Works of Interior Improvements projected or constructed by the federal government of the United States of America from 1824 to 1831

Steven Rowan
University of Missouri-St. Louis, srowan@umsl.edu

Guillaume Tell Poussin

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1834

Works of Interior Improvements projected or constructed by the federal government of the United States of America from 1824 to 1831

Steven Rowan, Ph.D., University of Missouri-St. Louis
Guillaume Tell Poussin

Available at: https://works.bepress.com/steven-rowan/66/
Works of Interior Improvements projected or constructed by the federal government of the United States of America from 1824 to 1831

by Guillaume Tell Poussin
former Major of American Engineers and aide-de-camp of General Bernard

“All of these things I saw, and of them, I was a great part …”
Virgil, Aeneid [Book II, lines 5-6].

IMAGE OF THE AMERICAN CAPITOL

Paris:
Anselin, Libraire pour l’art militaire, les sciences, et les arts,
Rue Dauphine, 36
Carilian-Goery Libraire des ponts-et chaussées et des mines
Quai des Augustins, 41

1834.

Translated from French by Steven Rowan, University of Missouri-St. Louis.


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<th>POPULATION</th>
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<td>Dist. Columbia</td>
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<td><strong>Totals</strong></td>
<td>10,535,232</td>
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</tbody>
</table>
[xvi] Value of currencies.
measures and weights of the United States

Currencies — The dollar contains 100 cents; it is divided into pieces of 10 cents, 25 cents and 50 cents. We adopt 5.42 francs as the legal value of a dollar, indicated in the *Annuaire du Bureau des longitudes*.

Linear measures — 1 yard = 3 feet; 1 foot = 12 inches; 1 inch = 8 lines.
Value in millimeters: 914.4; 304.8; 25.4
1 fathom = 2 yards = 6 feet.
1.82 centimeters
1 mile = 1760 yards; there are 69 42/1000 a degree.
1609.31 meters.

Measures of surface, square yard foot inch line
83.6 decim. 9.3 dec. 6.45 cent. 4.48 mill.

Agrar. Measures² Acre = 4,840 yards = 4,046 meters = 4/10 hectare.

Measures of capacity³ — Yard, foot, inch Line
764 ½ dec. 28,315 cent, 16,383 mill 9,261 mill.
My Dear Major,

I read with the liveliest interest the history of the great works on which you and I were associated over fifteen years, and which, in a different hemisphere, attest to the spirit of enterprise that characterize the American nation. The manner in which you treated this fine subject under political, commercial, and military aspects, and under those of art, will make your work, not only in France, but also in America, worthy of the attention of enlightened men.

Receive again, my dear Major, all the sentiments of esteem and devotion of your friend and companion in America.

Signed, BERNARD
Lieutenant general of engineers
Aide-de-camp of the King

To Monsieur the Major Poussin, engineer
Before describing the grand works constructed on the vast territory of the United States of America, it is indispensable to determine well the point of view you should grasp to understand the entire system of this republic, as yet too little known.
Some geographic and statistical notions will be useful preliminaries; these general characteristics will cause one to understand in a more complete manner and with greater ease in what theater and with what resources the works that I will describe were undertaken and directed.

(See the general map, plate I) The United States occupy the entire portion of the North American continent between 70° and 127° of western longitude [Paris Meridian is 2° 20’ 17” east of Greenwich], and is between 25° and 52° north latitude. This vast region is bordered on the north by Canada or English possessions; to its east by the province of New Brunswick, by the Atlantic Ocean, and by the Bahama Channel; on the south by the Florida Straight, the Gulf of Mexico and the Mexican Federation, and by the grand Pacific Ocean.

The extent of this immense territory has been estimated differently by various authors; following Mr. Tanner, it would be 2,037,165 square English miles.

The American confederation is currently composed of 24 states, a federal district where the capital of the Union is found, of three organized territories, depending on the federal government, of an immense western district that is not [xx] yet organized, and of which the Indian nations occupy the greatest part.

You generally divide the United States into four great divisions, that is, into states of the East, the Middle, the South, and the West.


In that of the Middle, the states of New Jersey, Pennsylvania, Delaware, Maryland, and the District of Columbia.

In that of the South, the states of Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, and the territory of Florida.

In that of the West, the states of Tennessee, Kentucky, Ohio, Indiana, Illinois, Missouri, and the territories of Arkansas and Michigan.

The frontier of the United States is divided into the maritime frontier and that of the land frontier, or the interior.

The maritime frontier of the Union is located between 25° and 46° north latitude and extends to the 27° of longitude. Without paying attention to the sinuosity of this coast and the large interior bays that make part of it, it represents a development of 3,300 miles (about 1,200 leagues or 5,358 kilometers). This frontier is subdivided in the following manner: northeast frontier, from Nova Scotia to Cape Cod; central frontier, from Cape Cod to Cape Hatteras; southern frontier, from Cape Hatteras to Cape Sable; frontier of the Gulf of Mexico, from Cape Sable to the opening of the Sabine to the west of the Mississippi.

The land frontier is in two divisions: the line of the North, or of the Lakes, separates the United States from the English possessions; the line [xxi] of the West separates them from the Mexican confederation, and extends to the shores of the Pacific Ocean.

The American Union has regular troops, national militias, and a navy. Fortifications and the interior communications extended (by land and by water) became the necessary complement of its military system.

It was necessary to coordinate these communications and these works of well-extended fortifications are extensions of European aggressions, of the states of the old continent. In the military system of Europe, the defense of frontiers was the first problem to resolve. Interior communications did not have importance until after the fall of the feudal system.

It is necessary to coordinate these communications and these works of fortifications in a way to cause them to contribute at once to the defense and to the prosperity of the country.

It was not the case in the United States, whose frontiers were extensions of European aggressions, like the states of the old continent. In the military system of Europe, the defense of frontiers was the first problem to be resolved. Interior communications had no importance except after the fall of the feudal system. It was necessary to form them following the plans
adopted and the works established for the defense of the territory. Doubtless, this was the origin of the many problems that we found in France on our frontier lines to create works that were useful for commerce without working against the system of defense. In America, there was no general plan for the armament and security of the frontiers: it was the same for interior communications. Thus, in the place having to coordinate two systems that already existed, the problem was to create a single one that responded to the double purpose of the defense of territory and the development of works of public utility.

To arrive at this end, a commission of engineers was instituted, and they were granted the important concern to create all the projects of permanent defense and combine them with a system of internal works. This commission was formed in 1816 by an act of Congress, immediately after the arrival of General Bernard. This celebrated engineer, to whom the political circumstances of 1815 caused him to quit his homeland, sought to ask asylum in the classic land of liberty. He took with himself his reputation well-earned as a great engineer and a great economist, and at once he found on this vast continent which he crossed, the occasion to develop resources of his profound spirit and of his rare knowledge.

If I speak of myself, after naming General Bernard, it is only to make it known with what title I write. Coming from France in the same unhappy epoch, I came to the United States, where, after having fought adversity, I entered the American Army as an officer. It was with this first title, and to apply discoveries and sketches topographically that I accompanied General Bernard in the first investigation he made on the maritime frontier of the Gulf of Mexico. Immediately afterward, by permission of the War Secretary, I was called to fulfill the functions of aide-de-camp of the General, and without delay to become a member of the commission of public works. Since then we were inseparable, and I have the honor and joy of contributing to the accomplishment with him of the great work of which I will present here the part that relates to civil works.

In military terms, everything had to be created at the time of our arrival; the United States was entirely denuded of the means of defense, Until now, everything that had been built as a permanent construction had no relation to a general system. They continued to guard the positions previously occupied by the Mother Country in colonial times. The difference of situations made most of these fortifications completely absurd; since if they protected the anchorages and approaches to towns, they were also destined to restrain their populations.

[xxiii] It was also necessary to supply the navy with yards for construction, repair, with stations, with anchorages, with gathering places and points of refuge protected by fortifications, defended by the regular army, by citizen militia, and capable of being supplied with men and war matériel by interior lines of communication.

Fortifications must have as their objects covering and defending all the ports, to assure the military and merchant marine, to deprive the enemy of every position where, under the protection of a superior naval force, it could establish itself in the interior, maintain itself during war and hold the entire frontier in alarm; further, they must protect large centers of population whose activity naturally influences in a vital manner the destiny of the country, halting as much as possible that the great avenues of interior navigation not be closed to their entry to the ocean; they must protect interior navigation by covering and defending the various harbors and accessible points that the coast offers; finally, they must assure the large maritime centers.

Interior communications must permit provisioning in security of all types gathered in stations, marshaling anchorages and construction yards; they must facilitate and accelerate the concentration of forces, so that troops may be transported from one point to another; they must also assure the means for obtaining provisions of all varieties, and maintain interior commerce intact, even during the most active wartime.

Finally, the regular army and militia constitute, along with the navy, the vital principle of the defense of the country. Following this rapid view of the means concurring to the defense of the territory, it is [xxiv] obvious that the system adopted by the American Union is composed of
elements whose numerous relations form a whole that, alone, constitutes excellence: each part renders to the other an indispensable aid. Finally, to that from the Chesapeake and the Delaware. In other circumstances, lands of the state domain were alienated to subsidize similar communications across other areas of this vast republic.

But the men who succeeded in the democratic hierarchy of the government who did not interpret the Constitution in a manner as large and as liberal, suspended, at least for a time, the action of this national munificence, which had allowed to give a more decided character more in harmony with their object in constructing works of internal communications.

In any case, the same spirit of enterprise having grown rather than declined, the federal government was constrained to continue to intervene in improvements that were possible to render some rivers of the Union to become navigable. They were considered as great natural roads of water, and as a consequence made interesting for the entire nation, the perfecting of which was possible, were executed at the cost of the federal government, which, every year, voted the necessary allocations [xxviii] for each particular object on the demand of district representatives who were most directly interested in these works. It is the same with works necessary to the protection of commerce on the seashore: these were planned and executed whole by the government of the Union, as in the case of an artificial port, or jetty, constructed at the mouth of the Delaware. Millions were dispensed for different varieties of public works.

Like the studies for projected canals made by the companies, the same is true for the many railroads that appear every day in reports and exchanges; they are conducted, in most cases, by Army officers, who often are called upon by the companies to direct construction with a special salary that is allotted by the same companies.

Many states of the Union have adopted a pace perhaps better suited to the state they improve, for their public works; they have created a fund, called a fund for interior improvements, administered by a committee chosen from their legislature; this committee confers with the state engineer, and, on the plans and reports, administers the distribution of funds in the manner most favorable to the construction of the system of interior improvements submitted to the same legislature and adopted by it.

Thus, for example, the single state of Pennsylvania, which today has a population of 1,348,233 souls, an area of nearly 35,796 square miles (9,348,233 hectares), that is, 38 inhabitants per square mile or 256 per hectare, has expended in the space of 40 years, to 1833, 192 million francs in works improving navigation, the construction of bridges, of Mac-Adamized roads, of canals and [xxix] railroads. This state will soon have nearly 702 miles (1,129 1/2 kilometers) of completed canals and railroads crossing its territory in every direction, not including the many works built in each district at the cost of residents of the same district.

Perhaps it would not be out of place here to call attention of the engineer to the means placed at the disposal of the commission charged to establish a system of internal improvements. These means are very weak relative to the purpose it must serve. There is never more than three brigades composed of officers of artillery or of engineering, numbering 15 to 20 officers, employed to carry out, under the orders of the commission, drafting plans, making studies of levels, soundings, and generally the operations necessary to the outer control of the projects proposed by this commission. If you compare this small number of men to the immense development of constructed works, undertaken or reclaimed by the interests of different parts of the Union, you would perhaps better explain how, in this country, you can achieve such great results: the scale and the number of projects do not absorb the means of execution. In a word, the form does not devour the fund.

I believe I am fulfilling a debt of honor in presenting to my fellow Frenchmen the results of these works on which I have worked in the New World. I doubtless would have preferred to consecrate to my homeland the long years and works that I have employed with such ardor, so conscientiously, and with investigation on a land generously hospitable, it is true, but still foreign; although my weak memory prevents me. In returning to my sacred land, I am reporting
at least the fruits of my long pilgrimage, the [xxx] simple but precise recitation of the works, immense in extent, in their wholeness, and remarkable for their fruitful utility.

I will be satisfied, in fulfilling my duty in a manner purely specialized and in reports in the manner of the engineer, I may offer to my French colleagues some interesting documents on works of art, and to France a new proof that its sons, in whatever land destiny throws them, always recall with pride a sacred duty to honor the French name.

[xxx] NOTE

This work is accompanied by general maps and profiles to facilitate knowledge. So far as the studies that were delivered to the War Department to help in the construction of these projects, I regret that I cannot reproduce them here; these drawings form a numerous collection which must remain in the archives of the American government.

There will be no considerations here of military works; those are American properties that we are not disposed to distribute. It is useless to question my silence on this subject.

[1] Chapter 1: Chesapeake Canal to the Ohio

[1] PLATE II. This canal has as its object to unite the Atlantic with the Ohio River so as to open a navigable link between the states of the east with those of the west. It was begun at the expense of a company whose shareholders are the federal government, the states of Virginia, Maryland and Pennsylvania, the corporations of the three towns of Washington, Alexandria and Georgetown, composing the District of Columbia, and some individuals.

[2] It is divided into three great portions, that of the east, the center, and the west.

The profile adopted over the entire line of his canal was calculated according to the probable commerce that will prevail on this important link, of the contributing streams of water needed to provide a canal of such a large extent, and having so many locks; of the dimensions most favorable to transport and bear the boats (these boats are 4.11 meters wide, 27.43 m. long, drawing 91 centimeters of water, carrying 60 tons); finally to the greater or lesser ease for these boats to pass through a prism of water with an indefinite lateral extent. It has the following dimensions: width to the platform, 10.05 meters; at the water line 14.62 meters, depth of the water 1.52 meters; hauling path, 2.74 meters wide, embankment rim, 1.52 meters at the edge, berm at the waterline, 0.61 meters; the summit of the hauling path and that of the embankment dike held at 0.61 above the surface of the canal.

This profile, nevertheless, may be varied according to the localities, and in any case as necessary, whether large trenches or large cuts in the rock, or large embankments, or linings to support the canal along large slopes. The greatest attention should be paid to all details of construction to adjust all possible advantages with the greatest economy.

All the locks are 4.27 meters wide by 31.09 meters length; their drop is generally 2.44 meters, saving exceptions due to the terrain. They are constructed of stone, their interior finish in trimmed rubble and hydraulic cement; the frames of the gates, the enclosures, the exit from the lock and the shoulders are in cut stone and hydraulic cement; the apron is formed of a reverse arch of brick with hydraulic cement.
[3] The Eastern Division

The Eastern Division begins in the District of Columbia, at the port of Georgetown near the town of Washington, capital of the Union. It extends to Cumberland at the mouth of the Savage River, tributary of the northern branch of the Potomac; it has a general length of 186 miles (315 kilometers) and a difference of pitch of 179.17 meters, facilitated by 74 locks.

The canal in its plan constantly follows the left bank of the Potomac Valley. Despite the advantages of terrain that the right bank happens to present, they have to avoid passing to the opposite side of this river on an aqueduct; effectively, such constructions would be very exposed during times of freezing, since they vary from 4.57 meters to 9.14 meters on a pitch of the bed of 91 centimeters per thousand. Nevertheless, they have managed the link of the canal with the river at the various points where it receives important tributaries coming from Virginia.

Central Division

This division comprehended the watershed, and it extends from Cumberland, where the Eastern Division ends, to the mouth of the Casselman River on the Youghagany, west of the Alleghany Mountains; it has a total length of 70 miles 1040 yards (113. 580 kilometers); the sum of pitches and counter-pitches is 950.56 meters; further, it crosses the summit of the chain by means of a tunnel through the rock that is 4 miles 80 yards (6,509 meters) in length, ranging 256.80 meters below the height of the Alleghanys; there are 246 locks on this division.

The Wills Creek Valley being very narrow, and the volume of this watercourse being very weak, it was necessary to follow the course of the canal from one side of the valley to the other, as the terrain offered greater utility; in the Casselman Valley, in contrast, the canal always follows the right bank. Neither of these rivers is navigable.

The canal tunnel had to be 6.70 meters wide, the water 2.13 meters deep, and 5.03 meters above the water to the overhead vault; the towpath was 1.21 meters wide. This tunnel had to be entirely covered in brick masonry.

The wells that served for the construction of this tunnel as well as to supply air were established for a distance of 164.52 meters; they were 1.83 meters wide besides the brick facing. They cut [5] a long gallery parallel to the tunnel; it communicated to the latter by small transversal openings cut at the same level as the wells. This gallery, which served to water the tunnel, was 91 centimeters by 1.98 meter in height; it was supported by masonry like the arcades of the main line. Each end of the tunnel had to link to a basin, 880 yards long (804 meters) and 58.50 meters wide, and they passed from one basin to the other by large trenches; that on the west was 1060 yards long (968 meters), that on the east had 140 yards (128 meters).

The tunnel, the large trenches, and the two basins that were at the ends formed together the watershed: two reservoirs were placed in Casselman Valley; together they produced 16,786,000 cubic meters of water; further, the running water brought to the watershed presented a development of 5 miles 1280 yards (9.215 kilometers); from each of these basins one passes to the canal by a lock.
Such is the provision of water to supply the watershed: two reservoirs are supplied in the Casselman Valley; they produce together 16,786,000 cubic meters of water; further, the running water caused to run into the watershed provides 0.50 cubic meter per second. Since one assumes that navigation of the canal would not be opened except eight months a year, it follows that the water resources per month was 2,098,250 cubic meters, from the reservoir, and 1,318,464 from running water.

Total per month 3,416,714 cubic meters

To make the best use of the water supply, and to save time, they proposed to regulate passage of boats over the watershed by a convoy of thirty, which would present more trouble than for a single boat; they also allowed that this convoy would take four hours to pass the watershed.

[6] If you assume that a double convoy of thirty boats would pass the lock at the east of the watershed, one rising and the other descending, this double convoy would use eight hours to pass this lock, at sixteen minutes for each double boat; so, at each moment the same number of boats would cross the western part of the watershed.

When a first convoy departs the western locks, it would arrive four hours later from the west going east. This second convoy will arrive at the eastern lock in four hours; there it encounters a third convoy that will pass the eastern lock during the passage of the first and second convoys. This third convoy will move toward the west, taking four hours to cross, and on its arrival, it finds a fourth convoy just having passed the western lock coming during the passage of the second and third convoy. Finally, this fourth convoy, moving east, will arrive at the end of four hours, and it encounters a convoy coming from the east, which will pass the eastern lock during the passage of the third and fourth convoy.

These four convoys have each taken four hours for their transit; they all amount to 120 boats, and this number may be considered as the maximum commercial movement that the quantity of water provides the watershed. For 120 boats per day give 3,600 boats per month, or 28,800 boats in the eight months the canal will be open.

These facts considered, and admitting that at each lock there is alternatively a boat ready to rise and another ready to descend, each of these boats will only consume one watershed lock in its passage, until at each lock there is no more than one half-closed. Nevertheless, to anticipate any unforeseen accident, it is supposed that the passage of a boat uses one and a half lock, or 475.35 cubic [7] meters of water; 3,600 boats per month will demand 1,711,256 cubic meters of water, which, drawn from the amount supplied per month, already evaluated at 3,416,714 cubic meters, leaves 1,704,383 cubic meters unused which serves to supply 18 miles of canal, at 94,721 cubic meters per mile and month, and accounting for filtration, absorption and evaporation.

Within these 18 miles there are 6 miles comprising the watershed, 6 miles in the Will’s Creek Valley, and 6 miles in that of the Casselman River; the remaining portions of this middle division will be supplied as follows: east of the watershed by the water of Will’s Creek, to the west by the water of the Casselman.

From the eastern end of the watershed to the eastern end of the First Division, the canal has 29 miles 240 yards in length (46.880 kilometers); the general pitch is 397.50, assisted by 166 locks. At the eastern end of the Central Division they have extended a navigable channel that extends the canal below that point. This channel attaches itself to the canal by means of a basin constructed in the actual bed of the Potomac, near the town of Cumberland: this will be a constant reservoir of water that will also serve for the commerce of the upper Potomac, and for the working of the coalmines that are near this basin. This basin extends for about 8 miles; the
channel is not more than a mile long and the water is 1.21 meters deep with a width of 9.14 meters.

From the western end of the watershed to the mouth of the Casselman River, where the Central Division ends, the canal is 35 miles 1,250 yards (57.337 meters); over this distance there is a total pitch of 190.80 meters adjusted by 80 locks.

The cost of the construction of all of the Central Division was estimated as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wells will cost</td>
<td>$1,236,038.59</td>
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<tr>
<td>The drainage gallery</td>
<td>$2,078,758.78</td>
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<td>The cross-galleries linking the drainage gallery and tunnel</td>
<td>$41,757.14</td>
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<td>Tunnel</td>
<td>$13,524,215.97</td>
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<td>Drainage</td>
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<td><strong>Total costs for the tunnel</strong></td>
<td><strong>$17,772,094.08</strong></td>
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<td>Eastern basin</td>
<td>$144,936.98</td>
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<tr>
<td>Large eastern trench</td>
<td>$101,532.80</td>
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<tr>
<td>Large western trench</td>
<td>$768,776.70</td>
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<tr>
<td>Western Basin</td>
<td>$30,720.56</td>
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<tr>
<td><strong>Total for the watershed</strong></td>
<td><strong>$18,818,061.18</strong></td>
</tr>
<tr>
<td>Eastern section of the Central Division</td>
<td>$20,902,899.91</td>
</tr>
<tr>
<td>Western section of the Central Division</td>
<td>$14,631,464.79</td>
</tr>
<tr>
<td><strong>Total cost for the Central Division</strong></td>
<td><strong>$54,352,425.88</strong></td>
</tr>
</tbody>
</table>

**Western Division**

The Western Division begins about a quarter-mile (402 meters) below the confluence of the Casselman and the Youghagany; it ends at Pittsburgh, at the mouths of the Alleghany and the Monongahela in the Ohio. Its total length is 85 ¼ miles (137.197 kilometers); the sum of pitches is 185.70 meters; the number of locks is 78.

On the first 27 ½ miles, that is, from the mouth of the Casselman to Connelsville, the terrain has presented great difficulties for the path of the canal, due as much to the straight gorges that must be crossed as much as the strong rock outcroppings to contour or the walls to raise to support the canal. It is not until Connelsville that you begin to emerge from the groups of mountains forming this great chain of the Alleghanies separating the slopes of the Atlantic from the slopes of the basin of the Mississippi, that is to say the lands of the east from those of the west.

Below Connelsville, the valleys of the Casselman open up somewhat, and although they still conserve a palpable outcropping, they still offer fewer difficulties to plotting the canal.

Throughout this division, the canal always follows the right bank valley of the Casselman and of the Monongahela until Pittsburgh. The sources of water for supply are superabundant: the Casselman River provides water at many points.

The costs for all of this division are estimated at $22,602,612.88 francs.

One may summarize the works and costs of the Chesapeake and Ohio Canal thusly:
Length  Pitch/Counterpitch  Locks  Costs
Eastern div.  186 mi.  179.17 m.  74  44,319,779 fr.
Middle div.  70; 1010 yds.  588.30 m.  246  54,352,425.88
West div.  85; 440  185.70 m.  78  22,602,612.88

341 mi 1450 yds  953.17 m.  398  121,274,817.76 fr.

The public works of moderns differ essentially in their construction from those raised in the past: which was to give a character of magnificence to their constructions. Large unemployed populations, masses of [10] men reduced to servitude by the destiny of arms or right of the latter always gave conquest, offered such resources for the building of the most gigantic enterprises, that economy was little consulted: make war and build great public works appeared to have formed the principal occupation of nations even among those whom civilization made the most progress.

Among moderns, on the contrary, it cannot be that way: the subdivision of labor among the different branches of industry, the abolition of slavery, or the progressive improvement of servitude where it still exists, renders to man the dignity that is proper to him, leaving him the liberty to act, and attaching to his work a value that identifies itself with its physical and moral existence.¹

Economy, consequently, has become an important consideration in the construction of works consecrated to national prosperity; to the premier conditions of utility and good construction, to which is attached another no less important matter, which wishes that the presumed advantages agreeing with the means that have been applied. When all these conditions are fulfilled, such works justly become a title of national honor.

To bring the civil and political institutions of the land, its literature, its military glory, all forming an amalgam of all the sympathies that the nation rallies and strengthens, is a glorious gathering which, transmitted from generation to generation, consecrate in a people unity and power. It is thus the duty of all enlightened governments to favor, as much as possible, such enterprises; all must know that, in our century of improvements and progressive instruction, all that can contributed to the national glory, all that promises real and important advantages, should receive judicious and prompt realization. The Chesapeake and Ohio Canal is one of these enterprises.

¹ You cannot find in any country a work that could be compared to the enterprise of the canal from the Chesapeake to the Ohio, whether due to the diverse works of art that accompany its construction, or by the immense political, commercial, and military advantages that must result. It is a truly national work; and if, on one side, the costs of construction are above the means, always limited, of individuals, on the other side the results are of such a great interest for prosperity, harmony, and the greatness of the Union, that its construction could not be neglected without compromising the positive advantages that would far surpass the costs. In effect, it is not always the cash value of capital employed that renders an enterprise more or less expensive, but rather the relationship between the capital and the results; however high the costs, that always becomes a secondary consideration to when the resources of the nation permit them, and the advantages are proportionate.

¹ This portion is found In the Message of the President [J. Q. Adams] of 12/7/1826, on the C & O Canal, Document 10, pp. 65-80, signed by S. Bernard, W. T. Poussin, William Howard.
In these terms, the canal from the Chesapeake to the Ohio cannot be regarded as too costly; it is a work that will produce such great results that the sacrifices it necessitates could be placed in balance with the advantages.

It must be admitted that, when a nation considers a work of public utility as is the one that occupies us here, it must have concern, before everything else, to the grand, generous interests that might attach to it. These interest are: to open relations between districts separated by large natural obstacles or great distances; to unite provinces deprived of access to what they desire, to create for the products of the soil and industry a value that they did not otherwise possess, due to the lack of a market, or because of the cost of transport; to progressively augment the quantity of products through ease of exchange and export; to encourage thus and to reanimate [12] agriculture; to favor the development of manufactures; to vary the class of producers, and to bring consumers together; finally, to increase production as well as consumption by ease of transport between a district where there is superabundance, and another where the same products are in demand.

When national interests are satisfied, the chief object of the work is accomplished, and the final advantage that must be expected, and which, for a particular company, would be of supreme importance, also desires it, even at a low degree, for the nation that charges itself with its construction.

Here, according to these views, the exposure of real and national advantage that could be realized from the building of this great enterprise, the question of the probable revenue of this canal becomes a secondary subject.

The districts that are most immediately interested in the construction of the canal from the Chesapeake and the Ohio may be divided into two classes: 1. Counties that are on the very line of the canal, 2. The western states, to which the canal will create a favorable opening to the Atlantic.

In this first class there are:

Nine counties of the state of Pennsylvania, whose population, according to the census of 1820, has risen to 256,782 inhabitants

Four counties of Maryland, rising to 92,000

Thirteen counties of Virginia 189,585

Total of 26 counties 538,367 inhabitants

Which is a little more than a fifth of all the population of these Three states.

The District of Columbia 33,039 inhabitants

who, when added to the 26 counties listed above, make a total of 571,406 inhabitants

[13] Among the states most directly interested in the construction of a parallel communication, one only cites the states

of Kentucky, population 564,317 inhabitants

of Ohio 581,434

of Indiana 147,178

Total 1,292,929

17
The 26 counties as a whole have an area of around 15 million acres (6,000,000 hectares); a large part of these lands is very fertile, another is covered with excellent woods for construction, and contain inexhaustible mines of coal and iron. It is estimated that an acre could have an average value of $4; 15 million acres would then produce $60,000,000, or 325,200,000 francs.

So, the current value of these lands is below what it could be because of the difficulties of transport. There is no doubt that, with the opening of the canal, the value of lands will receive a growth parallel to the augmentation of the value of its products. If you presume that the augmentation will be 20%, for the 26 counties you will have $12,000,000 or 65,040,000 francs.

The three states mentioned above have a total surface of 72,000,000 acres (28,800,000 hectares); their soil is so fertile that you could easily foresee that the population there will become more numerous than any other territory of the Union. An evaluation made in 1825 of the value of lands in the state of Ohio fixed at $2.49 (13.50 francs) average price per acre. If we take a mere $2.49 for the average price of the three states, we find that 72,000,000 acres (28,800,000 hectares) will produce $144,000,000 (780,480,000 francs).

[14] But the opening of the canal will increase the estimated price of land by about 12%; you will have an increase in value to $17,280,000 or 90,257,600 francs.

But this evaluation of the increased value of lands that will be the consequence of opening the canal should include the District of Columbia, at the end of this important link, will be the most favored of any other point on the canal. This district is only estimated at $15,000,000 (81,300,000 francs); which shows that properties are below their real value. You could reasonably suppose that the price of property will rise by 50%, producing $7,500,000 or about 399,347,600 francs (!).

Hence, with the opening of the canal, property-owners of these territories will gain a value equal to one and a half-times the cost of constructing the canal, a cost evaluated at 121,274,817 francs on page 9.

The federal government owns 59,998,000 acres (23,998,400 hectares) of land in the states of Ohio, Indiana, and Illinois, and in the Territory of Michigan, not including 18,946,000 acres (6,778,400 hectares) that are still in the power of the indigenous peoples. Evaluating these lands at two dollars an acre (10.84 francs), 59 million acres will give $119,996,000 (650,378,320 francs), which, due to at least a 10% increase in value, will bestow on the Union as owner 65,037,832 francs, rising to what should be the increase of value that the government owns in the District of Columbia.

Let us now examine what the advantages will be for the new products that, with the aid of the canal, will accrue in the market.

[15] It is to be noticed that the canal has presented succeeding results from the beginning of construction until the day it was entirely finished, while it tended progressively to diminish the distance of division between west and east, so that the tributaries of the Potomac were brought more directly in communication with the Atlantic. Thus, it was not only after the entire construction of the projected canal to be able to win all the advantages for which the enterprise was calculated. Hence, building on this consideration you may present the following results:

Exports from the District of Columbia consist of two varieties of products, those of agricultural and manufacturing industry, and those who share the soil.
The first class consists of wheat, maize, flour, rye, tobacco, hemp, linen, flax, beef, pork, lard, tallow, whiskey, iron, glassware, etc.

In the second class are coal, chalk, construction wood, planks, slate, marble, cut stone, etc.

The annual export of the first class of products may be estimated modestly at 350,000 tons, at a moderate evaluation of 325.20 francs per ton, giving 113,820,000 francs. In this estimate, we have included the products that find an outlet toward the sea by descending the Mississippi, and those that pour toward the shores of the Atlantic by passing down the Potomac and Chesapeake Bay. But even there the three named states are found to enjoy a double advantage of choosing an outlet on the sea via the Mississippi or the Chesapeake, it is just to expect that their products will grow every year; the problem is to set the amount of this augmentation: you may only conjecture, and setting it at 5% would be lower than its true value.

Accordingly, the annual profits would be represented by a value [16] of 113,820,000 francs before the construction of the canal, if you examine that this would be at the beginning of this link (and it must increase, if only due to the increase of population during the construction of the work), you would find that, calculating at 5% per year, the sum of successive augmentations over the first six years would rise to 129,956,261 francs, the increase for the sixth year alone being 38,704,247 francs.

This result is entirely a creation due to the canal; it is nearly 8½ million francs more without requiring the completion of the works, and almost double the cost of construction of the eastern and western divisions.

So far as the products that belong to the second series, such as coal, chalk, construction wood, etc., they had remained, so to speak, without any value because of the difficulty of transport for such articles; this was a new result of the construction of the canal, with the result that the most important was the utility of coal as a fuel in factories and manufactures of all varieties, The population simply of the counties neighboring the Potomac and the District of Columbia rose to 314,624 inhabitants, consuming every year 150,000 tons of coal at the rate of half a ton per inhabitant; and at the price of each ton at 38 francs, there will be a demand of 5,700,000 francs, and for six years a new result of 34,200,000 francs,

For articles that found consumption in the District of Columbia itself, such as chalk, construction wood, etc., the mere fact that these articles were brought there from distant states and by sea, proves that the canal will give a new value to these materials that are found in abundance on the very line of the canal. It could be supposed that these latter articles would produce a sum of $650,000 a year, or 3,902,400 francs.

[17] Thus:
For products of the first class, produced 129,956,261 francs
For those of the second class: coal 34,200,000
Chalk wood; Etc. 3,902,400

For the profit of the canal, 6 years 368,058,661 fr.

But this commercial movement from west to east led necessarily to a growth of commerce that had not existed without the canal; for this commerce could establish itself with two varieties of merchandise: on the one side domestic products, and on the other foreign manufactures. It would be difficult to fix in what proportion these would be exchanged; it could be proposed that the first would be a third, and the second two-thirds of the value of western exports to the east, only for articles of the first class. As a result, the third of 129,956,261, or 43,318,953 francs will represent this other source of revenue created by the canal, and in which fish will form an important article. This last sum, added to the last-but-one, gives (2) 211,377,414 francs

19
From this we conclude that six years after the canal was offered to industry, the growth of products derived from the canal, or in other terms the advantages acquired by the producers, will present a value equal to one and three-quarters times the total cost of the canal, and more than three-quarters of the cost of the construction of the Eastern and Western Divisions.

If the public revenue must retire some advances the canal has from increasing the price of public land, it also retires some from the increase of exports.

Since we have seen that they are estimated at two thirds of total quantity of first-class profits created by the canal, or two thirds of 129,956,261 francs; that is to say, that six years after the [18] opening of the canal, the result is entirely due to this new creation.

Adding this final result to that of the larger value of lands, 65,037,832 francs, page 14, it follows that the Union is invested for nearly 86,700,000 francs in the construction of the canal, or for more than two-thirds of the total cost of the canal, and one and a third of the combined expense of the Eastern Division and the Western Division.

It is proper here to remark that although the revenue of customs suffices to cover all the expenses of the government of the Union in peacetime, it probably would not be the case in time of war. The federal government will find important resources from this canal whose value will not enter into the present calculation.

They have not included in the previous calculations the greater demand for sailors that exports overseas will create, a result of great importance, which will encourage the increase of a class of persons on which the country’s defense rests. You might estimate the number of sailors employed as a result of the opening of the canal would rise, in six years, to nearly 2,000 men.

In addition to the advantages resulting from the construction of this canal should be added the immediate benefits that will go to interior commerce and for the commerce of transporting freight.а [19] They may be estimated at 6% of the total value of the profits from the first and second classes (page 17). You would have as a result, at the end of six years (4). 10,083,519 fr.

Thus, by limiting the real and national advantages that will result from the construction of this canal six years after it goes into operation, you have as a result the following summary in this table:

<table>
<thead>
<tr>
<th>Added value of lands ([1], page 14)</th>
<th>199,347,600 fr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successive increase in profits over six years, and consequent advantage for producers ([2], page 17)</td>
<td>211,377,414</td>
</tr>
<tr>
<td>Successive increase of customs profit ([3], page 18)</td>
<td>21,659,376</td>
</tr>
<tr>
<td>Benefits of interior commerce and Transport (4)</td>
<td>10,083,519</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>442,467,909 fr.</strong></td>
</tr>
</tbody>
</table>

Which proves that even conceding the added value of lands does not entirely equal the level benefits to the public were fixed at the end of the first six years after the opening of the canal, amounting on the whole to 442 million francs, a sum equal to 3 3/5 times the total cost of the canal. So, from the national point of view, supposing that the canal itself produces no revenue, and that its income was only proportionate to costs of maintenance and administration, the benefits that would result would always be well superior to the costs of construction.

Only a few years suffice to produce a sum equivalent to the capital expended for building this work. And if you add to these considerations those that justify at once the spirit of enterprise

а The commerce of transporting freight (carrying trade) includes trade from foreign nation to foreign nation; to a great degree the Americans gained a great benefit from the last continental war.
that so eminently characterizes the American people, the [20] rapid growth of population in these countries, the fertility of the soil of the districts most interested in the construction of this project, as well as the variety of productions, one could believe that the future will lead to results far above those that could be foreseen by the previous calculations.

So far as the fiscal revenue of the canal, whatever secondary interest in this occasion, we think in fixing the tariff at a very modest level, nevertheless one would obtain in the first years a reasonable interest that also would be progressively increased by the growth of population and by the development of industry that such an important link would cause to be born.

It has already been remarked when treating the division of means, that 28,000 boats would have to be considered the maximum of commercial movement from the east to the west; it is assumed that 14,400 boats would come from the west completely loaded, while 14,400 boats would come from the east only loaded by a tenth, or whatever you wish, while during the eight months of open navigation, there would be 15,840 loaded boats and 12,960 returning empty. The boats would be drawing 91 centimeters of water, and could carry 60 tons. The 15,840 boats would however carry 950,400 tons which, at 1 ½ cents per mile and ton, would produce, for a navigation of 342 miles $4,875,552

The 12,960 empty boats, representing 777,600 tons, will cover the same distance, but will pay only a tenth of a cent per ton and mile 265,939

So far as the commerce of the Eastern Division is concerned, it is estimated that 300,000 tons in both directions will produce, at 1 ½ cents per ton and mile, for an average distance of 90 miles 405,000

And the nine-tenths of 300,000 tons, or 270 tons returning empty, at 1/10 cent per ton and mile for 90 miles, will pay 24,300

Total annual revenue when its commerce, by the growth of population, combined with the influence of the canal, will arrive at maximum $5,570,791 or 30,193,687 francs

[21] Thus, in this period, four years of revenue will cover all the costs of the construction of the canal.

[21] So far as the total value of the maximum commerce that the canal could have, it is that four years of revenue would cover all the costs of construction of the canal.

So far as the value of the maximum commerce that this canal could have, it is impossible to establish more than conjectures, so that you are left with general views on the subject. The maximum transport from west to east, according to these calculations, will consist of

1. Of 14,400 boats of 120 tons 1,728,000 tons
2. Of 240,000 tons on the Eastern Division, carrying products of 1st and 2nd class, except for coal 240,000

Total 1,968,000 tons

Which, at 325 fr. per ton, from p. 15, will Pay 639,600,000 fr.
3. 300,000 tons of coal at 37.94 fr. the ton, will pay 11,382,000
For the maximum transport from west to east, annually,
On the canal, water supplied.
Now, since one may estimate the same level of commerce returning from the east to the west, the general maximum of transport on the canal in both directions
1,302,751,000 fr..

Having thus presented a brief view of the advantages that the Chesapeake and Ohio Canal could procure, we end by showing some other important results of this enterprise.
The acquisition of Louisiana was an operation of the greatest importance for the Union, since it will assure access to the sea for vast and fertile regions of the west. An emigration [22] has already begun toward these rich countries, and the population has already grown to an unheard-of degree throughout this land. Already a part of this population, placed at too great a distance from the Gulf of Mexico, demands new outlets for their rich harvests: that of the Mississippi no longer suffices, there must be more. Now this is a chain of mountains of greater rank than the Alleghenies that could arrest the progress of a nation as entrepreneurial as the American Union. This chain must be crossed at all possible points, a sage foresight will be needed, demanding the most rapid execution.
The state of New York, by opening a link to the Lakes, and in turning to this chain of mountains on the north, has given the first salutary example.\textsuperscript{2} It has already been compensated by its immense prosperity, which grows by the day, and the name of Dewitt Clinton, the illustrious citizen who contributed the most to cause this grand work to be carried out, registered among the benefactors of the homeland.
The canal was no sooner achieved than it was insufficient for the commerce that grew day by day; this fact alone demonstrates how important it is to oven new links.
Until now New York and New Orleans were the two sole ports toward which products could be directed with some economy of transport. Yet these two points, one in the north, the other in the south, could not have action except in a limited sphere, beyond which a large portion of territory that separates them could never send them their products.

\textbf{PLATE i.} The states of Tennessee, Kentucky, Ohio, Indiana, Illinois, as well as the territory of Michigan, are all in this category; one could even include there the regions west of the state of Virginia, and the state of Pennsylvania, but we will only [23] consider the states already mentioned: as a whole, they present a total area of more than 250,000 square miles, whose population in 1800 was 377,567 souls, and 1,779,949 souls in 1820. If these states remained deprived of ready and economic outlets to the sea, they could not aspire to the degree of prosperity to which they have a right to aspire; for, with the exception of cotton, they all have almost all the same products; between them there cannot develop any commercial exchange. It is only export that can re-establish an equilibrium to cause them to cooperate and participate in the prosperity of the Union.
In such a situation, the question cannot be to determine whether these communications will be profitable, but whether those that are doable will be enough. For the western states that we shall name form together an area equal to France, the Low Countries and Holland, whose total populations form a total of around 37 million. These three kingdoms have an extent of coast of almost 2,200 miles, and in addition eight great navigable rivers that form a link between the interior of the country and the ocean. The states of the west might one day have a population equal to that of these three kingdoms; the fertility of their land, the activity and spirit of enterprise of their inhabitants will eliminate every type of doubt on this point. These states will need a certain number of outlets for their products, and for the importation of goods of

\textsuperscript{2} See Chapter XI.
exchange. For the number of practicable links are very limited, and it probably will be very inferior to the commercial movement that has to be established between east and west. With the exception of local difficulties that the art of the engineer cannot overcome, no obstacle can halt the building of enterprises that can assure the development of the resources of the country, and that thus will tend to join together the countries of the east and west.

[24] Among all links, the Chesapeake and Ohio Canal occupies the premier rank; the possibility of its construction is being demonstrated, and the ties between the cost of construction and the utility of its results appear confirmed in a manner sufficiently exact. The canal already offers the Union important advantages that we may repeat.

It empties in Chesapeake Bay, which, by its central position on the Atlantic coast, is equally favorable to commerce to the south as to the north; in times of war, this outlet could be protected by the navy of the Union ensconced on Hampton Roads, under the protection of fortifications that have been raised in the double purpose of defending this vast interior sea and the maritime establishments created on the waters of Hampton Roads. The shipyards can receive from the canal provisions of all varieties; they will be, besides, in direct connections with Pittsburgh on the Ohio, a manufacturing town of the highest interest for the industry that develops in the middle of great abundance of natural riches, or iron mines and coal; the most favorable circumstances to join the interests of the west to those of the maritime states.

The Chesapeake and Ohio Canal possesses in common with all those that could be built to cross the chain of the Alleghenies, the inestimable advantage of preserving for the regions without a natural mouth such as the Mississippi, another access to the sea in the case in which war causes a fear of reaching the Gulf of Mexico.

This canal not only offers the shortest line between the Ohio and the Atlantic, but, by means of the extension of the canal planned from Pittsburgh to Lake Erie, or by the canal already built across the state of Ohio, between Portsmouth on the river of that name and Cleveland on Lake Erie, it will unite the Lakes to the Ocean, and will form a secure line of military operations that no unfavorable circumstance could disrupt the use.

This line will unite the center of the northern frontier with the center of the maritime frontier, and with the capital of the Union; an incalculable advantage in case of war, permitting a concentration via the shortest distance and at little cost of the greatest mass possible of militia and munitions of war on the points attacked on these two frontiers.

This canal was begun in August 1827, and already in 1830, all the distance from the District of Columbia and Point of Rocks, a point located in the Potomac Valley at 14 miles below Harpers Ferry, and the branching of the Shenandoah and the Potomac, was achieved, so as to give every hope that this great national work would be concluded in reasonable time. The construction of this canal over a distance of nearly 50 miles demanded very large works of art, such as: the basin of the mouth of the canal on the Potomac near the federal town, aqueducts, locks, bridges, culverts, great cuts into the living rock, and long portions of the canal supported by high facings. All these works were achieved with as much talent as economy by the able engineer (Mr. Benjamin Wright), who was called to direct the construction of this undertaking using the designs of the project that I will now recount.

Railroad from Baltimore to the Ohio

Plate II. Despite beginning construction that would have produced results as fortunate, this important work was absorbed by a rival enterprise that arrived to contest the terrain on some parts of its path. The enormous advantages described in the Report of the [26] Commission, and of which we will give a summary review, suggested the idea to a Maryland company to conduct a railroad in the same direction. This railroad was to commence at Baltimore, the principal commercial exchange-point of Maryland, situated at the head of
Chesapeake Bay on the Petapsco River, it was to cross the chain of the Alleghenies, terminating on the Ohio River at the town of Wheeling, or at any other point as favorable to commerce that opens the navigation of this important tributary of the Mississippi.

This railroad, which was to have 250 miles in length (402 kilometers), would have two tracks in certain portions, and was calculated for locomotive use. It was begun immediately at Baltimore and pursued with such energy that it soon encountered the path of the canal at the point called Point of Rocks, where the Potomac Valley is so restricted that there is barely any room to construct even one of the enterprises. The direction that was given to the route by necessity to approach as close as possible to the important town of Frederick compelled running the planned path of the railroad along the Potomac Valley to the point most favorable to cross one of the first chains of the Alleghany system, Cotoctin Mountain, which, at this point restricts the course of the Potomac between two very imposing cliffs. This local circumstance and the rival interests of the two companies present caused the cessation of works until courts could decide how to resolve the difficulty that had arisen. The delay created in reaching a decision on such an important matter occasioned a very unwelcome delay to two enterprises whose purpose, so national and praiseworthy, should have unified their missions.

Common efforts will assure complete success to the two companies, and soon they could overcome the chain of mountains separating [27] the east from the west without difficulty, by the aid of an artificial link.

The part of this railroad completed, from Baltimore to the banks of the Potomac, has 108 kilometers in length; over this distance, about 91 kilometers are in double track, from Baltimore to the banks of the Monocacy; from this point to Frederick, a commercial and manufacturing town of the rich Franklin County in Maryland, they have established a simple single-track branch, 6 kilometers in length. The total length completed is 140 kilometers.

The total altitude above sea-level they were forced to overcome was 247.50 meters; this considerable elevation of terrain was caused by the Parr-Spring hill, which separates the tributaries of the Potomac from those of the Patapsco. It was crossed by means of four inclined planes, of which two are to the east of the watershed, 1/160 and 1/300 in pitch, directed from east to west, and two west, both going in the same direction, the first 1/200, the second 1/230 in pitch. The second one is the shortest, with a base of 570 meters; the longest is the next-to-last, west of the watershed with a base of 960 meters on the base. These planes are separated by horizontal portions, all of it together presenting a total length of 2 ½ kilometers.

The actual watershed is crossed via a trench, 180 meters long and 9 meters deep. A wooden bridge resumes the link of the state road, which passes to the summit of this hill going from south to north. A stationary engine was placed near the head of the eastern inclined plane; this was the fastest and longest, requiring a greater force to draw the train of cars going east.

Before determining the respective position of the four planes, they have to be compelled to satisfy the conditions always imposed in solving a similar problem, which are:

[28]

1. That these planes are on a straight line, whatever the directions of their bases;
2. That at the head and at the foot of each plane there are at least 30 to 100 meters of level ground in the direction of these planes;
3. That at the foot of each plane you can cut the ground to a depth of about 1.80 meters to place machines that can cushion descent;
4. That the summit be as favorable for the erection of a fixed steam engine;
5. That the incline of the planes be as uniform as possible, to facilitate the movement of trains of cars;
6. That water may be found at the summit to supply the steam engine;
7. That the inclined planes be as much as possible in the general direction of the route;
8. That the height achieved on both sides of the watershed be as equal as possible without injury to previous conditions;
9. That in the case where two inclined planes are necessary to pass over a given height, the portions of the route that separate these planes be on a level, or at least near level;
10. That when all conditions are satisfied, it should not be forgotten that the application of this new force is subject to much improvement, and that it is good, as a result, to foresee different modes of appropriation;
11. Finally, that it is throughout essential to fulfill all conditions listed above, without violating the principles of strict economy.

After having determined the degree of pitch beyond which it will be impossible to continue on the two inclined planes nearest the watershed, that is, after having fixed the lowest [29] level and creating the largest horizontal space possible between the two planes, the second question was to determine the degree of incline needed for each direction above the foot of these planes.

You recognize at once by calculation that it would be helpful to introduce two more planes on which the trains of cars will be pulled up by a stationary engine, which creates the four planes that we earlier indicated as the means employed to cross the watershed.

Having adopted the system of four planes, you should see whether you need to extend it further, if you may approach the watershed from the foot of the two planes, whether by animal power or by locomotive power, so as to permit limiting the action of the fixed engine to these points of action.

[Follows extensive treatment of inclined planes and other methods used in the B&O construction]

[32] To review, commercial movement on the Baltimore and Ohio Railroad could not be uniform; nevertheless, since it is indispensable that a third of the total cars run empty, and since it is indispensable that the same number of cars run in both directions, taken on the whole, there was a relationship of 1 to 2, or 2 ½, a proportion which could be made more precise with effort.

In building this railroad, different modes of construction were used depending on the economy they offered in order to have a prompt achievement of such a great enterprise. We trace the different details in figures 1, 2 and 3 of Plate IV.

In localities where stone could be procured easily, the modes represented by the drawing fig. 1, pl. IV. These are supports in stone along the entire length of the way, covered with flat rails; the stones are hollowed out on their interior ends, to give more support to the wheel-rims of the cars.

In other localities, there was a combination of blocks of stone with supports in wood, fig. 2, pl. IV.

In the rest, finally, wood has been used throughout; the blocks were simply replaced by platforms of crushed rock as in Mac-Adam roads, and thoroughly beaten, fig. 3, pl.IV..

[33] The resulting expenses to the present day to build 114 kilometers, with the average cost of landscaping, masonry and hand-work, per running meter, double track, on stone blocks, 53 fr, on wood alone, 43 fr.

[34]

Chapter II

CANAL FROM THE CHESAPEAKE TO THE DELAWARE;
Railroad from Frenchtown to New-Castle.
CANAL FROM THE DELAWARE TO THE RARITON;
Railroad from Camden to Amboy; Railroad from Philadelphia to Trenton; Railroad from New Brunswick to New York

MORRIS CANAL;
Railroad from Peterson to New York

SECTION I.
CANAL FROM THE JUNCTION OF THE CHESAPEAKE TO THE DELAWARE;
General view of the object of this canal. — Description of his adopted path, — Construction of the canal.

Plate III. The object of the Chesapeake and Delaware Canal is to link the two large bays, thus to open a sure and easy passage to coastwise shipping that carry commerce in the bays of these two arms of the sea and on the rivers, that are their tributaries. It also forms one of the important branches of the interior navigation projected along the coast of the Atlantic, and it is joined to the system of defense adopted for the maritime frontier. It is throughout a means of this navigation parallel to the coast and by the routes that terminate in it, which could serve for the transport of the citizen militia, whose movements, calculated in advance, could gather all the forces of the Union in [35] the detached forts that occupy the most vulnerable positions of the coastline.

Various paths were studied and examined at different times to realize this important junction between the two greatest bays of the United States: all presenting advantages and inconveniences, but in all of them there was neglected the principal character of a canal for large-scale navigation in an equal locale. The commission for interior improvements was convened with two civil engineers of high distinction, Messieurs B. Wright and Canvas White, to determine as arbiters and recommend the best path to adopt.

For this purpose, the commission explored on the terrain the different directions one could open a canal across the Delaware Peninsula.

It examined three lines: the first opened on the Delaware via the Christiana River, opposite the town of Wilmington, and on Chesapeake Bay, via the Elk River, near Frenchtown; — the second had the same mouth as the other on the Christiana, but it traversed the Peninsula in a direction that procured the largest provisions of water to supply the canal, and lowering itself and opening on the Chesapeake near to the mouth of Back Creek; — the third departed from the Delaware itself about 14 miles below Wilmington and, following a more direct line across the Peninsula, it would open into Back Creek at a point where the depth of water would permit small seagoing boats to rise that have a draft of 2.28 meters.

The last two directions represented the most characteristics to satisfy the conditions imposed to such an important navigation and were the object of a particularly close investigation.

[36] The first of these last two plans presented a high watershed of 21.95 meters above sea level; it had a length of 24 miles, and could only rely on a water supply that would limit navigation to ordinary boats carrying 30 to 40 tons; the other line could only have a level of water through a large trench; it would unite the marshes of the two bays, Delaware and Chesapeake, and also serve for the passage of sailing ships; its length was only 14 miles. Although this last line would cost at least double the first, it was preferred.

Description of the Path

The canal commences at a point of the Delaware River where great depth is found, about four miles below New-Castle; it joins with this river in the middle of a guard-lock that, at
the same time, regulates the movements of the tide; its mouth is in a port or artificial basin constructed adjacent to and under the protection of Fort Delaware erected on Pea-Patch Island.

This basin is 150 meters wide directed north to south; it extends 180 meters into the river; the wharfs that form it are 9.44 meters high and 10.05 meters at the base. On departing the guard-lock on the Delaware, the canal crosses the Delaware Peninsula nearly from east to west; it follows over a distance of 4 ½ miles (7,241 meters) the St. George Marsh and prairie to the village of the same name. At this last point, the canal changes level by 2.44 meters via a lock; the surface of the water is then 3.66 meters above the usual tides, and it preserves this [37] height over a distance of nine miles (14,484 meters), at the end of which this surface is lowered to the level of the Chesapeake by a lock, dropping 1.83 meters. From this third lock of the canal to the mouth of the canal in Back Creek, is about a half-mile (804 meters). The mouth of Back Creek is negotiated by a guard-lock, regulating the movements of the tide of the coast of the Peninsula. The general length of this route is about 14 miles (22,529 meters). The plateau that separates the waters of the Delaware from those of the Chesapeake is crossed by a large trench with a greatest depth of 23.30 meters and only 23.30 meters in average depth over a length of 3 ¾ miles (6,033 meters). The depth of this trench at the watershed was to make possible a wooden bridge with a single arch, nearly 100 meters wide and 27.43 meters above the waterline; this bridge permits the passage of boats without being forced to lower their masts, and it secures passage of the Peninsula by land throughout its length.

The profile of this canal was designed for sea-ships drawing 2.28 meters depth and rated at 300 tons to cruise easily: the height to the waterline is 18.29 meters, and a width of 10.97 meters; the depth of the water is at least 2.44 meters; the towpath us 2.74 meters wide.

The locks have 30.45 meters in length between the gates, and 6.39 meters width between the walls. They are made of granite on a foundation of planks.

The canal is surfaced throughout with stone.

Its entire cost, with the unforeseen costs of repair during construction, was near 11 million francs.

This canal was begun in 1824 and completed in 1828; at once, near [38] its mouths both on the Delaware and on the Chesapeake, villages arose, founded by the needs of commerce; that near the Delaware is the more considerable, promising to become an important exchange point for merchandise consumed in the state of Delaware.

[40] Railroad from Frenchtown to New-Castle

Section II

General map. PLATE I. The canal from the Delaware to the Rariton will continue the interior communication, parallel to the coast extending from the state of Maine to Georgia; it also opens direct ties between two of the largest commercial towns of the Union, Philadelphia and New York; you see that, from the military point of view as from that of commerce, that this project is of national importance. The commission for public works was also charged to examine the plan for this projected canal and to furnish to the executive power of New Jersey, which was to realize the plan, all necessary information to satisfy general conditions for the project of which this fine branch of interior navigation was to be a part.

Path of the Canal

The canal from the Delaware to the Rariton was to commence close to Bordontown in Conwick’s Creek, a tributary of the Delaware; it would successively cross the Assunpuck and the Millstone, and, entering in the Lawrence-Brooks Valley, it will descend more in an easterly
direction, on the South River, to empty on the right bank of the Rariton at a point of its course preserves a depth of 2.44 to .74 meters, emptying in Amboy Bay.

The canal from the Delaware to the Rariton is a canal at the dividing point. The terrain situated between the Assunpick and the Millstone forms the superior watershed, and the terrain between the Millstone and the heads of the Lawrence-Brooks is more elevated.

[41] Before the canal empties in Conwick’s Creek, it will be necessary to cut with a chain-drag a channel of 2.74 meters across the bar closing the opening of this creek into the Delaware; the same means will serve to keep it open. From the point where the canal enters Conwick’s Creek to Bordentown, the canal will follow the left bank of this creek, which is a prairie whose soil is more elevated than the surface of the water of the Delaware, and, as a result, is never subject to being covered by the ice covering the Delaware during winter. The mouth of this creek forms a large bay, offering a sure port at all times for sailboats intending to use the canal.

Concerning the soil from which the canal is cut, it is generally light and composed of sand and gravel, which obligated not only to give a rather greater incline to the banks of the canal, but also to plane the bottom and banks, first to guarantee against leaks, particularly in places where the canal is constructed of rubble.

Besides the quantity of water necessary to support movement in the canal, it will be a prime necessity to give a rather larger provision to cover all the losses due to leakage, to absorption and evaporation found in a soil of this nature.

The Assunpick, Millstone and Lawrence-Brooks Rivers can provide water, but for greater security, you must add the water of the Delaware itself by means of a ditch that commences at the rapids of that river, at the level of the dam that has already been built on the river near Trenton, from 8.53 to 8.84 meters above the water surface of the canal, at the upper watershed. This ditch could [42] also feed a branch of the canal destined to open a link between the canal itself and the town of Trenton near to its mouth in Conwick’s Creek.

So far as the dimensions of the canal go, they must be quite similar to those that have been adopted for the canal at the junction of the Chesapeake to the Delaware, to render it navigable for seagoing ships that pass from the Chesapeake, having crossed the Delaware Peninsula, and destined for New York or some other town further east. It is one of the most important conditions of the system proposed for interior navigation parallel to the coast.

The commencement of building the canal only began in 1831. Its mouth on the Rariton River, rather than being at the mouth of the South River, was immediately below the town of New Brunswickk, at a point in the channel where ships drawing 2.28 meters of water can enter. The width of the canal at the waterline was 22.86 meters; the locks are 30.48 meters long by 7.32 meters wide.

By means of this canal, coastwise sailboats can travel from Philadelphia to New York in 24 hours.

Since the introduction of railroads in the United States, the Americans have given these routes of communication a development that has no example in any other country. The same entrepreneurial and national spirit that characterizes them has caused them to feel the importance of rapidity of movement in social transactions; also, from day to day the construction of new railroads is seen multiplying across this vast territory. All these routes form a system of strategic lines, of which the first were proposed by the commission of public works, then occupied specially on the nation’s defense. [43] Several of these civil works projects that were presented and which, to the present day, remain without being constructed, have been replaced by projected railroads, which, at this time, satisfy the conditions of the problem of national defense that are constantly proposed in the concept of these projects.

Hence, thanks to the national character, as well as to the farsighted energy of a great people inhabiting this portion of the new continent, the republic will soon see itself fortified by a double belt of communications parallel to the maritime frontier, one of canals, the other of
railroads; they themselves, to complete the system, will be mutually attached by other canals and other roads, along which necessary forces may be moved to protect the points which, for their military or commercial importance, would be susceptible to attack.

Railroad from Camden to Amboy

General map. --- PLATE I. It is in the whole of this happy system that this railroad arises between Camden and Amboy: its purpose is to open direct communication between Philadelphia and New York. The distance between these last two towns, which, by an ordinary road was 97 miles (156 kilometers), and which travelers can take in ten hours, is no more than 84 miles (135 kilometers), and could be passed today in six or seven hours. Which is judged to be an immense advantage for the relations of commerce between these two great capitals!

Camden is a New Jersey town located on the left bank of the Delaware River, opposite Philadelphia. Steam ferries form a sort of floating bridge between these two towns.

[44] Amboy is another town of the same state, located on the banks of Amboy Bay, near the mouth of the Rariton. The distance from this last town to New York has a navigation link that is sure and regular for steamboats; the distance is only 23 miles (37 kilometers), following a natural channel formed by Staten Island and the state of New Jersey.

This railroad is planned to be almost a straight line between Camden an Amboy, and its curves are always less than 550 meters in radius; its total length is 61 miles (98 kilometers).

The portion from Camden to Bordentown, which has a length of 34 ½ miles (55 ½ kilometers), is almost level, its greatest pitch being 1/244; from Bordentown to Amboy, the distance is about 26 ½ miles (42 ½ kilometers); over this distance, the path is as favorable, except at the place where the route crosses the Crosswick and South Rivers, and at the approaches to Amboy; at this last point the pitch is 1/1170. . . .

[45] This railroad is serviced at this moment by horses and by three locomotives; the most recent placed on this route are built by Mr. R.-L. Stevens, and has received great improvements from this wise factory manager. This machine can haul a train of cars loaded with passengers at 25 miles (40 kilometers) an hour; at least this was done as the result of experiments performed on the portion from Bordentown and Hightstown, over a distance of 13 miles, about 21 kilometers, in 13 minutes, even without going to full speed.

He also observed while following curves that there was absolutely no reduction of speed, and that the machine went at a rate of 40 miles (64 kilometers) an hour. This was intending to overcome the resistance on curves, or, in other terms, to overcome the loss of force occasioned by curves on railroads, which is one of the improvements of Mr. Stevens; the second permits the near doubling of the ability of the boiler to make steam; the proof of this last result was given by the fact that, while the machine does not lose any speed along a curve, it has to permit the surplus of steam to escape. During the movement of this new machine, it is served in part by anthracite coal, a circumstance that permits the hope that he could use this combustible on all of this line.

It is proposed to place ten locomotives on this route, which would permit abandoning horses completely as motive force.

The total costs, including the cost of buying land, [46] steamboats, locomotives, cars and construction of wharfs, rises to $1,466,375, or nearly 8 million francs.

Railroad from Philadelphia to Trenton

[46] General map. --- PLATE I. The projected railroad between Philadelphia and Trenton, the town located at the head of sailing navigation of the Delaware, and the capital of
the state of New Jersey, is also a part of the system of double communication that we have already signaled to the reader as being built along the coast from Boston to New Orleans. This route has been begun, and is even very advanced in its construction: it furnishes one of the many examples of advantageous competition that could support this new genre of communication, with its two rivals, canals and navigable rivers;

The rough distance from Philadelphia to Trenton the distance by navigation of the Delaware is about 40 miles; by the old land route through Bristol, 30 miles; by the railroad, only 27 ½ miles, or 44 kilometers: a distance that can be traveled in an hour and a half.

This railroad was planned to lie immediately on the right bank of the Delaware, and over a rather long distance it was parallel to its course and to the direction of a canal opened from Bristol to Easton. (this canal, whose object was to supply Lehigh coal to Philadelphia, was 59 miles long — about 95 kilometers).

It was proposed to lay this railroad as a double track, but to achieve a result more quickly and economically, they were compelled at the start to place the flat iron rails on wooden supports; which caused the cost of construction, all included, to amount to 2,000,168 francs.

Railroad from New Brunswick to Trenton

General map. — PLATE I. So we come to indicate that the railroad from New Brunswick on the Hudson has as its object to continue the line of land communication between the two largest commercial towns of the Union on the Atlantic, and as a result to assure relations in less than seven hours at all times; and, in this situation, to remark what growth of importance will result for each of them, for, to this day, the first, Philadelphia, whose population including its county rises to 188,797 souls, is principally a manufacturer, only exporting territorial products: the second, New York, whose population rises to 202,589 souls, is entirely commercial, that is, it is charged with exporting and importing for a great part of the territory of the Union. Hence, to facilitate to the highest degree the relations between these two towns is to reunite into a common market two great centers to commercial activity that each played heretofore exclusively.

This railroad has 30 miles (48 kilometers) in length with only two curves that are no less than 304 meters in radius; the rest consists of unbending tracks.

The point of departure is New Brunswick, directed at Rahway, — Elizabethtown, — Newark, and Jersey City, its stopping point on the banks of the Hudson opposite New York. It is to be a double track and served by locomotives; for this reason its greatest pitches [49] are 1/500, which permits it to complete its journey in less than an hour and a half..

From the point of departure on the banks of the Hudson, on the western side of the hillock of Bergen, the route is constructed at the common cost of the company of the railroad from Paterson to the Hudson; the first pays 3/5, the second 2/5 of costs, and each company had free use of this part of the route without being held to account to the other; costs of maintenance, nevertheless, remains at the cost of both, in the proportion of their respective original costs. …

[52] The law of concession of the railroad from New Brunswick to New York

[56] The Morris Canal

PLATE IV. The Morris canal brings the Delaware River into connection with the Passaic, and consequently with the Hudson. The purpose of this canal is almost entirely commercial; it is to provision the town of New York with coal, and the manufacturing towns of Paterson with the raw materials imported by the port of New York. Besides, this canal crosses the districts of the state of New Jersey that are richest in iron and copper mines. The probable revenue of this
canal determined the adoption of the project that was submitted to the judgment of the Commission of Interior Improvements, and of which I will present the analysis.

The Morris Canal begins on the left bank of the Delaware River, opposite Easton in Pennsylvania, or rather opposite the confluence of the Lehigh River, on which are found inexhaustible mines of the coal called anthracite; it follows the north side of the Pohantcung Valley, and the same side of the Musconetcong Valley to the village of Stanhope; it crosses the last-named river and remounts in the direction of Brookland, near Lake Hopatkon; this lake forms the point of division of the Morris Canal; it must serve to supply the [57] divisions east and west of the watershed. The canal then descends on the southern side of the Rockway Valley, which crosses about two miles of its confluence with the Passaic: 1 ½ miles further, it crosses the Passaic, and following a straight line from that point to the small chutes of the same river, it arrives at Paterson; from Paterson, it turns south toward the village of Aquacknock, and then empties into the Passaic. From this mouth at New York, navigation is by sail and favored by the tide.

[60] Railroad from Paterson to New York with a note on the system of wooden bridges of M. J. Town

Chapter 3
Louisville Canal, improvements to the Ohio River
Pp. 67-73

[73] Works undertaken to deepen the entrance to the port of Presqu’ile.

Plate X, fig. 8. The port of Erie or Presqu’ile, on Lake Erie, belongs to the state of Pennsylvania; it is the sole refuge between Buffalo and the head of the lake where ships may seek refuge from storms; at times of war this port acquires a double importance by the station it offers to warships that the Union is obligated to keep harbored on the Lake for the protection of this part of the northern frontier.

The advantages of this port for the commerce of the Lakes and for the Union could come to nothing through the build up of sand that forms at its opening and which would gradually reduce the depth of water in its channel if the means were not employed promptly to reduce the invasion of sand. The commission for interior improvements was charged, during one of its exploration campaigns of the country to oversee this position, to examine the localities, to seek what was the cause of the incursion of sand, and to propose means to combat this effect, to render a clear channel to this port for the entry of ships navigating the Lakes.

It was established that Lake Erie varied little in the level of its surface except when northeast winds ruled during a few continuous days; this phenomenon is extremely rare around the Lakes, where the most common winds were westerlies, the circumstance that promotes a current from west to east. It was also established that in the basin of the port of Presqu’ile, formed by the banks of the Lake and of the peninsula that gives it its name, there was a minor current that followed the same direction as that of the Lake but was weaker than it. We were then moved to conclude from these facts that the difference of rapidity of the exterior currents and [74] the interiors of the port was the cause of a sort of counter-current that established itself at the head of the peninsula, thus determining the formation of the deposits of sand that obstructed the entrance to the port.

It was proposed to cause the interior current of the port to have a rapidity that would counterbalance the effects of the exterior current, which of itself could contribute to maintaining the opening of the channel of entry, which would be deepened by means of dredging.

To achieve this a dam was constructed at the opening of the port, which was moved in opposite directions, to leave a free space of almost 200 meters on the natural bed of the
channel. At the time this was begun, the channel only had a depth from 1.21 meters to 52 centimeters of water.

This dam consisted of a single file of piles very close together and joined at the top by pieces of wood. At the foot of these piles a sort of rock foundation was created by means of stones piled there. At the southern end of the branch of the dam away from the peninsula, a form of stone foundation was created by piling large amounts of rocks. At the southern end of the branch of the dam extending from the peninsula, a wharf was constructed curved to form one of the sides of an artificial passage that was to be dredged. The portion of the dam extending from the lake-bank did not did not receive its extension toward the opening reserved for the artificial passage except through the results of the deepening of the channel.

One of the first results was a considerable increase of sand at and downstream from the dam, particularly on the northern branch. And as the southern branch of the dam was completed, the depth of water increased in the area reserved for the artificial passage, from 1.52 meters to 3 meters, and finally even to 4 meters at the northern end of the southern branch, which required more stones to maintain the piles.

[75] Before the construction of these works, the port of Erie or Presq’île never had more than 2.44 meters of water on its bar.

If such a result was of such great importance to the for the commerce of the Lake, it was no less for the national Navy, which had not been able to find a secure refuge in this port; so it was at this point that the Union established a magazine and yards for the construction and conservation of its Lake flotilla.3

Chapter 4
Postal Road from Baltimore to Philadelphia
Pp. 76-83

Chapter 5
National Road from Washington to New Orleans
Deviation to western Tennessee, northern Alabama, Mississippi and Louisiana
Pp. 84-115

[104] Military considerations

A national road from Washington to New Orleans will present facilities for a prompt concentration of forces in the case of interior troubles, and for the movement of troops and transport of war munitions in the case of an invasion. For it is toward the states on the Gulf of Mexico rather than toward the southern Atlantic states that any new route of communication must be directed.

In effect, the latter are closer to the seat of the general government; they can easily obtain the assistance of military depots and dispose of the resources of the Navy. The population that surrounds them is compact, united by a common interest. The states on the Gulf of Mexico, in contrast, are exposed by the neighboring Antilles, to enemy attacks, which find a natural refuge in the islands; a part of the population is constantly on the watch, constantly dreading one another, not only unwilling to help one another for the general interest, but even diminishing the means of defense of which free men dispose. Finally, if you consider that all aid going to the states bordering the Gulf comes from those of the interior, you may comprehend

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that the projected road must be directed toward these states to assure their particular security and the general defense of the country.

To arrive at such a result, we must remark that the states of Tennessee and Kentucky, as interior states, having no frontier to defend, are better placed than South Carolina and Georgia to come to provide the aid of their population, in necessity, to the states of Alabama and Louisiana, and to the [105] establishment of the Navy at Pensacola in the Floridas; if we consider that, due to the operation of their commercial relations, the inhabitants of these states are more particularly interested than those in Georgia and South Carolina in the defense of the maritime frontier on the Gulf, we will conclude again that a National Road in the western direction would have greater results than that of the east or the middle.  

Chapter 6
Canal of the junction of the Mississippi to Lake Pontchartrain

[116] PLATE III. The project of this canal was ordained by an act of Congress passed in 1827. This new route had a high degree of utility by the commercial relations it would contribute to develop between the Mississippi Valley and the eastern lands of this valley, and by the importance it would have for the system of defense already built on all the maritime frontier of the Union; also, this canal had to be measured for the most exact capacities of locality, as well as the general conditions to which every new route of communication in this direction. In consequence, the commission of interior improvements was charged to explore, in all their details, the terrain that this canal must cross, and to submit a project with all studies, to assure construction. Here is how this project was conceived.

Choice of the path of the canal

The projected canal was to follow, as much as possible, the shortest line of junction between the Mississippi River and Lake Pontchartrain, was to pass through the town of New Orleans itself or its neighborhood, since it is located on the most direct part of the terrain between the River and the Lake.

The Carondelet Canal, built some years ago, only opens a communication between the town of New Orleans and the Bayou Saint-John; this bayou empties into Lake Pontchartrain.

The Carondelet Canal departs from a basin cut in the center of the town, and [117] 877.50 meters from the banks of the river; between this basin and the river, the town is built in a compact manner. From the basin to the Bayou, the canal follows a straight line 2,560 meters in length; from its termination in Bayou Saint-John, the navigation to the Lake follows the very course of this Bayou, which, measured along its twists, presents a length of 5,825 meters: hence, the distance from the basin to the lake by this route is 8,412 meters, and the total length to the river, admitting that the canal was extended on a straight line from the basin to the river, would be 9,289.50 meters. This canal has a width of almost 12 meters; its average depth of water is 1.52 meters; it is without locks; the towing path on the banks of the Bayou is very imperfect. The emptying of the Bayou into the Lake is protected by two jetties that advance to where a uniform depth of 3.66 meters is encountered. Navigation on this canal is slow; that of the Bayou is very complicated, even difficult in certain points: the ships are pulled using alternatively a tow-line, is drawn from fixed stations to which the ship is hauled.

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4Report upon the Reconnoissance of a Route, across the Cumberland Mountain, of the National Road contemplated from Washington to New Orleans, Document 10, pp. 6-16, 17-19, dated 26 January 1828, signed Brigadier General Simon Bernard, Member of the Board of Internal Improvements, Capt. W. T. Poussin Topographical Engineers, Assistant to the Board.
This communication is the result of a private company; in its present state, it would not be able to satisfy the demands of a commerce as active as of New Orleans, now, for an even stronger reason, would respond to conditions desired as a means of defense for the country. You would be unable to continue this link to the river without a large increase of costs. And to reach the town proper, the distance would be even greater, and this canal would be an obstacle to movement and established contacts between the town and its suburbs. If we add to this the necessity of buying from the private company nearly 2,560 meters of canal already built, in too small dimensions, we will conclude that we must renounce the use of this line as the path of the proposed canal.

[118] An examination of the left bank of the Mississippi above the town has established the conviction that a canal cannot empty itself in the vicinity, for the ordinary storage places along the river have formed at this point an alluvial deposit that overturns any idea of making that the mouth of the canal; besides, the recently-formed terrain has no homogeneity, and will be a great obstacle to the construction of a guardian-lock.

The neighborhoods above the town not being found favorable to the mouth of a canal, investigation has moved below, starting at a point previously occupied by the Saint Charles telescope, and now constituting a part of Jackson Square on the wharf; they have followed the Avenue des Champs-Élysées, which has been extended in the direction of the Lake. This line is currently the shortest between the River and the Lake; it divides the Faubourg Marigny in half, it is true, but it is only little inhabited, when compared to other parts of the town; besides, it has the advantage of leaving to the west of its direction a good nine-tenths of the land within the limits of the jurisdiction of the town. By following this line the canal would open on the Mississippi on a riverbank of solid glazed earth that, since the foundation of New Orleans, has resisted the efforts of the River, whose continual action has tended to change the form of its banks. The river, at this mouth, with a depth of 3 meters at low water, and only 40 meters from the crest of the levee or guardian dike, the direction of the current at this point, resists alluviation, and the lock could easily resist driftwood.

{120} [A third alternative canal would pass through Trémé, two miles from the town.] It will not present the inconveniences cited for the line passing by the Faubourg Marigny; but also, from another side, it would not be as advantageous to the commerce of the city itself; further, you would have a navigation going up the river from its opening to the magazines in the town; finally, you could foresee that excavations would be costlier due to the extent of marshy terrain to be crossed.

From the military point of view, a canal in this direction appears, at first glance, to present the advantage of a line of defense against an unforeseen attack on the town, if it is not objected that once the canal was completed, the higher lands between the Mississippi and the cypress swamps would be rapidly occupied and built up; for, [121] since this would be the sole terrain on which an attack could be directed, defense would be harmed by the houses that would be built along the canal running through an urban suburb. If a line of defense became necessary, it would have to be erected following the circumstances of the moment; further, the distance between the river and the cypress swamps is so short, that you could always construct a line of defense in a few days. Thus, admitting that the natural result of the canal would attract population to its side, so that as a result the higher ground would soon be covered with houses, and the canal, far from creating a line of defense, would itself become a dangerous obstacle for any retreat from the position one would be obliged to occupy in advance.

After this comparative view of the last two lines, it is decided to prefer the direction via the Faubourg Marigny, because of its advantage for commerce and the means of sanitation that it presents.

Chapter 7
Canalization project across Cape Cod, Massachusetts
Railroad from Boston to Providence
Projected canal between Weymouth, near Boston, and the Taunton River
Pp. 143-155

Chapter 8
Breakwater of the Delaware
Pennsylvania Canal: junction of the west and east by canals and railroads
Pp. 156-185

Chapter 9
Project to cross Florida with a canal

General map. — PLATE I. It was under the presidency of Mr. James Monroe in 1821 that the territory of Florida was entirely conceded to the Americans by the Spanish government. After the acquisition of Louisiana, which assured to the United States the unique mouth that would open to the sea the rich regions of the West, tributaries of the majestic Mississippi, the possession of Florida became of the highest importance from the political point of view. The maritime frontier of the Union was thus completed, and the same national jurisdiction extended over the coast from Passamaquody Bay in the east to the Sabine River to the west of the Mississippi on the Gulf of Mexico. And further, there was no more fear to be had of aggressions or interior dissentions that could come from an enemy nation on this territory under the shadow of false neutrality, or as a result of the weakness of the Spanish government, which was unable to cause respect for its laws.

PLATE VII. In 1822, the two divisions of the Floridas, east and west, were organized under a territorial government; almost ten thousand inhabitants were counted in the Floridas. The fortunate position of this territory, located between the 24th and 30 ½ north degrees of latitude, offered all the advantages of climate of the Antilles, was for Americans a powerful motivation for emigration; we also see that in 1830 the population was already near 35,000 inhabitants. At once the active influence of the American character knew how to develop [187] in this latitude the agricultural resources of the greatest interest for the Union: sugar cane, long-staple cotton, Havana tobacco, silk-worms, succeeded there as they did in their native lands. Such great results attracted the attention of the national legislature to the means to aid the commercial relations of more-distant parts of the Union. Growing commerce on the Gulf of Mexico also demanded that it be determined whether it was possible to aid it by means of a canal across Florida to reduce the chance of hazards. On one side the Pensacola Roads in Western Florida, had been chosen as a maritime depot and yards for repairs by the same commission of engineering and naval officers who had recommended Boston on the northeastern frontier and Hampton Roads for the middle frontier. All of these reasons were powerful motivations for the Congress to gather positive information on the possibility of opening a canal across the isthmus of the Floridas, as well as on all means of improving interior navigation along the coast. The federal government manifested a more direct interest in developing the resources of a territory that did not have the population to be constituted a separate state and enter as a member into the great federal family.

So, in 1826, the Congress in Washington authorized the President of the United States to cause a study of the territory of the Floridas to be executed by the commission of interior improvements to establish the best line to be followed by a navigation canal between the Atlantic Ocean and the Gulf of Mexico, as well as the improvements possible for navigation of the waters of the peninsula.

In the same year this commission gave the special instructions [188] for construction of plans for the future project. After inspection of maps, the commission indicated in advance the

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watercourses by which the desired link could be established: last of all the commission divided the number of officers assigned to this work into two brigades: one was charged to deal with all operations in the eastern part, the other with corresponding operations on the western part of Florida.

In Spring, 1827, the commission itself explored the different directions by which a canal could cross the Peninsula, and it made several various hydrological operations along the coast of the Gulf from Tampa Bay up to and including the Mississippi Delta.

PLATE VII and PLATE VIII. It was as a result of various efforts at plans as well as after the personal observations of the commission that were applied to the general map of Florida, plate VII; it presents a more exact collection of geographic materials than were known up to now. This plate also contains the detailed plans of the coast of Florida along the Atlantic from Saint Augustine to Sainte-Marie, as well as two transversal cuts through the isthmus of Florida following the lines of levels. Plate VIII contains all the detailed hydrographic plans of the entrances to ports, harbors, straights and natural canals that are found on the coast of the Gulf of Mexico from Vassasousa Bay to Mobile Bay.

To follow the different researches that one was obliged to make before arriving at any conclusion on the object of this important work, we distribute the whole into five large divisions, specifically:

[189] 1. Topographic and hydrographic description of the territory where these projects will be built;
2. Results of investigations and levels of this territory, with detailed plans and profiles;
3. Exploration of the terrain of different directions following which the peninsula of Florida may be crossed by a canal;
4. Indication of lines of interior navigation to establish along the coast of the Gulf of Mexico from Tampa Bay to the Mississippi Delta;
5. Demonstration of the improvements to which the Mississippi Delta is susceptible.

Detailed description of Florida waters
Pp. 186-274.

Chapter 10
Projects for a canal parallel to the Tennessee River and other rivers of the state

Chapter 11
Historical notice on the Grand Canal of New York and the Champlain Canal, Railroad from the Mohawk to the Hudson, and the Middlesex Canal; the project of the Erie Canal.
Pp. 308-364.

[308] PLATE X. In this notice that we have composed after having consulted the reports of the commissioners delegated by the State Legislature of New York, we propose to show with what weak means the authors of the Erie Canal arrived by their noble perseverance and disinterest to assure construction.

We shall return to the epoch when the first idea of this great national monument was conceived, and we shall expose by what degrees the project passed to the moment it was adopted by legislative act; we shall follow the construction of this canal to the day when the waters of the west came to mingle with those of the Ocean by a new channel, which has become for New York an inexhaustible source of riches, and for the American Union a new development of interior navigation.