no public improvement of any kind should ever be undertaken, because it would be likely to furnish a very large amount of work to be done by some one. It is certain that the proposed improvement of the Erie Canal will bring employment and good wages to a very large number of our people in this State, not only in the construction of the work itself, but in the enterprises which the canal improvement will create throughout the State at large.

Occasionally we hear the complaint that the furnishing of water for the supply of the canal will drain the lakes and streams in the State along the line of the canal to the detriment of municipalities and to the injury of water powers. An examination of the exhaustive surveys made by competent and well-known engineers, embodied in the report of the State Engineer to the Governor, in 1901, shows that special attention was paid, under these surveys, to the important question of the water supply for the purposes of the enlarged canal. The profile of the proposed waterway shows a continuous descent from Lake Erie to the Seneca River, a distance of about half the length of the entire canal. Lake Erie furnishes the water supply for this entire distance. The Mohawk River, canalized, furnished the water for the larger part of the remainder. Its water supply presents no difficulties, and the requirements for the water supply of the intervening link, the Rome level, from Oneida Lake to the Mohawk, a comparatively short distance, have been fully provided for by a system of water storage, which will furnish the supply that is needed without endangering or embarrassing any vested interests. The water storage provided for under the act will not only preserve all the existing rights of towns and industries in respect to their water supply, but, in addition to furnishing a full supply of water for the 1,000-ton barge canal, additional water will be supplied for the use of towns and manufacturing establishments along the line of the canal by the storage system which has been adopted.

In some quarters the suggestion is made that the adoption of the canal improvement that will be submitted to the people next fall would involve the reimposition of a direct tax, and a heavy increase in taxation. If the present policy of the State is continued, as it no doubt will be, namely, to provide for the expenses of the State from sources of indirect revenue, the 1,000-ton barge canal will be constructed without imposing any burden on the farm or the home. The constitutional amendments, extending the time for the bonds issued in payment of the canal improve-

ment from eighteen to fifty years, and enabling the canal bonds to be paid from indirect revenues, have been passed by the Legislature and will be duly submitted to the people for their approval. If for any reason, in years to come, the policy of the State with regard to the raising of money for the expenses of the State should be changed, it must be borne in mind, that in any plan of taxation, Greater New York and Buffalo will pay more than eighty per cent. of any State expenses, the canal cities and towns will pay one-half of the remainder, and there will therefore only be a trifle of ten per cent. left for all the rest of the State to pay. The prosperity of Greater New York and Buffalo is, and will continue to relieve the burdens of all counties outside of these two cities.

Canal opponents seek to create the suspicion that the improvement of the Erie Canal will necessarily hinder the construction of good roads. This suggestion is made by the enemies of the canal for the sole purpose or arraying the farmers of the State against the canal proposition. The course of legislation at Albany has clearly shown that the same interests that stood solidly for the 1,000-ton barge canal, have also distinctly recognized the necessity of the construction of proper highways for the farmers of the State, and have supported, unanimously, all legislation for good roads. The two great Cities of New York and Buffalo, who will pay more than eighty per cent. of any moneys that will be required for the proposed canal improvement, stand fully committed to the proposition of good roads for the farmers, toward which expenditure they will also contribute their eighty per cent. of all moneys appropriated by the State for that purpose.

The suggestion has been made that it would be preferable to adopt the so-called "Lake Ontario Route" for an improved canal between Lake Erie and the Hudson River. This route has received careful investigation by competent engineers and by the business interests of the State, and has been rejected. Lake Ontario can not be navigated by ordinary canal boats in the spring and fall, as the insurance rates on that class of vessel on Lake Ontario are prohibitive. To navigate the waters of Lake Ontario on this canal route, vessels must be of stronger and heavier construction than those vessels that are confined exclusively to canal navigation, and the additional cost of such a vessel capable of navigating Lake Ontario would be approximately one hundred per cent. more than that of an ordinary canal boat, involving a much higher interest charge on the combined lake and canal vessel. The cost of maintenance and operation would necessarily be higher, as not only more men but crews of higher training would be required. Owing to the weather conditions during the early spring and fall on Lake Ontario, the towing of barges would be dangerous and at times impracticable. The substitution of the Lake Ontario route for that portion of the inland canal between Buffalo and Syracuse would deprive a considerable part of the State of the benefits that are expected to result from the improved waterway.

As a last resort of the enemies of canal improvement in this State,

the well-known National Ship Canal proposition is brought forward. Such people, after charging danger to the State from the use of a very small amount of water for the 1,000-ton barge canal, clamor for a ship canal that would require a very much larger quantity of water. The advocates of the ship canal scheme present a very fascinating picture of ocean-going steamers taking freight direct from the Western cities, through the lakes and through the canal, and across the ocean, without breaking bulk. To compete with an ocean-going steamer of the present day, such steamers must draw between 30 and 35 feet of water, they would therefore require a depth of canal of 35 feet, with corresponding size of lock. They would furthermore require an entire reconstruction of the channels between the lakes, and of the harbor work in all lake cities. No estimates of a ship canal of such size, and of the work needed to adapt the harbors of the Great Lakes to such craft has ever been made, and the expense of a ship canal of this size, with the expense of deepening the harbors and channels, would involve enormous sums of money heretofore unheard of. It is highly improbable that the Congress of the United States would ever consent to undertake a work of this magnitude, which would be the signal for demands from all parts of the Union for the execution of works of similar magnitude, in favor of particular localities. New York State would be obliged to surrender the Erie Canal to the National Government, and New York's commerce and industries, so far as they depend upon the canal, would thenceforth be at the mercy of a hostile Congressional majority, when application is made for the appropriations necessary, from time to time, to maintain the canal and the lake channels and harbors.

Assuming that all these difficulties, which are insurmountable, can be overcome, what is the gain? A ship canal that would not be used by ocean-going steamers! The type of vessel used for ocean transportation is totally different from the type in use on the lakes, as the type of vessel on the lakes again differs from that in use on the canal. The ocean-going steamer costs twice as much as the lake steamer, being built to withstand the storms of the North Atlantic, while a canal barge is a cheap affair, costing about one-fourth of the price of a lake steamer. In the opinion of shipbuilders, it is absolutely impossible to combine the three types in one vessel that would be economical for a trip through lake and canal, and across the ocean. The ocean steamer, of costly build, could not make a better rate of progress through the canal than 5 or 6 miles an hour; whereas she is built for a speed of two or three times as much. The result would be economically disastrous to ocean steamers.

Commenting on the ship canal through the State, Mr. Andrew Carnegie says:

"It would never pay to run big ships from Buffalo to New York through any canal, not even a ship canal. It is much cheaper to transfer from a 10,000-ton lake vessel to a 1,000-ton barge, and send it through the canal at slow speed, to be unloaded alongside into ocean-going ships, than to send ocean or lake vessels through the canal."

The ship canal, in view of these objections, can not for a moment be seriously considered in connection with the improvement of the waterways of the State of New York, and the argument of a ship canal can be used only as an obstruction to any improvement.

GEORGE CLINTON,
Chairman Canal Enlargement Com. of Buffalo.
HENRY B. HEBERT,
Chairman Canal Association of Greater New York.
E. L. BOAS,
Treasurer Canal Association of Greater New York.
GUSTAV H. SCHWAB, of New York, *Chairman,*
FRANK BRAINARD, of New York,
J. W. FISHER, of Buffalo,
R. R. HEFFORD, of Buffalo,
F. S. WITHERBEE, of Port Henry, Lake Champlain,
FREDERICK O. CLARKE, of Oswego,
Canal Improvement State Committee.



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ERRATA

- Page 68, in the first note, for "page 89,)" read "page 89, Roosevelt Report),"
- Page 76, last line, for "page 64," read "page 101."

The Thousand-Ton Barge Canal will benefit

THE MANUFACTURER

because it will reduce freight rates both on raw materials and on finished products, enabling the manufacturer of this State to compete with any factory or any location to advantage. Makers of iron, steel, copper, grain products, wood-workers, can not afford to remain outside the favored territory of New York State if the One-Thousand Ton Barge Canal is built.

THE MERCHANT

because it will make more buyers of his wares ; because it will build up the population and wealth of the State to an extent now scarcely dreamed of ; because it will add prosperity.

THE FARMER

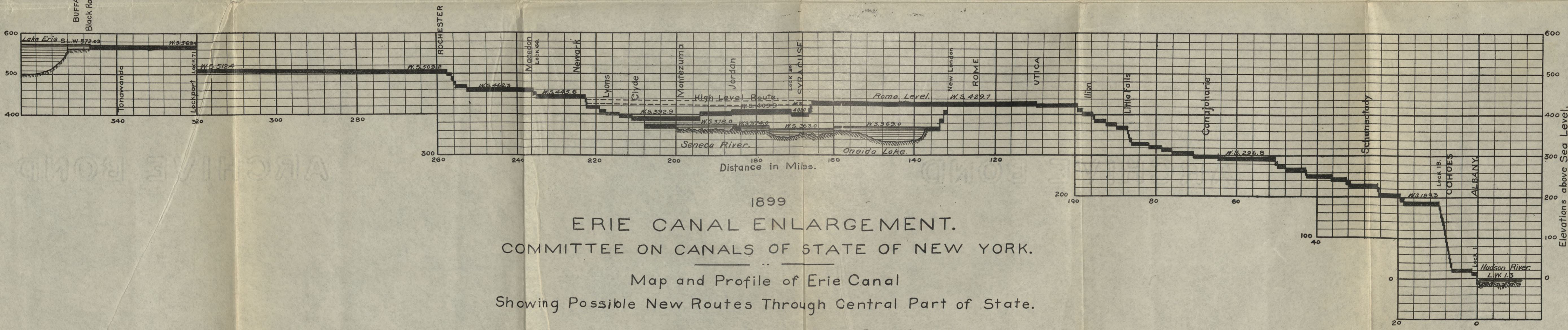
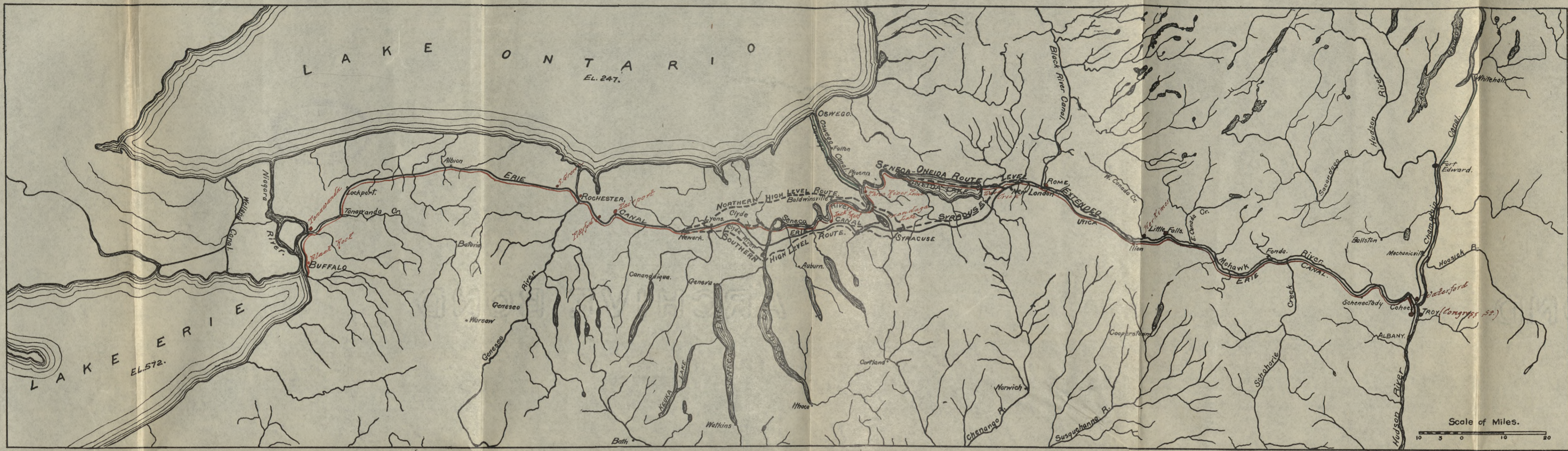
because it will give him a lower freight rate on everything he buys, and will enable him to reach his markets more cheaply with his products ; because it will build up for him greater and more prosperous markets, where he can sell his products at better prices ; because it will cheapen everything he has to buy, and increase his profit for everything he has to sell.

THE WORKINGMAN

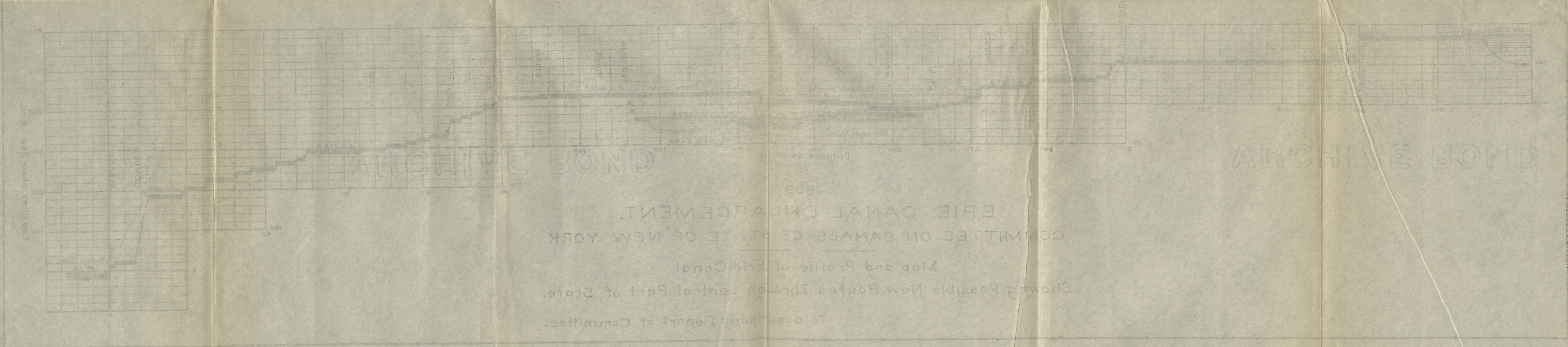
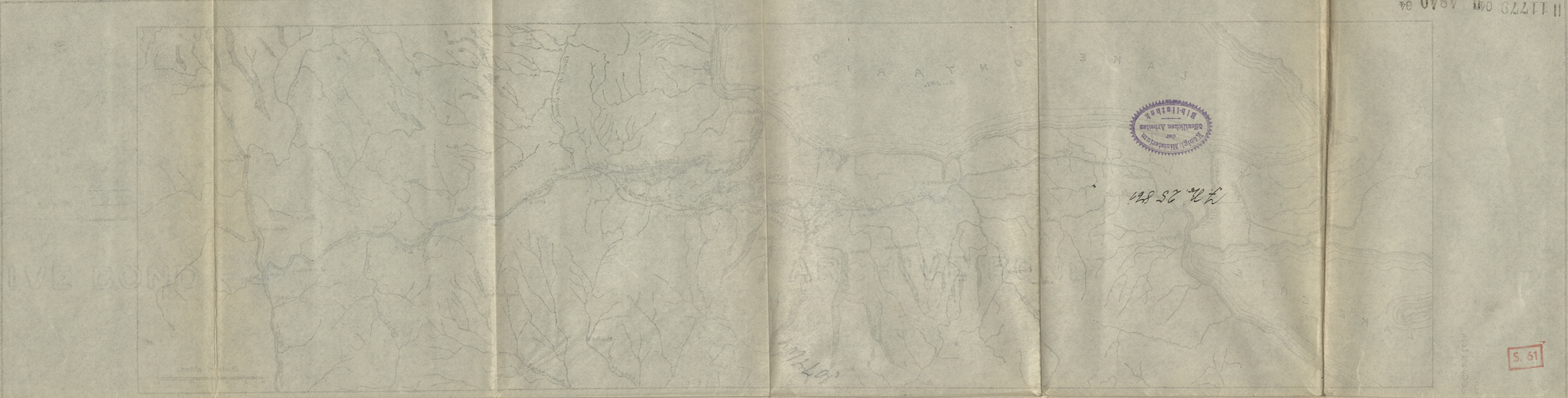
because it will result in the upbuilding of manufacturing industries throughout the State, and will secure to the workingmen of the State of New York steady employment at remunerative wages. The prices of all the necessities of life will be decreased by lower rates of freight on the improved canal to the further benefit of the workingmen of the State.

Every Citizen of New York State should

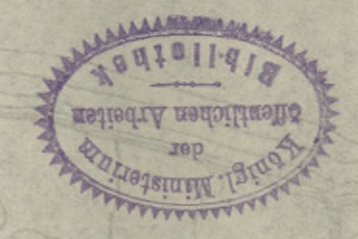
Vote FOR Canal Enlargement on Nov. 3



1899
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 COMMITTEE ON CANALS OF STATE OF NEW YORK.
 Map and Profile of Erie Canal
 Showing Possible New Routes Through Central Part of State.
 To accompany Report of Committee.



To accompany Report of Committee.
 Showing Possible New Routes Through Central Part of State.
 Map and Profile of Erie Canal
 COMMITTEE ON CANALS OF STATE OF NEW YORK.
 ERIE CANAL ENLARGEMENT.
 1853



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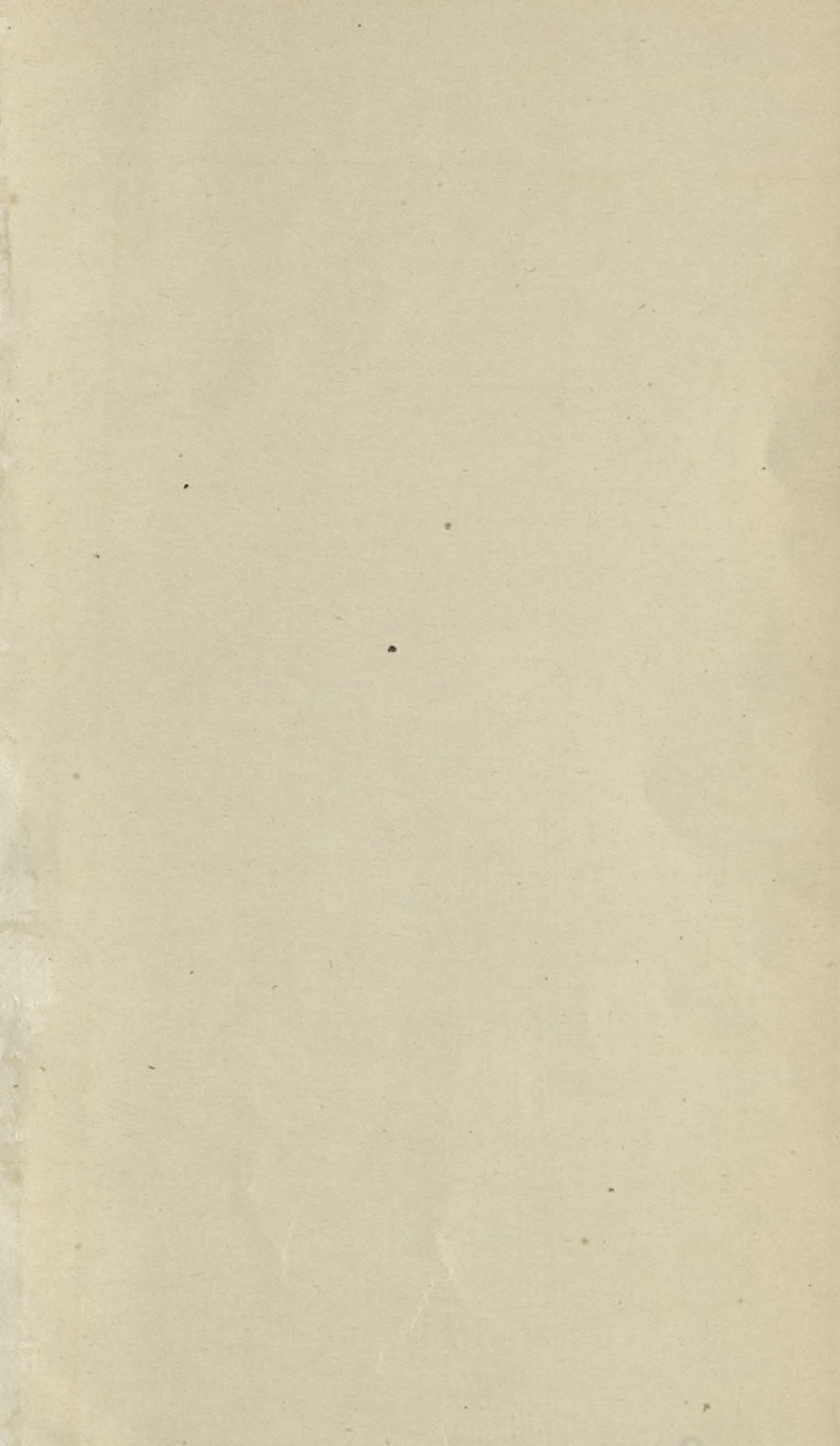
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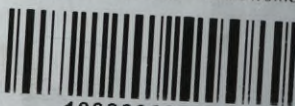
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